UNITED STATES OF AMERICA

NATIONAL TRANSPORTATION SAFETY BOARD

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Investigation of: *
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POSITIVE TRAIN CONTROL *
SPECIAL REPORT *
REPORT No.: DCA21SR003 *
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PTC INTEROPERABLE TRAIN CONTROL WORKING COMMITTEE - Q&A SESSION

Via telephone

Tuesday,
November 2, 2021

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I N T E R V I E W

MR. MANUTES: John Manutes. I'm an NTSB rail accident investigator. Today is November the 2nd, 2021. And we are meeting virtually via GoToMeeting today, to do a question-and-answer session with the PTC Interoperable Operations Working Committee. We're doing this question-and-answer session in conjunction with NTSB's Special Investigation Report regarding PTC systems.

The NTSB reference number is DCA21SR003. This is being recorded. We will transcribe and provide a copy to all of you for your review. The text transcription will be placed in the docket for this report.

So this is a highly modified part. I don't think that we need to do -- Ruben, do you want to do introductions around the whole room all over again? I was imagining what we could do is, the NTSB, we can read ourselves into the record, first name, last name, title. And then whoever answers a question, maybe the first time read your name and title into the record. Otherwise, I don't know how we're -- the transcriptionist will keep track.

MR. PAYAN: I think that’ll work best. Yes.

MR. MANUTES: Okay. So let me start. The three of us will do sort of an example of how we want to do this. And then whoever answers the first question, we might just remind you to do a simple first name, last name, and title. So like I said, my name is John Manutes. The spelling of my last name is

M-A-N-U-T-E-S. And I am an NTSB rail accident investigator on this report. Ruben.

MR. PAYAN: My name is Ruben Payan. P-A-Y-A-N. I'm an electrical engineer with the Office of Railroad Safety, NTSB.

MR. MANUTES: Thanks. Greg.

MR. SCOTT: My name is Greg Scott. Last name is Scott, S-C-O-T-T. And I'm a rail accident investigator with the NTSB.

MR. MANUTES: All right. Thanks, guys.

So thank you everyone for meeting with us today. I know Ruben said that initially but, just -- I think we all need to say it on behalf of NTSB and our team here; we really appreciate you taking the time out of your day to talk with us.

Our goal is to get the information from the experts so that we can provide a good report as to what's coming down the pipe, and what recommendations, and what solutions are out there for the next generation of PTC. And you're the folks that are leading the charts, so thank you. I will pass it back to Ruben. And just with a final reminder that whoever answers the question, just spell your last name the first time, and let us know who you are each time. Thank you so much.

MR. PAYAN: All right. Well, thank you very much. So one of the areas that we've been looking at as far as PTC systems is operating at restricted speed, trains operating at restricted speed and catching up to trains ahead of it. So we're kind of interested in seeing if there's been any research or any

enhancements that are proposed down the line for PTC systems to either be able to operate in restricted speed a little safer, or to make the rear of trains, a marker in PTC systems. Can anybody offer anything there?

MR. PARRISH: This is Jamie Parrish from CSX, P-A-R-R-I-S-H. And we have some enhanced GPS technology that we're working on. And, you know, I think there's some caveats here that, before we speak on this topic, before we turn it over to the gentlemen who'll speak about it, is that we need to understand that -- I want you to understand more so than anything that, you know, this -- these projects that, or these topics that we're going to talk about is not anything that's going to be implemented directly tomorrow. And some of these projects are years to come and they're in development stages, some of them are in prototype stages, some of them have, are in the process of being tested. And so this topic here is our Next Gen-E-O-T which Ed Tilley from BNSF will speak on. And I'll turn it over to him to provide some information on that.

MR. PAYAN: Okay. Thank you.

MR. TILLEY: All right, thanks, Jamie. My name is Ed Tilley, Director NLC Signal Operations at BNSF. I focus mainly on PTC and Next Generation Train Control. Before I start answering the question, I want to be clear that we are speaking only on the ITC-PTC System. And there're several other systems out there so I can't speak for them but this is the one that we are talking about

to make that clear so we don't confuse our system with others.

