

SMI Webinar: Future Ships: Perspectives from Classification Societies
Answers to Questions posted during the Panel Discussion
28 January 2021

No	Question	Answer(s)
1	Do you think autonomous ships are actually a reality or some wishful thinking? Secondly, I want to know if gauges can be found to measure a ship's emissions.	<p>[Mr Duncan Duffy] Good set of questions. Addressing the first one, it's both wishful thinking and reality. We already have unmanned surface vessels that are operating in ocean spaces. They are below the size that requires any certification, and they have the advantage in risk management, that they bounce off things, so that there's limited risk to the environment or to people from the operation of those. So, technology wise, it exists. Will it be put on to deep sea shipping, in terms of full autonomy? I don't see that as likely for many years to come, because I believe the engineering of the reliability and dependability necessary for the systems within a ship would prove very costly. The economic argument to do that, against continuing to employ suitably qualified and experienced crew doesn't really stack up. So, I think we'll see autonomous systems within deep sea shipping, but not fully autonomous ships for years to come. Specific concepts of use maybe, yes.</p> <p>Regarding the risk management, things like system theoretic process analysis was developed in aerospace to deal with safety of systems controlled by people. I think it does have advantages when you try to introduce the human element into design. Something like a Failure Mode and Effects Analysis deals rather badly with complex cascade causes and common causes and the human element, where that has better traction on those sorts of challenges. So, I think we can learn from there, but also from other areas, like offshore, where information sharing has led to great improvements and safety.</p>
2	I'll add on one more dimension to this, given that we are running the Centre of Excellence on Autonomous and Remotely Operated Vessels. How do you think the systems or systems approach that you have referenced in your presentation can actually bring us closer towards autonomy, especially in the context of the STPA framework as a risk management and control approach? Since as you've rightly pointed out, it's not possible to eliminate all risks faced by ships?	
3	Since this Webinar is recorded, may I suggest to share the recording with us, please.	[SMI] The recording of the webinar can now be viewed on the SMI website, under the 'Events & Activities' tab.
4	For predictive and preventive maintenance, one should go from Data Based Analytics or Model Based Data Analytics from shipping industries from your view point?	[Dr Gu Hai] That's a good question. From my perspective, database analytics and model-based analytics are not mutually exclusive. When we see a model-based approach, we'll include both the physics-based models, and also the data-driven models. We use both of these two types of models in our approach, and when to use which really depends on the applications. For example, we have the data-driven models to monitor the data from machinery and to identify any anomalies or to predict the future failures of the machinery etc. And we also use a data-driven model for structural or even for mooring analysis for station keeping. And we use physics-based models in many other applications. Sometimes we need to combine both of them to achieve the best efficiency. In many cases, with the data received, we really need a physics-based model to process the data, to make sense of the data. I use, again, structural health monitoring as the example. We install strain gauges on ships and structures. For example, we install 100 strain gauges, but the 100 strain gauges only give us information in 100 locations. What we want from these 100 strain gauges, is how to determine the stress distribution of the entire structure. To achieve that, I need a model, a physical physics-based model to do that. Of course, probably we can also develop a data-driven model to achieve the same goal. So the short answer is, I think these two are related but not mutually exclusive.
5	Hi @Jerome Flourey, is there a rationale behind the low volumetric energy density for hydrogen as an 'advantage' instead of a 'constraint'?	[Mr Jerome Flourey] In fact, the positive aspect is on the higher specific density by mass which, I agree, is a secondary constraint compared to the volume. I'd be more than happy to check with my colleagues in charge of the H2 initiatives, and come back to you by email.
6	As we are all seeking decarbonisation, are class societies able to work today to account for carbon credits for ship owners and operators?	[Ms Cristina Saenz de Santa Maria] I don't think the platform is the issue. I mean, carbon tax is used in countries and in other industries. I guess it's just having the agreement of the industry players, and that's what we need to do. I don't think technology and the platform is the problem here. There needs to be an agreement among the industry players. I think that's difficult, because it's such a diverse industry. So, I think that's where the tricky part is, not the technology.
7	Perhaps, if it's relevant in the context of how something like a collaborative platform such as the open simulation platform, or the data collection infrastructure, can help facilitate such an industry of global trading scheme?	
