VODCAST

ABB Decoded: How ABB Dynafin™ could transform marine industry efficiency.

Janne Pohjalainen, Global Product Line Manager for ABB Dynafin™, discusses how ABB Dynafin™ could transform marine industry efficiency.

Anthony Rowlinson: Hello and welcome to ABB Decoded, the podcast that tries to press pause on our fast-moving lives and to make sense of the technology and trends that are shaping our world.

I'm your host, Anthony Rowlinson, and if you can hear a little background noise, that's because we're recording this episode on the waterfront near Helsinki in Finland where we're come to meet Janne Pohjalainen, who's Global Product Line Manager for ABB Dynafin. Dynafin is a revolutionary marine propulsions system, currently being developed by ABB Marine and Port and it promises dramatic gains in efficiency and vessel maneuverability among other benefits.

It takes its inspiration form the body movement of whales but is also an extremely complex system of mechanical engineering and automated control. So let's hear more about how ABB Dynafin works and how it is already inspiring new concepts for marine design.

Janne Pohjalainen: My name is Janne Pohjalainen, and I'm working as the Global Product Line Manager for the ABB Dynafin™ propulsion systems.

AR: Fantastic. So we're here in Helsinki on the waterfront, a perfect place to talk about a marine product. Could you explain to us in broad terms, what Dynafin is, and perhaps why it's such a revolutionary product idea?

JP: Sure, so ABB Dynafin… it is a propulsion system meant to move ships, boats in the water. But in contrast to traditional propulsion systems, which dominantly are using screw propellers – I guess you well know that the typical screw propellor, rotating under the ship kind of in a horizontal position and then moving water and moving the boat. But in this case, it's quite different what we are talking about with ABB Dynafin. So ABB Dynafin, we have this big disk, big wheel, which is aligned with the ship's bottom, and then we have a number of vertical blades coming out of this wheel, and then we are rotating the big disk, and then these individual blades are controlled by a control system and motors. And they are creating the thrust, which is then moving the ship. And the really the point, the radical part of the stuff here is that by doing it in this different manner, we are creating totally

another level of propulsion efficiency. So it's about radical efficiency gains, reducing emissions, but also providing really accurate control of the ship. So the maneuvering agility, and accuracy is great with this solution. And as a bonus feature, we are also able to provide good comfort levels, to the ship operators, but also aiming to have really low underwater noise levels. So it's kind of a package of, I would say, another level of features in comparison to the traditional screw propeller propulsion.

AR: It sounds fascinating. And if I understand correctly, you've looked very much to the past, even to nature and the evolution of whales to actually develop this system. So could you explain how that works?

JP: Yeah, I guess if we take it a bit in a broader terms… nature, typically is pretty smart in producing, creating efficient and smart solutions. So I think, as a similar case, I think the aviation industry has already, for some time, looked at how birds are flying, what kind of wing structures do they have, and there has been some bio-mimicking going on in there. And we are kind of moving on the same avenue here, but now in underwater and the marine propulsion. So our inspiration is coming from the whale fish movement, how the whale tail is used as a propulsion. I guess it's commonly known that whale tail or let's say, whale type of propulsion is really the peak in the propulsion efficiency. And then the question has been already for quite a long time that is it possible, can you somehow mimic or let's say, make that happen in a mechanical world by human and engineering activity? And that's kind of that avenue we are on – to take the whale tail movement and then make it happen with mechanics and control automation.

AR: And how is it that ABB has been able to move early in this sector and with this idea?

JP: That's a good question. Because people in the industry quite well know that it's not kind of a brand-new idea as such. I mean, the idea of this kind of whale-tail, fish-tail movement has been around for actually tens of years. There's a lot of theory about the type of propulsion. But the tricky part here is that it's not that simple to make it happen in real life. So actually, you have to combine a number of different competencies and disciplines to make it happen in real life. So, to name a few, it is really deep-end knowledge of hydrodynamics, what's really happening when you move these kind of foils in the water. But that's not enough: you have to be able to conceive certain mechanical structures, which are good for operation of tens of years. But then, I think the most interesting part here is really the automation and control side. So how to really control this kind of complex bio-mimicking trajectories.

