

ASTA: Eurofighter simulation

Perfect flight – on the ground

To fly an extremely complex warplane like the Eurofighter Typhoon, pilots need a progressive, fully-integrated training programme. The simulators developed by Eurofighter and its partners in the ASTA programme represent a milestone in military jet pilot training.

José Antonio Gutiérrez in the cockpit of the Full Mission Simulator (FMS)



On the return leg of a training flight in the Eurofighter, I plunge out of the steel-blue sky from an altitude of 30,000 feet, headed for the military airfield near the coast. The white runway set into the brown landscape keeps getting bigger as I rapidly lose altitude. I pull the fighter out of the dive, strike out on a wide arc to get into the downwind leg and continue my descent. Since I'm far too high, I turn a few steep '360s' to get into the right position. Finally, I reach the correct approach altitude. To save a little time and to prepare for landing, I fly a little further out towards the ocean before turning into the base leg. OK, this might just work after all... "Watch your speed" suddenly comes over the headset. Then, with a touch



The FMS instructor station, where simulated missions can be planned – or the pilot can be confronted with an unexpected engine failure

of bemusement in the voice: "Mach one is just a little speedy for the base leg."

Okay, it's my first flight in the Eurofighter. So it should come as no surprise that I'm more of a passenger than a pilot. Being accustomed to single- and twin-prop planes, I don't even begin to stand a chance of adapting to the Eurofighter's unbelievable performance capabilities. But contrary to what one might imagine, given the twinjet fighter's extreme speed, the aircraft is exceedingly simple to pilot, at least as far as basic handling is concerned.

On final approach, I look around for the flap switch as usual. No joy... then I remember: flap deployment is fully automatic on the Eurofighter. After all – and this is the point that isn't immediately obvious, even to an experienced 'amateur' pilot – although the Eurofighter is the ultimate in aircraft, it has been designed with other aspects in mind than simply flying. The pilot of the single-seater is tasked with executing a mission, for instance intercepting enemy aircraft, and concentrating fully on his military assignment. Therefore his workload in terms of handling the aircraft needs to be kept to the strict minimum; all his attention should be focused on tactics, operating the weapons systems, i.e., fulfilling his mission.

Now on final approach, all I have to do is extend the gear and concentrate on the landing. Naturally, I don't stand a chance on the first attempt: Since I'm approaching the runway threshold at over 350 knots – my speed management was miserable – landing is im-

possible. I do the one right thing and execute a go-around, pulling back lightly on the stick at full thrust as the landscape quickly recedes beneath me. Without really being able to base such a comparison on actual experience, I think this is how the ascent rate

ASTA in service across Europe

The first phase of the ASTA programme consisted of development and deployment of seven Full Mission Simulators and four Cockpit Trainer/Interactive Pilot Stations:

- ▷ UK (Coningsby): 2 FMS, 1 CT/IPS
- ▷ Germany (Laage): 1 FMS, 1 CT/IPS
- ▷ Italy (Grosseto and Ronchi): 2 FMSs, 1 CT/IPS
- ▷ Spain (Moron): 1 FMS, 1 CT/IPS
- ▷ Austria (Zeltweg): 1 FMS

Experience with the initial units – already in service for over twelve months – has been consistently positive. In Laage, Germany, training operations using ASTA have been underway since March 2006.

The first FMS flight with a country-specific database took place in Austria on 15 March 2007.

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The ASTA development centre in Manching. An FMS is installed in each of the domes

of a rocket must feel like after launch. The engines are so incredibly powerful that there doesn't seem to be any resistance to my movements in the cockpit, and I feel as if I'm floating in zero gravity.

I push the stick left and, as if guided by a wire, I perform a pretty clean roll – at least for a rookie. That was certainly easier than in a single-engine aerobatics plane – just tilt the stick and the jet spins. No need at all to nose up, or even use the rudder. Just stick left and the jet spins. It can do an impressive loop, too, not only of enormous diameter – without afterburner! – but at an unbelievable 450 knots when I reach the apex and look at the speed readout's bright green digital numerals on the head-up display!

