Introductory Jingle
Innovate UK KTN, connecting for positive change.

John H
Welcome to this Maritime Innovation Podcast. In this series, we are going to be exploring the trending topics that innovators in the ports and maritime sector are always talking about. Following the success of Decarbonizing Ports and Harbours Innovation Network, we reaffirmed our commitment to decarbonizing our industries, including maritime, and a lot has happened since 2019. But the maritime sector is now rising to address large global and domestic challenges, as we transition away from fossil fuels, to net zero operations, along with ambitious plans to embrace automation, digitization, and striving to improve productivity and safety. We have assembled teams of leading experts in their fields drawn from our Maritime and Ports Innovation Network, to join us in discussions related to these grand challenges. My name is Mark Wray, and I'm the Buildings and Infrastructure Knowledge Transfer Manager at Innovate UK KTN. In this episode, we're going to be exploring how ports are becoming better connected, using cutting edge technology like 5G and the Internet of Things. I'm delighted to be handing over the reins to steer this conversation to my colleague and 5G guru, Richard Foggie, who's joined by some of those at the vanguard of 5G and IoT deployment in maritime settings. Richard,

Richard
Thanks, Mark. Hello, I'm Richard Foggie. I'm the Digital Economy and Internet of Things Knowledge Transfer Manager here. I'm pleased today we are joined by some experts within the industry who will be sharing their specialist knowledge with us. Now I'll get them to introduce themselves. We have two John's and a Simon. Perhaps if the John's go first, John Chaplin, could you let us know who you are and where you're from?

John C
Thank you, Richard. I'm John Chaplin. I'm the Director with responsibility for External Affairs and Special Projects at the Bristol Port Company.

Richard
Thank you, sir. And your colleague, John Harrison, who's with you.

John H
Hi, everyone. I'm John Harrison. I'm the IT Director at the Bristol Port. My interest today is about how we're going to deliver 5G across the port in a very realistic and usable way.

Richard
Thank you, John. And last, but by no means least, Simon Parry. Simon, who are you and where are you from?

Simon

Hi, so I'm Simon Parry. I work for Nokia, and I'm the CTO for our enterprise group in the UK and Ireland, which in normal person speak means taking the technologies that we developed for the big carriers, the big telcos and finding other uses for it, for example, wiring up ports.

Richard
Excellent. Well, great. Thank you all for your time and for coming along today. And thanks to everybody for joining us. So without further ado, we'll crack on and indeed this is a bit you know, who, what, why and when. So if I can start with the Johns, what did you do with 5G down at Bristol?

John C
Thank you, Richard. So the Bristol Port company was part of a trial sponsored by DCMS, the government body led by WECA, who's the Combined Authority in our region and with multiple participants from the region, including the universities, but very much led by Cellnex and a number of other innovative and forward leaning companies involved in 5G. So, having secured a DCMS grant towards work in the area, we looked at 5G and how 5G would work with the logistics chain, principally in anticipation of a freeport concept within the Greater Bristol region. So we were looking at how cargo comes into Bristol Port, particularly containerized cargo, and then how it might move through the port, through the various transitions from ship to storage, and then onto road or rail and then onwards to its final destination. Which for our particular use case, was considering your freeport concept with some location local to the region where manufacturing of raw materials might be embraced, and then those raw materials being returned to Bristol Port for subsequent export. So using technology provided by the universities, we undertook various physical works within Bristol Port to provide the necessary infrastructure, including cabling, 5G masts, various repeater stations, etc. Then using that equipment, we were able to track cargo down to a fairly small size effectively, boxes that sat on various pallets, being moved around as cargo within the port. And we were able to track that cargo all the way from Bristol Port, down the M5 to the gravity site which is a potential freeport or manufacturing facility at Junction 23 of the M5 where the former MoD site at that location is being redeveloped for future use and some potential manufacturing facility. The testing that was undertaken proved the concept of being able to track that cargo, all the way through the port and all the way down the M5 to the gravity site, and then effectively being returned up to the port. Whilst having established all of that 5G infrastructure within the port, we took the opportunity to test various other use cases, which included using drones to add to our security provision. So Bristol Port is not unique, but we are unusual in that we have our own police force - a constabulary of 40 police officers who provide security within the port. But checking our boundary which is several 10s of miles long, then the opportunity to actually use automated drones was proved using 5G technology in real time. So staff could actually sit in an office and monitor the drone as it flew over our boundary. In addition to that we looked at other use cases, for example, the opportunity to use a drone based on 5G technology, which would then take potentially life saving materials, whether it be machinery or drugs to a particular location within the port far quicker than an ambulance or other facility could undertake that particular role. Again, using drones and 5G technology, we tested how we could actually look at particular parts of the port and provide us with views for example, on the seaward side of a vessel where, for example, a fire incident might take place which wouldn't be visible from the shore. But using 5G drone technology, then we could actually look at how that might work. So as far as we were concerned, a very successful test and trial. Clearly that 5G trial that we undertook