And to your original question, ABB is kind of a unique company in a way and especially ABB Marine and Ports. We are actually working on all these disciplines already with our existing products. So we have really hardcore hydrodynamics specialists in our team, we are used to make complex mechanical engineering structures, like our current Azipod propulsion units. And then when it comes to the motion control automation, ABB is a big powerhouse of that kind of engineering. We are on the frequency converters, motion control robotics, that is actually our heritage, which we are bringing in also in this product. If you consider the industry, it's not such a common place that you have all these technologies and competencies within one house.

AR: And you mentioned Azipod, which is already as we know, a very well-established ABB marine propulsion system, but where is Dynafin in terms of its product evolution? How far are we away from seeing it being tested in the field?

JP: Yeah, so we are moving towards the let's say full scale units as we speak. But what is the current situation is that we are relying heavily on the CFD, that's computational fluid dynamics. So it's more or less kind of simulation work. But not only that, we also have model-scale real physical units, which have been tested in this kind of test facilities model basins – tank-testing how it's called in the industry. And also actually, in real life, in an environment like that. Just actually last week we were again conducting some, what we call lake trials. So we have this let's say, seven-meter long ship, and then model-scale, Dynafin units, two of them installed in the ship. And then we are doing the maneuvering tests… testing the control software. And that's real stuff. The only difference being at the moment that it's now this size, and not that size, what it will be then in the in the real use cases,

AR: It must be very exciting when you start seeing a product evolve like that. So how do you see its intended use? Where do you see ABB Dynafin being best used?

JP: Yeah, maybe, I would say there's a couple of ways to describe that what are the use cases. Maybe one practical way to talk about it is this kind of the vessel types, the ship types that we are aiming at, at least at the first phase. So we are really interested in providing this to ferries, these kind of short-distance shipping where we are having really high operating hours. And also we are moving to ships close to the, let's say population kind of in this kind of congested areas, close to the city centers, where of course the emissions are really of high importance.

Then on the wind industry, energy industry, there's a lot of vessel needs like SOVs – service operation vessels – CSOVs, that kind of energy segment vessels. Then there's a lot of interest in the small cruise industry, this kind of a smaller size cruise vessels. Of course, I would say that that yachting industry, which is typically looking for the latest and coolest technologies. There's also a lot of interest for that one. So I would say from the vessel type perspective, these are the key segments at the moment. Maybe from the size perspective to get an idea… so we talk about how initially that our unit sizes are between one and four megawatt propulsion power per unit. So that means that if we have anything from two to four units per ship, then it can be something between two and do 16 megawatts propulsion power, which translate that, for sure, we start with smaller boats, small and small, but less than 100 meters. Of course, they are not small boats anymore, I have a five-meter boat at my summerhouse but it's a little bit different size, already the smallest boat. But then the bigger ones, I think are somewhere between 100 and 200 meters. So they are really ocean-going vessels and ships already. So it's quite a, let's say, wide market we are aiming at.

AR: The Dynafin unit itself looks very revolutionary. It doesn't look like any conventional ship propulsion system. But could the use of Dynafin actually lead to changes in ship design or even revolutions in ship design?

JP: There is clear indications of that, that this is really inspiring the ship designers kind of beyond the current thinking, maybe some examples to be mentioned is that there's really serious thinking at the moment to talk about, for example, sail or wind assistance. And

the Dynafin propulsion has certain key features, which support that kind of thinking really nicely. And we have this kind of discussion that what would be the combination of a big sails, and then Dynafin, so that we would really kind of break the current rules, I'm thinking together.

AR That's almost like a “Back to the Future” approach. Because we're all aware of, you know, beautiful sail ships from the past, but you're talking about something that's inspired by a whale tail and wind technology that could perhaps be the future of some ship design.

JP: Yeah. And I think it also brings another topic on the table that if we would have been kind of thinking like this, maybe 10 years ago, even less, I mean, when the awareness of the emission avoidance or energy market would have been different, then I would say that the timing would not have been right. But I think considering now the targets, we are having to reduce the emissions and really take care of the greenhouse gas, let's say, challenges, there's a totally different kind of demand and pull for that kind of new, even revolutionary technologies. So it's not just the technology itself, but there has to be the need that the demand for it on the marketplace.