For my second approach, I throttle down right at the beginning of the downwind leg, and this time I also extend the landing gear at the right time to make reducing speed easier. The Eurofighter has such superlative aerodynamic characteristics that it barely slows down at first when power is reduced. Things are looking pretty good now: right on the centreline, angle of approach seems right, speed not too high at 140 knots. On just my second attempt, I actually get the aircraft back on the ground 'undamaged'. Albeit on a simulator.

It is unlikely that things would have gone as well with a real aircraft. The physiological factor alone – wedged into an anti-g suit, subjected to real centrifugal forces and sensations – would probably have been enough to cause a crash landing. And the vertical climb after takeoff, during which



The Cockpit Trainer instructor station. The trainer is used primarily for basic Eurofighter orientation and instruction in emergency procedures



Landing approach in the Cockpit Trainer. Even this more basic version can be networked over a WAN (wide area network) and take part as one of the Eurofighters in a training scenario

the machine almost broke the sound barrier, would probably have caused me to actually black out.

If my brief demonstration flight failed to provide sufficient proof of my capabilities as a jet pilot, it could not have been blamed on the simulator. The Eurofighter ASTA programme's FMS (Full Mission Simulator) in which I 'flew' permits training scenarios of such authenticity that there are plans to use it for up to 30 percent of official training flights. Added to which, the conditions under which I was flying, even when using a simulator, did not correspond to reality in all respects: during training, air force pilots wear the entire flight suit, including the Eurofighter helmet with its visual system and its remarkable DVI (direct voice input) communications features. The 'motion cueing' system used to set actual parts of the simulator in motion – not activated during my 'flight' – will also add a further dimension of realism.

To take full advantage in air-to-air combat of the military potential of the Eurofighter – one of the most advanced multi-role/swing-role weapon systems in the world – a common simulation and training concept was developed for the air forces of the four partner countries (Germany, Italy, Spain and the UK).

The consortium led by Eurofighter GmbH, which comprises Eurofighter partner companies Alenia Aeronautica, BAE Systems, EADS CASA, EADS Deutschland and Eurofighter Simulation Systems (ESS)*, has developed a programme called ASTA (Aircrew Synthetic

Interview José Antonio Gutiérrez

José Antonio Gutiérrez is one of the Spanish members of the Integrated Product Team, where he heads the Operational Factors group. He is also the chief test pilot for the Eurofighter simulator.

Born in 1965, Gutiérrez completed training at the Spanish air force's fighter pilot school at its Talavera base, later becoming a flight instructor at the 'Academia General del Aire' as well as a member of the 'Patrulla Aguila' aerobatic demonstration team, the Spanish equivalent of Britain's Red Arrows. In all, he has logged more than 3000 hours at the controls of supersonic jets such as the F-18 Hornet.

Planet AeroSpace spoke with this experienced fighter pilot, who works at Military Air Systems in Manching, about his responsibilities on the ASTA project.

Planet AeroSpace: Who is represented on the ASTA team?

Gutiérrez: The ASTA team includes employees from the four Eurofighter partner companies, as well as simulation specialists from the Eurofighter Simulation Systems (ESS) consortium.

PAS: Is your role in the project also a technical one, and does it require you to be a pilot yourself?

Gutiérrez: I lead the Operational Factors group, which comprises former military pilots from the countries involved in the Eurofighter development and procurement programme, and is a part of the ASTA Integrated Product Team (IPT). The primary task of Operational Factors is to utilise the more than 15,000 hours of mission experience that the group's members have accumulated in a wide range of fighter aircraft to ensure the highest level of product quality and thus keep the customer satisfied.

PAS: What are the advantages and disadvantages of working on a multinational team?

Gutiérrez: I see only advantages. Working in this kind of organisation, which is not only multinational but also incorporates every technical and operational discipline, provides an opportunity to have a unique learning experience, on both a professional and personal level. And living in a country like Germany further enriches this experience considerably.

PAS: What distinguishes ASTA from other simulators?

