



Transport Committee

Oral evidence: [Maritime 2050: implementation, objectives and effects](#), HC 160

Wednesday 25 May 2022

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[Watch the meeting](#)

Members present: Huw Merriman (Chair); Mr Ben Bradshaw; Karl McCartney; Grahame Morris; Gavin Newlands; Greg Smith.

Questions 94–183

Witnesses

I: Dr Basil Germond, Senior Lecturer, University of Lancaster; Professor John Hudson CBE, Director, MarRI-UK; and Huw Gullick, Associate Director, NOC Innovations.

Written evidence from witnesses:

- [Dr Basil Germond](#)
- [National Oceanography Centre Innovations](#)



Examination of witnesses

Witnesses: Dr Germond; Professor Hudson and Huw Gullick.

Q94 **Chair:** This is the Transport Select Committee's second evidence session in our inquiry, Maritime 2050. We have three witnesses for our first panel. I ask them to introduce themselves for the record.

Dr Germond: Good morning. Thank you for inviting me this morning. My name is Basil Germond. I am a senior lecturer at Lancaster University and an expert in sea power, maritime security and the maritime dimension of global Britain.

Huw Gullick: Good morning. My name is Huw Gullick. I am associate director of NOC Innovations, the National Oceanography Centre's UK-leading ocean science research and innovation centre. Perhaps more pertinent to the Committee is our 20-year history in the development of autonomous technology for the maritime sector, which has seen us grow our fleet of autonomous equipment to the largest in Europe.

Professor Hudson: I am John Hudson. I am a naval architect by background. I have spent my career in shipping, shipbuilding and submarine building. I recently retired from BAE Systems as the group managing director for its maritime sector, and have joined Strathclyde University as a professor of practice. I am a director of MarRI-UK—Maritime Research and Innovation UK.

Q95 **Chair:** Good morning, all three of you. Thank you very much for giving us your time.

We have been exploring some of the themes for Maritime 2050. In the first session, we looked at UK competitive advantage, environment, infrastructure and trade, which leaves us with the remaining three themes: technology, security and people. For the three of you, we are very much focused on security and technology. Please use this opportunity to bring alive in your ideas all the innovations and the concerns and challenges. That is what we want to drill into. Dr Germond, we will start with security, which is very much towards you. What do you believe the current major threats to the security and resilience of the maritime sector in the UK to be?

Dr Germond: In 2021, the integrated review made it clear that the prosperity and security of the UK strongly depends on the sea. At a high strategic level, maritime security is about the prosperity, security and resilience of the UK. At the level of the industry, it is about business continuation, to avoid disruption and to have a plan in case of disruption. It is also about stability. Investors need certainty. They need to know that the industry can operate in a safe, stable environment. Freedom of navigation is important for business continuity. It is also a national interest for the UK.



That brings me to your question about threats. We can think of three categories of maritime security threat. First, there are unintentional incidents, such as the recent accident in the Suez canal, disrupting the free flow of goods and people. It could also be external shocks; for example, shortage of labour, especially in Chinese ports, due to the Covid-19 pandemic. An external shock could also be linked to climate change, inducing floodings and thus disrupting operations at ports.

Those are unintentional incidents. Then you have for-profit attacks—maritime criminality. There is piracy and all forms of organised crime: people smuggling, drugs and arms trafficking and illegal fishing. The third category is politically motivated attacks: terrorism and attacks on shipping, in ships' ports, and using the sea to infiltrate operatives or materiel. There are not only non-state actors. There are also state actors that oppose freedom of the sea or the current status quo and that disrespect the international law of the sea, including using grey-zone tactics or hybrid warfare. We have an example now with Russia.

Q96 Chair: You have listed the three categories and taken us through them. How do you see them developing in the medium and longer term? Which category do you think will become more of a concern and which less of a concern? Can you predict future categories as well?

Dr Germond: If we look to 2050, it is unlikely that those types of threat will change a lot. It is likely that we will face the same types of maritime security threat. It is difficult to make predictions because of the global nature of maritime security. That is why we need to rely on strong early-warning capabilities and strong risk assessment and risk management capabilities.

I can think of some trends, if you wish. When we look at recent events—the accident in the Suez canal, the Ukraine war or the pandemic—we see that the supply chain is fragile. We see the vulnerability of shipping routes. This requires some sort of proactive response so that we can tackle the threats as soon as possible when they materialise, and as far away from the UK as possible, before they impact on us. That is something to take into consideration in the coming decades.

A second important trend is the new and emerging technologies: cyber, automated systems and artificial intelligence. These will provide states and the industry with solutions to deal with maritime security threats, but they will also be employed by criminal and disruptive actors. You really have two sides of the same coin there.

Thirdly, there is climate change. Climate change will have more impact on maritime security because it will create opportunities and incentives for maritime crime. It will also make it more difficult for states and the industry to respond to maritime security threats and it will impact on business continuity. I can talk about climate change in more detail later, if you wish.



Q97 **Chair:** Thank you. Do you believe that the Government, the IMO and the industry are doing enough to protect themselves and remain resilient, or is there more that can and should be done?