AR: You mentioned the efficiency gains of ABB Dynafin… is that something that's really framed the thinking for the whole product?

JP: Yeah, I would say that that's the hardest core of the product. So it's the efficiency gain, the efficiency delta against the normal propulsion systems. So maybe to put it in in figures, if you take a current good propulsion system utilizing screw propellers, in the industry, we talk about so-called open water efficiency. So, that is typically between 60 and 70 percent, kind of how much we can translate from the mechanical power provided to the kind of propeller to really moving the ship. So, from 60 to 70… 70 is already a really good achievement in this kind of vessel or ship sizes. And with the Dynafin, we are aiming at let's say propulsion efficiencies up to 85 percent. So, there is a huge, huge Delta there. So, I would say that is the most important differentiator here and value proposal we have to provide to the customers.

But as I mentioned earlier, it's not only that, but it is also then the combination of really quick reaction time, so to be able to maneuver very accurately in demanding sea conditions. And also then the potential to reduce the noise levels. Also, which is kind of a two-way avenue there, so that it's interesting for the passengers and crew onboard the vessel, but there's also increasing awareness that also the underwater noise is quite an important topic for let's say, sea life, sea mammals. So there's for good reason a lot of concern so what are we causing to the creatures below the surface when we are creating noise with the ships moving about.

AR: Could you expand on that a little bit this this, this point about marine noise pollution, which seems to be an emerging concern among many environmental concerns that we have at the moment, but that seems to be one that is going up the agenda.

JP: Yeah. And actually, I would say that ABB Marine and Ports has been really one of the forerunners on the agenda for a long time already. So… we didn't start the topic with ABB Dynafin. So, that that has been and is really core topic already with ABB Azipod propulsion systems, where we are really able to create benefit for the ship owners and operators and

for the sea life as we are able to fulfil even the strictest emission guidelines regulations by the classification societies. So it's let’s say, I would say long-term interest for ABB Marina and Ports to work on the underwater noise emissions.

AR: And going back to the conventional emissions, sort of fuel emissions and gas emissions and pollution… Where does Dynafin sit within that? What sort of gains could you potentially see with a with a fully kitted out commercial vessel fitted with ABB Dynafin? What are your projections in that area?

JP: Well simply put, if we kind of make the comparison between 60 to 70 percent propulsion efficiency versus up to 85 so then can we easily talk about 20 percent reduction in used energy and of course the energy you've never used is the best way to also avoid emissions, so there's kind of a really direct link to avoiding emissions with this kind of technology. But then of course there's the second layer of the topic that it's not just the direct emissions you are talking about, but if you can cope with let’s say 20 percent less installed power then actually you can use smaller main engines, you have less fuel tanks, you have less installed equipment on the vessel and of course that all kind of piles up to let's say total cost of ownership or tota,l let's say carbon footprint of the equipment manufactured for that kind of vessel so it has kind of this immediate fuel saving side but it has this kind of positive spiral for avoiding installed power and installed equipment.

AR: Janne, you mentioned earlier that one of the benefits of ABB Dynafin is the quick reaction time that a ship operator would notice in the actual use of the product and its thrust characteristics. Could you explain what that really means?

JP: So kind of where that is coming from is the fact that we are really actively able to control the movement of each blade during each revolution of the unit. So it's not a static propeller like the traditional ones. But we are really kind of able to track and control each of the blades during each revolution in real time. And then what it means for the operator is that we are really able to change the direction of the trust, and also the magnitude of the thrust, in really small amount of time. Roughly in one second, we can change the thrust direction and amount from zero to 100, plus/minus 360 degrees. And then, as a practical example, we have these wind energy sector, wind turbine, offshore wind park service vessels, and the one of the biggest values or let's say needs they have, is that they want to go to the windmill in as let's say, demanding weather conditions as possible. And of course, then the better accuracy of the thrust control you have in the vessel, then you can expand the weather operating window of the vessel. And of course, then, from the monetary perspective, if you can operate in more demanding conditions, then you can use the same asset in more days in a year, which then translates into more days andd that way, it's kind of a direct value to the operator.

