

# WORLD

- **THE EVOLUTION - EUROFIGHTER 2020**
- **THE REVOLUTION - A REAL 5TH GENERATION FIGHTER**
- **MORE AIR-TO-GROUND CAPABILITIES**

**INDIAN *MMRCA* **  
**SHORTLISTED**





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TYPHOON 2020

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THE REAL  
5TH GENERATION  
FIGHTER

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**Title:**  
Major Beltrame, Italian Air Force,  
climb his Typhoon after taking off at  
Aero India 2011

**Photography:**  
Aeronautica Militare – RSV

**Enzo Casolini**  
CEO Eurofighter GmbH



Welcome to a new edition of Eurofighter World that comes to you during an important time in the Eurofighter programme. After starting the year surpassing 100,000 flying hours, Eurofighter Typhoons began combat missions in Libya on 21st March 2011 as part of operation Odyssey Dawn. Operating in a combat mission for the first time, Typhoons from the RAF have been deployed to Gioia del Colle in Southern Italy, and have been working alongside the Italian Typhoons deployed to Trapani, in Sicily. Our fleet of Typhoons have been patrolling the skies above Libya to enforce the no-fly zone and have been active in multi-role missions, successfully using Paveway II guided bombs against Libyan forces. The recent news that Eurofighter Typhoon has been shortlisted along with Rafale in the Indian MMRCA competition is great news for the programme and confirmation that our aircraft is exceptional in many ways, but particularly in terms of technical capabilities. We look forward to working with the Indian Ministry of Defence as they progress through the procurement process.

Perfectly interoperable with other Nation's air force assets, the operations in Libya have proven once more what we already knew: Eurofighter Typhoon is a mature platform with exceptional levels of performance and multi-role capabilities. Above all, this mission has shown that the aircraft is capable of being quickly deployed, guaranteeing operational readiness wherever and whenever needed. With proven high levels of efficiency and with a sustained rate of missions, Eurofighter is proving yet again that it is the ultimate choice in air-to-air as well as air-to-ground missions.

Highly efficient when deployed overseas as well as when operating from home bases, the Typhoons are delivering better operational availability rates than any other aircraft within the customer nations' air forces. Primarily this shows us the exceptional achievements of

collaboration between air forces and industry. They have created an efficient and effective logistic support system with a definite trend towards the reductions in operating costs. This is a key element that could turn out to be decisive in our efforts to assure export contracts for the Eurofighter.

The "urban myths" describing the Typhoon as an expensive aircraft in both procurement and operating costs, are easily challenged when you have such tangible evidence to the contrary. In recent months we have noticed that many of our competitors have had to admit that their costs are well over those of the Typhoon, including those aircraft offering lower performance levels.

India, Japan, the Gulf and Central Europe remain the key elements of our marketing strategy, but we watch closely new, possible targets coming from changing political conditions, such as Canada and Denmark, which might well turn out to be very interesting once we consider that, by definition, the Typhoon is a perfect "Arctic fighter": twin-engined to assure a wide operational safety margin; long range; high speed and altitude; long-range radar; long-range missiles; already tested in coldest weather conditions; perfect interoperability with a ground command and control system; plus a proven multi-role capability in combat.

In the coming months we will know whether the investment in presenting the Eurofighter to markets with solid proposals will lead to real success. In the meantime, we can record a renewed commitment by the governments of the four partner countries to support the export of the Typhoon, which is a fundamental aspect of our business. In fact the saying "without political support, it is impossible to sell a fighter" remains valid.

Enjoy this Issue

**Enzo Casolini**  
CEO Eurofighter GmbH

EDITORIAL

ULTIMATE AIR POWER ON DISPLAY AT IDEX 2011 IN ABU DHABI

# NEWS IDEX 2011

■ Eurofighter Typhoon participated in the 10th edition of the International Defence Exhibition and Conference (IDEX) 2011 in February, the largest defence and security event in the Middle East and North African region. The show took place from Sunday 20th to Thursday 24th, at the Abu Dhabi National Exhibition Centre, in the United Arab Emirates. Eurofighter displayed a selection from the full range of capabilities of the Typhoon at the show, including: The Active Electronically Scanned Array (AESA) radar that offers a next generation array with the addition of an innovative re-positioner to broaden the field of regard to +/- 100°, the most advanced Helmet Mounted Symbology

System (HMSS) that forms a key component of Eurofighter Typhoon's weapon system, the Meteor missile, considered the "game changer" in terms of kill probability thanks to its dynamic performances, speed and range and the Thrust Vectoring Nozzle for the Eurojet EJ200 engines. Already in service with the Royal Saudi Air Force, the Typhoon is considered the perfect "desert eagle". The aircraft already demonstrates its full capabilities in the hot and humid climate of the Gulf region. Thanks to its exceptional thrust-to-weight ratio, the Typhoon suffers less than other fighters in

challenging environments and is able to fully exploit its payload capability and range performances. Totally interoperable with current as well as predicted Gulf and allied Air Force assets, the Typhoon is the ideal coalition fighter to offer deterrence to the Gulf States today and in the future.

## IPA4 EUROFIGHTER LOGS 500 FLIGHT HOURS

■ The first Spanish single-seat instrumented production aircraft (IPA) pioneers the most advanced technology within the Eurofighter programme.

The first single-seat instrumented production Eurofighter (IPA4) has completed 500 hours of flight at the Cassidian Spain facility at Getafe, near Madrid. This aircraft pioneers the most advanced technology within the Eurofighter programme for acceptance and subsequent entry into service with the national air forces, following a functional upgrade from the original Tranche 1 standard to the more modern Tranche 2. This may serve as a model for the possible upgrade of the Tranche 1 fleets currently in service with the nations, and substantially increases the aircraft's capabilities.

Test plans include the in-flight verification of the communication functionalities and the MIDS data link system which exchanges information with other parts of the combat scenario network as well as integration trials and the launching of air to surface weapons.

## EUROFIGHTER DEBUT AT IDET IN CZECH REPUBLIC

■ At IDET 2011, the International Exhibition of Defence and Security Technologies held in Brno from the 10th-13th May in the Czech Republic, Eurofighter had a significant presence. The team hosted many visitors ranging from government and military

officials to journalists, aviation enthusiasts of every age, students and families. The Eurofighter stand at the show included the latest Helmet Mounted Symbology System (HMSS), the world's most advanced helmet for fighter pilots and a scale model of the Typhoon. On 11th May, Eurofighter GmbH's Business Development Manager Massimiliano Marchisio and Eurojet's Vice President



From left to right: Col. Petr Lanci, General Jiri Verner, Massimiliano Marchisio (EF), Paul Herrmann (Eurojet)

Sales Paul Herrmann were pleased to welcome General Jiri Verner Commander of the Czech Air Force and Col. Petr Lanci, Chief of Caslav Air Base who were given a guided tour of the stand. On the same day, Jiri Sedivy the Deputy Minister of Defence for the Czech Republic and the Chief of General Staff of the Czech Army Vlastimil Picek came to visit Eurofighter Typhoon. During their visit, the Czech Republic "White Paper on Defence and Security commission" which recommended to keep the supersonic capability of the Czech Air Force was discussed. All "White Paper" issues were made public during a dedicated press conference held on 10th of May at IDET. Now the final decision



on the future of the supersonic fleet is in the Czech parliament and will be deliberated soon. The Eurofighter stand became the most popular place to be during the show when 11 Czech contenders for an International Beauty Pageant "Princess of the World 2011" stopped by to have their pictures taken with the Eurofighter scale model.