So for the end-of-train device, so we have been working -- there have been several projects funded by (indiscernible) RND and then there's projects at AAR to develop the Next Generation End of Train Device that can provide position to the end of train. And that's critical to implementing end of the train protection. And now the issue with this type of system is that there are multiple vendors in this space that need to develop hardware, and then there are long-term issues for railroads that need to basically wholesale swap-out all of their end-of-train devices. So this is going to be a multi-year, long-range project. It's going to take 7 to 10 years. This is the estimate to be fully implemented. So we understand the importance of it and it has been in the pipeline for a little while already. So we have developed prototypes and are ready to publish interoperable specifications for this device. So that's the first step. And then it's just getting the vendors to build these hardware. So if you have questions, I'll be glad to answer them. But that being short, that's where we are with the End of Train devices or, and integrated with PTC.

MR. PAYAN: Okay. So from a technology standpoint, are the railroads leaning more towards the rear-end talking to the head-in, or the rear-end talking to other trains? And what's the benefit of either one?

MR. TILLEY: No, the focus is the end of train device is already in communication with the head of train so that the head

of train is where the onboard computer is in like computing power, if you will, and then better radios to broadcast to, either the back office or to other trains to announce its position. So it's not the end of train device that's talking to the other trains. That's hard to make close the loop as far as Safety Critical Software goes. So the answer for us is to have the end of train device speak to the head of train, and then it put out the broadcast of location.

MR. PAYAN: Okay. Interesting. Very good. Greg and John, do you have any questions for in this area?

MR. SCOTT: I can't think of anything right now. If I have something pops up, I might have to come back to it.

MR. PAYAN: Okay. Yeah, no problem. So moving on to the next topic, I kind of talked to Jamie already about it, most of it. It was switching operations in PTC territory. We had an accident out in Ohio, and it was restrictive mode. And I know that the committee has already made some changes. Is there anything further down the road that's going to affect this restricting mode operations that hasn't been implemented yet or being worked on?

MR. PARRISH: Hey, Ruben, Jamie Parrish here. So like we talked about a few weeks back, I would say that there's nothing specific in the pipeline short term to enhance the features that we have implemented already. Further, what we've done, we've implemented basically prompting notifications to the engineer that

provides notification that he or she is operating in restrictive state and reinforces that to them, you know, kind of puts it out there in their face so if they're, they're happen to be operating in restrictive state, you know, when they're not supposed to be, they would have to answer the prompt that's provided to them, and if they do not acknowledge the prompt but they, yes, they're supposed to be running in restrictive state, then the onboard system, PTC, would provide a brake suppression.

And like I explained to you a few weeks back, that logic and functionality currently is designed to prompt the engineer, the operator, locomotive operator, at five miles as they move down the tracks. And they have a few seconds to answer the enforcement, the prompt, and then the enforcement will occur if they elect to not answer, or they do not answer the prompt itself. So from a systems perspective, that's what we've implemented to support restrictive state.

MR. PAYAN: Okay. And I can't remember if I asked you before. This -- all the railroads are going to do the same kind of kind of enforcement or prompts, timewise?

MR. PARRISH: That's correct. Yes, sir.

MR. PAYAN: Oh, okay. So it's going to be -- okay. Well, very good. Okay. Okay. So the other topic that we were talking about was --

MR. SCOTT: Hey, Ruben? I'm sorry.

MR. PAYAN: Hello?

MR. SCOTT: I did have a question. This is Greg Scott. S-C-O-T-T. With the restricted mode, is there anything -- and I missed the interview that you previously had, but is there a cap on the speed that they can travel at restricted mode? Like say, you know, that they can travel at 15 mile an hour under or 20 mile an hour under in restricted, or is it just unlimited speed?

MR. PARRISH: No, sir. It's set to a configurable value, which right now it's, I believe it's set to 20 miles per hour, you know, pretty much for the industry. I don't think anybody else has a different speed. But it's, it enforces the restricted speed of the railroad.

