



The cutting edge of the RAF's fighting force, two F-35B Lightnings of 617 Squadron 'Dambusters' fly alongside a fourth-generation Typhoon armed with live AMRAAMs, taking on more fuel
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PACKING A PUNCH

Alan Warnes discusses the potential of the RAF's fighter force with Air Commodore Mike Baulkwill, the RAF's Combat Air Force Commander.



Responsibilities of Commander CAF

The RAF Combat Air Force Commander role has been established for two years now and Air Commodore Mike Baukwill has been in the position for a year, being appointed in December 2021. He is responsible for the F-35 Lightning Force at RAF Marham and the two squadrons there, and all the Typhoon squadrons at RAF Coningsby and RAF Lossiemouth, also the RAF Red Arrows and the Battle of Britain Memorial Flight.

Air Commodore Mike Baukwill, Commander of the RAF's Combat Air Force Crown Copyright



When the E-7A Wedgetail AEW (airborne early warning and control) 1 aircraft arrives next year, it will become the fifth finger – alongside the Lockheed Martin F-35B Lightning, BAE Systems Typhoon FGR4, Boeing RC-135 Rivet Joint and Boeing P-8A Poseidon – in a fist that could launch a big punch.

Integrating them together is now a main priority and much of that focus over the past few years has been on the F-35B Lightning and Typhoon. Since Russia invaded Ukraine, that tempo of effort looks to have increased not just within the UK military, but by the

USAF and other allied nations both in NATO and Asia. Exercises like Cobra Warrior (p68-73), which took place in late August/early September in the UK, and Pitch Black in Australia mid-August/early September (*Air War*

over the Top End, November, p58-63) are all meant to sharpen the claws of fourth and fifth-generation integration.

International partners

Flying with a fifth-gen fighter is nothing new to the RAF, as Air Commodore Mike Baukwill explained: “Not just in exercises, because there have been numerous RAF exchange officers who have flown the impressive F-22A Raptor in recent years.”

The RAF's Combat Air Force Commander – who is himself a former Harrier GR7, F-16 and current Typhoon pilot – has also flown numerous times with fifth-gen aircraft in various occasions over the past ten to 15 years of his career. He said: “Now we have our own fifth-gen aircraft, we can fly it under our own terms, within the UK and overseas.

“Since the Russians invaded Ukraine in February, working together has become much more normalised. Maximising and multiplying our capabilities in a way I haven't seen before – it's a step change.

“There has certainly been an acceleration in fourth/fifth integration across Europe recently, particularly by the Italians flying F-35A/Bs and Typhoons [see *Italian Fourth and Fifth-Gen Fighter Integration*, September, p50-57] and now Germany has announced an F-35 buy.”

The Italians attended the recent Cobra Warrior, and during a Defensive Counter-Air (DCA) mission, with dynamic targeting, the Air Commodore witnessed British F-35Bs, working alongside German Tornados, USAF F-16s and Italian Eurofighters as well as numerous RAF Typhoons. He added: “It was really impressive

Tactical Evaluation Squadrons

The test and evaluation units 41 Tactical Evaluation Squadron (TES) at RAF Coningsby (predominantly working on Typhoon) and 17 TES at Edwards AFB, California (on F-35B Lightning) don't report to the Air Commodore because they fall under the responsibility of the Air and Space Warfare Centre at RAF Waddington. However, he is kept informed of their work, as he explained: "I need to know what both TESs are doing as it feeds into what we do, and we work together with 17 in the USA, just as we do with 41 in the UK. They are very much part of our team and fully integrated at all levels.

"It is vital what we see on ops is fed back to them and they work on it; and what they see and do with the new weapons systems coming on board, for Lightning and Typhoon."

The shape of things to come. A British Lockheed Martin F-35B Lightning with ASRAAMs mounted on the wing tips, and SPEAR 3 and Meteor carried inside the weapons bays MBDA CGI



When 6 Squadron returned from Pitch Black in Australia during late August, it took the opportunity to fly a mission with the Indian Air Force. Here, a 6 Sqn Typhoon flies in close formation with a Rafale and Su-30MKI. How interoperable the Typhoon is with an Su-30MKI is anyone's guess Indian Air Force

and where we have got to get to, working with those nations brings in that essential interoperability. It's not just about the platforms, but the ability to work together and maximise/triple the effect, and we need to keep at it."

