National Audit Office

REPORT

The UK's F-35 capability

Ministry of Defence

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The UK's F-35 capability

Ministry of Defence

Report by the Comptroller and Auditor General

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Gareth Davies
Comptroller and Auditor General
National Audit Office

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Key facts

37
UK F-35 aircraft in service at June 2025

2069
planned UK F-35 out of service date (previously 2048)

£11bn
National Audit Office (NAO) estimate of the minimum amount spent to date on the UK F-35 capability

Many times	extent to which the F-35 is more able to survive and successfully deliver attacks than previous UK aircraft
December 2023	planned date for Full Operating Capability in the UK F-35 Concept of Use document (2018), now expected by the end of 2025
Approximately one-third	extent that UK F-35 fleet was available to perform all required missions in 2024 against the Ministry of Defence's (MoD's) target. The NAO is not disclosing the actual percentage for national security reasons
Approximately half	extent that UK F-35 fleet was available to perform at least one of seven possible required missions in 2024 against the MoD's target. The NAO is not disclosing the actual percentage for national security reasons
Early 2030s	expected integration onto F-35 of full Spear 3 standoff weapon capability
At least 15%	approximate percentage value of each F-35 aircraft that is produced by UK companies
£57 billion	the recently compiled MoD estimate of F-35 whole-life equipment and support costs for 138 aircraft until 2069, although this figure has not been subject to full MoD validation
£71 billion	NAO estimate of F-35 whole-life cost, which includes wider MoD costs relevant to F-35 capability in addition to equipment and support, for example personnel, fuel and infrastructure, but excluding weapons development expenditure and other central overheads

Summary

1 The F-35 Lightning II Joint Strike Fighter (F-35) is a technologically cutting-edge multirole stealth fighter aircraft. Originally conceived in the 1990s by the US Department of Defense, the UK is one of 8 nations that are partners in the global F-35 programme, although the US has by far the most influence on the programme, so far ordering approximately 80% of all aircraft. Other countries purchase F-35s as foreign military sales customers. F-35s from different countries are designed to be interoperable.

2 The Ministry of Defence (MoD) began taking delivery of F-35B aircraft, a variant which can be used from land or aircraft carriers, in 2012 and has committed to purchasing 138 F-35 aircraft, with 48 currently on contract and 38 having been received but no approved timetable for purchasing the rest. The UK's policy is to be able to use the F-35 at any time or place of its choosing, which it calls 'freedom of action'. The MoD intends to demonstrate the F-35 capability as part of a Carrier Strike Group deployment in 2025, embarking up to 24 aircraft. The MoD expects its F-35 aircraft to remain in service until 2069 (extended from 2048).

3 The global programme is run by the Joint Program Office (JPO) based in Washington DC. The MoD is heavily dependent on the performance of the JPO for cost-effective delivery of the aircraft, engines and provision of support. While there are established processes within the global programme to allow partners to seek changes they want to see, influence remains a very important factor to secure change. The MoD is fully responsible for providing all other elements of capability, such as providing trained pilots, engineers and other personnel, infrastructure, weapons, and logistics. The MoD is also responsible for providing related capabilities, such as the aircraft carriers and air bases which the F-35 is designed to fly from.

4 We have previously reported on the UK F-35 capability as part of our Carrier Strike reports, as well as in wider reports on MoD capability and the MoD Equipment Plan but this is our first report considering F-35 capability in detail. The report covers:

- F-35 aircraft capability, delivery and availability (Part One);
- supporting enablers (Part Two); and
- how the MoD manages the programme and its costs (Part Three).

5 We undertook fieldwork between December 2024 and April 2025 and our methods and evidence base are described in further detail in Appendix One. We have not included in the scope of this report the other capabilities that the F-35 works with to form the UK's Carrier Strike Group capability, although we have referenced those capabilities when discussing the value that the F-35 can provide. Following discussions with the MoD we have not disclosed certain facts where publication posed a threat to national security (Appendix One).

6 In June 2025, the Government published the Strategic Defence Review (SDR), which stated that more F-35s will be required over the next decade, and that "this could comprise a mix of F-35 A and B models according to military requirements to provide greater value for money". Later in June 2025, the government announced its intention to buy at least 12 F-35As capable of carrying both nuclear and conventional weapons (Dual Capable Aircraft – DCA), and that they will form part of NATO's nuclear mission. The MoD has stated that it hopes that delivery will begin before the end of the decade. It also confirmed that the UK would purchase 15 F-35Bs alongside 12 F-35As in the next procurement phase. The MoD did not provide any details on timelines or further purchases but stated that it would examine options in the upcoming Defence Investment Plan.

Key Findings

Aircraft capability, availability and delivery

7 The capability provided by the F-35 across its multiple roles is significantly superior to any previous UK aircraft. It is a particular improvement in stealth capabilities, fusion of information from different sensors and electronic warfare capabilities. These combine to produce an aircraft many times more likely to survive and deliver operational effects in contested environments. Moreover, the F-35 can enhance the capability of other UK platforms, including Queen Elizabeth Class aircraft carriers and Typhoon aircraft, through its survivability, jamming of enemy air defences and intelligence-sharing capabilities (paragraphs 1.9 and 1.10).

8 There are some important capabilities that the MoD has delayed into the next decade. Most significantly the F-35 does not have a standoff weapon to attack ground targets from a safe range, which will impact its effectiveness in contested environments. It does not expect to have this capability in full until the early 2030s. Nor will the MoD have a sovereign facility to assure that the aircraft retain their stealth characteristics until the 2030s, much later than originally planned. Hardware and software updates, known as Block 4 and provided by the global programme, have also been delayed (paragraphs 1.11 and 1.12).

9 **The MoD expects to finish receiving its first phase of 48 aircraft by the end of April 2026, although this is behind schedule partly for financial reasons and partly because of global programme delays.** In 2016 the MoD announced its plan to buy 48 aircraft by the end of 2024, which it amended in February 2020 to the end of 2025. It currently has received 38 aircraft, of which one was lost in an accident in November 2021, leaving 37 currently in service. The MoD now forecasts that it will have 41 aircraft by the end of 2025 and receive its 48th aircraft at the end of April 2026. This has been caused by a combination of the MoD delaying its delivery profile to save money in the short term in response to wider financial pressures and, subsequently, problems in the global programme with the Technology Refresh 3 software upgrade (paragraphs 1.14 and 1.15 and Figure 3).

10 **The MoD has publicly committed to acquiring 138 aircraft, giving it a prominent position in the global programme, although slow progress towards this target risks undermining that position.** Although this commitment is the highest among programme partners after the US services, the UK has contracted for a lower percentage of its publicly committed number of aircraft than most other partners and for no additional aircraft since 2016 (paragraphs 1.16 to 1.18 and Figure 4).

11 **The MoD expects to declare Full Operating Capability (FOC) by the end of 2025, two years later than set out in the 2018 Concept of Use, despite facing several gaps against FOC requirements.** The MoD has also revised FOC requirements to be more qualitative since 2023. The MoD believes that it can declare FOC without resolving all these gaps, such as the lack of a standoff weapon, a sovereign facility to check that aircraft retain stealth characteristics and personnel shortages, although it does have mitigations in place for some of them. Furthermore, FOC will not be achieved sustainably. Evidence of FOC will be partly provided by the 2025 Carrier Strike Group deployment, which relies upon borrowing people and aircraft from the training squadron and will also reduce aircraft availability for several months after its conclusion (paragraphs 1.19 to 1.21).

12 The MoD has not been able to sustainably deliver its targets for aircraft availability, resulting in flying hours that were below its requirements for pilots. In 2024 the UK F-35 fleet had a mission capable rate (defined as the ability of an aircraft to perform at least one of its seven possible required missions) which was approximately half of the MoD's target. It had a full mission capable rate, (defined as the ability of an F-35 aircraft to perform all its required missions) which was approximately one-third of the MoD's target. The MoD's targets are themselves lower than global programme targets. The NAO is not disclosing actual percentages for national security reasons. The poor availability rates are driven largely by a UK shortage of F-35 engineers and a global shortage of F-35 spare parts. Comparable figures for the period between October 2024 and January 2025 also showed that UK rates were significantly lower than those of the global F-35B fleet. The MoD improved these metrics in April 2025 during the Carrier Strike Group 2025 deployment, meeting its target for mission capable rates and almost meeting its target for full mission capable rates, but these rates are unlikely to prove sustainable after the deployment. These problems with aircraft availability have resulted in fewer flying hours for pilots than the MoD wants. The MoD told us that it closely monitors live flying hours and synthetic training to judge individual pilot competence (paragraphs 1.20 and 1.22 to 1.27).

Supporting enablers

13 The F-35 force has major personnel shortages across a range of roles, which it does not expect to fully resolve for several years, although it is currently recruiting to fill some of these gaps. Most significantly it had serious gaps in engineering posts in November 2024 with especially acute gaps at supervisor grades. It also had shortages of cyber professionals, pilots and flying instructors. These gaps partly reflect MoD-wide shortages, but the F-35 force is also perceived by some Royal Air Force personnel as a comparatively unattractive posting because of long Carrier deployments. In addition, there are poor living arrangements and the MoD has previously underestimated the number of engineers required. The MoD is attempting to reduce these gaps, most importantly by funding the recruitment of 168 new F-35 engineers (paragraphs 2.3 to 2.7 and 2.13).

14 The MoD has delivered most of the infrastructure required for UK freedom of action but still needs to improve its other F-35 infrastructure. It has delivered four of the five facilities required to enable the UK to operate the F-35 at a time and place of its choosing. The exception is the Aircraft Signature Assessment Facility to assure its stealth characteristics. This was originally delayed for affordability reasons and will now not be delivered until the 2030s, albeit with partial mitigations planned. Beyond its freedom of action infrastructure, the MoD has yet to provide permanent working space for its second frontline squadron to operate independently and the poor quality of some domestic accommodation and amenities at RAF Marham act as a disincentive to personnel joining the F-35 force (paragraphs 2.8 to 2.13 and Figure 5).

15 The MoD is far behind its planned delivery dates for integrating UK developed missiles onto the F-35 and is pursuing interim alternatives. The original need by date for the Spear 3 air-to-surface and Meteor air-to-air missiles was December 2024. However, the MoD now expects to have both in full service in the early 2030s. These delays have been caused by poor supplier performance, the MoD negotiating commercial arrangements that failed to prioritise delivery and low priority given to Meteor by the global programme. The MoD wants to mitigate capability risk by early delivery of a limited capability and by purchasing interim weapons. However, it has not yet purchased an effective standoff air-to-surface weapon (paragraphs 2.14 to 2.16).

16 The MoD faces challenges getting the logistics support it requires from the Global Support Solution (GSS) but has arrangements in place to support deployments. The GSS, run by the global programme, has not been able to deliver spare parts at the rate that the UK, and other F-35 partners, require because the global spares pool has not grown as quickly as the global F-35 fleet. The MoD has also had problems accessing support equipment and its engineers have ongoing, though diminishing, problems with the maintenance management system. Despite these challenges the MoD has arrangements in place to receive additional support to mitigate these issues during operations such as the Carrier Strike Group 2025 deployment (paragraphs 2.17 to 2.21).

How the MoD manages the programme and its costs

17 The MoD's early $2 billion (£1.7 billion) commitment to the global programme and continuous presence in the JPO have helped bring the UK industrial and other benefits, and some limited influence in design, development and cost management. The MoD's 2001 commitment gave it 25% voting rights on design and development and secured UK freedom of action. UK companies now manufacture at least 15% of all F-35 aircraft by value, even though the MoD is buying under 5% of total production, which has resulted in £22 billion of contracts for UK companies so far. There are currently 38 MoD staff embedded with the JPO in Washington, more than any other partner nation, one of whom is now in charge of identifying potential areas of cost reduction within the global programme (paragraphs 3.5, 3.6 and 3.25).

18 The MoD's short-term affordability decisions and serious global programme delays have hindered the delivery of aircraft and other supporting capabilities. In 2010 the MoD removed £1.5 billion from the F-35 budget and since then Air Command has delayed delivery of F-35 aircraft on several occasions, most recently in 2020 when it delayed a batch of seven aircraft by a year to 2025, to save money. The MoD has also delayed F-35 infrastructure, for example in 2021 by stopping construction of the Aircraft Signature Assessment Facility for three years to save £82 million, even though this would lead to higher costs in the long term. More widely, the global programme has suffered from manufacturing problems with both aircraft and engines, and recent issues have meant that the completion of Block 4 upgrades is also running late. In 2023, the global programme delivered 91% of aircraft and 100% of engines late (paragraphs 1.11, 3.13 and 3.15).