MR. SCOTT: Okay. Thank you. Sorry Ruben.

MR. PAYAN: Nope. No problem. No problem. Good question.

So the other area we have has more to do with passengers than trains but some of these are on freight railroads. And it involves terminal passenger stations where we've had several accidents that the train has come in at restricted speed and instead of stopping at the end, they keep running and they run into the platform. Is there any work being done for end of -- terminal stations or for terminal tracks to be made targets for PTC?

MR. RICHARDSON: Hi. Good afternoon. This is Greg Richardson, R-I-C-H-A-R-D-S-O-N at Union Pacific. I'm the General Director of Operating Technologies Tier, and I'll make a run at that one. And, Ruben, I'll do this one by describing what

we have in place, what Union Pacific has in place in its Chicago passenger terminal. Union Pacific operates under an agreement with Metra in Chicago, operates a large number of commuter trains on a daily basis on three different lines out of Chicago.

Our Chicago passenger terminal there is a stub-end, 16-track, stub-end station under platform sheds with a bumper post at the end of the 16 tracks. And, you know, we've, like NTSB, we've had the same concern about passenger trains that get into that station. The nominal operation for those trains is that they stop three to six feet from the actual bumper post. That's far too close a distance to simply configure a stop at the bumper post location. No train -- the fidelity of PTC operation is such that no train would ever even come close to being able to make its normal intended stop.

But what we've done with the PTC System as it exists today is, we've been able to manipulate the track data and speed limits such that inbound trains encounter a series of speed restrictions that, in essence, allow the train to nuzzle-off to the three to six feet that I've discussed, but at the same time, enforce the speed of the train such that should any bumper post collision occur, it would be at a speed not more than two to three miles per hour. So there's some creative work with track data that allows that to happen.

I should also mention that the station is within the limits of a Main Track Exclusion Addendum as well for the PTC

Regulations, but at Union Pacific, I know at some others, we've been able to implement this configuration in order to step inbound trains down to safe speed but at the same time, allow them to continue their nominal practice of, you know, stopping three to six feet from the actual bumper post.

MR. PAYAN: Oh, okay. That's interesting. So this location that you're describing, are we still talking about aboveground where GPS and PTC get good signals?

MR. RICHARDSON: It's aboveground but it's -- there's a series of platform (indiscernible) that's there, so the GPS situation, it’s in an urban canyon as well as in a shed, it’s not underground but the GPS situation is not favorable at all. However, again, with, with recurring modifications and evolution in the PTC System, we've improved the ability of the PTC System to navigate for certain distances within very poor GPS areas. So we've been able to take advantage of that feature plus our track data configuration to provide that protection all the way to the bumper post.

MR. PAYAN: Oh, okay. You read my mind. That's where I was going. Has that technology been refined well enough to be able to bring in the train and be able to tell what track it's on, and over the switches and everything else, on like, busy interlockings?

MR. RICHARDSON: So again, the fact that in this particular case, the Chicago Pass -- Chicago Passenger Terminal is in an MTEA

and not all the switches, etcetera are equipped. And we've been able, through track data configuration, etcetera, to work past some of that. I think, you know, in some regards, there's many cases where this configuration would be available. There may very well be somewhere the distances and the configuration may not lend itself to this but I do know of this case. I know of a couple others where this type of configuration has been applied to protect that. I can't speak to whether it would work everywhere all the time.

MR. PAYAN: Sure. Sure. I understand. How about for the whole -- like, the station itself? Does doing this PTC target at the end bog down the whole, like does it tie up the whole, the host interlocking or --

(Crosstalk)

MR. RICHARDSON: That's a great question. So the answer is, we've been able, through a lot of experimentation and engineering, to find the right mix that allows the trains, you know, right -- we had three things. We needed them to answer and move through the interlocking, you know, without undue delay. At the same time, we needed them to be able to nuzzle up to the bumper post while at the same time, provide speed limiting that would result, you know, in a very minimal, you know, collision with the bumper post should one occur. We were lucky. We were able to find the right temperature portage to make all that comply to that if we have acceptable transit times through the interlockings there at

Lake Street.

