EUROFIGHTER

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The story of a remarkable Super Sonic Car

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Eurofighter Typhoon over the UAE Desert

Photo: Katsuhiko TOKUNAGA/DACT

EDITORIAL

Welcome to a special edition of Eurofighter WORLD. This issue is being published as one of the world's greatest showcase events in the aviation sector opens its doors for business – the Dubai Air Show. It's a unique event and one which firmly puts the spotlight on a region of the world in which having capable defence resources has never been more important.

Eurofighter GmbH, along with its Eurofighter Partner Companies, BAE Systems, EADS and Finmeccanica, will have significant presence in Dubai – and, as ever, you can expect to see the Eurofighter Typhoon make a real impression at the Show. It is an exciting time for us.

It's apposite then that this issue of the magazine has a focus on our operations in warmer climates. Eurofighter has already proven itself to be effective and trusted in operation over places like Libya. What has, perhaps, not been talked about so much is how we can support operators in the Middle East and the Gulf regions – and how our people are prepared to make a real commitment to doing so. In this issue we give you an insight into this as Nigel Davey, Vice President of Operations for BAE Systems in the Middle East, shares his view of working and living the region and the understanding that gives us of our customer's needs and aspirations. I can't let this issue go to press without congratulating all our customers and our partners on the fact that we have surpassed the 200,000 flying hours milestone with the Eurofighter Typhoon. It is a fantastic achievement and one we can all feel justly proud of.

In addition, we and NETMA also signed the contract for the Evolution Package 2 in October 2013. The signature of this contract represents a significant milestone for what is known as the Phase 2 Enhancement programme for the Eurofighter Typhoon. It brings with it a whole raft of enhancements designed to ensure the capability package we offer our customers is the best on offer anywhere in the world. This new development contract followed the Meteor Integration Contract signed at the Paris Air Show in June 2013. It secures the integration of the world's most advanced next generation Beyond Visual Range Air-to-Air Missile on to the Eurofighter Typhoon. So we are making significant progress to enhance the operational capabilities of our aircraft.

For me, what makes the achievement all the more special is the reliability of the aircraft during the journey to that target. This clearly reflects the fact that we got the basics right when we conceived the aircraft – and the fact that we have been able to build on the basic capability without compromising on the reliability. Elsewhere in this issue you can read the story behind this in our unique feature in which experienced former Test Pilots discuss in detail what makes a good fighter weapons system. For many it will provide them with the best understanding yet of just why we, and others, believe the Eurofighter Typhoon is a world-beater.

Last but not least, let me also take this opportunity to thank all of you for your great commitment and strong support to achieve our company's targets in 2013. In just a few weeks from now, we are entering into 2014 and I would like to wish you, your families and friends a very prosperous and peaceful new year!

Alberto Gutierrez
CEO Eurofighter

DUBAI AIRSHOW

EUROFIGHTER IN DUBAI – MAKING THE NEWS ON LAND AND IN THE AIR...

Huge interest surrounds this year's Dubai Airshow which is expected to attract up to 60,000 trade visitors and over a thousand exhibitors. It's one of the biggest events in the aerospace calendar and certainly one of the most spectacular.

Among those exhibitors will be Eurofighter GmbH, BAE Systems and Eurojet – together demonstrating a significant presence in the United Arab Emirates – and not without reason.

The Dubai Airshow is organised under the patronage of HH Sheikh Mohammed bin Rashid Al Maktoum, Vice President and Prime Minister of the UAE and Ruler of Dubai, and in co-operation with Dubai Civil Aviation Authority, Dubai Airports and the UAE Armed Forces.

It has been widely reported that the Emirates are looking to replace at least 60 ageing Mirage combat aircraft and it is public knowledge that the UAE has been in talks with a number of potential providers – including with BAE Systems, the key Eurofighter Partner Company for the Region. If there are updates on this – be sure to look on both the Eurofighter and BAE Systems websites.

At the time of going to press, Alberto Gutierrez, the Chief Executive Officer of Eurofighter GmbH, told Eurofighter WORLD: "Clearly this is an important Airshow for the whole of the Eurofighter community and our presence here in Dubai is a reflection of our genuine commitment to the region and its people. We know that the aircraft and its capabilities have been well received in the Middle East. We look forward to building on our track record here for many years to come."

- As well as a strong delegation of senior personnel in Dubai, Eurofighter will be hosting the fastest man on the planet – UK RAF Wing Commander Andy Green.
- It's an amazing fact that 50 years and a day after Chuck Yeager first took an aircraft supersonic, it was Wing Commander Green who did the same thing on land with a World Land Speed Record car. On that day, October 15th 1997, he reached a speed of 763.035 miles per hour and he remains to this day the holder of the World Land Speed Record. Now, as he prepares to beat the elusive 1000 miles per hour barrier in a new World Land Speed Record Car called Bloodhound, Wing Commander Green will be in Dubai to explain to Eurofighter, Eurojet and BAE Systems guests just why he is tackling this challenge and what it means.
- You can read an exclusive interview with Wing Commander Green elsewhere in this issue – and you can also find out more about the Bloodhound World Land Speed Record Car and the powerplants that will be used to drive it into the record books.

HITTING THE TARGET – METEOR

In June this year, at the Paris Air Show, Eurofighter Jagdflugzeug GmbH signed a weapon system integration contract with NETMA, the NATO Eurofighter and Tornado Management Agency, to facilitate and secure integration of MBDA's Meteor Beyond Visual Range Missile system.

The contract was signed following successful early firing tests using the NETMA-owned development aircraft IPA1 off the coast of Wales in the United Kingdom.

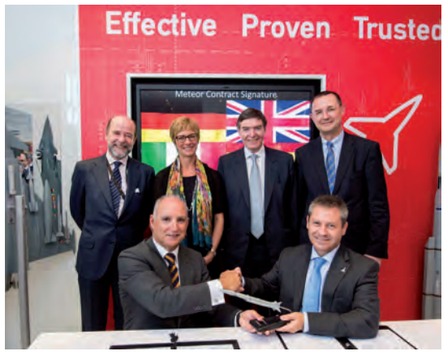
At the time, Alberto Gutierrez, the CEO of Eurofighter GmbH said: "These latest developments confirm the growing momentum of the Eurofighter enhancement programme which is delivering real capability to our customers. Meteor adds genuine potency to the Eurofighter Typhoon. When coupled with a range of other enhancements we are bringing into the programme, this will further secure the aircraft's position as best-in-class offering customers unrivalled levels of performance, reliability and support."

The signing was, and remains, further evidence of delivery around a range of capability enhancements for the Eurofighter Typhoon, and secures work on a programme to integrate the state of the art ramjet missile system through the partner nations in Eurofighter for the foreseeable future.

Early Meteor flying trial achieved

The Meteor missile system, integrated with the current class-leading M-Scan radar (and in the future the advanced E-Scan radar) fitted to the Eurofighter, and utilising the full potential of two-way data-link communication, will greatly increase the 'no-escape-zone' around the aircraft enhancing both its effectiveness and lethality.

Further design and test work on the missile system is now continuing as part of the integration programme as BAE Systems, Cassidian and Alenia Aermacchi embed the system within the programme in the UK, Germany, Italy and Spain. Over the next 18 months a further six firings are scheduled to test key elements of the integration programme and the missile's performance.



Back row, left to right: Pedro Argüelles Salaverría, Secretary of State for Defence in Spain; Roberta Pinotti, Under Secretary of State for Defence in Italy; Philip Dunne, Minister for Defence Equipment Support & Technology in the United Kingdom; Stéphane Beemelmans, Secretary of State for Defence in Germany

Front row, left to right: Jesus Pinillos Prieto, General Manager of NETMA; Alberto Gutierrez, Chief Executive Officer of Eurofighter GmbH

BLOWING HOT IN BULGARIA

The first Eurofighters ever deployed to a Bulgarian Air Base for operational missions flew into Plovdiv this October to take part in a joint exercise with MiG-29's.

In one of the warmest Octobers on record in Bulgaria, a pair of two-seat Eurofighters from the Italian Air Force's 4th Wing deployed to Graf Ignatievo AB - close to the town of Plovdiv, one hour drive from the Capital Sofia.

The Exercise included six flights totalling 15 hours flying time in which, as usual for Eurofighter deployment, the aircraft recorded 100% operational availability and demonstrated their outstanding performance to the Bulgarian pilots who also had the chance to fly them.

The activities during the quick deployment involved missions which included Basic Fighter Manoeuvres, Air-to-Air Engagement, and also Super Cruise (with under wing tanks, something that the Eurofighter can handle easily).

It is reported that the Bulgarian pilots were 'enthusiastic' having flown the European fighter.

The Bulgarian Air Force is accustomed to having a strong air force, which in the '80s had more than 300 fighters in service, and their pilots are very well experienced with the MiG-29 which is still a potent warrior, but not up-to-date for today's needs.

Key points with the Eurofighter that the Bulgarian pilots appreciated were:

- the twin engine configuration of the Typhoon and its performance,
- its simplicity in handling
- the good sensor fusion it offers compared with what they are used to

Bulgaria, as a NATO country, needs a new fighter to replace the MiG-21 and the MiG-29 today in service to update its defensive system.

DID YOU KNOW?

In the past both Italian and German Luftwaffe Typhoons have flown in Bulgaria but for display purposes only.

EUROFIGHTER TAKES ON **ARCTIC CHALLENGE**

Eight UK RAF Eurofighter Typhoons from 6 Squadron at RAF Leuchars joined more than 60 other aircraft in Norway in September for the first ever Exercise Arctic Challenge.

The aircraft and supporting personnel deployed to the Kallax Air Base in Sweden for the exercise which was designed to allow the different aircraft types to practice strategic planning and tactical war fighting simulations as well as in-flight manoeuvres and communications strategies. The Eurofighter aircraft flew alongside Norwegian F-16 Falcons, Swedish JAS-39 Gripens, Finnish F/A-18 Hornets and US F-15 Strike Eagles and KC-135 Stratotankers.

The two week exercise was hosted by Norway, Sweden and Finland. But it was Norrbotten F21 Wing of the Swedish Air Force, based just outside the town of Lulea which hosted 6 Squadron. The exercise was based on a two-wave flying programme with Typhoons from 6 Squadron flying six aircraft in two separate waves; 59 sorties were flown in the first week and 56 in the second. The first wave focused on training to allow the pilots to undertake syllabus work up and Dissimilar Air Combat Training against aircraft from other Nations.

The emphasis on the second wave was on the planning and execution of 'Large Force Employment with Combat Air Operations' in which there were up to 64 aircraft airborne. The RAF have reported that the Eurofighter performed well throughout with excellent serviceability and results throughout the whole exercise.

EUROFIGHTER MARKS 75TH ANNIVERSARY OF 36TH ITALIAN AIR FORCE WING

It's been a busy and active year for the Italian Air Force. In May Eurofighter honoured the 75th Anniversary of the 36th Italian Air Force Wing by presenting to its X Squadron, declared combat ready on Typhoon, a special Eurofighter Sword in a ceremony at the unit's base in Gioia Del Colle, Italy (see picture below).

On behalf of the Eurofighter consortium, Maurizio De Mitri, Senior Vice President of the Military Aircraft Sector at Alenia Aermacchi and Chairman of the Supervisory Board of Eurofighter GmbH, presented the Sword to Base Commander Col. Vito Cracas at Gioia Del Colle where the Sword will remain as a recognition of the achievements of the 36th Italian Air Force Wing and the relationship with the Eurofighter community.

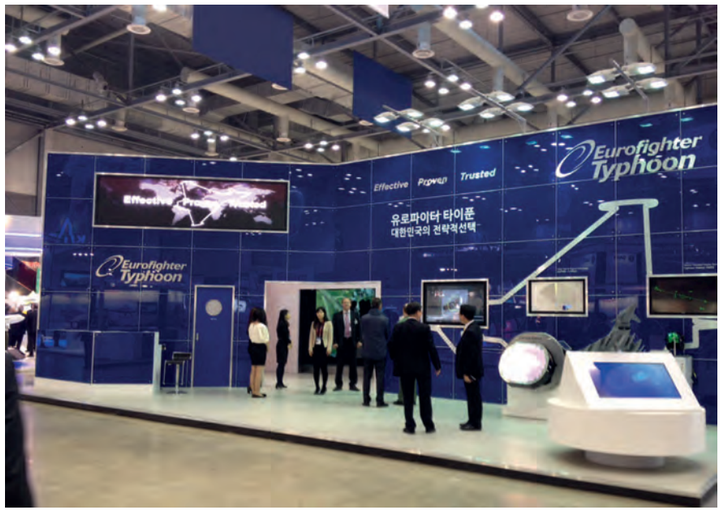
Speaking at the ceremony, Maurizio De Mitri said: "It is a great honour for me to hand over this Sword in recognition of this landmark anniversary and the remarkable achievements of the 36th Italian Air Force Wing."

At the Ceremony, 36th Wing Commander said: "The Eurofighter Typhoon is at the heart of the work that we do here at Gioia Del Colle and performs a vital role in the Italian Air Defence system. We are extremely proud to be celebrating this 75th Anniversary and we look forward to working with Eurofighter."

DID YOU KNOW?