19 We estimate that the MoD has spent £11 billion to date on F-35 capability, which is more than it has reported, and more than it anticipated it would spend at the time of the 2013 business case. As for all its programmes, the MoD monitors only the amount it spends on equipment and support, on which it reports spending of £9.35 billion by the end of March 2025. If spending on personnel, infrastructure, training flights, other overheads, and earlier sunk costs, are included, we estimate this would add at least £1.5 billion to the total. The 2013 business case stated that F-35 would be comparable to or cheaper than fourth-generation fighters such as Typhoon, but higher than forecast global programme production, development and support costs since then is proving this to be over-optimistic. The UK has limited influence on global programme costs, but has helped introduce a more disciplined approach to its cost management in particular since 2023 (paragraphs 3.22 to 3.28).

20 Despite the problems and increased costs, in recent years the MoD's day-to-day programme management has had strong leadership and some robust processes in place, although some standard MoD management practices have acted as barriers to progress. The MoD's management of F-35 has involved the co-ordination of nine capability areas, and other capabilities, each with their own accountability structures. Strong programme management and collaborative leadership within Air Command have helped bring integrated management and deliver capability. But each of the approximately 20 requests for approval for spending on the programme and related infrastructure have been time-consuming, and the expected tenure of two to three years for senior managers has acted against the need for them to build long-term relationships with key stakeholders (paragraphs 3.9 to 3.11, 3.16 and 3.22).

21 The programme does not have a robust measurement of success, which means that its overall value is difficult to assess. The programme monitors nine military and non-military benefits, covering areas such as operational advantage, freedom of action, reputation, economic benefits and environmental sustainability, as well as numerous sub-benefits. But they are not weighted in terms of priority or importance. Success or failure in military capability delivery is also based on judgment at a point in time, but the basis of the judgment is not clear, especially where some previously expected capabilities are absent. The MoD also does not capture some benefits, such as transfer of learning (paragraph 3.17 and Figure 6).

22 The programme's whole-life costs are considerably higher than the MoD has publicly reported. The programme's public forecast of whole-life costs of £18.76 billion assumes only 48 aircraft will be procured and that their out of service date will be 2048, even though MoD policy is to procure 138 aircraft and take them out of service in 2069. Following National Audit Office prompting, the MoD has forecast that the cost of 138 aircraft to an out of service date of 2069 would be just under £57 billion, although it describes this forecast as pessimistic and notes that it has not been subject to independent validation. This figure does not include non-equipment costs, such as personnel, fuel, and much infrastructure. We estimate these costs would add £14 billion to the MoD's estimate, making a full whole-life cost of £71 billion (paragraphs 3.27 to 3.35).

Conclusion

23 The 37 F-35 aircraft now in service represent a significant improvement in the warfighting capability of the UK's Armed Forces, with the ability to operate in high threat environments and to enhance the effectiveness of other UK defence platforms. They are in operational use, including on the current Carrier Strike Group deployment. But due to failings of both the MoD and the global programme, the level of overall UK F-35 capability is currently lower than the MoD intended it would be by now at the time of its 2013 business case, and will be for several years. For example, in 2024, the extent to which the UK's fleet was capable of carrying out its full range of missions was far below both UK and global programme targets. Moreover, the aircraft's standoff weapon will not be fully integrated on to the aircraft until the early 2030s.

24 Since 2010, MoD decisions to meet wider affordability challenges have led to delays in the delivery of aircraft and key infrastructure. The MoD has also failed to address personnel shortages and does not expect to fill gaps until 2028. And the global programme has had a series of issues which have delayed production and hindered logistical support while technology upgrade and support costs have also increased markedly over recent years. Despite this, in recent years the MoD's F-35 programme team has demonstrated effective day-to-day management, working collaboratively to deliver capability. Because of early and consistent commitment the UK's position in the global programme has remained influential and contributed to UK companies earning significant contracts supplying the global programme.

25 The MoD can do more to increase capability by urgently improving delivery of the enabling activities that will allow more F-35 aircraft to fly more hours. A robust measurement of success balancing all benefits and a comprehensive cost statement would together provide both a strong basis for future decisions, and a clear benchmark by which to measure the UK programme's overall value for money. In our view, the capability achieved for the estimated £11 billion spent to date is a disappointing return so far compared with MoD plans, even if other programme benefits have been significant.

Recommendations

26 These recommendations are intended to support the MoD as it seeks to get the maximum through-life value out of the F-35, identifying how it can improve its evidence for the programme's value and cost to inform future investment decisions. They may also be applicable to delivery of other major Defence programmes including the next-generation Global Combat Air Programme, as well as wider plans for Defence Reform.

a The MoD should develop, maintain and update an assessment of the value it intends to deliver throughout the life of the programme. This should include a clear weighting of all military and non-military benefits over the short, medium and long-term, for example in a balanced scorecard, to give decision-makers a fuller understanding of the programme's value and support to informed choices about trade-offs.

b In support of this assessment, and to enable full accountability, the MoD should calculate the following costs, including all relevant Defence Lines of Development and operational costs, including:

- costs to date, including all sunk costs;
- 10-year forecast costs which take a prudent view on programme issues and plans which could materially affect costs; and
- building on its recent whole-life cost calculation to 2069, including adapting for different scenarios depending on the number and variant of equipment type ordered, and adding in other relevant Defence Lines of Development and operational costs.

c As part of its wider plans for reform, the MoD should consider what structural changes it can make to support more effective F-35 programme delivery, including:

- extending the length of Senior Responsible Owner (SRO) and other senior programme staff tenures;
- providing appropriate financial and commercial freedoms including increasing delegations;
- simplifying lines of accountability so that, where appropriate, relevant Defence Lines of Development report more formally to the programme's SRO; and
- streamlining approvals regimes. In particular, the MoD should ensure that F-35 investment requests receive scrutiny based on the value of the specific request being made rather than the value of the total F-35 programme, thereby encouraging a proportionate scrutiny approach to lower value requests within the programme.

d The MoD should tighten its measurement of the capability of the F-35, relating it to an objective measure based on the high-level characteristics and key user requirements derived from the Secretary of State's policy baseline relating to F-35.

Part One

F-35 aircraft capability, delivery and availability

Background

1.1 This Part of the report introduces the background to the UK's F-35 programme and the wider global programme and assesses the UK's current F-35 capability.

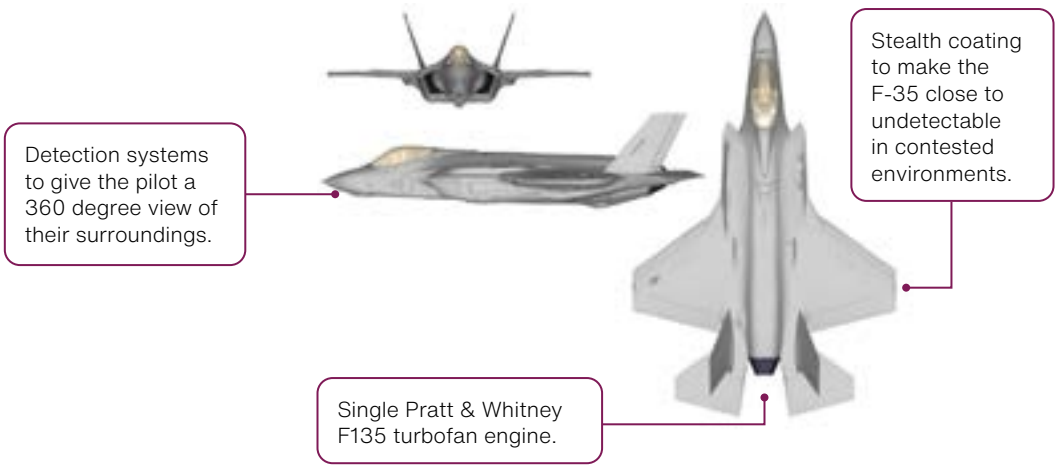
1.2 The F-35 Lightning II Joint Strike Fighter (F-35) is a technologically cutting-edge, fifth-generation, stealth fighter jet designed to undertake multiple roles by the American defence manufacturer, Lockheed Martin. Pratt & Whitney manufactures its engines and many other companies, including from the UK, are involved in the supply chain.

1.3 There are three variants of the F-35 (A, B and C). In 2012, the UK committed to purchasing 48 F-35Bs. In June 2025 it committed to purchasing at least 12 F-35As over the life of the programme, and at the same time the Ministry of Defence (MoD) announced that the next procurement phase would comprise the purchase of 12 F-35As alongside a further 15 F-35Bs. The F-35B variant can take off from short runways, hover and land vertically, enabling UK operations from its aircraft carriers and from land. The F-35A variant can only take off from land, but has a longer range and higher payload than the B variant, and can carry both conventional and nuclear weapons (**Figure 1** overleaf). The UK's 2012 commitment was a reversal of its 2010 decision to procure the F-35C, which we reported on in 2013.[1] The F-35 plays a key part in the Royal Navy (RN)'s Carrier Strike capability, being jointly operated by personnel from the Royal Air Force (RAF) and RN.

1 Comptroller and Auditor General, *Carrier Strike: The 2012 reversion decision,* Session 2013-14, HC 63, National Audit Office, May 2013.

Figure 1
Attributes of the F-35's A, B and C variants

The F-35B offers the greatest flexibility of the three variants but has lower fuel range and payload



	A	B	C
			
Description	Conventional take-off and landing variant – can only take off from runways on land.	Short take-off and vertical landing variant. This enables it to take off from land and aircraft carriers.	Carrier variant – designed only to take off and land on aircraft carriers using catapults and traps.
Fuel range	2,200 km	1,667 km	2,200 km
Combat radius	1,093 km	833 km	1,100 km
Weapons payload	18,000 lb	15,000 lb	18,000 lb

Notes

1 Combat radius – the maximum distance the aircraft can travel away from its base and return without refuelling.

2 Weapons payload – the maximum weight of weapons the aircraft can carry internally and externally.

3 The UK currently only has the F-35B in service. In June 2025, the UK committed to buy at least 12 F-35As capable of carrying both conventional and nuclear weapons.

Source: National Audit Office analysis of publicly available sources

1.4 The global F-35 Lightning Joint Strike Fighter programme (the global programme) is delivered through a US-led, multi-national collaboration underpinned by a Memorandum of Understanding (MoU) with 7 other partner nations and Foreign Military Sales customers. Partners pay a Composite Share Ratio (CSR) covering their share of the global costs of project overhead and administration, sustainment and the upgrades to the aircraft. It does not cover purchase of the aircraft itself. The CSR is calculated by the proportion of the global programme each country estimates it will buy. The UK set its overall procurement target at 138 F-35s in 2006, the largest agreed total among the programme partners behind the US Air Force, US Navy and US Marine Corps. The UK's CSR is 4.6%, the second highest in the programme after the US's contribution of 81.9%. All partners receive a share of the funds from every aircraft sold to Foreign Military Sales customers.