MR. PAYAN: Okay. I understand. Yeah, that's a difficult area with all the switches, and very condensed operations.

MR. RICHARDS: Yes, yes.

MR. PAYAN: Oh, thank you. Thank you for that. Another topic, switching topics here, another topic we came across was as far as dispatching activities, we've had an accident --

MR. MANUTES: Hey Ruben, I think I'd like to go back before we jump completely off of this topic. Sorry, I was giving you a second in case we -- but before we -- I'm going to write down dispatch so we don't get too lost. But I've got a couple of follow-ups on that one if you don't mind.

MR. PAYAN: Sure.

MR. MANUTES: This is John Manutes at NTSB. Couple of questions. First of all, you mentioned main track exclusions. Can you help me understand besides end of track terminal type locations, where else do you have the allowed-for main track exclusion addendums? I mean, what other locations are those likely to be encountered out in the system?

MR. RICHARDSON: So the Federal Regulations 49CFR236.1019, I believe identify three different categories of MTEA. The first is what's called the Passenger Terminal Exception, which is as the situation we just described. The second is what's called a Limited Operations Exception. And these are places where there is freight traffic below a certain tonnage threshold, I believe it's

15 MGT, and there are four or fewer passenger trains per day.

Speaking for Union Pacific, we hold one Passenger Terminal Exception which is there at Chicago's, I just described. And we hold two additional limited operations exceptions simply in places where we have low freight tonnage and very low volumes of passenger trains. And I think there's a third, I can't remember what the third type of MTEA is right now, but certainly the two I mentioned are the most prevalent.

MR. MANUTES: Okay. That's helpful. Thank you very much. You -- sorry, I lost my note. So you mentioned the word, the term certain distances without GPS. I'm curious, what range is a good, sort of ballpark, for -- what certain distance is PTC currently capable of achieving after it loses, say a GPS signal, and it's sort of doing a, -- maybe you can even talk to how it does it. Some sort of dead reckoning without position-finding, without, without GPS. Can you talk just a little bit more about that?

MR. RICHARDSON: Sure. Sure, I'll keep it at a very high level. The -- there's two phenomenon that we worry about GPS. There's no GPS and then there's bad GPS due to faulty path and reflection. What PTC can do is, just as you said, it can dead reckon solely based on wheel tachometer input. And as you operate dead reckoning, the engineering design is that the system accumulates uncertainty right where, with each turn of the wheel, we're less certain about how far we've traveled simply because of wheel size computations, wheel slip and slide, etcetera.

And so what we do when the system has accumulated a certain threshold of uncertainty, as it's accumulating that uncertainty, it buffers its computations by that uncertainty. But when you hit a certain threshold, the level of that uncertainty is deemed to be so great that operation becomes unreliable.

The answer to your question about how far can we do that is some very small number of miles. Maybe some single digit number of miles --

MR. MANUTES: Okay.

MR. RICHARDSON: -- before that uncertainty starts to become impractical from a safety and engineering standpoint.

MR. MANUTES: Okay. So how is the system designed someplace like Moffat Tunnel, where you go in for a certain number of single-digit miles but you certainly don't want to bring the train to a stop in the tunnels for an unneeded reason, right?

MR. RICHARDSON: So that's a softball. Fortunately, the six (indiscernible) mile Moffat Tunnel is less than the uncertain limit on that on a daily basis. I mean, specific trains (indiscernible) Moffat Tunnel dead reckoning at PTC. The --

MR. MANUTES: Okay.

MR. RICHARDSON: That threshold is longer than any of the tunnels that are currently on the Class 1 networks. Where we have bigger problems are in, say, long canyons, like Glenwood Canyon and places like that where maybe the whole digit numbers of miles with intermittent coverage that we -- there's -- those are the

areas that are a challenge now.

MR. MANUTES: Is there a wayside supplemental solution, or how do you get through Glenwood then?

