[Speech: DSEI 2017 naval technology zone](#)

It's wonderful to be surrounded by examples of the maritime expertise found within Britain's defence sector at DSEI, as I set out the next steps in the Royal Navy's journey of technological innovation.

When HMS Queen Elizabeth departed her builders earlier this summer I described it as a new era of maritime power and that was not a term I used lightly.

These ships will sit at the heart of the Royal Navy and, alongside the nuclear deterrent, will shape the UK's authority in the world for the next half century.

But the reason I used the term maritime power, as opposed to purely naval power, is that this is not a journey we take alone.

It is one we share with the maritime industrial sector and the wider defence supply chain.

The Queen Elizabeth class project sustained hundreds of businesses and thousands of jobs. Together, we proved that maritime investment can be a force for economic prosperity and regional growth as well as national security.

Meanwhile, at Barrow, submarine construction has settled into a steady drumbeat stretching into the 2030s and with the cutting of steel for the future HMS Glasgow, the same is now true for complex shipbuilding on the Clyde.

And what this programme of maritime investment provides us with is a basis to further strengthen our partnership.

Most obviously, the publication of the [National Shipbuilding Strategy](#) last week charted a course towards a more sustainable and competitive industrial capacity.

With the Type 31e general purpose frigate, we have the opportunity to better align the Royal Navy's requirements with those of the export market to help support that ambition.

But the opportunity extends far beyond shipbuilding.

Because with most of the Royal Navy's most important projects now in train, we can now look beyond the platforms, to the weapon systems, sensors and other technologies that will keep us at the forefront of capability in the decades to come.

Within that we have the opportunity to work in partnership to help meet the

relentless demand for skills in science and technology.

And this, more than anything else, will be the foundation for our nation's security and prosperity in the years ahead.

Technological ambition

At DSEI 2 years ago, my predecessor outlined the Royal Navy's technological ambition in bold and ambitious terms.

It is a future based on exploiting rapid developments in autonomy and robotics, additive manufacture, novel weaponry and the power of data, underpinned by continued investment in people and training.

We said we would explore the market to identify new capabilities that could be introduced into service quickly and that in doing so, we would use the Royal Navy's global reputation for operational excellence to open up new opportunities for British firms and for British research and development.

Over the past 2 years, I'm pleased to say we've done just that.

Last year's exercise Unmanned Warrior was a case in point.

We brought together technology firms from around the world to show us what their kit could do when put to the test, with UK companies leading the pack.

Together, we broke records and pushed the boundaries of innovation further than ever before, the ripples of which continue to be felt today.

Six months later, we returned for exercise Information Warrior, doing the same for cyber, ultra-modern communications, information exploitation and artificial intelligence.

In both cases, we knew that industry was far ahead of the military in exploiting the latest developments, but we were surprised by just how far.

During Information Warrior, for example, chest x-rays were passed through a handheld satcom terminal. Normally, this would take 30 minutes to transmit, but using IBM's Aspera bandwidth acceleration technology, it took less than 5.

The benefits this could bring to medical teams deployed at sea with a carrier strike group or 3 Commando Brigade ashore, or indeed with any force deployed at range, are obvious.

Of course, other bandwidth accelerators are out there, but time and again we saw examples like this of commercially available technologies that could have wide application across the armed forces.

And of all the many things we learnt from these exercises, the one lesson which stood out more than any other was the need to be faster and more agile in how we develop and introduce new capabilities into service.

Next steps

I'm proud that the Royal Navy took the initiative to challenge ourselves in this way.

Without doubt, we established the Royal Navy as a leader of innovation within the UK armed forces and internationally.

I'd like to pay tribute to my predecessor, Admiral Sir George Zambellas, whose instinct and enthusiasm was the driving force behind both these exercises.

But the question now is where we go from here.

Having demonstrated the art of the possible, the real test of our ambition is to bring these capabilities into service alongside or in place of existing equipment.

In some cases, the way forward is clear.

A good example is the compact deployable IT system.

It's small, lightweight and takes just minutes to configure, perfect for use at sea or in the field.

The Royal Navy's own innovation team, 'MarWorks', joined with Dstl and Antillion to help accelerate this technology through the development phase.

