EUROFIGHTER
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ONE MILLION FLYING HOURS

EUROFIGHTER WORLD SPECIAL EDITION

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Every Hour, Every Day, Ever Ready

One million flying hours is a measure of something deeper than endurance.

It is a measure of the trust that air forces across Europe and beyond have placed in a single aircraft.

As Eurofighter Typhoon reaches this milestone, Eurofighter CEO Jorge Tamarit-Degenhardt reflects on what it means for the programme, for the people behind it, and for the security of the nations it serves.

What does reaching one million flying hours mean to you personally – and as CEO ?

Reaching one million flying hours is a truly historic milestone for the Eurofighter programme. It represents more than three decades of commitment, innovation and collaboration across Europe.

As CEO, I see it as a very powerful signal of operational credibility. One million hours means that air forces have relied on this aircraft, day after day, year after year, to protect their airspace and execute demanding missions.

At a time when the security environment in Europe has fundamentally changed, this level of operational experience and trust is more important than ever. It confirms that Eurofighter Typhoon is not only a technological achievement, but a proven capability that contributes directly to Europe's security and deterrence.

Why is this more than just a number? What does it represent behind the scenes?

A figure like this can sound abstract, but behind it there are thousands of people and decades of dedication. →

Every flying hour represents careful engineering, rigorous maintenance, continuous upgrades and the professionalism of the pilots and crews who operate the aircraft. It reflects a whole ecosystem, industrial, technological and operational, working together to deliver reliable Air Power.

In today's strategic environment, those flying hours also represent readiness. They show that the aircraft is not simply a platform on paper, but a capability that has been consistently available and trusted to perform in real operational contexts.

What does this say about the durability and reliability of the platform over time?

We can proudly say that around 80% of Core Nations' operational air missions are executed by Eurofighter, which demonstrates its high mission reliability.

Whether it is air policing missions, joint patrol initiatives, combat missions or QRAs (Quick Reaction Alert), the Typhoon represents the air combat mass for Europe. If we think about its operational presence in the Middle East, we can reach the same conclusions.

So these million flying hours say everything. Eurofighter is, without question, one of the most reliable and combat-proven aircraft in the world, which has consistently delivered Air Power to the air forces operating it since its introduction into service.

That level of confidence does not happen by chance – it is built through experience, continuous improvement, and the robustness of the industrial and support network behind it. Today, Eurofighter stands as a cornerstone of NATO and allied air defence, fully interoperable and adaptable to a wide range of mission requirements. It is a platform you can trust, every hour of every day.

How has the programme maintained continuity and relevance across decades and generations of technology and personnel?

The key has been evolution. From the beginning, the programme was designed not as a static platform but as a system capable of continuous development.

Over the years, Eurofighter has integrated new sensors, weapons, connectivity and electronic warfare capabilities. This ability to evolve ensures that the aircraft remains operationally relevant even as the strategic environment changes.

At the same time, the programme has successfully transferred knowledge across generations of engineers, technicians and operators. That continuity of expertise is essential for maintaining such a complex capability over the long term.

What role has international collaboration played in sustaining the platform to this point?

International collaboration is at the very heart of the Eurofighter programme.

The platform is the result of a unique partnership between nations, industries and air forces across Europe. This cooperation has created a powerful industrial and technological ecosystem capable of sustaining and evolving the aircraft over decades.

In today's geopolitical context, that cooperation takes on even greater importance. It strengthens Europe's defence industrial base, reinforces alliance cohesion, and ensures that critical combat air capabilities remain available to European and allied nations.

Are there any decisions or turning points in the programme's past that feel especially important now, in hindsight?

Looking back, one of the most important decisions was to design the aircraft with long-term evolution in mind. That strategic approach has allowed Eurofighter to continuously integrate new capabilities and remain relevant as operational requirements evolve.

Equally important has been the sustained commitment from partner nations to invest in upgrades and enhancements. Those decisions ensured that the aircraft did not remain static, but instead grew in capability alongside the evolving needs of European and allied air forces.

Looking ahead, how does this legacy shape Typhoon's future and its role within European defence?

If anything, the current geopolitical situation makes the role of Typhoon even more relevant.

Europe is placing increasing emphasis on readiness, deterrence and strategic autonomy. In that context, Eurofighter represents a proven and immediately available combat air capability that can deliver air superiority, multi-role operations and credible deterrence.

At the same time, the aircraft will continue to evolve with new sensors, advanced connectivity and electronic warfare capabilities that will guarantee air dominance well into the 2060s. This means that Eurofighter will remain a central pillar of European Air Power while also contributing to the broader ecosystem of next-generation combat air systems.

Finally, what message would you want to share with the thousands of people – engineers, pilots, maintainers – whose work has made this milestone possible?

My message is one of pride and appreciation.

Reaching one million flying hours is not the achievement of a single organisation or generation. It is the result of the dedication, professionalism and expertise of thousands of people across Europe and beyond.

Thanks to their work, Eurofighter Typhoon continues to deliver the operational capability that our air forces rely on in an increasingly complex and uncertain security environment.

This milestone truly belongs to them. ←

What Lies Behind the Million

Eurofighter Typhoon has reached an incredible milestone, but what does a million flying hours actually represent?

For Jen Richley, (pictured left) Operational Factors Manager at Eurofighter and a former fast jet operator, the answer is clear.

“A million flying hours isn’t just a number, it’s a reflection of years of professionalism, reliability and teamwork.”

Flying Hours Are Just the Tip of the Iceberg

What counts as a flying hour? It starts with the wheels off the ground at take-off and ends with them touching down at landing, but the real story begins long before the pilot straps in. "For every sortie, you’re looking at around two hours of focused work before take-off. There are system checks, fuelling, arming, loading mission data," says Jen. "Behind that, the aircraft will have been through hours of maintenance and engineering prep. You’ve always got a team of engineers making it happen.

“On a typical frontline squadron, you’ll find six times more engineers than pilots. Their work covers everything from hydraulics to avionics, fuel systems to flight data downloads. And that’s just the day-to-day effort,” Jen adds. “There’s also deeper, periodic maintenance that strips the aircraft back to its core and ensures long-term reliability.”

How The One Million Figure Breaks Down

Training: Of the one million hours flown, a large percentage has been spent on training sorties. "You train the way you fight," explains Jen. "Every training mission is designed to rehearse the exact tasks Typhoon performs on operations - whether it’s air-to-air combat, precision strike, or close air support. Even training sorties have a deterrent element to them.”

Operations: The aircraft’s swing-role capability means Typhoon pilots routinely switch between air-to-air and air-to-surface tasks, often in the same mission. From Quick Reaction Alert duties to overseas operations, the hours build up fast. Add in NATO missions, exercises, and operational deployments, and the hours start to add up.

Testing: Industry plays a vital role in the total too. More than 11,000 hours have been flown by industry test pilots. These flights underpin every new capability, sensor, software update and export delivery. "Before any aircraft is handed over to a customer, it goes through a rigorous Production Flight Acceptance Test (PFAT)," says Jen. “Our industry pilots are the first to fly every aircraft that rolls off the line. They test every system, every function, in different conditions to make sure it performs exactly as it should.” Development flights, meanwhile, can range from assessing a new cockpit display to trialling advanced sensors like the Litening pod or next-gen datalinks. “Often we use a single sortie to test multiple things - it’s extremely efficient,” she says.

How Long Is an Average Mission?

“A standard training sortie lasts around 90 minutes to two hours, depending on mission type. But operational missions can stretch far beyond that, especially with air-to-air refuelling," says Jen. "On deployed operations, it’s not uncommon for crews to spend 12 hours on duty, including long transits and hours on station, all before the real action begins. At that point, the pilot must be ready to switch instantly from cruise to combat, precision strike or interception.”

A Record of Reliability

Perhaps the most remarkable part of the million-hour milestone is Typhoon’s safety record. “The number of airframe losses is still extremely low, even after all these hours,” says Jen. "That’s extraordinary, especially when you consider the types of missions we fly, the high-G manoeuvres, weapons releases, long-haul deployments, complex multi-role tasks. The Eurojet engines, avionics, and weapon systems are engineered for reliability under pressure, and that’s paid off across every operator nation.”

The Biggest Misconception

Jen says the biggest myth is that flying hours are all about the pilots. “It’s never just the pilot. Every hour flown represents an entire iceberg of effort - the engineers, the data analysts, the safety equipment specialists, the air traffic controllers, the supply chain, the software developers, and everyone involved in designing, certifying, and supporting this aircraft. But whether you’re working on radar software in Germany or building components in Italy, every time a Typhoon takes off, it’s your work being tested.” ←

The First Hour

In 1994, test pilot Peter Weger took the Eurofighter Typhoon into the air for the very first time in the aircraft known as DA1 (Development Aircraft 1). Today Peter looks back on that high-stakes moment; what he knew, what he didn't, and how it feels to have flown hour one.

The aircraft was ready. The cameras were ready. The telemetry rooms were ready.

Then you climb the ladder, settle into the seat, and the familiar sequence begins: helmet, gloves, kneeboard, cockpit setup, engine start, time checks, taxi. The same routine as the test runs before, because on a first flight you do not chase theatre, you chase discipline.