MR. RICHARDSON: The short answer is there's enough little opportunities for "GPS daylight" that we can reset the uncertainty counter we get through there.

MR. MANUTES: Okay. Okay. Interesting. Thank you. I really appreciate that. And then if (indiscernible) I don't mean to -- I really appreciate all your answers. That was really helpful. But I do want to pick on one, Drew, just for a moment. I'd love to hear -- I think I heard that Metrolink was on and I'd love to hear sort of their thoughts as far as getting into the L.A. end-of-track area or any other end-of-track situations and how Metrolink handles that, you know, real time today.

MR. HURST: Okay, this is Jerone.

MR. MANUTES: And to add to that since there's a big pause, to add to that, maybe, you know, what needs to be improved? I guess that's the focus of the conversation. So how do you do it today, and then what needs to be improved in the L.A. area?

MR. HURST: Okay, this is Jerone Hurst, Director of Communications at Signal Systems. Hurst, H-U-R-S-T. And what we do currently is very similar to what Greg Richardson described in Chicago. We have a MTEA as well as for Union Station, and we've done that exact same thing. We've used track data information to prevent striking a bumper post at a high speed. It's pretty much

the same exact thing that they did in Chicago. We've implemented it over a year. We've had it for a couple years here in Los Angeles.

MR. MANUTES: Great. Okay. Thanks. Thank you for that. I don't have any more questions, Ruben.

MR. PAYAN: Before Jerome gets off -- so do you use an actual signal there or transponder, or how do you mark the end of the track?

MR. HURST: It's using the information in the track database file. So it's the exact same thing that's done in Chicago.

MR. PAYAN: Okay. Okay. I see. Thank you.

So going back to dispatchers, we have this great PTC system, and it provides for protection of roadway workers out there. And we had several accidents where dispatchers lifted the authority without the workers out there knowing, in PTC territory. And so we identified that as a single-point failure where the dispatcher could take away a work zone authority without anybody knowing. And we were kind of interested and see what the industry was doing to, or if they were doing anything to identify that.

(Indiscernible) kind of talked to us about some -- down the future they were looking at tablets to issue, electronic tablets that the employee in charge would use, and he would actually see his work zone authority and he would allow trains to come in out of the work zone. And I think that would provide some kind of redundancy if the dispatcher removed the work zone authority.

Hopefully, he would notice that. But I'm kind of curious, is there anything different or any other approaches being taken for that?

MR. TILLEY: This is Ed Tilley with --

MR. ST. PETER: If I could jump in. Joe St. Peter. S-T-P-E-T-E-R, A.R. Law Department. I'm not totally sure this is the exact right group for that, dealing with, like NTSB's past redundant protections, recommendations, and whatnot. I feel like that might be something our operating folks might be more inclined to be able to discuss.

MR. PAYAN: Oh, operations would be more of the rules. I'm just wondering from a technology point if anything can be done within PTC, the system itself. Technology, not rules-wise, not operational procedure-wise. Just from a technology standpoint if there's any redundancy that's being considered or being implemented.

MR. TILLEY: So this is Ed Tilley with BNSF. We are and have been working with the FRA R&D folks on employee in charge terminals, we call it, and it's for strictly for work zones. And so for our work zone, the employee in charge would have control of when and when, and at what speed a train could enter his work zone for the day. That is under development. I think we are looking at software development and testing this, next year, 2022. And then -- but implementation, etcetera, requires hardware and further things, so it's at least a several-year project to get

this implemented across the industry, and specific -- would have to make a decision to do this.

But working on the technology and making it part of the interoperable PTC system, I think what you were talking about though is for -- this would not protect tracking time or anything like this strictly for work zones as defined by our rules. But for tracking time, etcetera, this function does not address that situation.

MR. PAYAN: Okay. Does it at least, does it provide like real-time information to the people out in the fields? Would --

MR. TILLEY: The employee in charge, he would have the terminal and his workgroup would work under his authority.

MR. PAYAN: Okay. Okay. So maybe it might provide some redundancy, maybe. Okay. Well, thank you for that. I appreciate that. So let's see, where are we at? So how about PTC systems and highway grade crossing warning systems? Is there any work being done to tie those two together?

