PODCAST

30 years of ABB's revolutionary Azipod® propulsion system

ABB Decoded

In this episode of ABB Decoded, we discover what it is about ABB's Azipod® propulsion system that has made it so successful and popular in the marine industry. This huge, complex, but robust and reliable piece of technology was born from the need to provide powerful propulsion systems for Finnish ice-breakers. And since the introduction of those early units, they have been refined to become ever more efficient and adaptable. They're now helping drive efficiency gains across the maritime sector.

Anthony: Hello! And welcome to episode six of ABB Decoded – the podcast that tries to press pause on our fast-moving lives and shine a light on the technology and trends that are re-shaping the world we live in.

I'm your host, Anthony Rowlinson, and in this episode we're going to be talking about one of the most revolutionary and influential pieces of technology that ABB has ever created. And although it's huge – and can be heavier than a fully loaded jumbo jet – it's something that's invisible most of the time.

That's because ABB's Azipod propulsion unit, which celebrates its 30th year of production this year, lives most of the time underwater, driving all manner of floating vessels.

This modern wonder of engineering has brought huge advances to the maritime industry, thanks to its efficiency gains, sustainability benefits and the increased maneuverability it offers any ship to which it's fitted.

And joining us to talk about this underwater wonder are two men who live and breathe Azipod propulsion: Jukka Varis, an engineer who has worked with the system from the very beginning and Ole-Jacob Irgens, who's also an engineer by training, but who now leads the sales and marketing initiative for ABB's Azipod systems.

There's much to explore around this fascinating propulsion solution, so we'll set sail with a quick engineering lesson on what exactly Azipod propulsion is, and how it works. Over to you, Jukka.

Jukka: My name is Jukka Varis and I'm currently responsible for the technology of Azipod Propulsion Systems, globally. And I've been working for ABB, over 30 years. So, I have much experience from electric machines and Azipod as well.

Anthony: Thanks, Jukka. Could you start by telling us what Azipod propulsion is – and give us a basic explanation of how these amazing drive units work?

Jukka: Okay. The Azipod propulsion is a huge equipment, which is like a rudder. I think everybody knows what a rudder is. And then if you imagine a gondola installed at the bottom of the rudder and put electric motor there. Electric motor that is big, that it can create the torque that is required for the large propeller. And then that pretty much is the Azipod.

And then you can compare that to an outboard motor. It looks pretty similar, but it's much, much bigger. Actually, the weight of the large Azipod is the same as a Jumbo Jet 747 when landing with a full capacity, full of people and full of cargo. So that's the kind of comparison.

Anthony: Wow! And large vessels can be fitted with several Azipod units, can't they?

Jukka: Yes.

Anthony: Okay, so it's fair to say that it's a pretty a sizeable piece of machinery!

Jukka: That's correct.

Anthony: And is it correct that one of the unique features of Azipod propulsion is that it works by making propellors pull a ship forward, rather than pushing, like a conventional shaft and propellor?

Jukka: That's right. And it actually is one of the main features, to create high efficiency. And the reason is that when the water enters the propeller, the water flow is undisturbed. This wakefield is, there is nothing disturbing it, compared to a conventional shaft-line propulsion where the shaft is protruding through the hull, and in many cases there is parts of the shafts and supports outside of the vessel hull. And they are creating turbulence to the flow, which then enters through the propeller and then the propeller is not functioning as efficiently. So, that's the big difference. And it's quite easy to compare that to a propeller plane. Well, most of those have pulling propellers instead of pushing.

Anthony: That's great, thank you. And could you tell us a bit about the underlying principles of how Azipod units work?

Jukka: It is simple in general. But the challenge is that there is so many different technologies included into one product. So, it actually combines conventional motor, the long shaft line, all the journal bearings and the supporting bearings from the motor to the propeller. It also includes rudder. And in many cases also for the larger ships, the stern thruster and steering gear. So, all these are packed into one unit. So, in general, it's an electric motor that rotates the propeller. And then that has just been integrated into this gondola unit. And then the rudder part of the whole Azipod can turn 360 degrees around its axis. So, then we are able to create thrust to any direction. And by that, having much better maneuverability of the vessel and such characteristics.

Anthony: And this maneuverability aspect is one of the key features of an Azipod unit, isn't it?