8	Hi, it will be useful if presentation slides can be shared among all participants.	[SMI] The presentation slides can now be viewed on the SMI website, under the 'Events & Activities' tab.
9	Digitalisation and visualisation would certainly improve performance and efficient operation, but implementation of a complex system with so many sub-systems would make it complex to implement. So what is the time frame we are looking at commercial implementation?	[Ms Cristina Saenz de Santa Maria] We have the JIP, and now we have this Trust Centre where we want to launch this technology, and we want to launch it in spring 2021. It will be a staged rollout in the sense, but we will be ready pretty soon. We will then upgrade and improve it, of course, and learn from the hiccups that are normal to have as we go along. But not only about this, the important thing I would say is any technology or any change process is to start now, and don't wait for the perfect solution. A quote from Voltaire, "Don't let the perfect be the enemy of the good." Because then we will never reach there. So, it is important to get pilots and industry partners working together, testing it out, improving it and upgrading it as we go along.
10	I see that all of you are talking about separate platforms, but are you looking at standards for collection of data? One standard for the maritime industry would accelerate the speed of digitalisation.	There is some effort at international organisations level to elaborate some standards for data harmonization. I believe that this harmonization will allow an accelerated digitalisation without the need for cut throat consolidation.
11	How do the panel propose addressing the significant data quality and interoperability issues which will increase as there is increased reliance on automation and simulation?	[Mr Duncan Duffy] I think that data question is one that we will all be facing together. Because as we wish to use data and analysis of data for increasingly safety related decisions, the trust in both the measurement accuracy, and the uncertainty of each of the processing stages become quite critical for the reliance that we can then place in the end decisions. Standardisation is of course the obvious route to begin to bring together and make data interoperable. But, there's quite a lot of work where there are existing but slightly different standards to look at API interfaces that will allow the exchange of that data in its context with sufficient understanding of the uncertainty to be able to use it appropriately.

12	Do you think it is safe if computers replace human to operate/navigate the autonomous ships?	<p>[Dr Gu Hai] In recent times, computers and software are increasingly being used onboard vessels. We see this in various systems for example the ship's engine control systems, integrated alarms and monitoring systems, navigation systems, etc. The challenge is to integrate and ensure the safe operation of computers and complex systems onboard ships. We see computers / software as the latest arm in addition to the traditional fields of: hull, machinery, electrical and piping.</p> <p>Advances and efforts are underway by ABS and various industry stakeholders to improve the safe operation of computers and complex systems onboard ships. This takes a variety of forms, including ensuring data integrity, cyber security and software quality.</p> <p>In the near to medium future, while there may be some smaller vessels that are largely autonomous, our outlook is that blue water vessels will still be manned, albeit with an increasing number of functions performed autonomously by machines and computer systems. In most cases, the current rules and regulation will not allow the use of autonomous functions, such as navigation. It is an ongoing industry-wide challenge to develop a safety framework that will enable increasing the autonomous functionality of complex systems.</p>
13	IMO targets shown are for a 70% reduction in carbon intensity by 2050. Is this good enough when many countries are signing up to zero carbon by 2050? What more can the Class Societies do to accelerate the zero-carbon journey?	<p>[Mr Jerome Flourey] I think class societies have a role to play in helping the value stakeholders in the supply chain and in the value chain de-risk the processes and the new aspects of the processing. I do not think class societies are in the leading position going towards a certain fuel, but they really have to support the industry. Ultimately, I also don't believe there would be one, and I think this has been shared by other panellists, there will not be one single bunker solution that fits all the business cases for all the ship owners and all the operators. So, there will be an energy mix with much more value achieved than there is today. With bunker stations specialising in certain field, with operators and certain lines operated on the specific fields or specific energy mix, class societies are here to make sure that the processes are safe. Coming back to the objective, I think the objectives are really dependent on industry and Class activities can help de-risking and confirming the validity of the processes that are selected, that those selections are aligned with the ultimate objectives.