Fourth/fifth-generation fighter integrations look to be business as usual now for the NATO nations, which are learning all the time. With the German government announcing on March 17 that it was set to order up to 35 F-35As, the Luftwaffe obviously feels it needs to up its game on that front. Air Cdre Baulkwill continued: "What was interesting about the recent Exercise Pitch Black in Australia is that France [Rafales], Germany [Eurofighters] and UK [Typhoons] all sent aircraft out there, illustrating how deployable and reliable they are as well as

getting there at a speed of pace.

"Sharing our experiences as part of the international co-ordination and co-operation definitely helps, particularly across Asia Pacific when working with the Japanese, Indonesians, South Koreans, Thais and fellow partner nations of the FPDA [Five Power Defence Agreement – Australia, New Zealand, Singapore and Malaysia]."

Understanding

Air Cdre Baulkwill admitted that fourth/fifth-generation integration is key to the output of the RAF: "I see it as my basic role to bring the Typhoon and F-35 together, to get the benefits of them both."

The lessons that the RAF and Royal Navy have learnt from the many operations and exercises that have involved the two aircraft, are helping to shape the way the jets work together.



"Since the Russians invaded Ukraine in February, working together has become much more normalised"

Right: Four 6 Squadron Typhoon FGR4s fitted with Litening laser designator pods participated in Exercise Pitch Black in August Crown Copyright

Op Babel Fish

The trials that have been going on for several years in the USA, with 17 TES and 41 TES based at Edwards AFB and RAF Coningsby, respectively, are helping platforms like the F-35B and Typhoon to communicate across platforms. "Basically allowing different types of data-link to talk to each other wherever that is in the world," the Air Commodore said. "The Air Warfare Centre along with the Capability team have been looking to maximise the platforms' integration, on Link-11 and 16, to send information rapidly but only when it's required. So pulling the data, rather than pushing – changing the mindset. Doing the work at working level and sending it when it is needed, instead of sharing everything."

The Air Commodore explained why Combat Air in the UK is so important: "There are several reasons, not just for its effects on enemy forces and its actions around the globe, but also what it does for UK defence industry."

RAF Combat Air has learnt a lot from the likes of Operation Shader flying out of RAF Akrotiri, Cyprus, where Typhoons and F-35Bs (twice) have worked together against the Islamic State in Iraq and Syria since 2015. There was also the eight-month tour by the HMS *Queen Elizabeth* during the Combat Strike Group 21 last year (*Choppy Waters Ahead?* AFM September 2021 p60-65 and *On Faraway Seas* October 2021 p58-63), to the Far East and back. Additionally, exercises Red Flag at Nellis AFB in Nevada, the Atlantic Trident series (*Transatlantic Tricks*, AFM August 2021, p42-49), Pitch Black this year and Cobra Warrior have all sharpened the Allies' techniques. That will undoubtedly continue, and highlights the importance of these drills.

Fighting with F-35, Typhoon

The RAF has to ensure the F-35B and Typhoon can work together seamlessly, to ensure it can pack a bigger punch. The RAF and Royal Navy have been working on this for several years, initially in the US, but now in the UK, too. So, what are the strengths of the two aircraft?

"What we have with Typhoon is a very high performance aircraft that can fly at very high speeds for a very long time, with an excellent DASS on board and can carry a lot of weapons. With an almost unrivalled 'dog fighting' capability,"

Air Cdre Baulkwill adds: "Its close-in fighting is superb, and with an impressive weapons suite – Meteor, AMRAAM and ASRAAM Block 6 – the latest version, it's as good as I've ever seen. Meteor is an exceptional weapon, and we are getting the AIM-120D AMRAAMs, too."

The RAF requested the purchase of 200 highly capable AIM-120D AMRAAMs in July 2018, that was eventually cleared by US Congress. They are intended to go on the F-35s and all tranches of Typhoons when the AIM-120C5s have timed-out.

The UK's F-35B Lightning is currently cleared for three weapons – ASRAAM, AMRAAM and Paveway IV, all of which the Typhoon can use.