We put it to use in 'Information Warrior' and, liking what we saw, we've decided to introduce it in place of 3 Commando Brigade's current IT straight away.

But this isn't simply about swapping old kit for new and carrying on as normal. The full potential of the technological opportunity before us is far greater.

From autonomous systems operating in squads to artificial intelligence assisted decision making, what we've glimpsed over the past 2 years has the potential to entirely change our approach to operations.

This requires big decisions, with far reaching consequences.

Are we, for instance, prepared to remove existing platforms from service in order to create the financial and manpower headroom to introduce new systems which, in time, could deliver truly transformative advances in capability?

Of course, change on this scale can be disconcerting, but if we hesitate, then we risk falling further behind.

So, for example, based on our experience from Unmanned Warrior and Information Warrior, we know that remotely operated and autonomous systems can make a far greater contribution to operations than is currently the case.

As a first step, we are ready to shift the process of trial and experimentation from the exercise arena to the operational theatre.

That's why we have deployed 3 unmanned underwater vessels on board the survey ship HMS Enterprise during her current NATO deployment.

But I think we can go further still.

So today I can announce the Royal Navy's aim to accelerate the incremental delivery of our future mine countermeasures and hydrographic capability (MHC) programme.

Our intention is to deliver an unmanned capability for routine mine countermeasure tasks in UK waters in 2 years' time.

Similarly, from what we've seen over the past 2 years, we know it should be perfectly possible for the Type 31e frigate to operate a vertical lift unmanned air system alongside or perhaps even in place of a manned helicopter from the moment the first ship enters service from 2023.

And as a precursor to this, we plan to work with our partners in the aerospace industry to demonstrate such a capability on a Type 23 frigate next year.

So, just as I challenge the Royal Navy to take the next step forward, there's also a challenge for you, our partners in industry, to meet us half way with credible solutions that can fulfil our requirements.

And mark my words: other navies will follow in our wake, reinforcing the reputation of British technology and expertise to a global audience.

Open architecture

The pace of technological change is relentless, iteration is constant.

Our current processes, whereby software updates can take months to introduce, simply aren't fast enough to match our ambition. We need to find an alternative.

The Royal Navy has been at the forefront of open architecture in our submarine combat systems for many years and during Unmanned Warrior, a single command and control interface was central to our success.

Now, we must look to introduce open architecture into operational service far more widely.

To that end, later this year HMS Westminster will go to sea fitted with an open architecture shared infrastructure which enable the rapid integration and development of new capabilities.

If successful, we will roll this system out to the rest of the Type 23s by 2020, and the remainder of the fleet thereafter.

And because this will form the basis for the integration of all weapon systems, engineering sensors and off-board logistics in the future, we have specified that the new Type 31e general purpose frigate should be designed with open architecture from the outset.

What this means in practice is that the Type 31e will feature different app based tools which can access the ship's data. These will be operated from a series of touchscreen displays, Siri-style voice controlled assistants and perhaps even augmented reality technology.

This is not a gimmick or a fad. As modern warfare becomes ever faster, and ever more data driven, our greatest asset will be the ability to cut through the deluge of information to think and act decisively.

Equally, we need to recognise the aptitudes and instincts of young people leaving schools and colleges today, the so called smartphone generation, and design systems and processes in a way that plays to their strengths.

Open architecture provides the means to do just that, melding technology opportunity with human ingenuity and skill which, incidentally, is the secret behind the Royal Navy's success over the past 500 years.

Artificial intelligence is also an important part of this future.

Under Project Nelson, the Royal Navy aims to develop a ship's 'mind' at the centre of our warships and headquarters to enable rapid decision making in complex, fast moving operations.

But these opportunities also require us to change our approach to how we design and develop systems, by adopting and defining the Royal Navy's open standards to bring about a more iterative and collaborative approach.

The Royal Navy must work more closely with SMEs and start-ups. We need to tap into their entrepreneurial expertise and, in return, we can help give them the big break they need to succeed.

We also want to find people who might not have trodden the usual conventional career paths but who have the creative and disruptive approach we need.

During Information Warrior we brought together some of the UK's leading experts in artificial intelligence for the UK armed forces first ever AI 'hackathon'.