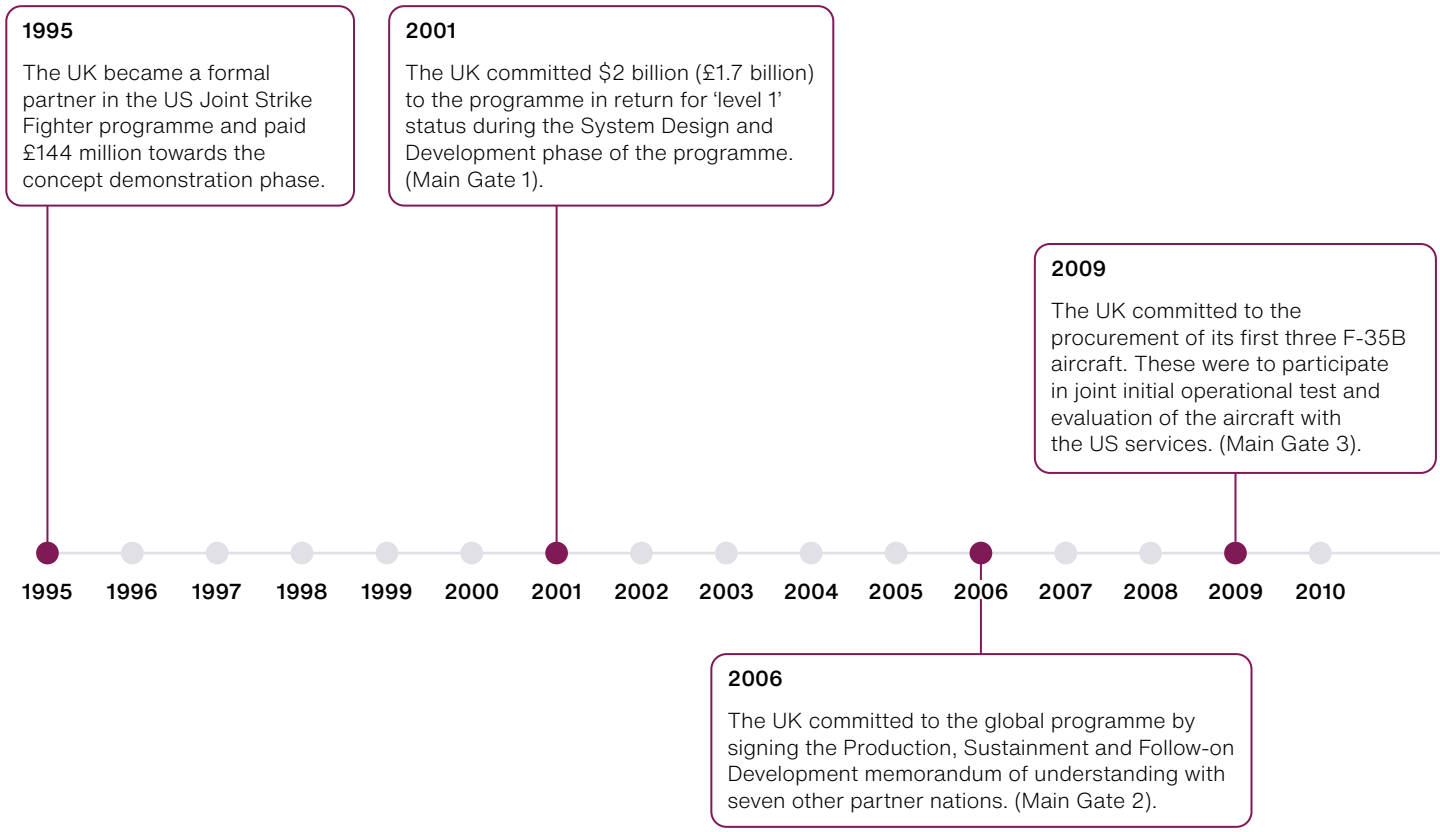
1.5 The global programme is run by the Joint Program Office (JPO) in Washington DC. The JPO also manages the Global Sustainment Solution which provides ongoing logistics and sustainment. The Joint Executive Steering Board oversees progress on programme delivery and is supported by advisory groups on operations, warfighting, airworthiness, logistics and sustainment. The UK has 38 staff based in the JPO (from a total of approximately 2,000 JPO staff) to support the global programme and promote the UK's needs.

1.6 The UK became the first partner to the US in the Joint Strike Fighter project in 1995 (**Figure 2** on pages 16 and 17 shows a programme timeline). The UK paid 10% of the concept demonstration phase costs for the future aircraft equating to £144 million. In January 2001, the UK committed $2 billion (£1.7 billion) to the programme to become the first and only 'level 1' partner. The UK's level 1 status, which lasted throughout the System Development and Demonstration phase to 2020, allowed input into the design and development of the aircraft, as well as gaining experience in developing stealth technology. Since 2014 the RAF's 17 Squadron has performed test and evaluation of the F-35 aircraft from the Edwards Air Force Base in California.

1.7 In 2006, the UK signed the Production, Sustainment and Follow-on Development MoU which committed the UK and all partners to the global programme. The UK's level 1 partner status contributed to opportunities for UK industry. UK industry currently manufactures at least 15% by value of every F-35 aircraft for the global programme with over 100 UK companies involved.

Figure 2
UK F-35 programme timeline

The UK has brought its F-35 fleet into service in stages over a long period of time



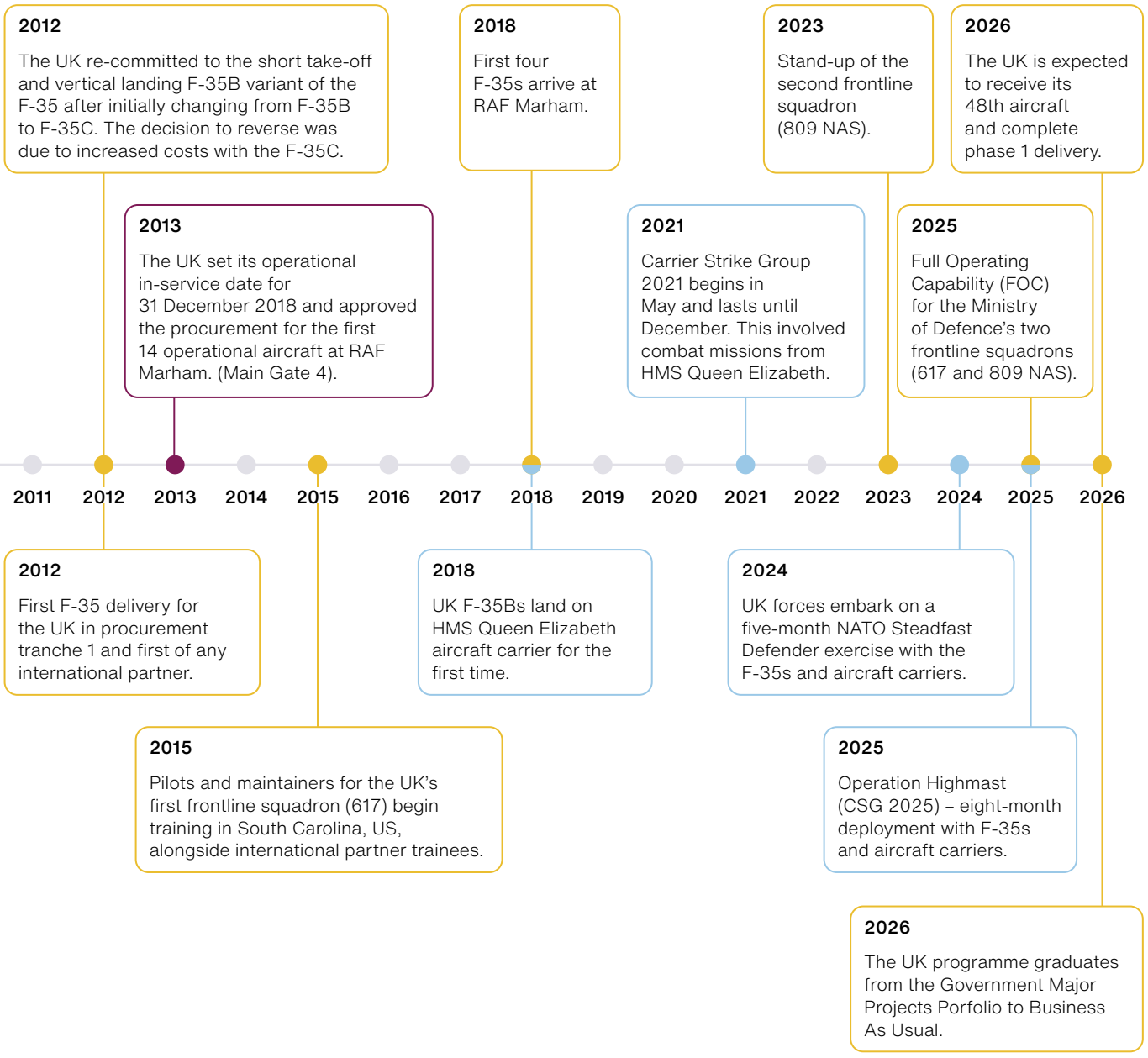
- Ministry of Defence funding approvals
- UK deployments and missions
- UK F-35 programme milestones

Notes

1 'CSG 2025' refers to Carrier Strike Group 2025.

2 'Main Gate' refers to UK programme decision points or milestones.

Source: National Audit Office analysis of Ministry of Defence data and publicly available information



1.8 The UK's formal requirement is to be able to use the F-35 at any time or place of its choosing, which it calls "freedom of action". The UK's requirement entails developing its own mission data, bespoke training for pilots and engineers, assurance of stealth attributes and aircraft maintenance. The MoD has built infrastructure at RAF Marham such as the Maintenance and Finish Facility to maintain airworthiness and an Integrated Training Centre for pilots and engineers (see Figure 5 in Part Two). It also programmes its own mission data files in the Australia Canada and UK Reprogramming Laboratory. However, the MoD still depends on the global programme for aircraft delivery, sustainment and upgrades to the aircraft.

Capability

1.9 The F-35 is significantly superior to any previous UK aircraft. It performs several roles, including suppression of enemy air defences, control of the air, electronic warfare, intelligence gathering and quick reaction alert responding to threats. Pilots and engineers told us that it was "absolutely cutting-edge" and that its advantage over previous aircraft was clear. The F-35 represents a considerable improvement in stealth capability, in the situational awareness provided to pilots by fusing information from various sensors and in its electronic warfare capabilities. This produces an aircraft that is many times more likely than other UK aircraft to survive in contested environments and deliver lethal attacks against the most serious threats.

1.10 F-35 capability also improves other UK platforms. F-35Bs combine with the two Queen Elizabeth Class aircraft carriers to provide the UK's Carrier Strike capability, with F-35 providing the strike element of the capability over long range. This capability, and the interoperability of UK and allied F-35s, was demonstrated in the 2021 Operation Fortis deployment to the Indo-Pacific region. Moreover, the increased power of F-35 jamming systems suppressing enemy air defences enables fourth-generation Typhoon aircraft to safely get into range for attacks which they would not otherwise be capable of. F-35 aircraft also share information gathered by their more advanced sensors with other platforms to improve their situational awareness. The UK has deployed up to 24 F-35 aircraft as part of its 2025 Carrier Strike Group (CSG) deployment (Operation Highmast).

1.11 Although the UK's F-35s are already effective, there are some capabilities that the MoD wants but has yet to deliver. Most importantly the UK F-35 lacks a standoff weapon to attack ground targets from a safe range. The MoD, via a separate major programme it is running independently of the F-35 programme, intended to deliver the Spear 3 missile by the end of 2024 but will not do so in full until the early 2030s. This will limit the UK's ability to conduct certain missions in contested environments. Additionally, the MoD has delayed building the required Aircraft Signature Assessment Facility (ASAF) to make short-term financial savings (paragraph 3.15). This is necessary for the MoD to assure itself that the aircraft retains its stealth characteristics. These can become eroded over time and require a cycle of checking for, and repairing, any damage. While this does not directly affect capability it could limit the MoD's ability to deploy the aircraft, or require the MoD to take more risk in deploying it, if it is not certain of its stealth characteristics.

1.12 The JPO has delayed the full delivery schedule of Block 4 upgrades, designed to modernise the aircraft and address new threats. These are designed to improve various aspects of aircraft performance including software, electronics and weapons integration. In 2013 the MoD expected that this would be fully delivered by 2022. But in 2023 the US Government Accountability Office (GAO) found that it would not be delivered until 2029. The JPO now expects that Block 4 will be completely delivered by 2033. It has had problems developing the required technology and the requirement requested by the global programme partners to deliver an increasing number of Block 4 capabilities.

1.13 The global programme has also announced plans for further upgrades beyond Block 4, as part of the ongoing development necessary for an aircraft that the UK expects to operate until 2069 (extended from 2048). These include an Engine Core Upgrade and improved Power Thermal Management System. The former is required to increase engine power and life and the latter because increased F-35 capability will increase cooling requirements and there is a risk that future upgrades could require more cooling than the aircraft can currently produce. A 2024 report by the MoD's Cost Assurance and Analysis Service noted a risk that any solution that increased cooling might not work for the B variant which the UK operates. The global programme is currently working to deliver the improved Power Thermal Management System for all variants. These plans are currently in the design phase.