</p> <p>[Dr Gu Hai] I think I can use this opportunity to answer this question and also to address another comment from my former colleague, Mr A.K Seah, about lifecycle and structural health monitoring. I think from a life cycle perspective, whilst design of the ship is the start of the lifecycle, it is quite important to have a platform and to consider lifecycle performance in the design. I think there is a convergence among all the class societies. We all talk about modelling and simulation and collaborative platform to do the design and for the lifecycle management. In this approach, we can incorporate lifecycle models in the approach so that we can evaluate lifecycle performance. To be more specific, related to Mr A.K. Seah's question about condition monitoring, there are some factors that we should consider in the design stage, which are not well considered now. For example, the condition monitoring, especially structural condition monitoring, we want to instrument the shape to know the condition so that we can achieve a condition-based classification process. Basically, is to understand the condition and based on that condition, we decide when to do the inspection survey and what kind of maintenance. But before doing that, we need to monitor the condition and the best timing to do this is at the design stage. Especially if you want to instrument the ship with sensors, then the best time is to do at the new build. That's why you need to consider that at the design stage. And there are some challenges we need to overcome, for example, we need a methodology to determine where we should put the sensors and how many sensors we put, and how to optimise that to get the balance of performance, and cost. So, all these factors we need to consider in the design. Condition monitoring is more like at the operation and maintenance stage. So, from lifecycle perspective, it is better to consider that in the design stage.</p> <p>Another thing is inspections. I think Jerome mentioned using drones and robotic platforms in inspection. Many times, the challenge we are facing is we have the robotic platforms, but the challenge is how to put those robotic platforms through a manhole into the tank. If in the future, we see that we will use robotics for inspection, and we may use robotics for maintenance, then we need to consider those factors in design so that the design is future proof. Just to share some ideas like how we should consider factors in the whole lifecycle in the design stage, so that is future proof.</p>
14	From class angle, its primary role is in monitoring ship's health - in safety & environmental standards. For a future ship, this should be digitalised or data-driven. To me, this future ship should be comprehensively 'instrumented' at delivery so that it could provide 'health data' to the class to allow monitoring continuously and throughout lifecycle. To some extent, this is done for some machinery, but a far cry from being enough, not to mention structures. Like to hear panel's comments.	Please refer to Dr Gu's response to this question in Question 13 above.
15	Hello Cristina, I have question related to 3D model-based approval. As we know many smaller shipyards still doing traditional 2D design due to high cost of 3D software. What is the initiative from class in order to encourage ship designer to shift from traditional 2D design to 3D model-based design?	[Ms Cristina Saenz de Santa Maria] Indeed, I think that happens with everything in the industry. We have a wide portfolio of ship owners, shipyards, and designers. So, I would say is the efficiency gains that you can get because again, it is a tough market out there, and it's going to just get tougher and tougher. So, it's important for all of the relevant stakeholders to gain as much efficiency as possible and then of course, to try to get better quality, that will always help the designer and a pain free or smooth process. I would say that it's basically survival if you want to be there in the future, we need to be able to adapt ourselves to these new technologies, which as I said, it will improve the quality, it will improve the efficiency and it will improve the process, which therefore should lead to more contracts in the future.
16	Climate change demands the same urgency that of COVID-19. The vaccine needed for shipping are the technologies. We are not there yet. Classes are the TICs. They are not in the Driver's seat. But like COVID-19, safe behaviour is needed as immediate need. That behaviour in shipping means operational behaviour. What is happening in this field?	[Mr Duncan Duffy] The need for urgent action in adopting low emissions technologies is clear; as the benefits of technology changes will only be delivered over time in use. Many operators are looking at fuel efficiency improvements as a hygiene measure that can be adopted immediately such as slow steaming. This and even conversions to optimise ships for slow steaming is one area that we can highlight where actions are being taken.
17	Currently regulations stand in the way of digitalisation, e.g. the electronic logbook. It would be difficult to visualise the possibility of autonomous ships by 2050 recognizing the legal hurdles, reliability of machinery on board, uncontrolled small vessels in the ocean either fishing or smuggling.	Thank you for your comment. You may refer to Mr Duncan's response in Question 1 above.