MR. RICHARDSON: Yeah, hi. This is Greg Richardson with Union Pacific again. I'll take that one. Again, I'll kind of walk through that by a specific implementation that's in place today.

You -- I don't know if you're familiar with the Illinois High Speed Rail Program which is over a portion of Union Pacific's line between Joliet, Illinois, and St. Louis. But today, we have in operation, about a 225-mile segment on which there's about 250

crossings which are integrated with a PTC-based communications warning system start and health feedback system.

I don't know if you're familiar with what we and AMTRAK have going on out there, but that's in operation. And it's their product, again, primarily as part of the Illinois High Speed Rail Initiative, and it currently, today, supports 90-mile per hour passenger train operation.

What we have in place out there is the result of a lot of funding from federal and state authorities. And again, it's really one of the -- there's a similar, I don't know if you're familiar with what AMTRAK has in Michigan with their ITCS, or the system that they have in place there. What we have in Illinois is very similar to that but with a couple of twists. First of all, I should mention that all those 250 crossings out there have four-quad gates. They have vehicle detector routes. They have exit gate management. They have a whole array of, what I'll call, traditional grade crossing warning system safety appliances added to them.

In addition, the crossings are started by the passenger trains via radio. And per a directive from the state regulator there in Illinois, the starts on those crossings are sufficient such that, at time of warning systems start, a passenger train could actually detect a health problem and make a stop, predict -- and stop at that crossing if, indeed, that problem is present at the time of start. The result of that are some extremely long

warning times at those crossings, on the order of a minute and a half, and that's what it takes to create time and distance for a predictive stop, short of any issue there.

We sort of see this as a feasibility program. Again, you know, working with our federal and state partners who wanted to see this operation and funded it, we put it in place. It requires a very exorbitant communications demands. It has very exorbitant onboard processing demands, and it has, obviously, you know, very exorbitant communications and equipment configurations at each crossing. So it's a tremendously expensive operation. We're gathering a lot of experience on how well it works. We see, you know, in a world where block crossings are an issue, these long warning times are somewhat problematic. But again, that's a function of what the desires perceive is to, you know, it’s to protect a crossing that's fouled by a car or has some warning-system problem in it. Again, I would say we're learning a lot about the operational disruptions and impacts that come from this, as well as the technical feasibility, and processing, and communications demands. But it's very much, you know, it's something we're looking at but, you know, today, it's been very expensive and very demanding from a processing communications and equipment standpoint.

MR. PAYAN: Okay. Very good. So if I understand right, it seems like more of the work and the research is being done on the railroad side of things, the health monitoring and information to

the trains themselves. Nothing yet for the highway user.

MR. RICHARDSON: Correct. That's correct.

MR. PAYAN: Okay.

MR. RICHARDSON: This is very, very rail-focused.

MR. PAYAN: Okay. All right. Very good. Very good. I am -- was familiar with the ITCS system. I was with FRA at the time when that was being put in, so I got to see it as it was being implemented. And it was a brand-new system. It was very interesting.

MR. RICHARDSON: Yes.

MR. PAYAN: So with all these different topics that we've been talking about, what are some of the obstacles that the industry is trying to or needs to overcome? And I know money comes into it, but from a technology side, is the computers fast enough? Is the communication fidelity good enough? What are some of the big obstacles that have to be overcome for some of these enhancements to come into play?

MR. PARRISH: Hey, this is Jamie Parrish, CSX. I'll take that, and whoever, whoever else can jump in as well. I think, you know, obviously, the cost for the industry and to each individual railroad is a big impact. The, you know, having to work with multiple vendors, you know, and coordinate, you know, requirements with different vendors and the different railroads is a challenge that we have. And then the interoperability piece is also a large challenge. You know, developing the requirements in such a

fashion that it meets all the different roads operating requirements and needs.