within the port proves that technology works. Our hope is that in due course working with other ports under the 5G tests that were undertaken across the country, we might marry that information together.

Richard
Fantastic. So indeed, primarily I think what you're describing is the principal business challenge was around logistics. But you then found that with that 5G infrastructure in place, there are other valuable use cases with surveillance, the seaward view that you could add on top of that.

John C
Indeed, and we're aware Richard that clearly the ports are participating in the DCMS trials and they're looking at other opportunities. And in due course, hopefully Bristol Port can benefit from those trials, for example, the ones at Felixstowe, which we know are looking at how cranes operate and how the maintenance of cranes can be addressed more accurately and properly by the use of 5G.

Richard
Indeed, you must also compare notes with the 5G CAL people up at the Nissan plant. Autonomous 42 tonne vehicles. Indeed, yep. Thanks very much for that. Indeed, if I might turn to Simon, beat that! What have you been up to? I think you've been a bit involved in quite a number of deployments across Europe, also in the UK. And Southampton. Southampton, I think is the jewel in the crown, or is that, what are the jewels in your tiara?

Simon
Okay, so the deployment of cellular technology with a 4G or 5G in a port environment has pretty much followed the regulation, it's followed the regulation about where you can get spectrum, and it's rolled out in countries around the world. So, you know, we've done large port operations in the US because of the CBRS spectrum over there, lots in the Nordics because stuff is lightly used, you can get specific site licences. John mentioned Felixstowe, which was actually some spectrum taken from mobile operator, but the UK is pursuing a sort of different track to everyone else, which is that we've got 5G spectrum and we've got 5G spectrum under a licence that makes it attractive for these sorts of modest camper sea sort of port sized operations and the UK is leading the world on that. Germany is coming along with us. And it's looking like the whole of Europe is looking to follow the example that we're setting here. So the projects that we've been doing have been coloured really by what you're allowed to do, from a regulatory perspective. You know, as John was saying, 5G, in the consumer market, is at the beginning of its trajectory. And along comes the devices. You spoke about some of the IoT challenges at Felixstowe, and there's you know, as the market matures, stuff becomes available. So we've gone a lot further in 4G, and have, you know, autonomous straddle carriers running around a port, several ports in Finland that, you know, you mentioned the 42 trucks, we've got, you know, the straddle carriers, the things moving the containers around, already wired up, connected, originally, as John said for one purpose, but then you find another one and another one and another one and another one, you find all these things are to throw on a network. Where we started this conversation before we started this podcast, what we were chatting about was Smart Sound Plymouth and Smart Sound Plymouth is another UK government funded exercise to look at, if you put it to seaward, and put it on the sea side of things. And you put a 4G network and a 5G network