## EXERCISE "WINTER HIDE": ITALIAN 4° STORMO HOSTED THE ROYAL DANISH AIR FORCE

■ Eurofighter Typhoon's from the 4° Stormo in Grosseto, Italy hosted the Royal Danish Air Force in a joint exercise at Grosseto, in February.

The joint exercise known as "Winter Hide 2011" saw the Royal Danish Air Force emerge out of hibernation with a team of eight F-16 operational fighters, three reserve planes, maintenance equipment, aircraft engineers, technicians of all kinds, pilots and forward air controllers, totalling some 100 people, to spend four weeks in Italy to enjoy better weather and exchange knowledge and experiences with their Italian colleagues.

The Danish F-16s operated in three slot missions a day to train in close air support (CAS) and air-to-air scenarios. With exercises taking place both day and night, the aircraft involved totalled in excess of 600 flying hours. In addition, the US Air Force F-15E jets of 494 FS that were deployed to Decimomannu, Sardinia, also joined the exercise.

The Royal Danish Air Force benefited from the stable weather conditions of Tuscany as well as from Grosseto's location close to the sea and mountains, which

provided the opportunity to train CAS and dogfight scenarios with the Italian Typhoons in different environments.

The Danes were excited about the opportunity to fly against the Eurofighter Typhoon, which they acknowledge has superior performance and engine power when compared to their updated F-16.

## NEW EUROFIGHTER SCREENSAVER LAUNCHED

■ With a new year comes a new Eurofighter screensaver and 2011 is no exception. Designed to highlight the international nature of the Typhoon programme, this latest screensaver will keep you occupied for hours when you really should be working. With 16 units located across the globe from the east coast of Scotland to the Falkland Islands in the South Atlantic, this year's screensaver is an interactive map that shows you the latest breathtaking images from the Eurofighter Typhoon, taken at locations around the globe. Take a look for yourself and download the latest screensaver from our website:

<http://www.eurofighter.com/eurofighter-world/screensaver.html>

## THE 2011 PHOTOGRAPHY COMPETITION HOTS UP

■ Following the launch of the Eurofighter Typhoon Amateur Photography Competition in the last edition of Eurofighter World, we have been inundated with some fantastic photos - but there is still plenty of time to submit your entry! The competition runs until the end of August 2011 and the winner will see their photo included in the 2012

## AUSTRIA'S EUROFIGHTER FLEET PLAYS KEY ROLE IN MISSION "DAEDALUS 11"

■ Mission "DAEDALUS 11" which began on the 26th January 2011 and ran until the 30th, demanded intensive air surveillance and security for the 41st World Economic Forum in Davos, Switzerland. For this important mission the Austrian Eurofighters were again called upon to protect the skies during a high-profile event.

Around 2,500 participants attended the Forum, amongst them were high ranking politicians from all over the world as well as international economic experts. Austria's Typhoons scrambled from their Air Base in Zeltweg, Styria to provide air superiority in the area over Tyrol and Vorarlberg, regions that are on the border to Switzerland and close to Davos. The Austrian pilots involved in "DAEDALUS 11" were ready to intercept, escort or force to land any unauthorised aircraft trying to enter the protected air space during the event.



The Austrian Air Force have been in great demand in the past for air surveillance missions in the surrounding areas - ranging from protecting the skies above the European Football Championships in 2008 in Austria and Switzerland to air policing over NATO's Defence Ministers meeting in Bratislava, Slovakia in 2009.

Eurofighter Calendar. Get your entry in now for your chance of winning. Terms and Conditions can be found on our website in the Eurofighter World pages under "photo competition". Good luck!

## EUROFIGHTER OPERATIONAL WITH TOM CLANCY: H.A.W.X. 2 RELEASED

■ Tactical manoeuvres, precise weaponry and allied support - all can be experienced in Ubisoft's new flight combat game H.A.W.X. 2, recently released for PC and consoles. One of the highlights in the game is the Eurofighter Typhoon. The name Tom Clancy stands out in the world of gaming to represent espionage, special tactical operations and war games. With the launch of H.A.W.X. 2, the second edition of the game, Typhoon is back in the air again in what is a



significantly improved version of the game. The Typhoon, which can be flown on several different missions in the game, was ranked as one of the favourites among the 31 different aircraft models.

It seems like Ubisoft have made some improvements to this latest version, taken the criticism of the players to heart and tweaked some of the errors made with the previous game. One of the major concerns had been the scenarios in which the players found themselves in. For one, flight simulation fans complained that each mission started and ended in mid air and the player did not have the choice to land or take-off.

## TWO AUSTRIAN EUROFIGHTER JETS ESCORT TURKISH PRESIDENT'S AIRPLANE

■ During a recent state visit to Austria the airplane of the President of the Republic of Turkey, Abdullah Gül was escorted by two



Austrian Air Force Eurofighter Typhoon jets as soon as it entered in the Austrian airspace. You can find pictures and a video taken during the mission on our website.



© by the Royal Wedding Collection

## A RIGHT ROYAL AFFAIR THE BEST OF BRITISH

■ At around 1330hrs on Friday 29th April 2011, a flypast took place in the skies over Buckingham Palace to celebrate the marriage of HRH Prince William to Catherine Middleton. This historic flight consisted of a Lancaster, Spitfire and Hurricane jets from the Battle of Britain Memorial Flight, which was then followed 30 seconds later by two RAF Typhoons and two Tornado GR4s in box formation. The aircraft passed over the wedding party, who were gathered on the balcony of the palace. The Typhoon roared past the happy couple who could be seen gazing up into the skies along with thousands of visitors who stood outside the gates of the palace waiting for a glimpse of the new Duke and Duchess of Cambridge. Just as William and Catherine will define the future of the British Monarchy in the coming decades, Eurofighter Typhoon will define the future of British Air Power. A fitting example of the best of British.

PART OF OPERATION ODYSSEY DAWN AND UNIFIED PROTECTOR

# EUROFIGHTER SWING-ROLE DEBUT IN LIBYA

Royal Air Force Typhoon aircraft at Gioia Del Colle, Italy, as part of Operation Ellamy, enforcing the No Fly Zone over Libya in support of UN SCR 1973.



**E**urofighter Typhoon began combat missions in Libya on 21st March 2011 as part of operation Odyssey Dawn decided by the United Nations Security Council Resolutions 1970 & 1973.

The mission marked the first time the Typhoons have been deployed in enemy combat and the debut as a swing-role platform.

Perfectly interoperable with the other assets deployed by the coalition air forces, Typhoons are providing air dominance patrolling the UN-imposed no-fly zone to ensure Gaddafi cannot unleash his air force against civilians.



Italian Air Force Typhoon taxiing at Trapani air base

RAF Typhoons from Leuchars and Coningsby air bases were redeployed to Gioia del Colle, Southern Italy on 20th March 2011 joining the resident Eurofighters of 36th Stormo of the Italian Air Force. The first mission was flown on 21st March taking just over five hours and saw the planes refuel three times during that period.

In addition, Italian Typhoons were deployed to Trapani air base and joined the operation to enforce the no-fly zone over Libya on 28th March 2011.

After having flown no-fly zone enforcement missions with both the RAF and ItAF, on 12th April the RAF Typhoons started air-to-ground missions, hitting targets with Paveway II guided bombs.