Even the smallest details mattered. If you watch the video, you might notice DA1 was not quite straight in the shelter. I brought it back onto the yellow taxi line for the live cameras. It sounds trivial, but it was part of the mindset. Get the basics right, every time.

Of course, it was a special moment. I felt calm and collected but in a high state of concentration. Because DA1 was in excellent technical shape, maintained and prepared for the first flight as well as any aircraft can be. The external set up was equally thorough: air traffic control, the test area, the chase aircraft, and support teams. In telemetry, experts were already monitoring all the essential technical data. In short, everything was in place. You may be the one in the cockpit, but you are never alone on a first flight.

And yet, no matter how many reviews you sit through, there is always a part you cannot rehearse.

A few days before the flight, our CEO Hartmuth Mehdorn asked me directly: "Herr Weger, können wir sicher fliegen?" Can we fly safely? It was not a slogan. It was a question that carried the full weight of responsibility. Because this flight was never only about aviation. If something went wrong in that first flight period, the damage would not stop at the aircraft. It could be detrimental for the entire programme.
Only after you have taken off do you fully understand what that means. →

Peter Weger
Test pilot Eurofighter Typhoon

What we did not know

We had confidence in what we knew. The Iron Bird ground test vehicle was close to the real aircraft in terms of handling and control, and it gave us a strong baseline of what to expect.

I knew the RB199 engines. The cockpit was a preliminary Tornado flight deck, familiar in important ways. I had also flown the EAP (Experimental Aircraft Programme), and that helped, but it also sharpened the real question: what will Eurofighter be like in the air, not just on paper?

We also knew about the ground handling characteristics of the aircraft up to lift off speeds, and we had worked through things like drag chute behaviour and barrier engagements should we need it.

What we did not know was the unknown, the unexpected. Every first flight carries that, and pretending otherwise is the quickest way to get into trouble.

There was another reason discipline mattered so much. It had been decided to fly DA1 with reduced functionality, as the flight control system was not fully developed at that stage. That resulted in a split flight envelope: low speed with the gear down and high speed with the gear up, with only a narrow overlapping corridor between the two.

It also meant operating with a non-standard take-off sequence: cancelling reheat at lift-off, leaving the gear down, and climbing at a constant 190 knots into that split envelope. As a test pilot, you train for exactly this kind of abnormal situation.

The day itself

On Sunday, 27 March, there was a last-minute briefing at 10:00, attended by all crews. After that, I locked myself in my office and went through the flight over and over in my head: take off sequence, timing with the chase aircraft, flight profile, test points, and last-minute system limitation changes. Over and over, until the sequence felt as familiar as a routine sortie, even though nothing about it was routine. I also spent time in the cockpit. It felt comfortable. My favourite office, you could say.

On the day, I strapped in with the same routine as always. The aircraft was prepared, the team was ready, and the system around the flight was designed to support good decision-making. Then in the air, the flight test schedule was flown as planned, as written in the flight test report. That is exactly what you want to be able to say about a first flight.

There were still moments that stay with me. As you might expect, the weather did not follow the script. An overcast cloud layer sat right in the departure sector and forced an impressively steep climb to reach the only hole in the sky. It was not part of the plan, but it was managed, cleanly and without hesitation.

There was also a small mishap that was more human than technical. The photo chase aircraft seemed to get a little carried away and crossed my nose too close.

Pressure, on and off the runway

People often ask about the pressure. I was aware the first flight was absolutely special. The local press wrote that “Test Pilot Weger is already in love with EFA”, even before it ever flew. In German, EFA sounds like Eva, a girl’s name, and they enjoyed that. Thousands of people were hanging on the airport fences.

Behind that attention was something more serious. A crash during the first flight period would have been detrimental for the total programme. You do not have to dramatise that. It is simply true, and everybody involved understood it.

After landing, the wider world arrived quickly. My crew chief climbed up the ladder with flowers, and we stood there smiling, tapping shoulders, relieved and happy. I stepped down the ladder, received another bunch of flowers, and then received congratulations from the Chief of Staff, General Kuebart, and the CEO, Mehdorn. Suddenly, I seemed to be everybody’s darling!

It is a nice memory, but the feeling underneath it was simple. Relief. Not because we had done something flashy, but because we had done something foundational, and we had done it safely.

Beyond the airfield

Any new fighter development programme is political, and Eurofighter was especially so. The Berlin Wall fell in 1989, the Cold War ended, and Germany reunified in 1990. There was a strong public mood of “never again war”.

Interest in a new fighter was low, almost non-existent. Even our Minister of Defence at the time, Volker Rühe, had called the programme dead. Industry slowed down the development programme. On top of that, we inherited 24 former NVA MiG-29s, and some people asked bluntly: if you have MiG-29s, who needs Eurofighter?

In that climate, the first flight was more than a technical milestone. It was a statement of intent. Industry woke up, because we had to set the mark. We had to demonstrate that Eurofighter was the best solution for a future air superiority fighter aircraft. And we had to do it fast.

The German media was not overly enthusiastic about the first flight. However, it captured the attention on the world stage. We presented early results at an experimental test-pilot symposia in Los Angeles and Europe, and you could feel the interest and respect.

Looking back now, yes, it feels different knowing that first hour led to a million more. But even then, I knew I was piloting an incredible aircraft and that we had something special. It was one of those days you remember for the rest of your life.

We had worked hard on the design of the flight control laws, on flying qualities and handling, on cockpit layout, and on outside visibility in a 9G environment. It felt like a great air superiority fighter was born.

Years later, watching Typhoon displayed at Farnborough and Le Bourget, I witnessed the unmatched manoeuvrability, precision and performance. I remember that while the pilot Chris Worning was showing off Typhoon’s display, I was “sentenced” to fly a Dornier 328 regional airliner display right after him.

A very different kind of flying, a slow roller coaster compared to what Typhoon could do. But, hey, that’s fine, Chris got the airshows, I had the first hour.

A message to today’s pilots

To the pilots flying Eurofighter Typhoon today, my message is simple: the platform is exceptional, and it was designed that way. The delta canard design and the intentionally unstable concept are ideal. Maximum effort was put into first-class flying qualities, low and high-speed manoeuvrability, and performance. It is a perfect platform, and it remains acceptable for future systems and avionics updates, including whatever comes next.

Eurofighter is now more than 30 years old, and it is certainly not at the end of its career. It will stick around for years to come.

That is why the first hour still matters. Not because it makes a nice anniversary. Because it was the start of a story that lasted, hour after hour, across decades. ←

The Longest Night

By Mike Sutton

Former UK RAF Typhoon squadron commander Mike Sutton recalls the first night of action.

For Typhoon over Iraq and Syria, that began in driving rain and ended after six hours in the dark. He looks beyond tactics to the human reality of sustained operations, the mental load of command, and the judgement required when fatigue and uncertainty become routine.

Can you take us back to one mission, one operation. What were the conditions, and what made it stand out?

The first strike mission against targets in Syria will stay with me forever. Following a UK Parliamentary vote authorising air strikes, we deployed the next morning from Scotland to Akrotiri: six jets, pilots, engineers and support staff. 24 hours later, as thunderstorms battered the airfield, I taxied out under the gaze of BBC cameras, knowing that somewhere back home, loved ones might later see a grainy clip on the news. The aircraft was heavy with weapons, the air thick with rain and gusting wind. Launching into a moonless night towards Iraq felt utterly surreal.

I remember a swirl of emotions: fear, excitement, and a persistent ache of not wanting anything to go wrong, coupled with the knowledge that a great deal could. After years of preparation, →

it felt like the culmination of everything I'd worked towards, and yet unmistakably the beginning of something new. The cockpit felt strangely familiar, almost homely, set against the inky black night with lightning flickering in the distance. The task ahead was anything but normal.

After meeting a refuelling tanker over Iraq, my wingman and I pressed on towards Syria. Releasing weapons onto oil infrastructure, then refuelling again, and conducting surveillance over hostile territory. Almost six hours after take off, I peeled myself out of the cockpit at around 2am. Night one was complete, with five months of operations ahead.

What does operating through sustained sorties do to your mind and body, during and after?

The Iraq and Syria deployment involved six-to-eight-hour sorties, every other day, for weeks on end. Some missions were quiet: hours of circling, watching and waiting. Others were frenetic, with a cascade of urgent taskings, repeated weapon drops in support of troops who were in immediate danger.

You lived in a constant state of mental flux, switching rapidly between extreme focus and relative calm. Over time, this uncertainty became familiar. A tasking to fly to Iraq and await further instructions became routine. You could see your own adjustment most clearly on the faces of new arrivals. Furrowed brows gave way, slowly, to routine.

I subconsciously built a mental shell. The flying was intense, and as the Squadron Boss it was hard to switch off. When I wasn't flying, those who were remained constantly on my mind. A work iPhone meant the critical and the trivial streamed into the inbox together, a modern feature of conflict. FaceTime made conversations with home easy enough, but the contrast was stark. The extremity of daily operations made life back in the UK feel muted, even benign. It was comforting to talk to loved ones, but at times the conversations felt strangely hollow.

