



## BRIEFING PAPER

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# The Combat Air Strategy: From Typhoon to 'Tempest'?

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What combat aircraft will the RAF be flying in two decades time? The [Combat Air Strategy](#), published in July 2018, sets out the Government's ambition to develop a new combat air system that will fly alongside Typhoon and Lightning by 2035.<sup>1</sup> The aerospace sector accounted for 87% of defence exports over the last ten years and the UK combat air sector has an annual turnover over £6bn.<sup>2</sup> The Defence Secretary said the strategy makes clear the UK intends to remain a 'world leader' in the combat air sector.

Work on the 'Future Combat Air System Technology Initiative' has already begun, with Government and industry pledging to invest £2bn over the next decade in exploring new technologies and retaining the skills necessary to develop, design and manufacture a combat aircraft. France and Germany recently announced plans to work together on a future combat air system and the UK will spend the next year talking to a range of potential partners and customers before making some early decisions by the end of 2020 and final investment decisions by 2025. The Strategy announces the creation of a Government/industry partnership called 'Team Tempest', drawing on MOD expertise and four major industry partners: BAE Systems, Leonardo, MBDA and Rolls-Royce.

### Box 1: What is 'combat air'?

"Combat Air refers to aircraft (manned or unmanned) whose prime function is to conduct air-to-air and air-to-surface combat operations in a hostile and contested environment; with the ability to concurrently conduct surveillance, reconnaissance, electronic warfare, and command and control tasks."<sup>3</sup>

### Tornado, Typhoon, Lightning... Tempest?

The RAF's combat air fleet is about to undergo a massive change. The aging Tornado GR4 aircraft will leave service in 2019 and replaced by the new Lightning (F-35) aircraft.<sup>4</sup> Lightning will then partner Typhoon, until the latter leaves service around 2040. Typhoon's successor is the focus of the Combat Air Strategy (Tempest was the name of a WW2 fighter aircraft although as yet it is only the name for the project team).

<sup>1</sup> "UK unveils Tempest fighter concept as part of new Combat Air Strategy", Jane's Defence Weekly, 25 July 2018

<sup>2</sup> The figure is 87% of defence exports from 2008-17: UK Defence and Security Export statistics for 2017, Department for International Trade, 31 July 2018; Combat Air Strategy, Ministry of Defence, 16 July 2018

<sup>3</sup> [Combat Air Strategy](#), Ministry of Defence, 16 July 2018

<sup>4</sup> The F-35 Lightning is a multinational collaboration with eight partner countries, led by Lockheed Martin in the US. The UK is the only tier 1 partner nation in the F-35 programme. UK-based companies will build 15% (by value) of each of the estimated 3,000+ aircraft.

## 2 The Combat Air Strategy: From Typhoon to 'Tempest'?

### Why is a strategy needed now?

While it may seem premature to discuss an aircraft not required until the 2030s, developing and delivering into service combat aircraft takes decades. Tornado and Typhoon were first conceived in the late 1960s and 1980s respectively while Lightning can trace its procurement programme back to the late 1990s. Decisions on a future aircraft for the 2030s need to be taken in the next few years.

“The UK is a global leader in Combat Air.”  
Combat Air Strategy

The importance of the defence aerospace industry and the defence export market to the UK is prominent throughout the strategy. Government figures suggest the Combat Air sector had an annual turnover of £6.5bn in 2016 and directly supported 18,000 jobs.<sup>5</sup> The Defence Secretary writes in the foreword: “the Combat Air sector delivers UK jobs, UK design, UK innovation and UK sovereign capability by taking an innovative and international approach”.

Ensuring the UK retains and develops the industrial capabilities to develop such a system and is a central message of the strategy. The Government intends to give industry a “clear indication of future military requirements” to stimulate the research and development needed.<sup>6</sup> The Strategy states:

UK-generated Intellectual Property, people, skills and facilities are critical to sustaining operational advantage and freedom of action, securing our national prosperity and the UK’s position as a defence exporter.

The aerospace sector accounted for 91% of UK defence exports in 2017 and 87% of defence exports over the last ten years (2008-17).<sup>7</sup> There is currently no obvious successor to the three European-designed and built combat aircraft in service: Eurofighter (BAE Systems, Airbus and Leonardo) Typhoon, Dassault Aviation’s Rafale (France), and Saab’s Gripen aircraft (Sweden), or their US fourth-generation peers, all of whom will begin to retire in the late 2030s. The MOD believes “there will be a significant market for a successor to these capabilities over the period 2040-2060”.<sup>8</sup>

Lastly, the Strategy comes after a series of publications by the MOD and the Government on the defence industry and procurement. The [National Shipbuilding Strategy](#) (2017) looked specifically at warship construction in the UK, prompting MPs to call for a defence aerospace industrial strategy in a [debate](#) in November 2017. The subsequent [Defence Industry Policy](#) refresh (2017) suggested a similar specific sector approach to the shipbuilding strategy could be applied to a few, high priority areas to “help deliver long-term value for money, operational advantage or freedom of action.”<sup>9</sup> The Defence Secretary later [identified](#) Combat Air as one of these sectors. And after pressure from the shadow Defence Secretary, Gavin Williamson said the MOD will look at the concept of developing a land strategy.<sup>10</sup> The Defence Secretary also described the Combat Air Strategy as a “crucial pillar” in the Government’s Modernising Defence Programme, the headline conclusions of which were presented to [Parliament](#) a few days after the Strategy was published.