Dr Germond: Overall, I think the approach we have is robust. The 2015 national strategy for maritime security put forward a whole-of-Government approach, so it is flexible and enables innovation and the inclusion of various stakeholders. The current refresh of the strategy is following the same path, with wide consultations with many stakeholders, so we can also expect the refreshed strategy to put forward a comprehensive approach to maritime security.

It is not just the whole-of-Government approach; it is the public-private partnership. This collaboration between the public and private sectors has been efficient, with information sharing, intelligence sharing and co-development of relevant regulations. Clearly, the aim is for the industry to be able to take care of the security of the systems and operation by itself. You have a kind of resilience, readiness and innovation complex, but there is the assistance of the public sector. There is also an emphasis on international co-operation with partners, allies and like-minded nations in the global south, and with competitors, as much as possible. Capacity building in the global south is very important, to help it with security sector reforms and to deal with marine environmental issues.

Overall, it is positive. Now, there is no overarching agency with overarching responsibility for everything that has to do with maritime security, so it might be legitimate to question whether there are potential duplications, a lack of economy of scale or even turf wars; that is to say, competition within the bureaucracies for resources and leadership. I want to make it clear that, because maritime security threats are transnational and multilevel, the responses need to be multi-agency, multinational and multi-stakeholder.

I am confident in the current approach. It may well be the best possible approach because it is flexible and enables us to draw on the expertise of various stakeholders across the board, even those with remote interest in maritime security. In 2020, there was the creation of the Joint Maritime Security Centre, with some responsibilities for co-ordination. That demonstrates that decisions were made to address possible organisational ineffectiveness. Overall, it is positive. I can think of some priorities to put forward, if you are interested.

Q98 **Chair:** I am sure that we will explore those with you. At this point, I should ask Mr Gullick and Professor Hudson whether they want to add anything to what Dr Germond said, not least about the technologies and the security aspect.

Huw Gullick: From my perspective, I agree. I think that that is a really good summary. The one point I would add is that there are quite a number of individual, disparate approaches, certainly on cyber-security, when it is integrated with technology, so a flexible approach from



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Government, with more of a facilitator role, to draw all of that together will be absolutely crucial. The scale of what we will be doing and the operations at sea are going to grow considerably. The use of data and reliance on technology will naturally grow with that. We cannot allow individual approaches to cyber-security to grow without being consolidated somehow by Government. That is the only thing I would add. I completely agree with the summary provided.

Q99 **Chair:** Thank you. Professor Hudson, is there anything you want to add?

Professor Hudson: My only observation would be that people are very aware of the issue, but maybe not very knowledgeable about it. There is something about education in industry—in shipping companies and ship designers—as to how to protect shipping from cyber-attacks. There is something about broader education in the industry as well.

Chair: Okay. We will come on to cyber-security. Let us continue on security. I will hand over to my colleague Greg Smith.

Q100 **Greg Smith:** Good morning to the witnesses. Some of the themes that I wanted to explore were teased out in earlier answers. Accepting that if a shipping lane is blocked, as Suez was, it is blocked, and there is very little to do other than move the physical blockage, which, as we found out, can take some time, given the experience of the recent Suez canal blockage, the conflict in Ukraine and the fragility of our shipping routes that has been thrown up by that, can you explore a little more the practical steps that need to be taken—not necessarily by Government; it could be by the private sector as well—to make our shipping routes more stable?

Dr Germond: You are right. It is one thing to react, but it is much better to pre-empt or prevent. There are things that are not going to change. The maritime milieu is liquid—fluid—and it is very difficult to control the sea. We cannot occupy and control the sea like we occupy and control the land. Actors, especially disruptive criminal actors, are transnational. They operate across boundaries.

What we need, and it is really crucial, is maritime domain awareness—to be able to rely on very efficient early-warning processes and mechanisms. That is why I think that the current approach, which is multi-agency, whole-of-Government, public-private partnership and multinational, is the best-adapted approach. That is what enables us to draw on not just the expertise but the knowledge of various stakeholders on a day-to-day basis. Key to that is the ability of our agencies to co-ordinate stakeholders, gather information and respond as swiftly as possible when threats emerge.

Q101 **Greg Smith:** Can you give some practical examples for when we as a Committee come to try to make some recommendations around this to Government and the wider industry? What are the current blockages or barriers to that co-ordination? What are the practical steps that could be



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taken to make it a smoother, quicker, more effective process, to bring the co-ordination you have just spoken about to fruition?

Dr Germond: Thank you for that question. I rather think that what we have at the moment in our co-ordinating means and processes, especially around the Joint Maritime Security Centre, is sufficient in the current context to assure a good level of co-ordination. I understand the question and the need perhaps to push different stakeholders a bit. Personally, I am satisfied with the current level of co-ordination. It is more important to think about some areas where we need to put more attention, such as the climate change-maritime security nexus and, obviously, the EU. We need to continue to be able to work flexibly with our European partners. It seems to me, as far as I can witness, that it is working well, but that when it comes to fisheries, the EU is becoming some sort of competitor. That is something to keep on our radar.