Was there a moment where you had to actively suppress instinct or emotion to stay mission focused?

Staying calm in the cockpit is an essential character trait, and most fighter pilots will have used up a few of their nine lives. One tense moment that stands out was being locked up by a Russian surface to air missile radar. Front line pilots are trained to respond almost instinctively to that stimulus. But this occurred during a transit over a large city, where a standard tactical response would have been wholly inappropriate.

Intelligence suggested a launch was unlikely, so I forced myself to trust that assessment, which was counter to my racing pulse. After five minutes, the lock ceased. It was either a good decision or a lucky one.

What kind of decisions are the hardest to make when you're in command of a mission?

Dropping a weapon close to friendly troops carries the greatest jeopardy, but when the situation is clear cut, the decision itself is not difficult. The hardest decisions are those with competing priorities or unclear outcomes. Balancing time on task, fuel state, air-to-air refuelling, weather, and multiple mission demands is where the flying became truly busy. The greatest risk was always making a decision based on incomplete or flawed situational awareness.

How do you decompress or reset after a sustained high-tempo period?

Resetting after sustained high tempo operations was rarely clear cut. Sport helped in small ways. I enjoy running or getting distracted with the Six Nations. Talking with others who had been there was often the most useful way of putting events back into context. Genuine opportunities to fully disengage on operations were limited. As Squadron Boss I was always reachable, and on returning from operations we moved directly onto UK Quick Reaction Alert while planning the next training exercise. I took what short breaks I could, but the priority was to keep functioning and to continue making sound decisions as Squadron life continued.

What lessons did you take from that experience, about yourself or about flying Typhoon?

I didn't realise how much weight I was carrying in the role until I moved into my next job behind a desk in the MOD. That brought different pressures, and in many ways more frustration, but far less that was visceral or immediate.

One of the key lessons I took from that experience is just how real, intense and unforgiving fast jet flying is, and how much responsibility we place on very young shoulders. That reality needs to sit at the forefront of capability and policy decisions, which are often made in offices far removed from the front line.

How does the aircraft perform?

The Typhoon has a genuine multi-role pedigree. In the close air support role it is superb. Stable, manoeuvrable, and a dependable platform from which to build situational awareness and support the ground troops. I trusted the airframe and the engines implicitly, and they never let me down.

As an air-to-air fighter, the performance is extraordinary. I still recall one occasion when my eyeballs actually hurt as I sustained a long 9G turn, the jet relentlessly accelerating through 520kts. At 9G, my 80-kg body effectively weighed around 720 kilograms.

So the baseline performance is immense, but with combat aircraft the evolution is never complete. Threats adjust and improve constantly, and if the jet doesn't evolve with them, it falls behind. Getting that balance right is a team effort, from politicians enabling the funding, through to the defence industry responding quickly, to those developing the tactics on the front line.

What are the challenges?

The aircraft is straightforward to fly. Although operating it well, tactically and consistently, takes years of experience. As you become more senior, the challenge shifts away from pure flying skill towards managing people and decision making under pressure. Multi-role operations demand constant proficiency across very different mission sets. While the aircraft feeds you vast amounts of information. I would say the greatest challenge for new pilots is becoming task saturated and mentally overloaded in the moment. The ability to prioritise ruthlessly, to process huge amounts of simultaneous information and to focus on what matters most, is something only experience can teach. ←

"At 9G, my 80-kg body effectively weighed around 720 kilograms."

ECRS Mk2
Radar for Eurofighter Typhoon

Making Sense of Typhoon

Tom Nash, Campaign Manager for Leonardo

Leonardo's sensor engineers have been at the heart of Eurofighter Typhoon since the programme's earliest days. From the original CAPTOR-M radar through to the development of the next-generation ECRS Mk2, their teams in Edinburgh and Luton have helped shape a sensor suite that has evolved continuously across more than a million flying hours. So, what does that evolution mean for the aircraft and the people who fly it. Tom Nash, Campaign Manager for Leonardo and a former RAF Tornado GR4 qualified weapons instructor and electronic warfare instructor with almost 2000hrs flying experience takes up the story. →

“The radar starts first time, every time – whether the aircraft is in the Arctic or the desert.”

Steve Bevan

A Eurofighter Typhoon pilot processing a fast-moving tactical picture is not relying on a single sensor. Radar, defensive aids, infra-red search and track, radios, datalinks – each feeds information into a fused picture designed to support decisions that may come down to fractions of a second. Whether a contact is friend or foe, whether a weapon should be released: these are judgements where the quality of sensor data is not an academic question. It is the question.

Getting that right across more than a million flying hours has demanded constant evolution.

The CAPTOR-M radar that entered service in 2003 remains operational with the Typhoon nations, but the threat environment it was designed for has changed fundamentally.

The range and speed at which adversary aircraft now need to be detected called for a step change.

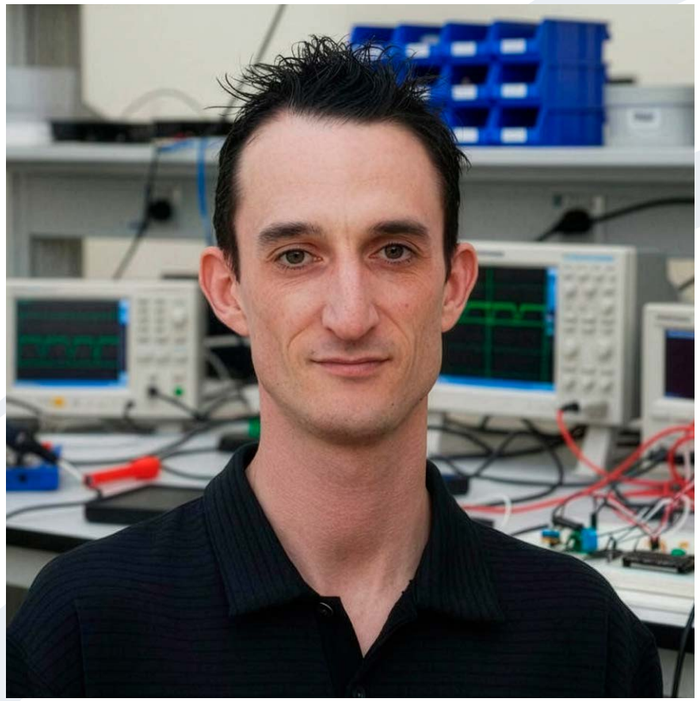
That arrived with the European Common Radar System (ECRS) Mk0. This is an Actively Electronically Scanned Array (AESA) radar is paired with an innovative mechanical repositioner that extends the system’s field of regard, well beyond that of a conventional fixed array. Detection performance, situational awareness and freedom of manoeuvre all moved forward significantly.

But evolution, by definition, does not stop. Development of the ECRS Mk2 radar is already under way in Edinburgh. It represents something more than incremental improvement: a fully integrated electronic warfare capability built into the radar itself, alongside enhanced traditional radar functions.

When fielded, it will open the door to mission types, including Suppression of Enemy Air Defences (SEAD), that Eurofighter has not traditionally undertaken. Combined with new digital architectures, enhanced communications and the Striker II helmet-mounted display, it points to a Typhoon that will operate in a fundamentally different battlespace, alongside fifth-generation aircraft and autonomous collaborative platforms.

Shaped by the people who face the threat

The sensor evolution extends across the full Defensive Aids Sub-System (DASS), too. Capabilities such as Britecloud – an expendable active decoy designed to disrupt incoming →



“First time, every time”

“We use a large range of tests to ensure what is released to an aircraft is reliable. Software releases undergo hundreds of hours of testing on a real radar system on ground rigs, making extensive use of emulators to replicate what the radar will be doing in flight.

For hardware, new technology is subjected to accelerated life testing – thousands of cycles of rapid heating and cooling. We apply a lifetime’s worth of vibration to a representative radar to ensure the delivered radar can last decades in the air.

We test complete systems in thermal chambers at temperatures that exceed worst-case aircraft conditions, to ensure radars start up first time, every time, regardless of whether it’s in the Arctic or the desert.”

Steve Bevan, Captor-E Chief Engineer

“Each iteration builds on genuine operational understanding rather than starting from a blank page.”

Steve Bevan

missiles’ tracking systems and generate significant miss distance – have been introduced to counter increasingly sophisticated threats. Many of the refinements to Eurofighter’s Praetorian DASS have been shaped directly by front-line operators and specialist electronic warfare communities.

Aircrew routinely challenge the engineering teams to employ existing cockpit symbology in new ways, helping them interpret complex situations more intuitively. The engineers respond by evolving the underlying software. It’s a cycle of operational feedback and technical refinement that has continued for over two decades.

Proving it before it flies

None of this capability reaches the aircraft without being rigorously proven first. At high-G, a Typhoon is an inhospitable environment for delicate micro-electronics. The testing regime that sits behind every software release and every hardware upgrade exists to ensure that what is delivered can last decades in the air.

That combination – relentless capability evolution underpinned by rigorous engineering validation – is what has allowed the sensor suite to remain credible and current across a million flying hours. The engineers who maintain and develop these systems, many holding doctorates and decades of specialist experience, represent a depth of knowledge that is itself a strategic asset. Their continuity within the programme ensures that each iteration builds on genuine operational understanding rather than starting from a blank page.