The first swords were initially presented to the Chiefs of Air Staffs of the four Partner Nations: Germany, Italy, Spain and the United Kingdom at the aircraft Type Acceptance in 2003. Ever since this event, the Swords have been presented for each new squadron to symbolise the long-lasting, successful partnership between industry and air forces across the Eurofighter community.

EUROFIGHTER TYPHOON ON SHOW IN SOUTH KOREA



More than 360 exhibitors from 28 countries showcased their products and systems during the Seoul International Aerospace and Defence Exhibition (ADEX) 2013 which took place from 29 October to 3 November in Republic of Korea's capital. Eurofighter Typhoon presented a Full Scale Replica just outside the main Exhibition Center. A Eurofighter Cockpit Demonstrator was also available to brief current and potential customers, industrial partners and media from all over the world.

Representatives of the Eurofighter Typhoon community explained to visitors that buying 60 of its combat aircraft would provide the Republic of Korea with the best deterrence and the best overall industrial package. They also described the advantages of a split procurement of Eurofighter Typhoon and the F-35 combining the benefits of the European and American programmes.

The Republic of Korea identified a strong need for stealth capability to cope with the various threats. The Eurofighter Typhoon includes a high level of active and passive low observability features. Exhibition visitors heard that Eurofighter Typhoon is able to deliver the capability to cope with these threats today and in the future. It was also explained that Eurofighter Typhoon is also fully interoperable with all other modern US combat aircraft. Its interoperability with US aircraft has been proven in international operations and exercises such as Red Flag.

In meetings with various target groups it was underlined that Eurofighter is still prepared to deliver the principles of our technology transfer and industrial participation package and to provide the Republic of Korea Air Force with full operational self-reliance. The EADS offer comprises a unique industrial package that will provide the Republic of Korea, and Korean industry, with the opportunity to significantly enhance their industrial competences, skills and capabilities. The package includes, for instance, a Final Assembly Line in Korea, a Software Centre Facility and a Depot Maintenance Facility. ADS had offered to invest 2bn US $ into the KF-X thereby strongly supporting the launch of the programme and the creation and sustainment of 30,000 highly skilled direct and indirect jobs.

Mariano Barrena, Eurofighter Campaign Director for the Republic of Korea, said on the sidelines of Seoul ADEX 2013: "We offer a world-class next generation combat aircraft with truly multi-swing role capabilities. Ten years after entry into service in 2003, the programme has never looked stronger than today."

Looking at the Republic of Korea's intention to acquire 60 new combat aircraft, Barrena added: "Eurofighter Typhoon is the right strategic choice for the Republic of Korea. We are convinced that the fighter procurement in this country is not a one-off expense, but a strategic investment in Korea's defence capability and the development of its own aerospace and defence industry."

Eurofighter Typhoon was proposed to South Korea's fighter procurement programme which aimed at acquiring 60 multi-role combat aircraft. However, the Republic of Korea recently decided to re-start the international competition.

EIGHT RAF TYPHOONS CHAPERONE FRENCH MIRAGES FOR **EXERCISE CAPABLE EAGLE**

The UK's RAF Leeming air base hosted a Combined Joint Anglo-French Expeditionary Force of eight RAF Typhoons and four French Air Force (Armée de l'Air) Mirage 2000Ns for Exercise Capable Eagle, which concluded on October 18th.

Capable Eagle was the air component exercise that ran concurrently with Exercise Joint Warrior. More than 700 RAF, FAF and Army personnel spent the eleven-day exercise working shoulder to shoulder as a corner of the Leeming airfield became a Deployed Operating Base in 'Dragonia'.

Wing Commander Mike Bracken, the head of Expeditionary Air Wing Operational Training led the planning for the exercise. "Over the last 18 months we've been tasked to re-engage with contingency operations for the RAF and in doing so we have looked at the Expeditionary Air Wing (EAW) concept and we've tried to reinvigorate a training process to enable our people to face contingency in whatever operational environment they are given."

Key to the exercise was the deployment of 1(F) Squadron from RAF Leuchars. Officer Commanding, Wing Commander Mark Flewin, explained how it tested the Typhoon's multi-role capability.

"We've been involved in a diverse range of mission sets from close air support to air interjection to defensive counter air." He went on to explain how closely they have been working with the four Mirage 2000Ns. "We planned together, we swept them in to allow them clear passage to their target and then we protected the four Mirages on their way out. We are both very professional and adaptable air forces and we've proven that on this exercise in austere conditions. I would say that the missions have gone very well indeed and we have worked very well with our French counterparts. As part of the on-going Anglo-French defence agreement I would see this as one of the stepping stones towards a closer relationship and I would see permanent joint exercises very much being a feature of the future."

As the exercise reached its crescendo the Deployed Operating Base received a visit from Chief of the Air Staff, Air Chief Marshal Sir Andrew Pulford and French Air Force Chief of Staff General Denis Mercier. In an address to exercise personnel and international press, Air Chief Marshal Pulford emphasised the importance of the Anglo-French relationship and the value of conducting a joint exercise."This is an extremely important relationship, not just for today but long into the future.

The Combined Joint Expeditionary Force is really forging the way in the bilateral relationship between our two militaries and our two air forces, allowing the two most powerful, and clearly the best, air forces in Europe to take the lead and bring the rest of Europe along with us. This is not just about economics, this is about modern military power and the ability to work together, to operate together. It is quite pointless time on time coming together for the first time, as it were and learning about one another. We've got to train together, we've got to prepare together and we've got to develop mutual procedures. That's what this is about."

General Mercier added, "It's very important for me to see our two air forces working together. The cooperation between our forces is not new, it started at the beginning of aviation. But what we are building here is not a co-operation; it is really a command force. I'm very happy with what I've seen today. We are ready to be part of this Combined Expeditionary Force."

RADOM 2013 – EUROFIGHTER IN POLAND

In the world of international campaigns, developing an awareness and relationships in a new market territory takes time and patience. Knowing your customer and their future requirements demands a listening ear, real understanding, and the ability to take a long term view.

This is exactly why if you had been to the 2013 Radom International Airshow in Poland this year you would have seen a well-resourced Eurofighter stand amongst the display with a steady stream of pedestrian traffic going in and out of the doors.

Walter Mancini, Vice President of Business Development for Eurofighter, explains: "Radom is Poland's most important airshow. It attracted over 180,000 visitors this year and among these are many senior representatives of both the government and the armed forces.

"We decided to go to Radom as part of increasing awareness of Eurofighter Typhoon in Poland. This is an early move ahead of any Polish request for information and it gives us a chance to highlight aspects that could become discriminators for our platform. At RADOM this is mainly achieved in dialogue with the MOD, with the Polish Air Force and with people from local industry."

As well as having a senior delegation at the Show, Eurofighter was also represented by two RAF Eurofighter Typhoons on static display and by one Italian Air Force Eurofighter displaying every day.

"People were open to us and they genuinely seemed to think it was a great aircraft. They also liked the fact that we are a European solution. They recognised by working with us they would have a relationship with the three largest defence companies in Europe and they understood that we already have experience of sharing knowledge."

He added: " We recognise that the military have their own priorities. We know that their first priority is air defence, then helicopters, then a trainer aircraft and the navy and the army. However, putting ideas and concepts in the minds of decision-makers and influencers ahead of a competition can often bring benefits.

"Our objective was to make it clear that we are a credible alternative for Poland, that we have a product that has longevity and that we have existing supply-chain and nations support and expertise behind it. I think, this year, we effectively began that journey of raising awareness. Poland is now aware of the European option."

ROSKILDE 2013 – EUROFIGHTER IN DENMARK

Every year the Eurofighter Typhoon increases its fanbase around the world at major Air Shows. Introducing the aircraft to Governments and Air Forces is a vital part of the export programme. Here, Cassidian's Project Test Pilot Chris Worning gives Eurofighter WORLD an insight into just one of these Shows –on this occasion it was in Denmark at the famous Roskilde Air Show which is staged mid-August.

Why go to Roskilde?

For Denmark it is an important event. There are around 30,000 spectators each day – and, with four candidates now competing for the Danish Air Force's next fighter programme – we were also set against each other.

We were the only ones flying together with Gripen – Boeing didn't have an F-18 there and Lockheed Martin were unable to bring an F-35 for obvious reasons so they had a replica.

We had two aircraft from Nörvenich, one static and one which I flew every day of the Show.

I did the same display I do at all the major air shows I have flown. It's all about lift and power. Anybody could see that we flew the socks off the Gripen. If other aircraft had been there, we would have done the same to them!

In this competition, in terms of pure performance, the Eurofighter is way out front. I think, after the display, it became clear that we had become something of a favourite for the spectators. It also helped that our team was small and a couple of us were Danes, so we could talk to them in their own language.

In Denmark, Eurofighter was, perhaps, not very well known.

The aircraft is now mature – but it's real strong point is that it is a flexible solution to the Air Force's needs. In Denmark, where they love their F-16 however, the Eurofighter is the absolute natural replacement.

It's an aeroplane that can do anything in the future. I told the Danish politicians recently that when I left the Danish Air Force at the end of the Cold War we had never fired a shot in anger – yet now, when all the militaries are about 30 per cent of the level they were back then - we have been to war three times.

The Danish Air Force has been to war on each of these three occasions with the F16. They have used the aircraft and they have dropped weapons that weren't even invented when the aircraft was built. We just don't know what the future's going to bring.

For today's requirements, there is no silver bullet – we need a flexible aeroplane.

And if you look at the Arctic – a big issue in Denmark – I don't think you should fly around the Arctic in a single engine aeroplane.

It is certainly true that we have left the Danes with some serious food for thought following Roskilde and we need to follow that up. We have put ourselves on their map.

And what about the display you fly?

It is not a new display – it's about brute power, so there's lots of vertical manoeuvring, lots of going straight up from low speed to high speed and obviously there are the spectacular bits, the rolls and the high speed turns – I do get to plus 9g a couple of times.

Slow speed around 100 knots and high speed 500 knots.

Can you explain a little more about how you have demonstrated the flexibility of the Eurofighter?

When the Danes came to visit us in Manching earlier this year we put four aeroplanes in four different configurations.

We had a very light A-A configuration typically used for peacetime QRA – then we had heavy A-A where we pointed out that if you are really up against getting air superiority, you need six long range and two short range missiles, that's the way the F-22 is laid out. And then we put on a couple of tanks and an LDP which is also very good – and then we had our "Swiss Army Knife", which was four Paveway IV's; four AMRAAMS, a couple of tanks – two short range missiles – all that is two times an F16 weapons load.

This in fact is what the new Eurofighter P1E specification gives you:

- Full A-A: 4 long range 2 short range missiles
- Four bombs
- Laser GPS
- The targeting Pod
- Two tanks

In our competition, the only one that is close to that would be the Super Hornet. The Gripen is half of that.

In terms of performance though, the Eurofighter is vastly superior to the Super Hornet. The Super Hornet is an extremely heavy aeroplane.

We also had the aeroplane with two Taurus and a full load of A-A missiles and a centre-line fuel tank. That was to point out that, if you really are on the first day of a real war, then maybe it's a good idea to bring in a cruise missile system to fly the last 300km – so stealth then becomes much less of an issue.

What we lined up in Manching was all the current and coming scenarios that you might want to cover.

The Danes need a package with a sensible price and good logistics system - and I think we can do all of that.

I feel very good about it – we still have things to learn – but we have our chances in Denmark and we can do this. We have the right team.

INCREASED OPERATIONAL CAPABILITIES FOR EUROFIGHTER TYPHOON

IPA7 flying over Cassidian´s Military Air Systems Center in Manching with Laser Designator Pod, two Supersonic Fuel Tanks, two IRIS-T Short Range Air-to-Air Missiles, four AMRAAM Medium Range Air-to-Air Missiles as well as four Paveway IV bombs loaded." - Credit: Josef Gietl, Cassidian

In October Cassidian, the defence division of EADS, announced that it had successfully finalized its flight testing of the Eurofighter Typhoon Phase 1 Enhancements (P1E) programme.

After an intensive test programme of this First Batch of Enhancements on Instrumented Production Aircraft 4 and 7, this enhancement confirms delivery of a robust simultaneous multi-/swing-role capability to the Nations' Air Forces. It will be ready for the customers by the end of 2013.

The testing took place at Cassidian´s Military Air Systems Centers in Manching/Germany and Getafe/Spain, in cooperation with BAE Systems and Alenia Aermacchi. "The Phase 1 Enhancements will provide a significant leap in Eurofighter's operational capabilities. Deploying multiple weapons with attack constraints simultaneously in all weather has never been easier", said Chris Worning, Cassidians Eurofighter Project pilot.

P1E implements full Air-to-Surface capability on Eurofighter Typhoon - including Laser Designator Pod -, full smart bomb integration, modern secure Identification Friend or Foe (Mode 5), improved Radios and Direct Voice Input, Air-to-Surface Helmet Mounted Sight System, improved Air-to-Air capabilities including digital integration of Short Range Air-to-Air Missiles and updated MIDS (Multifunctional Information Distribution System) Datalink functionalities for enhanced interoperability with Coalition Forces.

The Enhancements cover the design, development, qualification and clearance of the first major upgrade after the Main Development Contract.

It is a major milestone in the development of Eurofighter Typhoon giving seamless air-to-ground integration to the weapon system and forming the baseline for further enhancements such as AESA (Active Electronically Scanned Array) radar and the Meteor missile.