Q102 **Greg Smith:** It was not a trick question. It is perfectly legitimate to say that there is nothing that could be made better about the co-ordination, but I accept the point that you make there.

You talk about fisheries. It has always been thus; fishing waters have been a contentious point. We will continue to fish in our waters. European Union countries will continue to fish in theirs. There will probably be some encroachment either way as the years go on. Can you unpack how that is impacting the stability of the whole maritime sector, given that we have fished these waters for hundreds if not thousands of years?

Dr Germond: Fisheries are a good example of the complex nature of maritime security and how different factors and threats interact, and things that might seem remote or very limited in scope impact the UK's security and prosperity. That is linked to my point about climate change, for example. Climate change is having effects on natural systems: sea-level rise, the salinity of the ocean, sea temperature and extreme weather events. That then impacts on human systems: food shortage, poverty, resentment and grievance. That creates incentives to engage in, for example, more illegal activities—illegal fishing—in a remote region in the global south. In reaction, there will be more piracy there. Then, one region may become problematic in terms of freedom of navigation, and suddenly it starts impacting us here in the UK. That shows how everything is linked.

When it comes to the EU, it is interesting to understand that when we think about fisheries, there are the fisher folk, the industry, local councils, national regulations and the EU. All of that works together smoothly when there is political willingness to co-operate at all levels, but when there are suddenly issues here and there it can go in many different directions, with all that that entails in the longer term.

Greg Smith: Thank you very much. Do either of the other witnesses want to add anything to those points? No. Back to you, Chair.

Q103 **Mr Bradshaw:** The current framework has not prevented Russia from



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blockading the ports of Ukraine, with devastating consequences for the global economy. I imagine that this blockade is illegal.

Dr Germond: You can discuss the international law dimension and its legality when there is a war. There is the right of neutral actors to commerce and so on. The problem is there. There is the blockade. Ukraine is not in a position to challenge the Russian navy at sea, so there is a de facto blockade.

We face different solutions. One is to escort commercial ships there. It is justified by the fact that, as you rightly mention, there is an important food crisis building up and something needs to be done. Obviously, we have tried to avoid escalation with a nuclear power as much as possible so far, so we have to be very careful when we assess that option.

Arming Ukraine so as to make it able to break the blockade itself is very important and instrumental as well. Whether the shipping sector, especially the maritime insurance companies, will think that it is enough of a security guarantee is another question. You also have options such as using a Romanian port. It is a stop-gap option, a patch-up solution, but it needs to be explored.

For the UK Government, what is very important now is to take the lead in finding solutions to provide food aid to the global south, when needed, because that would send a strong message to Russia that its blockade does not work and we have other solutions to deal with the crisis.

Q104 **Mr Bradshaw:** Is there currently no international body or organisation with responsibility for unblocking that sort of blockade? Is there no organisation with the locus or legal legitimacy to do it?

Dr Germond: The obvious body would be the United Nations Security Council, but that is a problem when a permanent member is involved.

Q105 **Mr Bradshaw:** Given that, do you think that the talk at the moment, indeed echoed by our Foreign Secretary, of a coalition of the willing to break the blockade militarily would be legitimate and sensible?

Dr Germond: Legitimate? I would say yes because, as you mention, it is having implications beyond Ukraine. First of all, for the past three months, the blockade had an impact on the Ukrainian economy, but now it is going beyond that. It is impacting the whole world. I would say that there are grounds for intervening in one way or another.

As I said before, we have to be careful with anything naval, because of the potential consequences of escalation. That is why the current approach is good, because it is not focusing on just one aspect; there is also all the diplomatic and political support. When the Prime Minister was the first Head of State or Government to go to Kyiv, that meant something. Support to Finland and Sweden means something, as does the transfer of arms to Ukraine. We need a comprehensive approach, rather than one particular option.



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Q106 **Mr Bradshaw:** I am just trying to ascertain whether action to keep international shipping lanes open would be different from NATO boots on the ground in Ukraine in how it is perceived internationally and in international law.

Dr Germond: I understand. It would be different in terms of the justification. The justification would be to maintain freedom of navigation. That is very different from saying, "We are defending the sovereignty of Ukraine on the ground." But, in practice, how that would be interpreted by Russia, and the consequences, might be the same.

Mr Bradshaw: Thank you, Dr Germond. That was very interesting.

Chair: We are going to move on to technology. Karl, is this a good moment for the point that you had? Grahame will then take things forward.

Q107 **Karl McCartney:** I will put my question to you first, Mr Gullick. The supply chain is very important, certainly when you look at maritime. You mentioned robotics, technology and the things you are looking at. Although security is a big risk, what do you think the big risks for the supply chain and negative effects on it are outside security, or are they all opportunities, as far as you are concerned?

Huw Gullick: The opportunities are both in pure technology development—making existing technology better and better—and in the scale-up, on an international scale or for us as a nation. By that I mean scale-up of manufacturing with the new technologies that are developed. The opportunity there is an economic one, with jobs and so on.