around the whole sound at Plymouth. What could you do with it? It's experimental and you've got people, you know, doing stuff above the water, below the water, sensor networks, you've got ships driving themselves off to North America. You've got all kinds, I think the 60 use cases they're running at the moment, because it's free to access, they'd love you if you've got an idea, come along, try it. The Smart Sound Plymouth team would be very excited about that. In terms of commercial and practical stuff, Southampton, which is where you started, Associated British ports, Southampton have put in a 5G private network and are using it in anger today, to unload ships. It's essentially that they've got all of the data sitting in their database at their nice warm, dry offices at the centre of the port. Then you meet the reality of working dock-side and landside where it's wet and salty and awful and tracking stuff in and off the ships. They wanted to use barcode scanners into the longreach QR scanners just to pick up where they were putting stuff. It's a mixed operation port. And they just lost stuff. It's in their port somewhere. As I think John was alluding to, as a major use case that I think the figure that I see bandied around is 4% of stuff is currently lost in a port. It's in there somewhere, we're just not entirely sure where. So this, whether it's you know, John says active GPS driven tracking and going and finding stuff precisely where it is, or just logging when you pick it up and put it down so that you know where you put it down last time. There's a whole scanning with barcodes and which parking space you put the vehicle in. There's a whole lot of different technologies, but they all rely on connectivity out and about in the wet and nasty area that is the port.

Richard
Indeed, I don't feel so bad about that 4%. It could be worse, you could be in construction, where 10% of stuff on site can't be found.

Simon
Okay, but I'm not putting GPS trackers on sound though.

Richard
No, one of these days, we will do it by the grain with natural surface recognition or something but not today. Yeah. Interesting. And thanks for bringing up spectrum and sort of the UK's you know, idiosyncratic, well we do it our way, don't we? How do you deal with spectrum in these sorts of projects? Simon and all the Johns please.

Simon
Okay. So Ofcom has been extremely generous. Through a couple of you know, what's it now, three years that it's been available, they have a specific licence called a shared access spectrum licence. What they mean by shared access is that it's shared geographically. So you have exclusive rights to that spectrum in your location, but you don't in the neighbouring location. It's very cost effective, a few hundred pounds per mast, a year. It's very easy to get in terms of the paperwork. Yes, it's still a paper PDF form you have to fill in, but it's not difficult. The challenge for Ofcom is they have one shot to give this away. And they are trying to feel their way through what's the fair way of sharing it between everybody who wants to use it. So they've come up with these ideas of low power and medium power licence. Ports tend to be in the geographic regions where you're only allowed low power and a low power licence means your masts have to be really close together, which is not particularly cost effective. But Ofcom are up for a discussion and if you can state your case, as we did at the ports of Southampton, they've let us use higher than low but lower than medium powers, a

sort of low hybrid medium power. I don't know what you want to call it, but because we could demonstrate that there was one person occupying a piece of space, we weren't going to leak outside the space, we weren't going to interfere with any neighbours, we were allowed to use higher powers in an urban area inside the fence. And that's what made it economic and allowed us to have mastered sensible spacing.

Richard
Absolutely, yeah, I found Ofcom to be rather sporting. Particularly around experimental licences as well. Okay, a different matter when you want to put it in commercial operation.

Simon
Experimental licences are great for trials and demos, but you're not allowed commercial operation on them, whereas with the shared access spectrum, you can. John, I'm not 100% familiar with Bristol, do you know what sort of licence you operated under?

John H
No I don't as it turns out, because we're just sort of dipping our toe in the whole 5G spectrum exploitation and we're latching on to the sort of external providers for 4G / 5G. So we are simply just looking at, because not so long ago, we were still looking at Wi Fi with some carefully positioned access points aiming at our container gantry cranes. And lo and behold, when you stack up loads of high metal, ISO container boxes, you lose connection, and we were getting constant 2am phone calls from our network department saying we can't get connectivity, therefore, we can't unload the shipping container off this vessel. So what we've done rather crudely, just to sort of prove the experiment, is just throw a load of dongles in everything that requires connectivity. And guess what it's working. It's spit and sawdust, but it works really well. So it's kind of adding value to the fact or adding an awareness that 5G/ 4G is the way to go forward. So my dad's got a lovely expression: fitted for, not with. So if we're going to use 4G, we should fit 5G, because it's coming, I'm sure version six will be down the road not so far away, and we'll already be behind the drag curve. So we're just using our 4G, at the moment, because we're quite low latency, low speed at the moment, we're starting to explore, we're giving supervisors on the key walls tablets, so as vessels are coming off, and they're doing their returns, it's real time. And as you were saying about the lovely warm offices, we'll have people looking at whether it's Power BI or some other metrics, some other KPI looking at that incident and they can see when vessels are coming off, when shipping stops coming off ships, so that we can predict when they're going to go out because we're tidal, so we need to have that accurate information going forward. So we don't know, is the long answer to your question about that. But we've got BT and Cellnex, as other John sort of alluded to, that we've been engaging with. So we're just on that lovely voyage of looking at what port of Lisbon is doing, looking at what Southampton, Tyne and all the others are doing and figuring out what's our sweet spot for developing? We know it's coming and we will adopt it at some point. But how far do we go? Do we want drones? Do we want handheld scanners? 4G? Do we want wearables, near miss safety CCTV cameras monitoring stuff coming off, to the seals on ISO containers and things like that really?

