Ottawa Light Rail Commission

Desmond Ng
on Monday, May 2, 2022

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OTTAWA LIGHT RAIL COMMISSION

THALES CANADA INC. - DESMOND NG

MAY 2, 2022

--- Held via Zoom Videoconferencing, with all participants attending remotely, on the 2nd day of May, 2022, 2:04 p.m. to 4:21 p.m.

COMMISSION COUNSEL:

Christine Mainville, Co-Lead Counsel Member
Anthony Imbesi, Litigation Counsel Member

PARTICIPANTS:

Desmond Ng, Thales Canada Inc.
Maria Braker & Peter Mantas, Fasken Martineau DuMoulin LLP

ALSO PRESENT:

Joanne Lawrence, Stenographer/Transcriptionist
Laila Butt, Virtual Technician

-- Upon commencing at 2:04 p.m.

CHRISTINE MAINVILLE: The purpose of today's interview is to obtain your evidence under oath or solemn declaration for use at the Commission's public hearings. This will be a collaborative interview such that my cocounsel, Mr. Imbesi, may intervene to ask certain questions. If time permits, your counsel may also ask follow-up questions at the end of the interview.

The interview is being transcribed, and the Commission intends to enter the transcript into evidence at the Commission's public hearings, either at the hearings themselves or by way of procedural order before the hearings commence. The transcript will be posted to the Commission's public website, along with any corrections made to it, after it is entered into evidence. The transcript, along with any corrections, will be shared with the Commission's participants and their counsel on a confidential basis before being entered into evidence. You'll be given the opportunity to review the transcript and correct any typos or other errors before the transcript is shared with the participants or entered into evidence. Any non-typographical corrections made

will be appended to the transcript.

And finally, pursuant to Section 33(6) of the Public Inquiries Act, 2009:

> "A witness at an inquiry shall be deemed to have objected to answer any question asked of him upon the ground that his answer may tend to incriminate the witness or may tend to establish his liability to civil proceedings at the instance of the Crown or of any person, and no answer given by a witness at an inquiry shall be used or be receivable in evidence against him in any trial or other proceedings against him thereafter taking place, other than a prosecution for perjury in giving such evidence."

And as required by Section 33(7) of the Act, you are advised that you have the right to object to answer any question under Section 5 under of the Canada Evidence Act. Okay?

DESMOND NG: Okay. M-hm.

CHRISTINE MAINVILLE: Okay. So we can commence. Could you first explain your involvement

in Stage 1 of Ottawa's LRT project.

DESMOND NG: My role is the bid manager on behalf of Thales Canada Transportation Solutions, TCTS. My role is prepare the bid deliverables; which are technical, commercial, and price; and coordinate internally with Thales's functional departments to collect estimates and risks, et cetera; and then also support -- we have a number of internal gates for -- which are usually bid or no-go presentations with our senior management; and then also to work with the capture lead, the Ottawa LRT capture lead, on behalf of Thales in the preparation and submission of the documents. So I was involved in the Ottawa LRT bid, Phase 1, from December 2011 to approximately April 2013.

CHRISTINE MAINVILLE: Okay. And I might just pause because your video is frozen, even though your audio is fine. Do you know if you're able to restart that, the video?

DESMOND NG: The video... It looks okay from my end.

CHRISTINE MAINVILLE: Let's go off record for a sec.

-- OFF THE RECORD DISCUSSION --

CHRISTINE MAINVILLE: Okay. So --
DESMOND NG: Where did I leave you?
CHRISTINE MAINVILLE: So you were involved until April 2013. Did you have any --
DESMOND NG: Correct.
CHRISTINE MAINVILLE: -- further involvement after that on the project?
DESMOND NG: No. Once I handed over -- in a typical Thales process, once I -- the bid is awarded to Thales, I hold a hand-over meeting, which occurred, I think, on April 22, 2012, to the Thales Ottawa project team. So I hand over all the contract documents, decisions, and estimates and price, and after that, my involvement on the project is hands-off. So anything that happens after with the project, including changes in scope, is with the project team.
CHRISTINE MAINVILLE: And you said 2012, I think, but do you mean April 2013?
DESMOND NG: Yeah, I'm sorry. April -- yeah, handed over on April 22, 2013. Sorry.
CHRISTINE MAINVILLE: And so were you involved in the contract negotiations?
DESMOND NG: For this bid, no. The answer is no. But normally I do on other bids.

It's just that I was pulled off during the negotiation phase by my boss to work on some other bids, so...

CHRISTINE MAINVILLE: Okay. So do you know who took care of that for Thales?

DESMOND NG: It was the capture leader, Mr. Mario Peloquin, who is no longer with us, and then I believe a couple of the technical team in the Toronto office. I'm based in Vancouver, so...

CHRISTINE MAINVILLE: And was Mr. Dooyerweerd, Paul Dooyerweerd, involved in the bid?

DESMOND NG: I believe Paul was involved in negotiations, yes.

CHRISTINE MAINVILLE: Okay.

DESMOND NG: But I don't -- to exactly what was in the negotiations, I wasn't there, so I don't -- I don't have any record of meetings or minutes.

CHRISTINE MAINVILLE: Okay. Could you tell us a bit about your prior experience and background.

DESMOND NG: Yes. I have a computer science degree from University of British Columbia, over 40 years of working experience in software

engineering, project management, and business management. The past 18 years, I've been in bids and proposals with Thales, and I've been with Thales Canada for the past 25 years. I've worked over -- probably, in bids and proposals, over 90-plus bids worldwide and -- and at various industrial organizations, such as joint ventures, consortium, prime, co-contractor, and subcontractors organizations, so...

CHRISTINE MAINVILLE: So are you usually involved in the procurement phase or also in the --

DESMOND NG: Yes, always in the procurement phase, from -- usually, depending on the tender, from prequalification, RFP, question and answers, BAFO negotiations, and final contract.

CHRISTINE MAINVILLE: Okay.

DESMOND NG: Yeah.

CHRISTINE MAINVILLE: And were you -- have you been involved with other companies that provide signalling systems other than Thales?

DESMOND NG: You mean as a competitor?

CHRISTINE MAINVILLE: Yes, any competitor.

DESMOND NG: Yes. We always run in --

in all the work we do, it's usually the three or four big ones: Alstom Signalling, Siemens Signaling, Hitachi Rail signalling, and there used to be Bombardier, but they're out of it now, so the remaining is usually Siemens and Alstom signalling systems.

CHRISTINE MAINVILLE: So -- sorry. So you've worked with them on projects --

DESMOND NG: No, not with them. They're a competitor.

CHRISTINE MAINVILLE: Okay.

DESMOND NG: So we would submit a bid. They would submit a --

CHRISTINE MAINVILLE: Right.

DESMOND NG: -- competitive bid. Yeah.

CHRISTINE MAINVILLE: Okay. So what I'm wondering is if you've ever worked for another company that provides systems like this or only for Thales.

DESMOND NG: Oh, no, only Thales.

CHRISTINE MAINVILLE: Okay. And are you an engineer?

DESMOND NG: Yes, computer science.

CHRISTINE MAINVILLE: Okay. And have some of your other projects involved P3s? Have

they been P3s?

DESMOND NG: Yes. I've worked on a number of bids in Vancouver, Vancouver Evergreen Line and Vancouver Broadway Subway Project. Those were P3s with the Province of B.C. So funding came from three parties, tri-party: the Province of B.C., the Ministry of Transportation, and then the local regional authority. Sorry, the -- not -- the awarded proponent.

CHRISTINE MAINVILLE: Okay. And we've discussed this ahead of the interview, but you'll undertake to produce your résumé for us?

PETER MANTAS: Yes.

DESMOND NG: Yes, yeah.

CHRISTINE MAINVILLE: Thank you. Were you involved at all in industry consultations in the pre-bid period here?

DESMOND NG: For Ottawa LRT?

CHRISTINE MAINVILLE: Yes.

DESMOND NG: No, no.

CHRISTINE MAINVILLE: Okay. Can you tell us -- perhaps start with giving us an overview of how the procurement unfolded as it relates to Stage 1 of Ottawa's LRT, from Thales's perspective.

DESMOND NG: Okay. Around February

8th, 2011, there was a what we call Gate 1, and this is an internal meeting. It's a go/no-go decision for senior management to -- shall we pursue the Ottawa LRT opportunity? So the decision at that time, on February 8th, 2011, was a go: Yes, we will talk with proponents to go after the Ottawa LRT Phase 1 bid.

Then around the December time frame, we were in -- then started discussions with two proponents, Bouygues Travaux and also SNC-Lavalin, and we submitted prequalification documents to both companies at that time. And so it wasn't -- it wasn't to select one. We wanted to go with as many consortiums as possible to increase our odds of winning as a subcontractor for signalling.

On February 14, 2012, Bouygues sent us their signalling RFP package, and similarly, on March 19, 2012, SNC-Lavalin sent their subcontracting signalling package to us to complete.

CHRISTINE MAINVILLE: Okay.

DESMOND NG: So this is the formal RFP now.

CHRISTINE MAINVILLE: Okay.

DESMOND NG: And then during -- around

March, April time frame, we submitted a number of -- three offers to Bouygues on the RFP package, and then after -- the last one was around I think March or April time frame of 2012, and then after that, it was all discussions with SNC-Lavalin, so either Bouygues dropped us or we -- they went with someone else. I don't know why, but we just continued with SNC afterwards, starting from April 16th, 2012, which was a first initial offer to SNC-Lavalin, and the offer would be the -- a commercial -- the price and the technical for the base offer at this point. The -- later on would be the maintenance offer. And so from April 2012 all the way down to around August 2012, there were a number of submittals by Thales, and they -- there was price changes, scope changes, discussions, options, and finally the maintenance -- 30-year maintenance offer.

