

# Ottawa Light Rail Commission

Meeting No. 2  
on Thursday, March 31, 2022



77 King Street West, Suite 2020  
Toronto, Ontario M5K 1A1

[neesonsreporting.com](http://neesonsreporting.com) | 416.413.7755

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25

OTTAWA LIGHT RAIL COMMISSION  
MEETING NO. 2: THALES CANADA INC. - MICHAEL BURNS  
MARCH 31, 2022

-----

--- Held via Zoom Videoconferencing, with all  
participants attending remotely, on the 31st day of  
March, 2022, 11:00 a.m. to 2:18 p.m.

-----

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25

COMMISSION COUNSEL:

Christine Mainville, Co-Lead Counsel Member

Fraser Harland, Litigation Counsel Member

PARTICIPANTS:

Michael Burns: Thales Canada Inc.

Jennifer McAleer, Peter Mantas, and Maria Braker:

Fasken Law Firm

ALSO PRESENT:

Joanne Lawrence, Stenographer/Transcriptionist

Leila Heckert, Virtual Technician

1 -- Upon commencing at 11:00 a.m.

2 CHRISTINE MAINVILLE: Thank you,  
3 Mr. Burns. So the purpose of today's interview is  
4 to obtain your evidence under oath or solemn  
5 declaration for at the use at the Commission's  
6 public hearings.

7 This will be a collaborative interview  
8 such that my cocounsel, Mr. Harland, may intervene  
9 to ask certain questions. If time permits, your  
10 counsel may also ask follow-up questions at the end  
11 of the interview.

12 The interview is being transcribed, and  
13 the Commission intends to enter the transcript into  
14 evidence at the Commission's public hearings,  
15 either at the hearings or by way of procedural  
16 order before the hearings commence.

17 The transcript will be posted at the  
18 Commission's public website, along with any  
19 corrections made to it after it is entered into  
20 evidence, and you'll be given an opportunity to  
21 review your transcript and correct any typos or  
22 other errors before it is shared with the  
23 participants or entered into evidence. Any  
24 non-typographical corrections made will be appended  
25 to the transcript.

1                   And just to notify you, that pursuant  
2 to Section 33(vi) of the Public Inquiries Act  
3 (2009), a witness at an inquiry shall be deemed to  
4 have objected to answer any question asked of him  
5 upon the ground that his answer may tend to  
6 incriminate the witness or may tend to establish  
7 his or her liability to civil proceedings at the  
8 instance of the Crown or of any person, and no  
9 answer given by a witness at an inquiry shall be  
10 used or be receivable in evidence against him in  
11 any trial or other proceedings against him  
12 thereafter taking place, other than a prosecution  
13 for perjury in giving such evidence.

14                   And as required by Section 33(vii) of  
15 the Public Inquiries Act, you are hereby advised  
16 that you have the right to object to answer any  
17 question under Section 5 of the Canada Evidence  
18 Act. So if that's all fine, I'll start the  
19 interview.

20                   MICHAEL BURNS: Okay.

21                   CHRISTINE MAINVILLE: Could you explain  
22 your role in Ottawa's LRT project? Stage 1, more  
23 specifically.

24                   MICHAEL BURNS: My role is as the  
25 project manager for Thales Canada that was

1 providing the CBTC system to -- under subcontract  
2 agreement to OLRTC.

3 CHRISTINE MAINVILLE: Okay. And when  
4 did you start in that role of project manager?

5 MICHAEL BURNS: Shortly after the  
6 contract agreement was signed by Thales. That was  
7 April of 2013 that I joined.

8 CHRISTINE MAINVILLE: And did your  
9 involvement end with the project?

10 MICHAEL BURNS: The project has not  
11 ended for -- for Thales.

12 CHRISTINE MAINVILLE: And so you are  
13 still project manager?

14 MICHAEL BURNS: Oh, I'm still project  
15 manager.

16 CHRISTINE MAINVILLE: Okay. And could  
17 you speak to your -- briefly to your background and  
18 experience as it relates to this project.

19 MICHAEL BURNS: I was hired by Thales  
20 specifically for this project. Prior to that, I  
21 have many years of experience running similar --  
22 similar complex projects in the aerospace and  
23 defence industry.

24 CHRISTINE MAINVILLE: Do you have  
25 engineering experience?

1                   MICHAEL BURNS: No. I'm not an  
2 engineer.

3                   CHRISTINE MAINVILLE: And I understand  
4 you have project management experience. Was this  
5 your first rail project?

6                   MICHAEL BURNS: This was my first rail  
7 project.

8                   CHRISTINE MAINVILLE: And have you done  
9 others since, or have you always been focussed on  
10 Ottawa's LRT?

11                   MICHAEL BURNS: I've been primarily  
12 focussed on Ottawa LRT.

13                   CHRISTINE MAINVILLE: Were you involved  
14 in the procurement of the work Thales provided for  
15 the Ottawa LRT?

16                   MICHAEL BURNS: No, I was not involved.  
17 That predated my start at Thales Canada.

18                   CHRISTINE MAINVILLE: Okay. And you  
19 indicated that Thales entered into a contract with  
20 OLRTC?

21                   MICHAEL BURNS: Correct.

22                   CHRISTINE MAINVILLE: Do you know  
23 whether it entered into a contract with any other  
24 entity as part of its role on this project?

25                   MICHAEL BURNS: Yes. There was a

1 separate agreement entered into at the same time  
2 with Rideau Transit Maintenance.

3 CHRISTINE MAINVILLE: And that related  
4 to the maintenance of the OLRT?

5 MICHAEL BURNS: It related to the  
6 maintenance of -- maintenance support to RTM that  
7 came in -- came into effect after the -- the  
8 revenue service start of the Stage 1 system.

9 CHRISTINE MAINVILLE: And you indicated  
10 that Thales was contracted to deliver the CBTC  
11 system. Could you speak a little bit more about  
12 what it was that Thales was to deliver on this  
13 project.

14 MICHAEL BURNS: Yes. We were to  
15 deliver the onboard computer systems onto the --  
16 onto the LRVs, along with other peripheral systems  
17 necessary for this -- our CBTC system to monitor  
18 and control the movement of the LRV, and in support  
19 of that -- that primary objective, we also provided  
20 electromechanical systems that supported that  
21 detection of train movements and train operations  
22 along the guideway, and thirdly, we provided  
23 operator control centre systems to allow the  
24 operator - it would be OC Transpo - to monitor and  
25 operate the movement of trains.



1 CHRISTINE MAINVILLE: Okay. And is --  
2 is the -- the main deliverable what could be called  
3 the signalling system?

4 MICHAEL BURNS: Correct.

5 CHRISTINE MAINVILLE: Okay. And am I  
6 right that that's composed of both the CBTC and the  
7 VOBC system?

8 MICHAEL BURNS: They are not separate.  
9 The VOBC system, for lack of a better description,  
10 would be an onboard control system. But it -- it's  
11 an integral part to the overall signalling system  
12 that entails CBTC.

13 CHRISTINE MAINVILLE: Okay. And what  
14 does CBTC stand for?

15 MICHAEL BURNS: Communication-based  
16 train control.

17 CHRISTINE MAINVILLE: And --

18 MICHAEL BURNS: So --

19 CHRISTINE MAINVILLE: Sorry, yep.

20 MICHAEL BURNS: There's a significant  
21 software component beyond the -- the physical  
22 hardware. That software is tailored to the -- to  
23 the application in Ottawa. It's not new software  
24 developed for Ottawa. The software existed, had  
25 been validated as a product. The software

1 development that Thales undertook was adaptation of  
2 that software to meet the physical environment that  
3 the system would operate in as well as other  
4 parameters dictated by the project agreement.

5 CHRISTINE MAINVILLE: Okay. Would  
6 you -- given the adaptations that you've just  
7 mentioned, would you say that the system, the  
8 Thales system that was delivered on this project,  
9 would you consider it a standard Thales system?

10 MICHAEL BURNS: Yes. I would say it --  
11 it's a -- it's a standard system. There -- there  
12 was no -- the hardware was from existing systems  
13 that we had deployed elsewhere around the world.

14 CHRISTINE MAINVILLE: Was it a first  
15 for North America?

16 MICHAEL BURNS: No. There's been other  
17 systems in North America.

18 CHRISTINE MAINVILLE: By Thales.

19 MICHAEL BURNS: By Thales.

20 CHRISTINE MAINVILLE: Was it a first in  
21 other respects? For instance, was it the first  
22 time that Thales implemented a CBTC system on a  
23 low-floor LRV?

24 MICHAEL BURNS: I'm not aware of it  
25 being -- I can't tell you if there had been other

1 applications on a low-floor vehicle, and I don't --  
2 I don't want to speculate.

3 CHRISTINE MAINVILLE: Okay. Are you  
4 able to say what the main adaptations were to  
5 Thales's standard system?

6 MICHAEL BURNS: The adaptations were  
7 reflections of the guideway and how -- the reaction  
8 from the -- the LRV, so we would be adapting  
9 software to respond to how the LRV intended to  
10 perform.

11 CHRISTINE MAINVILLE: And the LRVs were  
12 being procured from Alstom; correct?

13 MICHAEL BURNS: Correct.

14 CHRISTINE MAINVILLE: And was this the  
15 first time that Thales's systems interfaced with  
16 Alstom LRVs?

17 MICHAEL BURNS: I am -- if I can -- I'm  
18 not sure of the history, given I started with  
19 Thales at that time. I know Alstom and Thales have  
20 been involved in other products, but the first is  
21 likely that the Alstom LRV was the first North  
22 American derivative from their European Citadis  
23 design.

24 CHRISTINE MAINVILLE: Right.

25 MICHAEL BURNS: So in summary, the LRV

1 for Ottawa, from Alstom, it was its -- it was the  
2 first that Alstom was designing for their North  
3 America market.

4 CHRISTINE MAINVILLE: Right. And were  
5 you familiar with the base model, which was the  
6 Citadis Spirit?

7 MICHAEL BURNS: I'm not familiar with  
8 the base model of the Citadis Spirit.

9 CHRISTINE MAINVILLE: Okay. Do you  
10 understand that -- well, can you explain your  
11 understanding that this was a first for North  
12 America? Was this not originally a model that  
13 Alstom had used elsewhere, particularly in Europe?

14 MICHAEL BURNS: My understanding from  
15 Alstom, in our early meetings with Alstom in early  
16 2013, was they were taking the Citadis Spirit  
17 design as its platform but had to do modifications  
18 to that design to comply with North American  
19 standards. That's like taking anything that has  
20 been designed in a different jurisdiction, and you  
21 have different standards you need to meet, even  
22 different hardware.

23 CHRISTINE MAINVILLE: And do you know  
24 if the modifications also had to do with the  
25 particular requirements for this specific project

1 as opposed to North American standards more  
2 broadly?

3 MICHAEL BURNS: Could you repeat that  
4 question again?

5 CHRISTINE MAINVILLE: Do you know if  
6 the design for the Ottawa project and the fact  
7 that, as you described it, it was a first in North  
8 America for Alstom, did part of the redesign have  
9 to do with the particular requirements that the  
10 City had in respect of this project as opposed to  
11 being the result of having to adapt to North  
12 American standards generally?

13 MICHAEL BURNS: That -- that's -- that  
14 would be beyond Thales's understanding and  
15 influence.

16 CHRISTINE MAINVILLE: Okay. Do you  
17 have a view as to, you know, what the implications  
18 might be of the fact that this was effectively a --  
19 the first time this particular model was used?

20 MICHAEL BURNS: The impact as it  
21 relates to Thales in that Thales had an -- was an  
22 integral interface to the LRV was that there were  
23 many delays in finalizing the interfaces to the  
24 train, interfaces from just the physical space  
25 where our equipment could be accommodated within

1 the train, where our peripheral equipment would be  
2 housed, and electrically what communications we  
3 needed from -- details from Alstom and, conversely,  
4 what Alstom needed from Thales to complete the --  
5 the message communication between the two systems,  
6 from the two companies.

7 CHRISTINE MAINVILLE: And was this  
8 something that was anticipated early on and  
9 provided for in the planning stages?