And then, obviously, you kind of mention in there the hardware and the software. I mean, you know, trying to keep up with the, you know, hardware that -- that's sufficient for our needs now and then our needs for the future changes, I think are some of the largest challenges that we have in the industry. I don't know if anybody else has anything that I didn't cover.

MS. WILSON: Hi, this is Lisa Wilson with Norfolk Southern. W-I-L-S-O-N.

MR. PAYAN: Yes.

MS. WILSON: I would add that, Jamie touched on some of it, but we also, you know, a lot of times, just like with PTC, we needed industry standards for the multitude of vendors to develop to so we could ensure interoperability. And another obstacle for all of this, particularly right now with what we're facing in today's current environment, is some of the hardware shortages that we're seeing across the supply chain, and if the hardware were available for these things, you know, being able, everybody being able to get it to implement it.

And then, additionally, just the -- again, just like we saw with PTC, the resource constraints we have on our main suppliers and vendors to develop these things and get them through testing for us to go through testing phases for implementation. So they're not, you know, they're not unlike the challenges that

we've faced already with PTC.

MR. PAYAN: So some of the same problems are still around.

MS. WILSON: Right. Some things just don't change.

MR. PAYAN: Yeah. Right. How about the FRA regulations, are they flexible enough to allow you to test these new changes in PTC, or does it bog down the system, the steps you have to go through?

MS. WILSON: I would say that it doesn't. The regulations don't necessarily support a lot of innovation and implementation in an efficient manner. There's understandably -- you know, there's safety cases to be made for some of these products. And others, not as stiff a hurdle to get over, but I think the regulations definitely, some of them, were written years and years and years ago, need to be amended. We've talked about amending them to support innovation and moving forward with technology.

MR. PAYAN: Well, thank you for that. Yeah. How about -- is there any technology that we can, or are we looking at any technology from the European side or the Asian Railroad rail markets out there?

MR. PARRISH: Ruben, this is Jamie. I'm not familiar enough with that to say that the industry hasn't looked into something like that. I know here at CSX, we specifically have not in regards to PTC, to my knowledge, but, you know, I'm not sure from an industry perspective. I can't say whether there's a railroad that hasn't looked into it.

MR. PAYAN: Okay.

MS. BITTNER: Hi Ruben, this is Debbie Bittner with CSX. I would say when we work with our vendors, most of the vendors that we work with are global, and so they bring the innovation to the table from their global partners, if you will. So, you know, I think it comes in naturally from the vendors.

MR. PAYAN: Okay. Yeah. Yeah, that's kind of where I was trying to -- yeah, you're right. The vendors, yeah, they're more world conglomerates, so that makes sense.

MS. BITNER: Yes.

MR. PAYAN: Very good. Thank you.

John, Greg, you have anything to follow-up?

MR. MANUTES: You know what, Ruben, I don't think I do.

MR. PAYAN: Okay.

MR. SCOTT: I don't think I do either, Ruben.

MR. PAYAN: All right. Well then I'll conclude the interview and then -- don't leave yet. Let me conclude this interview and stop the recording.

(Whereupon, the interview was concluded.)

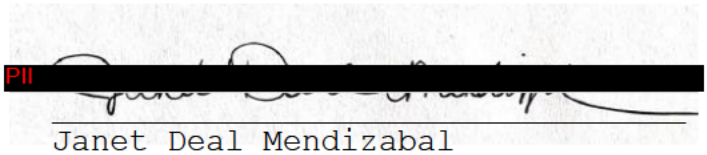
CERTIFICATE

This is to certify that the attached proceeding before the

NATIONAL TRANSPORTATION SAFETY BOARD

IN THE MATTER OF:	BNSF EMPLOYEE FATALITY IN LA MIRADA, CALIFORNIA ON OCTOBER 6, 2021 - PTC Interoperable Operations Working Committee Q&A Session
ACCIDENT NO.:	DCA21SR003
PLACE:	Via telephone
DATE:	November 2, 2021

was held according to the record, and that this is the original, complete, true and accurate transcript which has been transcribed to the best of my skill and ability.



Janet Deal Mendizabal
Transcriber