CHRISTINE MAINVILLE: So the maintenance, was that for the entire system?

DESMOND NG: The signalling.

CHRISTINE MAINVILLE: For just the signalling system. Okay.

DESMOND NG: It was only -- yeah. Only the signalling portion, yes.

CHRISTINE MAINVILLE: And who would -- who was the proposed vehicle provider for -- in relation to each of these offers to SNC or -- and Bouygues, or is that not something Thales would concern itself with?

DESMOND NG: At the beginning, with Bouygues, we didn't know, and we never did find out because they stopped communication with us. And for Alstom, on our initial offers, we didn't know until around middle -- I think it was around April -- August 29, 2012. That's when we started discussions with Alstom, and so we started scope split between our signalling system with the interfaces to the Alstom vehicles.

CHRISTINE MAINVILLE: Okay. What did you know about what the City's requirements were - like, the key requirements for the signalling system - at that point in time?

DESMOND NG: Yes, because they were flown -- flown down to us by SNC-Lavalin.

CHRISTINE MAINVILLE: And what were the key -- do you recall what the key requirements were that had to be met?

DESMOND NG: Well, the -- no, there were many, and we had a compliance matrix, so there

were hundreds of doc -- of requirements, and we had to actually provide a -- our compliance to those requirements for signalling. And our compliance matrix, Thales's compliance matrix, was part of our bid deliverables to SNC-Lavalin.

CHRISTINE MAINVILLE: Did you understand that SNC was part of a consortium at that point?

DESMOND NG: Yes, that's correct. Yeah.

CHRISTINE MAINVILLE: Was that the RTG consortium?

DESMOND NG: Yes. I believe so, yeah.

CHRISTINE MAINVILLE: So Thales didn't formally put forward a bid on -- in respect of another consortium, or it did on Bouygues?

DESMOND NG: Only two, right? The original was Bouygues.

CHRISTINE MAINVILLE: Okay.

DESMOND NG: And then SNC-Lavalin.

CHRISTINE MAINVILLE: Okay.

DESMOND NG: At prequal and also RFP phase, to both consortiums.

CHRISTINE MAINVILLE: Okay.

PETER MANTAS: Christine, did you

get -- I just want to make sure you got clarity on that. I may have misunderstood your question. I think you may have -- because remember Desmond also said that at some point Bouygues also was not -- they were not part of that bid. I'm not sure if you meant to say -- you know, you were referring to the prime as opposed to the sub. So I just wanted to raise that because when I listened to that question and answer, I think there may have been just been a lack of clarity about it, and I just --

CHRISTINE MAINVILLE: Sure. Well --

PETER MANTAS: -- for your sake -- sorry to interrupt, but I just thought --

CHRISTINE MAINVILLE: No, no, that's fair.

PETER MANTAS: -- it would be better to just deal with it now.

CHRISTINE MAINVILLE: My understanding is you are unclear about whether you guys dropped out or Bouygues decided to not go with Thales. Is that -- am I wrong?

DESMOND NG: Yes, yeah. The -- we submitted three offers to Bouygues, and the last one was on March 28th, 2012, and it stopped. So we did three offers on -- to Bouygues: March 16, March

21, March 28. After that, there was no further communication. I don't know why. Maybe the -- our capture lead knew. Maybe Bouygues dropped us; they went with another signalling supplier. I don't know why, so -- and --

PETER MANTAS: And, Christine, just to be clear, in other words, Thales was only on one --

CHRISTINE MAINVILLE: Yeah.

PETER MANTAS: -- bid to the City.

CHRISTINE MAINVILLE: To the City.

PETER MANTAS: So it wasn't on multiple bids in the end.

CHRISTINE MAINVILLE: Yeah.

PETER MANTAS: Okay.

CHRISTINE MAINVILLE: Okay. Could you tell me how -- or if you know, if you were involved, how the communication started with SNC, whether it -- whether Thales approached SNC or vice versa or how that came about.

DESMOND NG: I personally don't know. It's with our capture leader, because he -- he's responsible to win the bid overall, so I -- I -- I guess originally he went to the consortium to approach them, that we have a made-in-Canada solution, right? We're the -- we have many

systems, signaling system running for different signaling customers, so --

CHRISTINE MAINVILLE: Okay --

DESMOND NG: -- to prove ourselves, that -- I guess basically, you know, to hedge our -- win our -- improve our chances, he went to both consortiums, but he was the interface to those consortiums. I did not communicate at all.

CHRISTINE MAINVILLE: Okay. So do you have -- sorry, we're having a bit of audio issues, I think, but... Okay. Do you know whether SNC was in discussions with any other signalling system provider?

DESMOND NG: I personally don't know.

CHRISTINE MAINVILLE: Okay.

DESMOND NG: No.

CHRISTINE MAINVILLE: Do you know whether SNC was already in discussions with Alstom as the vehicle supplier or when it --

DESMOND NG: When we -- we only found out after we submitted our bids that SNC said they were going with Alstom, and so they wanted Alstom and us to communicate on the -- on the interfaces between our signalling system and the vehicle. So at that point, we knew they pretty well selected

Alstom as their preferred vehicle supplier.

CHRISTINE MAINVILLE: Do you have any knowledge of SNC or OLRTC, which was the consortium it was part of, first going with CAF as a vehicle provider?

DESMOND NG: The Spanish company? No. I personally don't know, no.

CHRISTINE MAINVILLE: You had no knowledge of that. Okay.

DESMOND NG: Yeah.

CHRISTINE MAINVILLE: So there were never discussions between CAF and Thales.

DESMOND NG: Correct.

CHRISTINE MAINVILLE: Do you recall whether Alstom entered the picture fairly late in the day? When you were notified that Alstom would be the vehicle provider, was that pretty late in the process?

DESMOND NG: No, because we did prequal to both companies, and they both were in the same time frame, around March 2012.

CHRISTINE MAINVILLE: So you mean Thales did prequalifications for Bouygues and SNC around that time.

DESMOND NG: Yeah, yeah. So we already

knew both were already in the game at that time.

CHRISTINE MAINVILLE: Do you recall who you were interacting with on SNC's side of things?

DESMOND NG: No. It -- I wasn't personally involved, but I know the technical team was on -- sorry, what was the question again, please?

CHRISTINE MAINVILLE: If -- like, who was your counterpart at SNC, if you recall?

DESMOND NG: That I don't know.

CHRISTINE MAINVILLE: That you would -- the main --

DESMOND NG: I -- oh, you mean, like, bid-manager-wise? No, I never spoke to SNC-Lavalin's -- oh, no. There was -- we submitted our package to a person -- it was the Vancouver SNC-Lavalin, SNC Western Constructors, in downtown Vancouver. So I did see some correspondence there, yeah, that we submitted our offer to that -- to the SNC office in Vancouver.

CHRISTINE MAINVILLE: And did you meet with the City directly at any point in time?

DESMOND NG: No, no. I've never met the City. And I've never met any of the consortium members personally, myself.

CHRISTINE MAINVILLE: Do you know if Thales met with the City at all during the --

DESMOND NG: Personally, I don't -- I don't know. I -- to be honest, I'm not too sure. I'm just subjectively saying -- we were subcontract, so we prob -- a subcontractor. I doubt we were authorized to speak to the City.

CHRISTINE MAINVILLE: Okay. So there -- when there were -- I want to call this the right thing -- there were vehicle design consultations with the City, the signalling system provider would not have been part of that.

DESMOND NG: If there were technical meetings - I don't know - we could have been there, but I wasn't present.

CHRISTINE MAINVILLE: Okay. And so you said that -- was it SNC wanted you to meet with Alstom? Wanted Thales to --

DESMOND NG: Yes, for the -- for the -- especially the onboard, the signalling portion of on the trains and specifically on the interfaces from our system with the rolling stock. Yeah.

CHRISTINE MAINVILLE: And we're talking about SNC. Was your understanding that you were always dealing with SNC in terms of the partners on

the consortium?

DESMOND NG: Yes, only SNC. Yes.

CHRISTINE MAINVILLE: Okay. So they were the ones effectively -- in terms of the consortium, they were the ones dealing with the signalling system --

DESMOND NG: Correct, yes, yeah. We did not deal with any other of the consortium members.

CHRISTINE MAINVILLE: Okay. And so when did you meet with Alstom about the interface?

DESMOND NG: I don't have a record when -- of those meetings. All I have is what we sent in our bid submittals, which included a Thales/Alstom vehicle scope split, and that -- when we did the submittal at that time, that was on August 29, 2012, so I would assume it -- maybe July, August time frame that we met with SNC-Lavalin also.

CHRISTINE MAINVILLE: Did you only meet --

DESMOND NG: The results of those meetings was updated -- well, not updated, but our Thales/Alstom vehicle scope split.

CHRISTINE MAINVILLE: Was there only

one meeting or several meetings?

DESMOND NG: I don't know.

CHRISTINE MAINVILLE: Were you part of --

DESMOND NG: Sorry. No, I was never part of that.

CHRISTINE MAINVILLE: Okay.

DESMOND NG: Yeah. I just got the results, which were to say here's the final agreed Thales/Alstom scope split as agreed, so -- and we bundled that and submitted it with our updated offer at that time.

CHRISTINE MAINVILLE: Do you know if there was discussion about -- with Alstom about how -- about the integration of the two systems, of Thales's signalling system and the rolling stock?

DESMOND NG: That would be, like, who is the system integrator of the -- of both systems?

CHRISTINE MAINVILLE: M-hm.

DESMOND NG: I can't remember if it was in the -- in a higher level scope split. Possibly. Usually we -- I would probably assume it's -- it's at the consortium level because usually it's -- it's signalling, rolling stock, traction power. They usually add it at the proponent level.

CHRISTINE MAINVILLE: Do you recall if the consortium had anyone in that role?