Jukka: Yes, it is. On top of the fuel consumption savings, but the maneuverability provides accessibility to certain ports and especially these large vessels. And I can use an example from the cruise industry, that some of the largest ships couldn't even be built, or they couldn't be operated without Azipod. So,

earlier there was some size limitations for the vessels, but nowadays they can build much larger ships and still can handle those safely on ports.

Anthony: So, it's more than just a drive system if you like – it's actually something that benefits the ship handling and the nautical qualities of the vessel?

Jukka: Yes. And that's actually the main characteristics and main points for the Azipod to succeed. That it saves fuel and it provides additional safety, and maneuverability features.

Anthony: And I guess this is why ship captains like it so much. Because they seem to be very fond of the Azipod unit.

Jukka: Yes. And we've got some feedback from some captains and whenever they have had experience with Azipod they don't want to get back to conventional ships.

Anthony: One of the key attributes of Azipod propulsion is that it can be adapted to suit almost any kind of ship. That's because its design means the drive units lie outside the hull, so ship designers are given more space and freedom to be creative. We asked Ole-Jakub Irgens to explain some more.

Ole Jakub: So, in principle, any vessel can be equipped with Azipod propulsion because our product range is pretty wide. But in practical terms, there are some limitations~~,~~ but in terms of the product itself, it can really meet any requirement. The key drivers for Azipod development was originally around ice-breaking vessels, which you can imagine has a different set of requirements in terms of robustness and, and performance and so on. So, to make sure we have the optimal product in that area, we had to make a special range of Azipods that had higher tolerances for forces on the units that had a stronger focus on, you know, robustness~~,~~ throughout the design of the unit. Then you have another big market for Azipod traditionally has been the cruise industry

And then a third main category would be thrusters, their main purpose is to produce a lot of thrust to put, let's say, in a vessel that needs to be in a DP position. So basically, keeping course using the thrusters instead of an anchor. So, for those characteristics, again, you need a thruster that is designed for maximum thrust rather than maximum power.

Anthony: As we've already heard, Azipod propulsion has its origins in the need to create ships that could efficiently break ice. And this is where the Azipod story takes us to the frozen ports of Finland's capital Helsinki. Here's Jukka Varis again.

Jukka: Yeah. I'll give the very long story. The reasoning is that Finland is probably the only country in the world, where ports are frozen during wintertime. So, we don't have any ports available unless we have very good icebreakers. So, Finland has been well known of building icebreakers and developing icebreakers, and I'd say applying new technologies on icebreakers.

Diesel-electric propulsion is a must for an icebreaker because electric motor can create full torque or even over-torque with zero speed. So, in case the propeller gets stuck in the ice, then you can really brush it off. ~~S~~o, it needs to be diesel-electric propulsion, but then there had been also interest on mechanical thrusters because there were some experiences from thrusters that it has benefit. You can direct the propeller thrust to different directions and then by that, you can even keep the channel open. When you open a channel with the icebreaker, and then if you have a certain angle with these thrusters, then you can blow the ice blocks under the ice, and then keep the channel open a longer time.

And then there was this Helsinki shipyard and ABB, who was called Stromberg, earlier days. They were together with the Finnish Maritime Ministry together thinking, what could be the solution. And then one

said, because electric motor can create the torque, and we would like to avoid the gear between, why don't we just put the motor in the rudder.

But then we started thinking, and that was actually the time when it was invented. So, ABB together with Helsinki Shipyard built the first prototype unit, which nowadays is actually in a Finnish museum, the Maritime Museum in Turku.

Yeah. So, it's the smallest one that we have delivered. And then the breakthrough was when the Azipod unit was installed on that first cruise vessel. The results were overwhelming. Nobody could have imagined that this is so efficient, and so economical and has the maneuvering capability that they then discovered. And that was by the way, the first vessel with pulling propeller as well. And then the rest is history.

Anthony: In the three decades that have passed since ABB introduced its first Azipod units, its true efficiency benefits have become more and more apparent – not only in terms of fuel saved, but also in the context of broader maritime commerce, as Ole-Jakub Irgens explains.

Ole Jakub: We've done some calculations on this. And for instance, just to give a reference point since the first installation on a cruise ship, 25 years ago, we have estimated that, the industry has saved more than a million tons of fuel just for these cruise ships alone. So that's an example. Another angle to this could be that Azipod propulsion opens new opportunities, shipping lines, et cetera, that wasn't feasible before. So, a good example there, that is a big, big part of ABB's plan right now is to support the opening of the North passage, so that vessels can actually have a shorter route between Europe and Asia. And to do that, of course you need vessels with that can go through ice.