Gutiérrez: Other simulators are only suitable for procedural training and learning hand-eye coordination. ASTA is intended to provide such a high level of quality that pilots are able to complete about 30 percent of their training in the simulator instead of in the air (30 percent Flight Hours Offtake). To achieve this, ASTA aims to provide the most realistic possible simulation of flight and mission conditions, so that the pilot can also practice the thought processes that are essential for decision-making and situational awareness.

PAS: What special contribution does a Spaniard like yourself bring to the team?

Gutiérrez: EADS CASA chose Operational Factors as the management function it wished to assume in the IPT. The job profile called for a fighter pilot with considerable experience of the operational roles that the Eurofighter Typhoon will be expected to perform. And in the opinion of EADS CASA, my experience as a pilot and commander of an F-18 squadron in the Spanish air force made me just the right candidate for this assignment.

Interviewer José María Palomino

Training Aids), a complete package of electronic training devices for Eurofighter crews. At the heart of the programme are two different flight simulators, which are expanded and complemented by additional modules such as a database generator, lesson planner and scenario generator, as well as debriefing systems. Integration of the ASTA simulators is taking place at the Manching site of Military Air Systems, a business unit of the EADS Defence & Security Division.

► Cockpit Trainer

The Cockpit Trainer utilises a five-channel visual system and an instructor station that has a relatively simple design. It will be used by new Eurofighter pilots primarily for

initial training in functions, procedures, and emergency drill procedures, but also to prepare pilots for working in the Full Mission Simulator.

Simulation of the landscape around the training base is specifically optimised for pilots transitioning from other aircraft to the Eurofighter. The Cockpit Trainer can also participate in networked scenarios as one of the Eurofighters involved, or as another aircraft type.

► Full Mission Simulator

Housed in a dome and equipped with a 13-channel visual system – which itself features a high-resolution six-channel target display system – the FMS boasts a unique

360-degree panoramic view, with which the Eurofighter's entire spectrum of mission scenarios can be simulated.

The final version of the Full Mission Simulator will also incorporate a motion cueing system. This technology (also used in ATR's new Full Flight Simulator) employs a sophisticated system to move the simulator, or just parts of it (such as the seat), to further increase the degree of realism in the simulation.

Complementing the FMS is a fully interactive Instructor Operating Station (IOS), used for planning and for programming mission profiles.

The FMS makes it possible to conduct a highly advanced training programme that provides pilots with fully interactive simulated mission training. Options include every type

Formation flying – here with a Russian MiG-29 – can also be safely drilled to perfection in the Full Mission Simulator



Not an application for a simple PC: the FMS visual system alone requires a mainframe that is several metres long

Images: airWORK aviation images

of air-to-air combat (including dogfights) as well as weapons training – even air-to-ground missions can be simulated with a high level of realism.

The ASTA FMS and CT/IPS simulators enable air force instructors to simulate complex tactical scenarios in fully networked environments. To this end, diverse Cockpit Trainers and Full Mission Simulators can be connected, for instance via a Europe-wide WAN (wide area network), in order to enable pilots to train as part of an allied group – or alternatively in a friend-or-foe mode.

The high quality of the simulation makes it possible for crews to conduct a large portion of their combat-ready training in an artificial environment. Achieving the goal of more realistic training missions required top-quality

simulations of both the aircraft systems and the environment. For example, the original software for the Eurofighter's avionics, flight control and general systems is used for the aircraft simulation.

► Full mission spectrum

ASTA facilitates simulation of a wide range of training missions:

- Basic aircraft handling
- Emergency procedures
- Instrument flight
- Night flying
- Formation flying
- In-flight refuelling

- Tactical training
- Mission planning
- Electronic warfare
- Training in hostile electronic environments

For air-to-air combat missions, pilots can drill on the Eurofighter's radar functionality and deploy any of the usual air-to-air missiles (AMRAAM, ASRAAM, AIM-9L) against a wide range of programmed computer scenarios. Air-to-ground missions of all types can also be practiced.

Alexis von Croy

* ESS is a consortium of simulation companies that have joined forces specifically for the Eurofighter ASTA Simulator: Meteor (Italy), Thales (UK), Indra (Spain), CAE and STN Atlas (Germany)