DESMOND NG: Specifically no, but I would assume that -- I would assume that's what we assumed because that's our typical going-in position. We, Thales, do not do system integration at a prime proponent level, and that's our standard default condition going into these PPP bids.

CHRISTINE MAINVILLE: Do you -- would you normally -- what would you have normally expected in terms of planning on the systems integration front during the procurement phase and contract negotiation phase?

DESMOND NG: Are you referring to what would be Thales's typical activities in our schedule?

CHRISTINE MAINVILLE: Well, yes. Let's start there.

DESMOND NG: Okay. So in most -- in -- at the RFP phase, as in most of our bids, we would assume that we would usually do -- we would install -- in the first two vehicles, we would install our onboard computers, and we would train the vehicle supplier on how to install, how to do static post-installation checkout, start up the

computer, make sure it works and all that, right? So we usually do always the first two trains with the rolling stock. From Trains 2 and beyond, then it's the rolling stock's responsibility, and we would just supervise to make sure they're doing all right but don't -- we won't actually perform the work ourselves. So that's our typical onboard installation and testing activities.

For commissioning testing, then it's Thales's full responsibility. Once the onboard computers are installed, it starts up properly, then Thales would take over, and we would test all the trains ourselves to make sure it's working because it's part of the -- the signalling system. And when we do it, it's a function of when the vehicle -- the new vehicles are delivered by Alstom, so we only can install our computers when they deliver the vehicles to the City. So -- and I can't remember if we had that vehicle delivery schedule in the bid or not, but -- so that's how we would lockstep our schedule with the rolling stock schedule.

CHRISTINE MAINVILLE: And why is it that Thales won't do the installation of --

DESMOND NG: For the -- all the trains?

CHRISTINE MAINVILLE: For all the trains, yes.

DESMOND NG: Because it's too expensive. Some of these vehicle manufacturings can take 3, 4 years, and so just to have people there for 4 years, it's a level of effort. It's too expensive --

CHRISTINE MAINVILLE: Right. Because --

DESMOND NG: -- and so that's --

CHRISTINE MAINVILLE: Thales would need to keep people on the project, you mean, until --

DESMOND NG: Yeah.

CHRISTINE MAINVILLE: -- the vehicles are ready. Okay.

DESMOND NG: Yeah. And it's also once you do two, it's a cookie-cutter. It's the same old, same old. So they can -- the rolling stock supplier can do it, yeah. And we've done this model in -- all around the world, in --

CHRISTINE MAINVILLE: Okay. And is there some testing of the internal components of the VOBC that is to be done by the rolling stock supplier?

DESMOND NG: No. They are not allowed

to touch our equipment. Like, we would install in a rack and then there's sub racks in there, so we would install the computers ourselves and then the cables that would maybe connect to the train peripherals - the brakes, the emergency stop button, the doors - that -- we will work with them to connect those. All the vital train lines we will connect, but that's the scope. So everything from the -- our vehicle onboard computer, called VOBC, to the train lines, that's where it stops, but once it touches the rolling stock body or the components, then that's the rolling stock's responsibility.

CHRISTINE MAINVILLE: Did you understand --

DESMOND NG: We are not allowed to -- we are not allowed to drill onto the -- you know, we can't drill and screw things onto the body of the trains.

CHRISTINE MAINVILLE: And is that what was done here in terms of division of --

DESMOND NG: Yeah, yeah, we -- there's no -- it was nothing different than what we would do on any other rolling stock, and our system -- our CBTC system is agnostic for rolling stock, so

we've installed it on not only Alstom vehicles: Siemens vehicles, Bombardier, Hyundai Rotem, CAF, CRRC in China. So we've had a lot of experience installing, so when we -- so at this point in the bid of the Ottawa LRT, we -- you know, it was the standard assumptions going in that procurement.

CHRISTINE MAINVILLE: Okay. So you don't -- you're not aware of any later challenges or dispute over testing within the VOBC as between Thales and Alstom? You're not aware of that?

DESMOND NG: At bid -- at RFP phase, no, no.

CHRISTINE MAINVILLE: Okay. Do I take it from what you've just said that Thales doesn't really have a preferred vehicle supplier that it likes to work with?

DESMOND NG: Yes, correct, yes. Because there are many tenders around the world where -- that the vehicle supplier is procured separately, and the signalling is procured separately, and so you just -- we just have to interface to whatever rolling stock suppliers there are out there. And this includes brand-new trains and retrofit, what we call brownfield trains. We've done both.

CHRISTINE MAINVILLE: And you mentioned Alstom as being one of the rolling stock suppliers with which Thales had worked, but am I right that this was the first time that the two systems were integrated on an LRV?

DESMOND NG: Yes, I believe so. Yeah. Because I -- I believe the Alstom vehicles were a new vehicle being manufactured specifically for Ottawa. But I know from firsthand experience we've -- we've worked with the Alstom vehicles in Shanghai and in China before, so...

CHRISTINE MAINVILLE: Are those LRVs?

DESMOND NG: No, they're -- these would be bigger -- bigger trains. Yeah.

CHRISTINE MAINVILLE: And what is your understanding of the train model -- the vehicle model that Alstom used in this case? You said it was new for Ottawa? Did you -- what's your understanding of the service-proven aspects of this vehicle?

DESMOND NG: The specs I don't have personally, the technical specifications. If I remember correctly, it was -- I think they may have used it -- or rebranded it from another project in the States to make it for Ottawa, but those are

just rumours that I heard, but I don't have the technical specifications of the vehicles themselves.

CHRISTINE MAINVILLE: Okay. And you don't know if it would be considered -- would have been considered a service-proven vehicle or not?

DESMOND NG: If it's brand-new, then no. It can't be, no.

CHRISTINE MAINVILLE: If it's adapted from a model that they had in Europe called the Citadis Dualis --

DESMOND NG: Okay.

CHRISTINE MAINVILLE: -- what would be -- maybe I should ask you: What would be your definition of a service-proven vehicle?

DESMOND NG: It's been in revenue service for at least minimum, I guess, 5 years -- right? -- and it's proven, so --

CHRISTINE MAINVILLE: The same --

DESMOND NG: -- but it's a lot of -- and if we --

CHRISTINE MAINVILLE: The same model.

DESMOND NG: Yeah, the same model, right, and -- which means the train characteristics are the same, the braking and the propulsion are

the same, then we can make assumptions that, yeah, it's the same old, same old for Thales, right, but -- an example -- like, on the SkyTrain, they're Bombardier trains, and they're the same models - Mark I, II, and III - that it's -- that are being manufactured at Bombardier, so we know how the trains are; we know where to install it; we know the characteristics of it. But for the Ottawa one, we -- this is new. It was brand-new to us, so...

CHRISTINE MAINVILLE: And -- but I take it each train has to be adapted to the specificities of any project. Is there not always some level of adaptation?

DESMOND NG: Yeah -- yes. If it's a new train, then we would work with the rolling stock provider to tell them, This is our vehicle onboard computer; here's our dimensions; this is where we like to install it. You know, and sometimes they -- they want it in the middle of the train or the back end of the train, so it depends on where the rolling stock provider will give us room to install the computers: This is where we want to connect our cables; do we run it across the entire cab, or can we go underneath? Can we go from cab to cab? So these were all -- these would

be typical what we call vehicle design interface points that we would then meet with the rolling stock once the project is awarded.

CHRISTINE MAINVILLE: Is there any industry definition or standard for what is considered service-proven?

DESMOND NG: Not that -- there may be, but from a Thales -- that I don't know, but from a Thales perspective, it doesn't affect our signalling system, so -- we only do the interface, right, so -- yeah.

CHRISTINE MAINVILLE: And how would you describe Thales's signalling system as it relates to the one used in this project? Let me start with this: Is there anything unique about it?

DESMOND NG: No. We -- we -- we -- our system, we -- we were the first CBTC system worldwide to deploy it in Vancouver 30 years ago, and also the first radio system CBTC was in Las Vegas, 2004, and that was Thales. So we've deployed CBTC systems all around the world, and it could be main line -- not main line but big trains or LRT trains all around the world, so there -- for Ottawa, it was nothing special. It was the same old, same old cookie-cutter product. And I think

there were some slight new functions, but they're mainly at the interface level, so...

CHRISTINE MAINVILLE: And what were those?

DESMOND NG: I think the -- well, the trains were on the -- on the roadways, right? So there were some interfaces to, like, stop at signals and stuff like that, but -- I'll have to check my notes, but from a signalling perspective, there was nothing major.

CHRISTINE MAINVILLE: I understand the system is wireless?

DESMOND NG: Yes, what we call radio CBTC.

CHRISTINE MAINVILLE: And is that unique to Thales?

DESMOND NG: No, no. We've -- as I mentioned, our first radio system installed was in 2004 in Las Vegas, and since then, we only sell radio solutions all around the world.

CHRISTINE MAINVILLE: Okay. And what about the fact that Thales's system comes, as I understand it, in different pieces or components as opposed to being what may be called a plug-and-play system?

DESMOND NG: Well, signalling systems are very complex, so it's not like buying an Apple product. So it's comprised of a number of major subsystems. Our radio system, what we call data communications, is one chunk, I guess you can call it, in a subsystem. The vehicle onboard computers, VOBC, is another subsystem, major subsystem. Our automatic train supervision, which is at the operations control centre, where the operators can see the trains move back and forth and send messages and stop the trains from HMI GUI - that's another subsystem - and then the wayside where we -- with our zone controllers, where we can separate the trains and stop them, that's the fourths major component. So there's four - zone controllers, VOBCs, the ATF, and the DCF - that comprises our radio CBTC system.

CHRISTINE MAINVILLE: And is that something that is proprietary to Thales or unique in some way?

