

● DEFENCE

Military trainers

Disrupting the military trainer market



Can a UK start-up bring the Airbus-style common family concept to the military fighter training market? **TIM ROBINSON** reports on progress with Aeralis, which is developing a unique modular trainer.

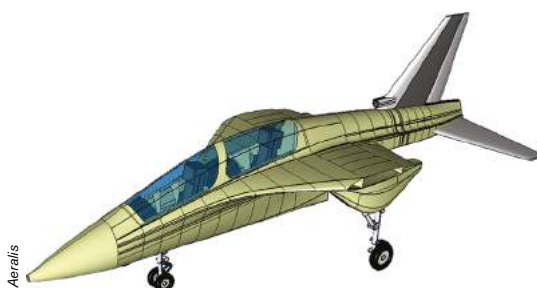
First revealed by *AEROSPACE* magazine in 2016 as Dart Jet, a UK aerospace start-up is now throttling up with a new name, new partners and an investment plan to turn its concept into hardware to go on show at the DSEI defence exhibition in 2019.

Lighter trainers, more sales?

Key to Aeralis' approach is its analysis that the military trainer market, particularly for advanced trainers suitable for fighter pilot training, has become unbalanced towards heavier and more expensive types, as manufacturers have attempted to address extra requirements for supersonic capability, payloads, and allow for growth to lead-in-fighter trainer or even light attack/fighter roles with heavier engines. While the latest generation of trainers, such as the Leonardo M-346, Lockheed Martin T-50A (and now the Boeing T-X) are picking up orders today, Aeralis notes that it was the BAE Systems' Hawk trainer that proved a runaway global sales hit in the past, with over 1,000 sold.

Aeralis points out that there is also a relationship with all-up weight and cost, with a 30% increase in mass leading to a 100% increase in cost. These heavier jet trainers, argues Aeralis, are thus pricing themselves out of many customers' reach, as they shift to become dual-role advanced trainers/light combat aircraft. Indeed, despite the marketing blurb, the majority of customers never utilise these dual-role trainer/attack aircraft fully in both missions. Is there then, an opportunity for a lightweight, affordable trainer, focused exclusively on just the training mission?

Meanwhile, although the latest turboprop trainers, such as the Embraer Super Tucano, Pilatus PC-21 and Beechcraft T-6 Texan II have incorporated jet-like features, such as yaw suppression, there still remains a training gap. "While today's advanced turboprops, such as the very capable Pilatus PC-21, can go some way to replicate jet handling, there is still a significant gap between a turboprop and a fast jet training aircraft, especially when it comes to air combat. With a turboprop the 'pictures' the student sees are all wrong – the truth is that to learn to fight in a jet,



Aeralis is planning to bring a demonstrator of its common core fuselage to the DSEI show later this year.

you just need to train in a jet," notes Tim Davies, Strategy Director, Aeralis and an ex-RAF Hawk T2 instructor.

France, for example, having acquired the Pilatus PC-21 turboprop, still plans to keep the AlphaJet for lead-in fighter training – perhaps an admission that advanced turboprops, for the majority of air forces, still cannot meet the entire training spectrum.

With today's advanced trainers becoming more expensive, the BAE Hawk now coming to the end of its life as far as the airframe can be pushed and the PC-21 and turboprops not able to bridge the entire gap between basic and fifth generation fighters, Aeralis believes that a sweet spot is now emerging for a £15m jet trainer, weighing less than 3.5tons, employing embedded training and able to supply all-jet training capability from basic to advanced courses.

The company predicts that, with this approach, a conservative forecast could see it win 300 sales of a potentially larger £83bn global market for 5,500 new trainers from 2023 onwards as air arms retire older types.

Learning from Airbus

In parallel with a lighter, simpler and more affordable aircraft – Aeralis plans to bring the Airbus business model of a common aircraft family to military aviation with a modular design able to span basic to advanced trainers. In the commercial world, airlines, for example, can right-size their fleet with the A319/A320/A321 family – and this common approach to spares, support and training delivers massive cost savings to the customer of around 30%. For Airbus, manufacturing is made simpler by a common wing, empennage, fuselage diameter – with the eventual model being dictated by the number of fuselage sections.

Though basic and advanced military trainers have a different set of requirements and missions than a narrowbody airliner, Aeralis believes that similar savings and efficiencies can be achieved by taking cues from the civil aerospace sector. Aeralis' approach revolves around common core fuselage that can be fitted with single or twin engine options, as well as basic (straight wing) or advanced (swept



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wings) and empennages to create a tandem twin-seat basic or advanced trainer. Aeralis has already filed international patents on this Common Core fuselage concept which cleverly sees the landing gear mounted on the inner wing. This means the engine nacelle 'egg' underneath the aircraft can be easily swapped between a single or twin engine configuration, without needing to remove the high-set wing or undercarriage.

With a swept-wing, the subsonic 'A' model would have a top speed of 560kt, while the straight-wing, single-engine 'B' basic trainer would be 360kt.

Internally, the avionics fit would reflect the role of the trainer variant, with the basic variant featuring centre-stick control and a large glass cockpit with standard instruments. Meanwhile, the advanced variant would feature a side-stick and a F-35-style large screen display, with synthetic weapons, electronic countermeasures (ECM), radar warning receiver (RWR), defensive aids and sensors.