10 MICHAEL BURNS: Anticipated by whom?

11 CHRISTINE MAINVILLE: Well, first,  
12 maybe you could speak to Thales's expectations --  
13 yeah.

14 MICHAEL BURNS: Thales understood that  
15 it was a critical interface that needed to be  
16 resolved quickly because there were schedule  
17 commitments for the production of the first onboard  
18 computer systems that we'd be providing. There was  
19 also schedule conditions for the provision of the  
20 first two prototype trains from Alstom.

21 CHRISTINE MAINVILLE: And could you  
22 tell us briefly or generally what was provided for  
23 in Thales's subcontract with OLRTC about when it  
24 was to deliver the VOBC racks?

25 MICHAEL BURNS: I recall it was

1 supposed to be -- I would say fourth quarter of  
2 2014.

3 CHRISTINE MAINVILLE: Okay. Was that  
4 for the first one?

5 MICHAEL BURNS: For the first two LRVs.

6 CHRISTINE MAINVILLE: Okay.

7 MICHAEL BURNS: In that time period.

8 CHRISTINE MAINVILLE: Okay. And what  
9 about prior to that? I understand -- well, maybe  
10 you could first describe the process planned for in  
11 terms of how to go about devising this interface  
12 with Alstom's LRVs.

13 MICHAEL BURNS: Well, the design --  
14 or -- let me step back. The Thales project  
15 agreement included three progressive design reviews  
16 of which the trains would be a component of, not  
17 its entirety: the -- a conceptual design review in  
18 June of 2013, followed by a preliminary review in  
19 September of 2013, and then a final design review  
20 in September 2014. That encompasses all of  
21 Thales's deliverables. A subset of those design  
22 reviews would be the progressive development of the  
23 design -- our design with the LRV.

24 CHRISTINE MAINVILLE: So the contract  
25 essentially provided for an iterative process to

1 this design interface.

2 MICHAEL BURNS: Correct.

3 CHRISTINE MAINVILLE: And did you come  
4 to understand what -- whether those corresponded to  
5 Alstom's deliverables?

6 MICHAEL BURNS: I can't answer what  
7 Alstom's deliverables are because I don't have  
8 access, nor should I, to the contract or the  
9 deliverable milestones within Alstom's agreement.

10 CHRISTINE MAINVILLE: Do you know  
11 whether there was any early thought put into the  
12 integration of the two systems from the two  
13 companies?

14 MICHAEL BURNS: I -- I believe Thales  
15 had a clear understanding of what had to be done to  
16 achieve that integration. Alstom demonstrated some  
17 reluctance in sharing the information we were  
18 requesting. Some examples where agreements were  
19 reached on how the signalling -- sorry, by  
20 "signalling," I mean the communication between the  
21 two systems, what is referred to as an IO signal  
22 diagram, so the in and out - 'I' being in and 'O'  
23 being out. So there's multiple communication  
24 channels, and Thales needs to understand and Alstom  
25 needs to appreciate what messages we are sending to



1 the train, and we need to understand what messages  
2 are coming from the train. That IO signal diagram  
3 was the topic of many meetings - I would probably  
4 say countless workshops - to try and resolve the  
5 needs of the two parties. Some -- some of the  
6 agreements reached in prior meetings were then  
7 changed in subsequent meetings.

8 CHRISTINE MAINVILLE: Okay. And we'll  
9 come back to those workshops, but at the earlier  
10 planning stages, design stages, what, if any,  
11 discussions were had between Alstom and Thales  
12 involving OLRTC regarding how that interface would  
13 be managed?

14 MICHAEL BURNS: I -- there wasn't a lot  
15 of overt discussion of managing the development of  
16 those interfaces. OLRTC participated -- or  
17 attended is a correct -- an apt description. They  
18 attended these meetings, but Thales and Alstom were  
19 left to work out those requirements and those  
20 interface controls between the two parties.

21 CHRISTINE MAINVILLE: And so was there  
22 any plan as to who was to -- who, if anyone, was to  
23 oversee this integration?

24 MICHAEL BURNS: As the prime  
25 contractor, OLRTC had the role of system integrator

1 within -- within the contract. They struggled to  
2 assign a resource or a group to fulfill that role  
3 of system integrator.

4 CHRISTINE MAINVILLE: Can you speak a  
5 bit more about that, what was conveyed to you in  
6 terms of the efforts that were made in that regard  
7 or what the plan was?

8 MICHAEL BURNS: My understanding was  
9 that the plan was that one group within the  
10 consortium, SNC Lavalin, was to provide that system  
11 integrator role out of the Vancouver office.  
12 That -- that same office had the responsibility for  
13 designing the tunnel ventilation system, but --  
14 they did design the tunnel ventilation system, but  
15 they -- they were not involved and -- and did not  
16 fulfill or execute a system integration capacity.

17 CHRISTINE MAINVILLE: Were any reasons  
18 given to you about why that was?

19 MICHAEL BURNS: No. I repeatedly  
20 raised the concern with OLRTC. At one point, they  
21 did acknowledge they had a problem in fulfilling  
22 that role. But that was in 2017.

23 FRASER HARLAND: Can I just jump in  
24 there and ask a question? Can you just help us  
25 with what the -- the impact, from your perspective

1 or from Thales's perspective, of not having a  
2 system integrator was on the project?

3 MICHAEL BURNS: The -- the impact is  
4 the parties that OLRTC contracted with, there's  
5 a -- there's always some interface between each  
6 other, and in some cases more than each other.  
7 There could be three or more parties. Initially,  
8 the system integrator needs to be able to reconcile  
9 the overall project agreement requirements as being  
10 met by the work that they have subcontracted out to  
11 different entities. They -- the impact on not  
12 having that system integrator, it -- it defaulted  
13 to the subcontractors, like Thales or Alstom or  
14 others, to try and resolve conflicts by -- of how  
15 the systems were going to meet the OLRTC's project  
16 agreement requirements.

17 So you're -- if we're -- if I use the  
18 Alstom/Thales example specifically is we can -- we  
19 can solve a problem by one path through Thales or  
20 another path through Alstom, and who -- who is  
21 going to be the -- the entity that's going to  
22 resolve the -- the issue. And that requires an  
23 overarching management, which is the system  
24 integrator.

25 FRASER HARLAND: Just to follow up on

1 that, do you have any sense of why there was this  
2 lack of a systems integrator, from your  
3 understanding? Was there a resources issue, a  
4 policy choice made, or -- if you can help us at all  
5 there, that would be great.

6 MICHAEL BURNS: I was -- I was never  
7 told why. I can only offer what I saw in terms of  
8 how it affected Thales's performance, and verbally,  
9 it was -- it was explained to me that they were  
10 having problems fulfilling that role. I don't know  
11 if it was a human resource problem, whether they  
12 overcommitted to do other projects. This is --  
13 this is pure speculation. I -- I just don't know,  
14 so I really can't answer the why. But it was -- it  
15 was made abundantly clear by me to OLRTC that this  
16 was a critical problem.

17 CHRISTINE MAINVILLE: And who  
18 specifically? Who was your main counterpart or  
19 counterparts on that?

20 MICHAEL BURNS: It would depend on  
21 the -- on which year you're talking about. But I  
22 had discussed this with Eugene Creamer, and I think  
23 Eugene came on as the lead project director in  
24 2017. Prior to that, my main commercial interface  
25 was Alex Turner.

1 CHRISTINE MAINVILLE: Okay. And --  
2 yes. And did they understand the issue? Did they  
3 appear to understand the issue?

4 MICHAEL BURNS: Eugene definitely  
5 understood it was a problem. Alex Turner, in his  
6 role -- his title was contract manager for the --  
7 for vehicle and signalling, so as it was initially  
8 offered to Thales that Alex was going to fulfill  
9 that role of system integrator, but he didn't have  
10 the requisite background to be able to fulfill that  
11 role.

12 CHRISTINE MAINVILLE: Do you know  
13 whether they kept looking, OLRTC kept looking for  
14 someone to --

15 MICHAEL BURNS: Yes.

16 CHRISTINE MAINVILLE: -- properly --

17 MICHAEL BURNS: Yes, they did, and they  
18 brought on other engineering resources that  
19 fulfilled some aspects of that integration role.

20 CHRISTINE MAINVILLE: Was there an MOU  
21 or some other mechanism put in place to facilitate  
22 the collaboration between Alstom and Thales on --  
23 on the interface?

24 MICHAEL BURNS: Sorry, what was the  
25 acronym you used? 'M' --

1 CHRISTINE MAINVILLE: A memorandum of  
2 understanding.

3 MICHAEL BURNS: Oh, MOU, okay. No,  
4 there was no MOU developed.

5 CHRISTINE MAINVILLE: And so how -- was  
6 there anything that defined your -- Thales's  
7 relationship with Alstom?

8 MICHAEL BURNS: Within the agreement  
9 itself, there -- I don't recall that there was a  
10 specific mechanism detailed, how the two parties  
11 would work together. They -- the two parties  
12 understood there had to be that collaboration, and  
13 that started immediately, in, you know, early 2013.  
14 It's the product or the output of those meetings,  
15 some of which were minuted, some of them were more  
16 informal. The -- what you might -- what you refer  
17 to as a memorandum of understanding or an agreement  
18 would be the product of what Thales produced, which  
19 was interface control document that defines --  
20 well, there's two documents specifically. There's  
21 a -- what we referred to as a black box interface  
22 which defines the mechanical, electrical aspects of  
23 what Thales is producing, and then the other  
24 interface is more the electrical, of the signalling  
25 components of what messages we're sending to the

1 train, what messages we're receiving and vice  
2 versa. So I referred to earlier about the IO  
3 signal diagram. That's a key component of that  
4 ICD.

5 CHRISTINE MAINVILLE: Is there a  
6 distinction between the ICD you just described and  
7 the -- well, let me put it this way: Is the ICD a  
8 mechanism to arrive at a finalized -- at finalized  
9 CBTC specifications?

10 MICHAEL BURNS: The ICD is -- serves  
11 two purposes. The first purpose is internally, it  
12 provides the engineering details necessary for  
13 Thales's software development, and then  
14 mechanically, on the black box interface, it  
15 provides details about how our equipment would be  
16 installed within that vehicle. So that -- it's  
17 a -- it's a document for, internal, Thales's  
18 project execution, and externally, Alstom and OLRTC  
19 then know what we are going to do and how the  
20 Alstom equivalent interface has to mirror the same.

21 CHRISTINE MAINVILLE: And were you  
22 receiving ICDs back from Alstom in terms of what  
23 their own design requests --

24 MICHAEL BURNS: Yes.

25 CHRISTINE MAINVILLE: -- required?

1                   MICHAEL BURNS: As part of that  
2                   iterative interface development, we did receive  
3                   some versions of an equivalent ICD from Alstom, and  
4                   that would have been produced as a product of the  
5                   workshops or interface meetings we had with Alstom.

6                   CHRISTINE MAINVILLE: And so how did  
7                   the integration of those respective ICDs, the ones  
8                   from Alstom and Thales, how did that ultimately get  
9                   done?

10                  MICHAEL BURNS: The -- we provided  
11                  the -- our ICDs to OLRTC, and Alstom provided their  
12                  ICDs to OLRTC as well, and then we would compare --  
13                  as I said, this iterative process, we would compare  
14                  what we received from Alstom to what we had  
15                  discussed and our understanding coming out of the  
16                  workshops and identify if there were any  
17                  discrepancies or errors, and in more than one  
18                  occasion, there were reversals of ICD decisions  
19                  that were made with Alstom when it -- the ICDs were  
20                  I believe developed in France. Our interface with  
21                  Alstom was a representative in -- out of Toronto,  
22                  and he would convey those -- the workshop interface  
23                  decisions back to France and then they -- the -- I  
24                  guess the Alstom France owned the -- the ICD  
25                  documents, and they would make the updates in



1 France.

2 CHRISTINE MAINVILLE: Would you have  
3 expected this process to -- to be different had  
4 there been a -- a systems integrator in place early  
5 on?

6 MICHAEL BURNS: Yes, but I don't  
7 believe it is the sole complication that we faced.  
8 We -- you have to appreciate that Alstom is a  
9 competitor to Thales, and that might explain their  
10 reticence of providing information to Thales. But  
11 definitely a system integrator would have  
12 facilitated that integration activity or the  
13 development of the interfaces much faster, in my  
14 opinion.

15 CHRISTINE MAINVILLE: So was it an  
16 issue that Thales's system was to be integrated  
17 with Alstom LRVs in the first place?