DESMOND NG: The software is proprietary. A lot of the hardware -- it's a mixture. For the hardware, some are off the shelf commercial; some are proprietary manufactured in China, in Germany Thales, so... Software is

proprietary.

CHRISTINE MAINVILLE: Do you know if other systems -- CBTC systems come as a plug-in, plug-and-play unit?

DESMOND NG: No. We're -- having worked in bids for 25 years and all the competitors, Siemens, Alstom, they're very similar. It's just -- what suppliers they pick, there's no -- I know for a fact Alstom doesn't -- there's not one office where they develop it. Everything's developed all across internationally and then they put it all -- integrate it at the customer's site. So all the major signalling suppliers are very similar to Thales.

CHRISTINE MAINVILLE: Okay. And --

DESMOND NG: For signalling.

CHRISTINE MAINVILLE: Sorry? For signalling?

DESMOND NG: Yeah, for signalling.

CHRISTINE MAINVILLE: Did Thales not have to create a new design for this particular signalling system?

DESMOND NG: It would only be at the -- typically on our -- when we do these projects, there's a what we call core product, so there's

a -- certain features that we will take from the main four subsystems and then we will adapt or put -- implement new features depending on the customer requirements. As I mentioned -- well, for sure the vehicle interface because it's an Alstom vehicle, so that would -- there would be some adaptation there, and then maybe some of the -- on the HMI, there would be requirements there, just to -- the City of Ottawa may want different GUI or HMI interactions, so... Yeah, there would be basically a core product and then some small adaptations, but then this is standard. For these main signalling systems, there's no such thing as 100 percent cookie-cutter. It's impossible.

CHRISTINE MAINVILLE: Yeah. And did this project have -- require more adaptations than the typical project?

DESMOND NG: No. No. It was -- because it's an LRT, it wasn't that major as some of our other projects, so...

CHRISTINE MAINVILLE: And you said that some adaptations are required -- would have been required to adapt to Alstom's vehicles. What discussions were there with Alstom early on in the project about that? Are you aware of what, if any?

DESMOND NG: None, because these would be internal to Thales, so... It's only at the interface level where we talk to Alstom.

CHRISTINE MAINVILLE: You mean once you're into the project phase? Into the --

DESMOND NG: No, the -- like, the messages that go from our signalling system to the Alstom vehicle -- because they -- the vehicles will have their own communications system, like a network, so what messages -- if we send this message, what does it control? If Alstom sends it back to us, what is the expected input to us? So it's only at the interface level where we talk, but anything -- any -- any adaptation within the Thales system, our own internal system, that's within Thales. Alstom doesn't need to know what's happening, so...

CHRISTINE MAINVILLE: And -- but when would those interface system discussions usually take place?

DESMOND NG: That was part of the Thales/Alstom scope split discussions, which was around probably July, August 2012 time frame.

CHRISTINE MAINVILLE: And do you know whether those were -- those discussions were more

limited than they would otherwise be in other projects?

DESMOND NG: I wasn't a part of it, so I don't know.

CHRISTINE MAINVILLE: Okay. I take it you're not aware of any challenges that arose on the systems integration front over the course of the project?

DESMOND NG: Yeah, well, I -- I wasn't involved in the project, but I heard through the project team and other sources within Thales, yes, there were issues on the project itself. But I don't know the real details and stuff because I'm not part of the project team, so...

CHRISTINE MAINVILLE: I take it part of the integration requires some different iterations of ICDs to be exchanged as between the signalling system provider and the rolling stock provider?

DESMOND NG: Correct, yes.

CHRISTINE MAINVILLE: So to what extent can that be planned in advance as opposed to it being an iterative process over the course of the project? Like, could that be sorted out fairly early on, or does it necessarily have to progress over a lengthy period of time?

DESMOND NG: No, we can -- I mean, sometimes we can submit what we call a vehicle onboard computer ICD or also a vehicle onboard computer black box interface where we state that this is our typical VOBC, these are our typical interfaces, and then, Mr. Rolling Stock Provider, this is our assumption for Thales; can you meet these? So...

CHRISTINE MAINVILLE: Do you know --

DESMOND NG: But I'm just checking -- I don't think we submitted anything like that as a bid deliverable, and it's only down to the Thales/Alstom scope split that was kind of, like, the definitive scope between Thales and -- and Alstom. Yeah.

CHRISTINE MAINVILLE: And do you recall what --

DESMOND NG: So we --

CHRISTINE MAINVILLE: Sorry, go ahead.

DESMOND NG: Yeah, we did not submit those documents to them as part of the bid deliverables. It was only the Thales/Alstom scope split submitted, which were part of the -- the final conclusion of the meetings between Thales and Alstom, so...

CHRISTINE MAINVILLE: And do you know why those documents would not have been provided?

DESMOND NG: They'd never asked for one, and we don't provide it unless -- sometimes, some competitive -- not competitive. Some tenders will require us to submit it, so we don't -- if they don't ask for it, we don't submit it. And also because we went straight to the -- because there were actually face-to-face meetings, that kind of superceded -- maybe it was presented at those meetings. I don't know, right? And -- because there had to be some meetings, they say okay -- maybe there was presentations and stuff like that, but I don't have records of those and what was presented.

CHRISTINE MAINVILLE: But presumably, even if it's not requested, at some point in time, that's something Thales needs to provide -- is it not? -- to the rolling stock provider.

DESMOND NG: At the project phase, yeah.

CHRISTINE MAINVILLE: Right. Okay. And do you know what was provided for on this project in terms of timelines for Thales to produce that?

DESMOND NG: Produce what?
CHRISTINE MAINVILLE: Well, yeah. Let's be clear what we're talking about. The ICD -- what I understood to be sort of a template base --
DESMOND NG: There were -- the ICDs and the black box interface were never submitted as part of the RFP bid documents to --
CHRISTINE MAINVILLE: No, but do you know whether the --
DESMOND NG: On the project?
CHRISTINE MAINVILLE: What the contract provided for in terms of when it would be produced during the project phase?
DESMOND NG: No, I -- I don't know the timeline itself, but -- but I would say it's part of usually preliminary design phase, which is about half a year into --
CHRISTINE MAINVILLE: Okay.
DESMOND NG: Half a year after NTP, typically.
CHRISTINE MAINVILLE: And I take it this is basically something that an ICD -- a base ICD that Alstom, in this case, could start working off of until the final ICD is --

DESMOND NG: Yes.
CHRISTINE MAINVILLE: -- firmed up. Okay.
DESMOND NG: Yeah, yeah.
CHRISTINE MAINVILLE: Okay. And you don't know when that was provided in --
DESMOND NG: No. Anything after the project award I was not involved.
CHRISTINE MAINVILLE: Do you recall if anyone by the name of Roger Woodhead was involved on SNC's end during the procurement period? SNC --
DESMOND NG: No. I -- his name is not familiar to me.
CHRISTINE MAINVILLE: Okay. And you don't know how the two subcontracts were negotiated as it relates to Thales's subcontract and Alstom's?
DESMOND NG: No. Yeah, I don't know how Alstom -- because it's a separate -- it's a vehicle subcontract, right? So we had no involvement in it. Only the Thales signalling portion.
CHRISTINE MAINVILLE: And you don't know, for instance, who on OLRTC's end, on the consortium side, was involved and whether they were involved in negotiating both?

DESMOND NG: I don't know.
CHRISTINE MAINVILLE: Okay.
DESMOND NG: I was not involved.
CHRISTINE MAINVILLE: Would you have had -- you or Thales, to your knowledge, would have had discussions with OLRTC about the systems integrator role?
DESMOND NG: No because we're very clear that we don't do system integrator -- integration.
CHRISTINE MAINVILLE: But would you make clear the need for it, or would that be a given?
DESMOND NG: I would -- yes, there -- we -- because having worked on these many consortium bids, I believe the capture lead would have for sure iterated to the consortium that Thales does not do system integration.
CHRISTINE MAINVILLE: When would you --
DESMOND NG: And if we had to, we would probably not bid, so -- to be honest.
CHRISTINE MAINVILLE: When would you expect a system integrator to start becoming involved in a project like this?
DESMOND NG: Even as early as during

the preliminary design phase. They need to understand how the system fits together. Then they have to do the planning, the scheduling, when the site -- when is equipment being procured, delivered to the site, when can installation start, when can construction start, then all the testing activities that go along with it. So usually, on a project this size, it's as early as possible in the project phase, not at the back end, we assume, so...

CHRISTINE MAINVILLE: And do you know if there's typically any work done to ensure that the rolling stock subcontract and the signalling system subcontract aligned?

DESMOND NG: We were never given the overall project master schedule at the consortium level, and I did -- I checked notes. We don't even have the delivery schedule of when Alstom vehicles are actually delivered to us. So we just made assumptions and say here's where we think, and we submitted our project schedule, Thales's project schedule.

CHRISTINE MAINVILLE: So you never --

DESMOND NG: And then maybe --

CHRISTINE MAINVILLE: Sorry, keep going.

DESMOND NG: Yeah. So -- and then we assumed that the consortium would integrate our schedule into the overall master schedule.

CHRISTINE MAINVILLE: So you're saying Thales never had Alstom's timelines or schedule. And just for the record, you have to say --

DESMOND NG: Correct, yes.

CHRISTINE MAINVILLE: Yeah. And -- but I would assume Thales at least had a date -- would have had a date for when, under its own contract, it expected to receive the rolling stock, either the -- the specifications and then the vehicle itself?

DESMOND NG: Yes, we would have made assumptions in Thales's design phase, procurement phase, testing and installation phase.

CHRISTINE MAINVILLE: So you -- so it would not -- there would not be a date in the contract that said this is when you will receive -- you can -- Thales, you will receive -- like, wouldn't OLRTC undertake to produce the vehicle by a certain date?