For the enforcement of the no-fly zone over Libya, Italian Air Force Typhoons were equipped with 4 AMRAAM medium-range missiles and 4 IRIS-T short-range missiles for use in the no-fly zone enforcement role, while the RAF aircraft were equipped with AMRAAM and ASRAAM short range missiles plus Paveway II guided bombs.

In this Typhoon deployment, the RAF demonstrated the limited footprint needed to keep a sustained rate of operation. With only 100 technicians supporting the Typhoons deployed, the aircraft was immediately operational on arrival in Italy.

## RAF TYPHOON PILOT DESCRIBES FIRST AIR TO GROUND STRIKE IN LIBYA



Royal Air Force Typhoon equipped with Paveway II bombs taking off from Gioia Del Colle, Italy

**T**he Royal Air Force pilot who carried out the first operational Typhoon air strike on a ground target has been describing the mission via the British Forces News website.

The first strike was made against a Libyan regime main battle tank during a mission on Tuesday, 12th April and the pilot involved

said: "I left Gioia Del Colle in a mixed pair with a Tornado GR4.

"We'd been tasked to Misratah in the west of Libya, which is pretty much a city under siege, with significant numbers of attacks against the civilian population from

**"WE HAVE PROVEN THAT THE JET CAN CARRY WEAPONS A LONG DISTANCE, DROP THEM ACCURATELY, LAND AND GET PUMPED FULL OF FUEL, RELOADED WITH WEAPONS AND GO AND DO IT AGAIN, DAY IN DAY OUT".**

pro-regime forces. We were looking along one of the main supply routes in Misratah when we came across a compound with around 10 - 15 main battle tanks in.

"We reported our findings to the command and control assets we work with and shortly thereafter, were cleared to engage.

"At that point, we generated coordinates for the targets and dropped weapons. Each time we assessed the likely weapon effect and whether there would be any collateral damage implications.

"It was a precision attack from a significant altitude.

"To be honest, I was a little bit nervous but you just revert to the training you've done before. I've dropped a significant number of weapons from the Typhoon in train-

ing. It felt no different from that, only this time I was even more relieved to see the bomb go exactly where it should have done, in the Litening III image displayed in my cockpit."

"That makes this capability enduring, and while it may seem like a milestone to some, it's just a hurdle that had to be overcome at some point. It has been done, and we will drop more over the life of the aircraft. I think people are just pleased we've got the first one out of the way."

## SAUDI ARABIA EXHIBITION TYPHOON AIRCRAFT CAPABILITY IN JANADRIAH

■ Typhoon participated in the National Al-Janadriyah Heritage and Culture Festival, held on the 13th of April 2011 within the BAE Systems Saudi Arabia Stand. This is the first time the company has participated in this grand annual event, which enjoys the patronage of the Custodian of the Two Holy Mosques King Abdullah bin Abdulaziz.

BAE Systems Saudi Arabia was represented by an exhibition space of 400 square metres matching the grandeur of the cultural festival and showcased its achievements in the Kingdom. The stand featured models of aircraft and land armament vehicles manufactured by the company. An interactive table was displayed to provide information about the company's activities in Saudi Arabia and the role they play in providing job opportunities and training programmes for the Saudi youth. A briefing about the company's activities in the areas of social responsibility was also a feature displayed in the interactive table. In addition, a replica



of a Typhoon cockpit was exhibited for visitors to experience being a Typhoon pilot.

Overall the number of visitors at the festival totalled more than 7.5 million people.

Line up of Italian Eurofighter Typhoons at Trapani air base

## SURVIVAL OF THE FITTEST

## EVOLUTION – TYPHOON 2020



Development aircraft DA5 during the tests for the LERX - Leading Edge Root Extensions (marked in orange at join between the wing and the fuselage).



fighter) will be upgraded with new modes and a safety feature called Automatic Critical Altitude Recovery is planned to supplement the highly praised Automatic Low Speed Recovery system.

The Interoperability evolution will be extremely important with continuous upgrades to the fighter's GPS (navigation), IFF (identification/blue force tracking), MIDS (NATO datalink), IDM and Rover (datalink to Forward Air Controllers) and SATCOM (voice/broadband to talk to the generals at Headquarters via satellite).

All will also be developed according to the guidelines of NATO's Network Enabled Capability (NEC) programme.

One of Typhoon's major advantages over its competitors is the aircraft's powerful sensor suite. The high-end Captor mechanically scanned radar was wisely implemented in the initial tranches of Typhoon given that the first AESA radars being produced and in service with our competitors could not compete with the Typhoon's Captor which is considered the best mechanical fighter radar available. Fortunately, the AESA radar technology has evolved rapidly in the last few years, and is now promising the low weight, reduced heat generation and high performance required to beat the Captor. The Typhoon's large aperture allows a Wide Field of Regard (WFOR) solution, where the AESA radar is mounted on a repositioner that makes it possible to point the AESA radar anywhere in the Typhoon's frontal hemisphere. This is a dramatic improvement when compared to the fixed

The newest generation of fighters: Typhoon, Gripen, Raptor, Lightning II and Rafale, share one significant attribute that separates them from all the previous generations of fighters: they have been designed from the beginning to handle extreme amounts of externally as well as internally generated data, and filter this data down to one single "digestible" picture which gives the pilot a "God's view" of the tactical situation – typically called "Sensor Fusion".

But just fusing data and sharing it with others is not enough to either survive on the battle field or to kill the opponent in contested airspace. In fact, the only consequence is that the crew "will die with full

situational awareness" as a pilot graphically put it at a recent air show.

So on top of Sensor Fusion, each fighter design uses different strategies for survivability and lethality in a combat situation. Some platforms have arguably chosen a singular approach – for example low signature only – others like Typhoon have chosen a much more multifaceted and balanced approach to survivability and lethality.

However, this is not enough. There must be room for growth – the fighter design must be able to evolve over time. The perfect fighter possesses the real estate to cope with unavoidable increases in operational weight; demand for electrical power and cooling as well as the addition of new sys-

tems and antennas without jeopardising its survivability, lethality and perhaps most importantly, its affordability. So as in nature, only the most flexible and fittest fighter design will survive and remain relevant in the long term.

Thanks to this performance surplus, Typhoon is able to absorb the growth whilst still maintaining superiority. Eurofighter Typhoon is designed to maintain operational dominance well into the 21st century. This is achieved by combining extreme performance, speed, acceleration and manoeuvrability with superior detection systems, a world-class electronic warfare system architecture, complemented with reduced signature and a large load of advanced guided

weapons, all carefully balanced to ensure high survivability and lethality against any threat in almost any conceivable long or short-range engagement.

Growth will be managed in four areas: within the platform itself, including the cockpit, avionics, autopilot, the airframe and the engines; externally mounted sensors like targeting pods will be updated several times over the coming decades; additionally, a multitude of weapons will be integrated covering a broad range in sophistication and capability; finally, the whole sustainment of Typhoon will be continuously modified to keep the fighter at the leading edge of affordability, deployability and maintainability, whilst concurrently provid-

ing the now well known small logistic footprint and high availability of the aircraft.

Typhoon's open architecture allows step-wise technology insertion which ensures that upgrades do not become too resource consuming and impossible to manage. The concept behind this process is to keep Typhoon at the leading edge with the insertion of technology carried out only when it is mature enough and affordable to do so.

In the following text, some of the planned updates will be presented. There is never enough fuel on any aircraft, so although Typhoon has a surprisingly long range especially at high altitude, larger external tanks and conformal fuel tanks will be added. The latter is actually more motivated by the need to free up under wing pylons for more weapons.