The challenges around that are the co-ordinated use of the technology; where technology is developed in an aligned way, with the governance and regulation to use it, and we have a controlling hand in that or, better still, lead the way on a global scale. Otherwise, someone else will step into that space and do that, and we will be just an adopter, rather than a developer. The opportunity is huge economically and from an export perspective, but it needs to be done in a really aligned way, with adoption and governance.

On the supply chain, we are back to the normal questions around use of metals and what types of metals. It is a similar story in the aviation sector and the whole supply chain that underpins that, with reliance on other territories and countries to supply the products and the labour pool that underpins and makes all of this stuff. Every opportunity is clearly a challenge in that respect, but the co-ordination of that is a place where we can play a really good role, both through the Maritime 2050 strategy and through UKRI, as the innovation co-ordination point.

Q108 **Karl McCartney:** Would supply chain profitability be maintained or enhanced if we were to lead the technology, rather than be adopters?



Huw Gullick: It depends on what hand we want to play. If we see ourselves just as a research nation, that is a certain business model with a certain level of profit expectation, but there is probably a bigger role for us to play in that, not just to research and give it to someone else, but research through to manufacturing and everything that that entails. I would look at it as a business model where we can play and own the whole supply chain. That is where we can extract maximum profitability, rather than in just one particular area.

Q109 **Karl McCartney:** Professor Hudson, do you want me to repeat those questions, or are you happy to talk about supply chain opportunities and supply chain profitability within the maritime sector?

Professor Hudson: I agree with the previous speaker. There is clearly a role for innovation, development and developing new technology, but there is a greater opportunity if we can export that knowledge and expertise, and sell products associated with that research. Fundamentally, I agree with that point.

Q110 **Karl McCartney:** I am going to hit you with a very specific question. Do you think that the time has come and gone for “just in time” economic models when it comes to the maritime supply chain, or do you think that we will be going back to it very shortly?

Professor Hudson: I am not sure that I understand the question. Are you asking about just in time in the context of manufacturing technology?

Q111 **Karl McCartney:** Maritime freight around the world has not proved itself to be robust enough in recent years. Do you think that we will maintain that just in time model for car manufacturing and so on?

Professor Hudson: There is a very interesting question about logistics. There is clearly some instability around, and manufacturers may feel that they need buffer stock. I don’t know that I am particularly well informed to answer that specific question, but I can certainly see a risk in the disruption of supply chains and hence the need potentially to have some buffer.

Q112 **Karl McCartney:** Thank you. Finally, Dr Germond, do you have anything to add to any of the answers I have just received from your two colleagues on the panel? I just want to give you the opportunity.

Dr Germond: I mentioned that I am satisfied with the approach of involving the private sector. It would be interesting perhaps to reflect on the joint investment by the public and private sectors in new technology. Has it had a positive return on investment? Has it helped in better responding to a maritime security threat? I do not have an answer to that, but I think it is something that would deserve further investigation.

Q113 **Karl McCartney:** Do you see anything else that could affect the supply chain in maritime, freight and shipping as much as security, or do you think that security is the biggest threat to the maritime supply chain?



Dr Germond: When there is a security incident, it becomes the most important threat, but in peaceful times, without those kinds of external incidents or shocks, obviously what my fellow witnesses mentioned matters the most. When there is a security issue happening, it becomes the main focal point. We see that with the Ukraine crisis, but previously when there was the Suez canal incident or the Covid-19 pandemic.

Karl McCartney: Thank you, all three of you.

Chair: We will drill further now into technology, as Karl has started us at that point. The Government themselves have broken down the technology aspects into four components: future shipping, smart ports, digitalisation, and communication, navigation and exploration.

Professor Hudson and Mr Gullick, you are right in the heart of this, with all the innovation. Bring it alive with your evidence. We are keen to champion new ideas and see what they are. Plenty of examples would be wonderful for us. Over to Grahame Morris to start us off.

Q114 **Grahame Morris:** That was really interesting and good evidence about whether the UK is going to be a developer or an adopter, and whether we are going to be a base for research that other maritime nations and countries can take advantage of. We are very keen to see the benefits across the whole of the economy in skilled, well-paid, secure jobs that this potentially very exciting strategy could bring if it is applied in the right way.

Could you give us some examples? Earlier, in questions from my colleagues, you mentioned the application of artificial intelligence. Could you give the Committee some examples of where we could really strike ahead?

Huw Gullick: Sure. If you look at the technology trend in the maritime sector, it is being driven in large part by autonomous, unmanned systems, alternative green fuels, and so on. There are two elements to that. There is an understanding of how they operate, such that you can regulate, legislate and govern the use of the equipment. You only get that effectively through data analytics. It is big data because all of these different technologies have different ways of communicating and operating that ultimately rely on data algorithms. You have proving the concept and testing the water, so to speak, and then of course once that is proven and we are comfortable adopting that technology, we have the scale-up, which is adding more and more data as we deploy the equipment in real-world use.