18 MICHAEL BURNS: In terms of the  
19 relationship between Alstom and Thales? No.

20 CHRISTINE MAINVILLE: Well, it's -- no?

21 MICHAEL BURNS: No. I -- it's a -- my  
22 understanding was Alstom and Thales had different  
23 discussions before the contract award, so there --  
24 the parties knew that there was the potential that  
25 they would be working together, so that should not

1 have resulted in a problem.

2 CHRISTINE MAINVILLE: And is it the  
3 case that Thales's systems often interface with  
4 LRVs produced by other companies?

5 MICHAEL BURNS: Yes.

6 CHRISTINE MAINVILLE: And you've spoken  
7 about this issue of Alstom being a competitor.  
8 Does that issue not arise generally, then, on other  
9 projects?

10 MICHAEL BURNS: Yes. Because Thales is  
11 not a rolling stock manufacturer, they have to  
12 interface with whomever is the rolling stock  
13 provider, the train provider. So we're used to  
14 what's required to develop interfaces with other --  
15 other trains. So -- I don't know if that answers  
16 your question.

17 CHRISTINE MAINVILLE: You're used to  
18 it, but are there similar challenges, then, in  
19 terms of receiving the information that Thales  
20 needs for the interface?

21 MICHAEL BURNS: I can't speak to  
22 historical experiences since I -- I don't have  
23 that. I don't expect that -- I expect there's  
24 always going to be a -- a challenge in trying to  
25 come up with an agreeable fit within the train

1 and -- and what each train might need in the way of  
2 communication and what Thales needs, conversely,  
3 from the train. But it should not have been as  
4 protracted as our experience, in my opinion.

5 CHRISTINE MAINVILLE: Would you agree  
6 that as a result of this being the first interface  
7 between Thales's system and this particular LRV  
8 model that there was a heightened need for strong  
9 interfacing management?

10 MICHAEL BURNS: I would say that that's  
11 a need, in my experience, in complex integration  
12 activities. You always need a very strong  
13 integrator.

14 CHRISTINE MAINVILLE: And to be clear,  
15 this project never did have one, as it related to  
16 the Alstom/Thales interface; correct?

17 MICHAEL BURNS: That is correct.

18 FRASER HARLAND: Just related to that,  
19 can I ask, was that -- I mean, was that the  
20 expectation of -- what was the expectation of  
21 Thales prior to the contract being signed with  
22 respect to system integration?

23 MICHAEL BURNS: I can only report what  
24 our contract specifies, and it specifies that OLRTC  
25 would fulfill the role of system integrator.

1 CHRISTINE MAINVILLE: Are you aware  
2 that Alstom's subcontract with OLRTC required OLRTC  
3 to deliver to Alstom a finalized CBTC specification  
4 by April 26th, 2013?

5 MICHAEL BURNS: I am, because that was  
6 repeatedly mentioned by the Alstom vice president,  
7 Derek Hurst, on the very first meetings with OLRTC  
8 and Thales.

9 CHRISTINE MAINVILLE: And was this -- I  
10 take it the CBTC specifications needed to come from  
11 Thales; correct?

12 MICHAEL BURNS: The specifications from  
13 the CBTC system? Is that --

14 CHRISTINE MAINVILLE: Yes.

15 MICHAEL BURNS: Yes.

16 CHRISTINE MAINVILLE: And so was  
17 that -- given the iterative process you've  
18 described, was that a realistic timeline for Alstom  
19 to receive those specifications?

20 MICHAEL BURNS: Well, I believe the  
21 specification you're referring to was provided by  
22 Thales very early, like within the first month or  
23 two.

24 CHRISTINE MAINVILLE: Were these  
25 finalized, though, in terms of being frozen in

1 time?

2 MICHAEL BURNS: The -- you're -- I'm  
3 not sure if there's a disconnect in the  
4 interpretation of what Thales was initially  
5 providing and what Alstom's contract specified they  
6 would get. So it's difficult for me to give you an  
7 answer. We definitely provided the requirements  
8 that Thales needed because that was known. It's  
9 the adaptation of what we needed and the -- and  
10 that adaptation vis-à-vis the train itself is what  
11 was the protracted interface development.

12 CHRISTINE MAINVILLE: And is it  
13 accurate to describe what Thales delivered to  
14 Alstom in April 2013 as the IC -- a draft ICD or a  
15 version of the ICD? An early version?

16 MICHAEL BURNS: I don't recall. I know  
17 there was a -- definitely a document that defined  
18 our requirements. I don't know if that would have  
19 been interpreted or deemed to be a draft or first  
20 version of an ICD.

21 CHRISTINE MAINVILLE: But there were  
22 subsequent revisions to the Thales ICD; correct?  
23 From April 2013 onwards?

24 MICHAEL BURNS: No. I'm going to  
25 correct your question.

1 CHRISTINE MAINVILLE: Sure.

2 MICHAEL BURNS: Because what was  
3 provided in April by Thales may not have been an  
4 ICD.

5 CHRISTINE MAINVILLE: Okay.

6 MICHAEL BURNS: And so once the ICD --  
7 the first version of the ICD, I would have to refer  
8 back to our records to understand if it was, in  
9 fact, Revision 1 of the ICD back in April.

10 CHRISTINE MAINVILLE: Do you recall  
11 whether Thales had committed to providing a fully  
12 defined ICD in the first half of September 2013?

13 MICHAEL BURNS: No, I don't recall  
14 that. I don't recall that there was that  
15 commitment. As I mentioned earlier, the final  
16 design review was September of 2014. So the --  
17 the -- the development of those interfaces should  
18 have been concluded no later than at final design  
19 review.

20 CHRISTINE MAINVILLE: Did you come to  
21 understand what Alstom's expectations were and  
22 whether they aligned with Thales's expectations in  
23 terms of that timeline?

24 MICHAEL BURNS: Expectations of the  
25 timeline or expectations of the ICD?

1 CHRISTINE MAINVILLE: Right, both, in  
2 terms of what it would receive when.

3 MICHAEL BURNS: We -- we regularly  
4 communicated with Alstom's contact, Lowell Goudge,  
5 about our deliverables and when they would be  
6 submitted. So they -- they were definitely aware  
7 of what we were doing and when the next update  
8 would be provided.

9 CHRISTINE MAINVILLE: But did they  
10 express concern about that or --

11 MICHAEL BURNS: I never experienced  
12 with Alstom a concern about finalizing the ICD.  
13 There -- I could speculate that they may have had  
14 other challenges that could be hidden by the  
15 continuation of ICD update revisions. They were  
16 taking this train and -- from Europe and having to  
17 design it to meet North American requirements, and  
18 I know they struggled with a number of issues on  
19 that front. There was a number of changes of where  
20 the trains were going to be manufactured, where  
21 they were going to be tested, and that may have  
22 been a product of delays in -- in completing their  
23 train design.

24 CHRISTINE MAINVILLE: Right. So  
25 speaking to that, could you explain what was the

1 original plan in terms of where the train  
2 manufacturing was going to take place.

3 MICHAEL BURNS: The first two trains  
4 were to be manufactured in France, and they were to  
5 be delivered prototypes - they were to be tested in  
6 France before - and the balance of the trains were  
7 to be assembled in Ottawa.

8 CHRISTINE MAINVILLE: And then what  
9 happened?

10 MICHAEL BURNS: There was a change so  
11 that the first trains were then being assembled in  
12 their facility in New York State, and because the  
13 trains were not in France, we were unable to  
14 execute our test -- the planned testing of the  
15 trains with the first of our onboard systems, and  
16 the schedule -- the initial schedule and -- and per  
17 the contract, we were to execute that testing of  
18 the mechanical and electrical performance of our  
19 systems on the train and do the first of the what  
20 we'll call ASC testing, automatic speed control  
21 testing, where we are able to assess the train's  
22 reaction to our commands, and that's a variable  
23 that needs to be developed into our software -  
24 again, the adaptation performance - so that was --  
25 that was not achieved in France because the trains



1 never were finally assembled in France but were  
2 assembled in New York, and the New York facility  
3 didn't have the test track that would allow us to  
4 be able to do the dynamic testing of the trains.

5 CHRISTINE MAINVILLE: So was that  
6 testing ever done on the first two LRVs?

7 MICHAEL BURNS: No. The first -- the  
8 first train that we were given access to was train  
9 number 5. We had to -- they -- we had to postpone  
10 the automatic ASC testing until much later, and  
11 that -- the results of that testing being --  
12 were -- were pushed back such that it impacted our  
13 software development. So as you move through the  
14 design, software development, and testing, pushing  
15 off certain functions from testing leads -- leads  
16 to a protraction of the overall timeline for our  
17 testing.

18 CHRISTINE MAINVILLE: It led to  
19 additional complexities down the line which could  
20 have been streamlined. Is that --

21 MICHAEL BURNS: That's a fair summary.

22 CHRISTINE MAINVILLE: And was that  
23 considered when the move was made -- the decision  
24 was made to move the assembly from France to New  
25 York State? Do you know whether that was

1 considered and discussed, the fact that this  
2 testing would not be performed by Thales?

3 MICHAEL BURNS: My recollection is that  
4 that -- we weren't asked to comment or offer an  
5 opinion. It was more of a notification that this  
6 is where the trains would be going to.

7 CHRISTINE MAINVILLE: Do you know what  
8 led to that change?

9 MICHAEL BURNS: No, I don't. I do not  
10 know -- I -- anything I could offer would be just  
11 speculation.

12 CHRISTINE MAINVILLE: Okay. And did  
13 Thales raise this issue with OLRTC upon being  
14 apprised of the move?

15 MICHAEL BURNS: I recall that I had  
16 raised this likely in my monthly report at the  
17 time.

18 CHRISTINE MAINVILLE: Was there a  
19 response back by OLRTC?

20 MICHAEL BURNS: I -- I do not recall.

21 CHRISTINE MAINVILLE: And do you recall  
22 approximately the time frame for when Thales was  
23 able to perform this test for the first time on LR  
24 5?

25 MICHAEL BURNS: No, I don't recall, but

1 it would be no earlier than 2017 and likely  
2 probably into early 2018.

3 CHRISTINE MAINVILLE: So this would  
4 have had a significant impact on the delivery  
5 timelines. Is that fair?

6 MICHAEL BURNS: It would have had an  
7 impact on the completion of our testing, site  
8 testing.

9 CHRISTINE MAINVILLE: Did that have  
10 other repercussions on subsequent testing?

11 MICHAEL BURNS: Well, again, the  
12 iterative nature particularly of ASC testing is as  
13 you're testing the performance of the train, you --  
14 there's tuning that needs to be made on -- on our  
15 software, so it would have involved more software  
16 build releases so there would be time to develop,  
17 validate the software, and then issue for uploading  
18 on the system. So it led to -- it's one of the  
19 sources for the prolongation of testing.

20 CHRISTINE MAINVILLE: And I'll come  
21 back to testing, but do you -- I understand there  
22 was an issue that arose regarding whether the  
23 system, Thales's system, was to be delivered as a  
24 complete signal rack as opposed to in -- broken up  
25 into components, so whether it would be a

1 plug-and-play system or not.

2 MICHAEL BURNS: Alstom had expressed  
3 that opinion to Thales. I had to explain to Alstom  
4 that our offer - and it was part of the artifacts  
5 in the -- our subcontract agreement - identified  
6 the VOBC as a -- as a single-rack assembly.  
7 That -- the comment from Alstom was a surprise to  
8 our engineering team.

9 CHRISTINE MAINVILLE: Should this have  
10 been --

11 MICHAEL BURNS: They also expected that  
12 the VOBC would -- would be fully integrated and  
13 wired so that it was -- they -- as you -- and they  
14 used the same term, that is was just plug in or  
15 plug-and-play system.

16 CHRISTINE MAINVILLE: And do you recall  
17 when -- around when that came to Thales's  
18 attention, that Alstom had this expectation?

19 MICHAEL BURNS: It was in 2013.

20 CHRISTINE MAINVILLE: And was it  
21 resolved around that time?

22 MICHAEL BURNS: The resolution -- well,  
23 there was no -- no, sorry. I have to regroup on  
24 this. Thales was very clear on the expectations as  
25 defined within our agreement. Alstom did not

1 accept or reject it directly. Indirectly, and  
2 subsequent to this view of what they expected from  
3 Thales, they offered a variety of obstructions:  
4 wanting the rack to be located in various  
5 locations, under a heat source; they wanted it  
6 mounted from the ceiling; they also wanted it  
7 removed from the cabin and put on its side in the  
8 roof, as a number of the feedbacks that we got and  
9 proposed changes to where we would physically have  
10 the equipment.