Richard
Thanks for that, indeed that nicely illustrates the choice of approach that you can have. Yeah, you can go with a major vendor, a BT, someone who's got loads of spectrum in the bank, and they'll take care of all that for you, and particularly the non-standalone, so if you're

using 4g as well, why wouldn't you? I suppose the downside is there is a bulkier kit to install than what you have. But yeah, non-standalone is good, solid enterprise stuff.

John H
But the customers are demanding it as well, a little bit. So the car manufacturers, they're even talking to us saying, we'll rent some space on the port and we'll set up our own network. But it takes nine minutes to download some software onto these cars that have come across from wherever they've come from. And can you do it in three? And then you get into tracking what's actually you know, so can we have access to a private network, so when we're driving the cars to the area that they're being stored in, they're downloading the user guides or their updates or whatever, so the customers are driving it and even so much as cruise ships start to come back in now after COVID, the ship's company will want connectivity, the customers coming off the vessels, because the vest, the shipping will want to have this lovely environment given to them and they're asking us can we provide anything.

Simon
I was just gonna pick up on the cruise ship one, because that's a really important factor in the decision making at Southampton, the fact that there's a cruise ship port and mixed goods port next to each other. And that was one of the challenges that they tried doing this barcode scanning using the public network. And it worked brilliantly, right up until the cruise ship turned up, at which point the network fell over with...

Richard
Everyone phoned home.

Simon
A couple of 1000 people who suddenly now are not paying the inflated roaming charges, and can actually use their things and have a huge amount of Instagram backlog to upload. Because the thing that was, that was why the private piece of Spectrum was good at Southampton. The other thing I've just tripped over myself talking about is that enterprise applications are all about the uplink, that typically you want to send data from the devices, whether it's video feed, or as you say, the wonderful database systems and Power BI, is that the data flow is the opposite way to the public mobile network. And the public mobile network isn't great at large scale uplink.

Richard
Typically a 3 to 1 ratio with one monthly upload.

Simon
If you're lucky, it's more like 10 to 1 in most of them. But it's very asymmetric and that makes some serious challenges for some of these use cases. You know John C, you mentioned flying drones around the other side of ships, that's great. But to get, you know, an HD video stream back over the network is quite a taxing challenge.

Richard
Compare notes with the video production people. They absolutely, they will tell you tales. Broadly, you can get about 50/50 without too much hassle. But taking it beyond there, the network timing goes on the fritz.

Simon
Well your ecosystem disappears, because no one's built the chipsets for it.

Richard
That too. Yeah, minor technical hitch. But of course, the beauty with a 5G network is indeed if you're serving these different customers, then you can slice the network. Early, early days yet on that, but yes, indeed. So if a client on your estate wants their slice, if you want to carve a slice because that ship is coming into a berth, and they're all gonna jump off and get on to Tiktok and what have you. Then certainly 5G has the architecture to enable that, to do it. Guys, was there anything in your projects you thought would be easy, but proved to be difficult? Or vice versa? Things that you thought: how are we going to get out from under this? But actually it didn't turn out to be problematic.