18	Digitalisation is a journey and we see there is a large inclusion of many platforms. Does the panel think that like the tech industry, will we be able to see convergence towards some platforms? Just like we ended with Linux & Windows or iOS & Android?	<p>[Ms Cristina Saenz de Santa Maria] I think it's a bit complex, that we only get a couple of them. I think there are already many to start with. What is important is to think how would these platforms be able to work together, and I think that's what everyone is working on with APIs, and that they are in a way future ready, future proof in order to be able to interconnect with modules that we didn't even know right now exist. But of course, in a sense, the more the companies are trying to create their own systems and platforms, it might get trickier as we go along. You'll see a lot of intelligent and competent people out there whom I'm sure will find solutions.</p> <p>[Mr Jerome Flourey] I think there will be an effort for harmonisation and standardisation for the better. As I believe we have all said, it would be very difficult in our industry to fathom one solution that fits all the needs. So, the availability of standards and harmonised standards for the exchange between platforms will be critical and will facilitate the digitalisation without requiring the consolidation around single platforms.</p> <p>[Dr Gu Hai] To add on to my colleagues, I think for some part of the simulation of data exchange, they are already common standards existing. For example, when we talk about the modelling simulation, there is the standard called FMI, which stands for Functional Mock-up Interface. As we build up the modelling and simulation platform, that is the kind of common interface we can use. If we support that, that means the models built from different platforms, we can through this interface, exchange and do co-simulation. In our maritime industry, sometimes we follow, we're not leading the technology. So in many cases, we can leverage what had been developing in other industries and to use to support our efforts. Co-simulation of the model-based approach is not really very new. It has been used in advanced manufacturing operations in the world, especially for the aerospace and defence related organisations. We can learn from them and use the standards and protocols they developed for our industry, like FMI.</p>
19	When will class implement and accept 3D plan approval instead of conventional plan approval methods used in new shipbuilding?	<p>[Mr Duncan Duffy] Yes, provided the information necessary to assess compliance with Rules is available within the 3D models this is a service that more classification societies will offer.</p> <p>[Mr Jerome Flourey] BV has already started pilots in Europe! And the developments are still going on, to increase the versatility of the platform and tools. In local context, while 3D may bring some convenience to the more established shipyards, especially those with in-house design capabilities, the general feedback from some local newbuilding shipyards being that moving towards 3D Class approval also involve investments on their parts and this may provide some inertia in the immediate term. But it is definitely an area that BV is pursuing.</p> <p>[Dr Gu Hai] ABS currently accepts 3D models for both design review and survey. At ABS, advances in technology and 3D modelling techniques now enable one, end-to-end project model – helping designers achieve a time savings of up to 10-25% with the elimination of 2D, paper-based drawings. To find out how ABS can work with you to accept 3D models for design review and class survey credit, please refer to: https://ww2.eagle.org/en/rules-and-resources/3d-model-for-class-approval.html</p> <p>[Ms Cristina Saenz de Santa Maria] 3D plan approval can be agreed upon between DNV GL and contractor on a case-by-case basis from 2021. An amendment to our January 1 Rules has been added to allow for this. From July, we plan to offer 3D approval as an option in the customer portal.</p>
20	With the digitalisation, there will be a "big swift" of the mindset and also the approach including the employment within marine industry. How to ensure that the big swift will be controlled?	<p>[Mr Jerome Flourey] Digitalisation is indeed an important subject these days in our industry, but the concept of digitalisation should not be overhyped. As an example, recognising that the aerospace industry is far more advanced than shipping, and planes have been flying on autopilot since 1912 (re. Sperry Corp). More than a hundred years later today, planes are still flying with human pilots onboard – sometimes with three pilots even. In short, the transition is expected to be manageable, and not really a "big swift". Nevertheless, workers should constantly upskill and re-train as necessary, and leverage all opportunities provided by their employers or their governments.</p>
21	In terms of digitalisation and platform, you've highlighted the remote survey schemes that BV have developed and how do you see these? Because they address the ships-in-service type of application, as compared to ship design, which we've been discussing so far. So how do you see the platforms being leveraged or being harnessed to catalog all the remote surveys data?	<p>[Mr Jerome Flourey] That's a good question. I think today the way remote surveys are deployed, they really focus on the connectivity between the ship and the surveyor, the guarantee that the information being transferred cannot be tampered with, and is of sufficient quality to support the judgments that come from the surveyor. The process of that survey after the actual execution follows the usual data process. So, I don't think the platform for remote survey needs to go outside of its own class society, and as soon as the surveyor has access to the information, he will be able to use the traditional survey platforms. That being said, on the connectivity between the ship and the surveyor, then the platform is critical. I think all the class societies involved in remote surveys put a lot of energy and a lot of focus on making sure that the connectivity is what controls the information.</p>