DESMOND NG: Yes, they would -- they would have to. We, Thales, provided our own schedule of a certain duration too - like, maybe

it's 4 or 5 years - so everything to Thales had to fit within there, so...

CHRISTINE MAINVILLE: You don't know who that was --

DESMOND NG: But maybe -- maybe the overall project schedule can be longer than that, right?

CHRISTINE MAINVILLE: You don't know who that was provided to at OLRTC?

DESMOND NG: No. Sorry, our Thales project schedule?

CHRISTINE MAINVILLE: Yes.

DESMOND NG: It was part of the -- one of the bid submissions from Thales, so it's a part of the package.

CHRISTINE MAINVILLE: Okay.

DESMOND NG: It would go to our capture lead, capture lead to SNC-Lavalin.

CHRISTINE MAINVILLE: Okay. And I just want to be clear: Are you saying, in this project, Thales produced its schedule, but there -- in Thales's subcontract, there was no -- to your knowledge, no date set for when Thales would receive what it needed from the rolling stock supplier?

DESMOND NG: Yes. I just want to double-check one thing.

CHRISTINE MAINVILLE: Are you consulting the contract, or do you have -- is that what you have?

DESMOND NG: Yes. We made a number of assumptions that we put into our project schedule, when the customer has to provide certain things -- customer would be, in this case, SNC-Lavalin. So there's a number of dependencies that we've already included into the Thales schedule.

CHRISTINE MAINVILLE: Okay.

DESMOND NG: Which -- which in -- let me check. I think it includes the vehicles. Let me check. So we would need their interface -- vehicle interface data by a certain date, and... Okay. Yeah. So no -- okay. So I confirmed that in our Thales schedule, there are dates when we expect the vehicles to be delivered from Alstom. It's in the -- our project schedule.

CHRISTINE MAINVILLE: Okay. And do you know whether OLRTC committed to that, ultimately?

DESMOND NG: No. I -- that I don't know. I don't know if we --

CHRISTINE MAINVILLE: Okay.

DESMOND NG: -- we put those dates in or it came from the customer.

CHRISTINE MAINVILLE: Okay.

DESMOND NG: SNC-Lavalin.

CHRISTINE MAINVILLE: And do you know how the client -- here, OLRTC, how they would normally go about ensuring that the two subcontracts align, so that the rolling stock contract aligns with the signalling system contract? Do you know anything about how -- what you would expect or what you know to happen on projects in that regard?

DESMOND NG: On -- on other bids I've worked on, we would -- we would normally request the vehicle delivery dates from the -- the -- the customer, right? Sometimes they don't have it, because they say, well, the rolling stock is still -- the contract still being negotiated; I don't have those dates. In that circumstance, we then make assumptions based on our experiences - so many weeks for the first few vehicles and then so many weeks or months for the next remaining vehicles. If the customer provides us the vehicle delivery schedule, then we will align our schedule to match the rolling stock schedule, and then we

then put -- submit this -- Thales's schedule to the customer.

CHRISTINE MAINVILLE: So you might occasionally receive the vehicle supplier's schedule?

DESMOND NG: Yes. If they have it ready, yes.

CHRISTINE MAINVILLE: Do you know if it was received in this case?

DESMOND NG: We -- we have it in our master schedule, but the question I can't answer is whether we made assumptions or it came from the customer.

CHRISTINE MAINVILLE: Okay. Got it.

DESMOND NG: I don't know. I just see the schedule itself right now, so...

CHRISTINE MAINVILLE: And would Thales ever see the subcontract between the rolling stock provider and the client?

DESMOND NG: No. By the subcontract, you mean their terms and conditions, their price and all that? No, we would never see it. We can see it if it's at the project agreement or the customer requirements because sometimes there's sections in the tender where it says these are the

vehicle rolling stock requirements, right? So if it's at that level, we can see it if it's passed to us, but the actual physical subcontract, no, we would never see it.

CHRISTINE MAINVILLE: Okay. Do you recall what the plans were for validation testing?

DESMOND NG: We -- well, Thales would -- would develop the software -- our typical process is we would develop the onboard software in Canada, Toronto, and then we would test in house, in our labs, and then we would deliver the software -- firmware, actually, to the vehicles themselves and then install it there, and then we would then work with the rolling stock provider to test our trains, but it would be under the responsibility of Thales to test the trains with the signalling supplier. But in terms of a system integration between signalling and vehicle, no, no documents were ever provided at the RFP stage.

CHRISTINE MAINVILLE: Can you clarify that on the integration piece?

DESMOND NG: Well, the integrate -- we would provide a system test plan, but it's more at a high level: This is what we typically do to test the trains and all that. But down to the specific

task of testing every little component on the train, we don't -- that was never submitted. That's -- that would be on the project phase.

CHRISTINE MAINVILLE: Okay. I take -- would that include the dynamic testing that's part of the --

DESMOND NG: Yes. Our typical testing would be static PICO, which is to start up the computer; dynamic PICO, where you actually move the trains on a test track; and then the full system testing/commissioning would be on the actual main line itself, yeah, controlled by the signalling system.

CHRISTINE MAINVILLE: So was there any planning for the validation testing during your time -- during your -- the procurement phase on this project?

DESMOND NG: It would be just probably very high -- schedule activities in our schedule, like system testing, half a year or something like that. But we would not break it down to more details than that.

CHRISTINE MAINVILLE: So you don't recall if there were discussions with Alstom about where this would be done on the first --

DESMOND NG: I saw some -- it could be -- I think the static PICO was on the rolling stock test track. I think the test track's in -- I assume Ottawa, and then the -- the actual testing itself was on the customer's system, tracks.

CHRISTINE MAINVILLE: Okay. You don't recall plans about testing on LRV 1 and 2 in France or the United States?

DESMOND NG: No. That I wasn't even aware of, no.

CHRISTINE MAINVILLE: Okay. How important is validation testing for Thales?

DESMOND NG: Extremely important because without that, every train -- even though the vehicle manufacturer says, Oh, yeah, once we manufacture Train 1, all other trains are the same, it never happens in reality. Every train is a little bit different - every one stops a bit differently; they accelerate a bit different - so we -- a lot of times, we have to tweak our software a little bit for some of the -- a couple of the trains to make it ride or stop properly, so -- and this takes a lot of time.

CHRISTINE MAINVILLE: When would you have expected validation testing to take place on

the Ottawa project, based on the --

DESMOND NG: On the project phase itself, in the project phase itself, it would be when we start -- when the trains are actually moving on the main line, so it would be in the testing/commissioning phase, which is typically almost a year before revenue service, typically. Revenue service, go back a year. It's about a year.

CHRISTINE MAINVILLE: So that's --

DESMOND NG: For the system commissioning.

CHRISTINE MAINVILLE: Is that the integration testing?

DESMOND NG: Yeah, system integration testing.

CHRISTINE MAINVILLE: Okay. And so --

DESMOND NG: That -- so when you say "validation," to me, it means in house, which is then -- when we develop the software, we then have FAT, factory acceptance test, right, in our factory, and then once we verify that it works and then there's usually integration to make sure it's FAT-ed properly, we're happy with it, then we can officially release it to the field, and then we --

for system integration testing.

CHRISTINE MAINVILLE: But would the validation testing phase, in your mind, include dynamic testing?

DESMOND NG: Yeah -- okay, the -- that's on the blurry boundary, so I go -- yes, I assume so because sometimes when we do the dynamic testing, you find a lot of defects and bugs that you then have to update the software to make sure the test works. Yeah.

CHRISTINE MAINVILLE: Right.

DESMOND NG: Before they can start -- before they can system testing officially, so yes.

CHRISTINE MAINVILLE: So would you not typically do that early on, on the first one or two LRVs, before you produce the series?

DESMOND NG: Yes, yes.

CHRISTINE MAINVILLE: So -- so for instance, here - leaving aside the system -- the proper full system integration testing towards the end of the project - would there not be plans for some level of integration testing on the first one, two, or three LRVs?

DESMOND NG: First two we would do static PICO and then followed by dynamic PICO

testing. Yeah.

CHRISTINE MAINVILLE: Okay. So when would you expect the static PICO testing on the first LRVs to happen in --

DESMOND NG: When the test track is ready.

CHRISTINE MAINVILLE: Okay.

DESMOND NG: Because they're typically done on the test track.

CHRISTINE MAINVILLE: And typically you would want that fairly -- early on enough that you're not producing the series before that's done? Is that --

DESMOND NG: Correct, yeah. It has to be tested on the test track first before it goes onto the main line. Correct.

CHRISTINE MAINVILLE: And what are the implications of not doing that? Is it just that you're going to end up having to do a lot of software changes?

DESMOND NG: Yeah, yes. Later in the -- in the -- in the back end of the project, we then force the -- doesn't give us much time for system testing.

CHRISTINE MAINVILLE: Okay.

DESMOND NG: So that test track being available was always a dependency for Thales for dynamic testing.

CHRISTINE MAINVILLE: Okay. Do you have any views on the sufficiency of the budget here? Of course, Thales had a -- just one piece of this, but from Thales's perspective, were there any concerns in terms of the financial constraints?

DESMOND NG: You mean at the project agreement level?

CHRISTINE MAINVILLE: Yes.

DESMOND NG: No because that's beyond us, and in these prime PPP ones, typically signalling is usually between 5 to 8 percent of the overall civil contract, typically.

CHRISTINE MAINVILLE: And so for Thales's piece of this, there were no concerns about -- it was not unusual?

DESMOND NG: No, no.

CHRISTINE MAINVILLE: So do you recall in terms of the City's requirements in this case that there was a need to move -- a significant ridership and a need to move a significant number of people per hour per direction?