John C
Just from our point of view, just in relation to the actual trial that we undertook, timing was not good in that there were significant supply issues for some of the key stakeholders, just because of COVID and the repercussions of that, from a project direction point of view. It was difficult to manage the process, given the number of parties involved in our trial. It was challenging, but not impossible to bring those parties together. And just physical issues on site, trying to undertake a fairly complicated high tech trial within an operating port, with the challenges of security. Who's coming to the port? What are they doing? Are there conflicts with us trying to get on with the work? So yeah, brilliant trial to do, very successful insofar as proving the technology works and the particular use cases that we were setting out to prove, but just in terms of management time, leadership, and minor but slight inconvenience in our operations. That was our experience. Richard, thank you.

Richard
Okay. Very helpful. Simon, perhaps you've got more of a helicopter view.

Simon
I wouldn't disagree with any of those. You know, COVID has, you know, the repercussions are long, long of that. In terms of specifically 5G, the challenge is always devices, we're at the beginning and we haven't hit critical mass that there's a lot of things out there that don't come in a 5G variant, as John was saying. Because at Southampton, we're actually using XR20 smartphones as a gateway between Bluetooth and the 5G and there's a lot of string sealing wax, two box solutions that would be nice if it was one, with the associated battery challenges, but no one can buy them yet. The other one, and it's just basic physics that getting power and fibre into places through an operating port is distinctly non trivial. The amount of coordination that's required, you know, to get 20 metres, it's a very frustrating 20 metres sometimes, but we have to put the antennas there because we need it there, because that's the only other power level we're allowed to use. Or, you know, we've got to reach behind a stack of containers, etc, etc, etc. So the physical reality looks lovely on a nice CAD drawing. But, trying to make a hole in the ground is ridiculously difficult in practice. So, yeah, do not underestimate the challenge of physicals.

Richard

Okay thank you for that, sir. I think we're getting close to the end, so my final question is, I suppose this is specifically to the Johns, if you knew then what you know now, would you still do it?

John C
Absolutely. Yes, it was a great project to be involved in, it proved that we can coordinate a multitude of very different parties from innovative 5G driven companies like Cellnex, through to coordinating with the universities, which in our case happened to be Cardiff and Bristol, who had their own sort of agenda or being led by a local authority project manager. But certainly, the lessons that we learned, invaluable, great things to do, slight questions over, for example, at this particular stage, and John H can comment more, but return on investment for 5G at this stage. And as Simon alluded to, those issues of the inconvenience of actually putting in the network and the trials, the tribulations, you know, blockages in existing BT ducts within the port, massive issues to overcome in the circumstances. But yeah, absolutely, we would do it again, great lessons learned. Great teamwork, great project to be involved in.

John H
Yeah, and that's from my side, I sort of start off from where John C left it there with the, for me, it's an education piece to the owners of the port, because we are a private port, and the return on investment that John sort of hinted out there is we had to sort of, we've got to take them on a bit of a learning journey as well, to understand what the art of the possible is. And I think John C's work was instrumental in underpinning, where I can then take a step forward from that for the port and the owners to say, here's all the things we can do. But here's a very real roadmap, which will add real value and at a pace where they're happy to spend, and we're happy to develop. And that's sort of echoing Simon's bit about saying, well, you are digging up a hole in the road, it's gonna impact operations, is that right? don't dig it up twice. And you have this real challenge in planning this piece of what's your 5 year, 10 year even, plan of 5G. And by the time you've got to a point where you've laid everything in place for 5G, are we looking at the next 6 and 7 and so. My dad's old "fitted for not with"? How far do you start looking forward to offsetting 6G and whatever else is coming around the corner. So that's the lesson for me is to understand where we're pitching and how to go about putting the infrastructure in place to support it, without actually then having to unpick that infrastructure five years down the line.

Richard
Absolutely. So have a vision, but keep your eye on the details. Thank you. Thank you, John C, Simon and John H for joining me, we appreciate you taking the time to share these valuable insights with us. Thank you for joining us, and make sure to check out the rest of the podcasts in this series. Also, make sure to take a look at the Maritime Imports Innovation Network section of the Innovate UK KTN website for the latest funding opportunities, news, announcements, and events to get involved with, within the sector. Finally, a massive thanks to our podcast guests, make sure to reach out to them and check out their organisation websites. Thank you.

Outro Jingle
Innovate UK KTN, connecting for positive change.