AR: So if I understand correctly, what you're saying, would a Dynafin unit or multiple Dynafin units, enable a boat almost to turn on its own axis, like almost a pirouette kind of movement?

JP: Yeah, it is. The beauty of the Dynafin type of propulsion is that typically, if you have this kind of normal thrusters, then you have to mechanically rotate the whole thruster, if you want to change the thrust direction 90 degrees, then you have to rotate it. And they are big, heavy equipment. So it takes some time to do the rotation. But here, you actually don't have to rotate the whole unit at all because it is rotating already, as we go. But then

you just make a decision, how do you move the blades, which you do anyhow. And then if you kind of control the blades a bit differently, then the thrust direction changes kind of almost instantly. So let's say as a working number, in one second, which is a totally different approach to the thrust controlling.

AR: It sounds like a beautifully simple idea, but with some very complex engineering behind, is that fair to say?

JP: I think that's fair to say. I think that also relates to your earlier question, that why is ABB now the first mover with this kind of a product and innovation. And I would say that it is not an easy task to make it realize and it needs kind of, I would say, kind of a unique combination of different competencies. So there's fairly complex control engineering on the background, which we happen to possess in our company for a long time.

AR: And has Dynafin development to the to the current stage benefited from much of the knowledge that you've already gained with ABB Azipod, or are they completely separate projects?

JP: No, I think there's a really heavy link between the, let's say, Azipod world, and Dynafin. I mean, especially when it comes to the hydrodynamic studies. I mean, we have been investing a lot for that for the past 30 years. So we have a lot of in-house, let's say, competence and capabilities on that one, and then of course, without that, you really cannot move in this kind of field. But then when it comes to the control side, then I think we are really pulling in a lot of competencies from our advanced motion control businesses, robotics for that kind of businesses, where we have been doing this kind of accurate, real-time motion controlling also for decades. So kind of we are merging these kind of technologies together. And then maybe I could say that the beauty of this technology is that kind of the core technologies, which we are combining, they are really mature technologies. I mean, there's it's not the kind of rocket science at the moment to say that you have an accurate, motion controlled hydraulic motor with frequency converter, or we have a lot of knowledge on seal systems from the Azipod – so how do you keep water in the right place. Let's put it that way. So kind of the core technologies are really mature. But the unique thing here is that we are combining these kind of mature technologies in a quite innovative way. And that kind of gives you the edge of the innovation.

AR: And if you are being optimistic, how long do you think it will be before we might see a fully Dynafin equipped vessel taking to the seas? Because there will be a first ship…

JP: Absolutely. And that is, of course, the exciting day when we really are there. And we have a lot of discussion with the customers at the moment. And of course, that is one of the first questions that 'Okay, guys, this is great, when can we have it?' And at the moment, we are aiming to have the first pilot deliveries in 2026, in that timeframe. So let's say, kind of full size equipment would be kind of coming into realization already in '25. And then when we talk about the deliveries to the shipyards and first pilot installation, that we are aiming at '26 in that timeframe.

AR: So it's almost within touching distance?

JP: It is pretty close. And then of course, we want to keep the ambition level high, because, of course, we want to move as fast as possible, and then prove it in real life and really get

the first-hand practical experience from the unit. Because I think then that that is the key to really start conquering the market and expanding the delivery.

AR: So hopefully the next time we do an interview like this, and they will be sitting on the deck of the first Dynafin-equipped vessel to take to the seas?

JP: Yeah, I think that that's the latest point I would say that we have to be together, but I think there might be some interesting milestones available even in between.

AR: Okay Janne, thank you very much. It's been a fascinating chat. We'll conclude it for now. And I look forward to our next discussion.

JP: Hey, thanks for the opportunity to talk about really exciting and interesting topic. Thanks.

AR: And that’s all for this aquatic episode of ABB Decoded. If you’ve enjoyed it, why not like, share, and subscribe wherever you get your podcasts.

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