And the unique features of the Azipod enables that, and again, for the world fleet and, and, you know, the world overall concern for, for reduced emissions that could play a big factor. And as I said, a lot of container and cargo traffic goes from Asia to Europe. And by opening this route you could save many days actually in transport, which of course then will have a benefit. So, we have delivered several vessels with Azipods that are, are doing these voyages now. And it's very impressive. We have vessels that can almost plough through two meters thick ice with the Azipod units.

Anthony: As well as these already recognized efficiency savings, it seems that Azipod units are bringing further environmental benefits to the maritime industry, the full extent of which may not even be fully appreciated.

Ole Jakub: Another feature that we are working a lot on is underwater radiated noise which will be an increasing challenge in, especially in coastal waters. And we already see stricter legislation coming in for instance, here in North America related to underwater noise. In Europe, we see the same. And again, the Azipod there has its own challenges. You have a motor in the water rather than on board, but on the other hand, we have much less mechanical noise. So, that's another challenge area that I see can also become a great opportunity for Azipod.

Anthony: Could you explain what you mean by "underwater noise"?

Ole Jakub: So, underwater noise it's an area that we are continuing to kind of learn more about how it affects our environment. So, there is a big focus on reducing noise in the industry.

Anthony: So, given all the benefits of Azipod propulsion that have been identified, it begs the question: 'why doesn't everybody use it'? We put that to Jukka Varis:

Jukka: I believe that could be the future, but it just takes time. First there was only a few units and markets were quite suspicious of how does it work? And if, and when there were teething problems, there was more and more to discuss, and that these will not fly. But we have been able to, improve lots of different things in Azipod. And the market has been getting bigger and bigger and there is, approval from different ship types. It's getting, larger.

But it just seems to take time. And then also there has been competitors. There's been lots of different providers of podded propulsion. For some reason, ABB has been the only one that has succeeded with this product. And now let's see what the future brings. But I believe that the electric propulsion is the future propulsion anyway. And then podded propulsion is even better.

Anthony: And why do you think ABB succeeded when others maybe haven't?

Jukka: I think the biggest difference is that ABB is one company. All the technology that we are utilizing on the Azipod is coming from ABB. And some are different entities, but still ABB. Compared to the competitors who usually have had one company who is responsible for the hydrodynamics and mechanical design and the other company who is responsible for the electric motor and the drives, those parts. And then in case there's any problems, you can imagine that these two companies are then arguing, who is responsible.

Anthony: And once shipbuilders realized the potential benefits of Azipod propulsion, is it right that their designs started to incorporate the units from the outset?

Jukka: Yeah. First of all, the ship's hull lines can be designed in a different manner, but the biggest difference becomes from the internal parts of the vessel, you save lots of space. You can have more, productive space inside the vessel, whether it's a carrier or a passenger ship. And then of course the installation process is also different. When you install the Azipod propulsion system, you only have one interface. So, instead of having the very complex, and time-consuming alignment job for the main shaft and the bearings, and keep the vessel hull in position, you just plug the pod at the aft of the ship. And usually it can be done just prior to launching the vessel. So then there's also economic benefits for the ship builder.

Anthony: With electrification being a growing trend in in the maritime industry, it would seem that ABB's Azipod units, about to enter their fourth decade of production, have truly caught the wave.

Ole Jakub: We have some interesting projects now. I mean, just to mention one that I'm working on now, as a concept of, you know, these kinds of floating power plants where we're basically, you know, that it's not so much that these power plants are moving all over the place, but they, they need thrusters to put them in position and, and to keep them in position and then be able to move. Another interesting concept, you know, in the, I think we'll see opportunities in the fish farming industry, where-traditionally these fish farms have been quite fixed and moored and so on, but in the future, I think there will be, there'll be opportunities. And we have some projects also on there, where these kind of these installations are becoming bigger and bigger, and they need to be more flexible and maybe move out of the sheltered waters into open sea and then, and then move around and so on. Lots of new, interesting applications coming.

Anthony: Thank you Ole-Jakub, and gentlemen, thank you so much for sharing your passion for Azipod propulsion with us. That's been a truly fascinating insight into these mechanical giants that are revolutionizing the maritime industry beneath the waves. And that's all for this episode of ABB Decoded. If you've enjoyed it, don't forget to like, subscribe, and share, wherever you download your podcasts. Until next time.