11 CHRISTINE MAINVILLE: And I understand  
12 that that had more to do with the dimensions of the  
13 rack.

14 MICHAEL BURNS: Yeah, and the -- well,  
15 the dimensions of the rack were -- were known  
16 before the contract. It was the space that Alstom  
17 deemed available to Thales, so we -- we looked at  
18 alternate locations, either in the cab or behind  
19 the cab, even locations of where we would put  
20 the -- the operating display, and they were  
21 generally met with a rejection, that that space  
22 was -- was not available, that they had already  
23 allocated the space for their own systems.

24 CHRISTINE MAINVILLE: Okay. But in  
25 terms of how the rack would be delivered more

1 specifically, I understand that there were to be a  
2 number of wires, for instance, to be connected  
3 within Thales's equipment upon delivery.

4 MICHAEL BURNS: Right.

5 CHRISTINE MAINVILLE: And was there a  
6 reason those would not be connected prior to  
7 delivery?

8 MICHAEL BURNS: The agreement was  
9 that -- within the work share that was broken out  
10 in our agreement of -- Alstom was responsible for  
11 some things, and Thales was for others, and it was  
12 very -- it was -- it was broken up, to my view.  
13 There wasn't a clear, natural demarcation of who  
14 should do what and then hand over a complete unit  
15 to the other. So having it unnaturally divided  
16 would create conflicts or misunderstandings. The  
17 way we were responsible for was the first two, the  
18 two deliverable prototypes, we would prewire the --  
19 with all the final connecting pieces that would  
20 interface to the train, either on the -- their --  
21 either a direct train line or MVB connection, a  
22 multibus connection. So it's difficult to deliver  
23 that if there's still discussions about the ICD.  
24 But how that specifically got resolved was that  
25 OLRTC recognized that there was a gap in that work

1 share because it only addressed the first two VOBC  
2 systems, so they then funded us to complete the  
3 prewiring of the racks for the balance of the --  
4 the VOBC systems.

5 CHRISTINE MAINVILLE: Okay. So we hear  
6 Thales did eventually provide the personnel to  
7 assemble and test the rack, and was that at the  
8 point of installation?

9 MICHAEL BURNS: No, it -- that was done  
10 prior to installation. If you -- the VOBC -- the  
11 subassemblies within -- the major subassemblies  
12 within that are factory-tested and certified, and  
13 they are -- they slide into the rack, and beyond  
14 the first article tests where we had the complete  
15 VOBC rack and populated and wired, the -- the  
16 Thales approach was that because these modules are  
17 interchangeable, they're not tested and -- and  
18 fixed to that particular train, from a  
19 maintainability, you have to be able to swap them  
20 out with spare or move them between different  
21 VOBCs.

22 So the way we explained it to OLRTC was  
23 we prewire the rack and validate that they -- all  
24 the connections are there, and we ship the rack  
25 without populating the heavy modules because of the

1 risk of physical distortion of the rack because of  
2 the weight of all these interchangeable modules.  
3 So we deliver a wired rack, ready to accept all  
4 these modules that slide in, and then after that is  
5 installed, then there's the connections that are  
6 made to the -- to the train.

7 CHRISTINE MAINVILLE: So did Alstom  
8 only end up making those connections between the  
9 rack and the train?

10 MICHAEL BURNS: That -- that was within  
11 Alstom's responsibility of taking the -- taking the  
12 wired rack, mounting it into the train cab,  
13 populating those modules, and then terminating the  
14 connections at a common connector mounting point at  
15 the base of the rack.

16 CHRISTINE MAINVILLE: And who ended up  
17 doing the SPICO testing on the connections within  
18 the VOBC rack?

19 MICHAEL BURNS: Well, there was a  
20 dispute about that as well, again I think tied back  
21 to this unnatural division of responsibilities.  
22 Thales provided the SPICO procedures, so -- by --  
23 SPICO being static post-installation checkout. So  
24 there's no power to it. Nothing is moving. Alstom  
25 had responsibility to perform the SPICO tests, and



1 then after those tests were passed successfully and  
2 the results shared with Thales, Thales would then  
3 take it to the next level, which is to do dynamic  
4 testing of the completed assembly.

5 By that -- by the SPICO test procedure,  
6 everything is in, installed, and we know that all  
7 the connections to the train are successful, and  
8 then we do another series of dynamic testing where  
9 there became an issue is in part by where the  
10 connections were made inside the Thales rack.  
11 Alstom refused to do some of the SPICO tests  
12 because it involved going inside the envelope of  
13 the VOBC. So OLRTC was forced, because of Alstom's  
14 refusal, to request Thales undertake a subset of  
15 the SPICO tests.

16 CHRISTINE MAINVILLE: So that's what  
17 ultimately happened, that Thales performed --

18 MICHAEL BURNS: Some of the SPICO tests  
19 the Alstom was under contract to perform.

20 CHRISTINE MAINVILLE: And did Thales  
21 perform all of the SPICO testing that Alstom  
22 objected to performing?

23 MICHAEL BURNS: Yes.

24 CHRISTINE MAINVILLE: And so was -- was  
25 the entire testing done, ultimately, the SPICO

1 testing?

2                   MICHAEL BURNS: Yes, it -- the --  
3 regardless of who performs the test, Thales will  
4 not, cannot perform dynamic testing because you're  
5 taking the train onto the track, and you're going  
6 up the track with it. So it's a precondition that  
7 the SPICO test must be successfully completed,  
8 regardless of who performs it, and it's only after  
9 that is done that we are allowed to undertake the  
10 dynamic testing.

11                   CHRISTINE MAINVILLE: And just  
12 (indiscernible), did Thales end up doing more SPICO  
13 testing than just testing the battery and  
14 low-voltage hardware interface?

15                   MICHAEL BURNS: I don't know the  
16 specific descriptions of the SPICO tests we  
17 performed. I can only say that we didn't perform  
18 any extra tests that we hadn't previously  
19 instructed. We just did the tests that Alstom  
20 refused to do, if that answers your question.

21                   CHRISTINE MAINVILLE: Yes. You spoke  
22 about this unnatural division of responsibility, so  
23 can you be a bit clearer on that? What was  
24 provided for initially was not what you would  
25 expect? Is that what you mean?

1                   MICHAEL BURNS: Well, it was -- when I  
2 first met with OLRTC - so that was in probably May,  
3 early May of 2013 - I was asked what my initial  
4 thoughts were on the agreement and what -- what  
5 might keep me up at night. And my opinion, new to  
6 the industry but not new to managing complex  
7 projects, was you have too many interfaces, and  
8 each interface is an opportunity for a  
9 misunderstanding of what one party is expecting and  
10 a misunderstanding of what the other party  
11 receives. It's -- it's a -- it's akin to a  
12 translation service: You need -- you -- every time  
13 there is a handoff or an interface, there is  
14 misunderstandings or a misinterpretation that could  
15 arise.

16                   And so I expressed that to OLRTC very  
17 early. It's not something that I expected them to  
18 change, but it was in response to that, you know,  
19 question of what -- what would keep me up at night,  
20 and the interface between -- or the work share  
21 between Alstom and Thales as it specifically  
22 related to interfacing the onboard equipment onto  
23 the Alstom vehicle was a perfect example of that.

24                   CHRISTINE MAINVILLE: It's fair to say  
25 there should have been more thought put into that

1 interface at the design stage?

2           MICHAEL BURNS: No. It was baked into  
3 the agreement. So in a perfect world -- and I  
4 don't understand the logic at the time. I could  
5 only speculate it was based on money -- was that  
6 since Alstom's going to be assembling the train,  
7 why not get them to assemble the onboard equipment  
8 that we're providing at the same time? I'm  
9 assuming the logic may have been it would be  
10 cheaper to have Alstom take on that work than to  
11 make it a more of a turnkey installation of all the  
12 Thales systems. You know, we -- a cleaner  
13 interface would have been, You build the trains,  
14 Alstom, and when you're finished building it and  
15 doing whatever testing you need to do and you're  
16 ready for the VOBC system, then Thales will come  
17 and take care of the installation of that. And  
18 then you have to agree to where it's going to go  
19 and all of that, but there wouldn't be debate about  
20 who's going to put a -- a screwdriver into the rack  
21 assembly and -- and tighten this up.

22           CHRISTINE MAINVILLE: Right.

23           FRASER HARLAND: Just to be abundantly  
24 clear, when you talk about this unnatural division  
25 of responsibility in the agreement, you're

1 referring to the subcontract between Thales and  
2 OLRTC; is that right?

3 MICHAEL BURNS: Correct. It's --  
4 it's -- there's a table in our subcontract  
5 agreement called work share. It's a -- it may be a  
6 separate schedule. And in it, it shows the  
7 different tasks and who does what, and it's a -- if  
8 you look at it, you can see Alstom throughout or  
9 you can see Thales throughout. So there's little  
10 bits that each of the two parties are responsible  
11 for, to either deliver materials, install  
12 materials, and test materials.

13 In a perfect world, the parties would  
14 have understood each other and would have been --  
15 maybe understood better what was going to be  
16 required, but as we've discussed earlier, Alstom  
17 claimed to have an expectation very different than  
18 what Thales had offered and our subcontract  
19 agreement provided.

20 So I -- I can't speak to Alstom's  
21 motivation of why they may have had that  
22 expectation, but that's -- it's an example of  
23 the -- those expectations or misunderstandings may  
24 not have arisen had there been a clearer  
25 demarcation between the scope of one subcontractor

1 and the other. And the best world would -- you'd  
2 have, you know, Alstom subcontract and Thales  
3 subcontract and a single interface, one cable  
4 between the two, as a graphic explanation.

5 CHRISTINE MAINVILLE: Right. And  
6 Alstom's requirements were not known to Thales. Is  
7 that fair?

8 MICHAEL BURNS: Alstom's requirements.  
9 Alstom's --

10 CHRISTINE MAINVILLE: In their  
11 contract. In their contract and what they had to  
12 provide.

13 MICHAEL BURNS: I have to assume that  
14 the same work -- work share schedule is in the  
15 Alstom agreement and in the Thales agreement.  
16 It -- it had to have been. But I cannot -- I  
17 haven't seen the Alstom agreement, so I can only --  
18 by the discussion and efforts, it's definitely  
19 there because we did have discussions about who  
20 should do what and who should -- who should define  
21 the type of connector that we were terminating to.  
22 And in that -- that work share agreement, that  
23 responsibility was given to Alstom, so therefore  
24 they dictated the connector, the mating connector  
25 to their train.

1 CHRISTINE MAINVILLE: Would you say  
2 that Alstom's ICDs and Thales's ICDs never fully  
3 spoke to each other?

4 MICHAEL BURNS: That's a very true  
5 assessment.

6 CHRISTINE MAINVILLE: And can you talk  
7 about why there was never -- why a full integration  
8 of those ICDs was not achieved?

9 MICHAEL BURNS: I can explain it in --  
10 with a -- an example, if you permit. Where we --  
11 we -- we meet, our engineer's present, and we walk  
12 through the IO signal diagram and explain what  
13 command this is going to and what reaction is  
14 expected, and -- and it's an iterative review with  
15 the Alstom representative, and there's an  
16 agreement, and it's minuted, and then, because  
17 Alstom has the same needs as Thales, these ICDs go  
18 back to homeroom, and it's used for software  
19 development or for their development of the trains  
20 and -- or their software.

21 So Alstom isn't going to issue  
22 internally a Thales document to fulfill the same,  
23 and conversely, Thales isn't going to issue to our  
24 software group an Alstom document that describes  
25 the interface. They're each -- each entity is used

1 to its own processes and procedures. So Alstom and  
2 Thales needed to generate identical ICDs to reflect  
3 the agreements that were reached at meetings.

4           Once we thought we had a full  
5 agreement, the requests went back to Alstom France  
6 to update their ICD, and what came back was  
7 completely different. It was -- it reflected what  
8 appeared to be a -- generic Alstom signalling  
9 interfaces. It was as if Thales was not -- a  
10 Thales signalling system had been removed and an  
11 Alstom signalling system had been replaced.