Aircraft deliveries

1.14 The MoD has delayed its original schedule for receiving aircraft. Its Phase 1 procurement consists of 48 aircraft, which it started receiving in 2012 (**Figure 3**). In 2016 it intended to complete Phase 1 by the end of 2024. It amended this date in February 2020 to the end of 2025, delaying the order of seven aircraft in response to wider MoD financial pressure (paragraph 3.15). Although it has contracted with the JPO to receive all its Phase 1 aircraft by then, the MoD now forecasts that it will have received 41 aircraft at the end of 2025 and will not have received 48 aircraft until 30 April 2026. It has currently received 38 aircraft, of which one was lost in an accident in November 2021, leaving 37 in service. The MoD did not receive any aircraft between November 2023 and December 2024.

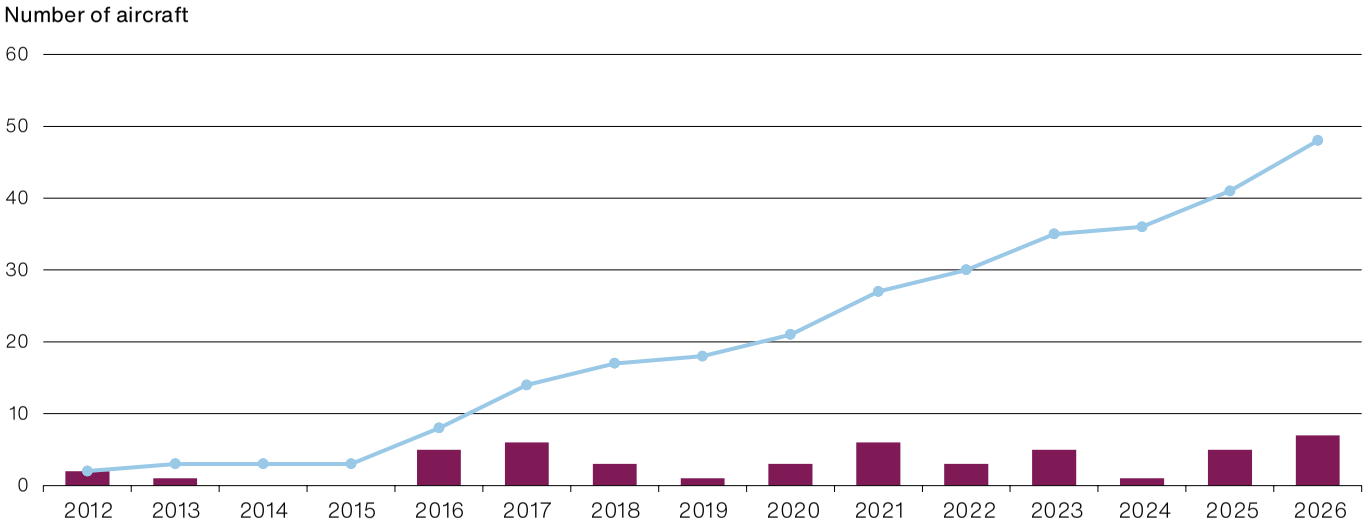
1.15 These more recent delays have been caused by global programme problems. Technology Refresh 3 is a hardware and software upgrade to improve the F-35's processing power and functionality, and is necessary to enable future upgrades including many Block 4 capabilities. Software problems have resulted in a nine-month delivery delay as otherwise complete aircraft were parked awaiting completion of software upgrades. The UK could have chosen to receive earlier deliveries with less capability but those would have required upgrading later.

1.16 The contracted delivery of 48 aircraft only represents a minority of the UK's public commitment of buying 138, which is based on Defence Planning Assumptions of requirements to provide the necessary military capability. This objective has been in place since 2006 and has been reconfirmed in successive defence reviews. It gives the UK the largest share of the programme among the partners after the US Air Force, Navy and Marine Corps. It does not commit the UK to any further purchases beyond those already contracted for and the MoD has not made any additional aircraft procurement approvals since 2016.

1.17 In 2024, the MoD set out internal plans to procure another 27 aircraft between 2030 and 2033, depending on the outcome of the Strategic Defence Review (SDR) and internal approvals processes. In June 2025, the SDR stated that the UK will require more F-35 aircraft over the coming decade but did not specify how many would be required or provide a more detailed timeline. The SDR also stated that this "could comprise a mix of F-35 A and B models according to military requirements to provide greater value for money", but it gave no further details on how the MoD will consider better value for money. Later in June 2025, the government announced its intention to buy at least 12 F-35As capable of carrying both nuclear and conventional weapons (Dual Capable Aircraft – DCA) over the life of the programme, and that they will form part of NATO's nuclear mission. The MoD has stated that it hopes that delivery will begin before the end of the decade. It also confirmed that the UK would purchase 15 F-35Bs alongside 12 F-35As in the next procurement phase. The MoD did not provide any details on timelines or further purchases but stated that it would examine options in the upcoming Defence Investment Plan.

Figure 3
Growth of the UK F-35 fleet from 2012 to 2026

The UK's F-35 fleet has been hindered by delays and in both 2019 and 2024 only grew by a single aircraft



	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Number of aircraft entering service each year	2	1	0	0	5	6	3	1	3	6	3	5	1	5	7
Total F-35 aircraft received by the UK	2	3	3	3	8	14	17	18	21	27	30	35	36	41	48

Note

1 The figures for aircraft entering service from 2025 and 2026 are forecasts: the actual delivery schedule may vary.

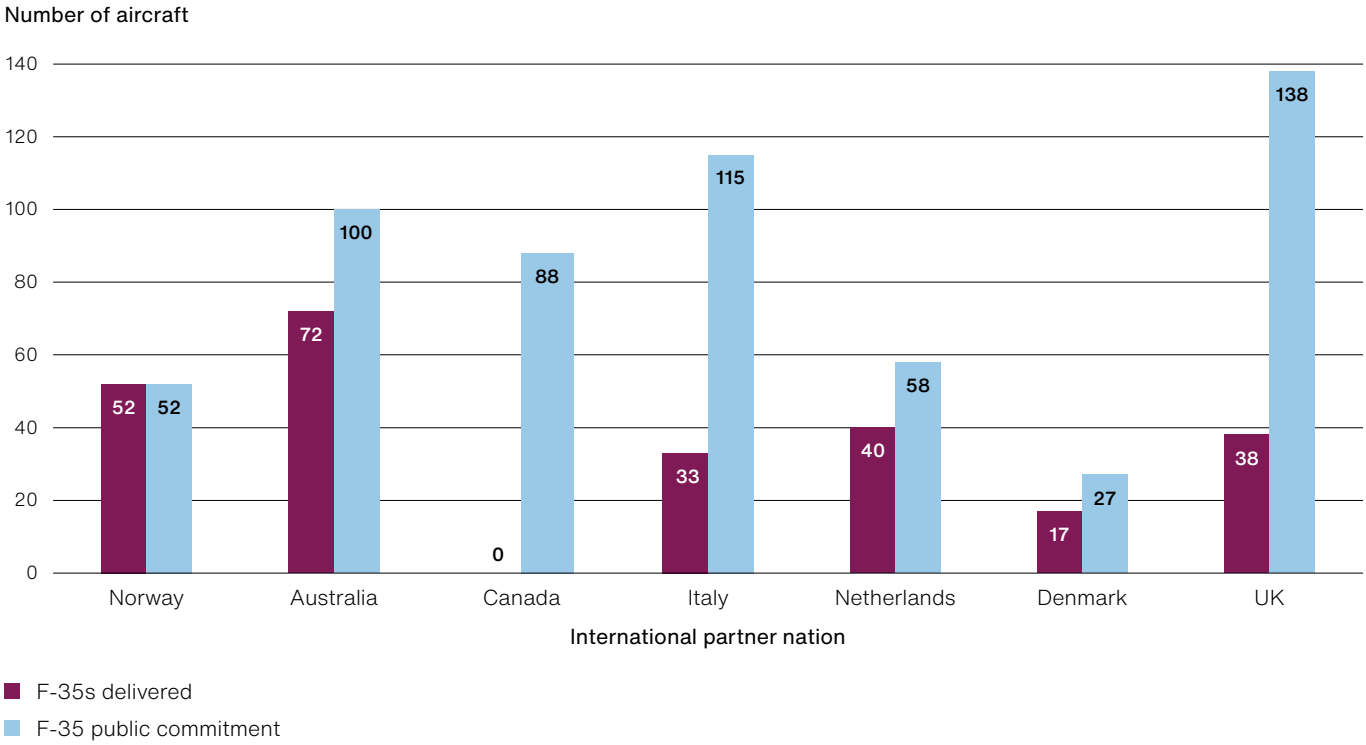
Source: National Audit Office Analysis of Ministry of Defence data

1.18 The UK F-35 programme officials are concerned that slow progress towards 138 aircraft could jeopardise the UK's position within the global programme. UK production orders compared with its public commitment are significantly lower than most partners, despite the UK's strong industrial participation. For example, Australia had received 72 aircraft by the end of 2024 against a public commitment of 100 having received its first F-35 in 2014, and Norway fulfilled its commitment of 52 F-35s in April 2025 (**Figure 4**). The UK programme stated that this discrepancy has been noted by partners and that the UK's relationship with the global programme had been put at risk by the failure of the 2021 Integrated Review to increase UK orders. Separate to any capability considerations the MoD noted that any future reduction in the planned programme could put UK industry contracts at risk.

Figure 4

Global programme F-35 deliveries to international partners compared to partners' public commitments from 2012 to 2025

The Ministry of Defence has made less progress towards its public commitment than most international partner nations



Notes

1 Based on publicly available information from September 2024 to March 2025 about overall partner nation deliveries.
2 'F-35s delivered' refers to the number of aircraft which have been received by each nation.
3 'International partners' refers to all F-35 partners except for the US services (US Air Force, US Navy, US Marine Corps).
4 The UK and Italy are the only international partner nations that operate the F-35 B variant.
5 Canada committed to F-35 procurement in 2023.

Source: National Audit Office analysis of Ministry of Defence data and publicly available data

Full Operating Capability

1.19 Despite ongoing challenges to capability and delivery the MoD expects to declare Full Operating Capability (FOC) by the end of 2025, two years later than planned. In its 2018 F-35 Concept of Use document the MoD set an FOC target of December 2023. It defined this as being able to generate two frontline squadrons of 12 aircraft each. The MoD has deferred the target date twice, to April 2025 and then to December 2025, as establishing a second frontline squadron was delayed by a shortage of trained engineers, pilots and aircraft. In 2023 the MoD also changed FOC criteria to a more qualitative assessment rather than requiring frontline squadrons to reach a particular number of aircraft and for the training squadron to be at full capacity. Assessing FOC involves a report into capability components, combined with the Senior Responsible Owner's military judgement that the force is ready to conduct operations.

1.20 The MoD faces risks to FOC even against this new date and definition. In December 2024 the UK F-35 programme set out several capability gaps against FOC requirements. The most significant risk is shortages in engineering professionals. The programme was also concerned by shortages in cyber roles and the lack of sufficient single living accommodation at RAF Marham. Other issues included the lack of a standoff weapon and of a facility to verify that aircraft retained their stealth characteristics. The MoD expects to mitigate some issues, such as by building 200 temporary accommodation units at RAF Marham by September 2025. But others, including the gap in engineering and lack of standoff weapon, will not be resolved by the planned FOC date. The MoD believes that it can meet the FOC criteria without resolving all these gaps. The National Audit Office (NAO) report *Defence capabilities – delivering what was promised* noted that the MoD declared F-35 Initial Operating Capability in December 2018 with 67 exceptions, with 20 still outstanding by February 2020.[2] The MoD expects to have fewer than 20 exceptions at FOC.

1.21 The 2025 CSG deployment, which is linked to the FOC declaration, will provide an opportunity to demonstrate a range of capabilities at scale but will also have negative consequences for the F-35 programme in the medium term. Because the second frontline squadron is not fully operational, having two full squadrons on the deployment requires borrowing aircraft and engineers from the 207 Squadron designated for training new pilots. This risks a reduction in training capability. There are likely to be fewer available aircraft following the deployment as aircraft need significant maintenance following deployment in the more corrosive maritime environment. Engineer availability will also reduce as staff take leave. The impact on operational readiness and force growth may last several months. Even if the MoD meets its FOC criteria, it will not yet have a force that can deploy sustainably.