The next million hours will be flown in a very different operational context. The sensor suite will be central to ensuring that Typhoon remains decisive in that environment – and that its pilots return home safely. ←

Training for Every Hour

One million flying hours do not happen by chance. Behind every sortie sits a training system that prepares both pilots and engineers for everything from routine operations to moments that may only occur once in a career.

Graham Pemberton — former RAF Typhoon pilot and Deputy Force Commander — is now Head of Operational Training Delivery for BAE Systems. He has been part of that system from the start.

Here explains how training has evolved to keep pace with one of the world's most capable combat aircraft.

It starts with the people

For all the technology that underpins modern military training, the single most important element remains the people who deliver it. The instructional staff supporting RAF Typhoon training are overwhelmingly former service personnel, who bring thousands of hours of operational experience into the classroom, the briefing room and the simulator.

The scale is significant. BAE Systems trains roughly 500 engineers a year alongside the pilot pipeline. These teams of technicians and specialists need skills to be equally sharp as those in the cockpit. The Formula One analogy applies: the driver gets the limelight, but it is the whole team that delivers performance.

From emergency practice to operational edge

The evolution of synthetic training represents one of the biggest shifts in how the RAF prepares for operations. A generation ago, simulators served a narrow purpose. Back then a pilot might visit the simulator once a month to practise emergency procedures, like engine failures, fires or system malfunctions. That was essentially it. On Typhoon, simulators are an integral part of operational training, used not just for emergencies but for tactical mission rehearsal, collective training and the development of combat judgement. →

The key has been understanding what each training domain does best. In the synthetic environment, you can go anywhere in the world, at any time of day or night, facing realistic threats in a secure setting where tactics are not exposed. Scenarios are repeatable, drawing out lessons that a single live sortie cannot.

But the live environment offers things that no simulator can replicate. There is a fear factor: no matter how immersive the simulation, a pilot knows deep down they are not going to crash into the North Sea at supersonic speed. There is real-world friction: sun in your eyes, mist on the windscreen, a slippery runway. And there is physiology – pulling 9G hurts, and pilots need to do it regularly to stay conditioned.

A new generation of simulators

The latest Typhoon simulators, currently being integrated and rolled out, represent a significant step forward in three respects. First, fidelity. A 360-degree dome with external projection onto a translucent surface gives the pilot a completely unimpeded view from inside the cockpit. The effect is fully immersive and it feels like the real aircraft.

Second, concurrency. When simulators lag behind the aircraft standard, pilots risk learning the wrong lessons, wrong hand positions, wrong information layouts, or wrong decision baselines. The new simulators are designed to maintain lockstep with the aircraft as it continues to develop. Third, connectivity. Through a new RAF programme, the simulators will connect across multiple sites and platforms, enabling collective training on a scale previously only possible in the live environment – with all the benefits of repeatability, threat realism and security that the synthetic world provides.

Three ways to train

One of the most significant evolutions in Typhoon training philosophy is the way the RAF now defines three distinct modes of simulator use.

The first is part task training: pure repetition, free of scenario or context. An intercept repeated ten times. A procedure drilled until it becomes muscle memory.

"The new simulators are designed to maintain lockstep with the aircraft as it continues to develop."

Graham Pemberton

The purpose is to automate core skills so that cognitive capacity is freed up for higher-level decision-making – the same principle as an athlete in the gym building the physical foundation that allows them to perform under pressure.

The second is training for training: replicating peacetime exercises in the simulator before doing them for real, with all peacetime rules applied. When the RAF prepare for exercises like Red Flag, pilots fly the scenarios in the simulator first – so that by the time they arrived, the unfamiliar had already become familiar.

The third is training for operations: the real thing, without peacetime constraints. Real missiles loaded on the aircraft. No artificial height separation from adversaries. When a pilot is shot down, they disappear and stop communicating – just as they would in reality. This is where pilots learn to make decisions based on what they would actually do, rather than what peacetime safety rules allow.

Only in the synthetic environment can all three of these modes be delivered safely, securely and repeatedly. It is a world away from my old monthly emergency session on the Jaguar.

What comes next

It's all about data. Modern simulators capture everything, every input, every decision in digital form. The potential of AI to analyse that data, identify patterns and feed tailored insights back into individual training programmes is, frankly enormous.

For an aircraft still coming off the production line, maintaining the pace of training development is not optional. Just as Typhoon's mission sets continue to expand, from quick reaction alert to the emerging challenge of countering drones.

Each demands its own knowledge, its own skills, its own training. Behind every one of those million flying hours, and every hour still to come, sits a training system designed to ensure that pilots and engineers are ready for whatever they face. ←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1 MILLION
FLYING HOURS

A Million Hours and Me

One million flying hours is not a number that belongs to any single person, aircraft or nation.

It is a collective achievement – built by pilots, engineers, programme managers, instructors, analysts, and the countless people who have worked on Eurofighter Typhoon since the programme began.

We asked four of them – from industry, from the front line, and from the organisations that hold it all together – what this milestone means to them. →

Andy Flynn

Retired
BAE Systems Eurofighter
Project Director

I remember a moment in 2016 at the Royal International Air Tattoo. Our development aircraft, fitted with Meteor and Brimstone, displayed and won the prestigious Steedman Award against fearsome opposition. A photograph of the Typhoon as it flew down to the show was used in the UK Air Defence Strategy paper and is still seen in briefings to this day. That was a significant milestone – a clear sign that Typhoon had become the platform of choice for force commanders to deploy on operations. It really felt like we had come of age.

What I am most proud of is watching Typhoon move from being accepted onto Quick Reaction Alert to becoming the backbone of air defence across NATO and the Middle East. The narrative of the aircraft has really developed as it has put in the hours.

And I would say we are now in the Renaissance of the programme. Demand for the platform is as high as it was in the early 2000s. If I could bottle one thing that made this milestone possible, it would be the partnerships. The level of learning shared across the Eurofighter nations over the years remains strong, even as people move into and out of roles. It has always been a great place to work on a significant defence programme. ←

Simon Ellard CB FREng

General Manager, NETMA (NATO Eurofighter and Tornado Management Agency)

Two things make me most proud when I think about a million flying hours. First, the incredible impact the platform has had on our security and keeping us safe. And second, its strong safety record. Those two things are connected, and they matter enormously.

What has surprised me most is just how flexible the platform has been, and the wide range of roles it has delivered against. Initially conceived as a Cold War fighter, it has evolved into the most capable platform for a wide variety of missions. Today, it is the backbone of European combat air power.

If there is one thing I think deserves more recognition, it is the people behind the safety cases – the technical reliability analysis, the loss models, the safety analysis. Those responsible for Typhoon's strong safety record do not get the recognition they deserve. And the team itself has not changed in one crucial respect: the same enthusiasm, collaboration and dedication that was there from the very start is still there today. If I could bottle one thing that made this milestone possible, it would be the belief that we are all working on something incredibly important. Dedication. Going the extra mile. Because what Eurofighter Typhoon does really matters. ←

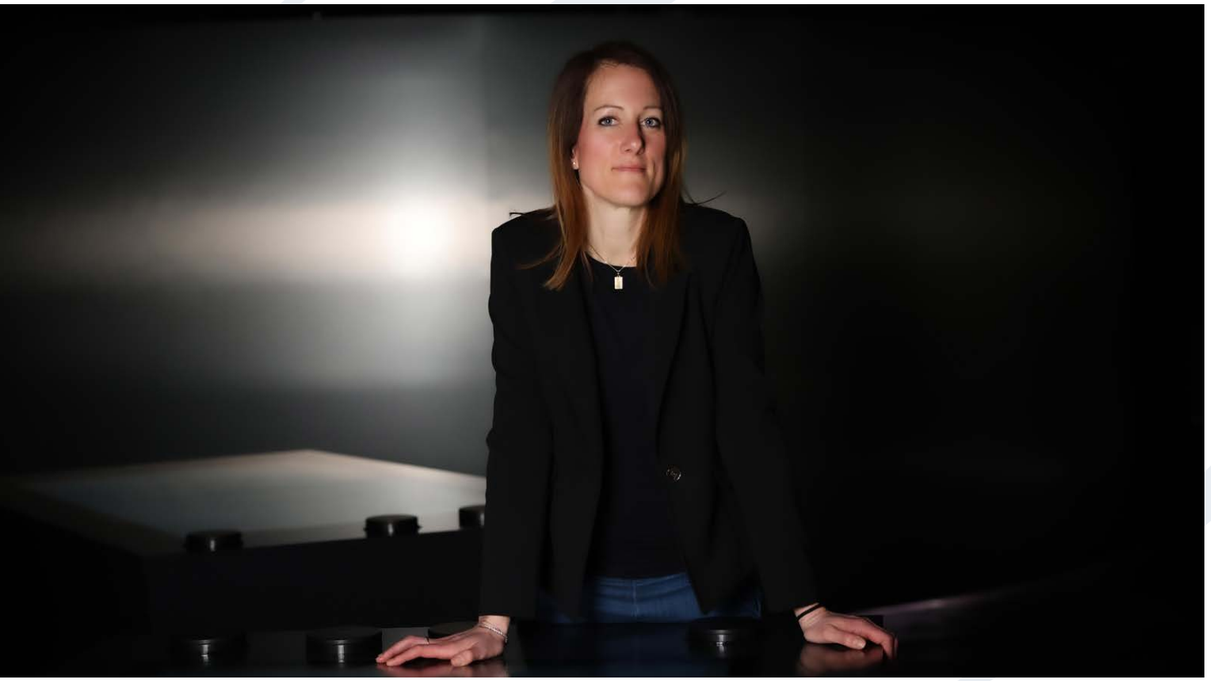
Elena Galli

Vice President Commercial, Eurofighter GmbH

When I started my career 20 years ago in the Eurofighter programme, with the initial deliveries to the Core Nations and Austria as the first export customer, I could never have imagined that it would be the starting point of such an amazing adventure. The pride I feel today comes from a sense of accomplishment, passion and recognition of hard work – all together, as part of the Eurofighter family.