Packing a punch. Arming a 'Dambusters' F-35B aboard HMS 'Queen Elizabeth' during Westlant 19 exercise. Armourers practise preparing the jet for combat operations, mounting AMRAAMs internally, while there are ASRAAMs and Paveway IV laser guided bombs under the wings. The aircraft never flew with these loads because the SRVL (Shipborne Rolling Vertical Landing) had not then been perfected Crown Copyright



When the E-7 Wedgetail arrives next year, it will enhance dramatically the operational prowess of fourth/fifth-generation interoperability. Having worked with the RAAF Wedgetail during FPDA exercises and recent Pitch Black drills, the RAF is excited at the prospect of the cutting-edge capabilities of this airborne early warning and control platform with its extremely able MESA radar RAAF

Doing more with less

The RAF is much more integrated across all the platform systems than it was 20 years ago when the service was operating a fleet of Jaguars, Typhoons and Tornado F3/GR1 fighters. Today's platforms have much more sophisticated and advanced systems on board, like Link-16, a radar, defensive aids subs systems (DASS), helmet-mounted cueing systems, advanced targeting pods and advanced weapons. "If you look at what a Typhoon pilot has to deliver in the air-to-air and air-to-surface roles, it's massively more and requires a lot of training as well as test and evaluation," said Air Cdre Baulkwill.

"The Typhoon is basically doing everything that a Tornado F3 did in the air defence role and a Tornado GR4 in one role, with a single pilot.

"The RAF has never looked so good from an air combat capability. A single Typhoon can carry more Paveway or laser-guided bombs than a whole Jaguar squadron could [in 2007 when they were retired]. A Jaguar could only carry one laser-guided bomb and to work the bomb had to be 'lased' by a targeting pod on another aircraft. So, for two bombs it was four aircraft!

"A Typhoon carries four bombs, which is basically eight Jaguar aircraft, and of course with air-to-air missiles that the Tornado F3 carried."

His praise for the Typhoon, doesn't end there: "It can get airborne from RAF Akrotiri in dry power, in very high temperatures with a full weapons load. Afterburner is not used. Tornado pilots were surprised by that, and it's a capability in itself. The [Rolls Royce EJ 200] engine is exceptional."

The Air Commodore added: "That's where you really get the benefits of both types, with double the weapons load of the F-35s in both air-to-ground and air-to-air roles along with Lightnings' exceptional capabilities, the punch we pack is now considerable."

When the E-7A Wedgetail AEW 1 AEW&C aircraft enters RAF service in 2023/24 with its impressive multi-role electronically scanned array (MESA) radar alongside the SIGINT RC-135 Rivet Joint and P-8K Poseidon MRA1 maritime patrol aircraft, it can only add to the recognised air picture through the Link-16 network, delivering a very broad capability where the RAF can target parts of the mission that are required.

With their helmet-mounted cueing systems, the RAF pilots can get a full picture of what is needed to fulfil their sortie's objective, and according to Air Cdre Baulkwill: "The picture they see [from all these different sensors] is enough to blow people's minds. A deeply impressive capability.

"We see the F-35 very much in the offensive counter-air/SEAD role and clearly there are a number of weapons like SPEAR CAP III and SPEAR EW, which will be an important capability jump, and Meteor, to add to the three weapons already cleared on F-35.

"Add the Typhoon with its new ECRS 2.0 radar [*Ahead of the game*, September, p84-91 – best radar in the world?] – with its capabilities you can start to mix and match in a far greater way.

"Also, Typhoons that don't receive the new radar will receive SPEAR CAP 3 too, so when you add the Storm Shadow, plus the upgraded version, you end up with a really good suite of weapons and sensors to allow you to get after any problem sets that we might face.

"With the weapon selection I have on Typhoon,

and its assurance, speed and manoeuvrability coupled with its sensors, with the payloads the F-35s carry, you end up with what I describe as 1+1=3. Whereas it used to equal two."

Sharing is caring

Operationally, the F-35 will act as a deep strike ISR platform that can operate in areas that other aircraft cannot. "And that's our choice, because the Typhoon would be operating further back, with all its new longer-range capabilities – Litening V, radar and weapons.

"Allowing the Typhoon to stay out of range of the enemy while working with the F-35B Lightning, RC-135 Rivet Joint, E-7 Wedgetail and P-8 Poseidon, providing the network-centric capability that we talked about ten years ago.