2 Comptroller and Auditor General, *Defence capabilities – delivering what was promised*, Session 2019–2021, HC 106, National Audit Office, March 2020.

Availability

1.22 The MoD is delivering F-35 availability far below its targets. In 2024 the UK F-35 fleet achieved approximately half of the MoD's target for mission capable rate – meaning the amount of time aircraft could fly and perform at least one of the seven F-35 mission sets. It did not come close to the target in any individual month. The UK F-35 fleet achieved approximately one third of the MoD's target for full mission capable rate – the time that aircraft could fly and perform all required missions. This was despite the UK setting a target for its fleet significantly below the JPO target for the global F-35B fleet. The NAO is not disclosing actual percentages for national security reasons.

1.23 UK availability rates also compared unfavourably with the global F-35B fleet, primarily consisting of aircraft used by the United States Marine Corps.[3] Over a three-month period between October 2024 and January 2025 the UK fleet's mission capable rate was approximately three-fifths that of the global F-35B fleet, and approximately two-fifths of the global F-35B fleet's full mission capable rate.[4] The NAO is not disclosing actual percentages for national security reasons. The MoD believes that these differences are partly caused by different approaches to aircraft maintenance, with the UK only preparing aircraft that are scheduled to fly whereas the US tries to have the maximum possible number of aircraft available.

1.24 The MoD improved these rates during the beginning of its 2025 CSG deployment. For April 2025 UK full mission capable rates and mission capable rates were both higher than the equivalent average for the global fleet, although the full mission capable rate was still slightly below the UK target. However, these availability rates are likely to prove unsustainable once the deployment finishes and the UK no longer has such a high priority in receiving spare parts or has as many maintainers available (paragraphs 1.19 and 2.20).

1.25 Problems with aircraft availability have resulted in pilots receiving fewer flying hours than the MoD wants. The MoD originally set a requirement of 10 hours per pilot per month. In 2024 the UK F-35 fleet flew 3,106 hours, an average of 259 hours per month. Even after the MoD reduced the requirement to approximately 7.5 hours per month to account for other duties required of pilots, this number of flying hours was insufficient to meet requirements for all pilots in post as of March 2024. The MoD has stated that it has enough aircraft capacity to enable its required force growth. The MoD is also making significant use of synthetic training in simulators to support pilot training, including some activities which cannot be performed in live flying, although it has been operating fewer than the budgeted hours for synthetic training. The MoD told us that it closely monitors pilot live flying hours and synthetic training to judge individual pilot competence.

3 Due to differences between the variants, it is most appropriate to compare the UK F–35 fleet, consisting solely of the B variant, to the global F-35B fleet.
4 The global F-35B fleet rate includes UK F-35Bs.

1.26 The UK's availability problems are largely driven by slow maintenance activity and a lack of spare parts, as well as an emerging issue with higher corrosion than expected in maritime environments. Maintenance activity including dealing with corrosion is largely within the MoD's control, but it is dependent on the global programme for spare parts.

1.27 Between October 2024 and January 2025, the UK F-35 fleet had aircraft unavailable to perform any missions because it was undergoing maintenance (non-mission capable due to maintenance) at more than twice the target rate set by the JPO. The NAO is not disclosing the actual percentage rates for national security reasons. This was primarily caused by a shortage of UK F-35 engineers. Over the same period, the UK F-35 fleet had aircraft unavailable to perform any missions because of a lack of spare parts (non-mission capable due to supply) at a rate which was over two-thirds higher than the JPO's target rate. The NAO is not disclosing the actual percentage rates for national security reasons. For both rates the global F-35B fleet had a significantly lower rate of aircraft unavailable than the UK fleet. This global rate was still higher than the JPO target, reflecting a global shortage of spare parts. In January 2025 the MoD identified corrosion as an important issue affecting aircraft availability.

Part Two

Supporting enablers

2.1 Delivering military capability from its F-35 fleet requires the Ministry of Defence (MoD) to coordinate activity in supporting enablers. Enablers are primarily dealt with through nine Defence Lines of Development (DLODs).[5] The DLODs include the equipment DLOD that primarily deals with the aircraft, which was covered in Part One. Staff responsible for DLODs contribute to the F-35 programme but are mostly not within it (paragraph 3.10). This part will cover what we consider are the other most important DLODs for the F-35 programme – those relating to personnel, infrastructure and logistics. Current and future weapons for the UK F-35 are managed by separate MoD-run major programmes.

Personnel

2.2 Delivering F-35 capability requires a range of personnel that includes engineers and other maintenance staff, ground crew, cyber specialists, pilots and qualified flying instructors. The Royal Air Force (RAF) provides 58% of staff for the programme and the Royal Navy provides the remaining 42% of staff. The MoD faces shortages in a number of these areas.

2.3 Shortages of suitably qualified engineers represent the biggest threat to delivering the F-35 capability, according to a 2024 National Infrastructure and Service Transformation Authority (NISTA) review.[6] There are particular shortages in supervisor grades in aviation electronics and mechanical engineering. The National Audit Office (NAO) is not disclosing the exact requirements or the actual numbers of engineers for national security reasons. In December 2024 the MoD delayed the declaration of the Initial Operating Capability of the second frontline squadron because of engineering workforce shortages. Pinch-points for engineering supervisors and managers meant that the squadron was incapable of operating independently of the first frontline squadron.

5 The full list of DLODs is: equipment, personnel, training, infrastructure, logistics, organisation, information, concepts & doctrine, and interoperability.
6 NISTA was known as the Infrastructure and Projects Authority until April 2025.

2.4 Engineering shortages are partly due to the MoD miscalculating its F-35 engineering requirement. The MoD originally used the assumption, based on advice from the JPO, of 12 engineers per aircraft. However, this did not account for engineers being unavailable because of other requirements such as annual leave, sick days, mandatory training and guard duties. In 2023, the MoD approved the recruitment of 168 additional F-35 engineers, since its workforce growth was lagging 18 months behind the requirement for managing the expected aircraft deliveries. However, it does not expect all these personnel to be in post until 2028. There will be an ongoing impact on aircraft availability until the uplift is complete.

2.5 Challenges remain for the MoD to deliver the necessary engineers. The MoD generally has problems recruiting and retaining people with the required STEM (science, technology, engineering and mathematics) skills. This partly reflects an economy-wide shortage and partly challenges making a military career sufficiently attractive. The MoD has introduced a financial retention incentive for engineers, although this did not cover all supervisor grades. Moreover, there are some issues specifically relating to the views of the F-35 within the RAF. Some RAF engineers see the F-35 force as an unattractive posting, partly because of the prospect of long aircraft carrier deployments. In June 2024, the programme had a 58% Profession Workforce Level for engineering supervisors, compared with 80% across the RAF.[7]

2.6 The MoD also faces a growing problem recruiting enough cyber professionals. The F-35 has significantly more complex computing requirements than any previous UK aircraft, and cyber professionals are essential to assuring and protecting it. In January 2025, the F-35 programme team noted that sustaining its cyber workforce was competing with dealing with engineering and aircrew shortfalls as the main workforce priority. The NAO is not disclosing the exact requirements or the actual numbers of the cyber workforce for national security reasons. This reflects wider government shortages identified in the recent NAO report *Government cyber resilience*.[8] The MoD considers this a significant risk to supporting two frontline squadrons concurrently, as required for Full Operating Capability.

2.7 The MoD is forecast to have slightly fewer F-35 pilots than required until 2029-30. The UK has consistently had a significantly lower ratio of pilots to aircraft than the ratio achieved by the global F-35 programme, although the NAO is not disclosing the exact requirements or the number of pilots for national security reasons. This is partly because of low aircraft availability caused by the shortages of engineering personnel, with the training squadron (207 Squadron) flying fewer hours than it was funded for in 2024-25. The MoD also lacks enough qualified flying instructors. In 2025 the training squadron had five full-time qualified flying instructors compared with its target of 16. It partly fills this gap by calling on qualified flying instructors who hold other roles. The MoD believes that it might reach its pilot requirement sooner if it can increase the number of qualified flying instructors.

7 Profession Workforce Level is a measure of availability. It does not represent the number of posts. It represents availability to perform the role and the MoD does not expect it to be 100% because of other duties and workforce churn.

8 Comptroller and Auditor General, *Government cyber resilience*, Session 2024-25, HC 546, National Audit Office, January 2025.

Infrastructure and Amenities

2.8 The UK requires a range of infrastructure to support its F-35 fleet. This includes technical infrastructure, some of which is necessary to maintain UK 'freedom of action' (**Figure 5**) and some of which is standard technical infrastructure that includes hangars, runways and engineering facilities. It also includes domestic infrastructure for F-35 personnel. In 2013, the MoD declared RAF Marham in Norfolk the main F-35 operating base. The MoD has not calculated how much has been spent repurposing the base for the F-35 capability.

2.9 The UK's infrastructure to maintain freedom of action is mostly in place. From 2013 the MoD set out to develop these buildings, including the Integrated Training Centre, the Lightning Operations Centre, the Maintenance Repair Upgrade and Finish Facility and the Australia Canada and UK Reprogramming Laboratory (ACURL) mission planning reprogramming lab. These facilities are all now completed and operational. In 2016 the MoD further planned to build an Aircraft Signature Assessment Facility (ASAF) as the final requirement to attain UK freedom of action.

2.10 The MoD has delayed delivery of the ASAF. The MoD approved a £151 million budget for the facility in 2016, intending for it to be in operation by 2021. It will now not be delivered until the 2030s, due to a lack of funding resulting from the need to reduce costs. The MoD is now considering building a joint ASAF for the F-35 and the Global Combat Air Programme. In the meantime, the MoD is planning to send two aircraft a year to an ASAF facility in Italy but this will not provide the scale or freedom of action it wants.

2.11 The MoD has built new infrastructure to support the F-35 force at Marham besides that required for freedom of action. The Defence Infrastructure Organisation oversees these builds. A 1.7 mile-long runway has been resurfaced and new areas to practice short take-off and vertical landing built. The RAF has repurposed existing hardened aircraft shelters to store F-35 aircraft. New technical infrastructure including hangars have also been built for the Operational Conversion Unit (207 Squadron) and the first frontline squadron (617 Squadron).

2.12 Delays to infrastructure for the second frontline squadron (809 Naval Air Squadron) is impacting force growth. This squadron does not currently have permanent facilities including hangars and tool stores, instead using temporary portacabins and sharing facilities with 617 Squadron. This prevents 809 NAS from controlling its engineering programme and risks being unsustainable as more aircraft are delivered. The MoD originally planned to have these facilities for 2022, but it is now expecting a delay until 2029 because of wider departmental affordability challenges. These delays are expected to lead to increased construction costs due to inflation, with this infrastructure now expected to cost £143 million compared with the original forecast of £89 million. Similar delays are at risk for the proposed third frontline squadron as the MoD delayed planning pending the outcome of the Strategic Defence Review.

Figure 5

New infrastructure to enable freedom of action for the UK's F-35 fleet

With one exception, UK freedom of action facilities are now operational

Facility	Description	Cost to date	Status
		£mn	
Integrated Training Centre	A centre to train pilots and engineers on the F-35. The centre delivers synthetic training for pilots through full mission simulators and classroom training. The centre is designed to enable training for UK-specific missions for pilots and engineers.	81	Operational
Maintenance, Repair, Upgrade and Final Finish facility	This facility is a hangar which allows maintainers to repair, modify and establish the stealth coating on the aircraft for the frontline squadrons and the Operational Conversion Unit (OCU). The hangar is being used for the UK fleet and for repair of the global fleet. Repair is increasingly focused on issues such as corrosion on the F-35B when at sea.	94	Operational
Joint Reprogramming Enterprise	Based in Eglin Air Force Base in Florida, this is known as the Australia, Canada and United Kingdom Reprogramming lab (ACURL). This facility enables these countries to develop their own mission data for tailored missions which feeds into the simulators and aircraft for training. This is a core part of freedom of action.	51	Operational
Lightning Operations Centre	This centre became operational in 2018 and is designed to be the central delivery hub for the UK's F-35 operations. It consists of personnel from across the Ministry of Defence to manage operations and connect with the global F-35 programme.	29	Operational
Aircraft Signature Assessment Facility (ASAF)	This facility will verify and maintain the stealth integrity of all F-35s. The build of this facility has been delayed due to affordability constraints and mitigations are now being planned for its absence.	*151*	Not built

Notes

1 The Ministry of Defence defines freedom of action as the ability to use the F-35 at any time or place of its choosing.

2 In 2024, the UK received a $45 million rebate after Canada joined the ACURL – this has not been netted off the figure in the table.