Right now, like never before, I realise how Eurofighter massively contributes to our common security. I see it as a pillar that guarantees stability, independence and the ability for our nations to protect our own skies with our own technology in every possible operational scenario.

The way the platform has evolved is truly impressive – conceived at the end of the 1980s, for a completely different geopolitical era, and yet it never stops bridging for the future with constant development to keep the Typhoon state of the art for the next decades. ←



Giovanni Colla

Military aviation photographer and journalist | 18 years covering armed forces worldwide | Regular contributor to Eurofighter World, Combat Aircraft, Air Force Monthly

The moment I flew in the back seat of an Italian Air Force Typhoon changed everything. Until then, I had always seen the aircraft from the outside – chasing light, angles and composition. Being in the cockpit, feeling the acceleration and the intensity of every manoeuvre, made me understand the aircraft in a much more visceral way. It shifted my role from simply documenting to truly interpreting the experience, trying to translate that energy and complexity into images.

One million flying hours is not just a number. It is a legacy built in the air and on the ground, and I am proud to have witnessed and captured a small part of that story from a unique perspective. If I had to bottle one thing that made this milestone possible, it would be dedication to detail. As a photographer, you quickly learn that every small element matters – light, timing, positioning – and I saw the same mindset reflected across the entire Typhoon programme. From the ground crew preparing the jet to the pilot executing the mission, everything relies on precision and care. ←

Photo:
© Giovanni Colla

The Hour

That Never Feels Routine

One million flying hours is more than a milestone.

It represents discipline, preparation and decisions made in real time.

Behind that number are thousands of individual sorties, each demanding focus and professionalism.

For Captain Manuel Bermejo Casado of Ala 14 at Albacete Air Base, none of those hours has ever felt routine.

Captain

Manuel Bermeo Casado

Ala 14 at Albacete Air Base, Spain

"Definitely not. Our training flights must be demanding enough to keep our performance above the expected standards, and we need to optimise every minute in the air. There is no time for routine."

What may appear straightforward from the outside carries its own intensity in the cockpit.

"On ferry or positioning flights, I consider what I am doing to be something outstanding, not achievable by just anyone. The views, the clouds, the seat vibrations, the feeling of the stick and the sensations related to the flight make every moment unforgettable."

That heightened awareness is constant because circumstances can change without warning. Captain Casado recalls an evening sortie over the Mediterranean Sea while returning to base after a training mission, when the tasking shifted unexpectedly.

"I remember we were coming back when suddenly we were tasked with identifying an unknown aircraft flying at medium level. It was evening, and the sunlight was turning red in the west."

Within moments, a standard recovery became an operational intercept.
"We received the tracks via Link 16 and within seconds had them on our radar. We proceeded to intercept. As we approached, our FLIR image revealed seven aircraft flying in close formation."

The situation quickly clarified.
"It was the Patrulla Aguila returning home from an airshow in France. We escorted them back to San Javier air base."

For Captain Casado, experiences like this reinforce a simple principle. No flight can be taken lightly.

"Experience has taught me that there is no such thing as a low intensity flight. The key is to consider all possible variables and prepare a response for the most probable situations. You must always think ahead."

Becoming operational on Eurofighter requires a shift in perspective. The platform fundamentally changes how a pilot manages information and makes decisions.

"The most important change is understanding the level of situational awareness Eurofighter provides about the tactical scenario developing around you in real time. Compared to other aircraft, you learn to focus on the mission and the best course of action, rather than gathering that awareness yourself while also fighting to control the aircraft."

The design of Eurofighter supports that evolution.

"Eurofighter makes it easy to maintain flight energy, and combined with the sensor fusion capabilities, it becomes much easier to understand what is happening around you. You can concentrate on decision making instead of simply managing the aircraft."

Sustaining performance over time, including during QRA rotations, comes back to repetition and rigour.

"Training is what allows you to keep up to date with new tactics, techniques and procedures. Eurofighter enables highly realistic combat simulation even in training environments."

For new pilots entering the cockpit, the adjustment is immediate and demanding.
"The engine power and thrust, the high manoeuvrability and G performance, and the amount of information available in the cockpit can make it challenging at first to focus your attention in the right place at the right time."

His advice reflects the mindset behind every one of those million flying hours.
"You must remain disciplined. Never underestimate Eurofighter or the mission."

One million flying hours is not built on routine. It is built on vigilance, preparation and the professionalism of pilots who approach every sortie with intent. ←

"Experience has taught me that there is no such thing as a low intensity flight."

Alpha Scramble

Fabrizio S.

Lieutenant Colonel

Lieutenant Colonel Fabrizio S. has spent his entire flying career at Grosseto, operating exclusively on the Eurofighter.

With more than 2,000 flying hours, he is among the Italian Air Force's most experienced Typhoon pilots.

He never considers a single one of those hours routine — and one sortie over southern Italy proved exactly why.

"There are no visual communication systems in the cockpit.

Then my eye fell on a simple sheet of paper."

Lieutenant Colonel Fabrizio S.

The siren sounded and Lieutenant Colonel Fabrizio S. was running. An Alpha Scramble. Within minutes he and his wingman had reached their aircraft, completed their start-up sequences and were airborne from Grosseto, heading south to intercept a civilian aircraft that had lost radio contact with air traffic control.

It was the kind of sortie that every Quick Reaction Alert pilot trains for repeatedly. What happened next was not.

"In the first moments the adrenaline is intense," he says. "Then it gradually subsides and, as often happens, I expected the situation to resolve quickly and for us to be sent back to base."

It did not resolve. The radio silence continued. They intercepted the aircraft near Naples, carried out all identification procedures and passed the information to the tactical controller. They made the standard call on the emergency frequency, asking the crew to contact air traffic control. Up to that point, the mission profile was virtually identical to the training scenarios they had practised dozens of times.

Then it diverged. No response came from the civilian aircraft. The standard radio failure code was not being used either. The tactical controller asked whether there was any other way to re-establish contact with the crew. "I have to admit I was initially taken aback," Fabrizio says. "There are no visual communication systems available in the cockpit." →

For a moment, he had nothing. The training prepares you for the intercept, for the identification procedures, for the emergency frequency calls.

But what truly prepares you during training is the exchange of experience among pilots, because that is what teaches you to find alternative solutions – often simple ones – even when none seems to exist, especially in those situations where the only apparent option would otherwise be a direct intervention to force a radio-silent aircraft to change course.

Then his eye fell on a simple sheet of paper he uses to jot down flight data. He wrote the radio frequency on it, moved in close to the civilian cockpit, and when the pilots turned towards him, held up the sheet, hoping it would be clearly visible. “Fortunately, the idea worked, and shortly afterwards radio contact was restored.”

A good kind of routine

It is the kind of moment that no amount of simulation can fully prepare you for – and it is why Fabrizio, after thousands of hours in the cockpit, rejects the idea that any Typhoon flight is routine.

Every sortie, regardless of how it looks on paper, demands what he calls a “mission bubble”: a state of complete focus created through detailed planning and briefing that keeps all distractions at bay. “It is an approach that helps me be prepared for any type of mission, from the simplest to the most complex.”

What he values within that discipline is what he calls the good kind of routine: the habits built up over years that sharpen awareness rather than dulling it.

“The way I approach the aircraft, the walk-around, the sequence for removing safety pins, strapping into the seat, preparing my helmet, checklist and gloves – these are actions I’ve repeated in the same order for many years,” he says. “This framework is extremely valuable because it allows you to spot anomalies immediately. If something isn’t where it should be, you notice it straight away.”

“That’s the good kind of routine for a Typhoon pilot: the kind that sharpens awareness and attention, rather than dulling them.”

Lieutenant Colonel Fabrizio S.

Tactical decision making

Flying the Eurofighter itself, he says, is not where the difficulty lies. The fly-by-wire system and onboard computer automation make piloting the jet far simpler than the aircraft he flew before. The real challenge is managing and integrating the numerous onboard sensors to complete extremely complex missions.

“The biggest mindset shift was learning to analyse all the information the aircraft provides in real time, process it, and quickly make the right tactical decision,” he says. “It forces you to develop a much more analytical and decisive approach to flying and to the mission.”