NEW DEVELOPMENT CONTRACT FOR EUROFIGHTER TYPHOON

A major new Development Contract which will pave the way for continuous capability enhancements of the Eurofighter Typhoon has been signed by Eurofighter Jagdflugzeug GmbH and the NATO Eurofighter and Tornado Management Agency (NETMA).

The package (known as Evolution Package 2) will be delivered by the end of 2015. The Contract signing was announced on Wednesday 30th October in South Korea at the Seoul International Aerospace & Defence Exhibition 2013.

Evolution Package 2 consists of a number of improvements including enhancements to the major avionics sensor such as the Radar and the Defensive Aids Sub Systems (DASS) of the Eurofighter Typhoon. It also includes enhancements designed to cater for the latest operational requests of Customers and important enhancements to the Multifunction Information and Distribution System (MIDS). In addition, the package will include further improvements to the Flight Control System (FCS) and the Utility Control System (UCS) that will allow the Eurofighter Typhoon to be more compatible with evolving requirements within the Commercial Aviation air space environment.

Alberto Gutierrez, Chief Executive Officer of Eurofighter GmbH, said: “The signature of this Contract represents a significant milestone for what is known as the Phase 2 Enhancement programme for the Eurofighter Typhoon. It brings with it a whole raft of enhancements designed to ensure the capability package we offer our customers is the best on offer anywhere in the world.”

Jesus Pinillos Prieto, General Manager of NETMA, said: “Eurofighter Typhoon was designed, from the outset, for capability growth, and this package of enhancements is further evidence that we are building on this fundamental strength. It is something we firmly believe sets us apart from the competition.”

This new Development Contract follows the Meteor Integration Contract signed at the Paris Air Show in June 2013. It secures the integration of the world’s most advanced next generation Beyond Visual Range Air-to-Air Missile on to the Eurofighter Typhoon.

LATEST PAVEWAY IV TRIALS DEMONSTRATE ENHANCED AIR TO SURFACE CAPABILITIES FOR EUROFIGHTER TYPHOON

BAE Systems, working closely with Raytheon UK, have completed a series of trials culminating in a successful release of Raytheon's Paveway IV precision guided bomb from a Typhoon, demonstrating further enhancement of Typhoon's air to surface role.

The trials demonstrated the latest Phase 1 Enhancements to the aircraft that enables the full capability of the Paveway IV to be utilised on Typhoon for the UK customer. Typhoon is capable of operating with up to 6 Paveway IV weapons.

The Phase 1 Enhancement programme includes the integration of new weapons including Paveway IV and EGBU-16 alongside integrating a Laser Designator Pod (LDP) onto Tranche 2 aircraft of the partner nations. It will further strengthen the Eurofighter Typhoon's position as a multi-role fighter aircraft.

Raytheon's Paveway IV is a highly accurate, precision guided bomb capable of significantly minimising collateral damage. It will provide Typhoon pilots with the very best technology for operations with its all-weather, day and night precision capability.

AIR FORCES SALUTE TO SAY FOND FAREWELL TO RAF LEUCHARS

Leuchars AIR SHOW 7th September 2013

Stormclouds cleared to give way to sunshine for a poignant farewell to RAF Leuchars in Scotland this year as the famous Royal Air Force base staged its last Airshow in front of packed and appreciative crowds.

More than 40,000 people attended the Show which was themed “Attack and Protect” – and which honoured the 65th Battle of Britain at Home Day and which paid tribute to 617 Squadron 70 years after the famous ‘Dambusters’ raid.

While today RAF Leuchars provides the northern base for RAF Eurofighter Typhoons protecting the UK with an unmatched Quick Reaction Alert capability – next year Eurofighters from 1 and 6 Squadrons will transfer to RAF Lossiemouth. →

The highlight was the Red Arrows in formation with a box 4 of Eurofighter Typhoons led by Wg Cmdr M Flewin OC No 1 (F) Squadron (see inset above) and members of 1 and 6 (F) Squadrons.

Photos for Eurofighter WORLD by Goeffrey Lee

→ AIR FORCES SALUTE TO SAY FOND FAREWELL TO RAF LEUCHARS

Typhoons from both Squadrons were on the tarmac at the conclusion of the Show to receive the final salute from Station Commander and Air Force Scotland Air Commodore Gary Mayhew prior to transition to Lossiemouth.

Air Commodore Mayhew said: “It was very fitting that RAF fast jets, the Typhoon and the Tornado GR4, were able to conclude the Show, underlining the extensive RAF contribution to current operations at home and abroad, and the transition of the Typhoon Squadrons from Leuchars to RAF Lossiemouth during 2014.”

The Air Commodore also thanked the Austrian Air Force who made history at Leuchars when they provided a special demonstration of Quick Reaction Alert operations intercepting a Hercules with a 2-ship Typhoon formation and forcing it to land. This was followed by a highly dynamic 1v1 engagement as the second part of the demo. Besides the power of the EJ-200 engines the Austrian presentation outlined the excellent manoeuvrability of the Typhoon. Additionally Leuchars Airshow was supported by a Solo display from Cpt. Alexander Miksitz. It was the first time the Austrian Air Force had landed a Eurofighter Typhoon in the UK and their biggest international deployment so far.

At the aftershow crew evening the Austrian intercept demonstration was honoured by the Airshow organisation with the award for "Best Flying Display".

RAF Typhoon Display pilot Flight Lieutenant Jamie Norris also put the Eurofighter through its paces at the Show wowing crowds as he demonstrated the aircraft’s world-renowned agility. Eurofighter cameraman Geoffrey Lee was on hand, as these pictures show, to capture both the Austrian and RAF Air Forces in action.

Italian and Austrian Eurofighter Typhoons join in with the RAF to represent the Eurofighter community. The Austrian Airforce demonstrated how to intercept aircraft with 2 Eurofighter Typhoons and a C-130 Hercules.

6 Squadron Eurofighter Typhoon prepares to taxi out from HAS site for take off to perform mock airfield attack during the Leuchars airshow.

below: The RAF Eurofighter Typhoons were out in force at Leuchars air show. There were 6 different Squadron painted aircraft in the line up.

left: Austrian air forces first overseas detachment showing 2 of its pilots after demonstrating the aircraft agility.

right: Wing Commander Mark Flewin OC No 1 Squadron leaves his HAS to lead a Box four formation with the Red Arrows.

TRANCHE 3 – EVOLVING CAPABILITY AND WHAT IT MEANS...

Tranche 3 offers a number of provisions that future proof the aircraft. These will allow Typhoon to take on additional capability.

TRANCHE 3 FEATURES

E-SCAN RADAR
Over the long term the Active Electronic Scanned Array (AESA) will offer capability improvements over Mechanically Scanned Radar, including higher levels of multi-target tracking, and enhanced weapons integration.

HIGH SPEED DATA NETWORK
Tranche 3 aircraft are provisioned to be able to offer high bandwidth data transfer, which means it could carry weapons and stores that need high data bandwidth for, say, video.

AVIONICS
Will allow for increased computing power and additional mission computing capacity.

NEXT GENERATION FIBRE OPTIC WEAPONS BUS
There is a provision for fibre optic cabling which may be needed for future generations of weapons.

CONFORMAL FUEL TANKS
The tanks increase the fuel load which mean extra range for the aircraft and also free up positions under the aircraft for larger or additional stores where under-wing fuel tanks would previously have been carried.

FUEL DUMP
In case an emergency return to base is needed or the pilot has a mission requirement, the fuel dump allows the aircraft to make rapid fuel reductions as opposed to needing to jettison stores.

CHIEF TEST PILOT MARK BOWMAN BAE SYSTEMS INTERVIEW

Mark Bowman is one of the Eurofighter Typhoon's most experienced and knowledgeable Test and Development Pilots. As well as having extensive military experience flying a number of platforms, Mark has developed close relationships with many of the pilots who are in the Armed Forces of Eurofighter's customer-base. Here he talks exclusively to Eurofighter WORLD about how the latest iteration of this world-class aircraft is likely to measure-up in an increasing demanding air warfare environment.

From the pilot's perspective, what do you think the significance is of us having this new package of capabilities in the Eurofighter?

"Clearly from the pilot's perspective he will essentially have entered a new era in terms of capability and flexibility - and also in terms of the persistence of the airframe. And from a war-fighting context, it makes sure that the aircraft will sit at the leading and cutting edge of capability that can be fielded against any other potential adversaries out there. It really does mean that we are hitting a pinnacle in terms of what we can try and ring out of the aircraft and airframe.

"At the same time though, I think it is fair to say that, even with things like conformal fuel tanks and E-Scan, all of which are absolutely pivotal, it means we have a platform that is a springboard to where we want to take the aircraft in the future. We want this aircraft to remain relevant, and more plans are in place now to look at how we do this through things like an enhanced human/machine interface and in protecting the aircraft against future changes in technology."

Where will the aircraft sit in terms with its relationship with so-called '5th generation' aircraft?

"People clearly like to put labels on things. But if you look at what 5th generation means, it talks about sensor performance and the distribution of these sensors – in that context that's exactly what we are doing through things like the enhanced DASS and the E-Scan. Ultimately it's what the pilot can achieve, and what the aircraft technology can achieve in maintaining a combat and capability advantage."

How will history see platforms like the F-35 in this context – for example against the claims around the value of stealth?

"If we look at stealth, if you look at where some of the current platforms are going they have decreased the overall relevance of stealth in the RF environment to the point where it is being mitigated by existing and developing technologies. So, at the end of the day, someone will have to answer over the cost of ownership of developing some of the stealth technologies. Most probably other investments, such as improvements in infra-red detection devices and other techniques will reduce the overall relevance of stealth. "That's not to say, of course, that a lot of aircraft aren't designed with different facets. F-35 has a high degree of relevance and that will be developed over its life. The important thing is that the Eurofighter Typhoon is being developed on a par with that aircraft and will also remain complimentary to the battlespace."

Interoperability then – what can you say about that – how well does Eurofighter fit into armed forces' requirements in terms of having a flexible asset?

"Eurofighter is a worldwide capable aircraft – and being capable worldwide requires a significant degree of interoperability. I know many people are already aware of the interoperability capability with the US, but the adaptability of its' sensors and its' sensor-fusion capability is obviously 'right there' for all customers and new potential customers of the aircraft. "Interoperability with other assets, whether they be other aircraft, or whether it is between sea and land, is pretty much getting to the heart of what the Eurofighter Typhoon mantra is all about. If you look, for example, at the limitations that the US are looking at with the F-22 aircraft at the moment, which can only field intra-aircraft or intra-flight interoperability, then they too are recognising those limitations. From the outset, Eurofighter has looked at adapting into wider networks and that obviously has been developed well and will remain vitally relevant to what we need to do worldwide."

So why then, speaking as a Chief Test Pilot, do you think the aircraft has found itself in such a good place?

"Well, I think from where I sit, which is very much looking at the cockpit and, to some degree outside it as well, you have to go back to the foresight of the designers and the clever engineers of most probably 10 or 15 years ago and also the current set of visionaries over what has been achieved and where the aircraft can be taken in the future."

"For me there is clearly some satisfaction in that we have some of the best engineering brains on the planet and we have customers who have a very clear appreciation of where their requirements are and what they want this aircraft to do. We accept, of course that the aircraft is still very much in its adolescence now, and even with a Tranche 3 aircraft we can expect the platform to be around for another 30 or 40 years or so and therefore we have to build-in adaption to emerging future capabilities. Our focus remains on maintaining clear combat advantage into the future."

Do you think the Eurofighter has been misunderstood by those not right inside the programme or who are involved as customers?

"I don't think we have a difficult message or problem. That's not to say that there haven't been issues with timeliness or maturity - but take a look at any of the other major programmes that are also suffering from delays and funding issues and you see a similar story. For me, the important thing is we have the confidence that we can retain our advantage and we know we have something that can be deployed today – and not in five years time or so which is where some of the other platforms are."

What about cost of ownership and reliability?

"Yes, some of the figures coming out of Libya for example indicate that we are at the top end of 98 or 99 per cent availability – however looking further ahead, I don't think we can sit back on our laurels. Growth and sustainability long term will come from the important export contracts that are currently out there to be won and through our ability to adapt to the emerging technologies that are coming along the pipe..."

OK, looking at a mission - how will the CFT's, the E-Scan system, Meteor, the Enhanced DASS capabilities and all the new items coming on stream help?

"If we take them from the top. If we take conformal fuel tanks, we have greater persistence with no reduction in real airframe performance. It will enable us to remain on station for longer and go further and also to carry additional loads.

"E-scan radar will help us adapt to the environment of doing simultaneous air to surface and air to air activity – again with enhanced performance."

"And, if you take DASS, then smarter technology means enhanced survivability, and with new weapons like Meteor, the aircraft will have greater reach and potency."

"As a package, mission wise, you stick with multi-role but in each of those areas Eurofighter Typhoon is going to be the potent and sustainable capability that everyone is expecting."

"There is no doubt that the more available tools you have in your toolbox then the more available jobs you can go and service. You can never have enough – but 13 hardpoints which can be mixed, is a very good number."

What would you say in summary then?

"Eurofighter has always brought a smile to my face. I am incredibly optimistic about where this aircraft is going now – and also the plans for the future that I hope very much to be involved in."

And your message to potential customers?