3 The ASAF figure is budgeted cost.

4 All operational facilities are based at RAF Marham except the Joint Reprogramming Enterprise.

5 All figures are rounded to the nearest £1 million.

Source: National Audit Office analysis of Ministry of Defence data

2.13 Domestic accommodation at RAF Marham is poor and insufficient for the MoD's needs. This situation has required the use of hotels across all ranks. The MoD is building 200 temporary accommodation units and expects to complete them by the end of September 2025. A 2025 NISTA review stated that most of the accommodation that is in place at Marham was the lowest-quality category of MoD accommodation due to a lack of historic investment. Frontline personnel told us that existing domestic accommodation was shabby and sometimes lacked hot water. They also told us that RAF Marham needed more amenities, such as a bus service to a local town, a better gym and more accessible dental treatment, to be attractive to service personnel.

Weapons

2.14 The MoD intends to use bespoke UK developed air-to-surface and air-to-air weapons on the F-35.[9] These are the Spear 3 air-to-surface missile and the Meteor beyond visual range air-to-air missile.[10] Spear 3 is a new missile currently being developed by a separate major programme independent of the F-35 programme, while Meteor is already in service awaiting integration onto the F-35. The UK is dependent on the Joint Program Office (JPO) providing laboratories and aircraft to test missile integration, but the integration of new weapons is delayed as part of the wider Block 4 upgrade delays.

2.15 The MoD is far behind its planned delivery dates for integrating Spear 3 and Meteor onto the F-35. The MoD originally set its need by date for both missiles as December 2024. However, it now expects to have them in full service no earlier than the early 2030s, although the MoD is attempting to bring forward delivery of a limited Spear 3 capability. Spear 3 has been delayed by poor supplier performance partly resulting from a lack of suitably qualified and experienced people. The commercial arrangements between the MoD and the supplier also fail to prioritise delivery. The Spear 3 programme is also waiting on delivery of a key component from the US. Meteor has been delayed by the lack of opportunities provided by the JPO for integration.

2.16 The MoD has not fully mitigated the capability risk caused by these delays. As interim measures it uses alternative weapons. Paveway IV is currently the primary air-to-surface weapon and the AIM-120D the primary beyond visual range air-to-air weapon. But Paveway IV lacks the range to be an effective standoff weapon. This means that UK F-35 aircraft cannot currently perform all missions against ground-based targets at a safe distance. To acquire a more capable interim air-to-surface weapon the UK F-35 programme has requested funding for Small Diameter Bombs. The MoD has yet to provide this funding. The AIM-120D will effectively mitigate the capability risk of delays to Meteor integration, as long as they are available in sufficient numbers.

9 Italy also intends to use Meteor for its F-35 fleet.
10 The UK also already uses the Advanced Short Range Air-to-Air Missile (ASRAAM) as a short-range air-to-air weapon.

Logistics

2.17 UK F-35 logistics, essential for keeping the aircraft flying, depend on the Global Support Solution (GSS). This is a contract between the US government and Lockheed Martin and Pratt & Whitney as the primary suppliers. It is managed by the JPO on behalf of programme partners and customers. As a result, all assets used for sustainment, including spares for the aircraft, spare engines, support equipment and the Autonomic Logistics Information System (ALIS) used by engineers to determine when maintenance is required, are owned by the US government. They form a global spares pool held around the world, including at RAF Marham, but ownership is only transferred to partner nations when they put the spares on their aircraft.

2.18 The GSS is not delivering the volume of spare parts that the UK, and other partner nations, require. Between October 2024 and January 2025, the global F-35B fleet was non-mission capable due to supply at a rate which exceeded the JPO's target by around one fifth, where the aim is to remain below the target. Within this rate for the global fleet, the UK's fleet exceeded the target by around a half. This reflects an ongoing supply chain issue, with the US Government Accountability Office having previously found that in fiscal year 2022 approximately 27% of US F-35 aircraft were unable to operate due to lacking spare parts. The MoD told us that the global fleet was growing faster than the spares pool and that suppliers were having to choose between supplying parts for new aircraft and spares. The spares pool has also been strained by the global F-35 fleet flying significantly more hours than anticipated.

2.19 The MoD has other problems with support. The MoD has repeatedly noted that it has insufficient support equipment across the programme, limiting its ability to perform concurrent operations from the main UK F-35 operating base at RAF Marham and from a deployed operating base on land elsewhere in the world. This is also the result of global shortages and will become more important as the second frontline squadron is stood up. ALIS has also frustrated users. It was described in a February 2024 US Department of Defense Operational Test and Evaluation report as having poor usability and failing to provide information to the point that US services kept separate records. Frontline engineers told us that, although performance had improved, they would still be removed from the system and forced to log back in multiple times per day. ALIS is set to be replaced by the ODIN system although no transfer date has been set by the JPO.

2.20 The MoD has plans to ensure that it has the necessary support for operations. Once UK F-35s are operationally deployed they receive higher priority from the GSS. In April 2025, at the beginning of the Operation Highmast Carrier Strike Group deployment, the extent to which the UK fleet was non-mission capable due to supply decreased significantly, although the figure still did not meet the JPO target.

2.21 In addition to receiving spares from the normal GSS process, the MoD will embark both its spares packs. These are pre-prepared packs which each provide spares for a certain period based on a particular flying rate. The NAO is not disclosing the precise period for national security reasons. These can both be deployed from aircraft carriers, although one is designed for use from land and contains fewer spares. The MoD will also embark supplementary spares. This will create significant risk against logistics and engineering activity for aircraft remaining in the UK, including for the training squadron. But it demonstrates that the MoD can increase its access to spares for operational requirements.

Part Three

How the MoD manages the programme and its costs

3.1 This part sets out how the Ministry of Defence (MoD) manages the programme, including in the areas it fully controls and those it does not. It also examines how the MoD has measured programme value, and how it has managed and estimated costs.

The MoD's role in managing growth in F-35 capability

3.2 The MoD is fully responsible for providing all elements of capability (known as Defence Lines of Development, or DLODs) other than the development and construction of the aircraft and engines, and the provision of spares and support. The MoD is also responsible for providing related capabilities, such as the aircraft carriers which the F-35B aircraft are designed to fly from.

The global programme

3.3 For construction of the aircraft, engines and provision of support, the MoD is heavily dependent on the performance of the global programme for cost-effective delivery, in particular the Joint Program Office – the JPO (paragraphs 1.4 to 1.7). The MoD does have some responsibility but is only a minor programme partner relative to the US. The JPO has established processes for all global partners to seek changes that suit their national priorities, but in practice influence is a very important factor in securing change.

3.4 The global programme's commercial and procurement arrangements for delivering and sustaining the aircraft are set by the JPO with outcomes procured under US law. The JPO has placed US government contracts with Lockheed Martin and Pratt & Whitney as the prime contractors for design, manufacture and sustainment. The programme is currently in full-rate production and is now in its seventh year of a hardware and software modernisation effort known as Block 4 (paragraph 1.12).

The MoD's relationship with the global programme

3.5 In 2006, following the MoD's 2001 $2 billion (£1.7 billion) commitment to the global programme (paragraph 1.6), the MoD's second business case tied the UK to a through-life collaborative partnership with the programme, using the programme's governance and procurement processes. MoD personnel based both in Washington DC and in the UK both work for, and negotiate with, the JPO to ensure UK interests are heard and acted upon, for example in accepting UK bespoke requirements.

3.6 As a result of its early commitment, the UK became embedded in the programme from the outset, which it has leveraged to advantage in different ways.

- In 2001 the MoD received agreement from the US that it could have the freedom of action to decide where and how to operate the aircraft.[11]
- The MoD has had some influence on the programme's management and development as follows:
    - In the System Development and Demonstration phase it had 25% voting rights on development and design decisions.
    - MoD oversight and involvement is high: in 2025, there are 38 staff from Defence Equipment & Support embedded with the JPO in Washington, more than any other partner nation.
    - Evidence from industry and other stakeholders suggests that there are close and productive relationships built over many years, but a full assessment of influence is difficult, as the MoD team in the JPO does not report formally on its activities.
- To date, the industrial benefits from the F-35 programme have outweighed government investment by two to one. UK industry has secured approximately £22 billion of contracts to date against MoD spending of approximately £11 billion.
- New technology provided by UK companies has enhanced the UK's reputation within the global programme. For example, Leonardo UK's development of more sophisticated decoys to better protect aircraft from radar-guided missiles has recently been adopted by several NATO nations that operate the F-35.

11 UK requirements for the F-35 Lightning II freedom of action were formally established in the 2006 Production, Sustainment and Follow-on Development memorandum of understanding in a bilateral annex between the US and UK, which sets out the UK's requirements for operational sovereignty.

The MoD's management of F-35 capability

3.7 Co-ordinating DLODs is complex and challenging, as most of them have their own large and complex programmes on different timetables. And the aircraft's capability potential is also dependent on the delivery of other programmes such as Carrier Strike and new Command and Control systems.

Governance and leadership

3.8 Since 2010, the MoD has assessed F-35 (the programme) as a major programme, and has applied structures and processes standard to the programmes it gives that category. These include enhanced governance with increased assurance, and priority management resources. Approximately 250 staff are dedicated to the programme's management within the MoD, most of them within the Equipment DLOD managed by Defence Equipment & Support.

3.9 We found management processes are now mostly working well. F-35 is a mature programme and has well established governance structures and assurance in place, with strong organisational and project controls. Key arrangements in place include the following.

- Management and coordination of pan-DLOD activity occurs through well-established programme boards, chaired by the Senior Responsible Owner (SRO).
- The programme's assurance requirements are detailed in an Integrated Assurance and Approval Plan. A Head Office representative provides an independent quarterly analysis of progress and risks for senior MoD boards. The National Infrastructure and Service Transformation Authority (NISTA) also provides independent assurance.

3.10 As with all its programmes, overall responsibility for F-35 delivery resides with the SRO. Although officially responsible, the SRO must depend on delivery of aspects of capability by other bodies within the MoD with their own separate accountability structures. The nine DLODs each have their own priorities and funding constraints, which can clash. For example, in January 2025 the Programme Board noted that the "Personnel DLOD lacked engagement" with the programme which amounted to a risk to Full Operating Capability.

3.11 In this environment, collaborative personal relationships and leadership at different levels are as important as strong structures and controls to secure the integration needed. We found that much of this was in place in the programme. The NISTA supports this view: in its 2024 report, it repeatedly heard that the Programme's leadership engaged well with its stakeholders, using a collaborative and inclusive approach.

Delivery delays and problems

3.12 Despite good practice at the programme level, there have been significant delays and problems, as detailed in Part One and Part Two. The programme's success has been hampered by issues in the global programme and by funding constraints and common MoD procurement weaknesses affecting the programme.

Global programme problems

3.13 The global programme continues to deliver the engines and aircraft late. The US Government Accountability Office (GAO) reported that 100% of engines and 91% of aircraft were delivered late in 2023. Problems with software development and engine upgrades are also causing delays: a 2024 GAO report stated that the efforts to upgrade engines: "continue to face risks due to undefined requirements, immature technologies, and varying cost estimates". Similar problems have been encountered with sustainment, where contractual disputes and delays have adversely affected aircraft availability.

Affordability challenges and weak practices in the MoD

3.14 Notwithstanding the challenge of managing across different accountabilities and global programme delays, the consequence of many years of Air Command over-programming and of the necessity of keeping within tight annual cost limits, has been detrimental to value for money and capability for the programme. In our last Equipment Plan report in 2023 we found that Air Command reported a £3.7 billion deficit between budget and cost to 2033.[12] But even this figure materially understated the true picture as it did not include many expected equipment costs. For example, it excluded any budget for operating the third frontline squadron planned in F-35 Phase 2.

3.15 Over its history, the MoD has made decisions because of affordability challenges, adversely affecting the programme's progress directly and indirectly. Some examples include the following.