Typhoon's sophisticated autopilot (that prompted one pilot to comment that "Typhoon is probably a manned-unmanned

Tests with the METEOR missile are progressing on as planned. The METEOR will be a game changer in future air-to-air engagements



plate solutions found with even the most advanced competitors.

The Typhoon's Pirate IRST Infrared Search and Track system – in reality an "infrared AESA" – and the Praetorian Electronic Warfare system will also evolve continuously.

RecceLite will be the next major evolution of the podded sensors and will provide Typhoon with a leading edge reconnaissance system. RecceLite has already been demonstrated and proven in flight evaluations and is now being fully integrated.

The WFOR AESA radar combined with the long-range ramjet powered Meteor air-to-air missile will ensure that Typhoon will prevail in air-to-air combat for the next decades.

The air-to-surface capability enhancements will turn Typhoon into the most lethal swing-role fighter. It will obtain extended Air Interdiction capabilities including stand-off weapons such as Taurus and

Storm Shadow. Also, long range glide bombs will be integrated and in combination with the rest of the weapon system, will for example give the aircraft the capability to fight enemy air defences or ships. Later in the Typhoon's career, dedicated maritime attack capabilities and anti-radiation missiles will be added. Other weapons such as the highly successful, low-collateral damage Brimstone anti-armour weapon will give Typhoon's Close Air Support capabilities a lift.

Thanks to its growth potential, it is widely recognised that Typhoon will maintain its leading edge on weapon loading capability, manoeuvrability and raw aerodynamic performance for the next 40 years.



## FUTURE CAPABILITY ROAD MAP

### MAIN DEVELOPMENT CONTRACT

- Combat Ready
- Multi-Role
- Carefree Handling

### PHASE 1 ENHANCEMENTS

- Simultaneous Swing-Role
- Laser Designator Pod
- Enhanced GBU-16
- Paveway IV
- Enhanced Defensive Aids
- Interoperability upgrades
- Enhanced mission computers with new software architecture

### NEXT ENHANCEMENTS

- Meteor BVR Missile
- Active E-Scan Radar
- Stand-off Weapons
- Long Range Glide Bombs
- Anti-Armour Missile
- Anti-Ship Missile
- Satellite Communications
- Laser Warner
- Passive Missile Warner
- Recce/Advanced Targeting
- Range Extension
- SEAD / DEAD

## WHAT IS TYPHOON 2020?

Typhoon 2020 is the future of the Eurofighter programme. The aircraft is set to evolve in the coming years with the introduction of various cutting edge technologies. Typhoon in 2020 will be even more capable, more effective, more efficient, more operationally flexible, more adaptable to the changing scenarios of the next decades.

In the 2015 to 2020 timeframe, this will be evident through an upgraded Tranche 3 aircraft with the incremental delivery of enhanced capabilities.

Beyond 2020, the scenario will be dominated by highly capable aircraft such as the Typhoon, the F-35, the PAK-FA and by the new Chinese projects which will probably

be the only major combat aircraft still in production at that time.

Typhoon is likely to be the only non-aligned product available to nations wishing to acquire a manned fighter aircraft.

The development plan for Typhoon is already underway, with the target to cover all aspects of the weapon system, including such items as stealth measures, new mission systems, updated HMI and improved platform kinematics (including thrust, mass,

flight envelope, range and fatigue life). The plan can be summarised in the chart above (more details about the plan will be published in a next issue of Eurofighter World).

If in the 2015-2020 timeframe the manufacture of Typhoon will be based on the currently defined Tranche 3 standard (including the possibility of a dedicated Naval variant), Typhoon delivered after 2020 will basically be a new aircraft, potentially

developed thanks to the collaboration with export customers industries with strong aerospace and defence capabilities.

In the 25 years between 2020 and 2045, the Typhoon fleet (which may also include retrofitted aircraft from earlier standards/tranches/blocks) will see new weapons, new sensors, and new communication and datalink systems.



# REVOLUTION THE REAL 5TH GENERATION FIGHTER



*Close Air Support 2030: "A Typhoon checks into the Forward Air Controller Network as Mission Commander, replacing another Typhoon which has just completed its slot. The Typhoon pilot gets the latest update via the venerable MIDS datalink including information on how many autonomous scout-UAVs are docked to the scout mothership and checks the status of the two unmanned In-Flight Refuelling Tankers in the area. The pilot takes note that the tanker in the Northern Sector will have to leave soon. With an affirmative command the Typhoon pilot – now the FAC Commander – assumes charge of the mission and selects the FAC phase of flight. This amazingly intuitive mode uses an innovative display format (also called "The Pigeon Format" by the pilots) which projects*

*the 360 degree spherical world comprising the full battlefield and all its participants into one picture, allowing the single-seat Typhoon to safely interact with all the assets under its command. The Commander briefly appreciates that it took nearly two decades of laboratory research and flight tests to get this far. Everything is calm, but suddenly a scout-UAV detects suspicious activity and via a low-bandwidth signal activates a voice warning and the appropriate indications on the Pigeon Format. The Commander zooms in on the scene and with a voice command establishes a high bandwidth multispectral video link to the scout via the mothership.*

*In the middle of a cluttered scenario, which not even the normally very reliable Automatic Target Recognition function can handle, the only human involved in this event immediately recognises the target everybody and everything has been searching for in the last couple of weeks.*

*The target identity is confirmed and the Typhoon immediately accelerates to supersonic speed to provide the chosen glide bomb with enough energy to hit effectively.*

*While the Commander monitors the live transmission from the scout, the Typhoon's autopilot flies the fighter into the optimal position in space and time and releases the weapon. The scout controls the rest; although*

*the Commander remains ready to abort the engagement if required. Having achieved total tactical surprise, the target is successfully destroyed two minutes later. Both the scout UAV and the Typhoon automatically - using the popular Auto-In-Flight-Refuelling Autopilot mode - hook up with the remaining In Flight Refuelling UAV. With full tanks, the Typhoon continues its mission while the scout returns to the mothership. The UAVs have truly become the forward eye and extended arms of the Typhoon"*

Throughout military aviation history, advances in technology have greatly enhanced the aerodynamic performance and firepower of fighter aircraft. When compared to the old F-15 Eagles, F-18 Hornets and F-16 fighters, the present weapon system generation - Typhoon, Gripen, Rafale, F-22 and F-35 - have revolutionised aerial warfare through networking and sensor fusion of externally and internally generated data.

The next major revolution will be the integration of manned and unmanned systems into one operational "organism" where the boundaries between each independent entity dissolve. The aircraft capable of playing a role in this evolved scenario will truly be a 5th Generation fighter.

The political impetus for less risky and less costly platforms for military purposes is leading to a vast expansion in the search for unmanned systems and military operations in the last decade have demonstrated that the UAV's persistence and endurance have made it difficult for the adversary to hide.

Compared to humans, machines have the advantage of endurance, persistence and the ability to efficiently handle large volumes of data. Humans on the other hand, are better able to make complex cognitive decisions rapidly and are able to infer, interpret and synthesize contextual information.

However, the UAVs cannot be a one-for-one replacement for manned platforms. There is no production cost advantage if a UAV is designed to the same reliability, survivability and performance standards as manned platforms. And as long as UAVs remain low-density assets, they will continue to be expensive to acquire and operate.