There are two elements. The skillsets that are required in both are very different from a labour pool perspective, but tools such as AI and machine learning straddle both sections. They will be absolutely critical for real-time response, navigation and communication—effectively, telling equipment what to do—and all of that needs to be done in real time. You cannot have a bank of 30 people sitting there pressing keyboards to do that; you need to rely on data analytics. Specifically, what AI and



machine learning bring is an iterative process of understanding what is going on in the environment at any one time and being able to react and learn from that to tell the equipment to do something else. It will be an absolutely central thread going forward. I can talk a bit about the skills required for that later, but Professor Hudson will probably have a view on this as well.

Q115 Grahame Morris: I want to come to Professor Hudson, but are there any security issues in the application of innovation and roll-out, Dr Germond, that could benefit the sector and the economy more generally?

Dr Germond: I am not an expert in technology itself. I just reiterate my point that when it comes to security you have two sides of the same coin. New technology, like artificial intelligence, will prove very important for states and the industry to tackle maritime security threats, but they will also be employed by criminals and disruptive actors. Some of those technologies are relatively cheap and easy to access, so we have to pay attention to the two sides of the coin.

Q116 Grahame Morris: Professor Hudson, could you give us some examples of the technology roll-out? Are we just at the stage of scoping, or are we quite well advanced in identifying the opportunities?

Professor Hudson: My sense is that the marine sector is quite conservative in the adoption of technology generally. It is certainly less innovative, and the pace of development is slower than in aerospace or automotive.

Through Maritime 2050 and other studies, we have identified that there is a wealth of expertise in the UK, both in academia and in the supply chain, around these technologies. We have heard about some of them. They can be applied in military applications, in surveillance applications and in operational applications. There are lots of potential applications for these advanced technologies and artificial intelligence.

The challenge now is to start to develop them into real, workable solutions. We have touched on regulation, which is a very significant part of introducing new technology in operation and enabling it to be adopted by industry. The regulators are in a very difficult position. Clearly, they want to maintain and enhance safety standards, and they are very enthusiastic about supporting research and development, but the lived experience is that, whenever we try to do things innovatively, regulation is slightly one step behind. One of the things I would make an appeal for is to create more bandwidth in the regulatory environment and to support them to be able to adopt and enable these new technologies.

Q117 Grahame Morris: Mr Gullick, I am sure that you followed the Committee's evidence session last week. We had some really good evidence from the port of Tyne, from Lucy Armstrong, about the innovation hub that they have on the Tyne.

In the creation of innovation hubs, there is an immediate benefit to the



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area by providing skills, employment opportunities, secure employment and so on. Do you have a view on how innovation hubs linked to the maritime sector should be developed? What lessons can we learn from that?

Huw Gullick: It is quite easy to pull a bunch of organisations together and create a hub. There is no issue or challenge in creating hubs, innovation centres or whatever we want to term them. The challenge is finding the joined-up motivation for all of the members to work together. This is where hubs or innovation centres, in my view, succeed or fail. Without tapping into the joint motivation of their members to work on something or develop something, ultimately they are a nice forum to talk about technology, but the output is somewhat limited. That comes down to traditional industry that has existed in a sector. We are based in the Solent. There is a lot around marine autonomy and robotics, and it is very easy to bring people together to work and develop under a hub banner. The infrastructure that is provided by UKRI from different Government funding schemes is the second element to that.

Combining the two, there are really good examples around the UK, but keeping it focused specifically on a technology, a theme, a port or whatever it might be is absolutely critical. It is really broad and it becomes a little bit of a talking shop, in my view, so it is absolutely critical to keep it focused on something. Ports are a great example of that.

Q118 **Grahame Morris:** Professor Hudson, could I put the same question to you? The Department for Transport wants to encourage the development of these innovation and technology hubs for the maritime sector. What advice or view would you have for the Committee in respect of how these hubs should be developed?

Professor Hudson: Collaboration is a really important theme—enabling the sharing of learning and knowledge, and building collaboration across the enterprise. The maritime sector is quite a siloed enterprise. Once these developments are proven, it is about the exploitation of them, and enabling collaboration across the enterprise would be an important aspect.

Q119 **Grahame Morris:** Thank you. Dr Germond, is there anything you wish to add to that in respect of the development of the innovation hubs?

Dr Germond: With regard to the last point, I completely agree. If there is effective sharing of intelligence and co-ordination of needs analysis for regulation, technical expertise and operation, and if it all works smoothly, it emphasises the fact that the industry needs to be able to take care of itself when it comes to the security of systems and operation. That will be effective, but it is really dependent on the effectiveness of information sharing, expertise sharing, and so on.

Grahame Morris: Thank you. I will hand back, Chair, because we have to move on to smart shipping, I believe.



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Q120 **Chair:** Indeed. Just before Ben moves us there, I want to pick up a point with Professor Hudson. You drew comparisons with the aerospace and aviation industry and the speed they adapt compared to maritime. Do you have an insight as to why there may be a difference? Is it cultural? Is it lack of investment? Is it people-based?