DESMOND NG: Probably. That's -- if

it's in the project agreement, the customer requirements, then it's -- and it's -- but that's standard in all these big bids, so... It's higher throughput, better -- more ridership, faster headway, less maintenance, so it's -- these are, like, the five or six big -- major win themes for all customers worldwide. Yeah.

CHRISTINE MAINVILLE: That everybody wants.

DESMOND NG: Everyone wants. But from a Thales perspective, it's -- to be honest, it's immaterial to Thales, right, because as long as our system meets the requirements for the signalling subsystem, then that's our contractual obligation, so...

CHRISTINE MAINVILLE: Okay. Does it not impact Thales to the extent that it creates certain specific needs for the train control system and the headway between trains?

DESMOND NG: Yes, because if those are signalling -- I mean, those are typically signalling requirements. Headway, reliability, maintainability, percentages or numbers, those are contractually obligated by Thales to meet those performance numbers or KPIs.

CHRISTINE MAINVILLE: Was this not a fairly innovative design in this case in that regard?

DESMOND NG: No. We didn't see anything out of the ordinary from what we've seen on other major bids, as far as I remember. So -- I don't think any of the criteria or key performance indicators were out of the ordinary.

CHRISTINE MAINVILLE: And what about the speed, the maximum speed limit of 100 kilometres an hour?

DESMOND NG: At the design -- the operational speed? No, we've -- we've hit trains up to 110, 120 before, so --

CHRISTINE MAINVILLE: Light rail trains?

DESMOND NG: That I do not know, no. We've -- we've -- I've seen tenders where we can -- we've -- meet LR -- 110, 120 kilometres per hour, so... But I don't know if they're specifically LRT trains.

CHRISTINE MAINVILLE: Would that impact Thales's system, the speed?

DESMOND NG: Yes. The higher the speed, then there would be design -- could be

design issues if it's a radio -- radio system, because it has to keep track of the -- of the accuracy of where the trains are. But I've -- we've never, as far as I know, encountered any issues in tracking the trains, so -- especially at 100 kilometres an hour. I've never seen an issue, no.

CHRISTINE MAINVILLE: Do you recall the journey time requirements on this and whether those were quite aggressive?

DESMOND NG: No, I don't specifically recall. If it was part of signalling requirements, we did do a compliance on it if it's part of it, but I can't remember what our actual compliance to it was.

CHRISTINE MAINVILLE: Okay. Would you normally expect the journey time to vary depending on climate or weather, like inclement weather?

DESMOND NG: Journey time, just to confirm, is from one point and then coming all the way back to the same point? Is that what you consider journey --

CHRISTINE MAINVILLE: Or between stations. Would you have -- would you ever have a guarantee like that?

DESMOND NG: If it's a requirement, like, yeah, it could. There's headway usually -- design headway requirements and operational headway requirements. There's stopping time, stopping distance. Could be round trip, like, from -- you have to go the entire circular route, so I've seen those requirements. But I can't remember specifically what the numbers are for journey time in Ottawa, so -- but I did not see anything -- I did not see anything flagged as out of the ordinary.

CHRISTINE MAINVILLE: Okay. So you don't recall whether it required some adaptation to the acceleration rate and whether there would be coasting prior to braking?

DESMOND NG: No, I don't recall seeing anything on this.

CHRISTINE MAINVILLE: And am I right that the journey time -- let's say it's from the beginning of the -- not the cycle, but the ride --

DESMOND NG: Yeah.

CHRISTINE MAINVILLE: -- to the end of it.

DESMOND NG: End to end. Yeah.

CHRISTINE MAINVILLE: Would -- should

that -- should the speed -- let me rephrase. Should the speed depend -- be dependent on weather conditions?

DESMOND NG: No. Our system is -- works independent of weather conditions.

CHRISTINE MAINVILLE: So even in a climate like Ottawa's, with winters and -- you wouldn't adapt the speed based on that.

DESMOND NG: No, no, no. And we were -- I remember there were discussions on the heavy snowfall in Ottawa that -- that's one of the discussions and whether we -- it would handle it, and our technical team said yeah, it will handle the heavy snowfall, so...

CHRISTINE MAINVILLE: And when the -- would there not be more expected sliding on the tracks based on the temperature or -- or --

DESMOND NG: Possible, yes, but our system can handle what we call slip-slide. It will compensate for that. For example, in Vancouver SkyTrain -- I mean, it snows here in Vancouver, and then what we've seen the operator do is actually put a -- put -- on fully automatic, let the trains with no driver just go up and down the track all night long to remove the snow, right, and then --

so that's ready to go all -- in the morning. Because it's fully automated in Vancouver, and so we were -- there is possible operational scenarios from Ottawa city that they could do to avoid getting snow on the tracks.

CHRISTINE MAINVILLE: And is that adjusted with a different speed profile? As I understand it, there are different speed profiles and --

DESMOND NG: There are different speed profiles depending on the gradient of the track, because some -- it's never perfectly linear or horizontal. There's always curvatures -- or ups and downs and valleys and stuff. So the speed profile is already hard-coded into the trains because the track is fixed. So we know where it will go down to a station, where it will go up on the guideway. So the speed profiles are already -- they're hard-coded already in the trains, so -- which comes from the civil, the civil guideway data.

CHRISTINE MAINVILLE: Sorry, repeat that.

DESMOND NG: The -- it -- the elevation and the speed and the curvature and the maximum

speed it can go on certain parts of the guideway, they're provided by the civil contractor, right? So maybe between this station and this station, you only can go 80 kilometres. Another station, because there is a curve, you have to slow down to 30 kilometres, but maybe this stretch is 2 miles long; you can go up to 100 kilometres. So all of that is already preprogrammed -- or not preprogrammed but provided by us. In fact, it's a dependency. The guideway data and speed profile data must be provided to us by the client before we can even -- because we have to enter this input into our signalling system.

CHRISTINE MAINVILLE: If -- tell me if this makes sense, this question, to you, but if you don't adjust the speed profile, could that lead to emergency braking --

DESMOND NG: Possible --

CHRISTINE MAINVILLE: -- unnecessary --

DESMOND NG: Yeah, it could.

CHRISTINE MAINVILLE: -- emergency braking? Yes.

DESMOND NG: Yeah, and maybe the speed profile will have to change because maybe once they build it, it's not perfect, what they gave to us,

and so yeah, so maybe part of testing, you might have to adjust the speed profile. Yeah.

CHRISTINE MAINVILLE: Okay. And if there's too much emergency braking, could that lead to wheel flats?

DESMOND NG: That I don't know. That's a pure technical question.

CHRISTINE MAINVILLE: Okay.

DESMOND NG: Yeah.

CHRISTINE MAINVILLE: Was Thales to do any work onsite in Ottawa at the MSF facility?

DESMOND NG: The maintenance and storage facility, I think so, but again, that's now at the project deployment phase, but I -- there could be. If that is where our operations -- the operations control centre is, the OCC, then yes, we would definitely be there. Yeah.

CHRISTINE MAINVILLE: What plans were there for testing and commissioning as it relates to Thales's systems?

DESMOND NG: At the bid phase or the project phase?

CHRISTINE MAINVILLE: Well, I mean, one would inform the other, but what was --

DESMOND NG: On the -- on the project

phase, so we would typically have a test plan, system test plan, system test procedures, system test reports, integration testing, system acceptance tests, a deployment schedule, so maybe six or eight major documents. We would then need to work with the civil or the prime: When can we access the guideway or the buildings to install our equipment, all that? So there's -- and then there's drawings, right - all the as-builts, the equipment to connect from here to here - so there's many, many deployment drawings.

CHRISTINE MAINVILLE: Would Thales expect those to be incorporated in the contract?

DESMOND NG: No. They would be CDRLs, contract data requirement lists, so they would be part of the project deliverables. But as part of the bid phase, we will not provide all those because we don't know yet, but it would -- there would be a list of documents we would typically provide during the project phase.

CHRISTINE MAINVILLE: Okay. You would provide during the project phase the various test plans and requirements that Thales has for its systems?

DESMOND NG: Yes, yeah, yes.

CHRISTINE MAINVILLE: To -- so what would be provided in the contract on this? Like, what would Thales -- is there anything that you would expect to be reflected in the contract?

DESMOND NG: At the RFP phase?

CHRISTINE MAINVILLE: In terms of the -- no, no, in the actual contract, in terms of the types of tests that would need to be done. Would you provide for that in the contract?

DESMOND NG: Yes. Those documents, as I mentioned, like system test plan -- signalling system test plans, signalling test procedures, integration of the -- probably between our system and the rolling stock, so these -- at a higher level, we would provide these and all the drawings that come along with part of system testing and -- the part -- they usually are part of our typical package that we provide. But they did -- they're not fleshed out until, you know, all these meetings start happening between the different suppliers.

CHRISTINE MAINVILLE: In the project phase.

DESMOND NG: Yeah, in the project phase.

CHRISTINE MAINVILLE: Okay. So after

the contract is signed.

DESMOND NG: Yes, yeah.

CHRISTINE MAINVILLE: Okay. Would Thales ever want to provide for, you know, a certain period of, you know, dry running or burn-in period or anything like that? Would it ever make that -- make that request to ensure that that's done?

DESMOND NG: It would -- I don't know if it's a -- it would be part of the -- usually the preliminary system testing, the -- I think what we call SIT, system integration tests, where we would do kind of, like, the preliminary dry running, just to make sure -- shake out the system, all the interfaces work, external interfaces, our system works, and then go into full, complete system testing. Yeah. So there -- there would be a phase called -- as I remember, SIT, system integration test, which is this, I guess, dry running period. Yeah.

CHRISTINE MAINVILLE: How long would that normally be for, or how long would Thales want it to be for?

DESMOND NG: Probably -- I -- a couple months, maybe. 2, 3 months at the most.