12           So I don't know if that was meant to be  
13 frustrating or just an oversight or the wrong  
14 individuals in France given the responsibility for  
15 updating their ICD, but it's an example of we put  
16 the effort in, we thought we had an agreement --  
17 well, we did have an agreement, but it wasn't  
18 reflected in the documents that came back. And  
19 there was a lag between coming to a workshop  
20 agreement and then getting an artifact that  
21 validates that we both have the same understanding.

22           Another example is -- and it happened  
23 more than once, where Alstom added new requirements  
24 into their ICD and provided what should have been  
25 validation of what we had agreed at the previous



1 meetings. But you find new things, new  
2 requirements that have not been discussed but  
3 included in an ICD release. So why that would  
4 happen, it could be they were learning things as  
5 they were designing the -- the LRV, or they were  
6 trying to be obstructionist. And that's -- I'm  
7 speculating. I -- I'm not -- I'm not accusing them  
8 of that.

9 CHRISTINE MAINVILLE: And it's fair to  
10 say that had there been better planning for the  
11 systems integration early on, much of this  
12 confusion probably would have been avoided?

13 MICHAEL BURNS: Yes. Now, I did  
14 mention, I think, that they -- this -- the role of  
15 a system integrator isn't just between Alstom and  
16 Thales. It's -- it's much broader. That's -- when  
17 I'm talking about system integrator, it's all the  
18 systems that make up the LRT network, the system  
19 that is operating today. What OLRTC did achieve is  
20 bringing in some people later on to help in  
21 finalizing the interfaces between Alstom and  
22 Thales. Jacques Bergeron was the name that comes  
23 to mind. He was somewhat effective, but a lot of  
24 what -- of the lost time or the -- the -- the  
25 issues between the two parties had already arisen.

1 CHRISTINE MAINVILLE: Do you recall  
2 about when he came onboard?

3 MICHAEL BURNS: Oh. No, I don't. I  
4 would say -- I'm speculating. It would be maybe  
5 2015 for maybe a few years and then he retired.

6 CHRISTINE MAINVILLE: And the systems  
7 integrator role, would that be -- would that person  
8 be involved through design, construction, and  
9 testing?

10 MICHAEL BURNS: Absolutely.

11 CHRISTINE MAINVILLE: Did Thales  
12 interface at all with RTGEJV, the engineer --  
13 engineering designers?

14 MICHAEL BURNS: The -- oh, the -- we  
15 interfaced with -- yes, with the Vancouver office  
16 of SNC Lavalin.

17 CHRISTINE MAINVILLE: Well, they  
18 have -- one of the members of the consortium is SNC  
19 but not -- I don't believe it's SNC Pacific which  
20 is part of OLRTC.

21 MICHAEL BURNS: Right. So I'm not  
22 sure --

23 CHRISTINE MAINVILLE: Okay.

24 MICHAEL BURNS: No, I'm not -- I'm not  
25 sure of who we're asking. We -- we interfaced with

1 a lot of people, and it's -- I'm not sure of their  
2 homeroom. I mean, we -- we interfaced with  
3 EllisDon on certain aspects. The -- the EJV  
4 that -- if you're thinking about it that did the  
5 design of -- the civil design of the LRT --

6 CHRISTINE MAINVILLE: Yes.

7 MICHAEL BURNS: -- or the  
8 infrastructure, we -- we received drawings of the  
9 guideway which we needed to be able to complete our  
10 software design. It's a -- it's -- probably the  
11 best example of application software development is  
12 we -- we need -- we need to know where the -- where  
13 the track is, the elevation changes, and -- and  
14 that gets baked into the operating software that we  
15 deliver. So our interface, though, was the receipt  
16 of the design documents, not necessarily involved  
17 in an exchange of -- of design opinions.

18 CHRISTINE MAINVILLE: And you mentioned  
19 earlier in respect of the workshop meetings and  
20 other meetings as between Alstom and Thales that  
21 OLRTC attended, but can you speak a bit more to  
22 their level of participation in terms of assisting  
23 with the coordination?

24 MICHAEL BURNS: Well, they -- they  
25 coordinated a meeting. They attended the meeting,

1 but with the exception of Jacques Bergeron, while  
2 he was involved, they didn't fulfill an expectation  
3 of interpreting between the two parties, mediating  
4 maybe a -- not a dispute but how to -- how to  
5 resolve an interface or some issue. There's a  
6 number of examples - I can't recall off the top of  
7 my head - where we offered OLRTC a solution, but it  
8 would require us to change our software.

9           And conversely, Alstom could have  
10 changed their software to -- to resolve it, but,  
11 you know, someone was going to have to make a  
12 decision, and probably there was a cost associated  
13 with whatever decision was made, so that's  
14 fundamentally what the system integrator should be  
15 doing is making that determination of how to solve  
16 the issue and instructing the parties the path  
17 forward.

18           CHRISTINE MAINVILLE: And so what was  
19 done? How were those issues resolved, ultimately?

20           MICHAEL BURNS: Some issues -- well,  
21 there was -- what happened on the one example I can  
22 think of where it's -- Thales does as part of its  
23 safety sort of prelaunch test is we test that the  
24 emergency brake command, that we command the train  
25 to brake, actually responds, and we do this before

1 the train starts moving, so it's called a 3EB test.  
2 We weren't aware -- Alstom hadn't disclosed that  
3 they have a safety condition that if the train --  
4 while it's operating and -- you know, operating at  
5 regular speed has a number of emergency brake  
6 commands within a short period of time, that  
7 they -- they stop the train. And it's -- it's for  
8 a good safety reason. But we're doing the same --  
9 we're doing this test while the train is not  
10 moving, so there's not the same -- there's not a  
11 safety concern.

12 So Alstom could have put in a change in  
13 their software that said only if the train is  
14 moving would that -- that reaction be taken, and  
15 that would have solved the problem. It was not  
16 solved for a long time until OLRTC finally enforced  
17 us to modify our software as a condition of an  
18 extension of time settlement they had provided us.  
19 So they just added it in.

20 CHRISTINE MAINVILLE: And so it was  
21 these -- the resolution of any given issue was done  
22 on an ad hoc basis? Is that fair to say?

23 MICHAEL BURNS: That's a fair  
24 summation.

25 CHRISTINE MAINVILLE: And going back to

1 the fact that the ICDs don't fully speak to each  
2 other, could that have an impact on the performance  
3 or reliability of the system?

4 MICHAEL BURNS: Depending on what --  
5 depending on what we don't know, there is that  
6 potential. There was one example where we -- we  
7 discovered that there was a reaction or that Alstom  
8 had made a connection to a door enable function  
9 that we were unaware of, and so under a particular  
10 scenario where the -- the door opens that -- or  
11 that -- where we enable the door to open, it closed  
12 prematurely, and -- on -- actually caught a woman's  
13 arm.

14 So we -- we did an investigation and  
15 found that there -- Alstom had -- had assigned a  
16 signal to a circuit that was vital to us and I  
17 guess attached another -- another command to that  
18 same signal, and so we were unaware of -- in that  
19 particular event of the command that the door would  
20 react as it did, where it didn't -- didn't remain  
21 open for the entire dwell. Like, when the train  
22 comes into a station, there's a dwell time where  
23 the door opens, and -- under normal circumstances,  
24 the door opens, and there's a period of time where  
25 then it -- it closes. And our expectation was --

1 and through the ICD was that Alstom has -- within  
2 the door edge, there's a sensor that if something  
3 blocks, like an arm blocks, that the safe reaction  
4 is that the doors immediately open, right, as a  
5 safety, to avoid that scenario.

6 So that was a behaviour that wasn't --  
7 that wasn't shared in the ICD between Alstom and  
8 ourselves, but because of what we discovered  
9 through the investigation of the operational logs  
10 of what signal reaction had been, we then made --  
11 made a modification of our -- our software to avoid  
12 that in the future, and that -- like, we didn't  
13 bother getting into a protracted debate about who  
14 should change what. We just made the change in our  
15 software to disable that -- that reaction.

16 CHRISTINE MAINVILLE: And so this, for  
17 instance, was not tested for because --

18 MICHAEL BURNS: Well, you wouldn't test  
19 it because you're not expecting that reaction.  
20 You're -- the -- you're -- the software testing is  
21 testing of the -- the behaviours the ICDs reflect.

22 CHRISTINE MAINVILLE: You can only test  
23 what's known to you is effectively what you're  
24 saying.

25 MICHAEL BURNS: You -- you -- you're

1 more articulate than I am.

2 CHRISTINE MAINVILLE: Would there be  
3 any value today still in conducting that exercise  
4 of their -- you know, of a full integration?

5 MICHAEL BURNS: I think from a level of  
6 maturity, I think -- and given that the system's  
7 been in operation for over 2 years, or coming up to  
8 3 years -- no, 2 and a half years, that no, I don't  
9 think there would be -- and keep in mind I'm not an  
10 engineer.

11 CHRISTINE MAINVILLE: M-hm.

12 MICHAEL BURNS: I don't see there would  
13 be further value in reopening and -- and  
14 reinvestigating what -- what they -- that -- those  
15 interfaces are.

16 CHRISTINE MAINVILLE: Because there --  
17 by this time, there should not be any more such  
18 surprises. Is that --

19 MICHAEL BURNS: Well, you -- you would  
20 think, after 2 and a half years, you -- you've gone  
21 through all possible scenarios of commands and  
22 behaviours of the train and -- and the operations  
23 so that they would have shaken out, I think, by  
24 now.

25 CHRISTINE MAINVILLE: Okay. And I just



1 want to go back to your indication that OLRTC was  
2 not able to find someone to perform the systems  
3 integrator role -- or properly or fully able to  
4 perform it. What's the source of your information  
5 on that? Who would have conveyed that to you?

6 MICHAEL BURNS: Directly, Eugene Creamer  
7 in 2017. I would have, prior to that, in early  
8 2013, brought it up as a concern, and I guess  
9 the -- the executives of the consortium at that  
10 time. The senior project director was David White  
11 and Paul Tetreault. So we shared those concerns in  
12 our regular meetings in Ottawa.

13 CHRISTINE MAINVILLE: And --

14 THE WITNESS: So I would participate at  
15 those meetings, and then depending on the agenda,  
16 there would be other engineers or resources.  
17 Typically the project design authority attended all  
18 those meetings with me.

19 CHRISTINE MAINVILLE: Who is that?

20 MICHAEL BURNS: I'm sorry?

21 CHRISTINE MAINVILLE: Who is that? The  
22 project design authority?

23 MICHAEL BURNS: His name - and he still  
24 is the design authority - is Paul Dooyeweerd.

25 CHRISTINE MAINVILLE: And what was the

1 response back when you kept raising concerns about  
2 the -- fulfilling this system --

3 MICHAEL BURNS: I expressed it in terms  
4 of the implications on schedule, and my concern was  
5 that they were unable to complete a fully  
6 integrated schedule with all of these systems that  
7 they had procured, and therefore without being --  
8 without having that integrated schedule of all the  
9 inputs from these subcontractors, you had no way of  
10 knowing when you would finish. Their schedule --  
11 and I participated in a number of schedule  
12 workshops with them. It was civil design and  
13 construction-centric. So there wasn't an  
14 appreciation or they hadn't demonstrated in their  
15 schedule an appreciation of the weaving of  
16 deliverables or even inputs to deliverables from  
17 all of the subcontractors.

18 CHRISTINE MAINVILLE: And I was going  
19 to move on to all these delays in the schedule, but  
20 just before I do that, can I just be clear, they  
21 weren't able to find someone to fill the system  
22 integrator role, but by then, by 2017, Jacques  
23 Bergeron had come in, so was he just not -- as  
24 well-intentioned as he was, was he just not in a  
25 position to fully perform that role?

1                   MICHAEL BURNS: I think he may have  
2 been capable, but his mandate was focussing on what  
3 was already apparent to the consortium was the  
4 trains being late and issues related to the  
5 vehicle. So his focus was vehicle.

6                   CHRISTINE MAINVILLE: As opposed to the  
7 interface, you mean?

8                   MICHAEL BURNS: As opposed to the  
9 interface. But by extension, Thales is drawn into  
10 anything that's related to vehicle, right?