Professor Hudson: It is all of those things. When you are operating vessels at sea in heavy weather, there is a natural conservatism. You want things to be reliable and robust. Introducing new technology sometimes brings in questions about reliability and those sorts of things. The systems that get adopted and taken to sea need to be very reliable and proven. There is an aspect there.

In certain sectors of the marine sector profitability is quite low. Therefore, there is less room for spending, developing and innovation. That is where it needs encouragement to enable industry to invest, develop and adopt new ideas. There are plenty of ideas in the domain. Academia is very vibrant. We have seen from several reports how advanced we are in the UK in maritime research and development. The two things we need to do are to foster the environment for that investment within industry and then foster the confidence in industry.

I referred to regulation. Regulation is the last hurdle. Sometimes people just do not want to take the risk of not being able to get regulatory approval for innovation. I think that has had an impact on stifling innovation, to a degree.

Q121 **Chair:** If we look at aerospace, we have Airbus and Boeing almost determined to beat each other as to who can get there first. Do we have the same equivalent in the maritime space that may see private competition drive innovation?

Professor Hudson: I think that is absolutely true. When you have competing airframe manufacturers and competing engine manufacturers, the level of innovation in those sectors is very high. We do not have it to the same degree in the maritime sector.

Q122 **Chair:** Mr Gullick, do you want to come in?

Huw Gullick: I completely agree with Professor Hudson. The other element is that the physics requirement requires innovation. Aero engines are only going to get quicker by getting hotter with the metals that are used in them and the manufacturing techniques. Through the supply chain, overcoming the physics of what you are physically trying to do will drive innovation as well. That is the other element I would add. It is the science side of things. You do not need advanced rare earth alloys to build a ship hull, but you do need them to put in turbine blades for an engine, if you want to make that engine run hotter. Physics is involved. That is just a simple fact that we have to overcome.

Chair: Thank you both on that point. Apologies, Ben. Over to you for smart shipping.



Q123 **Mr Bradshaw:** That leads on nicely. Given the lack of competition in the sector, it means there is a greater role for Governments. Professor Hudson, how do you think the UK Government are doing in comparison with other Governments in encouraging the development of smart shipping?

Professor Hudson: It is fantastic that the maritime sector has this level of engagement from Government. I think that is extremely encouraging. With UKRI and the Department for Transport grants, there has been considerable support to the enterprise and industry. That is extremely good.

If you look at the 2050 vision, it is categorised into one to five years and five to 15 years. We are now at the phase where we have to develop the thinking beyond the five-year phase. There is a lot of technology, a lot of innovation and a lot of ideas around. A lot of people are thinking about the VHF/Betamax moment. Which is the technology solution that we need to pick to progress? We have to resist being held back by that. We have to decide which we think is the technology, and back it. We have to increasingly focus on getting demonstrators, getting things proven, such that we can go to industry and show that the equipment works and delivers benefits and efficiencies, and that we have solved the regulatory issues that enable the technology to be adopted by industry. I am very encouraged by what we are doing, but I think we need to move up a gear and into the development phase.

Q124 **Mr Bradshaw:** Mr Gullick, do you share that positive view?

Huw Gullick: Yes, I do. If we leave it unchecked, industry will take care of itself, in my view, and the answer will be determined for us as a nation. I share that positive outlook.

The only thing I would add is that we have a long-term ambition outlined in the 2050 strategy, but I think some short-term milestones with some quite aggressive targets to focus the mind and drive some collaborative activity would be one area that is needed. Whether that is on alternative fuel types or we make the decision to go bio-synthetic for five years, to see what the market does on hydrogen ammonia and then make a play, is to be determined. I would certainly inject some specific targets quite early in that 30-year timeframe.

Q125 **Mr Bradshaw:** Are either of you aware of any progress having been made towards the establishment of the centre for smart shipping that was promised in the 2050 maritime strategy?

Professor Hudson: I am personally not aware of direct progress on that, but it may be that I have not been engaged.

Huw Gullick: Similar.

Mr Bradshaw: Thank you.

Q126 **Gavin Newlands:** I will step back for one second, if I could. Automation



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is seen by many as having negative connotations, with the erosion of jobs and trust in any automation that comes in. Professor Hudson, briefly and succinctly could you list the main benefits and perhaps, if any, drawbacks of smart shipping and automation?

Professor Hudson: Frankly, we are struggling to get skilled seafarers and people who want to spend their careers at sea. Automation provides an opportunity to compensate for some of the skill shortages that we have. Automation can be deployed at several levels. It can be deployed in taking over responsibilities that are currently done by operators, by people. It can then go to the level of remote operation but still having manned vessels. Then it can go to full AI self-shipping.

There are certain areas where AI can be deployed extremely effectively. If one thinks about survey, where one needs a lot of sensors deployed off maybe relatively modest vessels, trying to do that manually would be extraordinarily expensive and difficult. AI provides a fantastic opportunity to develop those things and develop capability for industry. There are examples where it simply enables technology, which we could not do without AI or automation.