ANTHONY IMBESI: And just to be clear on your evidence on that, that's before revenue service?

DESMOND NG: Sorry?

ANTHONY IMBESI: Just to be clear on your evidence, what you're talking about in terms of preliminary system testing, the SIT testing, that's prior to revenue service?

DESMOND NG: Yes, yes. Everything's prior to revenue service, yes.

CHRISTINE MAINVILLE: So I suppose my question is on many projects, I take it you'd agree that the testing and commissioning phase often ends up being compressed? Is that fair to say?

DESMOND NG: Yes, usually. And it's -- on these big civil projects, it's -- it could be -- could be the civil construction, right? They find problems, but -- maybe they're boring tunnels that came out of nowhere and delayed the project for half a year. An example is Vancouver Evergreen Line. Maybe they're having problems with other suppliers, platform screen doors, tracks, laying the tracks, maybe the power, maybe building some of the buildings itself, like OCC, the depots, so -- which could all delay Thales, yes.

CHRISTINE MAINVILLE: And --

DESMOND NG: Even the rolling stock. Sometimes the rolling stock, the first two or three, it's not what was stated in the -- in our assumptions, right? They made new -- new assumptions and stuff we didn't know until -- until the project time. So yeah, any of these can change our -- can impact our schedule.

CHRISTINE MAINVILLE: So I guess my question is would Thales ever seek to preemptively protect the time period it has to run the tests it needs to run? You know, to ensure that it's -- that there's sufficient time from -- sufficient from Thales's perspective to run the tests fully. I think you may be frozen. Yeah.

PETER MANTAS: He looks frozen. And, Ms. Mainville, I'm just wondering, maybe we should take a break?

CHRISTINE MAINVILLE: Yes, I was going to --

PETER MANTAS: Maybe that's --

CHRISTINE MAINVILLE: -- ask after --

PETER MANTAS: -- a good time.

CHRISTINE MAINVILLE: Exactly. I was going to do it after this question, but let's break

and come back to it. Let's go off record.

-- OFF THE RECORD DISCUSSION --

-- RECESS AT 3:32 --

-- UPON RESUMING AT 4:00 --

CHRISTINE MAINVILLE: So, Desmond, I don't know if you understood my -- if you heard my last question, but it really had to do with whether Thales would ever seek to kind of protect the time that it needs for -- to conduct certain tests relating to its signalling system.

DESMOND NG: I mean, yes. If there's significant delays that cannot -- I mean, first of all, Thales would try to work with the prime to make sure that activities were aligned within Thales's schedule and risk profile, right? So -- but if there's -- without any cost impact. If it gets to a certain point where it's huge delays and there's a big impact and a risk to Thales, then there's a possibility that they can go for a variation or a claim.

CHRISTINE MAINVILLE: Okay. I see.

DESMOND NG: I personally -- I personally do not know if that has been done on the Ottawa project - that is, if there's been any claims by Thales.

CHRISTINE MAINVILLE: Okay. So I take it by "prime," you mean you would look at the project agreement, the overarching project agreement, look at the -- what requirements --

DESMOND NG: No, not the project agreement. It's the subcontract, signalling contract documents signed and agreed between Thales and SNC-Lavalin. There's a set of subcontract signalling documents.

CHRISTINE MAINVILLE: Okay. And that would reflect the testing, at least the core testing requirements and criteria?

DESMOND NG: Well, it would reflect the -- at this phase, it was -- as I mentioned, it was very high level, right, at the -- at the testing level, so maybe a couple lines in the schedule. It's only during the project phase that -- let's say there's a start and end date during -- at the bid phase, but at the project level, when we really delve into the activities, then that end date of the testing, let's say, slips, then there's a possibility that Thales could claim for future price increases. Does that answer your question?

CHRISTINE MAINVILLE: Yes. Well, let

me put it this way: Does Thales typically -- does it try to provide for a burn-in period or a certain duration of trial running or anything like that prior to revenue service availability?

DESMOND NG: Yes, yes, they would. Yeah. I don't know -- like, I just took a guess. Maybe it's 2, 3 months.

CHRISTINE MAINVILLE: So would you have that provided for in the contract -- in the subcontract?

DESMOND NG: No, it wouldn't go to that level.

CHRISTINE MAINVILLE: Okay. And could you? Is there a reason you wouldn't?

DESMOND NG: Provide it in the contract?

CHRISTINE MAINVILLE: Yeah.

DESMOND NG: Because we -- it's probably too detailed at that level, right, and so as I mentioned, it -- we're -- it's still very high level at the RFP phase. Because even if you put in the schedule, those maybe might shift left or right --

CHRISTINE MAINVILLE: Okay.

DESMOND NG: -- depending on the actual

project execution, so I guess they didn't want to go down to that level yet.

CHRISTINE MAINVILLE: Got it. It might evolve during the course --

DESMOND NG: Yes.

CHRISTINE MAINVILLE: -- of the project. Would the trial running period typically involve Thales?

DESMOND NG: We would be there for support if required, but it's usually at the prime level.

CHRISTINE MAINVILLE: What do you mean by "prime level"?

DESMOND NG: The EPC level, the proponent level.

CHRISTINE MAINVILLE: I'm not sure I'm following.

DESMOND NG: The consortium. The consortium level.

CHRISTINE MAINVILLE: Okay. They would ask you to be there or they may not.

DESMOND NG: Yeah, because you're running trial running at the entire system level, right? Not just signalling, but it's signalling, rolling stock, traction power, elevators, all that

stuff. So it's trial running at that level.

CHRISTINE MAINVILLE: Okay.

DESMOND NG: And if there's any issues for signalling, then they would ask us to fix it if required.

CHRISTINE MAINVILLE: Okay. Would you -- would Thales provide for any kind of interface with the operators of the system?

DESMOND NG: Only at the operations and maintenance training of the signalling system - that is, we would train them how to use the signalling system, the HMI, how we do maintenance of the equipment for the signalling system.

CHRISTINE MAINVILLE: And would provisions typically be made for ongoing training, or once you train them once, then you leave it in their hands?

DESMOND NG: We will only usually -- usually we do, like, a train the trainer, where the customer -- the end customer, the City, would have their trainers; we would train them, and then they would then subsequently train their internal staff.

CHRISTINE MAINVILLE: Okay. Would you --

DESMOND NG: And this would be done --

this would be done before the revenue service of the system.

CHRISTINE MAINVILLE: Okay. Is there ever an interface agreement between the rolling stock provider and -- so if there's no direct contract, as in this case, would there ever be any kind of interface agreement or memorandum of understanding of sorts between the rolling stock provider --

DESMOND NG: No, no formal -- no formal MOU or -- it's just a scope split matrix that I saw that we provided at the RFP.

CHRISTINE MAINVILLE: Right. Okay. Do you know if there was any clear interface document prepared in this case in terms of how this interface would function, other than the matrix you just mentioned?

DESMOND NG: I checked, and we did not provide any of the vehicle interface documents to the rolling stock provider.

CHRISTINE MAINVILLE: Right. And --

DESMOND NG: Formally. Maybe -- maybe they were presented at the technical meeting. That -- so I -- I don't know. I don't know.

CHRISTINE MAINVILLE: And you said --

DESMOND NG: But from a bid perspective and bid deliverable, there were none provided.

CHRISTINE MAINVILLE: And you said, I think, earlier because you weren't asked, but would Thales not ever just provide it to the -- like, would it not be useful to just simply provide it if -- given that it's available?

DESMOND NG: Yes, yeah, yeah, but -- maybe it was, but I don't -- I was never involved in those, so I can't say.

CHRISTINE MAINVILLE: Okay. So you don't know why it wasn't done in this case.

DESMOND NG: Not at the bid phase. Yeah.

CHRISTINE MAINVILLE: Okay.

DESMOND NG: I don't have any records of those, so...

CHRISTINE MAINVILLE: Okay. And would you ever expect -- aside from what you're referencing in terms of Thales's ICD and interface document, would you not expect some other interface document prepared by the consortium or the client to prepare -- to plan for the interface between the rolling stock provider and the signalling systems supplier?

DESMOND NG: At the end customer level?
CHRISTINE MAINVILLE: Yeah.
DESMOND NG: Like, from the City of Ottawa?
CHRISTINE MAINVILLE: No, no, not --
DESMOND NG: No.
CHRISTINE MAINVILLE: -- the City. OLRTC, in this case.
DESMOND NG: No, no. They usually don't do it because they -- either it's they don't know -- they could either go with another rolling stock provider who has their own trains, so it's probably a lot of work, and they usually let -- it's handled between the rolling stock provider and the vehicle supplier themselves.
CHRISTINE MAINVILLE: They let them deal with the interface?
DESMOND NG: Yes, yes.
CHRISTINE MAINVILLE: That's your common experience?
DESMOND NG: Yes, yeah. No consortium has ever provided an interface on any of my bids. It's thou shall, Mr. Signalling Supplier, work with this rolling stock. They don't want to -- first of all, then they take the risk, right? Then -- so

they don't want to take that risk, and so they want to let the two subcontractors work it out among themselves.

CHRISTINE MAINVILLE: Well, isn't it a risk not to provide for that integration - you know, not to oversee that?

DESMOND NG: Possibly, yes.

CHRISTINE MAINVILLE: So for instance, I thought you mentioned earlier there would typically be a systems integrator provided for by the consortium or the client.

DESMOND NG: Yeah, yeah. They would integrate, but not at the -- I mean, they would integrate at a very high level, but they don't usually go right down to the -- all the interfaces in detail because they would expect that to be done by each of the subcontractors.

CHRISTINE MAINVILLE: Would you expect an engineer at the consortium level to be overseeing this, the interface?

DESMOND NG: If there was one, then yes, it would be at the -- at -- at the engineering level.