"I would always be proud to demonstrate how outstanding the aircraft's current capabilities are and show the true commitment and focus for the future potential of this remarkable 21st century war fighting platform."

TRANCHE 3 ENGINE GROUND RUNS COMPLETED

BS116, the very first Tranche 3 Typhoon, has successfully completed engine ground runs in our de-tuner facility at Warton in the United Kingdom.

The Tranche 3 jet offers a number of provisions that future proof the aircraft and will allow it to take on additional capability in the future including e-scan radar, conformal fuel tanks and a high speed data network.

THE ENGINE GROUND RUNS WERE CARRIED OUT IN 3 DISTINCT PHASES:

➔ GREEN SCREENS

Involving a final check of the airframe for foreign object debris (FOD) using a wire mesh screen attached directly to the front of the engine– you can guess what colour the mesh is. The engines are then started up and any FOD that has not been found in the production process, through manual and X-ray searches, is sucked towards the engine and caught on the green screen. It's a testament to the good work carried out in Typhoon final assembly that usually nothing at all is found during this process.

➔ INSTALLATION RUNS

Carried out by the on-site Rolls Royce representative, each engine is operated individually before both are fired up together and run through the full performance range all the way up to maximum re-heat. These are the final checks and sign-off to ensure the engines meet all of the performance and design criteria.

➔ STAGE Cs

Once the engines have been certified as fully serviceable, we test the way the engine interfaces with all of the aircraft systems. We check the environmental control system, that's cooling for the avionic equipment and also for the pilot, the fuel system to make sure the engine receives fuel in the correct way, life support to make sure the pilot's oxygen generation system works, the electrical power generation to ensure it's working correctly and also the hydraulic system that supplies the flying control system.

Engine ground runs are the last stage of testing before the aircraft makes its first flight which is currently on target to take place before the year end.

TOP BIRD FOR TOP GUNS

At an airfield in Lancashire, England, in this issue we look at the peregrine falcon and how this bird, considered to be one of the most successful birds of prey in the world has inspired the world of aviation.

For years engineers have recognised that when they hit a problem, nature has probably encountered and resolved that same issue years before. It's a sensible place to start looking for a solution.

The peregrine falcons hooked bill, powerful wings, large feet and sharp talons all contribute to it being the fastest bird in the world so it's no surprise that it has inspired developments in aviation and technology for years.

Take the solution to managing airflow in and around the jet engine – a repetition from nature. The air pressure from a 200mph dive on its prey could damage the bird's lungs if it wasn't for the small cone shaped bones within its nostrils (called baffles) which guide the powerful airflow away from the nostrils enabling the bird to breathe more easily while diving. A similar cone design was devised to tackle the same issue in the jet engine.

Mark Bowman, Typhoon test pilot stands by the old adage 'If it looks good it probably is good'. A look at the Typhoon and the falcon proves it. Both come packed with aerodynamic prowess and some serious attack capabilities built in.

With uncompromising speed and agility the Peregrine Falcon and the Typhoon aircraft have a few things in common from incredible eyesight to some top rating speeds.

To this day the peregrine falcon plays an important part in the development of aircraft. No less than in a role that sees the bird protecting pilot and plane. At the BAE Systems airfield in Warton, falcons are used on a daily basis to scare birds from the airfield and reduce the risk of bird strike. Improving flight safety to support the development of the Eurofighter Typhoon aircraft.

(see backcover)

MEET THE MAN AT THE SHARP END...

If you want to really understand an aeroplane, then you need to talk to someone who's been at the sharp end. Someone who knows what makes the aircraft tick. Someone who can wring the absolute best from it. Someone who can give you a real insight into its full range of capabilities.

Ideally that person will have had frontline experience. They will have helped develop the aircraft from a technical point of view. They will have seen the deployment of those developments on exercise and on operational deployment.

Allow us to introduce you to a man who has all of this, and more, and who until very recently was a serving UK Royal Air Force Squadron Leader - Paul Smith.

Eurofighter WORLD is proud to announce that Squadron Leader Smith recently joined the Eurofighter family to take up residence as Manager of Capability Promotion and Business Winning. It's a real coup for the business and, as Paul shares his experience, it will provide fantastic opportunities for those who want to understand what the Eurofighter Typhoon is all about to talk first-hand with Paul and glean what they can from his razor-sharp mind.

Paul has known the Eurofighter intimately since it was first introduced to the RAF. He was one of three Flight Commanders on 3 Squadron, the first frontline Eurofighter Typhoon Squadron. He has flown the Eurofighter on many major Exercises and was involved with the first multi-role Eurofighter Typhoon Training Deployment in May 2008 at the Nellis Air Force Base in Nevada – where one of his jobs was to 'drop a bomb on America'.

His work has also given him extensive experience of Middle Eastern operations – including as an advisor to the Iraqi Air Force. More recently he managed the RAF's Operational Flight Test Programme working in 17 Squadron – the Test and Evaluation Squadron where the focus was Radar and Defensive Aids development work.

He told Eurofighter WORLD: "My work has two main thrusts. Firstly supporting our Export area where I can bring to bear my knowledge and experience – and secondly working closely with our Capability Team where I can help prioritise capability development and make sure the jet is kept moving forward with new capability introduction."

He added: "What all this means is, that when I speak to other fighter jet pilots I can tell them what areas the Eurofighter Typhoon really excels in, what areas we are further developing, and what the potential for the future is."

Look out for *Squadron Leader Paul Smith – he could be coming to an Air Show near you!

EUROFIGHTER FOCUS
ON MIDDLE EAST AND GULF REGION

In this issue of Eurofighter WORLD things are hotting up. Our focus is on the Middle East and the Gulf Region. With aircraft and personnel actively deployed in the Region, and with significant and growing customer interest in Eurofighter Typhoon, we hope to give you a flavour of our involvement and of the commitment to a part of the world that is seldom out of the headlines.

NIGEL DAVEY
INTERVIEW

Position now:
Director, Combat Air Support,
Military Air & Information – BAE Systems

Position in Middle East:
Vice President, Operations, BAE Systems Saudi Arabia

Age: 52

Marital Status:
Married with two grown-up children

Nigel, what took you to the Middle East?

"The role I went out to do initially in Saudi Arabia was focussed on all support activities for the Royal Saudi Air Force (excluding Typhoon) and Royal Saudi Naval Forces. Before joining the Saudi Arabia business, one of my previous roles was Project Director for Harrier where we were at the forefront of customer engagement in the transformation journey, as we focussed more on support solutions – looking at both availability and upgrades.

"The experience was very relevant. It is exactly what our customers in the Middle East are looking at."

Nigel explained that his initial role was primarily based around developing 'single-point accountability'.

"One of the things that our Export customers are not interested in is our internal organisation.

"I think where we have that single point of contact, we have effectively, in Eurofighter's case, got the power of four behind us. You get the views and the experience. We are in the business of using our combined energy to bring to bear our breadth of experience. We have four operational air forces at the core which are all different and which all bring different experiences and this enables us to offer the benefit of that to our wider customer base.

"The diversity that we have as a consortium puts us in a great position to understand diversity within our customer base. Our customers behave differently and we are able to use our experience of communications, stakeholder management, working across international boundaries to our advantage."

So how did you adapt to life in Saudi Arabia and working alongside the Customer?

"The thing that probably struck me most about actually moving to the Middle East was that having visited a number of times - around 20 trips in 13 months - this in no way prepared me for actually living in the Kingdom of Saudi Arabia. There is a common feeling that visiting a place will give you a feeling of what it is like but that is simply not the case.

"We need to value those who are prepared to go and spend a couple of years living in another country. Within the consortium we have got examples of large numbers of people who go and live and work in other parts of the world and who support our customers and our products.

"We have significant numbers of people working on customers bases who are prepared to make that commitment. We have that experience within the consortium. We have the machinery in place to make this happen and we can take this forward with other customers."

So what can we offer by making this commitment?

"I think the fundamental thing is the difference between treating a customer as somebody to whom we export, and actually having a level of intimacy with them. It is particularly important when we are operating alongside other worldwide cultures – having a presence there gives us a real understanding of how they want to use their aeroplanes, how they want to be supported, what levels of help and support they need – that can't always be done at the other end of a telephone or via an email.

"I think when we do this well, we are world-class. There is no doubt about it – people recognise the support they get from us. The challenge is to work at getting this right everywhere."

"For me, it is the shifting of the focus to not just sell the aircraft, which is obviously important, but it is understanding what are the expectations of the customer over the life of the product. Some will be quite straightforward, like the operating environment. We also need to understand what the changing expectations will be – after all we are talking about changing operating environments and this, of course, will affect capability requirements. Our real opportunity is to really inject pace into those things – and we do that by working with our customers and understanding, early on, when they need or expect something. It is then a question of having the boldness within the organisation to respond quickly and effectively."

Does the evolution of our products in those different environments directly reflect the learning and understanding we have gained from these enhanced levels of customer intimacy?

"I think it does. I think the offerings that we have made in support are more complex than those we offered traditionally. I think we have got a much better level of understanding of the customer now. This is what keeps us in the game."

Can the customer get more out of our products and services through this approach?

"Certainly when we are inserting new capability, we have to make sure we have the logistics support, the training, the information, the technical publications – all of those things in place – and working alongside the customer and applying what could be called 'partnership behaviours' makes a significant difference to the outcome.

"I have seen evidence of where a capability has been acquired, it did exactly what it was designed to do, but the customer wanted it to do something different. What is needed is flexibility within the organisation to delight the customer by working through practical solutions with them.

"What I think doesn't work is to visit a customer on say a monthly basis for a review, and then not speak to them again until the following month. I don't see that as a good working relationship. We need to be able to have people on the ground who are having a regular dialogue at a time that it is appropriate and needed. We find our customers want a number of things. They want access – they want to speak to someone face to face. My office in Riyadh was next door to the office of my principle customer. I found this very beneficial to understand what was needed, why it was important and how we could help deliver it.

"They also want accountability, they don't just want a figurehead, they want someone who can say 'OK, I understand your issue, I will go and get it fixed.' They also, therefore want responsiveness – so having found someone who is accountable, they want someone who can deliver.

What was one of your key learning points?

"I think the single biggest thing I returned with is that I spend probably most of my time now thinking about things from a customer perspective."

Has this changed the way you work?

"Yes I think it has. It is one thing to have a relationship with a customer – it is another to look at what we are doing from a customer perspective. If you start with the view that you are on the front line with your back to the aeroplane and you look back – and everything that is being done is to support that aircraft getting into the air then you start to look at things from a different perspective."

What advice would you offer to those making this level of commitment?

"A couple of things. I have absolutely no regrets about spending three and half years out there, in fact in many ways I wish I'd made the commitment earlier. I think the best way for someone to understand something like this is to experience it for themselves. At BAE Systems we have always said we support our people to achieve this were possible. I would stand by that – people should feel that this is a really positive thing – soaking up all that experience – particularly if it's somewhere in a country with a different culture.

"The amount I have learned about Middle Eastern culture has been very enriching. I would encourage people to do it early in their career as it gives you a different outlook personally and professionally. From a business and personal perspective it is great.

"We provide goods and services to support our armed forces. That's what we do. And so seeing exactly what they do and living alongside them, is a very valuable experience. In my view there are only positives. Actually going and living somewhere will change people's mindsets – you can't buy that, you can't read it, you can't get it off the internet."

Does this make you feel proud in the way we support our customers?

"We are incredibly proud about our ability to support our armed forces. That's what drives us. One of the proudest moments I had in the Kingdom of Saudi Arabia was attending the Graduation Ceremony for the cadets in Riyadh – just being part of the machinery made it very special."

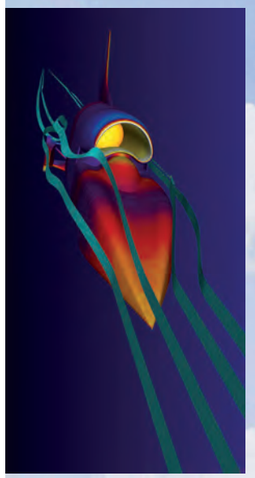
What is your feeling about the future of Eurofighter Typhoon in the Middle East?

"I think it could be phenomenal. I think there are lots of opportunities. What the air forces from those regions will want to be assured of is that the product will continue to have the capabilities they need in an evolving environment. If we can meet those challenges and provide efficient support I am sure customers will want to continue working with us."