The above vision of multiple UAVs operating alongside the manned Typhoon poses enormous challenges on mission management technologies such as automation, human-systems interface and dynamic re-planning algorithms.

Permanent concepts and rules for UAVs flying together with manned military and civilian aircraft need to be developed both for a war zone as well as for civilian airspace. If unresolved, this can significantly degrade the operational effectiveness at war and constrain training in peace time.

Efficient communication is going to be a massive challenge. The data transfer rates required for accomplishment of a single unmanned surveillance sortie (~100 Mbps)



would saturate most of the operational communications links available. The bulk of the bandwidth requirement is needed to pass raw video data, while UAV command and control takes a very small portion of the required data rate - typically less than one percent.

Providing the UAVs with autonomy and an on-board processing capability so that the UAVs automatically recognise events of interests would reduce the data rates required significantly. The UAVs should only transmit its status and a very high level description of its environment.

However, the Typhoon pilot may need the on-board data for analysis, thus negating some on-board processing benefits. Therefore, to avoid data congestion, the Typhoon will operate within line of sight of the UAVs to allow the high data transfer rate required. A distance that will keep the Typhoon safe from the predictable surface-

to-air defences around the target but that will still offer a quick reaction time to engage a target. There will be a lot of work determining the optimum mix of on-board and off-board processing.

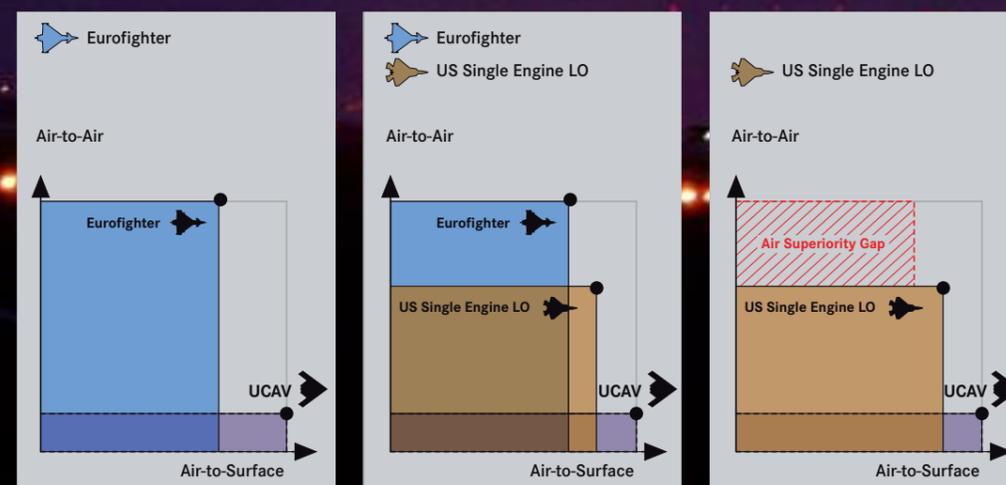
As the systems develop greater autonomy, dynamic planning and re-planning cycles will speed up, operators will need to understand the unmanned vehicle's level of autonomy, trust it appropriately and dynamically shift their control of the vehicle to respond to these faster cycles. Further more, methods of positive control of weapons will need to be determined.

When will the vision become reality? It will take at least twenty years for this revolution to materialise, which includes 10-15 years to transition from a demonstrated laboratory capability into an operationally fielded system, followed by 5-10 years of spiral development of the system until the ultimate derivative is in production.

In the above scenario, the Typhoon will be the playmaker, assisting where help is

required and where opportunities appear. The manned, swing-role Typhoon will be the ideal UAV partner thanks to its flexibility, large flight envelope, growth potential and ability to fill any combat task from attacking a surface target to air-to-air roles (including the protection of the UAVs operating over the target area). Together they will be the true 5th Generation weapon system!

## FORCE STRUCTURE OPTIONS – TIMEFRAME 2025 ONWARDS



**THE KEY EQUATION: TYPHOON + UCAV > JSF + UCAV**

# SHORTLISTED

## TYPHOON STAYS IN THE RACE FOR THE NEW INDIAN FIGHTER

**THE TECHNICAL EVALUATION CONFIRMED THE SUPERIORITY OF THE EUROFIGHTER OVER F-18, F-16, GRIPEN AND MIG-35**

On 28th April, great news began seeping out from the press in India: the Typhoon had been shortlisted for the fighter tender launched by the Indian Ministry of Defence for 126 aircraft - a deal that has a potential value of between 10 and 11 billion dollars and is considered the most important in the international aerospace market, guaranteeing for the winners continued production well into the next decade.

The Eurofighter office in India did indeed receive the official letter asking the company to extend the validity of its commercial envelope until the end of 2011, effectively confirming the down-selection of the Typhoon for the Indian tender.

This, it has been said, is a choice made exclusively on the basis of the technical evaluations completed in April 2010 on 643 parameters that have seen four of the six competitors in the tender - the F-18, F-16, Gripen and MiG-35 - knocked out of the race. The competing aircraft did not pass the flight and weapons evaluation trials. The Indian evaluation has been the most rigorous and comprehensive ever done for any tender with live bomb drop and missiles launches, in-country tests and evaluation - including at high altitude and in the desert during hot and humid conditions.

This choice serves to reaffirm the superiority of the Eurofighter over its competitors.

With the down-selection made, the full procurement process has started. It was announced by the Indian authorities that their goal is to have it completed before spring 2012. India has fixed a 50 percent offset requirement for the MMRCA deal to ensure that half of the deal's worth is reinvested in India to energise its defence industry. This is a fundamental step that would see Eurofighter fully involved in providing India with the best industry partnership programme possible.

Eurofighter technology and industrial processes are world class. The Typhoon is made up of 80% composite materials, the aeronautical material of the future, already used for civil, military and UAV applications and will be the solution of choice for any future major designs. The companies able to manage the composite material in an efficient and effective way will have an edge over their competitors as the new material offers - with respect to the metal alloys - at least 20% less weight at the same level of resistance and the possibility to shape the surfaces at will, to obtain the best possible aerodynamic design.

Currently comprised of four Partner Companies, the Eurofighter consortium has been vocal in offering to India the chance to become a new Industrial Partner. Eurofighter is truly an international aircraft programme and if India were to select the Typhoon over the Rafale, they would gain engineering and manufacturing excellence from Europe's leading aerospace industries.

Italian Air Force Typhoons on "pole position" in a line up at Aero India 2011

The Italian Typhoon Team celebrating "Zero Defects" after a successful air show.

100% OPERATIONAL AVAILABILITY, NO DEFECTS, TOTAL INTEROPERABILITY

## PERFECT JOB AT AERO INDIA 2011

A deployment far from the operational base, operating with a reduced number of personnel and spare parts on a crucial mission: demonstrating the excellence of what is today the flagship of European technology to a market that is potentially worth 10 billion EUR - India.

We are talking about the deployment of two Italian Air Force Typhoons last February, to Yelahanka air force base near Bangalore - India's technology capital - for Aero India 2011, Asia's leading military aviation exhibition. The show provided a privileged showcase for the tender launched by the Indian Ministry of Defence in Delhi to modernise the Indian Air Force's fighter aircraft.

The Italian Air Force was asked to support the commercial efforts of European and Italian industry, which plays a key role in the Eurofighter programme through Finmeccanica and Alenia Aeronautica.