CHRISTINE MAINVILLE: Like a system -- you mean if there was a systems integrator, it

would be at the engineering level?

DESMOND NG: Yes, yeah.

CHRISTINE MAINVILLE: Would you expect, like, a chief engineer during the contract phase to oversee those --

DESMOND NG: No, probably not a chief engineer level because he's usually looking at the overall system. I would -- it would be most likely like a -- maybe at the deployment -- deployment testing managerial level, and even then it would be very high level. They're not going to go down and say, okay, for every -- for this interface, I expect there's an output/input, right? They're looking at it at a functional, high level system level.

CHRISTINE MAINVILLE: So would your --

PETER MANTAS: Ms. Mainville, sorry to interrupt, but I just -- I don't mean to interrupt, but I just want to make sure that the witness is speaking from -- this is more than just speculation, because I know he's here as an expert, and -- or he's here as the procurement guy, and it seems like we're sort of getting into what would normally happen in a later phase, and I just want to make sure, in fairness to the witness and in

fairness to you and to the process, that it's fair as to the scope of his knowledge in this area.

CHRISTINE MAINVILLE: So -- well, I know you were not involved in the contractual phase on this project, but are you not frequently involved in these projects, in those phases?

DESMOND NG: No.

CHRISTINE MAINVILLE: No? Okay.

DESMOND NG: No. Once I hand over the bid to the project team, I rarely get involved again.

CHRISTINE MAINVILLE: I see. I thought you often are involved in the contractual negotiations.

DESMOND NG: No, no. Well --

CHRISTINE MAINVILLE: Okay.

DESMOND NG: -- up to the hand-over of the -- of the -- yeah, the negotiation of the final contract documents, right, but afterwards, when I hand it over to the project team, I rarely get involved.

CHRISTINE MAINVILLE: Okay.

PETER MANTAS: But you think --

DESMOND NG: A lot of the stuff -- as Peter mentioned, it's just based on what I kind of

know or I hear from people, or maybe some of it's my experience, right, but --

CHRISTINE MAINVILLE: Okay.

DESMOND NG: -- the actual occurrence of what happened on the Ottawa project is -- I was not involved, just to be clear.

CHRISTINE MAINVILLE: Yeah. Okay.

PETER MANTAS: And, Ms. Mainville, I think the next witness we've got for you, I think he may have more actual knowledge and experience in this particular phase of the project, if I can call it that, or this aspect of what you're dealing with.

CHRISTINE MAINVILLE: Okay. Fair enough. And so this is -- you're perhaps not the best placed to answer this either, but do you have any clear understanding of what the ultimate issues were with this LRT project in terms of some of the breakdowns and derailments that were encountered?

DESMOND NG: No, I do not.

CHRISTINE MAINVILLE: Okay. And was there anything that stood out for you on this procurement in terms of the RFQ or RFP process?

DESMOND NG: No. Even from prequal to RFP to final contract negotiations, there's --

there was nothing that stood out. It's basically same old, same old for Thales. We've done this many times with other consortiums, and yeah, there are risks, obviously, risks at the RFP phase. You don't know a lot of the details, and there are unknowns, but -- but nothing stood out.

CHRISTINE MAINVILLE: Okay. And what -- even on the risk front, there were no particular risks that were slightly more enhanced on this project or that stood out for you?

DESMOND NG: Yeah, correct. There was nothing that stood out risk wise.

CHRISTINE MAINVILLE: Okay. Okay. Okay. Well, then those are my questions, unless my colleague has any or your counsel has any follow-up.

ANTHONY IMBESI: I just have one or two.

So you had mentioned that in the subcontract, there's an obligation on the two different subcontractors, when you were speaking about the signalling provider and the rolling stock provider, to work together; is that correct?

DESMOND NG: So you're saying if there was a physical requirement, thou shall work with

the rolling stock supplier, a requirement? I don't think there ever is. It's assumed you're going to work with them, but our responsibility is with the consortium level, right?

ANTHONY IMBESI: And in the assumption that Thales has in terms of the work that they have to put in with the rolling stock provider, could you just give me a sense of how far that would go in terms of what Thales would be required to do?

DESMOND NG: You mean working with the rolling stock provider?

ANTHONY IMBESI: Yes, in terms of this sort of assumption you just mentioned of working together.

DESMOND NG: Okay. Okay. So we would -- I mean, we know -- at the bid level, we define the scope split between the signalling and the rolling stock, so that is what equipment we, Thales, are providing, what equipment the -- let's say we're providing the onboard computers. The rolling stock would provide the mounting brackets and braces, et cetera, maybe some of the train lines, right? So the delineation between the equipment provided by Thales and the rolling stock is defined in the -- in the scope split, and Thales

would therefore cost -- or price that equipment accordingly. And then also in the scope split, it physically states that Thales shall install and commission and static PICO, dynamic PICO the first two trains, and then Trains 3 and beyond would be we're just doing the installation supervision, and then the scope split also says what -- who's doing the training on the signalling system, all that. So down to that level, it was -- it was pretty well clearly defined at the scope split level. But if it comes down to, like, oh, well, the speed profile changes and the schedule changes, not -- well, that is -- that is at more of a system level, and it would not ever be captured at the scope split between both rolling stock and Thales.

ANTHONY IMBESI: Okay. So what you're saying, then, is that Thales -- what you just mentioned in terms of the assumption as to Thales working together with the rolling stock provider, in your view, that's set out in detail fully in the scope split that you had talked about?

DESMOND NG: Yes, yeah, yeah. And there was nothing, like, stood out from all the tenders I've worked on. It just a -- pretty well a standard scope split between signalling and rolling

stock that I've seen, so...

ANTHONY IMBESI: Okay. And I just had one further question, and I'm taking you back to earlier in your interview. You had spoken about internally that there were discussions about heavy snow and the performance of the system. Do you recall that?

DESMOND NG: Those were just -- someone mentioned it to me briefly, but I was not involved in any of those discussions. I mean, our system has worked -- the radio system has worked in all different types of weather, so -- but we did do that, but I know someone once mentioned, oh, there's a lot of snow, and I said -- and we said, oh, does it work, and -- so it was just hearsay, but there was no documented or anything -- meetings or anything like that.

ANTHONY IMBESI: Okay. And my specific question was you had given us an example about the Vancouver SkyTrain, and you had talked about the trains operating all night to clear off the snow.

DESMOND NG: Yes, but that is an operational procedure, and that is by the end customer, BCRTC, B.C. Rapid Transit Corporation. It's how they deal with heavy snow in Vancouver.

ANTHONY IMBESI: Right, and my --
DESMOND NG: We don't -- we don't prescribe on how they clear snow and stuff off the system, so --
ANTHONY IMBESI: No, my question to you was going to be when you had indicated that your technical team had said that your system, that the Thales system, could handle the heavy snow, was that based on any assumptions that the operator would be doing certain things to keep the system in a specific state?
DESMOND NG: I do not know.
ANTHONY IMBESI: Okay.
DESMOND NG: I don't know.
ANTHONY IMBESI: Thank you.
DESMOND NG: It was -- and my statement was just based on, like, a coffee -- a coffee -- meeting at the coffee station, so...
ANTHONY IMBESI: Okay. Thank you. Appreciate that. Those are my questions.
PETER MANTAS: Counsel, I have just a question that I'd like to address on re-exam, if that's okay.
CHRISTINE MAINVILLE: Please go ahead.
PETER MANTAS: Okay. Can you hear me,

Desmond?

DESMOND NG: Yes.

PETER MANTAS: Okay, good. You were asked a question a little bit earlier on today by Ms. Mainville about the uniqueness of the Thales system, and I just want to make sure that we've got your answer. I suspect -- and I don't want to put words in her mouth. I suspect Ms. Mainville may have been asking you something a little bit broader, so I want to make sure I give you a chance to answer it more broadly. Can you tell us about the Thales system in a more general sense? What makes it unique? Perhaps I should -- you know, the right way to put it is, you know, why would somebody choose the Thales system as opposed to going with another system or perhaps going with the Alstom signalling system? That's my question.

DESMOND NG: Okay. Thank you. The Thales -- well, Thales first invented the term or coined the term communication-based train system, CBTC, 40 years ago, and we were the very first signalling -- driverless CBTC system running in Vancouver, and -- since 1986 Expo, and we were also the first to develop the radio-based CBTC system in Las Vegas in 2004. Thales's system is well known

by many customers around the world. It's what -- we think we're the Cadillac of the signalling systems, with a turnkey product and many, many features and customizations. And we -- as I mentioned before, our system is very agnostic - that is, it doesn't matter what vehicle supplier it runs on. We've worked with everyone, from Alstom, Siemens, Bombardier, Hyundai, Hitachi, CAF, CRRC in China, and we have an extremely -- very good safety record as a fully automatic driverless CBTC system. It's been deployed in over 40 countries, 120 lines including extensions and -- and brownfield and greenfield systems of all major customers in the world: London, Paris, Shanghai, New York. So it's -- it's well known around the world. I guess that's my marketing pitch for Thales.

PETER MANTAS: Thank you, Mr. Ng, and thank you, Ms. Mainfield, Mr. Imbesi. I have no other questions. Thank you.

CHRISTINE MAINVILLE: Thank you.

-- Concluded at 4:21 p.m.

REPORTER'S CERTIFICATE

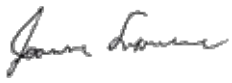
I, JOANNE A. LAWRENCE, Registered Professional Reporter, certify;

That the foregoing proceedings were taken before me at the time and place therein set forth, at which time the witness was put under oath by me;

That the testimony of the witness and all objections made at the time of the examination were recorded stenographically by me and were thereafter transcribed;

That the foregoing is a true and correct transcript of my shorthand notes so taken.

Dated this 2nd day of May, 2022.



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