National Audit Office

Report
by the Comptroller
and Auditor General

Ministry of Defence

Delivering Carrier Strike

HC 1057-I SESSION 2016-17 16 MARCH 2017

Key facts

£6.2bn

approved cost of two new Queen Elizabeth Class aircraft carriers

Queen Elizabeth class aircraft carrier

£5.8bn

forecast cost of Lightning II procurement up to March 2021

Lightning II fast-jet

£0.3bn

cost of developing and buying the airborne radar system to protect the carriers (Crowsnest)

Merlin Mk2 helicopters (for hosting Crowsnest)

December 2020 when the Ministry of Defence (the Department) expects to have an initial capability to operate the carriers, Lightning II and Crowsnest together (Carrier Strike)

April 2026 when the Department expects to have a fully flexible carrier capability, allowing a range of roles (Carrier Enabled Power Projection)

Summary

1 In 1998, the Ministry of Defence (the Department) decided to replace its Invincible Class aircraft carriers with two larger, more versatile carriers and to replace its Harrier jets with a new generation of fast-jets. Deploying a carrier and jets, with a new radar system, is referred to as 'Carrier Strike'. This is the first step towards 'Carrier Enabled Power Projection' (CEPP), which the government considers will allow it greater flexibility in responding to conflicts, engaging with allies and supporting humanitarian relief efforts. CEPP will allow the UK to deploy military capabilities from anywhere in the world. By making a long-term commitment to projecting power in this way, the government has signalled that it intends the carriers to form a significant part of its response to changes in global security.

2 The two new Queen Elizabeth Class carriers are the largest warships ever built for the Navy, and will be an important defence capability for the next 50 years. Deploying the carriers will involve much of the Navy's existing fleet to protect and supply them. The Department has committed to buying 48 F-35B Lightning II aircraft to fly from the carriers. This is the first tranche of the 138 Lightning II aircraft that the UK has committed to purchasing over the life of the programme. These sophisticated jets will employ stealth technology, allowing them to fly in contested airspace, a significant military advantage. As well as flying from the carriers, the Lightning II jets will be used for land-based operations. The US-led F-35 programme is the largest defence programme in history.

3 The Department plans to use the Carrier Strike role from 2021. This will involve flying a squadron of up to 12 Lightning II jets from a carrier, supported by a new airborne radar system called Crowsnest to detect threats beyond the horizon. Between 2021 and 2026, the Department will introduce the second carrier and a second squadron of Lightning II jets. It will complete trials and training to allow the carriers to perform a range of roles, including acting as helicopter carriers or transporting military forces. This represents the full CEPP capability.

4 The Department is now close to moving from the build to the operational phase of the programme (**Figure 1**). The first carrier (HMS Queen Elizabeth) is nearing completion and the build of the second (HMS Prince of Wales) is progressing well. Systems testing is being carried out before the Navy formally accepts the first carrier from the supplier by the end of 2017. The UK has a growing fleet of Lightning II jets, and is training pilots in the US. The first squadron is expected in the UK in August 2018. The Department signed a contract for Crowsnest in November 2016.

5 The next phase between 2017 and 2020 will be critical to establishing the capability. The Department must bring together the carriers, Lightning II jets, and Crowsnest with trained crews and supporting infrastructure, logistics, communications and surveillance. It needs to test and operate all these elements together in preparation for deploying Carrier Strike in 2021.

Scope of this report

6 We have reported three times on the Department's progress, focusing on the decisions about the type of carrier and jets it would buy.[1] Our last report in 2013 also noted that the highest-risk phases of constructing and integrating the carriers were still to come. The risks relating to integration remain.

7 This report examines how the Department has managed the programmes and handled the technical, cost and schedule risks since 2013. It also outlines the challenges the Department faces in reaching the first milestone of an initial Carrier Strike operating capability by December 2020. Our report examines:

- the strategic importance of the Carrier Strike capability (Part One);
- programme performance and risks to delivering Carrier Strike (Part Two); and
- the effectiveness of management arrangements (Part Three).