Exercise Green Flag 2013 (Photo by Geoffrey Lee)

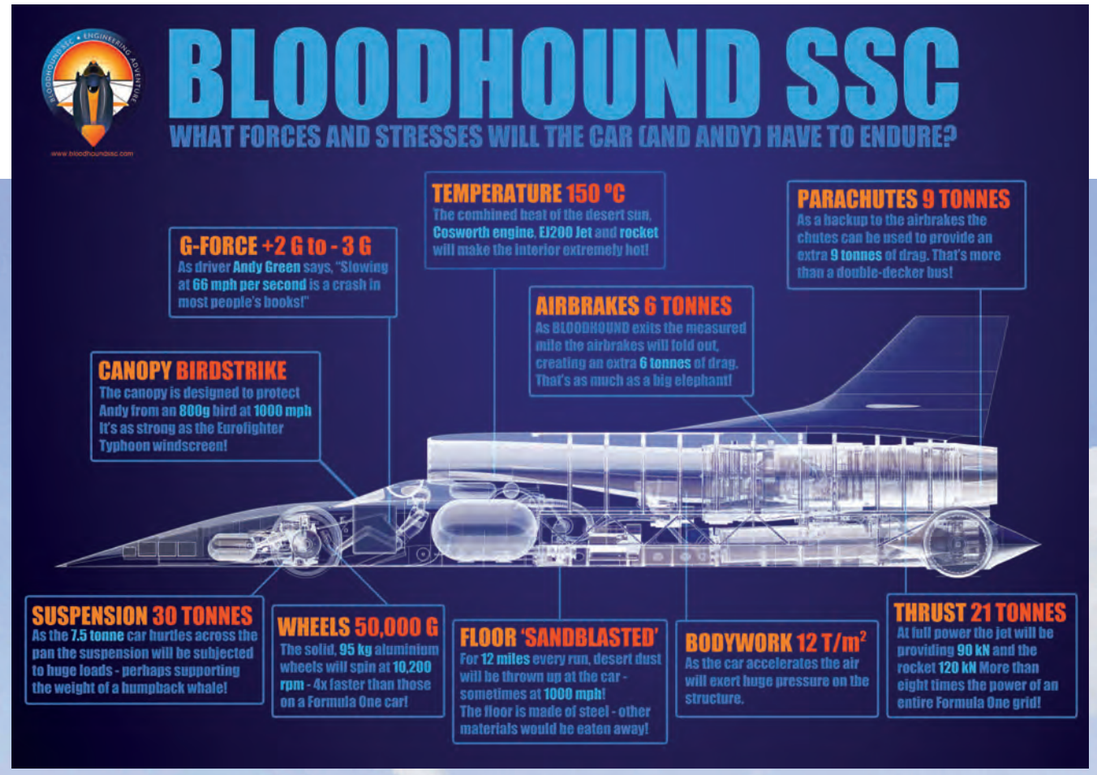
THE BLOODHOUND STORY...

THE STORY OF A REMARKABLE SUPERSONIC CAR



Bloodhound relies heavily on simulation work

Engineers work with the finest materials that Europe has to offer



The story of this remarkable SuperSonic Car began on 23rd October 2008 when in the UK, at the National Science Museum Lord Drayson, Minister of State for Science and Innovation, launched The BLOODHOUND Project, a three-year mission led by Richard Noble OBE to create a land speed record car capable of achieving 1,000mph.

It will be driven by Wing Commander Andy Green (see special interview) who set the current record of 763mph (1228kmh) at the controls of ThrustSSC on 15th October 1997. If the new vehicle achieves its target of 1,000mph (Mach 1.4) it will mark the greatest incremental increase in the history of the World Land Speed Record. It will also exceed the low altitude speed record for aircraft (c.994mph).

Building a car quicker than a fighter jet is not, however, the primary goal of the project. Rather, it is to inspire future generations to take up careers in science, technology, engineering and mathematics by showcasing these subjects in the most exciting way possible.

The BLOODHOUND SSC will be the catalyst for a raft of cutting-edge research in fields such as aerodynamics, computational fluid dynamics, materials technology, composite manufacturing and sustainable high-tech engineering.

- The 12.8m long, 6,422kg (fuelled), jet and rocket-powered vehicle will be more advanced than most spacecraft and faster than a bullet fired from a handgun.
- Its 900mm diameter wheels will spin at over 10,000rpm, generating 50,000 radial g at the rim.
- The car will accelerate from 0 – 1,050mph in 40 seconds and at V-max (maximum velocity), the pressure of air bearing down on its carbon fibre and titanium bodywork will exceed twelve tonnes per square metre.
- At this speed, Andy Green will be covering a distance equivalent to over four football pitches every second, or 50m in the blink of an eye.

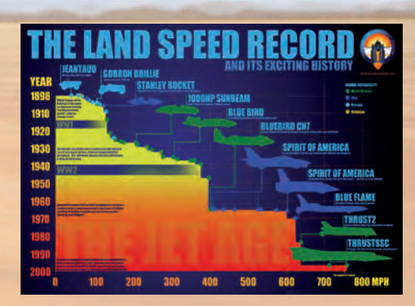
The prime objective of The BLOODHOUND Project is to create an unprecedented education and engagement programme, led by a dedicated team of teachers and education specialists.

The BLOODHOUND Project is a private venture. Government is part-funding the three year education programme but not the build and running costs of the car. These costs will be covered by sponsorships.

The BLOODHOUND Project is an iconic adventure that will push technology to its limit.

Lord Drayson said: "Breaking world land speed records is no longer about strapping an engine onto a buggy and pointing it at the horizon. Today, the application of new and exciting science and technology is the only way to achieve such results. This project is not just about the bragging rights to the world land speed record. This will result in tangible scientific developments that will benefit all, for example in areas such as fuel efficiency and safety and which could be used in the cars we drive in the future."

Richard Noble OBE, Project Director said: "There has never been anything like BLOODHOUND SSC before. It is undoubtedly the most stimulating and challenging programme I've ever been involved with. The next three years are going to be tough, testing and damned exciting!" →



FIGHTER PILOT RAF
ANDY GREEN
WORLD LAND SPEED RECORD HOLDER
INTERVIEW

In this issue Eurofighter WORLD is proud to bring you an exclusive interview with Wing Commander Andy Green – the fastest man on four wheels on the planet – an RAF Wing Commander and Fast Jet pilot – and co-incidentally – the holder of the World Land Speed Record. Andy travelled to Dubai this Autumn joining Eurofighter, BAE Systems and Eurojet to present at a special Reception at the Dubai Air Show. Here's what he told us just before he went.

How did you get involved in the Bloodhound Project?

I became involved in the Bloodhound Project as a consultant in 2007. Richard Noble asked me for some advice on a design project they were doing and, primarily, how they would go about selecting a driver for the new car.

I produced some options for them about how they would go about objective testing, and looking at control ability and learning ability – and the one which is most difficult to test - the ability to work within a design and development team. It is a personal skill which is difficult to test.

How do your skillsets deploy across the two areas of your work – one in the RAF and the other with Bloodhound?

At a strategic level, we are able to use the Bloodhound SSC programme to try and inspire a generation of young scientists and engineers, and would-be scientists and engineers, by getting them excited about science and technology. It is a direct and dramatic jump-start tactic that is going incredibly well.

On a tactical level, I bring the skills needed to drive a jet-fighter and the skills to support the planning, safety and management decisions, needed for such a project. I also bring the skills needed to be able to operate in a high speed, high acceleration, high-g, high-noise and high pressure environment like a jet fighter - or indeed a jet car. I would struggle to imagine anyone without that kind of background being able to jump in, as a part of a design and development team, and provide that driver expertise.

What criteria were used in selecting the right jet engine for Bloodhound?

We looked at what was available on the market in terms of high-power, low bulk and low mass, and clearly we also wanted something that would have a reasonable chance of getting up to a speed which is outside the operating envelope of any jet-engine in history – we are trying to go faster than any jet-fighter has ever been.

When we looked at all of that, the clear winner, if we could get hold of one, was the EJ200.

How does piloting a Eurofighter compare with piloting Bloodhound?

They are not directly related, but the skills needed, from the planning and the risk assessment, through to the second by fraction of a second decisions about whether things are looking right, or whether you need to do something about it - those background skills in these two environments are hugely applicable.

I have huge admiration for anyone who would even consider attempting a World Record without that kind of background, because, without the years of experience that a jet-fighter pilot has, the sensations and challenges must be completely overwhelming.

Is this a reference to Richard Noble then Wing Commander?

It's to everybody. The last fighter pilot to attempt a World Land Speed Record was Henry Segrave in 1929 – and he flew fighters when they were still held together by string.

I have the range of skills needed and the training as a fighter pilot to analyse the instruments and the performance characteristics and feel comfortable. But for someone like Richard, to do this from scratch, to learn the basics of driving a jet car so that he could keep it straight and develop the car, is an astonishing feat.

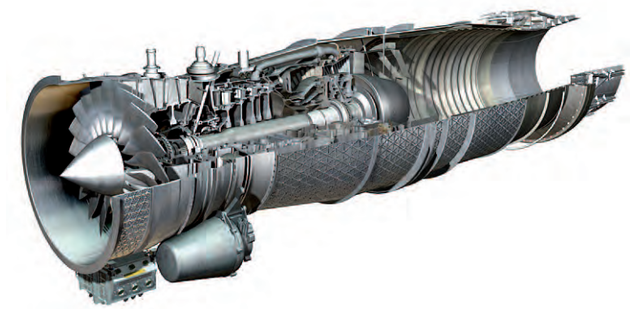
How do you cope with nerves?

It comes back to my background. When you jump into a jet fighter and work with a bunch of other aircraft on something like Red Flag, for example, where days of work have gone into planning your particular sortie, and you have travelled a third of the way around the world to get there - you know what – there's pressure there. That's the day job. It is exactly the same mental approach when stepping into the car. Being under pressure and having that stimulation does get the best out of you.

Nobody gets through fast-jet flying training and onto the frontline in the Royal Air Force without being able to control their nerves and adrenalin and get the very best out of themselves. It is not something you can do with the mindset of sitting at home playing a video game.

WHAT YOU SHOULD KNOW:

- The engine needs a huge range of information from the Eurofighter Typhoon aircraft, including air speed, temperature and pressure, as well as the pilot's control inputs. While you're reading this, the next time you decide to move the computer mouse, it will take about 220 milliseconds for the nerve signals to reach your hand. In that time, the EJ200 will receive 20 messages, each containing over 30 pieces of information for the engine.
- Early on in the life of the Project, the Bloodhound Team were loaned three EJ200 development engines that had come to the end of their flight-test lives and were destined for museums. However, the engines have just enough hours left (aircraft component life is measured in hours) for them to run up and down a desert racetrack.
- The Bloodhound Team are the first people ever to put the EJ200 in land vehicle.
- 5.500 schools are involved in the Bloodhound Project in the UK .
- Bloodhound has had 10 million hits on YouTube already – and it is still 2 years from when the car will make the record attempt.



What do you think the single most surprising thing is about Bloodhound that people might not realise?

It is very difficult to explain to people what 1600 kmh actually looks like. You are covering a football pitch in two tenths of a second. Imagine wherever you are reading this article that you pick a point 12 miles away. In Bloodhound, in two minutes from a standing start, you will be there.

How does acceleration manifest itself in the car as you travel that distance?

If you compare it with a state of the art world-class aeroplane like Typhoon, which is a 9g aeroplane, the car only does about two or three g. It doesn't seem much. But the point is, Bloodhound can sustain over 1g for the whole of the period of acceleration. If you sustain 1g for one minute you will be doing over 1,000mph and, by definition, no-one in history has sustained that amount of acceleration in a car for that long.

Bloodhound, when it is slowing down, will hit 3g on at least a couple of occasions and, in fact, depending on how we use the air brakes it may actually sustain 3g for a period of time.

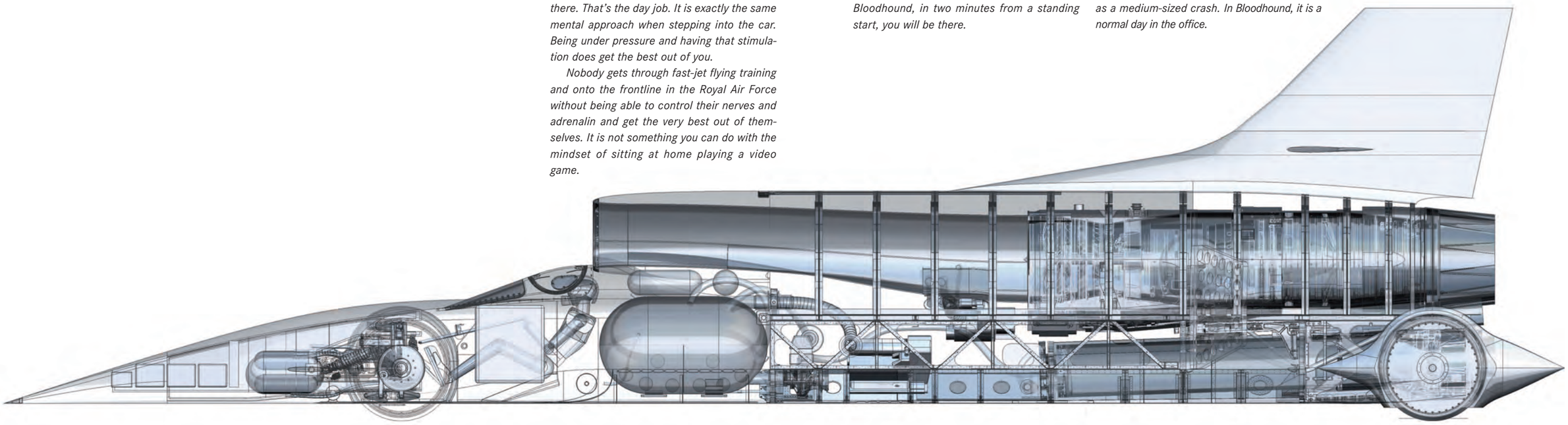
Think of it this way. 3g is the equivalent of travelling at 60mph and coming to a standstill in one second. 3g is effectively the same force as a medium-sized crash. In Bloodhound, it is a normal day in the office.