As Head of Operations at Grosseto, Fabrizio now leads pilots with far fewer hours than his own. He is direct about the stakes. “Letting your guard down in our line of work is extremely dangerous and can lead to very serious consequences.”

But his approach to preventing that is not about lecturing. It is about showing. “More than words, I believe it is essential to set the right example,” he says.

“A professional and methodical approach to planning, execution and debriefing for every mission is the best signal you can give new pilots. Only in this way can you create an environment where safety and attentiveness always remain the top priorities – regardless of experience or familiarity with the mission.”

2,000 hours on one aircraft type, an entire career spent at Grosseto, and not one of those sorties routine. Somewhere over Naples, a piece of paper with a radio frequency scrawled on it proved exactly why. ←

The Hour

That Never Feels Routine — Second Voice

Some parts of flying the Eurofighter, like take-off, landing, and basic handling, become second nature.

But for a pilot at Taktisches Luftwaffengeschwader 31 at Nörvenich, one of the German Air Force's front-line Typhoon wings, the tactical mission is never the same twice.

"Every second, something new can happen," he says. "That's what makes flying so much fun. And adapting to every situation is a skill that we learn."

That skill was tested during a routine training sortie when, mid-fight, a call came over the radio asking how much fuel he had left in minutes. He responded: approximately 31.

Within moments, the training mission was terminated and he was suddenly on an Alpha Scramble – tasked with intercepting a Boeing 787 Dreamliner that had lost radio contact on its approach into Frankfurt!

"Even though we fly in close formation all the time, seeing an airliner that close is quite special," he says. They intercepted the aircraft, carried out the identification procedures, and the situation was resolved.

But the transition – from a simulated engagement to a live intercept – had been instantaneous. There was no pause, no reset, no time to mentally shift gears.

It is the kind of moment that underpins everything the German Air Force teaches its Typhoon pilots about readiness.

"I never take a flight for granted," he says. "The flight can change any second. Weather might deteriorate, another aircraft might need help, technical problems can develop or you may suffer a bird strike, for example. Giving 100 per cent every time is the minimum."

He says there is even a visible transformation that happens every time a pilot walks to the aircraft.

"We can be the funniest people, until we step to the plane. You can literally see how every pilot gets into their bubble, into their professional mindset."

It is a discipline reinforced by a hard truth: most accidents happen in the phases of flight that feel least critical. Complacency, not complexity, is the greater danger.

"You should always be on guard," he says, "and never underestimate a flight." ←

1 MILLION FLYING HOURS

" Bookie "

Eurofighter Typhoon Pilot, Taktisches Luftwaffengeschwader 31 "Boelcke", Nörvenich German Air Force

"We can be the funniest people, until we step to the plane.
You can literally see how every pilot gets into their bubble."

Collaboration and Capability

Collaboration and capability. Those are the two words I use to sum up my experience with Typhoon. I did two tours on the Test and Evaluation squadron in the early days when we were developing the capability, and it was collaboration between every part of the Royal Air Force and the industry team that was the magic dust.

We had a combined test environment and it was electric. We would get the early software drops and we would test the software, analyse it, change it, test it, analyse it, change it, train the front line – and off we would go.

What has been pleasing is watching how that collaboration led to real capability on the aircraft. Then watching it grow from there.

I am still part of it today, collaborating with colleagues just on the other side of the fence.

And when you look at what the jet is doing right now, it's the backbone of combat air with so many partner air forces, and it has so much left to offer. All of that stems from those early days: doing something exciting with what has been a very capable platform from day one. ←

Graham Pemberton

Head of Operational Training Delivery, BAE Systems Former RAF Typhoon Squadron Commander and Deputy Force Commander

1 MILLION FLYING HOURS

The Next Million Hours

Mike Baulkwill flew Eurofighter Typhoon for 20 years in the Royal Air Force, commanding squadrons, a station and ultimately the entire combat air force.

Now, as Combat Air Strategy Director at BAE Systems, he helps shape what the aircraft will become.

With 1,400 hours on the jet and a career that spans every tranche from the earliest days to today's operations, he is uniquely placed to look ahead. What will the next million hours look like for Eurofighter? →

"Keeping Eurofighter relevant against increasingly sophisticated threats over the next fifteen to twenty years means the pace of change must accelerate, not simply continue."

Mike Baulkwill

Coming soon

There is really exciting stuff coming around the corner. By the end of the decade, a series of major upgrades will transform what Eurofighter can do. The ECRS Mk2 radar will give the aircraft the ability to operate in denied and degraded electromagnetic environments – dealing with jamming, targeting multiple threats simultaneously, and delivering electronic attack capability. A new Defensive Aids Subsystem will significantly improve survivability. Joint tactical radio systems will enhance connectivity across coalition forces. And the Striker II helmet will provide day-night colour display with off-boresight targeting and enhanced situational awareness at levels not previously seen. The Eurofighter of 2030 will represent a generational leap.

The threat does not stand still

The threat will continue to increase at pace. That is clear around the globe right now, and there's no reason to believe it will slow through the end of this decade and into the 2030s. World politics shifts, often unpredictably, and it is almost a case of planning for the unexpected. Eurofighter is a fourth-generation platform, but with advanced sensors and capabilities that are pushing it well beyond that classification. The ability to adapt rapidly will matter as much as any single upgrade. Keeping Eurofighter relevant against increasingly sophisticated threats over the next fifteen to twenty years means the pace of change must accelerate, not simply continue.

Long term plan

Long-Term Evolution (LTE) will change the fundamental computing architecture of the aircraft. The Striker II helmet and a new large-area display will replace the current three-screen cockpit, enabling pilots to manage the vastly increased volumes of data that new sensors will generate. Critically, LTE will decouple operational capability from the aircraft's safety systems, allowing rapid software updates without affecting flight-critical functions. It's this architectural change that will allow Eurofighter to iterate capability in a far easier and faster manner – pushing the aircraft well beyond its original design intent.

New roles

Eurofighter will continue its current roles – Quick Reaction Alert, defensive counter-air, control of the air – but its mission set will grow. The aircraft will move into suppression and destruction of enemy air defences. Storm Shadow/Scalp long-range standoff weapons will remain in the armoury. And the integration of collaborative combat aircraft uncrewed platforms carrying weapons, sensors and electronic attack capabilities) will open up entirely new ways of employing the aircraft. Air forces receiving these upgrades will end up using Eurofighter in ways that have not even been considered yet. The next 15 years could well prove more exciting than the last 20.

Reliability still crucial

Availability and reliability are not secondary concerns. If it is not flying, it has got no capability at all. In the Royal Air Force, no pilot has ejected from a Eurofighter in twenty-three years of service – a record that reflects the quality of the aircraft and the people who maintain it. Getting aircraft into the air safely, consistently, and in sufficient numbers is what turns a capable platform into an operational force. Maintaining that record as the fleet grows and demands increase will remain a fundamental priority. →

A European asset

Eurofighter is the backbone of Europe's combat air capability – one of only three fighters designed and manufactured on the continent. That sovereign industrial base matters. It means that Europe's ability to defend itself does not depend on a supplier outside of the continent. With a growing fleet, as Italy, Spain and Germany are all increasing their orders, plus an expanding export customer base, the programme's industrial footprint is becoming more significant, not less. The strategic value of a combat air capability that is built, sustained and evolved within Europe will only increase in the decades ahead.

Supply chain resilience

You are only as good as your supply chain. The conflict in Ukraine has reinforced the lesson that wars are not won by equipment capability alone, but by the industrial capacity to sustain and fight for four years and more, not weeks. Ensuring that supply chains, particularly the smaller suppliers across Europe who feed critical components into the aircraft, are resilient enough to support sustained operations will be a priority across all four partner nations. That work is already under way at pace.

Deterrence as a strategic output

Capability, availability and training are not separate objectives. Together, they produce something larger: deterrence. By demonstrating to potential adversaries that its forces are well trained, well equipped and able to act quickly, Europe de-escalates rather than escalates.

Eurofighter's operational presence across NATO's posture is already visible and credible. The synthetic training capabilities now being fielded will strengthen that posture further. Deterrence is not a by-product of military capability. It is the point of it.

The evolving pilot

Eurofighter will remain a crewed fighter for the foreseeable future, but the skill set required will continue to evolve. In the 2030s, pilots will need to be as fluent in system manipulation as they are in flying – though flying still matters, because there are not many aircraft in the world that can touch Eurofighter for power, acceleration and manoeuvrability. Artificial intelligence will enter the cockpit to reduce workload and support decision-making. On the ground, it will transform engineering, fleet management and maintenance. Warfare remains a human endeavour and people will always be the deciding factor – but what is asked of them will keep changing.

A good design endures

Just as the iPhone has barely changed shape in 20 years while its internal capabilities have been transformed, Eurofighter's fundamental design, its structure, engines, and flight control system, has proven strong enough to support continuous evolution. It is a good aircraft, it is reliable and safe. So we can keep moving it on.