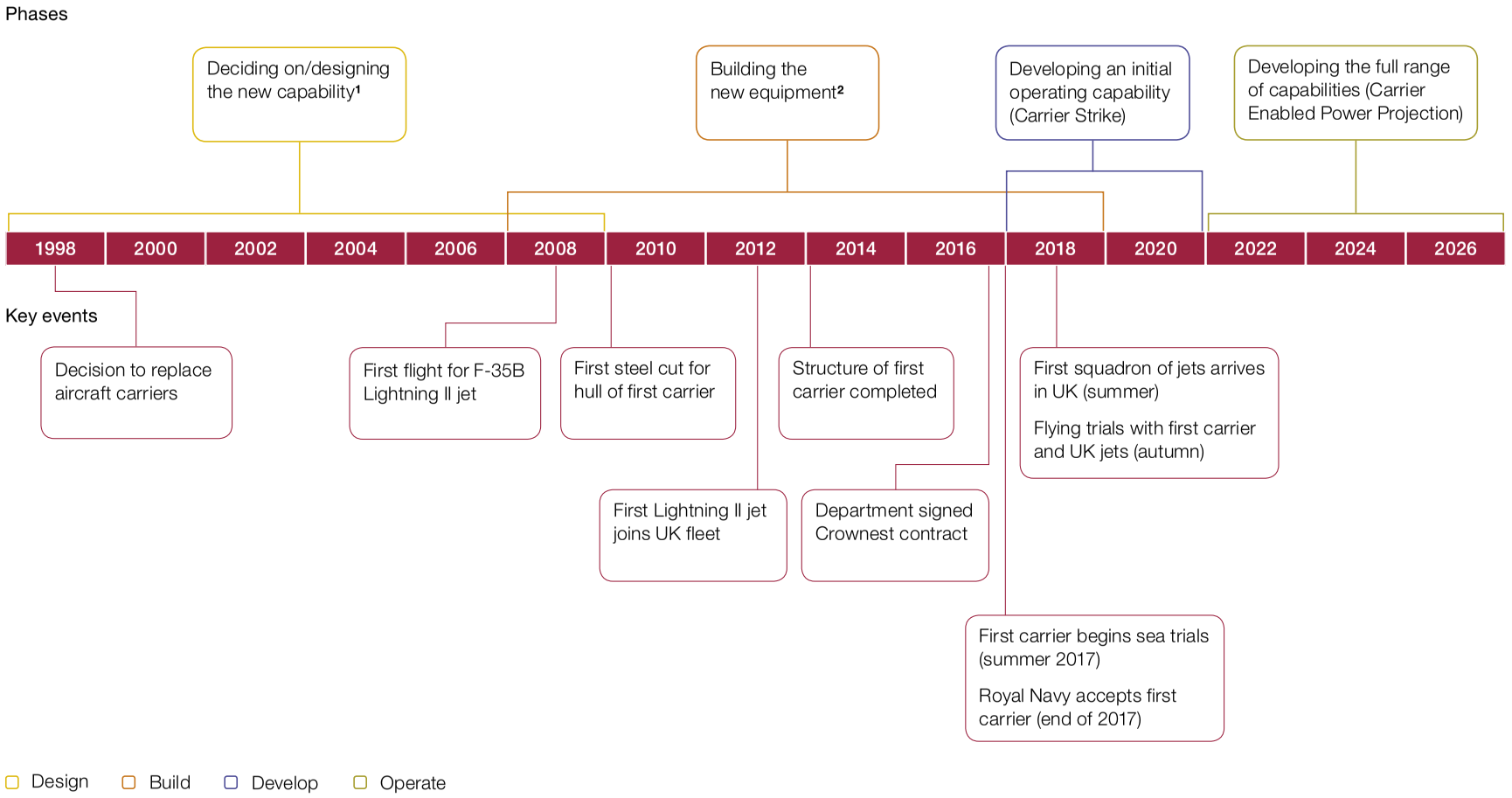
8 We conclude on how well the Department is managing delivery of Carrier Strike, the programme's progress and how well placed the Department is to achieve value for money in the future.

1 Comptroller and Auditor General, *Carrier Strike*, Session 2010–2012, HC 1092, National Audit Office, July 2011; Comptroller and Auditor General, *Carrier Strike: Supplementary Report*, Session 2010–2012, HC 1657, National Audit Office, November 2011; Comptroller and Auditor General, *Carrier Strike: The 2012 reversion decision*, Session 2013-14, HC 63, National Audit Office, May 2013.