We provided them with more than a terabyte's worth of information, including radar and sonar data, as well as access to an open architecture infrastructure with standardised data formats and Royal Navy defined interfaces.

Over 3 days they were able to use this information to develop astonishing solutions to real problems at extraordinary speed.

We proved, for example, that a drugs smuggler is no longer a bobbing needle in an oceanic haystack but has an identifiable algorithmic fingerprint. In

the engineering world, we can predict, and therefore prevent, component failures.

So, in future, hackathons and agile sprints will become regular events, and we are programming a regular series of Information Warrior exercises between now and 2021.

Scoping for Information Warrior 18 is already underway and we will need your help, through MarWorks, 700X Naval Air Squadron and others, to make it a success

It's encouraging that a number of industry partners have already begun to plan their involvement, and their investment, accordingly, and I would welcome your thoughts on the possibility of an Unmanned Warrior 2020.

Investing in skills

Underpinning all of this is our ability to meet the demand for skills in science, technology, engineering and maths; both within the Royal Navy, and more widely.

I expect most of you saw the images from Nautilus 100 project last month, through which we challenged some of the brightest apprentices and graduates in UK industry to imagine what the future of submarine technology may look like 50 years from now.

From drones that dissolve on demand to algae electric propulsion, science and engineering doesn't get more exciting than this.

Last week, the government launched its "Year of Engineering 2018" campaign with the aim of inspiring the next generation and Nautilus 100 is proof that Royal Navy can make a huge contribution to that objective.

But I know we can do more than simply inspire, and in truth, we can't afford to wait around in the hope that the education system produces the people we need. We're prepared to play a much more active role to steer more young people to careers in these areas from an early age.

That's why we're working with companies from across the defence and maritime sectors to sponsor a growing number of university technical colleges.

The latest of these, a purpose built, state of the art college in Portsmouth, opened its doors yesterday, just a stone's throw from QinetiQ's soon to be built facility at Portsdown Technology Park.

The initial tranche of 140 students will eventually grow to 600, from which 150 STEM qualified students will enter the local and national economy every year.

We have also met with the Scottish government to identify ways we can support the promotion of STEM skills north of the border.

Today I can also announce that the Royal Navy is to shortly affiliate with 4

further UTCs, in Aston, Reading, Newton Abbot and Peterborough.

Unlike Portsmouth, none of these places are traditional naval towns, only one of them is near the sea, but that's not the point.

The Royal Navy's future success is indivisible from the UK's strength in the design and manufacture of advanced systems, and the associated research and development. It's in our interests to help support the national requirement for STEM skills, as well as our own.

We don't expect every student we work with to join the navy, but we do want to play our part to help them develop the skills required for a successful and rewarding career, and whether they ultimately choose a career in uniform or in industry, we still gain in the long run.

Conclusion

I've spoken a lot about the future but, in drawing to a close, I want to dip into the past.

In the early part of the last century, Jackie Fisher fashioned the Royal Navy into a focused fighting machine that could meet the growing challenges Britain faced in an era of global political upheaval.

He did this by sweeping away the ornaments of Victorian imperial power to make way for new technology, from the torpedo and the turbine engine to the submarine and the destroyer.

Most of all he is remembered for HMS Dreadnought, the battleship that was so revolutionary that it rendered all others obsolete at a stroke.

Today, we stand on the cusp of another great technological revolution.

It's not because of a single ship, like the Queen Elizabeth class carriers or even the new Dreadnought class submarines, revolutionary as they will be.

The real revolution comes from a combination of different technologies and trends that are moving forward at the astonishing pace.

They are shaping the future of warfare before our eyes, but they offer the opportunity to keep Britain safer and more prosperous in the years ahead.

Of course, letting go of the familiar to make way for the new is never easy.

A degree of risk is inevitable, but then nothing in innovation or warfare has ever been achieved by playing it safe; and as I see it, the biggest risk of all is carrying on as we are.

International security is deteriorating and demands on the navy are growing, public spending remains tight, why would we not adopt new solutions if they can help us square the circle?

Ultimately, it's about courage as an organisation. The Royal Navy has always

succeeded by being bold.

We've seen what the technology can do.

Now we must take a brave step forward to embrace the opportunity before us,
and I intend to lead the Royal Navy to do just that.