The way nations will use the aircraft in the 2030s will be completely different from the way it was originally designed to operate. That is what happens when an aircraft is built right: you keep iterating it. There is every reason to believe Eurofighter will still be flying well beyond 2060.

Two million – and faster

Two million hours could come quicker than the first million. The fleet is growing, the customer base is growing, and the jets are being used more and more right now.

Eurofighter continues to protect airspace on operations as we speak, from the Baltic to the Eastern Mediterranean. The second million flying hours will not take another 23 years to reach. ←

Powering A Million Hours

“In a military context, two million engine flying hours is a very significant milestone.”

Dave Morgan
EUROJET Technical Director

You hear a Eurofighter before it reaches you. Then the pilot selects reheat. The thrust turns into something you can feel too. Then you see them: the two red-hot plumes. That surge of power is the EJ200 making its presence known.

For Dave Morgan, EUROJET Technical Director, it is the visible side of a much bigger story: a powerplant that delivers that performance safely and repeatedly.

If you’ve seen a Eurofighter Typhoon at full power, the thing most people never forget is the noise. It is thrust on demand. For Dave, the sound represents something far harder to see but just as important: consistency at scale, over years, nations, climates and operating patterns.

When Eurofighter passed one million flying hours it meant that two million engine flying hours had been surpassed, as each Eurofighter benefits from the power of two EJ200 engines.

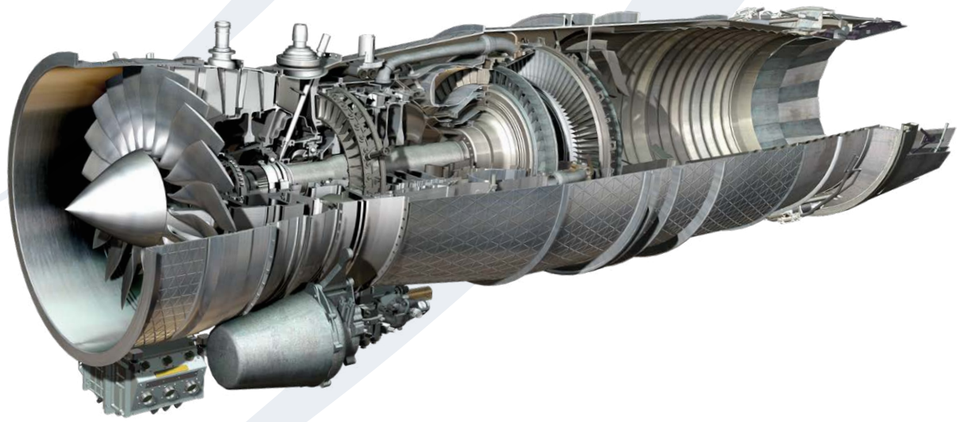
“In a military context, two million engine flying hours is a very significant milestone”, says Dave. “You only reach it thanks to very well defined and executed objectives that go back all the way to initial development then continued through to certification and then finally to the in-service support that the product sees today.”

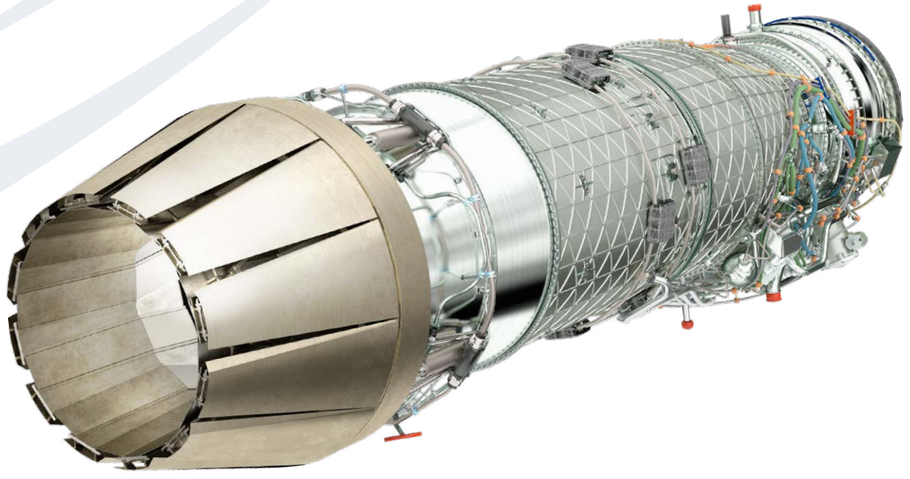
That long term service track record, Dave argues, comes from the design that evolved throughout the development and certification programme. The partner nations set demanding requirements that reflected how Typhoon would be used, and they held industry to them. This early development effort was tough, he says, but it proved the engine could meet the challenges of the environments it was designed to operate in.

“They wouldn’t let us out of the gym and onto the field to play the game until after we had completed the most rigorous training imaginable. The payoff is a fantastic product with 20 plus years of service. It’s a product that’s shaped and strengthened by extensive operator feedback on real world performance.”

A busy Eurofighter Typhoon needs engines that are as safe and reliable as they are powerful. It rarely makes headlines for this aspect, but the EJ200 is reliability personified.

For the team at EUROJET it is a fundamental that they are set up to deliver. For their engineers, success is based on factors like product safety, maintainability and →





availability-time on wing (how long an engine can remain installed before it needs to be removed being a key metric. All these factors add up to ensuring Eurofighter is primed and ready whenever it's called upon. The track record is remarkable.

"Our in-flight shutdown rate is five times better than our specification, which was already a challenge," says Dave.

"The engine typically remains on wing for more than 1,000 flying hours before needing removal, which for military fast jet engines is hugely impressive."

Dave says there's a team of dedicated and talented people across their consortium and Eurofighter Partner Companies who support the EJ200 every day. It includes people on the base frontline across Germany, Italy, Spain and the UK.

"At the sharp end, crews handle day-to-day maintenance and troubleshooting," says Dave. "They also capture first-hand observations from ground crew and flight crew, then feed that back for deeper engineering analysis, always with safety as the priority."

Data is crucial he says. "The metal can't speak for itself, but the data can. The feedback loops validate assumptions, highlight emerging trends, and help plan maintenance and support more intelligently. They also inform practical decisions, from manpower planning to supply chain activity."

In day-to-day monitoring, indicators reveal how the engine is performing over its life, including thrust and fuel efficiency trends, vibration levels, and life consumption on parts.

For Dave, the two million milestone is more than just technical. "Being part of the Eurofighter story makes me exceptionally proud," he says.

"The EJ200 engine is by far the best engine I have ever worked with. And that still could be something I say the day I retire." ←

Eurojet in Numbers:

1,400 engines delivered

2 million engine flying hours (EFH)

1,000 EFH - average time on wing

20 years in service

10 customers worldwide

IPA6: 1,000 Hours at the Edge

IPA6 has passed 1,000 flying hours. Against Typhoon's one million hour milestone, it is a fraction. But these are not routine hours. They are the hours that shape the future.

IPA6 is one of Eurofighter's Instrumented Production Aircraft, the IPA fleet used by industry to prove what comes next. Outwardly, they look like frontline jets. Inside, they are wired like airborne laboratories, built to capture what the pilot feels, what the aircraft does, and what the systems are really saying when performance, complexity and risk all rise together.

This is where Typhoon's future is created. Not with theoretical margins on paper, but with measured evidence in the sky.

Every IPA sortie is designed around a single notion: extract certainty from the unknown. These aircraft carry dedicated flight test instrumentation that records the entire chain of events from take-off to touchdown, down to individual pilot inputs and system behaviour at precise moments. Like a top tier motorsport operation, the jet can stream real time telemetry to the ground team, giving engineers a live view of parameters no pilot can monitor in the cockpit while managing a demanding profile.

That live flow of data matters most when the programme is operating at the edge of the envelope. In flight control system trials, the difference between a refinement →

Every IPA sortie is designed around a single notion: extract certainty from the unknown.

and a risk can be found in fine detail. In air to air refuelling work, it can be hidden in fuel pressures, valve behaviour and quantities that need to be analysed in real time. The ground crew is not watching passively. They are part of the flight, tracking what is happening now, and helping keep the test on the safest, fastest path to a clear answer.

Before the aircraft ever leaves the runway, the work begins on the ground. Modelling and rig testing build the first picture of what should happen. The IPA flight is where that picture meets reality. Some events cannot be simulated. A weapon release is one of them. When that moment comes, there is no substitute for doing it for real, with maximum instrumentation and a plan that leaves nothing to assumption.

That is why IPAs can be fitted with high speed camera pods and distinctive chequered markings on aircraft and test stores, not for show, but to calibrate exactly how an airframe or a store behaves at release. For key events, a chase aircraft may film the moment, while the store itself can transmit telemetry back to the team on the ground. It is a multi angle, data rich record designed to answer one question: did it behave as predicted, and if not, why.

Typhoon is designed to deliver the opposite: Maximum performance, right up to the boundary.

IPA6's own history shows how these 1,000 hours underpin the operational fleet. The aircraft has supported Typhoon avionics upgrades, trials of systems such as helmet mounted equipment, and demanding air to air refuelling testing. It was also the first Typhoon to jettison and later fire the Brimstone 2 missile, capturing aircraft data, missile telemetry and video so performance could be verified against prediction and used to shape what follows.