Figure 1

Timeline for delivering the Carrier Enabled Power Projection capability

The Department is near the end of the build phase



Notes

1 The Department decided on design of the jets and carriers, but it was still considering the Crowsnest design until 2016.

2 The build of the new equipment will continue to take place into the 2020s, as Lightning II jets come off the production line and further Crowsnest radar are fitted into Navy helicopters.

Source: National Audit Office analysis of Departmental data

Key findings

Current status

9 The Department has clear plans to achieve an initial Carrier Strike operating capability by December 2020, but these could be delayed by technical issues with the first carrier, which are yet to be resolved. The inaugural sailing of the first carrier is expected in summer 2017. This was delayed for approximately three months because of technical issues. At the time of our report, the Department was assessing the impact of this delay on the overall schedule. However, it believes that the current target of accepting the carrier from the Aircraft Carrier Alliance by the end of 2017 is achievable. The build phase of the second carrier is progressing well, and the carrier is expected to leave Rosyth dockyard in 2019. The Department has accelerated its purchase of Lightning II jets and Crowsnest so that it will have enough jets and helicopters to fly from the first carrier by December 2020. The senior responsible owners for these three core programmes are reporting that successful delivery of an initial operating capability by December 2020 is feasible, but significant issues remain (paragraphs 2.7, 2.20 to 2.23, 2.26 and 2.30).

10 Successful operation depends on a mix of equipment, support and infrastructure, but plans for some of these are not yet mature. Alongside the core equipment programmes (carriers, Lightning II and Crowsnest), the Commands are responsible for ensuring that crucial enabling capabilities are in place.[2] Improvements to Portsmouth Naval Base and RAF Marham to accommodate the carriers and Lightning II jets are progressing well. However, new support arrangements to provide spares and maintain the equipment are less developed. Operating Carrier Strike will rely on logistics, communications and surveillance. While the Department has advised us that it is normal to prioritise investments according to strategic need, the Commands have yet to fund all of these capabilities, which could restrict how Carrier Strike is used (paragraphs 2.31 to 2.37).

11 The build costs of the core programmes have remained stable since 2014, but forecast costs of supporting and operating Carrier Strike are less certain. The Commands manage individual programmes within their delegated budgets. These budgets have already been committed to programmes. Therefore, if the cost of the core Carrier Strike programmes increases further, the Commands will have to prioritise their spending, potentially at the expense of other capabilities (paragraphs 2.15 to 2.19, 2.24 and 2.27 to 2.28):

- **Build costs**

  The Aircraft Carrier Alliance and the Department are dealing with potential cost growth of between 1% and 2% on the £6.212 billion approved cost of both carriers. The Department has not accepted this increase and is working with the Alliance to minimise any cost growth. The Department has brought forward Lightning II costs originally planned for after 2020, so that two squadrons of jets are available sooner. The total forecast spend of £5.8 billion on Lightning II procurement to March 2021 could change if foreign exchange rates shift and the total number of jets on order globally varies. The Department signed a £269 million contract for Crowsnest in November 2016.

2 Navy, Army, Air and Joint Forces.

- **Support and operating costs**

  Support and maintenance costs to March 2021 are forecast at £1.3 billion. These are less certain because contracts have not been let, and requirements will continue to be refined as the equipment is used. Historically, the Department's estimates of the cost of supporting equipment have been less robust than its estimates of the costs of buying it. The Department has estimated that operational costs up to March 2021 will be £0.6 billion. It has budgeted for a sustainable level of use of Carrier Strike within available resources and is developing its assessment of the additional costs from deploying more equipment or deploying it in different ways, where the costs will arise and how they will be funded.

Managing risks to delivery

12 The Department has made decisions that could limit how its uses Carrier Strike. The carriers and Lightning II jets rely greatly on technology for military advantage. Technological failures on the carriers might mean that larger crews are needed or place greater pressure on existing personnel. The design and testing of the US-led Lightning II programme is happening concurrently until 2019, increasing the risk that jets already in the UK fleet will need modifications. This could reduce the number available for forming the first squadron in readiness for first carrier-based deployment in 2021. The Department accelerated its purchase of Lightning II jets, which will support pilot training. But the number of pilots will be just sufficient up to 2026, with limited resilience if staff decide to leave the RAF. Additionally, the Department is relying on an unusually high level of simulator-based training for pilots. If this training is not sufficiently realistic, it could limit how well prepared pilots are to operate the jets. The Department decided to fit Crowsnest radar systems to Navy helicopters that are already in demand, rather than buying new aircraft. High demand for helicopters could limit the availability of Crowsnest to protect the carriers (paragraphs 1.9 and 2.9 to 2.14).