What will be your key concerns when you make that record run and when will you do it?

There are so many. In 2015 we will be taking the car to around 1300kmph and in 2016 we will then be taking it up to 1600kmph. It has been deliberately designed as a two-stage process, with some downtime for development and improvements, because there are bound to be some needed.

When we actually do the 1600kmph run, we will know by then that the car is staying on the ground, as we will have done the step-by-step testing. So that won't really be a concern. The structural loads when we hit peak speed are interesting.

We are talking about 10,000 rpm for the wheels which is the equivalent of 50,000 radial g at the wheel rim. That's a high load. Now, we have quite a big safety margin even within that. We have had nearly five tons of aluminium specially smelted for the wheels, with 18 →



discs forged by the best forging house in the world – Otto Fuchs in Germany. Castle Precision Engineering, in Glasgow, who more usually make engine discs for Rolls-Royce, are leading a consortium of other companies to build the wheels to aerospace standards – so we have a high degree of confidence in them.

The fact is that every single bit of the engineering needs to be nailed down, which is just what we're doing. The other big thing is slowing the car down again. While we are accelerating towards the timing lights, towards the measured mile in the middle of the track, more acceleration is always optional. If something isn't quite right I can always slow down – but as soon as we come out of the timing lights, I now have about 9km ahead of me and slowing down just became compulsory. Slowing the car down is at least as difficult as making it go fast.

Is this the most difficult thing for you then?

Well, in some ways, the natural state of the car is at those high speeds, so all of the engineering goes into getting it up to those speeds and controlling it, but the key priority is to make it stay on the ground – in one sense that's the only major safety requirement – if you can keep it shiny side up there is nothing to crash into. Unlike an aeroplane, you don't have to control it and land it on the surface, because you are already on the runway. You could say this is a very high speed abort in aeroplane terms.

The challenging bit, just like in an aeroplane, is that you have got to stop before the end of the runway.

The runway, in this case will be 20 km long and has been hand-cleared by over 300 people. It will be the best prepared racetrack in the history of motor racing – but we still have to stop and that will take some high energy devices such as air brakes and parachutes.

Is this where the main adrenaline rush is for you?

No. To be honest, most of my work is about acceleration and control, and getting it up there. The stopping of the car is much more a risk-management and design exercise. The design specification of the air brakes, for example, is to stop the car by themselves from 1600kmph. But there is also a parachute that will stop the car and there is a back up parachute to that. So we have three independent systems which, in themselves, are electrically fired. Each one from a different battery. And, if the electrics go down, I actually have cable back-ups going nine-and-half metres to the back of the car which will initiate the deployment of each parachute.

If you do all these things then you have a very reliable system. It should be as reliable, for example, as you could possibly make an aeroplane.

Do we need the car to back me up – in other words, to stop automatically – if something happened to me? To build in a system like this would be very difficult, and there is no legal requirement for it. I have a full fast jet aircrew medical. So in terms of perhaps a 10-to-the-minus-8 risk of collapse in the cockpit, it is well within the 'normal' minimum risks that we accept in other activities, like flying.

What message will this project send to the rest of the world?

First, this is not just great British engineering, but actually great European engineering.

The core of the car is the EJ200. I mentioned the wheels. There is a huge amount of British and European engineering being displayed to the highest world-beating standards on a global stage. It is a great opportunity to promote great engineering.

Secondly, we are able to share pretty much everything.

If you go into the Bloodhound website, you can download all of the CAD drawings of the car. You can see, week by week, how we are solving the technology challenges. And, when the car starts running, we are going to run live data and live video from the car. People will be able to watch, for example, the EJ200 doing its job, driving the car outside the operating envelope of the Eurofighter.

We're taking all sorts of technology to places it has never been before.

What about the comparison between the Eurofighter and Bloodhound then?

The Eurofighter has 2x90kn of thrust – that's two times nine tons of thrust. Bloodhound has 9 tons of thrust from its EJ200 and 12 tons of thrust from our rocket – only for 20 seconds – but we only need it for 20 seconds.

It would be rubbish in an aeroplane – a 20 second burn and it's all over. But in Bloodhound, for the 20 seconds we need it, it's perfect, and for that time we have over 15 per cent more power than Eurofighter.

And think about this. Bloodhound weighs half as much as Eurofighter does on take-off – and has less drag. People are amazed at how quickly Eurofighter can get down the runway and off the ground - but Bloodhound would leave it standing. We are using similar technology in a package half the size.

What do your family think of this?

I met my wife just after I got involved in this project. So once we decided to get married we needed to have a serious chat about whether I was going to commit to it. She said: 'absolutely, you've got to, this is a brilliant project.'

We have to ask this! How do you, as a pilot and Wing Commander, rate Eurofighter?

I was lucky enough to be the Chief of Staff out in Southern Italy, during Op ELLAMY, looking after the RAF's air assets across the Mediterranean. During the whole operation, the performance, reliability and capability of the Eurofighter platform was just staggering.

The best weapons platform in theatre was the Tornado. I know it's a slightly shocking thing to say in this context, but bear with me. The Tornado has been developed to that level for over 20 years .In just a few years' time, the Typhoon will have all that capability, added to its next generation platform capability to pop up to 40,000ft, super cruise to the target, and carry out it's own air defence with radar and datalinks. The Typhoon brings 360 degree protection to whatever formation it is in and that's why the Tornados always wanted to go to war with the Typhoon on the wing. It had so much capability, and when we've completed the integration of the swing-role capability, it will be absolutely amazing.

The engineering performance was also legendary. In over 3000 hours of combat flying by the Eurofighter, there were no engine changes. Unheard of reliability. Just amazing.

Wing Commander Green –
World Land Speed Record Holder – thank you very much.

EYE OF THE TIGER...
THE NEW BAVARIAN TIGER


Little Tiger...

Eurofighter WORLD recently travelled to Neuburg in Southern Germany to meet with the new 'Bavarian Tigers' and find a little more about the induction of the Eurofighter Typhoon into the Tiger Association's 'hall of fame'.

When Sylvester Stallone commissioned American rock band Survivor to write a title song for Rocky III in 1982 he had no idea what he was about to unleash. 'The Eye of the Tiger' stormed the charts world-wide – its catchy riffs, powerful lyrics and anthemic chorus lighting up radio airwaves, car stereos and discotheques for months on end. The lyrics, of course, were written with a boxer in mind – but they could just as well have been written for the NATO Tiger Association's latest club members – The Bavarian Tigers:

The NATO Tiger Association began in 1961, a year after two RAF Squadrons (79th and 74) had come together for a chat over a wee dram and a 'meet' which proved highly successful. On the 19th July that year the USAFE (United States Air Force Europe) 79th TFS (Tactical Fighter Squadron) invited No.74 Squadron Royal Air Force and EC 1/12 Squadron of the French Armée de l`air to Woodbridge in England. It was an historic moment. The Association of Tiger Squadrons was born. It was established to improve relationships between individual squadrons within NATO.

Each of the squadrons had a Tigers' head in their squadron crest. The tiger stands as a symbol of strength, speed and hunting prowess. It was decided then and there that future 'meets' would be held annually....

The Association was formed around three simple objectives:

- Improvement of solidarity between NATO members
- The creation and maintenance of team-spirit and camaraderie between the participating members
- The exchange of experiences and cooperation in line with the military goals of NATO

Worldwide there are over 40 squadrons in the Association covering many different countries and many aircraft types.

What makes the Bavarian Tigers special – is that they are first Tiger Association members to introduce the Eurofighter Typhoon into an Annual Meet.

Kommodore Frank Gräfe, who heads Tactical Fighter Wing 74, explained: "We are very proud to have been the first wing that has physically introduced the Eurofighter into the Tigers when we took three aircraft and associated personnel to Norway in June this year for the Annual Meet at the Ørland Main Air Station."

The Kommodore said the Eurofighter was "extremely well received" adding "anyone that can bring a brand new operational fighter aircraft into the Tigers is likely to be made welcome."

What makes the story even more remarkable is the speed with which the Bavarian Tigers acted once it was clear that probationary Membership of the Association was on the cards. "We became Tigers on March 18th this year and within three months we were able to unveil a specially liveried Eurofighter. I flew the first flight in a Tiger Typhoon to Lechfeld – the place where our Tiger tradition came from with 321 Squadron/Jagdbombergeschwader 32 before it was disbanded."

It was Tiger pilot Major Raffael 'Klax' Klaschka who headed the Bavarian Tiger's delegation to their first Tiger Meet in Norway. He and Stephan Kingl, representing the maintenance crews, run the 13-strong Tiger operation in the Fighter Wing. Klax says: "When people saw we were keen during the exercises in Norway they were very happy to get involved with us. Since then we have exchanged many conversations – both by phone and email. It works really well."

Stephan adds: "I think on the maintenance side it will be the same – but it will take time."

So why bother with a Tiger Association at all – especially when there are valuable exercises like Red Flag already well established in the military calendar?

"Both have their value, "says Kommodore Gräfe, "and deployments like Red Flag will always remain at the pinnacle of exercise training, but Tiger Meets are run on a much more flexible squadron to squadron basis and they allow greater interaction between squadrons and give you the opportunity to specify exactly what it is you want to practice."

The Kommodore explained that exercises like Red Flag emerged after it was discovered that, if a pilot survived the first ten missions, then they survived the whole of the war. The exercises were developed to give them that mission experience before they went to war thus dramatically increasing the chances of survival.

"On a Tiger Meet," he said, "you share a lot of information – often on an unofficial basis during several events that take place during those two weeks. The community of the Tigers is something very special and is something very different to a more conventional military exercise. It is also cost-effective because it is in Europe without an overseas-deployment."

Next year there will be a NATO Tigers Association Meet in Germany. You can be sure the Bavarian Tigers will be ready for it – and that Eurofighter WORLD will be ready to bring you the action...

LUFTWAFFE MUSEUM
OFFERS INSIGHT INTO EVOLUTION OF THE GERMAN AIR FORCE

Stephan Kingl

Almost hidden in the corner of a German airfield called the Fliegerhorst near the city of Neuburg, just a few hundred metres away from where Eurofighter Typhoons stand sentry on Quick Reaction Alert duties, there is a discrete museum.

You wouldn't know it was a museum to look at it – it's entrance just looks like any other entrance door to any other hangar. But inside is a treasure trove of German aviation history taking visitors on a journey from the landing of the first military aircraft to land in Neuburg in 1912, to the retirement from service of the awesome Phantom F-4 before the Eurofighter Typhoon became the new backbone of the Luftwaffe.

Stephan Kingl, a Supervisor who looks after the first-line maintenance for Fighter Wing 74 at Neuburg, recently took time out, along with Ralf Schmitt (Oberstabsfeldwebel) to give Eurofighter WORLD a tour of the museum and to explain its historic significance.

He started by showing us images and artefacts from just over a century ago when the first aircraft, an EULER Doppeldecker, landed at the airfield and thus began the military aviation history of the region. "This was the first aircraft which was able to carry a machine gun," says Stephan. "We recently recreated that landing with an UDET Flamingo in 2012 and held a special party on the airfield of Neuburg."

top: F-86 Sabre-Dog
bottom: F-104 Starfighter

Phantom F-4

You can also see the Luftwaffe's unique journey into and through the Second World War with relics and aircraft parts from a range of historic machines including the Heinkel 111 and the Messerschmitt 262 – found with its 30mm gun in a field close to a nearby village. The 262, of course, claims to be the first jet powered aircraft in service in the world – but it was too late to play any significant role in that War where the best-known aircraft from the German Air Force was undoubtedly the Messerschmitt 109.

Perhaps a surprise to some is the quantity of American artefacts in the museum including the F-86 Sabre-Dog and the infamous F-104 Starfighter. The Starfighter still draws gasps when visitors see it in the museum with its rocket-like fuselage and razor sharp stubs for wings. It's a powerful example of the limitations of having an aircraft being designed to meet a specific and very tightly confined brief meaning that it flounders when asked to demonstrate any kind of versatility.

Stephan reminded Eurofighter WORLD, that, in the German Air Force, the losses of Starfighter aircraft were so heavy that the aircraft quickly earned the name Witwenmacher ("Widow maker"). To its credit, the aircraft was the first military aircraft built which could sustain a speed of Mach 2 – but this was little use if it was a speed achieved in a plane that was almost impossibly difficult to land safely. Today, of course, the Eurofighter Typhoon aircraft just a few yards away from the Museum in Neuburg routinely fly at speeds in excess of Mach 2 and has no such problems and, of course, can deliver a formidable weapons load with very high kinetic effect. How times change.

No visit to the Museum can be completed without an up close and personal look at the massive and imposing Phantom F-4. A much-loved aircraft only recently retired from QRA duties in Germany, the Phantom's sheer size is the thing that takes your breath away. A tandem seat cockpit and underslung defensive aids again underlines how the Eurofighter has progressed the art of military aviation – and a sit inside the cockpit takes you back to a time when mechanical dials and analogue instrumentation made huge demands on the pilot and weapons system officer. It's a stark contrast to the clean screened and digitised ergonomically efficient environment of the single seat Eurofighter. "There was one thing though, said Ralf: "In his left hand the pilot had 140,000 horses at his command. Even so, " he added, "while pilots liked the power and stability of the Phantom, they relish the power and performance of Typhoon once they make the transition."