11                  CHRISTINE MAINVILLE: M-hm. And --

12                  MICHAEL BURNS: You -- you -- you -- I  
13 don't think it's clear in your mind.

14                  CHRISTINE MAINVILLE: Well, I'm  
15 wondering whether effectively what you're saying is  
16 by the time he came around, it was too late to --  
17 to do a proper systems integration or because there  
18 were other distractions and issues to resolve.

19                  MICHAEL BURNS: Well, ideally you --  
20 you map out at the very beginning how you're going  
21 to integrate all of these systems together and then  
22 develop that timeline, and you -- and in that  
23 initial timeline development, you will identify  
24 where you have problems, where you have constraints  
25 or risks for not making your ultimate goal of -- of

1 May 2018, and then you -- then you work around a  
2 plan of how you're going to address it. That's --  
3 that's how it should be, regardless of the  
4 industry. And I think by the time Jacques was  
5 brought in, he was probably -- his role was, I  
6 think, largely trying to bring forward the Alstom  
7 schedule. And he came from Bombardier, so he was  
8 very familiar with trains.

9 CHRISTINE MAINVILLE: M-hm. So in  
10 terms of schedule delays, first can you speak to  
11 the impact, if any, of the infrastructure delay or  
12 the civil work delays on Thales's work?

13 MICHAEL BURNS: Well, it -- yes. The  
14 schedule was to commission the yard first, but  
15 there was a lot of delays in completing the design  
16 and -- what was visible to me is the construction.  
17 It was late. And OLRTC was responsible not only  
18 for the construction but installing a lot of --  
19 well, all of Thales's equipment that we were  
20 providing that wasn't going on a train. They --  
21 they installed that, so another -- another  
22 unnatural division of work. But -- that was late,  
23 so that meant we couldn't start our testing, and  
24 there's a -- probably it wasn't until Eugene Creamer  
25 was brought in to try and recover or accelerate

1 testing in 2017 did we see an acknowledgement that  
2 they were in -- they had a serious problem.

3           So we -- we need a lot of time to test.  
4 We have to test the trains, we have to test our  
5 software by the various -- segmented by zones, and  
6 as the -- our testing will -- will require -- we'll  
7 discover things during testing that will require us  
8 to modify software to react to the real-world  
9 environment, because our -- our base software, it  
10 takes into account the guideway I mentioned  
11 earlier, so we know where the trains are going, we  
12 know the -- the track layout - you know, the peaks  
13 and valleys - we're given speed limits that we can  
14 perform. We've got speed performance inputs from  
15 the train itself, but it's not until we start  
16 testing where there's nuances in the real world  
17 that materialize.

18           Prior to that, it's -- it's tested in  
19 our lab. So it's a lab environment that validates  
20 that it -- it should perform as -- as designed, and  
21 it will perform as designed, but it's -- it's the  
22 real-world discoveries that are made that require  
23 us to do some -- some modification to our software  
24 to reflect.

25           So what I'm saying is our test time

1 is -- is -- is protracted, and it needed a good  
2 portion of time, but it -- because of our -- where  
3 we fit in the -- the cycle, OLRTC consumed a lot of  
4 the -- the timeline, leaving very little time for  
5 Thales to perform its tests.

6 CHRISTINE MAINVILLE: And is that --  
7 was that a concern to Thales, the compressed  
8 timelines?

9 MICHAEL BURNS: Oh, absolutely.

10 CHRISTINE MAINVILLE: How would you say  
11 that impacted, ultimately, the testing that was  
12 done and the implications of it?

13 MICHAEL BURNS: By -- well, do you mean  
14 did we minimize our testing?

15 CHRISTINE MAINVILLE: Did -- yes, or  
16 did you ultimately get enough time to do the  
17 testing you would have wanted to do?

18 MICHAEL BURNS: Well, our test time  
19 is -- is not really subject to a tolerance of  
20 whether I have available time. There's -- there's  
21 very strict safety conditions that are placed on --  
22 on the system, and we have to satisfy --  
23 internally, we satisfy our internal testing before  
24 it ever gets released to the field and installed,  
25 and then we have to conduct all the tests to

1 satisfy it meets all our safety conditions, and  
2 then that gets -- all of those results have to be  
3 internally reviewed, and it's only after that is  
4 satisfied by our safety committee do we authorize  
5 safety certification.

6 CHRISTINE MAINVILLE: M-hm.

7 MICHAEL BURNS: So there's no shortcuts  
8 other than what was -- and it's not a shortcut. I  
9 should choose my words better. And one of Eugene  
10 Creamer's early moves was to seek an acceleration of  
11 our testing, and they had -- he had recognized that  
12 they weren't going to make their May 2018 date, but  
13 he wanted to mitigate that -- the amount of  
14 prolongation of testing. So he funded Thales to  
15 put a second test team in Ottawa so that we -- we  
16 had not just a single test team doing the testing  
17 during the day but some tests could be done off  
18 hours or for a -- in the course of a week, you'd  
19 get more tests done. So that's -- that was one  
20 approach that OLRTC took to try to mitigate the  
21 delays.

22 CHRISTINE MAINVILLE: And I understand  
23 all the necessary testing was done, but would  
24 Thales, in a perfect world, would it have wanted to  
25 do more or different or additional testing?

1                   MICHAEL BURNS: No. No. It's --  
2 it's -- there's -- these are absolutes.

3                   CHRISTINE MAINVILLE: And were there  
4 changes made to what -- to the testing requirements  
5 as it relates to Thales's testing?

6                   MICHAEL BURNS: I don't know if I can  
7 answer that question. I'm not -- I'm not sure what  
8 you're -- where you're going.

9                   CHRISTINE MAINVILLE: Well, in terms of  
10 what the initial testing criteria were, were there  
11 any changes along the way to those criteria as it  
12 related to Thales's work or system?

13                   MICHAEL BURNS: I'm sure as testing  
14 evolved, and maybe there was interfaces that were  
15 conveyed to Thales, we had to adapt or add more  
16 tests. I'm thinking specifically the SCADA system  
17 or the -- the passenger information announcement  
18 system. There may have been something that --  
19 because they -- they came on later in the project  
20 timeline, so there may have been additional tests  
21 that were added. But I'm not really the right  
22 person to ask.

23                   CHRISTINE MAINVILLE: Okay. And just  
24 to be clear on what we're talking about in terms of  
25 the testing, are you referencing the dynamic PICO



1 testing or more broadly Thales's tests?

2 MICHAEL BURNS: I -- there's -- I would  
3 say more broadly the Thales tests. The -- and  
4 maybe we can spend a moment on this, just so --

5 CHRISTINE MAINVILLE: Yes.

6 MICHAEL BURNS: -- you're clear is that  
7 the train testing has a -- has a very specific  
8 number of tests. The quantity I can't remember,  
9 but it's not -- it's testing that can be done -- if  
10 we're not obstructed, could be done in a week or a  
11 week and a half, and then we validate the results  
12 with our safety committee and then the train itself  
13 is -- we certify not the train but that our VOBC  
14 system controls the train as it's supposed to. We  
15 don't certify the train. That -- that's a small  
16 set, and it's done incrementally as trains become  
17 available. The -- the broader or more complex and  
18 time-consuming is testing on the -- on the track or  
19 testing in the control centres.

20 CHRISTINE MAINVILLE: And on the track,  
21 that's the dynamic PICO testing; correct?

22 MICHAEL BURNS: Well, there's -- I'm --  
23 my concern is you've -- you're saying "dynamic PICO  
24 testing." We refer to that for the train, but  
25 there are tests where we -- we have to see how

1 our -- we -- and we use trains, so they're moving  
2 in some -- on some tests, so that is dynamic, but  
3 it's testing to see how the train performs on a  
4 section of track and it performs as we expect.

5 We also do -- before we get into tests  
6 with train movements, there's other tests that are  
7 performed to make sure that communication between  
8 the zone controller and the control room is --  
9 is -- is operating as -- as expected. Because what  
10 we're providing is a communication system, in -- in  
11 simple terms. So we need to make sure that all the  
12 communications that are expected are being sent and  
13 received by the -- the right parties.

14 CHRISTINE MAINVILLE: And so would  
15 Thales also have conducted testing on the -- the  
16 full track - not just a test track but on the  
17 entire --

18 MICHAEL BURNS: Oh, yes.

19 CHRISTINE MAINVILLE: Yes.

20 MICHAEL BURNS: Oh, yes. The main  
21 line, from a Thales perspective, is broken into  
22 four zones, and testings are done zone by zone.  
23 And there's communications across zones to each  
24 other, and that is tested as well. So we completed  
25 all of that testing before the decision was taken

1 to go into revenue on the main line, and main line  
2 only. So yes.

3 CHRISTINE MAINVILLE: And so were -- in  
4 terms of delays, you spoke about the yard, but is  
5 it fair to say that the delay to the completion of  
6 the stations impacted scheduling for Thales?

7 MICHAEL BURNS: Insofar as -- and I'm  
8 not familiar with the station delays you're  
9 referring to, but we have to be able -- whether  
10 there's an elevator operating at Rideau is of no  
11 consequence to Thales, so as long as the track is  
12 clear and as long as there isn't other  
13 construction, you know, going on that has the  
14 potential to interfere with a train movement, it  
15 would not necessarily delay Thales testing. But  
16 clearly the -- the -- that -- those were the --  
17 probably the final steps, I know, in -- in  
18 finishing the civil construction, but the delays  
19 predated all of that station completion.

20 CHRISTINE MAINVILLE: And so what were  
21 the main sources of delay outside of the  
22 Alstom/Thales interface and the vehicles but as it  
23 relates to infrastructure? Was there -- in terms  
24 of the tracks, was there -- did that -- was there  
25 any delay there that impacted Thales?

1                   MICHAEL BURNS: The -- the -- the  
2                   entire civil construction schedule was later than  
3                   originally planned, so the answer to that is yes.  
4                   And, you know, they also experienced a sinkhole,  
5                   right, and -- downtown, so that would have caused a  
6                   problem for testing, obviously, and what we were  
7                   forced to do is do some testing on the extremes of  
8                   the -- the guideway but not in the core, the  
9                   downtown core. So Thales tried to find a way to  
10                  work around any of those I'll call them  
11                  obstructions or -- or inefficiencies to get some  
12                  testing completed, but it wasn't done -- in an  
13                  ideal world, it would have been a much more -- not  
14                  fragmented into pieces.

15                  CHRISTINE MAINVILLE: M-hm. And I just  
16                  want to be clear on the delays to the yard and how  
17                  that impacted Thales. Was that -- you spoke about  
18                  the installation of Thales's equipment not going --  
19                  the equipment that was not going on a train. Can  
20                  you just be clear on what you mean by that?

21                  MICHAEL BURNS: Well, in the -- both --  
22                  there's no difference between the yard and the main  
23                  line in term -- terms of the type of equipment that  
24                  Thales provides that OLRTC had installed. So  
25                  there's radios -- I call them wayside radios;

1 there's switch machines. Part of the detection of  
2 the train is dependent on a transponder tag that is  
3 on the -- between the tracks - and there's hundreds  
4 of them that the onboard system reads as the train  
5 goes over the tag - and the -- the control centre,  
6 with all the computer systems and the -- the mimic  
7 wall display of the guideway where you can see the  
8 train movements. Those were all equipment and  
9 computers that we provide and OLRTC was responsible  
10 to install.

11 CHRISTINE MAINVILLE: And so what was  
12 the issue there? How was that impacted by the  
13 delay to the yard?

14 MICHAEL BURNS: Well, they couldn't  
15 install until they finished the construction piece,  
16 and so it's -- you can't pick a particular source  
17 as the cause. It's all the pieces leading up  
18 behind it, so -- but there were delays in that, and  
19 we were notified, surprisingly, that they were  
20 going to -- we were told to not continue testing in  
21 the yard, that they had taken a decision to not  
22 commission the yard and to do it -- to separate the  
23 two events. Well, by contract, they're supposed to  
24 be commissioned at the same time, or before revenue  
25 service, the yard was supposed to be commissioned.

1 CHRISTINE MAINVILLE: Right. And is  
2 the implication of that that the yard is not  
3 automated?

4 MICHAEL BURNS: The yard is not  
5 automated.

6 CHRISTINE MAINVILLE: And is that  
7 the -- that's the implication of not having  
8 commissioned it?

9 MICHAEL BURNS: Right. There's --  
10 there's restrictions that we impose on any of the  
11 operators, like RTM or OC Transpo that they have to  
12 operate train movements manually or with some  
13 restrictions. So there's -- it's a complication  
14 for probably RTM's operations, and certainly  
15 compounding that is the number of trains that --  
16 like, they have Stage 2 trains that are in some  
17 level of assembly or completion but not tested that  
18 are occupying the yard as well.