There is another dynamic, which is always the challenge about human behaviour and human performance. I think something like 29% of ship incidents are due to failings of the human operator. Automation can compensate for that. Automation can bring its own safety challenges, but provided they are properly researched and developed, those things can improve overall safety, both for equipment and personnel.

Yes, I think there are areas of technology development that are simply going to create capability for industry and for society that cannot be done through other means. There are things where we are compensating for societies changing the sorts of jobs that people want to do. I accept that in the margins there is potential risk for eliminating people employed in the deployment of assets, but we are creating wealth and opportunities in the technologies that are deployed.

Q127 **Gavin Newlands:** Jobs and potential safety issues, which can be resolved, are the main drawbacks for you. Mr Gullick, do you have anything to add to that, or has Professor Hudson covered it pretty succinctly?

Huw Gullick: The only thing is that the nature of the skillset and the labour pool will change. We are talking about technology development and scaling up. The skillset and the labour pool will gravitate to those types of jobs, so we will see different skillsets required. Automation is not right for every single process that we operate through the whole supply chain. It is the nature that will change rather than the numbers.

Q128 **Gavin Newlands:** We have seen the automation move on at pace in road vehicles, with elements of self-driving and self-parking available on many models. I suppose the technology of tomorrow has, in many cases,



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become the technology of today. That makes a Luddite like me a bit uneasy, I have to say. I do not like being a passenger when somebody else drives, let alone the car itself. What can the maritime sector learn from other industries—thinking particularly of road vehicles—in relation to automation and digitalisation?

Huw Gullick: The first thing to say is that the maritime sector is already operating in this space, albeit on a far lesser scale and in a space we are comfortable with, which is generally under the surface because people are not operating there. It is a bit of a case of out of sight, out of mind, I would say. Nevertheless, the technology is operating in the maritime sector.

The one thing for me is the critical link with governance and regulation and making sure that is absolutely aligned so that, as the technology develops and rolls out, the regulation is right there with it and it can go in the water when it is ready on day one, and the operating environment is set from a regulatory perspective. That is what we missed with cars. Cars have automated capabilities in isolation, but they have only recently been brought together. Front sensors and self-driving can be turned on and off, but they have never been integrated. We are talking about integrating those things, and it is exactly the same in the maritime sector.

The pacing item will be the regulation. We do not want to find ourselves, in 10 years' time, with all this wonderful technology that we cannot actually put in the water and scale up because the regulation is five years behind. We will just be self-limiting. Bringing the two together is absolutely crucial.

Q129 **Gavin Newlands:** Professor Hudson?

Professor Hudson: I think there is potential for evolution. Maybe in small craft and then autonomous vehicles, we can see that in the near term. For larger vessels, I think we will start to automate certain activities, with things like berthing. We could bring the ship alongside using an automated system rather than the manual control today. With mooring, instead of having seamen on the ships and stevedores on the quayside, we could automate those systems so that we can adopt technology progressively to improve safety and reduce costs.

Q130 **Gavin Newlands:** Dr Germond, I have a final question for you because I am conscious of the time. With the ever-increasing use of smart technology, will connectivity be a challenge to the benefits of new innovations? Will poor connectivity get in the way?

Dr Germond: I would like to see the industry really paying attention to the security implication of the adoption of the technologies of tomorrow, including obviously connectivity. The maritime sector depends a lot on a space-based system of connectivity. Just think of GPS for the technology of today. The security implications of automation and artificial intelligence need to be taken into consideration pre-emptively.



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Ports are part of critical national infrastructure, so obviously any disruption is problematic. They also constitute valuable targets for terrorists or state actors who would like to harm the UK's interests. It is important to pre-empt that by taking into consideration potential security implications, especially in the cyber realm. The shipping sector is ultimately dependent on connectivity technologies, and space-based technologies are particularly important.

Q131 Gavin Newlands: Mr Gullick, you mentioned how critical real-time information and data was, so presumably you agree that good connectivity is vital.

Huw Gullick: Absolutely. It goes without saying, of course. If you look at our network coverages and ability to use satellites for connectivity, it is pretty good. It is where it needs to be, in line with the physical technology. Of course, as you scale that technology up, you are flooding the system with more and more data needs. We do not want to be in a position where the whole thing slows down. Using different connectivity types helps get round that. Of course, as you design into the technology back-up systems, options and things like that, that will become critical as well. The infrastructure is there, but it is a bit like the charging infrastructure. It is there but it needs to grow as we scale up the technology.

Gavin Newlands: Thank you.

Chair: We are close to time, but I want to bring Greg back and then I have a couple of quickfire questions of my own.

Q132 Greg Smith: Thank you, Chair. Whenever we talk about technology, there is always a balance between the R&D, the development and creation of that technology, and then on the other side of the coin its commercial viability, and scaling it up and making it actually practical and affordable within business models. Is enough attention being paid to the latter part of that: the scalability and commercial viability of these emerging technologies?

Huw Gullick: Along the tech development journey through UKRI, there is a really good, solid framework for helping small start-ups coming out of the academic world and commercialising. It is good up to a point with funding, business model support, and so on.