Each asset will have high quality data, shared across all platforms. Not only generated by E-7, but by Lightning and Typhoon, so now our information is better fused, allowing greater integration and therefore improving our air-to-air and air-to-surface capabilities.

"Having that stand-off capability gives us flexibility and when you add in capabilities such as swarming drones and other un-crewed assets that are being developed by the Capability team for the future, you start to develop a problem set for potential enemies that we have not seen the like of."

Integration is only going to grow, and the Combat Air Force commander wants to ensure it does: "We will have the ability to be agile, where we want to employ with our capabilities and deploy rapidly to locations of our choice such as we have recently done to Norway, Sweden and Finland."



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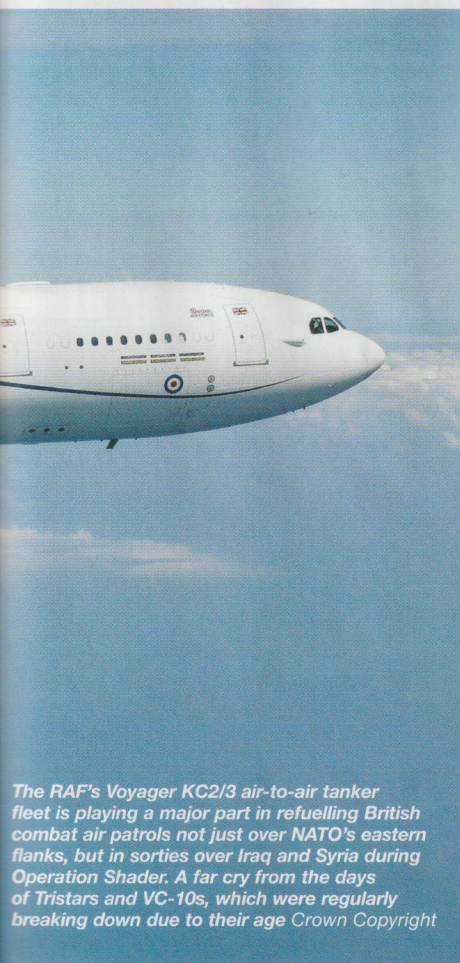
Another finger playing its part in the RAF's fist is the P-8A Poseidon maritime patrol aircraft – the first RAF sub-hunter is seen here being escorted to its new home in February 2020 UK Ministry of Defence 2019



New radar: ECRS 2

The Typhoon's 'crown jewel' will allow the jet to simultaneously detect, identify and track multiple targets in the air and ground role. Electronic attack is one clear benefit from this new sensor. Air Cdre Baulkwill said: "There is a bit of commonality [with the other two ECRS versions being developed], but the RAF's requirements were significant and right at the top-end because of what we wanted to do with our fifth-gen Lightning. The requirements we set at the outset were demanding and when we looked at other variants we saw they differed, which is fine.

"The issue is bringing the conversation together, to discuss and share experiences and what it means. We have been on ops for a long time, [Op Shader and also Op Ellamy in Libya during 2011], so we learnt a lot of lessons and we are sharing that with our European nations."



The RAF's Voyager KC2/3 air-to-air tanker fleet is playing a major part in refuelling British combat air patrols not just over NATO's eastern flanks, but in sorties over Iraq and Syria during Operation Shader. A far cry from the days of Tristars and VC-10s, which were regularly breaking down due to their age Crown Copyright



Russia's threat has seen fourth/fifth-generation integration by all NATO forces gain some real momentum. Here, an RAF Typhoon is seen intercepting a Tu-142MZ 'Bear' during a Baltic Air Policing mission in 2019. Two QRA sites at RAF Lossiemouth and RAF Coningsby protect the skies over the UK Crown Copyright



During the recent Exercise Cobra Warrior, the RAF F-35Bs and Typhoons worked with this Italian Air Force Gulfstream 550 Conformal Airborne Early Warning aircraft. With the Sentry AEW1 retired last year and the E-7 not due to enter service until 2023/24, it was handy to work with a similar asset from an allied force Joe Campion

Working with new NATO members

"Exercising with Gripen is forming very much of our conversation, and when we look at Norway, Finland and Sweden as our partners and we continue to grow it, Gripen E with its air to air capabilities quite similar to Typhoon will offer us even more choice," said Air Cdre Baulkwill. "There are many things we could learn from Sweden and Finland, who are potential new NATO partners – how they operate up north, the way they operate in an agile way, changing some of the rule sets. Again, it's that kind of diversity... looking at opening ourselves up to – they do some amazing things. These new ideas are what we want to do."