With less than a month's notice, the Italian Air Force seemed to be faced with nothing short of "mission impossible". As a matter of fact, the mission was planned in a very short space of time (the kick-off meeting took place 25 days before departure), demonstrating the operational flexibility of the Italian Air Force and of the aircraft. The individual legs of the journey - Souda Bay, Greece; Al Azraq, Jordan; Doha, Qatar; and Jamnagar, India on the way out, and Ahmedabad, India and on the return leg, Minhad, UAE; and back to Al Azraq and Souda Bay - had to be rescheduled on a daily basis due to diplomatic difficulties and customs issues.

The mission support system (MSS) was able to respond rapidly to the various demands, making it possible to ensure that all the necessary tasks were completed on schedule.

During the show in India, neither of the two aircraft used suffered any defects that restricted their operational availability. The missions were all completed on time, both with regard to the transfer to and from In-



Major Beltrame, Italian Air Force Display Pilot ready for his display flight at Aero India 2011

dia and the display flights at the exhibition. The two reserve aircraft on stand-by at Gioia del Colle Air Base were not used.

The mission was carried out using a reduced logistics footprint equating to 11 air cargo pallets, including two pallets required to transport the aircraft equipment necessary for the display, such as the smoke generators to be fitted to the aircraft.

There were just 15 maintenance technicians from the operational units on hand, who were mainly responsible for managing

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the aircraft during the transfer to and from India, while the seven specialists from the Experimental Test Flight Unit of ItAF were primarily concerned with looking after the aircraft during the air show.

No spare parts were used during the mission, since there were no malfunctions that required components to be replaced.

The aircraft's engineering support system (ESS) was made operational in one of the two C-130Js used to assist the transfer from Italy, thereby simplifying management of the aircraft and removing the need for customs documentation for the various legs of the journey.

For the transfer phase, the aircraft were deployed in a configuration with three external fuel tanks, affording the maximum level of range without the need for in-flight refuelling, which helped to keep down costs and minimise the logistics footprint.

Thanks to the aircraft's long range, it was possible to limit the number of legs on the outward journey to five, and the same number on the return journey. In actual fact, the original plan was to have four legs, but with Cairo West airport unavailable due to the political unrest in Egypt, the route was extended, necessitating the addition of another stop.

As stated above two C-130Js were used to assist the operation, one as an "advanced" aircraft tasked with preparing the arrival of the Typhoons at the various air bases, and one as a "sweeper", with the job of assisting the Typhoons until take-off from the bases and dealing with any technical issues, although fortunately none occurred.

The operational flexibility of the Typhoon was amply demonstrated by the aircraft's ability to operate with ease even in civil airports. The ground support equipment, particularly generators and refuelling facilities of five different countries (Greece, Jordan, Qatar, UAE and India), normally used for civil aircraft, proved to be fully interoperable with the Typhoon.

This major success confirms past experiences where Typhoons from various air forces have been deployed to other bases, including bases far from their home territory: the aircraft offers a high level of operational availability, a limited logistics footprint, a long transfer range and total interoperability with equipment at forward operating bases or civil airports.

All this, plus the hundreds of thousands of spectators were left gazing in amazement at the stunning manoeuvres executed by the Italian Typhoons during Aero India!



Guido Crosetto  
Italian Undersecretary of Defence

## GUIDO CROSETTO POLITICAL SUPPORT KEY TO EXPORT INTERVIEW

*The Eurofighter is the most important European defence programme in which the Italian industry is involved. What do you think about this participation?*

*Involvement in a programme of this technological significance and strategic importance enables the Italian industrial system (and by this I mean all its component parts, from major companies to small and medium-sized businesses, or second-level suppliers) and the defence industry to grow even further and to reaffirm its tradition of excellence in aeronautics which stretches back almost a century. Programmes of such striking importance, in which relationships, interconnections and exchanges of expertise and information with European partners form essential elements and represent a fundamental requirement for the achievement of the specified objective, bring with them strategic benefits such as technological returns, as well as direct and indirect employment equating to around 12,000 jobs in the high-tech sector and around the same number of jobs per year in supporting industries. This production and maintenance capacity is attributable not just to the international programme itself, but also to its continuation over time, especially if the aircraft becomes, or rather continues to be a success on the export market, as demonstrated by sales of aircraft to Austria and Saudi Arabia.*

*Do you think that it would be possible to "open" the participation on the programme to new partner nations and industries?*

*It is certainly true that a number of countries are interested in becoming partners in the programme, and this should be seen as an opportunity to share costs to keep the production running and possibly gain an additional technological contribution. It is also true that any such involvement would only apply to future evolutions of the aircraft, i.e. to new de-*

**"I REALLY THINK I DESERVE A FLIGHT IN THIS MAGNIFICENT FIGHTER..."**

*velopments. To prepare for this eventuality and in view of the interest shown by certain countries, we are working to establish a legal framework, such as a memoranda of understanding and protocols of intent, to enable those already interested and any countries interested in the future to know in advance the exact rules of engagement.*

*Which countries do you think could be interested in becoming a partner of the Eurofighter programme?*

*It would be very restrictive to name only a few countries; let's just say that there is a lot of interest in the aircraft and that this interest is not confined to any geographical limits. Some campaigns are certainly very "hot" and are being followed extremely closely, as are all the others, by the people responsible for exports. In terms of numbers and strategic importance, India is definitely one of these, as my presence and the presence of my counterparts from the other founding nations of the programme at the Bangalore Air Show last February confirms. The number of requests for information is increasing and the receipt of various requests for proposal demonstrates the value of the aircraft in absolute terms.*

*The Typhoon has been in service since the end of 2003, so it's still at the beginning of its operational career. What do you see as the future for the Eurofighter?*

*To improve and enhance the aircraft's operating capabilities, the participating countries have agreed to launch new developments. The already launched and financed upgrade programmes carried through by the Eurofighter partner companies will later be followed by other innovations that will ensure that the aircraft's operational capabilities continue to be at the cutting edge of technology. The Typhoon was designed to have extensive growth capability, in view of the fact that it is intended to remain in service and to continue to meet national operational requirements until 2040. It should also be noted that the participating countries are considering adopting electronic scanning radar, which signals a clear generational shift that will enhance the aircraft's operational capability and make it even more attractive to the export market.*

*And, as a final question, when will you fly a Typhoon?*

*This is in fact a question that I have been asking myself for some time. Given my involvement in the programme, I really think I deserve a flight in this magnificent fighter...*

# TYPHOON SUCCESSFULLY ADDS MORE AIR-TO-GROUND CAPABILITIES

The first ever release of a Paveway IV precision guided bomb from a Typhoon aircraft, using the avionics system to safely release the weapon, was achieved in an hour long test flight over the Aberporth Range in Wales in March 2011. The integration of Paveway IV demonstrates a commitment to enhance and upgrade Typhoon's capabilities in its ground attack role and forms part of the Typhoon Future Capability Upgrade.

BAE Systems Typhoon Test Pilot Nat Makepeace, who was at the controls of development aircraft IPA6 that made the release, said: "This was a successful test demonstrating the avionics system is able to use global positioning system (GPS) data and target information sourced from the aircraft to prepare for the release. All communication with the aircraft and safe release of the bomb went to plan."

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

The test is part of an ongoing programme to integrate Paveway IV onto the aircraft and builds on the environmental and jettison trials which have already been performed.

The Eurofighter's air-to-ground capabilities were further improved in April when partner company Cassidian Spain achieved the first EGBU-16 precision guided munition avionic release.