Ralf Schmitt is understandably proud of the fact that the team at Neuburg have built up a Museum from small beginnings, but one which tells a powerful story. He says: "I think it is very important to show our Visitor Groups. We have a lot of Visitor Groups – we have between 150 and 200 groups a year and we can show them here the history of military flying in Neuburg."

Stephan Kingl adds: "They leave having touched an aircraft and having sat in one. They can then begin to understand a little more about what they must have been like to fly in. Here in the Museum you can now see the link to the present day and the future and the way which the single seat and twin seat Eurofighter aircraft now help secure the safety of Southern Germany. It closes the loop. You can understand the future better if you understand the past."

EUROFIGHTER TYPHOON
AMATEUR PHOTO COMPETITION

Eurofighter WORLD can exclusively reveal in this issue the shortlist for the 3rd Eurofighter Typhoon Amateur photo competition.

The competition opened for business in May. Since then there have been over 100 entries and the standard has been impressively high.

Thrilled by seeing the worldwide Typhoon photographer community growing day by day, Geoffrey Lee, Eurofighter's leading photographer and panel expert said: "I am proud to be a part of the judging panel. Every year there are exceptional photos capturing a unique Eurofighter Typhoon moment and highlighting the jet like you have never seen it before."

This year Eurofighter WORLD is proud to give you a sneak preview of the shortlisted photographs in the competition at this stage/so far.

The judging panel, which will include last year's winner Gaz West, will meet at Eurofighter Hallbergmoos to choose the winning photograph. The winner will receive a guided tour of the Eurofighter from a Eurofighter pilot and have their image featured in the 2014 Eurofighter calendar.

The judging panel for the competition will be Geoffrey Lee from Plane Focus Ltd – Eurofighter's leading Typhoon photographer; Andreas Westphal – photo expert and Managing Director of Images Art Design and Theodor Benien, Head of PR & Communications for Eurofighter GmbH.

The winner will be announced during Dubai Air Show on November 20th. Watch out for it and see if it matches your personal winner from our selected shortlist!

Laurie Hilditch

Craig Penrice

Eurofighter WORLD recognises that its readers want access to the best information from the best people with the most relevant experience. This article provides a unique insight into the rationale behind the claims of competency made for the Eurofighter Typhoon. It might just change the way you see this iconic aircraft from this point on. We hope you enjoy it.

"What was needed was an aircraft that was capable of defeating the then emerging reference threat"

THE SECRET BEHIND A GOOD FIGHTER WEAPONS SYSTEM

SPECIAL ARTICLE BY TEST PILOTS

CRAIG PENRICE AND LAURIE HILDITCH

In time-honoured test pilot tradition, lets kick off by being very clear on the terms involved here when we talk about a 'good fighter weapons system'...

Firstly the term Weapons System (WS) does not mean the part of an aircraft which fires or drops the weapons – indeed it is the other way around. It is the combined whole of the air vehicle, with all sensors, weapons and the 'clever black boxes' that glue it all together in a manner that a human operator can employ, that comprise the airborne part of the WS. There are of course very important ground based elements which are also vital parts of the WS, including Mission Planning, Training Aids and Engineering Support; however, today we will consider only the airborne element of the WS.

Secondly - what constitutes 'good'? We would contend that a good fighter WS is one which can deal effectively in peace and war with the full range of tasks allocated to it by the national authorities. In today's world of asymmetric threats and potential conflicts in non-superpower regions where sophisticated and highly lethal threats are deployed, this is a FULL range indeed. The danger for a fighter aircraft is to be conceived and brought into service as a 'point' design – very effective at one task, but compromised in many others. Point strengths can be countered more easily than a balanced suite of capabilities and operational flexibility can be compromised.

Eleven into one *will* go...

The Eurofighter Typhoon, born from a combined operational requirement to replace multiple aging legacy aircraft types, was not conceived as just an airframe with some sensors and weapons attached, but as a coherent Weapons System, where the performance of the whole was to be much greater than the sum of the parts. Way back then, what was wanted was a single platform capable of defeating, by a significant margin, the then emerging reference threat of the Su-27 Flanker (and its likely future derivatives – that we see today as the Super Flanker Su-30/35 series) and one which was also capable of carrying out the myriad of roles of the aircraft it was to replace.

So when the WS that became today's Eurofighter Typhoon was specified, the 4 NATO nation procurement offices wanted balances across all areas. They asked for, and got: a comprehensive suite of sensors with defined performances; high and flexible weapon and store carriage options and agreed levels of reliability, maintainability and safety – and, importantly, they also got single seat operation.

Furthermore, building on the first Tranche 1 standard and the experience gained in the 10 years since it entered service, today's Tranche 2 Eurofighter Typhoon with the Phase 1 Enhancement upgrade delivers superior operational capability across a wide range of roles, even within a single mission, while allowing a reduction in the pilot's workload through increased levels of automatic control and a federated system architecture. High system integrity and safety is ensured through comprehensive redundancy within and between systems and by implementing customer-led rigorous safety analysis processes. In addition, the Eurofighter is achieving a reduction in life cycle costs through higher

standards of testability of the systems and extensive Built In Test (BIT) facilities and a flexible design to facilitate through-life upgrades. This includes standard weapon interfaces at all store stations; mission data and software controlled weapon and system functions and modular systems architecture, reducing hardware / software inter-dependency.

Fundamental also is maintenance of built-in growth provision – now a key differentiator for Eurofighter when in competition with other aircraft.

SO, LET'S BE CLEAR...

The Typhoon was designed, from the outset, as a truly single mission multi-role aircraft.

Whilst the NATO specification for the aircraft and its support systems (aka – the Weapon System) was wide ranging, this article will limit its consideration to the operational capabilities only and not venture into the debate or discussions on the other "ilities" such as supportability, and affordability. The NATO specification (The Turin Agreement) was elegantly simple. It focused clearly on the Weapon System Performance against the threat, founded upon only four basic physical characteristics: a low basic mass; a high installed thrust; a large wing area and a high internal fuel fraction*.

These characteristics had been identified and quantified through extensive operational analysis and parametric trade studies of various design options in tactical scenarios against the reference threat.

The key conclusion from these trade studies and operational analysis was that finding the correct "Balance" of physical characteristics made the winning difference between simply a good design and a great design.

A couple of examples follow to illustrate where finding the correct balance makes a vital difference:

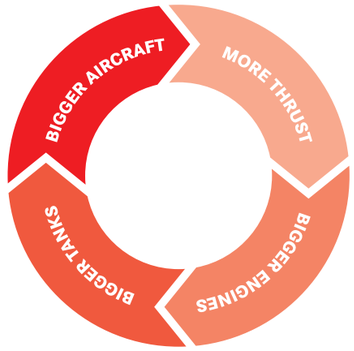
*Editor's note: the fuel fraction denotes the ratio between the weight of the fuel and the weight of the aeroplane

FIRST A TRIVIAL EXAMPLE TO MAKE THE POINT:

Thrust: every fighter pilot wants more thrust! More thrust usually means bigger engines, bigger engines means greater fuel consumption, greater fuel consumption means greater fuel capacity required to maintain range or endurance, greater fuel capacity means bigger tanks, bigger tanks means bigger aircraft, bigger aircraft means more drag, which, dear reader, leaves your poor fighter pilot wanting yet more thrust!!

NOW A MORE INVOLVED CONSIDERATION:

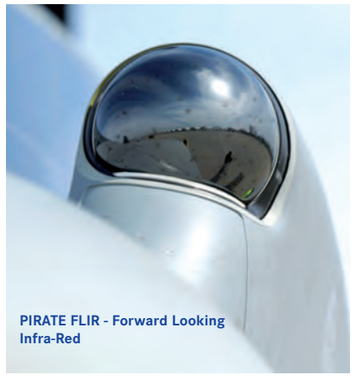
Radar aperture: In very simple terms we are after "First look, first shoot, first kill". You get



that "First Look" by having the best sensors. For radar that means making the radar equation work in your favour – anything that relies on a fourth power relationship means not just clever electronics but gross power performance.. The simple Laws of Physics mean that the bigger the dish (old fashioned word for antenna or radiating and receiving aperture), the more power you can transmit/receive and focus; consequently the further you can "look" and "see". However, the size of the dish will clearly dictate the overall dimensions of the nose – and this in turn drives the size of the aircraft, its drag and therefore affects its performance. A huge radar will mean a huge aircraft behind it to force it through the sky – with bigger engines with more thrust and all the associated problems described previously.

Other much more interactive "Balances" had to be struck everywhere you look and required detailed design iterations, including a significant design review in the early 90's. One engine or two? One seat or two? Number of weapons stations? (13, of which 6 are dedicated A/A was the outcome in case you were wondering) And how many are 'wet'(3)? These are just some of the considerations that immediately come to mind.

Of course 'balance' can also mean consideration of the interaction and complementarity of parts of the WS. This meant that to cover the electromagnetic spectrum for target and threat detection, Typhoon was not just a radar fighter, but included the Infra-red as well. The PIRATE system found a home just above the radar (not in a external pod) and even included Forward Looking Infra -Red video and a passive Infra-Red Search and Track functionality in the same sensor. Add in interoperability using the NATO L-16 Datalink



PIRATE FLIR - Forward Looking Infra-Red

and a wingtip mounted ESM/ECM/Decoy Defensive Aids system, all tied together by Sensor Fusion, and you start to see the balancing process in action.

SUPERSONIC PERSISTENCE

One of the most important design drivers was for Air Superiority through Supersonic Persistence.

Supersonic Persistence is the ability to attain supersonic speed quickly and be able to maintain it whilst tactically manoeuvring to achieve the first weapon release and successfully defeating any incoming missile threats; this being delivered through the combination of high thrust-to-weight ratio; low wing loading, low supersonic drag and hence: high Specific Excess Power (SEP). Typhoon's high-speed digital FCS controlling an aerodynamically unstable airframe meant that the pilots could be given not just the performance and agility from such an airframe, but also the optimum and safe handling characteristics,

An unspoken, but intrinsically understood, requirement was the need for Eurofighter to fulfil the multiple roles of the numerous aircraft fleets it was to replace.

Once again those canny procurement officials capitalised on the emerging technologies of the time. Whereas previously the limitations of flight control systems (FCS) and aerodynamics meant that the characteristics of good "fighters" and good "bombers" could ONLY effectively be achieved in separate airframes, Typhoon would not be so constrained, since another benefit of the digital FCS was carefree handling and with the same basic 'feel' irrespective of whatever stores are carried. Also, the high margins of SEP ensured that any mass or drag rise from bigger or heavier stores or weapons was easily overcome without significant performance penalty.

Previously limitations meant that the characteristcs of a "good fighter" or a "good bomber" could only be achieved in separate airframes

From these simple, insightful, clear and specific operationally derived requirements was born the multi-role Eurofighter Typhoon.

However, balance on its own is not the only measure of 'goodness' when it comes to a Fighter WS. The individual elements must also play their part to contribute to the performance of the whole. The WS fights at the level of its lowest component as it were. So let's examine the elements that make up the major parts of this WS...

The propulsion, flight control and utilities systems can easily be understood through mental comparisons with legacy aircraft. The Eurofighter's avionic system, however, is extremely non-traditional and it has a large impact on the operational capabilities of the aircraft.

It is really what helps define the Eurofighter as a multi-role highly flexible interoperable high performance weapons system.

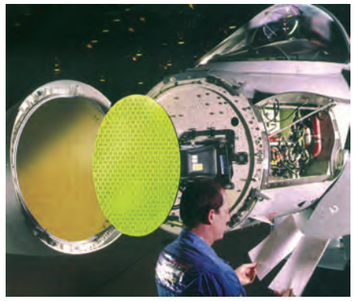
The systems that comprise the Avionic System are:

- Armament Control System
- Attack and Identification System
- Communications System
- Defensive Aids Sub-System
- Displays and Controls System
- Integrated Monitoring and Recording System
- Navigation System.

The following graphic shows the Avionic system to illustrate the point that although these are all separately identified systems, they mutually interact and share data across the systems to the mutual benefit of the whole WS.

WHAT TOOLS ARE IN YOUR TOOL BOX?

Any skilled tradesman will tell you that you need the right tools to do the job right. Typhoon is a well-equipped tool box. Once again the tools and the balance of those tools were specified from the outset, based on sound analysis and designed to provide the optimum and balanced design. In Typhoon's tool box you will find a set of sensors covering the full spectrum allowing the Typhoon pilot to search for, detect and track threats across RF and IR frequency bands without gaps or holes. These comprise:



Captor-E Radar is the future primary sensor

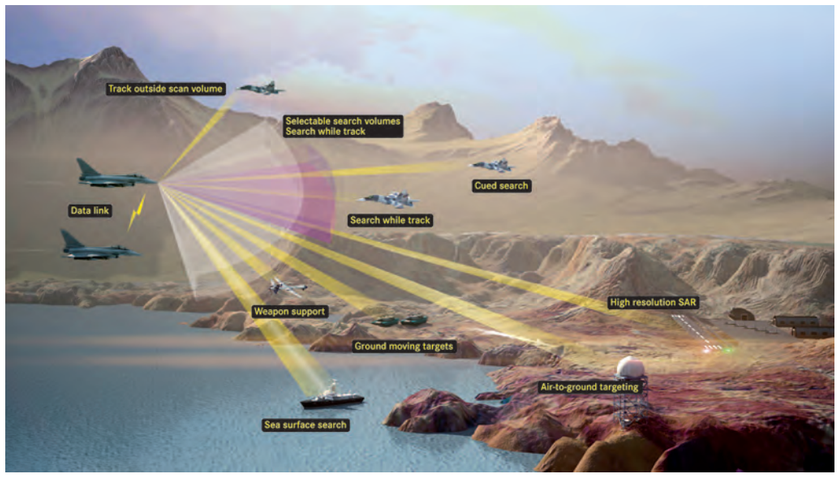
The field of regard is 50% wider than traditional fixed plate systems

CAPTOR RADAR

The Captor-M mechanically scanned radar was designed from the outset to offer capability growth commensurate with that of the platform. It is a best in class radar with an extensive modes suite to meet the customers' operational requirements and in the critical area of field of regard, it out-performs the existing "Fixed Plate" E Scan radars.

