Dear Julian

Thank you for your letter dated 2 February, requesting information about reported issues with the Power and Propulsion System in the Type 45 Destroyers.

In 2000, the Ministry of Defence (MOD) selected an Integrated Full Electric Propulsion (IFEP) system for the Type 45 Class. At the heart of the Type 45 IFEP is the WR21, a combination of a Rolls-Royce Gas Turbine engine and the associated recuperation system. These work together to deliver efficient power generation over a wide range of demand, not least by using an intercooler to cool the air that flows through the engine before combustion occurs.

The system represented a significant advance in propulsion design, offering the potential to rely on a reduced number of prime movers, acting in a more integrated fashion. The fuel efficiency and accompanying reductions in the need for fuel tanker support offered greater operational flexibility, as well as long-term savings in maintenance and personnel costs, along with a lower environmental impact. Balancing these potential advantages was the fact that the Type 45 would be the first class of complex warships to use IFEP. As the then Defence Secretary, the Rt Hon Geoff Hoon MP, acknowledged at the time, his selection of the WR21 in preference to GEC’s more mature, but not intercooled, LM2500 engine presented a greater degree of risk to the programme.

In recognition of this, the MOD and its industry partners invested in shore-based technology demonstrators to test and assure key aspects of system performance and maturity before commencing sea trials. The first evidence of performance and reliability shortfalls emerged during the shore testing of the IFEP in 2005. This was not unexpected given the novel and complex nature of the system and industry undertook additional development at the shore-based locations. By the end of that year, the level of performance was deemed

Rt Hon Dr Julian Lewis MP
Chair
House of Commons Defence Committee
House of Commons
London
SW1A 0AA
sufficient to proceed to the next stage of the programme; sea trials for the first of class began with HMS DARING during July 2007.

Despite the risk mitigation undertaken ashore, trials in DARING were the first time that all elements of this complex and highly integrated propulsion system were brought together and numerous, multi-layered defects were found. The system did not meet the expected level of reliability and industry identified and implemented improvements in system configuration, tuning and reliability. Between the first Type 45 launch in February 2006 and the sixth and final Type 45 launch in October 2010, approximately 50 design changes were implemented.

The nature of the interrelated defects associated with the fully integrated propulsion system masked the true extent of the inherent design shortcomings. In 2011, when an independent study commissioned by the MOD reported there was "no single root cause underlying the low reliability" but a "large group of unconnected individual causes" it nevertheless concluded that "IFEP" remains a sound choice for the propulsion of the Type 45 Class..." but that "acceptable reliability will [only] by achieved once the issues identified in this report have been satisfactorily resolved". On design in particular, the report concluded that the Type 45 Power and Propulsion System performance was "a combination of both 'design shortfall' and 'reliability problems'". It made 16 recommendations relating to Power and Propulsion, all of which were approved and design, testing and implementation began.

The process for design, integration, trial and acceptance of the design modifications is necessarily rigorous and time consuming. As a result, the majority of IFEP system alterations were embodied into the ships after the sea trials of the last of class, HMS Duncan in 2012. The ships were therefore accepted into service based on the performance and reliability improvements anticipated. Key to this was the clear conclusion of the 2011 independent report that acceptable reliability would be achieved when all its recommendations were implemented.

By 2013, all of the modifications recommended in the 2011 report had been realised, but whilst reliability continued to increase, the rate of improvement began to slow. Furthermore, experience gained by deploying the ships to the most demanding operational environments revealed that the original design intent of operating the ship whilst running WR21 alone was flawed. The system in this mode was still not capable of delivering the desired level of reliability and the power generated by the ships' diesels meant that they could not provide the resilience required. Only the addition of extra prime movers, in effect changing the design architecture, would allow these shortfalls to be addressed.

In 2014, Project Napier was established with two core strands. First, the Equipment Improvement Plan (EIP) is building on the work to enhance system
reliability and to meet the original design intent in the near term. This work is delivering positive results with increases to availability across the Fleet. In the longer term, the Power Improvement Plan (PIP) will improve system resilience by adding upgraded diesel generators to provide the electrical generation capacity required to meet many propulsion and power requirements without reliance on WR21. Feasibility studies to prove the concept have been implemented and we are now working with four companies to assess alternative technical options and a variety of delivery models. We expect to launch the PIP Assessment Phase later this year which will allow us to consider detailed technical proposals and make a recommendation to the MOD Investment Approvals Committee. The total cost and the timetable to implement the PIP will be determined once the final design solution has been selected. Until we have taken that decision we will not be in a position to provide further details of any operational implications for the existing Type 45 programme.

You asked for details of the number of outages and breakdowns that have occurred. Whilst it is not possible to provide details within this unclassified letter, I would be content for officials to provide you with a private briefing. In broad terms, however, current failure rates are one third of those experienced in 2010.

The issue of liability stems from decisions taken early in the programme. The main investment decision by the MOD in July 2000 to proceed with a T45 design based on an IFEP solution was taken consciously, in the knowledge that a new technology inevitably involved a degree of risk, but judging that, on balance, these risks would be outweighed by the long term benefits. The selection of the WR21 in autumn 2000 added another layer of risk to the programme. The lessons of choosing simpler, more robust design architecture and investing in earlier, more comprehensive shore testing have been applied in the Queen Elizabeth Class and Type 26 propulsion designs.

MOD’s early focus was to seek measures to improve reliability and thereby achieve the required level of system performance. We now know that reliability improvements alone will not enable us to realise the potential of the class. Rather, the performance and design of the Power and Propulsion System is simply not able to deliver the resilience and reliability required.

As I have outlined, we have already seen significant improvements in the reliability of the ships’ Power and Propulsion System, not least in the WR21 gas turbine, and we have a plan to achieve the required level of equipment performance. In last year’s Strategic Defence and Security Review we committed to improving the propulsion system resilience and reliability of our Type 45 Destroyers through the PIP, and to provide the funds needed to deliver the programme.
In closing, it is worth noting the successful deployments of our Type 45 Destroyers in a range of operations worldwide. HMS DEFENDER is currently deployed to the Gulf, where her recognised world-leading Anti-Air Warfare capabilities see her employed in providing direct support and protection to the US carrier which is mounting operations against Daesh. As a result, the Type 45 is held in the highest regard by the United States Navy. In addition, a Type 45 Destroyer has been deployed to the South Atlantic (October 2014 to May 2015) and provided support to the United Nations Security Council resolution mandated mission to assist in the removal of chemical weapons from Syria (January 2014 to July 2014). Furthermore, in autumn 2015, HMS DAUNTLESS successfully took part in a US-led NATO exercise (At Sea Demonstration 15) which re-affirmed the radar capabilities of T45 to successfully track multiple fast-moving contacts within a multinational task group. These successful deployments underline the fact that our Type 45 Destroyers are hugely capable ships and continue to make an enormous contribution to the defence of the UK and our international partners.

Agreed by the Defence Secretary and signed in his absence

THE RT HON MICHAEL FALLON MP