EGBU-16 test with IPA4 aircraft taken in Spain

This trial saw the EGBU-16 being successfully released from a Eurofighter aircraft and focused on the functional integration into the weapon system.

The EGBU-16 is the selected dual mode precision guided munition for Germany, Spain and Italy, whereas the Paveway IV precision guided bomb is the choice for the UK. Included in the broad-ranging Phase 1 Enhancement (P1E) programme, both weapons improve the all weather precision attack capability on the Typhoon.

The Typhoon aircraft has been autonomously air-to-ground capable since 2008 when the Industry successfully integrated the Paveway II laser guided bomb with the Litening III laser designator pod, for use by the Royal Air Force. Demonstrating an

unrivalled precision, the combination of weapons has been tested during several exercises both in the UK and abroad, confirming the built-in multi-role capability of the Typhoon.

The recent flight tests with state-of-the-art air-to-surface and air-to-air munitions have proven the cutting edge all weather multirole capability of the Typhoon into the next decades. Future planned and agreed development work and flight testing will continue to assure this market-leading capability is the most advanced new generation aircraft on the market, integrating the Air Forces' latest weapons of choices in a timely and cost efficient way.

# TYPHOON QUICK REACTION ALERT



“Within minutes, they were escorting the plane to Stansted Airport. It later transpired the bomb threat was a false alarm”.

In January this year the pilot of an Etihad flight, carrying 163 passengers, sent out a terror alert shortly after entering UK airspace. James Glen had told a flight attendant one of his fellow passengers had a gun and was threatening to blow himself up.

On the same day - January 24th - a suicide bomber killed 35 people at the arrivals terminal of Moscow's busiest airport. Air traffic control immediately scrambled RAF fighter jets to intercept the Airbus 340-600.

The dramatic events of January 24th - the details of which came out in a recent court case - illustrate how emergency procedures, set up after the 9/11 attacks on the US, and refined in 2007, are fundamental to national security. QRA is fundamental to these procedures.

The Quick Reaction Alert (QRA) role in the UK is provided by the Typhoons based at RAF Coningsby and RAF Leuchars.

It is part of a layered defence of the UK and their role is to get airborne, any time of day or night, 24 hours a day, 365 days a year, to intercept any aircraft, for almost any reason.

It can be anything, from an innocent civilian aircraft that has had a system failure, to the more publicised 9/11-style rogue airline threats, and everything else in between.

Air Commodore Harry Atkinson, Station Commander at RAF Leuchars in Fife, and Head of the RAF in Scotland, is a veteran of QRA missions.

“It absolutely is a Quick Reaction Alert operation,” he said. “The air crews are fully dressed in their flight suits and ready to go at a moment's notice.

“When you get the call, it's exciting, it's a moment of reflection, and a moment to be

confident because it's what you have trained for. It also requires a huge amount of trust in the team around you”.

“The real backbone of the team is the people who ensure the aircraft is fit for purpose and ready to perform because, when you press that button, everything needs to work first time.” Considering there are 147 computers in a Typhoon, across 19 different networks, that is some responsibility.

In March 2009, BAE Systems was awarded a contract by the UK MOD for the maintenance and support of the Typhoon fleet. Called the Typhoon Availability Service (TAS), it's a partnering arrangement with the MOD, which sees the company take a

major role in ensuring the availability of the Typhoon fleet to meet its standing and contingent operational commitments.

BAE Systems staff, quite literally, work side-by-side with MOD and RAF personnel at RAF Coningsby, and RAF Leuchars. Between them, they ensure that when there is a QRA and the pilot has to press that button, everything works. A strong relationship is therefore absolutely essential.

Spend a day at RAF Coningsby in East Lincolnshire and it quickly becomes apparent this really is a team effort. Dominating the airfield is a brand new hangar, called the Typhoon Maintenance Facility, which was built by the MOD 18 months ago. It houses the Typhoon aircraft and is the most advanced facility of its type in use across the RAF.

It is operated by a joint team of RAF and BAE Systems staff - around 400 BAE Systems personnel work at the base in total - and that's where the main maintenance work is carried out.

In October 2010, the Typhoon Availability Service was extended to the second main operating base, RAF Leuchars in Fife to coincide with the deployment of 6 Squadron. It was a move that presented a number of

logistical challenges but, after months of intensive training preparing for QRA north duties, Typhoon officially took over full responsibility from the Tornado F3 fleet in March this year.

Air Commodore Harry Atkinson, who was responsible for overseeing the transition, said: “I think we should warmly embrace the fact this is very much a team effort. Two years ago, when I was appointed Station Commander of RAF Leuchars, our mission was to transform it into the northern base for the Typhoon QRA service. That mission reached its conclusion in March, when the Tornado F3s completed QRA for the last time. None of that could have been achieved without team-work and the help of BAE Systems”.

“This is the start of the future for the Royal Air Force, as we look to see how well the Typhoon can be developed, and to promote its potential capabilities in delivering the paramount duty, which is to control the air, over the United Kingdom and our partner nations,” added Air Commodore Harry Atkinson.

It's good to know our skies are protected when the alarm is raised.

# SMOKE IN THE AIR



## POWER, AGILITY, SPEED AND CLIMB RATE FOR THE "FERRARI OF THE SKY"

This air show season will be just like any other. Typhoon display teams from the Austrian Air Force, Italian Air Force and the Royal Air Force will perform throughout the summer months to thousands of aviation enthusiasts across Europe. All will execute a well-rehearsed display of the aircraft's raw power and agility for the spectators, but did you know what goes on behind the scenes to make the display you might see this summer so spectacular? Each routine takes extensive planning and training to be perfect each time, with weeks of preparation and team work. In this edition of Eurofighter World, we finally gain an insight into the process behind the incredible Typhoon displays.

The RAF have, with the help of BAE Systems, created a visual work up of their display for 2011. This "work up" of the routine is represented in a series of ribbon diagrams which are published annually on the RAF Typhoon display team website <http://www.raf.mod.uk/tyhoondisplay/>.



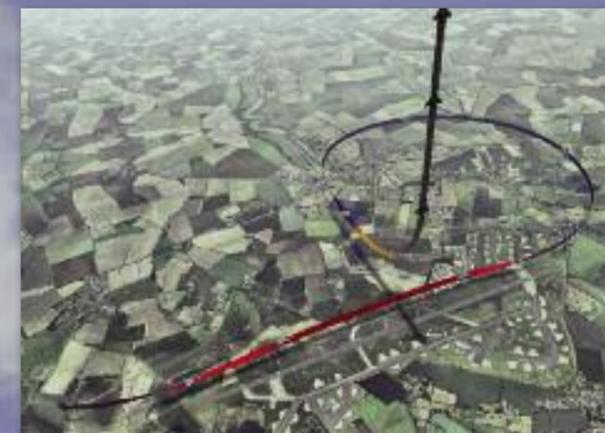
This process takes place with the simulation team based in Warton in Lancashire where the Typhoon flight simulator can be found. Each RAF Typhoon display pilot goes through the same process. This year's pilot is Flt. Lt. Tim (TC) Clement who did such an outstanding job in 2010 that he was given the honour again in 2011. Tim begins by designing his own routine and then analysing it in the simulator. This is a long process and takes a considerable amount of time before they see the finished article.

Tim highlighted how the simulator in Warton is integral to the 2011 display. "The use of the simulator is essential because it allows me to go to the edge of the envelope, checking manoeuvres are feasible and safe before being in an aircraft. In practical terms, using a simulator prevents the display team from depriving those on the front line of a valuable asset".