Captor-E Radar is the future primary sensor on Typhoon and has a full suite of air to air and air to ground modes. Again the capacious front fuselage of Typhoon allows the installation of Captor-E's optimised array and, with the addition of an innovative re-positioner, the Field of Regard (FoR) is 200 degrees which is some 50 per cent wider than traditional fixed plate systems.

This wide field of regard offers significant benefits in both air to air and air to ground engagements and given the large power and aperture available provides the pilot with the key discriminator of "First Look and First Shoot" capability with much enhanced angular coverage compared to fixed plate.



AESA Radar scenario

PIRATE/IRST

PIRATE is the passive scanning and tracking sensor of the Typhoon. It provides the simultaneous detection and tracking of multiple, manoeuvring at all aspects, targets in a silent manner, i.e. without electronic emissions, on a wide FOR.

The very narrow IFOV of its high sensitivity LWIR detector supports long BVR combat scenarios featuring accurate angular location and discrimination of opponents in combat formation.

It enables passive ranging of multiple targets through dynamic change of target bearing. During missile engagements, it supports safe, long range assessment of weapon effects for a more effective situational awareness.

It is also a stealthy sensor capable of defeating stealth, low observable rivals. As such it is the ideal complement to RADAR and DASS for effective cross sensor cueing supporting the flexibility of AESA in BVR combat.

Under the right conditions and in combination with a designation pod and in combination with the EW suite it offers the possibility to perform silent ground attack.

PIRATE is intrinsically unaffected by known countermeasure conditions.

Within the same 'box' the PIRATE contains imaging modes supporting A-S and A-A recognition and identification through cueing of ground targets and visual identification. The fixed FLIR mode supports low level operations including navigation with simultaneous threat detection and landing aid modes.

It is designed to be fully integrated also with the HMD offering the option of steerable IR image without NVG.

DASS: A major and discrete system

PRAETORIAN'S ESM/ECM

The Typhoon DASS is a mature ESM system controlled through a highly flexible and 'tuneable' Mission Data (MD) input. It provides reliable long range detection and identification of airborne and ground emitters. It has excellent performance in dense environments with complex signals. The DASS provides automatic self-protection through the highly intelligent and rapidly re-programmable Defensive Aids Computer (DAC).

The on-board and off-board (towed radar decoy) ECM equipment continue to benefit from technology enhancements. As (RF) threats have evolved, so have countermeasures; no less the Praetorian/Typhoon DASS, which is already fielding 5th Generation Fighter EW technology. Praetorian/Typhoon DASS has been upgraded and continues to be modified as new threats emerge.

The Typhoon DASS and MD were major contributors to the UK RAF Typhoons' success on a recent RED FLAG exercise- this due in a large measure to the investment and emphasis on developing MD which the RAF has made, populating the DASS (and Radar) with up-to-date (on a mission-to-mission basis) vital information to enable peak performance in high threat scenarios.

Also in the tool box is the Multi-Function Information Distribution System (MIDS) which allows the Typhoon pilot to have the complete tactical situation displayed and equally importantly contribute to the formation of that tactical situation with information from on-board.

HMD - HELMET MOUNTED DISPLAY

However, perhaps the sharpest new tool in the box is the Helmet Mounted Display.

Far more than a helmet cueing system, the HMD could be considered a HUD that is projected onto the inner surface of the helmet visor. It does allow the pilot to cue his missiles - if necessary, over his shoulder to target an unsuspecting enemy fighter that was trying to sneak up on the Typhoon. Need to gain an early tally on a suspected enemy fighter located by the radar? The HMD cues your eyes to the correct piece of sky to help you gain 'eyes on'; in a similar fashion it will direct you to the position of your formation members using positional information supplied by datalink.

Close Air Support (CAS) operations with Army ground units historically required extended radio conversations to locate and differentiate friendly forces from adjacent enemy positions. HMD will display ground positions to the pilot, enabling almost instantaneous recognition of the ground situation and a rapid strike saving coalition forces' lives. Flight reference and navigation information can be displayed although this can also be decluttered via the HOTAS when the situation demands.

A GOOD FIGHTER

Looking at the last element of a good fighter Weapon System - what is a good 'fighter'? A perennial debate is what makes you multi-role (or omni-role, or swing-role, or whatever the marketing buzz words are).

We believe, and we can support this belief, that Eurofighter Typhoon's tactical differentia-

tor is that it is truly a Swing Role fighter. But, what do we understand by the term Swing-Role?

In the past we had single mission (role) designs – Fighters (escort, pursuit, night etc), Bombers (light, heavy, tactical, etc), Reconnaissance and Maritime - for example. Then we had an era of aircraft that could do several different roles – but importantly not really in the same mission or flight (they had to be reconfigured to achieve adequate effectiveness in different roles). Then followed a range of aircraft that could perform different roles within the same mission or flight, however with some compromise or degradation to the effectiveness of each role.

NOW WE HAVE EUROFIGHTER TYPHOON

Whilst other aircraft make similar claims, only Eurofighter Typhoon possesses both adequate weapon availability (up to 6 bombs whilst also carrying 6 missiles, a canon and a targeting pod) and sufficient processing power and capacity to support missile in-flight updates and bomb in-flight targeting – ***at the same time***. A true Swing Role Capability.

Equipped in such a manner, Eurofighter Typhoon delivers to the war-fighters and commanders a highly coveted and enviable level of flexibility and efficiency.

WHAT MIGHT THIS LOOK LIKE?

As an example, in a typically complex mission against a heavily defended, unplanned target set in a time-sensitive situation the aircraft provides the ability to engage both air and surface targets simultaneously.

In a typical multi-role configuration Eurofighter Typhoon would embark on the mission with a configuration as shown here on the right.

In the past we have had single mission designs...

The evolution of Fighter-Power – from Spitfire to Eurofighter

MULTI-ROLE CONFIGURATION:

6 Air-to-Air missiles:
- 4 Active (Meteor or AMRAAM)
- 2 IR (ASRAAM, or IRIS-T),

4 PGB (E/GBU 16 or Paveway IV)

2x 1000ltr Supersonic Fuel Tanks

Targeting Pod

Internal 27mm Canon

Internal Self Protection
- ECM
- Chaff
- Flares
- Towed Decoys

ARMED WITH THIS SET OF CAPABILITIES, THE EUROFIGHTER PILOT CAN THEN:

- Accept real-time re-tasking through Data Link Network messages
- Detect hostile air and ground threats and engage them at long range using the combination of sensors and weapons while still progressing towards the target location.
- Maintain full situational awareness of the combined air picture through the sensor fusion of on-board sensor information with the NEC (Link 16) derived information
- Detect and defeat threats using a combination of Electronic Countermeasures, expendables, manoeuvre and pure kinematic performance.
- Locate, identify and designate multiple ground targets and engage them either individually or as a sequential or simultaneous group in a single release pass.
- Designate targets using:
  - Data-linked co-ordinates
  - Manual slewing of the designation pod
  - Line-of-sight slewing using the helmet mounted display
- Conduct post-impact Battle Damage Assessment (BDA)
- Remain on task awaiting further tasking using its remaining fuel and ordinance

SUMMARY

In summary then, what is the secret of a good fighter WS? Well, it's not a Secret at all – it is a balanced capability design, with all elements operating in harmony to satisfy the operational and performance requirements of the modern 21st century air force. Eurofighter Typhoon provides and realises such a design and what's more, the product and capability strategy underpinning it ensures that these requirements, and the crucial superiority over emerging threats, will be maintained going forward.

ICY SKIES
ICELANDIC AIRSPACE PATROLLING MISSION

It has been 80 years since Italian aircraft first flew over Iceland. But this summer the spectacular skies over one of the most entrancing landscapes on earth roared once again to the sound of Italian-based aviators.

On this occasion the aircraft were Italian Air Force Eurofighter Typhoon fighter jets from Grosseto's 4th Wing, Gioia del Colle's 36th Wing and Trapani AB's 37th Wing. They were there as part of Operation 'Icy Skies' which involves Iceland benefitting from airspace patrolling and training activities where European/NATO partners guarantee Icelandic airspace patrolling following the withdrawal of the US Air Force's permanent garrison in the country.

The Italian deployment was actually named 'Task Force Air Ice' and it operated from Keflavik Air Base under the aegis of the Italian Air Force Operations Command. It is part of an operation which according to the Army General Staff, provides a clear example of rational management and sharing of resources available among NATO partners.

The TFA Ice Commander - Col. Urbano Floreani also met the Honorary Consul of Italy, Petur Biornsson, who recalled the historical Second Transatlantic Fight of 1933, when a formation of Italian planes reached Iceland. He told the TFA Ice Commander: "That event meant a lot to the Icelandic people for it shown how plane travels could open to many people providing a new fundamental, fast and effective connection of the country to the rest of the world. That flight transformed our sense of isolation and introduced the modern world to us. That's why we remember it so well, and seeing Italian planes flying our skies again, after 80 years, is very exciting".

Two KC-767A aerial tankers and a C-130J cargo plane, operating by the 14th Wing in Pratica di Mare (Rome) and the 46th Wing based in Pisa, respectively, supported the Eurofighter jets in their flight back to Italy.

"Icy Skies" also involved the participation of related ground including the Air Defence controllers of Air Operations Command of Air Defence Reconnaissance and Control Group, of Poggio Ballone's (Grosseto) 21st Radar Group and Licola's (Naples) 22nd Radar Group.

As these spectacular images, by Lt.Col. Daniele Porelli, shows, it was one exercise few of the Italian Air Force pilots will ever forget.

FACTS & FIGURES

20 UNITS OPERATE EUROFIGHTER TYPHOON

United Kingdom:
Coningsby no. 3, 11, 17 and 29 sqn
Mount Pleasant no. 1435 Flight RAF
Leuchars no. 1 and 6 sqn
Germany:
Tactical Air Wing 73 "Steinhoff", Laage
Tactical Air Wing 74, Neuburg
Tactical Air Wing 31 "Boelcke", Nörvenich
Spain:
Morón 111 sqn, 113 sqn
Albacete 142 sqn
Italy:
Grosseto 9 and 20 Gruppo
Gioia del Colle X and XII Gruppo
Trapani 18 Gruppo
Austria:
Überwachungsgeschwader, Zeltweg
Kingdom of Saudi Arabia:
In-Service

■ SERIES PRODUCTION - STATUS
United Kingdom: 115 a/c delivered +++ **Germany:** 105 a/c delivered +++ **Spain:** 51 a/c delivered +++ **Italy:** 71 a/c delivered +++ **Austria:** 15 a/c delivered +++ **Saudi Arabia:** 32 a/c delivered +++ **In Total:** 389 production a/c + 1 fatigue test delivered +++

■ ORDER
719 under contract and **571** aircraft ordered +++ ordered by seven nations +++ Germany +++ Italy +++ Spain +++ United Kingdom +++ Austria +++ Kingdom of Saudi Arabia +++ Sultanate of Oman +++

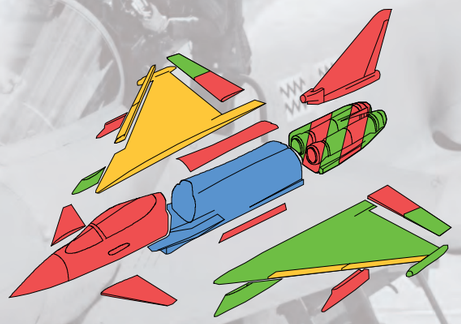
■ FLYING HOURS
six air forces have accumulated over **210,000+ flying hours** +++

■ EUROFIGHTER EXPORT CUSTOMERS
+++ Austria +++ Kingdom of Saudi Arabia +++ Sultanate of Oman +++

■ PARTNER NATIONS
+++ United Kingdom +++ Germany +++ Spain +++ Italy +++

■ MARKET OPPORTUNITIES
United Arab Emirates +++ Malaysia +++ Qatar +++ Kuwait +++ Republic of Korea +++ India +++ Denmark +++ Poland +++

■ EUROFIGHTER PROGRAMME JOBS
+++ more than **100,000 jobs** across 400 companies in Europe +++
Germany: 25,000 +++ **Italy:** 24,000 +++
Spain: 22,000 +++ **United Kingdom:** 40,000 +++



- 30.0% Cassidian Germany
- 13.0% Cassidian Spain
- 19.5% Alenia Aermacchi
- 37.5% BAE Systems

Go to page 18 for the story behind the picture...