Both the A and B would feature fly-by-wire (FBW) controls but with different handling and limits optimised for the different stages of the syllabus. The 'A' model FBW would seek to replicate the 'carefree handling' of fighters such as the Typhoon or F-35, allowing the student to concentrate on mission management, sensors and fighting with the aircraft. Meanwhile, the 'B' straight-wing trainer, paradoxically, while it would have benign handling, would also have fewer artificial limits on the FBW, allowing students to make mistakes when learning the basics of flying.

With 85% commonality and thus common spares, maintenance and training, Aeralis estimates



Aeralis

Aeralis will have a re-configurable, wide-area display cockpit, able to flexibly emulate any training cockpit from Basic through to Lead-In fighter training.

that this modular approach could reduce the costs of OCU training by 11%, acquisition by 35% and training operations by another 35% and deliver equivalent operating costs to the turboprop PC-21.

Building a dream team

As well as refining the design of aircraft (input from fast jet (FJ) instructors has tweaked the concept with practical user questions like 'where would we store our kit on away flights?'), Aeralis has also succeeded in attracting supporters – including some heavyweight aerospace industry names to the project, such as Thales.

AERALIS B – Basic Trainer

Single-engine, straight wing, benign handling, full commonality with AERALIS family

AERALIS A – Advanced Trainer

Twin-engine, swept wing, advanced performance, full commonality with AERALIS family

AERALIS X – Bespoke / Aerobatic Team Jet

Single or twin-engine, individual customer design, full commonality with AERALIS family



Aeralis

As well as its industry partners, Aeralis has also beefed up its management board with (as noted earlier) a former head of RAF fast jet training, Tim Davies, as Strategy Director, along with Dick Eastment (ex-MoD and BAE Systems head of training) and Brian Hibbert (ex-Lockheed Martin UK MD).

Having already raised £2m, earlier in October, the company launched a second round of funding activity – crowd funding via the Syndicate Room investment platform to raise £1m to build a composite fuselage demonstrator which would then go on show in DSEI 2019. Aeralis says, however, should that goal not be met, this would not mean the end of this project, merely that it would proceed at a slower pace. For potential investors getting in on the ground floor now, the company is also promising 'high multiples' of return on investment (ROI).

Given enough funding, and its industry partners, Aeralis is aiming to fly a prototype in the early 2020s, with certification of both A and B variants leading to production in 2023.

Leased trainers

While the aircraft could enable air forces to save money and potentially afford to buy more aircraft, a final piece of innovation from Aeralis is a new business model that could see the trainers leased to air forces and operators. Aeralis envisages the company itself owning the airframes and thus being able to respond to some customers' requirements by converting and refurbishing the aircraft from 'A's to 'B's (or vice versa) depending on customer need. This leasing model, much like airlines do, could also help air forces cope with shorter-term 'surge' training requirements by 'flexing' their fleet to the greatest need.

This disruptive leasing business model would also extend to the avionics, says Tim Davies: "Aeralis aircraft will be leased to the customer to reduce the necessity for costly 'up-front' capital expenditure and this also includes the aircraft's avionics. Should a customer not require the synthetic radar, then the system will be deactivated and they will not have to lease that particular functionality but, should they develop a wish to train with the system as they progress in their flying training development, then the radar can be remotely activated along with the courseware and every other system component, such as the simulator and Mission Planning System."

Further applications

As well as the Aeralis B (basic trainer) and Aeralis A (advanced trainer) Aeralis also sees a further model, the fully configurable Aeralis 'X' which could function as an aerobatic type (the Red



Arrows Hawk T1As are getting increasingly long in the tooth) a high-speed technology testbed demonstrator, or a 'Red Air' commercial aggressor. While Aeralis is firmly focused on the trainer variants to begin with, a future Aeralis X could potentially be equipped with a jammer pod or AAM training acquisition missiles – depending on customer needs. It is also not too much of a stretch to ponder whether Aeralis' patented low-cost, modular approach may also have further applications in the future. For example, could a common core fuselage/body concept form the basis of a family of low-cost UAVs or UCAVs?

Summary

The rebranded Aeralis, with its new highly experienced partners and team, comes at an opportune time for UK Plc as it aims to boost its competitiveness on the global stage, post-Brexit. Meanwhile, the UK's Team Tempest and the Combat Air Strategy, has put the focus back on piloted fighters in the 2030s and beyond. It is true that the Aeralis is attempting to enter a crowded military trainer market but, as noted earlier, it is one in which it is aiming to reverse the inevitable 'Augustine's Law' cost growth in military trainers through a lightweight modular design concept and highly innovative leasing model.

Finally, Aeralis arrives when the UK has woken-up to the fact it needs to rebuild and reinvigorate its neglected 'whole-aircraft' design capability lest it lose it forever – with the last all-British military aircraft, appropriately enough, being the BAe Hawk, over 40 years ago. Can Aeralis follow in its footsteps and shake up the military trainer market?

An innovative leasing model could enable air forces or operators to mix and match basic and advanced variants as well as only paying for the synthetic training avionics they actually use.