Millie Barnes, from the BAE Systems, Military Air and Information Simulation team said: "After Tim has worked up and finalised his routine, we record information, in real-time, on the aircraft position and orientation during the simulated flight. The necessary data is then extracted from the saved file and we use another piece of software to create a series of electronic ribbons that visualise what the aircraft is doing at any time during the flight.

The whole sequence is split up into several sections, each containing three or four individual manoeuvres. This makes it easier to follow the path of the complex display. The images are then used by the RAF display team as part of their promotional material at air shows and on the team's website."

As quoted on the Typhoon display team's site, it is the team work that makes the display happen. "Whilst it is the pilot who displays the aircraft, he cannot even begin to do his job without the unfaltering commitment and backing of the dedicated group of professionals that make up the Typhoon Display Team".





## MAJ. RAFFAELE BELTRAME ITALIAN AIR FORCE TYPHOON DISPLAY PILOT INTERVIEW

Maj. Raffaele "Boff" Beltrame is the 2011 Typhoon test pilot for the Italian Air Force. Maj. Beltrame joined the Italian air force in 1993, coming from the 6th wing in Ghedi where he flew Tornados and was assigned to the Italian test centre in 2002.

Graduating as a test pilot from Pax River (USNTPS) - the US navy test pilot school - Maj. Beltrame is currently the Chief of the air-to-air section of the 311th Gruppo (squadron).

As test pilot of the 311 Gruppo of the Italian Reparto Sperimentale di Volo, Flying Test Center, he has been assigned to the Eurofighter Typhoon programme since 2004. In his career to date, he has logged almost 3000 flying hours on 43 different aircraft and helicopters. Here he gives us an interview on what it's like to be given the role of Typhoon display pilot.

*Can you tell us how you go about working out defining the content of the display for each season?*

*The choice of the pre-determined manoeuvres that are to be performed during the display must meet precise criteria. The main objective is to come out with a display that is focused in highlighting aircraft performance and flying qualities. That being said, it is probably more correct to define it as a technical display flight where everything is performed in a specific parametric way. This requires a period of training during which the display is build-up from paper drawings.*

*How important is the use of the simulator in your work up for the display?*

*The use of the simulator is very important for nailing parameters, manoeuvre sequencing and overall geometry of the display. It is also fundamental to know thoroughly the aircraft and its characteristics to get the most, performance wise, out of it while trying to make a nice figure in the sky.*

*What are you looking forward to most from this year display calendar?*

*We have quite a lot of displays this year and each one is going to be very important. Recently I had the opportunity to perform at "Aero India 2011" and this was a great experience. I'll be moving around Europe and will get to perform in Italy as well. I'm looking forward to it!*

*From a spectator's perspective, what should they expect from your display this year?*

*This year, for the ones who have seen the past season displays, there are a few changes that were made in order to enhance the overall display geometry. The display will also be slightly longer than the past season. I hope everyone will enjoy it.*

*Talk to us about the Typhoon aircraft.*

*The aircraft is very nice to fly and you definitely can appreciate, from the cockpit and from a spectator point of view, its extraordinary performance as well as its manoeuvrability. This allows me to confine the display to a very small area of the sky while keeping a very high energy state. That is very difficult, in general for an aircraft, to achieve unless you have enough thrust and manoeuvring capability (that a canard-delta wing design can offer, coupled obviously with great engines).*

# THE PERFECT FIT

Ever since Tom Cruise strutted his stuff in *Top Gun*, it has been a truth universally acknowledged in the lads' mags at least that the primary function of the jet fighter's wardrobe is to make the aviator look effortlessly cool. However, it doesn't take too long in the company of Sam Stewart, a BAE Systems Survival Equipment Fitter, to shatter that little illusion.

"Protection, communication and comfort". That's the mantra of Sam and his colleagues in Flight Operations, where thoughts don't linger on what the kit they supply to a pilot looks like, but on its ability to help him do his job and cope if things go wrong.

The gear may look great but if you were to witness a pilot getting fitted into an anti-G suit with enough lace tightening to make even Lady Gaga blush you would quickly realise it's a serious bit of kit. There aren't many of us who go to work in a suit worth upwards of £40,000 but looking the part really doesn't enter the equation, this is all about function rather than form.

The whole operation of fitting a pair of trousers is carried out with, as you might guess, military precision. It has to be. The margins for error, well, there can't be any errors.

Sam puts all the fastidious primping and preening, testing and re-testing, into perspective. "If everything else goes wrong with the aircraft, our kit has got to work, it's the only thing the pilot has keeping him alive." The 21-year-old's primary function is to make sure all the pilots have the kit they need, when they need it.

## PCC: PROTECTION, COMMUNICATION, COMFORT.

The kit is designed with those three elements in mind and in that order of priority too. So let's deal with the notion of comfort first. If you're thinking clothing with a bit of give to accommodate an expanding waistline think again. Comfort for Sam's team means that the pilot's movements aren't too restricted. For example, it's more than a little useful if the pilot can lift his leg high enough to step up into the cockpit and, once inside, he may wish to lift his arms to helmet level. That about covers it for the comfort side of things.

The jacket is a one-man survival kit. Its collar incorporates a life preserver which inflates on contact with water and yes, it contains a light and a whistle. There's also a little aerial attachment which transmits



The new generation helmet, the purpose made flying suit and the dedicated equipment make sure that the Typhoon pilots can do their job in the most efficient and safest way possible.

the wearer's location, making them easier to be found by search parties.

The life preserver is inflated for several hours to check it is fit for purpose. The pockets are packed with an array of survival equipment: flares (two types), a torch, a mirror, a first aid kit and much more. There's even a sachet of drinking water.

The jacket also includes a little black box, the air crew service package, which connects all the vital hoses for oxygen and communications. It's small and rather innocuous looking but if you wanted to buy one it would set you back £12,000.

Then there are the anti-G trousers. The pilots can fly up to 9G's in the Typhoon, which put simply means a pilot will weigh the equivalent of 9 times his normal weight. Let's put it another way, a man weighing 90kg including the equipments on the ground would weigh close to a 900kg at 9G!

To help their bodies cope with this force, pilots are issued with the anti-G trousers. There's a standard issue for standard jets, but then there's a second set, specifically designed for the Typhoon, known as fagots which kind of stands for full coverage anti-G trousers. Both types have a series of inflatable bladders built in. During in-flight manoeuvres these automatically respond to the jet's movements

and fill up. The effect is to force the pilot's blood to travel upwards ensuring a good blood supply to the brain and other vital organs

The helmets are next. Again there is the question of getting the perfect fit so various parts, including ear protectors, are adjustable.

"The helmets and visors are remarkably tough. I have seen examples down at RAF Henlow where the helmets have been tested in action and have withstood incredible impacts. They do a vital job of protecting the brain and they have to be checked every few weeks." And finally there's the immersion suit, which keeps the pilot alive if he needs to eject over the ocean. It is essentially a specially constructed dry suit that the pilot has to wear over his flight thermals. They are worn when flying over the sea during winter months.

"Without the immersion suit you'd last a couple of minutes. With it you have a little bit more time," says Sam, whose job spec clearly isn't to make sure the pilot looks like the next Tom Cruise but to help keep him safe.

"The job title says it all, I'm a Survival Equipment Fitter."

"If everything else goes wrong with the aircraft, our kit has got to work, it's the only thing the pilot has keeping him alive."

# TOTAL DOMINANCE



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