19 CHRISTINE MAINVILLE: And is the yard  
20 still not automated?

21 MICHAEL BURNS: The yard still is not  
22 automated.

23 CHRISTINE MAINVILLE: And do you know  
24 why that wasn't done?

25 MICHAEL BURNS: It's getting -- well,

1 you have to go back to the -- the origin of the  
2 decision to proceed with the Stage 2 trains. The  
3 construction that was almost done in the yard, a  
4 lot of it had to be torn up to extend the tracks to  
5 accommodate more trains and add -- add lanes to the  
6 storage area. So that -- that was a profound  
7 impact on our ability to test.

8 Now, in the -- we are getting very  
9 limited access to perform tests. The priority of  
10 OC Transpo and RTM, as they have explained to me,  
11 is that the priority is testing of the Stage 2  
12 trains over the commissioning of the yard, and  
13 that, I assume, is to be able to maintain the --  
14 the fleet for the main line revenue operations. So  
15 they're building in float to their fleet of trains.

16 CHRISTINE MAINVILLE: Okay. Can you  
17 talk a bit more about how the schedule impact for  
18 Thales was mitigated? So you've given at least one  
19 example of the amount of prolonged testing and  
20 how that schedule managed to get compressed, but  
21 were there other impacts to that, and how were they  
22 addressed?

23 MICHAEL BURNS: Well, the -- if I can  
24 speak first to the acceleration, prolongation,  
25 the -- we were funded to accelerate by deploying a

1 team, an additional team, which we did, but the  
2 access and the other conditions -- or assumptions  
3 and conditions that OLRTC had to fulfill weren't  
4 largely completed.

5           So one of the conditions was that we  
6 would deploy another team, and those teams would  
7 each get so many hours in a week for testing, but  
8 we didn't get those hours, and our -- our testing  
9 is a function of hours approved and -- on the  
10 track. So we know how long it will take to do a  
11 test, but it's a function of access hours, and  
12 OLRTC struggled to grant us those access hours, and  
13 that was because there was still -- well, during  
14 the same approach of acceleration, OLRTC was trying  
15 to also accelerate and complete a number of other  
16 major systems, such as the overhead catenary  
17 system. So you can't have trains running  
18 underneath workers that are trying to complete  
19 overhead catenary power.

20           So there was -- there -- Eugene's  
21 approach was throw everyone onto the -- into the  
22 guideway and get everyone to do everything all at  
23 the same time, but from a safety standpoint, you --  
24 we couldn't, and nor did they authorize unsafe  
25 activities.



1                   So the OLRTC failed to recognize all  
2 the other suppliers or users that needed to do  
3 either installation and testing - or even  
4 maintenance at that stage. So there was a number  
5 of stakeholders all needing the same access, so not  
6 everyone could get there. So it meant -- even  
7 though we doubled up our resources, the test hours  
8 that we were able to be granted was severely  
9 restricted.

10                   CHRISTINE MAINVILLE: Okay. And are  
11 there any repercussions of that ultimately on the  
12 reliability of the system?

13                   MICHAEL BURNS: No.

14                   CHRISTINE MAINVILLE: Okay.

15                   MICHAEL BURNS: No. The -- well, let  
16 me -- let me take that back. I can speak for the  
17 Thales system. I cannot speak for the other  
18 systems that were operating under that hurry-up  
19 approach.

20                   CHRISTINE MAINVILLE: M-hm.

21                   MICHAEL BURNS: Right?

22                   CHRISTINE MAINVILLE: And did Thales  
23 participate in trial running?

24                   MICHAEL BURNS: No. We had resources  
25 in Ottawa. I specifically asked -- the director at

1 that time was Matthew Slade, what support he needed  
2 from Thales or our participation in the trial  
3 running, and I was advised we were not to  
4 participate in trial running, but he would  
5 appreciate us having techs in Ottawa as a backup  
6 for -- if an issue came up that they could  
7 immediately check and investigate.

8 CHRISTINE MAINVILLE: And those were  
9 not resorted to, those --

10 MICHAEL BURNS: No. They -- the people  
11 that we had there were not called upon to respond  
12 to anything.

13 CHRISTINE MAINVILLE: And did Thales  
14 have any concerns about not participating in trial  
15 running? Would it have preferred to be there?

16 MICHAEL BURNS: We didn't have an  
17 opinion. It -- it -- we had -- we had provided the  
18 certification that our software was fit for  
19 revenue, but we couldn't -- we couldn't offer an  
20 opinion of whether the system was ready to go into  
21 revenue, just that our software was safe and -- and  
22 had been tested and certified for a revenue  
23 operation.

24 CHRISTINE MAINVILLE: Was there, as a  
25 result, though, an ability to run the trains and

1     troubleshoot for unexpected issues that Thales  
2     might have benefitted from?

3                   MICHAEL BURNS:    Could you restate that  
4     again?

5                   CHRISTINE MAINVILLE:   Yes, sorry.  I  
6     don't think it was clear.  Was there -- would there  
7     have been value - let me put it that way - to  
8     Thales in a period of running the trains beyond the  
9     testing to troubleshoot for potentially unexpected  
10    issues arising?

11                   MICHAEL BURNS:  I would -- I would say  
12    my -- my view is that the -- our testing has  
13    already washed out those bugs that may -- may have  
14    occurred, so my -- I would say no.  I think if  
15    anything that would have some benefit would be the  
16    trains -- because the trains had experienced some  
17    issues, so if -- but we've been operating with a  
18    mix of trains as they were offered to us, but those  
19    trains should all perform in the -- identically,  
20    right?

21                   So I'm not an engineer, but I would say  
22    no, there's no value, I think, in extend -- well,  
23    there's always value in more and more testing.  You  
24    may find something.  But the level of testing that  
25    was performed by Thales is enough to satisfy us

1 that it's -- we've -- we've found any -- any  
2 problems that could arise.

3 CHRISTINE MAINVILLE: Do you have a  
4 view as to whether there's a need for a burn-in  
5 period for the -- and maybe it's not specific to  
6 Thales's systems, but the trains generally?

7 MICHAEL BURNS: Well, I think the  
8 burn-in, as you characterize it, there's -- I think  
9 there's always value in a burn-in of any -- any  
10 electromechanical system, but I believe as they go  
11 through the testing that Thales does with those  
12 trains, and I believe even after we perform our  
13 D-PICO and certify, I believe Alstom does -- or --  
14 I believe it's either Alstom or OLRTC does a  
15 burn-in of the train. They -- they run it for some  
16 period of time.

17 CHRISTINE MAINVILLE: So you think  
18 there may have been one in this case.

19 MICHAEL BURNS: I think -- as we speak  
20 today, each of the trains, after they are certified  
21 by Thales, go through a burn-in period.

22 CHRISTINE MAINVILLE: Okay. Do you  
23 know or have a view as to whether there is value to  
24 a soft start after trains go into service, sort of  
25 to allow for troubleshooting of issues after

1 revenue service availability?

2 MICHAEL BURNS: I -- I'd like to  
3 decline to comment.

4 CHRISTINE MAINVILLE: Okay. Because  
5 Thales is not well placed or you personally are not  
6 well placed to speak to that?

7 MICHAEL BURNS: Well, it's -- I can  
8 speak in general terms, and, you know -- okay. I'm  
9 going to answer this. In a -- in a generic  
10 deployment of a complicated system, there's an  
11 inherent risk if you go 100 percent on Day 1. And  
12 so there -- there is some hypothetical benefit of  
13 starting slower, and that may shake out operational  
14 bugs, not necessarily a problem with the system,  
15 but how it -- how the supporting operations are  
16 able to support.

17 CHRISTINE MAINVILLE: And in terms of  
18 the winter testing, I understand there was winter  
19 simulation testing done? Would you be aware?

20 MICHAEL BURNS: Well, because the  
21 testing was protracted over a long period of time,  
22 there was some winter testing, and I know it was a  
23 requirement for winter validation, but are you  
24 specifically asking about what validation was done  
25 on the trains or as the system?

1 CHRISTINE MAINVILLE: Well, on the  
2 trains. So in terms of being tested in real  
3 conditions, you believe there was some of that  
4 done?

5 MICHAEL BURNS: Not -- not as a planned  
6 specific test to see how the trains could move snow  
7 or ice, but by extension, as the testing happened  
8 over a number of seasons, it did get some of that.  
9 I thought you may be asking about the qualification  
10 testing that was done on the train that -- by  
11 Alstom. There was an environmental simulation. I  
12 think it was done at the NRC labs.

13 CHRISTINE MAINVILLE: Right.

14 MICHAEL BURNS: Okay.

15 CHRISTINE MAINVILLE: Well, would you  
16 have -- in terms of from Thales's perspective,  
17 would you have a view as to whether that type of  
18 simulation is sufficient, or you would have wanted  
19 an actual winter testing done in winter conditions?

20 MICHAEL BURNS: I'm not in a position  
21 to comment.

22 CHRISTINE MAINVILLE: And can you just  
23 speak to or confirm how this system worked in terms  
24 of the different grades of braking, which I think  
25 were dependent on weather conditions? And there --

1 as I understand it, there was an issue with the  
2 speed profiles not being suited for Alstom's  
3 braking mechanisms. Is that something that --

4 MICHAEL BURNS: No, that's -- that's  
5 news to me.

6 CHRISTINE MAINVILLE: Okay.

7 MICHAEL BURNS: I'm not -- I'm not  
8 aware. I know there was a lot of -- a lot of  
9 discussion, all part of the ICD, where we needed to  
10 get, you know, particularly the guaranteed  
11 emergency brake rate, which is referred to as  
12 GEBR - it's an acronym - and then that data, all of  
13 the braking performance curves, we load that into a  
14 safe braking model, and that -- that is submitted  
15 to OLRTC and I assume shared with Alstom. But  
16 that -- that modelling is done largely with inputs  
17 of the behaviour that Alstom has told us the train  
18 will perform. And yes, there's different braking  
19 commands and such, but... I'm not aware of a  
20 specific issue that Alstom had raised.

21 I had raised a concern with OLRTC - and  
22 at that time it was Matt Slade - because they were  
23 replacing the brake calipers, and they were coming  
24 up with a -- from a different supplier, and I  
25 raised the -- the concern that because those brake

1 calipers materially affect the propulsion and  
2 braking performance of the train, and you were --  
3 they were replacing all of them on all the trains  
4 that had been D-PICOed by us and certified, would  
5 they have to be recertified. And I was  
6 advised by -- there was a letter from OLRTC on this  
7 that they had determined that the replacement brake  
8 calipers behaved identically to the originals, and  
9 therefore they were taking the position that the  
10 trains did not need to be recertified.

11 CHRISTINE MAINVILLE: And that's  
12 something that Thales could not verify itself, I  
13 take it.

14 MICHAEL BURNS: No. There's -- we have  
15 no way of -- of validating.

16 CHRISTINE MAINVILLE: And so did Thales  
17 ever need to recertify -- following its safety  
18 certification, did it ever need to recertify  
19 following -- the system following retrofits or  
20 repairs or other work done?

21 MICHAEL BURNS: No. We -- we've been  
22 never -- we've been never called in to recertify a  
23 train that has been previously certified. So  
24 we're -- and nor are we aware of if there's changes  
25 to the train in some way that might cause a demand



1 for recertification.

2 CHRISTINE MAINVILLE: Are you aware of  
3 the retrofits that were deferred until after  
4 testing or after revenue service availability?

5 MICHAEL BURNS: No.

6 CHRISTINE MAINVILLE: Retrofits to the  
7 trains?

8 MICHAEL BURNS: I'm aware that there  
9 were some retrofits being planned, the details of  
10 which, no, I'm not familiar with.

11 CHRISTINE MAINVILLE: So Thales was not  
12 asked to give a view as to whether it may need to  
13 perform additional testing pursuant to those --

14 MICHAEL BURNS: No.

15 CHRISTINE MAINVILLE: -- deferred  
16 retrofits.

17 MICHAEL BURNS: We were definitely not  
18 asked to offer an engineering assessment of the  
19 validity of the current certification.