### Working with partners

Any new combat aircraft is likely to be developed with at least one other country. Tornado, Typhoon and Lightning were all developed in collaboration with other nations. The most

<sup>5</sup> Combat Air Strategy, Ministry of Defence, 16 July 2018, para 2

<sup>6</sup> Gavin Williamson, HC Deb 17 July 2018, c241

<sup>7</sup> [UK Defence and Security export statistics for 2017](#), Department for International Trade, 31 July 2018

<sup>8</sup> Combat Air Strategy, Ministry of Defence, 16 July 2018, para 15

<sup>9</sup> [Industry for Defence and a Prosperous Britain: refreshing defence industrial policy](#), Ministry of Defence, 20 December 2017, paras 57

<sup>10</sup> [HC Deb 17 July 2018 c243](#)

obvious reason for this is cost - combat aircraft are eye-wateringly expensive and additional partners can help (in theory) to diffuse both developmental and through-life costs. The drawback of such a partnership is the potential for complicated management structures, slow decision making and political issues, particularly if a consensus is required from all the partner nations.<sup>11</sup>

The UK has been working with France for the last few years on an unmanned combat air system demonstrator programme. However, the future of that was thrown into doubt last year when France teamed up with Germany to develop its own Future Combat Air System.

Whether the UK eventually partners France and Germany, or forges ahead on a separate programme with other partners, won't become clear for some time. It is quite possible the three nations will eventually work together – which is the view of the CEO of the Eurofighter Typhoon consortium, who believes “Europe will converge on one fighter solution”.<sup>12</sup>

The Combat Air Strategy does clearly signal the Government's intent to ensure the UK remains at the forefront of any future Combat Air acquisition programme, by supporting and promoting UK industry expertise:

The UK's experience in developing Tornado and Typhoon, on the F-35 programme and integrating 4th and 5th generation systems means we are ideally placed to work with a wide range of partners to achieve first mover advantage within this market.

The MOD will undertake a series of rapid feasibility studies with potential partners over the next year to scope out the potential for collaboration.

### **Team Tempest**

The Strategy announced the creation of Team Tempest, an “innovative Government-industry partnership” to deliver the Future Combat Air System Technology Initiative.

Team Tempest includes the UK's major defence companies who will each bring a particular focus to the programme: BAE Systems (advanced combat air systems and integration), Rolls-Royce (advanced power and propulsion systems), Leonardo (advanced sensors, electronics and avionics) and MBDA (advanced weapons systems).<sup>13</sup> European Defence Review magazine provides a [closer examination](#) of the specific areas of focus of the four lead companies.

Government personnel are drawn from the RAF's Rapid Capabilities Office, the Defence Science and Technology Laboratory, Defence Equipment & Support. The Government warns alternative options will be considered if Team Tempest's performance does not meet expectations.

### **About the aircraft**

Tempest was a fighter aircraft in World War Two, although the Strategy only uses this term in the context of ‘Team Tempest’ – it does not confirm this will be the name of whatever aircraft or system emerges.

While the announcement of the strategy at Farnborough Airshow took place in front of a full-scale mock-up of an aircraft – a twin engine single-seater - aerospace analysts warn not to read

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<sup>11</sup> For example, the National Audit Office found the collaborative decision making on the Typhoon was inefficient: “Management of the Typhoon project”, National Audit Office, HC 755 2010-2011, 2 March 2011. The 2012 Defence White Paper [National Security through Technology](#) acknowledged the advantages and disadvantages of multilateral collaboration, Cm 8278, February 2012, para 87

<sup>12</sup> “Europe’ to settle on one fighter solution”, Jane's Defence Weekly, 17 July 2018

<sup>13</sup> “Farnborough 2018: Team Tempest outlines future combat air strategies and technologies”, Jane's Defence Weekly, 17 July 2018

## 4 The Combat Air Strategy: From Typhoon to 'Tempest'?

too much into the initial designs (Justin Bronk of RUSI provides some detailed [analysis](#) of the concept drawings).

The Strategy makes clear that Team Tempest's purpose is to explore the technologies and systems that could form a future combat air system. It is not yet at the stage of building a demonstrator aircraft (unlike the previous exploration of a future unmanned combat air system which led to BAE Systems developing [Taranis](#)).