- The MoD has delayed its aircraft delivery orders to the JPO on several occasions. For example, in 2010, as part of the then government's policy of fiscal consolidation across many departments, the MoD reduced the F-35 budget to 2020 by £1.5 billion, delaying aircraft delivery and reducing flying hours among other consequences. In February 2020, the MoD slowed delivery of seven aircraft by a year, in response to ongoing wider financial pressures.
- In 2021, the MoD delayed construction of the Aircraft Signature Assessment Facility. It calculated that this would save it £82 million by 2024-25. However, our 2021 Equipment Plan report concluded the delay would actually cost £16 million more overall by 2031-32.[13]

12 Comptroller and Auditor General, *Equipment Plan 2023–2033,* Session 2023-24, HC 315, National Audit Office, December 2023.
13 Comptroller and Auditor General, *Equipment Plan 2021-2031*, Session 2021-22, HC 1105, National Audit Office, February 2022.

- As a 'Category A' (major) programme, any programme requests for even small amounts of additional funding from central Air Command funds are subject to extended approval processes and uncommitted programme funds are liable to be re-allocated quickly. In 2024, the NISTA found that these issues were reducing flexibility and adding time and effort. The NISTA stated that greater flexibility of budget and approvals would be the biggest improvement to the chances of the F-35 programme delivering. The F-35 programme team also told us that approvals take a long time.

3.16 Another MoD central policy which hinders the programme is the lack of leadership continuity. The current SRO has been in post since July 2023, and the Programme Director since 2024. Some of the relevant DLOD owners are also relatively new to post, as is the RAF Marham station commander. It is standard for the MoD to rotate senior roles regularly for operational and career management reasons, with the current SRO's tenure on F-35 lasting between two and three years. But this can be at the expense of longer experience on a very complex programme where personal relationships with stakeholders matter. In 2023, the NISTA noted that on-the-job learning was more common compared with formal project management training.

Success criteria and programme value

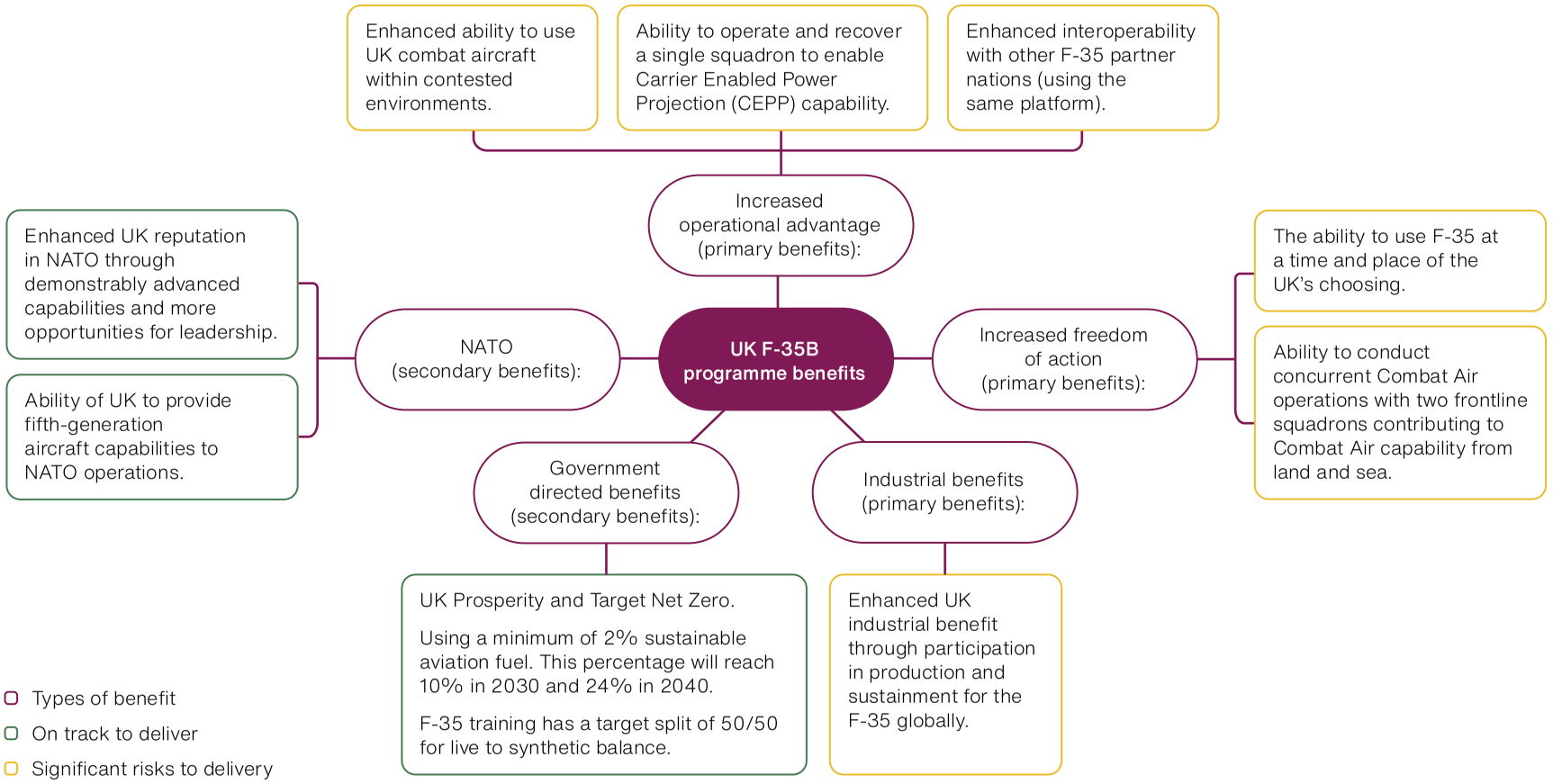
3.17 Programme management best practice emphasises the need for a clear view amongst stakeholders of what objective and outcomes the programme intends to achieve, including understanding what success looks like. Currently the MoD does not articulate its objectives and vision of success clearly enough, despite setting out a set of objectives and benefits, and associated sub-benefits in its programme documents (**Figure 6** overleaf), for the following reasons.

- The objectives are to achieve FOC by 31 December 2025 and for the Programme to become Business as Usual (BaU) by March 2026, but there is no separate objective of through-life capability improvement.
- FOC is measured subjectively in part on the basis of the SRO's military judgement, but the basis of the judgment is not clear, especially where some previously expected capabilities are absent (Part One and Part Two).
- The MoD is tracking both military and non-military benefits, but does not weight them in terms of priority or importance, beyond labelling some primary and some secondary. It is also not clear how the military benefits map on to the objectives.
- The MoD does not capture some benefits being achieved, such as transfer of learning.

Figure 6

Progress towards achieving benefits from the UK's F-35 fleet

The Ministry of Defence still has work to do to deliver the programme's planned benefits with all primary benefits carrying significant risks



Notes

1 These were the programme benefits originally set out in the 2023 programme mandate with six primary benefits and three secondary benefits.

2 These benefits exist across the entire life of the UK F-35 programme (until 2069).

3 The green and amber colours represent the F-35 programme's red/amber/green ratings at January 2025 of the likelihood of these benefits being delivered by the planned declaration of Full Operating Capability (by the end of 2025).

4 'Live to synthetic balance' means the split between live flying training and simulator training.

5 'Combat Air' refers to the Royal Air Force's full complement of combat aircraft.

6 'Carrier Enabled Power Projection' refers to UK military capability to maximise the use of its aircraft and carriers.

Source: National Audit Office analysis of Ministry of Defence data

F-35 costs and financial management

3.18 This section considers the costs of F-35, and the MoD's financial management of the programme. Specifically, it looks at:

- the types of MoD cost relating to F-35, and how they relate to JPO costs;
- the programme's financial management and how it has accounted for costs; and
- forecasting of future costs, including calculation of the whole-life cost of the programme.

Types of cost

3.19 The MoD's F-35 costs consist of the aircraft, including its design, development and procurement, its operational costs and the large number of supporting enablers and DLODs. Most costs are driven by aircraft development, production, and sustainment costs (spares, support equipment and related information systems), which are managed by the JPO. JPO contracts are denominated in dollars, making the programme highly susceptible to fluctuations in foreign exchange costs. To mitigate exchange risks, the MoD undertakes forward purchase and hedging of forward rates of dollars in accordance with HM Treasury guidelines.

Basis of JPO payment mechanisms

3.20 The MoD pays the JPO for production and sustainment of UK aircraft, and for the UK share of capability and technological development costs. These payments are made using different mechanisms.

- Production/sustainment: The MoD makes payments when aircraft are delivered based on the production costs to the prime contractors. The MoD contracts with the JPO for sustainment based on the number of flying hours it forecasts it will need in the forthcoming year.
- Development: The JPO uses the Composite Share Ratio (CSR) to calculate 'non-recurring' costs including development of capability and for work on integrating nation-bespoke capability, such as weapons, on to the aircraft. Partner nations contribute based on the number of aircraft they are committed to purchase in relation to the total (for the UK: 138 aircraft out of a global total of 3,088 up to 2019). The suspension of Turkey from the programme in 2019 increased the UK contribution from 4.47% to 4.62%.

The MoD's financial management of the programme

3.21 The programme's process for managing and reporting costs follows the MoD's standard procedures for its large programmes. Each relevant DLOD seeks budget approval for its expected costs from the Investment Approvals Committee (IAC). And reporting of F-35 capability costs only includes those related to the equipment DLOD.

Equipment DLOD cost management

3.22 Within the Defence Equipment & Support organisation, the Lightning Delivery Team (LDT) manages equipment, which includes the aircraft, its support and the specialist freedom of action infrastructure. In pursuing the programme's incremental acquisition approach, the LDT has made around 20 formal submissions to the MoD's IAC, obtaining approval for a total of £11.6 billion to complete Phase 1 procurement and support up to 2028. At the end of March 2025, against these approvals, the LDT had spent £9.35 billion, most of which involve payments to the JPO, and expects to stay within the approval limit by the time the last of the UK's 48 aircraft has been delivered, which it predicts will be in April 2026.

Cost increase in the global programme

3.23 Despite the LDT's forecast that it will keep within its £11.6 billion approval limit, costs have turned out to be higher than forecast at the outset of aircraft procurement, where the 2013 business case stated that F-35 would be comparable to or cheaper than advanced fourth-generation fighters such as Typhoon. The main two reasons for the increases have been higher than forecast production and development costs in the global programme, and the under-estimation by all global programme partners of the level and cost of support needed to sustain F-35 fleets.

- Production and development cost increase: According to the GAO, by 2023 procurement and development costs for the global programme were $47 billion higher than forecast in 2012. In addition, engine costs are now expected to be $38 billion higher than forecast, and Block 4 costs $6 billion higher.
- Under-estimation of support levels and cost: the UK underestimated the number of maintainers needed for F-35 support (paragraph 2.4). More widely, in 2024, the GAO identified that the cost of support had increased significantly in recent years, and estimated that lifetime sustainment costs have increased 44% since 2018, from $1.1 trillion to $1.58 trillion.

3.24 The LDT has built a cost model to manage and forecast costs, and it negotiates with the JPO over annual procurement and support costs. The MoD's Cost Assurance and Analysis Service (CAAS), which provides independent assurance of the LDT's cost model each year, told us that it used to assess the LDT's cost management as weak, but that it is now sound, with the skills and capacity it previously lacked. As a minor partner committed to the programme, the MoD has limited influence on global programme cost management, and therefore it is unlikely that the previous weaknesses made more than a marginal difference to MoD costs.

3.25 Since 2023 the MoD has helped introduce better cost management into the global programme. In January 2023, the JPO established a 'War on Cost' initiative, to instil a better culture of cost-consciousness and control within the JPO and its contractors. The War on Cost is led by the director for affordability, who is currently an MoD official. According to the director, for the first time in the global programme's history, the JPO's management now understand their costs, and through better transparency of contractors' cost estimating has a better influence on their cost management.

Forecasting future equipment costs

3.26 Every year the LDT forecasts and manages its annual budget carefully, making sure it does not request excessive amounts from Air Command. But its longer-term cost forecasting risks over-optimism. CAAS's 2024 assessment of LDT's 10-year future forecast, which totalled £7.4 billion, concluded that it under-forecast against a realistic outturn by £390 million or 5%. Its main concern was that LDT assumed 'adjustment for realism' in its forecast without sufficient evidence.[14] But CAAS also told us that its assessment, following global programme practice, excluded potential costly issues which inherently risked under-forecasting on a greater scale, including the following.