The challenge, as I see it, is that injections of cash develop businesses, but they do not grow businesses. Customers grow businesses. We actually switched this round, to the question of where small SMEs or spin-outs from academic institutes spend their time and how they prioritise their time. Where we struggle is at the gap between a really good product that is perhaps demonstrated and maybe has a few initial customers, but is scaling up and UKRI support drops off, understandably. An injection of cash is not perhaps what they need. They need the time and the business skills to go out and gain customers, because they are the ones who will grow it.



There are various ways of doing that. Venture capitalist and private investment is one way of getting the injection of cash and the contacts. Underwriting and accepting the risk that some technology will not work from a UKRI or UK Government perspective is a really interesting concept. Certainly what you see in the US model is the underwriting of tech that has developed in the maritime sector, where perhaps they pre-order from a DOD perspective certain types of submarine technology.

It is that space. We are very good up to a certain point, but when we need to scale up, it is about allowing people the time, and giving them the support, to gain customers, not investment, because the customers grow the business and scale it up.

Q133 **Greg Smith:** That is really helpful. Does anybody else want to come in?

Professor Hudson: I think zero-carbon technologies are going to be very interesting. Certainly in the first phase they will be more expensive than the competing carbon technologies. To get technology adopted into industry and to get zero-carbon fuel solutions into ships will require some serious thinking about how we incentivise shipowners to invest in that technology and deploy it.

Greg Smith: This Committee has done an inquiry into fuels of the future. Clearly, there is massive R&D going on, but how you make, for example, a synthetic fuel affordable when the scaling up of the production of that synthetic fuel is, at the moment, monstrously expensive, I totally accept is a massive challenge. It would be helpful if the entire sector and the Government paid more attention to the commercial viability of delivering on some of the challenges that Government are setting.

Q134 **Chair:** Thank you. I have a few questions. I might put them just to one witness unless somebody else has a burning desire to come in. The first is on the ambition in Maritime 2050 to map the UK waters. Why is this important? Mr Gullick, you are nodding, so I will pick on you for that.

Huw Gullick: We need to understand what we own. Only through doing that can we make sensible, well-informed decisions about how we use that resource. At the moment, we do not know what is in our EEZ in any great level of detail. We have the technology to do that, so it is a question of will.

The reason specifically why it is important for us is that, with the understanding of how our waters operate, we can rate downstream efficiencies from a logistics perspective, from a shipping perspective and from a transportation perspective. It helps build confidence in adoption of new technologies as well. From my perspective that is the core reason, and then clearly there are offshoot benefits for upscaling offshore renewables in certain sectors. It starts with understanding, to make informed and strategic decisions about how we use the resources that we own.

Q135 **Chair:** Are we mapping what is below?



Huw Gullick: Yes.

Q136 **Chair:** To go back to the regulatory issues, are there examples of where regulation, or lack of it, is actually holding you back and not keeping pace with where we could be with technology? Mr Gullick or Professor Hudson?

Huw Gullick: From my perspective, my interest is in what lies beneath the surface. Of course, because that is a fairly empty space in terms of other vessels, it is pretty unregulated. That is a positive thing because it allows freedom for testing and scaling up technology. In a perverse kind of way, it is quite good not having regulation there.

Q137 **Chair:** Because regulation can then come into the space and hold you back from doing something that you are currently doing?

Huw Gullick: Exactly. There is a lot of play when you are operating in that environment. If you have a specific boundary that regulation says you are not allowed to go over, and you have strange currents on a particular day, how do you account for that? You find yourself in hot water when your regulation is stopping you. Having that freedom is actually quite good from a scientific understanding perspective.

Q138 **Chair:** Professor Hudson, looking more to the surface?

Professor Hudson: Regulation is a challenge. At every step, whatever we try to do in this brave new world, we tend to hit a regulatory challenge. Take the adoption of high-energy batteries. They have a higher fire risk, so one of our organisations that is trying to fit batteries on coaster ships is finding real challenges in demonstrating safety to the regulator. That is an example. As we deploy hydrogen, and maybe burning hydrogen as part of a fuel mix, again we face regulatory challenge.

It is trying to get the regulators up with the hunt in what we are trying to do in the innovation space and helping them to get ahead of the game. The regulation tends to be a hurdle that comes later in the programme, when we understand the issues associated with the technology. It is trying to get regulation a little bit further up the innovation chain, earlier in the cycle, so that we anticipate the regulatory challenges early in the technology development.

Q139 **Chair:** Is it a similar parallel to rail, where innovation is suggested but then there are questions as to whether that is safe, so we do not necessarily keep pace with innovation and do not see change?

Professor Hudson: Yes, absolutely. People make decisions not to innovate based on the pain of going through a regulatory check. It is a disincentive to innovation.

Chair: That is really helpful to conclude on. Dr Germond, Mr Gullick and Professor Hudson, thank you so much for all the evidence you have given us. I am sorry that at times we have had one of you and then not the other, but collectively we have had the whole lot on technology, security



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and resilience. I thank all three of you very much indeed.