13 The Department is now entering a high-risk phase. It is focusing on managing strategic risks across the programmes over the next three years which could have a significant impact on delivery. These risks include:

- **A tight schedule with limited contingency**

  The Department has set an ambitious master schedule that brings together the interdependent schedules of the three core programmes to achieve the full CEPP capability by 2026. It has taken a number of decisions to address slippage, which has compressed the schedule and increased risk (paragraphs 2.2 to 2.8).

- **Operational unknowns that will only become clear once the equipment has been tested**

  The schedule to 2020 includes several 'firsts' where the result is uncertain. For example, the first sailing of HMS Queen Elizabeth will take place in 2017, followed by flying trials from the carrier at sea in 2018. The Department has made good use of external expertise where available, for example UK personnel are training alongside the US military to maintain carrier skills. This means the Department will not need to train personnel from scratch when the carriers enter service (paragraphs 1.13 and 2.3).

- **Increasing pressure on a few highly trained personnel to operate the capability**

  The Department has a shortage of military personnel, running at 4% below a target strength of 145,560. Key shortages include engineering roles and war-fighting specialists in the Navy and engineering, intelligence, and some aircrew cadres in the RAF. To minimise the impact of these gaps on Carrier Strike, the Department is prioritising the capability and carrying out targeted recruitment. However, it will rely on a few people in certain roles to build up the skills and experience needed in time. This is creating a risk of overburdening a small number of personnel in the build-up to first operational use from 2021 (paragraphs 1.11, 1.12 and 2.12 to 2.14).

Planning for operational use

14 Introducing Carrier Strike will fundamentally affect how the Navy works. The Department is turning its attention to planning different options for using the capability. Incorporating use of CEPP into the Commands' existing plans will be challenging. It is not possible to satisfy all demands for its use with current levels of equipment, budget and personnel. Iterative planning work is giving the Commands a better understanding of the prioritisation decisions they will need to make to balance the demands of Carrier Strike and other capabilities. This will be particularly important for the Navy, because a significant proportion of its fleet will be needed to support and protect the carriers. The Navy will need to fundamentally change how it operates, moving away from deploying single ships. Building on existing cooperation with the US to reintroduce a carrier capability, the Department is planning early use of Carrier Strike alongside the US and other allies (paragraphs 1.6 to 1.13 and 1.17 to 1.19).

15 Deploying Carrier Strike depends on a period of trials, training and further work. Increasing awareness of Carrier Strike as the equipment is completed may lead to demand for it to be deployed earlier than December 2020. The first carrier is expected to sail during 2017 and the first squadron of jets will be flying from the UK in 2018. But before the Department can operate the two together as Carrier Strike, there will be an intensive period of training, trials and further work. This period is crucial to ensure that crews can operate the equipment safely and to give the Department confidence the capability works as intended. While the equipment could be used together before these trials are complete, this could carry safety risks or limit how the equipment could be used. It would also disrupt the Department's planned schedule. The Department has examined the feasibility of deploying Carrier Strike before December 2020 and advised against this in anything other than an operational emergency (paragraphs 1.14 to 1.16 and 2.8).

Arrangements for managing the programme

16 To oversee CEPP the Department has set up governance arrangements that reflect its strategic importance. It has appointed a small team to oversee the programmes managed separately by the Commands, creating a CEPP 'portfolio'. This arrangement is new for the Department and reflects the challenge of fostering collaboration between the Commands. Placing the CEPP team in Head Office, and appointing the Deputy Chief of Defence Staff (Military Capability) as the senior responsible owner (SRO) for CEPP affords the programme prominence and strategic importance. The SRO's role in ensuring coherence across defence's many capabilities allows him to balance competing demands and mediate between them. For example, he determined which Command would fund and provide staff for UK-specific software programming for Lightning II when the Commands did not agree (paragraphs 3.2 to 3.5).