In a high pressure industry, progress is a controlled confrontation with the unknown. The safest aircraft is one that never flies. Typhoon is designed to deliver the opposite: maximum performance, right up to the boundary. The IPA fleet exists to reconcile those two truths. IPA6 reaching 1,000 hours is proof of a discipline that lets Typhoon evolve without compromising what matters most.

Because those hours do not just add to the total. They expand what the whole fleet can do next. ←

The Translator

Stephan Leuthner
Engineer and Test Pilot

As a trained engineer and test pilot, Stephan Leuthner sits between two worlds, turning what frontline pilots need into language engineers can act on, and turning engineering choices into something a pilot can feel in the cockpit.

From Manching, where he has helped push Eurofighter Typhoon's envelope to places no one had seen before, he reflects on what a million flying hours really means.

Is there such a thing as a routine flying hour in Typhoon?

There are routine parts of a flying hour, but it is never routine, neither in operational missions nor in test. That is one of the great things about it. There is never a day or a flight like the last one. Once you start feeling it is all routine, you are probably missing something.

Why is that, do you think?

I think it comes from the kind of task we fulfil, whether in flight test or operational missions. All the parameters change: mission objectives, aims, weather, opponents, test tasks, test conditions, test points, whatever you can think of. Everything always changes.

Have there been any instances where a standard flight changed unexpectedly and you had to adapt mid-flight?

If you are looking for major emergencies, then on Typhoon I have not had too many. The aircraft is built with safety in mind, and that shows. Unexpected events come up every flight, but they are hardly ever due to the aircraft failing the pilot. Most of the time it is due to changing circumstances: changing opponent tactics, changing results at test points, weather challenging you, things like that.

Can you explain what your role as a test pilot involves?

When you think about test pilots, you might picture someone strapping into new aircraft multiple times a day and just trying things out. Unfortunately, flying is maybe 20 percent of the job. On the flying side, we are tasked with a test programme. It might relate to software upgrades, where you prove the system works as designed and meets requirements and specifications. Or it might be system performance testing, for example looking at a new radar and testing radar performance against dedicated set-ups. It is basically a very scientific job.

We are also involved in the design of the flight control laws and the early looks at the flight control system in simulation, and influencing how the control laws are designed. That is almost as exciting as flying. Working with the engineers, discussing options and solutions, finding things that are really good, and then discovering where great ideas do not work the way you intended. Although it is not flying, it is exciting to have the chance to impact how the aircraft feels to the pilot. →

Looking at something like the Aerodynamic Modification Kit (AMK), it must be exciting to be among the first pilots to take a new design into the sky?

It is. That is what test pilots dream about, getting a new aircraft. In 2014, when I started test flying Typhoons in Manching, one of the first programmes I flew was the AMK testing. I was the first pilot to achieve a maximum angle of attack – well in excess of what the Typhoon had seen until then. It was exciting because you enter parts of the envelope no one has ever seen before. You get to be that person.

I guess you are an advocate for the frontline pilot?

I try to be. I would say I am a translator. I am a trained engineer and a trained test pilot. When pilots come here and say they want the aircraft to do this or that, I translate those operational requirements into something an engineer can use in control law design, and vice versa.

When something comes up in control law design and an engineer asks whether they should do it one way or another, I translate that into operational terms and ask the pilot: do you want the aircraft to behave like this, because that is what will happen if we do this variant, or do you want a different way? It is very interesting.

How do you prepare mentally so you do not slip into "just another routine day in the office", and you are on it every time you get in the cockpit?

It starts with being involved in preparing a flight test campaign. When there is a request for flight test data, that is the starting point. When engineers design a flight test programme and define what results we are looking for, I am involved in the techniques we might use. That is how you get your mind into the programme. For each individual flight, you have a very detailed briefing going through all the test points. Then you do chair flying, like any operational pilot would – mentally going through the whole flight: what your actions in the cockpit will be, and how you will respond to specific things coming up. Between briefing and flight, you go through the test cards again, imagine yourself in the cockpit doing the test points, and imagine your responses to different outcomes. That is how you get into the mindset.

How do you stay sharp over repeated flights and training?

I am 48. At a certain age you feel it requires more effort to stay focused and to achieve the same quality of work you could achieve at 30 or 35. To stay sharp, I spend a little more time preparing: more chair flying, more going through things in my head before I do them, compared with ten years ago. And I have increased my physical training. I was not a big fan of sports, and I could work well without it, but now I realise I need more exercise to stay in shape.

When you meet younger pilots, what do you say about not letting their guard down or becoming complacent once they have clocked up a few flights?

To be honest, I don't try to tell younger pilots what they should or should not be doing, because they are very good at their jobs. With my background as a test pilot now doing very little air combat training, I would not be in a position to advise them on how to act in the aircraft. It's actually the other way around: I try to listen to them, hear about their daily job and challenges, and think about improvements that we can bring into the aircraft.

I remember when I was younger in the squadrons: test pilots from Manching came for yearly tech flights on Tornado, and back then they were probably the age I am now. When they came, I thought, how are those old guys still flying fighter jets? I listened to their stories, but they never offered advice on how I should do my job. That is what I try to do as well.

When you reflect on your part in hitting the one million flying hours milestone, how does it feel, and what are you most proud of?

As the project pilot in Germany, one of our main tasks is the Flight Control System. My job is to get the aircraft to the best operational capability within the technical feasibility and the clearance requirements, and still keep it safe to operate.

Of course, as the saying goes, the safest aircraft would be one that does not fly. But we operate in an extremely high-performance environment, with a high performance aircraft designed to explore the envelope up to the boundary and get the most out of it, a bit like a Formula One car. Safety and maximum performance contradict each other.

Considering the aircraft has now passed a million flying hours without a high number of major accidents, and probably very few accidents related to the aircraft alone, there is a sense that maybe we did it right.

Typically, pilots are very critical of their weapon system, and you hear criticism about Typhoon sometimes. But, if you look at its operational record and capabilities, it is a very good combat aircraft. It performs at the edge of the envelope without an unduly high loss rate.

When you look at that one million flying hours number, it shows the scale of the achievement. I have around 1,000 hours on Typhoon, which is a very small percentage and therefore I am just a tiny part of the project and the aircraft. It comes down to the pilots, the maintenance people and everyone operating the aircraft in the air forces who should be proud of that number. I am happy to be interviewed and to be part of that story, but I am a very small part of that success. ←

I was flying a completely different aircraft

Stefan Auer spent more than a decade as a Typhoon pilot in the German Air Force – flying operationally, commanding a squadron, deployments from the Baltics to Australia.

Then he made one of the biggest decisions of his career: crossing to industry as a test pilot at Airbus Defence and Space in Manching.

What he found on the other side changed how he sees the aircraft, the programme and the people behind it. →

Stefan Auer

Test pilot at Airbus Defence and Space in Manching

I thought I knew the Typhoon. I had 1,500 hours on the aircraft, 10 years as an operational pilot, a squadron command. Then I was in the simulator and the Eurofighter had the Aerodynamic Modification Kit fit and realised I was flying a completely different aircraft. In areas where you think the aerodynamics and the flight control system are already excellent, it still finds improvement. What I saw there was crazy. And colleagues in my team who have flown the AMK for real tell me it is exactly what they experienced. That is where Typhoon is heading.

Getting to that point – crossing from the German Air Force into the test world at Manching – was one of the biggest steps of my life.

But development aircraft I am lucky to fly today is very different from what I was used to in the operational squadrons. There I had different software, different mission sets, different objectives. I am no longer the formation leader or the tactical trainer. I am there to help engineers do their job properly, translating what the pilot experiences into something they can act on.

It changes your perspective. Working closely with the flight control engineers, I now have a deeper understanding of the aircraft. I realise how even small adjustments to the flight control system can make a pilot's life significantly easier – freeing you to concentrate on your mission rather than on flying the aircraft.

In a single-seat, multi-role fighter, that is not a luxury. It is essential. But I have also seen how a small adjustment that nobody thought too much about can completely screw your day as a pilot. The flight control system is one of the quiet strengths of Typhoon, and the people behind it deserve real credit.

“I sat in the simulator with the Aerodynamic Modification Kit and realised I was flying a completely different aircraft.”

There is a definite shift in momentum across the programme. New resources, new projects, new capabilities coming through. Bringing the AESA radar to the frontline squadrons is one of them.

Right now, a lot of work still needs to be done, but we are on the way. What I see now is really exciting.

When I think about what made a million flying hours possible, I don't think about the technology. It is the people. In 10 years of operational flying, we received various taskings, we deployed to the Baltics or Romania at very short notice. We went to Australia. We even supported an Alpine search and rescue mission. Not once did anyone say it could not be done. The people involved made every single mission happen.

Pilots are a very small part of that team. Maintenance crews, mission planners, engineers, managers, the whole family, everyone working on Eurofighter has this desire to make things work.

They chose this job for a reason. That same passion runs through the entire team, right down to the people who stand on the flightline every day and photograph the jets taking off and landing. It is all the same hunger. ←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for their incredible achievement!
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