- Without a rapid solution being found to problems with the engine and its cooling systems, current engines will burn out quicker than planned and need to be replaced sooner, undermining Block 4 benefits.
- The US Congress has constrained current Block 4 costs. This risks significant additional costs in future years as important capabilities are developed.
- The US Marine Corps has decided to reduce its F-35B orders and stop all procurement after 2035. This could push up the unit cost of F-35B aircraft in coming years.

In June 2025, the government stated that the procurement of 12 F-35As instead of 12 F-35Bs "will deliver a saving of up to 25% per aircraft for the taxpayer".

14 MoD programme teams use adjustment for realism to take account of projects proceeding more slowly than expected.

Other costs in addition to equipment and support

3.27 Since the start of the programme, the MoD has been incurring significant other costs on F-35 in addition to those related to equipment and support, most notably from personnel, infrastructure, flying training, and other logistics, such as fuel. Air Command also runs its own related projects, for example on safety and security, and there have been foreign exchange costs. A full assessment of costs would also include apportionment of central MoD overheads. Many of these costs are significant but are difficult to determine as they are common to a number of Air Command programmes, and there are gaps in much of the data, as shown in the following. Examples include:

- RAF Marham: personnel and infrastructure: Some 2,000 people work at RAF Marham, at least three-quarters on F-35. In 2024-25, F-35 employee costs were around £110 million, and running costs were almost £8 million. Infrastructure costs, not included in the LDT costs for freedom of action infrastructure, have been approximately £36 million since 2018-19, and a further £196 million is forecast to be spent by 2029-30.
- Fuel and consumables: In 2024-25, around £8 million was spent on fuel, consumables and other stock on F-35.
- Foreign exchange: In 2024-25, Air Command spent £6.86 billion in total, of which £983 million or 14.3% was spent in US dollars ($1,252 million). The F-35 programme accounted for over three-quarters of this latter amount (£750 million or $957 million), as its equipment and support costs are denominated in US dollars. To mitigate risks resulting from fluctuating exchange rates, the MoD purchases dollars in forward contracts in accordance with HM Treasury guidelines. By convention, 20% of any in-year exchange rate costs are borne by Air Command (rather than specific programmes), with the remaining 80% of costs covered by the MoD centrally. Due to the aggregated way the MoD accounts for foreign exchange costs, the actual amount incurred since 2001 by the F-35 programme is not clear.

3.28 The partial data above suggest that F-35 costs unrelated to equipment and support were at least £135 million in 2024-25, and are likely to have built up to that figure gradually for over a decade. If available, cost data on other areas such as training, foreign exchange, central overheads and weapons would push the £135 million cost figure higher. In addition, earlier sunk costs are not included in the LDT's costs to date figure of £9.35 billion, and include for example £144 million spent on development between 1995 and 2001, and £74 million written off by the MoD when it decided to revert to the B from the C variant in 2012. Based on this analysis, we estimate the total spent to date by the MoD on F-35 is approximately £11 billion.

The programme budget and whole-life cost

3.29 The MoD has not produced an overall programme budget containing all equipment and non-equipment costs, against which to monitor spending and performance. Instead, it has published a whole-life cost estimate based on 48 aircraft to an out of service date of 2048. Its current estimate of £18.76 billion has changed little since 2013, when it stood at £18.425 billion.

3.30 In October 2020, the then MoD accounting officer wrote to the Committee of Public Accounts breaking down the whole-life cost figure into the following categories.

- Development: £5 billion.
- Production: £5 billion.
- Sustainment/Support: £8 billion.

The accounting officer confirmed that these figures did not include operating costs such as personnel, fuel and weapons expenditure. They also did not include other non-equipment costs.

3.31 The current published estimate seriously under-forecasts the likely overall cost. In addition to excluding support and operating costs, the programme has not updated the estimate for the MoD's often restated commitment to buy 138 aircraft, nor for the proposed acquisition of 27 aircraft by 2033, nor the publicly announced extension of the F-35 out of service date to 2069.

3.32 In 2017 the then accounting officer wrote to the House of Commons Defence Committee to defend a restricted whole-life cost, stating it was "beyond the bounds of reasonable predictability to provide any cost or timeline estimates for the second planned batch of 90 aircraft" and that such a figure "could potentially compromise the position of the Government, the taxpayer and international partners in any future contractual negotiation".

3.33 The 2025 Strategic Defence Review appears to mark a change in the appetite for accurate through-life cost data. It has specifically recommended that the MoD provides the Secretary of State for Defence with detailed analysis of through-life programme costings to help with effective prioritisation of capabilities for acquisition. As the MoD does not account for costs outside equipment on a programme basis, current gaps in its cost data make estimating a full whole-life cost for F-35 difficult, notwithstanding the inherent uncertainty of estimating costs decades into the future.

3.34 Following National Audit Office prompting during our audit, the MoD has forecast that the cost of 138 aircraft to an out of service date of 2069 would be just under £57 billion, although it describes this forecast as a pessimistic estimate with significant risk and contingency included and notes that it has not been subject to independent validation. This figure does not include costs other than equipment, such as personnel, fuel and infrastructure for accommodation. To include these costs, we have used the MoD's forecast and added in an estimate of non-equipment costs based on our 2024-25 analysis (paragraph 3.28), scaled up proportionately to reflect the increases in aircraft deliveries from the current 38 to the full 138. On this basis we estimate the non-equipment costs to be £14 billion, and therefore the whole-life cost to be £71 billion.

3.35 The calculation by the US Department of Defense (DoD) on the US F-35 programme's lifetime cost is similar to our estimate, once relative scale and different out of service dates are taken into account. In 2024, the DoD estimated the US programme's lifetime costs at $2.022 trillion.[15] The US expects to procure approximately 80% of the total number of aircraft produced in the global programme with an out of service date of 2088, whereas the UK expects to procure 4.6% of aircraft and has an out of service date of 2069. Allowing for these differences and applying an average exchange rate to convert US dollars to pound sterling, the equivalent whole-life cost for the UK is £70 billion.

15 Government Accountability Office, *F-35 Sustainment: Costs Continue to Rise while Planned Use and Availability Have Decreased,* April 2024.

Appendix One

Our audit approach

Our scope

1 The Ministry of Defence (MoD) is purchasing the F-35B Lightning II fighter aircraft, as part of a US-led global programme. The UK F-35 programme started in 2001 and the MoD has publicly reported that the fleet will cost more than £18 billion over its life. The UK took delivery of its first F-35 aircraft in 2012. The 2015 Strategic Defence and Security Review stated that the MoD would procure 138 aircraft in total, without specifying a target delivery date. The MoD currently expects to receive 48 aircraft, enough for two full frontline squadrons, by the end of April 2026.

2 We reported on F-35 capability as part of our series of reports on Carrier Strike, most recently in 2020. Since then, the F-35 fleet has taken part in operations and exercises from land bases and aircraft carriers. However, the date for F-35 achieving Full Operating Capability has been pushed back and the global programme has faced delays and cost increases.

3 This report examines whether the MoD is delivering its F-35 capability aims in a way which maximises value for money including:

- F-35 aircraft capability, delivery and availability;
- supporting enablers; and
- how the MoD manages the programme and its costs.

Our evidence base

4 In examining these issues, we drew on a variety of evidence sources, including document review, interviews, site visits and financial analysis. We also drew on findings from our previous series of reports on Carrier Strike between 2011 and 2020, and our 2020 report: *Defence capabilities – delivering what was promised*, as well as our Equipment Plan reports and our recent report on Government cyber resilience.

Document review

5 We reviewed documents to assess how successfully the programme was delivering the required capability and availability. We also reviewed documents assessing whether required enablers, such as personnel, infrastructure, sustainment and weapons, were being effectively delivered. We also reviewed documents to assess whether programme management, including financial management, was being run in line with best practice. We also assessed previous reviews of the programme. The documents we reviewed were:

- submissions to the MoD's Investment Approvals Committee including successive business cases and scrutiny reports as well as annual review notes;
- programme board papers and working group papers;
- programme risk registers;
- delivery schedules including contractual arrangements;
- the Concept of Use document;
- cost profiles and cost forecasts;
- National Infrastructure and Service Transformation Authority reviews;
- Portfolio Management Reporting System reports;
- internal audit reports;
- memoranda of understanding with the F-35 global programme;
- programme papers for enabling programmes; and
- criteria for declaring Full Operating Capability.

We also reviewed documents at higher classification to inform our understanding of the capability. We have not been able to refer directly to evidence from those documents in the report; however, we have used evidence from those documents to triangulate our findings from other sources. There was one classified document that we requested which the MoD did not provide.

Interviews

6 We conducted more than 30 semi-structured interviews with representatives from the UK's F-35 programme, Defence Equipment & Support, other parts of the Ministry of Defence with an interest in the F-35 programme, the global F-35 programme, Lockheed Martin, and other Supreme Audit Institutions with experience of auditing F-35 programmes.

7 We interviewed members of the programme team to understand the programme's governance and management arrangements, including its financial management arrangements and how the programme manages dependencies that are outside of its direct control. We also interviewed them to understand the programme's capability, availability and sustainment requirements, including whether they were being met.

8 We interviewed members of Defence Equipment & Support to understand the programme's commercial and contractual relationships with suppliers and the global programme. We also interviewed them to understand the relevant cost drivers.

9 We interviewed members of other parts of the MoD, including within Air Command as well as the Cost Assurance and Analysis Service, to understand the programme's capability requirements within the MoD's wider capability requirements, as well as the programme's costs and forecast costs.

10 We interviewed people within the global F-35 programme who dealt with the UK programme to understand the relationship between the UK and the global programme, including what influence the UK has over the global programme to receive the aircraft and spare parts that it requires.

11 We interviewed Lockheed Martin representatives to understand their perspectives on the UK programme and the UK programme relationship with Lockheed Martin as the main supplier to the global F-35 programme.

12 We interviewed representatives from the National Infrastructure and Service Transformation Authority to understand their perspectives on programme governance and delivery, as well as the delivery of the Spear 3 missile via a separate major programme.

13 We interviewed auditors from the US Government Accountability Office, National Audit Office of Norway and the Australian National Audit Office to understand their insights from auditing F-35 procurement and sustainment, programme costs and the influence that partner countries have over the global programme.

Site visit

14 We visited the main UK F-35 base at RAF Marham. This visit particularly informed our understanding of infrastructure as well as the capability of the aircraft.

Focus group

15 As part of the visit, we held a focus group with a small number of pilots and engineers from the F-35 force. These included commissioned officers and enlisted individuals from the Royal Navy and the Royal Air Force. They were self-selected from within the F-35 force, which was necessary for logistical and security reasons. This focus group was intended to be illustrative to inform our understanding of the experience of frontline staff and was not intended to be representative. We triangulated evidence from this focus group with the views of other interviewees and written evidence.

16 We analysed the data provided by this discussion based on thematic analysis covering key sections of our report. These data informed our understanding of supporting enablers of the F-35 fleet including infrastructure, personnel and logistics, as well as the capability of the aircraft.

Financial Analysis

17 We performed a range of financial analyses using information provided by the F-35 programme and other parts of the MoD including Air Command and the Defence Infrastructure Organisation. This information included:

- equipment Defence Line of Development (DLOD) costs incurred to date;
- forecast whole life costs for the Equipment DLOD covering equipment and support;
- current costs not included within the equipment DLOD including personnel costs, fuel costs and domestic infrastructure costs;
- assessments of forecast costs by the MoD's Cost Assurance and Analysis Service;
- costs under the global programme's Composite Share Ratio; and
- MoD mechanisms for managing exchange rates.

Calculating the overall whole life-cost involved combining costs to date with an estimation of future costs based on a range of techniques, such as apportionment, extrapolation and triangulation of sets of data.

Data Analysis

18 We analysed a range of data for the UK programme and the global programme, including comparisons between the two, provided by the F-35 programme and the Joint Program Office including:

- aircraft delivery profiles compared with the planned schedule;
- availability rates including mission and full mission capable rates;
- flying hours;
- workforce numbers compared with targets; and
- maintenance and repair metrics including the rates at which aircraft were non-mission capable due to maintenance or supply.

Classification

19 As part of the normal clearance process the MoD raised concerns that publication of certain facts posed a risk to national security. We considered these representations and made redactions where the MoD provided compelling evidence. Where we have made redactions for national security reasons, we have indicated that in the text. We have also removed several related figures for national security reasons.

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