17 Governance arrangements are working well, but will be tested during the crucial period between 2017 and 2020. The way the Department manages CEPP aligns with good programme management principles. There are clear roles set out in mandates from the SRO for CEPP, regular reporting cycles and consistent management information, visibility of risks and issues, and strong leadership. There is good buy-in from stakeholders across the Department. The period between 2017 and 2020 will be challenging and may require the Department to take difficult decisions to keep to schedule. The CEPP team has no authority to manage the programmes, but provides clear visibility of composite risks across the programmes. Decisions are often made at a senior level, reflecting the strategic and defence-wide nature of this programme (paragraphs 3.6 to 3.10).

18 Governance arrangements will change as the Department plans for operational use of Carrier Strike. Current governance arrangements focus on scrutinising the build phase and ensuring coordination between the Commands managing the core Carrier Strike programmes. The CEPP team will disband once the new capability is delivered. The Department is introducing new governance arrangements so that those responsible for making decisions on using the capability are involved in early preparations. These arrangements are emerging and may introduce some duplication in the short term, but they are important for ensuring coordination across many stakeholders within Head Office and the Commands (paragraphs 1.14 and 3.7 to 3.10).

19 The Department is reliant on complex commercial arrangements that could stretch its capacity. The Department has formed an alliance with industry to build the carriers, sharing cost increases above a target price. Changes since 2014 have strengthened governance and introduced better joint working between the Department and industry. The Lightning II programme is an international arrangement. The Department had some early influence on the programme, but has limited contractual levers on cost or time. The Crowsnest contract is a more straightforward contract with industry, although negotiations were protracted because of issues with the technical specification of the chosen radar system. The Department's immediate priority is contracting for complex support arrangements. Ensuring there is sufficient commercial capacity to do this will be challenging, as there are long-standing skills gaps in the Department's contract management teams (paragraphs 2.21 and 3.11 to 3.13).

Conclusion on value for money

20 The Department has made good progress since we last reported on Carrier Strike. The build phase is nearing completion and the Department has clear plans to achieve an initial Carrier Strike operating capability by December 2020. The Department still has a lot to do as it brings together equipment, trained crews, infrastructure and support. Problems in any of these areas could mean that use of the carriers is delayed or reduced. To achieve its plan, the Department needs to coordinate many tasks across the Commands. It will have to make difficult decisions to accommodate the demands that use of the carriers will place on existing equipment and manpower, particularly for the Royal Navy. It has put in place arrangements to support these decisions, but they will only be fully tested as the capability is introduced.

21 The next three years are critical as the programme moves into a high-risk period of trials, testing and training. The technology is innovative and operational unknowns, which will only become clear during testing, may affect plans and increase costs. For example, at the time of reporting, the Department and Aircraft Carrier Alliance were considering how to fix technical problems with the first carrier which could delay progress.
To recover earlier delays, the Department has already compressed the timetable and is running some testing in parallel with other tasks. The closely timed sequence of tasks offers no further room for slippage and there remain significant risks to value for money. We expect to return and review progress later in the programme's timeline.

Recommendations

22 The Department should:

a **Maintain a realistic view of the aggregate risk and review the master schedule and key milestones regularly.** This will help to mitigate the risk of the schedule driving poor decision-making that does not make operational sense or that leads to greater risks or compromises elsewhere.

b **Guard against over-ambition and robustly resist any pressure to bring operational dates forward.** In assessing any decision to use elements of Carrier Strike before December 2020, the Department should set out the risks of doing so, the impact on achieving the full capability and the wider impact on defence.

c **Make the decisions needed to integrate Carrier Strike into wider defence capability within the Department's next annual planning round.** This will help identify where there are conflicts such as overcommitting equipment or differing views on deployment. Clarity about these issues will be important for ensuring that current programme plans are realistic.

d **Set out arrangements for long-term leadership and oversight of the CEPP capability.** Even after reaching the milestones of Carrier Strike and CEPP, there will still be a need for strategic oversight and a forum for discussing issues across the Commands and wider Department.

e **Build more resilience into its workforce model.** The Department should continue to monitor workload and time away from base, and ensure that personnel have enough support. In the longer term, the Department needs to maintain efforts to recruit and train extra personnel.

f **Promote formal and informal sharing of lessons learned**, and ensure transfer of learning to other complex defence programmes such as the Nuclear Enterprise.