22	Humans have been sailing for thousands of years, even longer than before we started driving. To convince autonomous shipping as the future (with goal of Y2050), how do we best weigh the human elements and economical value? How can we best shift this paradigm?	<p>[Mr Duncan Duffy] Well, I think whenever we talk about autonomous systems, at some point, consideration of the human element within that design is necessary, even if that's at the level of completely autonomous asset, having to deal with instructions from vessel traffic management facilities, and equally the sort of work in part when we have to handle cargo. It's certainly possible to envisage complete automation of all of that from a technology viewpoint. But I think the economic case may not stack up. There are some things, probably many things, that are still better done by people who have the experience and qualification to follow the rules safely. I see from research that was done on ferry operations in Norway, in some cases, break the rules for safety.</p>
23	If the autonomous is, implemented, it will affect human interactive. Many seafarers will have no job and unemployment will be high in the world.	<p>Thank you for your comment.</p>

24	<p>How to avoid the incident if all the ships worldwide become autonomous? What is the function of seafarer thereafter? Is it possible that in 2050, ships will become all autonomous?</p>	<p>[Mr Duncan Duffy] In some ways, it is desirable to have either all autonomous ships or no autonomous ships as the decision making requirements become simpler. Due to the CAPEX multipliers when the systems can no longer rely on direct human interventions during abnormal conditions, un-crewed autonomous ships is a technology step that we are unlikely to see in all maritime applications within the 2050 timescale. It is more likely that technology solutions will be adopted that support reductions in crew numbers and that work together with reduced crew numbers to operate the ship as a safe system.</p> <p>[Dr Gu Hai] It is important to appreciate the distinction between the terms "autonomous" and "unmanned". In the near to medium future, our outlook is that ships will largely still be manned, with exception of some smaller vessels in sectors such as Harbour tugs. However, many vessels will see an increasing number of functions performed autonomously by machines and computer systems.</p> <p>Implementation of autonomous functionality without compromising safety requires a deep understanding of onboard operations, the behaviours of the ship and its systems during both the design and engineering phase. This is where the input from the knowledge and experience of seafarers will be crucial.</p> <p>At the same time, there will be an increase in the collection of operational data and use of data analytics tools in improving the safety and operational efficiency of ships. With the implementation of smart and autonomous functions, the skillsets of seafarers would need to be upgraded to keep pace with new technology. ABS has been leading the call for the industry to make the development and dissemination of digital skills among seafarers a top priority.</p>
25	<p>Listening to all the presenters, it appears to me that Collaboration will override the commercial Competition among different classification societies to meet the challenges of CO2 and GHG targets, realisation of the autonomous commercial ships, and acceptance by the society of the new normal in the aspects design, construction, operation, and classification...leading to convergence and consolidation, and centralization.</p>	<p>Thank you for your comment.</p>
26	<p>Question to Cristina: There is a certain understanding that this Paradigm shift (Digital Transformation + AI+ML) will happen step by step as the stakeholders start to see the value. In the market, we have advanced detail engineering software (like Smart 3D from Intergraph) which enables rich model information including Design & Fabrication. My question is, in your view, what would be the one use case that is not there yet but will appeal to the reasoning of major stakeholders if not all to make use of such rich model information?</p>	<p>[Ms Cristina Saenz de Santa Maria] Software for detailed engineering is indeed creating content rich models with large amount of information (eg geometry, properties, arrangement, and possibly information about intended use and functionality). As such, the digital twin models for complex system simulation are subsets of the complete (rich) engineering model.</p> <p>Many engineering software today are able to export system simulation models as FMUs (functional mockup units) following the relevant international standard (https://fmi-standard.org/). Then these exported models can be used in a variety of system simulation tools incl the Open Simulation Platform (www.open-simulation-platform.com), OSP. DNV GL plans to make soon available OSP technology in an easy and convenient to use environment.</p> <p>If the customer is interested in a demo of OSP, do let us know.</p>

Panelists

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