Exchange pilots

Air Cdre Baulkwill confirmed that the RAF currently has personnel on exchange on the B-2, F-15, F-22, F-35 and F-16, allowing the service to be fully integrated not only in test, but operationally, too. There are also RAF personnel on the Rivet Joint (both RAF and USAF cleared to the same level), E-7 (in Australia – 'Seedcorn') and P-8A Poseidon (US Navy).



Another weapon of the future for the RAF's F-35B fleet is SPEAR (Select Precision Effects At Range Capability) III a network-enabled air-to-ground weapon with a spin-off SPEAR EW weapon. The latter would see the warhead replaced with an EW jammer MBDA

Simulation?

Simulator training is a massive part of what Combat Air is driving towards and it is not just to lower costs.

As Air Cdre Baulkwill explained: "It allows us to train at the highest level, and with our plan to integrate the simulators from the Typhoons and F-35s [at RAF Coningsby, Lossiemouth and Marham] under our Gladiator programme, pilots can fight in a single environment, allowing us to do a lot of work that we do on exercise, at the highest security level whilst still maximising our training. So, the synthetics [to flying ratio] is 50/50 Lightning and 50/50 Typhoon, when the new Typhoon simulators arrive.

"The 'sims' allow us to test the pilots to the maximum extent whereas in the live environment we can't always do that because of the security aspect. Synthetics gets around that and allows us to practise procedures and techniques against our opponents.

"Meteor is an example – we don't want to disclose all the capabilities. The Typhoon has a lot going for it with so many upgrades coming – P4E [phased enhancement package] and LTE [Long Term Evolution] enhancements across all European partner nations, and with Radar 2.0."

Back to dispersing?

We only have to look at how the Ukraine Air Force has developed tactics to fight with mighty Russian war machine; a threat to peace that doesn't look set to go away just yet, and dispersed operations have been a way of fighting. The Air Cdre added: "What has happened in Ukraine means the threat is more serious, and there is a change in perspective, you realise the importance of Combat Air, for the Combat Air Patrols, what Typhoon and F-35 have been doing from the UK over Poland, or out in Romania or Cyprus.

"We've been at the leading edge of NATO

defence and Combat Air is always the first to arrive. We have seen the Ukrainian Air Force disperse its aircraft, to pretty good effect, and we now want to ensure we can move between bases quickly, just as we did with Harriers, Jaguars and Tornados during the Cold War.

"Do I want to disperse my F-35s? Not necessarily in hides like we did in the old Harrier days, but I do have the F-35B STOVL (Short Take Off Vertical Landing) version that gives me far more flexibility.

"I could put the F-35B in places the F-35A cannot go. And that's an exciting capability that we are going to grow over the next few years, so it is not just about the weapons or the sensors, but where that jet can land. How quickly can it be turned around, can I arm it quickly in that location? I might get a C-130 to land with a fuel bag, to refuel an F-35 just like we used to do with Harrier. We have to re-learn how useful this [expeditionary warfare] was over the years." **AFM**



"It's not just about the platforms, but the ability to work together and maximise/triple the effect, and we need to keep at it"

Litening V on Typhoon

The new Rafael Litening V targeting pod entered service earlier this year, and by all accounts is proving a phenomenal success, as Air Cdre Baulkwill said: "It's a big jump up [above other targeting pods] and we are already using them out on ops, in Op Shader, and see the effects of them. It's a highly capable pod, and the US was deeply impressed when they saw it and the footage they saw out at a Red Flag recently. It's about maximising our phased capabilities – good at air-to-air and air-to-surface roles, couple that with ECRS 2 radar coming around the corner and improved DASS [Defensive Aids Sub Systems], we are going from strength to strength.

Left: The RAF took delivery of its first General Atomics Protector RG1 in California on October 6. Being allowed to fly in UK air space, the RAF will operate it in a completely new manner to the MQ-9 Reaper currently out in ops. Providing persistent ISR and Combat ISR, with the ability to deliver weapons and being part of Link-16, will bring another big boost to Combat Air capabilities