The companies involved have given some indications of the technologies and techniques they are looking at. The Strategy itself discusses 'Pyramid': the project to develop open mission systems architecture. This should make upgrades simpler and more cost effective and allow partners/export customers to easily integrate their own mission systems. Rolls Royce has talked of developing a future power system that drives not just the aircraft but provides a "step-change levels of electrical power (for the future systems on board)".<sup>14</sup> [Leonardo](#) says it will "mature the critical technologies to deliver next generation sensing and communications alongside the advanced open-system architectures that will deliver a step-change in how the sensors are employed within an operational system". An [MBDA](#) slide lists a range of possible weapons, including deep strike, swarming, directed energy, hypersonic and strike weapons. BAE Systems is looking into a software-driven cockpit to be all in the pilot's helmet. Media reports also talk of the aircraft being 'optionally manned' suggesting the MOD is looking at the possibility of flying a system without a pilot on board.<sup>15</sup>

There is no mention in the Strategy of the required capabilities of a future combat air system. So no mention of whether the MOD expects it to fly from the Queen Elizabeth aircraft carriers. [Justin Bronk](#) thinks the concept drawings do not indicate any plans for the aircraft to provide a carrier strike capability. Nor does the Strategy give any indication of the potential number of airframes.

### Funding

The Prime Minister said the Future Combat Air System Technology Initiative (FCAS TI) will deliver over £2bn pounds of investment up to 2025.<sup>16</sup>

The Combat Air Strategy suggests the £2bn will come jointly from Government *and* industry:

The 2015 Strategic Defence and Security Review also initiated the Future Combat Air System Technology Initiative to bridge this gap [between the end of Typhoon production in the 2020s and production on new aircraft]. This enables over £2Bn of joint Government and industry investment in sustaining and enhancing key skills and capacity into the 2020s. By continuing to implement this policy, including the critical next phase of the National Programme, we will provide investment in key UK design engineering skills and a means to generate UK Intellectual Property. This will help to maintain long-term choice for future UK Combat Air system acquisition and ensure a major role for UK industry in delivering the systems that succeed Typhoon.<sup>17</sup>

The RAF's Chief of staff for capability says are "50:50 funding arrangements on key elements of the programme with industry".<sup>18</sup>

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<sup>14</sup> "Farnborough 2018: Team Tempest outlines future combat air strategies and technologies", Jane's Defence Weekly, 17 July 2018; "Tempest jet takes UK engineering by storm", Sky News, 18 July 2018

<sup>15</sup> "Farnborough 2018: Team Tempest outlines future combat air strategies and technologies", Jane's Defence Weekly, 17 July 2018; "Tempest jet takes UK engineering by storm", Sky News, 18 July 2018; "[Team Tempest formed for future RAF attack aircraft](#)", European Defence Review, 17 July 2018

<sup>16</sup> [Prime Minister's speech at Farnborough International Airshow](#), Prime Minister's Office, 16 July 2018

<sup>17</sup> [Combat Air Strategy](#), Ministry of Defence, 16 July 2017, para 13

<sup>18</sup> "Farnborough 2018: Team Tempest outlines future combat air strategies and technologies", Jane's Defence Weekly, 17 July 2018

The Strategy also lays out a 'National Value Framework' which, it says, will allow the MOD to "compare the relative benefits of a range of options from procuring 'off-the-shelf' to partnering with allies". It will look at military capability (operational advantage and freedom of action); prosperity and industrial capability, and international influence.

### Reaction

The response from industry and in Parliament was broadly positive. Nia Griffiths, the shadow defence secretary, suggested an overarching defence industrial strategy would have been better than a combat air strategy "to give the wider industry the certainty it requires", prompting Gavin Williamson to promise to look at the concept of a land strategy.

Several MPs asked about potential collaboration with international partners. The Defence Secretary suggested the UK is looking beyond Europe at "new nations that have not usually been involved in such collaborations before".

Stewart McDonald, the SNP's defence spokesman, was among those questioning the budget. His question about currency projections (a reference to buying equipment in US dollars) elicited a hint from the Defence Secretary that the MOD is looking at UK manufacture: "I hope to avoid the many problems relating to currency projections by ensuring this new fighter is built in Britain".

The pressure on the defence equipment programme is well documented – the National Audit Office says the current defence equipment is "unaffordable".<sup>19</sup> Justin Bronk, a specialist in air power at RUSI, questioned the MOD's combat air procurement plans: "it is unlikely that the MOD will be able to adequately fund the testing and procurement phases of the Tempest while buying significant numbers of F-35s and maintaining an increasingly aging core Typhoon force...Something will eventually have to give".<sup>20</sup>

### Next steps

The Strategy lays out an ambitious timeline leading up to an initial operating capability of 2035:

- End 2018: a strategic outline business case
- Mid-2019: initial assessment of international collaboration options
- End 2020: early decisions for capability acquisition (capability, partnership approach, cost and delivery schedule)
- 2025: final investment decisions
- 2035: initial Operating Capability

The Defence Secretary will report annually to Parliament on implementing the Strategy.

Library briefing paper [Prospects for Combat Air: What follows Typhoon and Lightning?](#) CBP08304, 15 May 2018, provides a more detailed at the RAF's current and future combat aircraft fleet, the UK aerospace industry and prospects for international collaboration.

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<sup>19</sup> "The Equipment plan 2017 to 2027", National Audit Office, 31 January 2018, HC 717 2017-19

<sup>20</sup> Justin Bronk, "[Enter the Tempest](#)", RUSI Defence Systems, 16 July 2018

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