20 CHRISTINE MAINVILLE: You've said  
21 before that you wouldn't -- didn't have a view or  
22 are able -- or not able to express an opinion as to  
23 the readiness of the overall system. Is that fair?

24 MICHAEL BURNS: Correct, yes.

25 CHRISTINE MAINVILLE: So do you --

1 could I ask it this way: Did Thales have any  
2 concerns relating to Alstom's readiness or the  
3 readiness of the rolling stock at the time of  
4 opening?

5 MICHAEL BURNS: There's always a danger  
6 of -- of being perceived as throwing rocks at your  
7 competitor, and I'm not, but -- I -- I have nothing  
8 that I'd be prepared to go on record of having a  
9 concern for that. I -- I really have no way of --  
10 of knowing whether there's -- there's a legitimate  
11 concern.

12 I do -- I can look at what had happened  
13 over the preceding years, and there was a lack of  
14 transparency that would cause a critical mind to  
15 maybe question whether there was a concern or  
16 should there be a concern, but officially, I -- I  
17 am not in a position -- I have no -- I have no  
18 visibility to make that assessment.

19 CHRISTINE MAINVILLE: What about  
20 OLRTC's readiness? Would you be able to speak to  
21 that?

22 MICHAEL BURNS: Well, whether the --  
23 they're -- that they were ready for revenue  
24 service?

25 CHRISTINE MAINVILLE: Yes.

1                   MICHAEL BURNS: Well, I would say  
2 almost before revenue service was achieved, they  
3 had kind of started to demobilize their project  
4 team. I think the question ought to be, you know,  
5 were they ready to trans -- transfer responsibility  
6 to, like, Rideau Transit Maintenance to maintain  
7 the system.

8                   CHRISTINE MAINVILLE: Yes.

9                   MICHAEL BURNS: Yeah. My -- my concern  
10 about the maintenance aspect is -- and I'm  
11 uncertain how robust the -- an ongoing training  
12 program is in place because under the -- the  
13 agreement with OLRTC, we provided training to  
14 their -- OLRTC's trainers, and so they were going  
15 to have a -- you know, an embedded training  
16 organization that would train operators, train  
17 drivers, RTM, also maintenance, and we executed  
18 that training, and in some cases with Alstom  
19 maintenance, actual maintainers.

20                   But I -- I believe that training  
21 infrastructure at the very least became invisible  
22 to us. I know that the individuals that were  
23 deemed the trainers, that trained the trainers,  
24 they have left the organization, but I don't know  
25 if anything has replaced them. And there's

1 certainly a lot of turnover in Alstom maintenance,  
2 so I have a concern that they're able to  
3 effectively maintain the systems.

4 CHRISTINE MAINVILLE: Because Thales  
5 has not been brought in to retrain any new  
6 trainers.

7 MICHAEL BURNS: Correct. I have -- I  
8 have proposed on a number of occasions that we  
9 would come and perform training as they deem fit,  
10 but that has not been -- that offer has not been  
11 taken up.

12 CHRISTINE MAINVILLE: And so Thales  
13 trained OLRTC trainers on both operations and  
14 maintenance; correct?

15 MICHAEL BURNS: Yes, correct.

16 CHRISTINE MAINVILLE: And was there  
17 training on -- did it cover system operations,  
18 standard operating procedures, incident response,  
19 and safety?

20 MICHAEL BURNS: Definitely not incident  
21 response. What were your other topics?

22 CHRISTINE MAINVILLE: The system  
23 operations?

24 MICHAEL BURNS: Yes, system operations.

25 CHRISTINE MAINVILLE: Standard

1 operating procedures?

2 MICHAEL BURNS: Well, OC Transpo would  
3 probably have their own -- they would take our  
4 procedures, and they would develop their own  
5 operating procedures with the guidance of what we  
6 have provided. So I want to -- I want to be  
7 careful that you're not thinking that we -- we are  
8 developing OC Transpo's CONOPS.

9 CHRISTINE MAINVILLE: Would you have  
10 had a view into OC Transpo's operating procedures?

11 MICHAEL BURNS: A view into -- no, we  
12 wouldn't have had a view into, no.

13 CHRISTINE MAINVILLE: Okay. And that's  
14 not a concern for Thales, that it wouldn't be able  
15 to review that?

16 MICHAEL BURNS: We wouldn't have a --  
17 it's -- it was -- it would be beyond the reach of  
18 Thales's scope, so I'm not sure how those  
19 procedures necessarily were -- they would have been  
20 developed with OC Transpo's view of how -- how  
21 they -- they choose to operate the system, and I  
22 don't mean ignoring what -- what we're providing,  
23 but there's definitely -- they would have a certain  
24 style -- or it's not a style. Process that  
25 reflected even their -- their union agreement of --

1 of turnover of -- or people -- number of people in  
2 the operations centre, for example.

3 CHRISTINE MAINVILLE: So Thales  
4 delivered, I take it, some manuals or handbooks to  
5 OLRTC?

6 MICHAEL BURNS: As part -- as part of  
7 the training program, yes. And -- and as those --  
8 if those manuals required any update, then we would  
9 update to a higher revision level and issue them to  
10 OLRTC, and then they would pass those along to the  
11 user, which would be RTM or OC Transpo or both.

12 CHRISTINE MAINVILLE: Did Thales not  
13 also provide them directly to RTM, given their  
14 direct line of -- direct contractual line with RTM?

15 MICHAEL BURNS: Contractually, the  
16 manuals are -- are from the OLRTC agreement, and it  
17 was -- it's for OLRTC to convey those updated  
18 manuals to RTM. Now, having said that, there's  
19 been a number of incidents where we found that they  
20 didn't have the most current manual, and I provided  
21 it directly to RTM.

22 CHRISTINE MAINVILLE: Do you have a  
23 view as to the sufficiency of the training for the  
24 operators, where -- whether the training that would  
25 have been provided was sufficient?

1                   MICHAEL BURNS: No. I -- I don't have a  
2 view in this specific instance, but our training is  
3 well established, and it's not been developed  
4 uniquely for Ottawa. It's -- it's adapted for --  
5 just as our software is adapted for the Ottawa  
6 environment, our training manuals and the training  
7 material would have been adapted to reflect those  
8 adaptations, but it's a well-established training  
9 program that's used in other countries around the  
10 world.

11                   So if you're asking me the absorption  
12 level of the students, that I can't speak to, but  
13 the students are -- are tested at the conclusion of  
14 the -- each training module, and the results are --  
15 are provided to OLRTC that they've passed.

16                   CHRISTINE MAINVILLE: M-hm.

17                   MICHAEL BURNS: So you give them that  
18 feedback.

19                   CHRISTINE MAINVILLE: And do you have  
20 any knowledge of whether their training was rushed  
21 or anything like that?

22                   MICHAEL BURNS: I'm not aware that  
23 there was any rush. At the time, OLRTC had, as I  
24 say, a training group. There was a manager of that  
25 group, Randy Fonger, and we would say we need X

1 weeks of training, and he would schedule the time.  
2 We'd provide the materials in advance, and then we  
3 would send the trainer or multiple trainers down,  
4 and the training was conducted and tested.

5           So I have to assume that the -- the  
6 students that were assigned were competent, that --  
7 that came into the training with the -- the  
8 specified prerequisites for the training, and I  
9 don't -- I -- I don't imagine that there was a --  
10 an issue. The only issue that may be in play today  
11 is are those students still there, and if they're  
12 not there, how were -- how was that training or  
13 retraining or the replacements trained to cover  
14 that. That would be my only reservation.

15           CHRISTINE MAINVILLE: Okay. And am I  
16 right that there was no interaction, then, between  
17 Thales and the operators? Like, are you able to  
18 speak to the level of interaction, if any, between  
19 Thales and the OC Transpo operators directly?

20           MICHAEL BURNS: No. During testing,  
21 quite often the Thales techs will be in the OCC  
22 because they have to coordinate with the operators  
23 to get access to trains, they have to launch the  
24 trains, so there is ongoing interaction with the  
25 control centre for -- as a minimum of just in



1 support of conducting our -- our tests.

2 CHRISTINE MAINVILLE: And subsequent to  
3 testing, though, there's not a direct relationship.

4 MICHAEL BURNS: No. The doors are  
5 locked.

6 CHRISTINE MAINVILLE: To the control  
7 room.

8 MICHAEL BURNS: Yeah, from a -- secure  
9 access.

10 CHRISTINE MAINVILLE: M-hm.

11 MICHAEL BURNS: So we just -- we can't  
12 just walk in.

13 CHRISTINE MAINVILLE: So in your  
14 experience, is the level of operator interaction  
15 that Thales had before going live, before revenue  
16 service, was that normal, in your experience?

17 MICHAEL BURNS: Well, my  
18 experiencing -- my experience being limited to this  
19 project, I -- I have heard that there -- of no  
20 issue with the interaction with the operators.

21 CHRISTINE MAINVILLE: Okay. And what  
22 exactly has been Thales's role post-opening? Has  
23 it been involved in resolving deficiencies or  
24 performance improvements?

25 MICHAEL BURNS: Part of the -- part of

1 our -- my challenge is that we have -- we have a  
2 team -- two teams in Ottawa right now trying to  
3 commission the yard and trying to test trains, the  
4 Stage 2 trains. So they will routinely be tasked  
5 to investigate things that maybe a more competent  
6 maintainer might be able to do themselves, but in  
7 any case, we're not being tasked to do improvements  
8 of our system that I can recall. I know the -- the  
9 City had a number of things they wanted differently  
10 but were not provided, but we've been -- to the  
11 extent that we can, been supportive.

12 One example I can think of is that the  
13 City I think it was last year hired a cyber  
14 security consultant, and they wanted to do  
15 penetration tests on the system to see how the CBTC  
16 system would withstand a cyber attack. So if  
17 that's the -- an example of a -- an improvement,  
18 it's not that we're changing anything, but it was  
19 more, I think, out of an emerging cyber threat that  
20 the City's asked for RTM to fund us to participate  
21 in -- in a -- an investigation. So we've done  
22 that.

23 CHRISTINE MAINVILLE: What about some  
24 of the issues that the LRVs have experienced since  
25 revenue service - some of the breakdowns,

1 operational problems? First of all, do you have  
2 any view as to whether the Thales/Alstom interface  
3 played a role in any of these incidents?

4 MICHAEL BURNS: From what I have read,  
5 a lot of it in the press or from analysis of the  
6 system logs that we have, no, the Thales system did  
7 not have an -- have an impact on -- on the train  
8 issues.

9 CHRISTINE MAINVILLE: Do you know --  
10 there were door issues, for instance. Would there  
11 be any connection to Thales's systems?

12 MICHAEL BURNS: I touched on that  
13 earlier --

14 CHRISTINE MAINVILLE: Right. Right.

15 MICHAEL BURNS: -- right? So that's  
16 the only one where I think there was a connection.  
17 In our assessment -- and there's letters that we've  
18 sent back explaining our findings and how we have  
19 made modifications to the unexpected behaviour --  
20 or unexpected reaction from -- initiated by the  
21 train to the door closing. So we went and  
22 modified -- like, you can -- you can lay it all out  
23 in the ICD, and everyone can design it, but then  
24 if -- if something isn't in the ICD and a behaviour  
25 surfaces, then the only recourse is you have to

1 react to it, and that's what we've done is react to  
2 what wasn't disclosed to us to avoid that circum --  
3 the series of events that -- circumstances that led  
4 to that door close incident, then we've -- we've  
5 taken steps that it would not close.

6 CHRISTINE MAINVILLE: Do you have any  
7 awareness of the following issue, where  
8 periodically there may have been improper platform  
9 or no platform information being displayed on the  
10 driver's display, which would have been reported on  
11 the minor deficiency list that would have been  
12 devised by -- I believe that's between OLRTC and  
13 Alstom?

14 MICHAEL BURNS: Sorry. I'm -- whose  
15 deficiency list?

16 CHRISTINE MAINVILLE: Well, a minor  
17 deficiency list -- well, let me ask you first: Do  
18 you have any awareness of these deficiencies lists?

19 MICHAEL BURNS: I'm aware there was  
20 some issue with the reporting that -- the passenger  
21 information, there's a lag, but you -- you  
22 described it a little differently, so... And minor  
23 deficiencies in whose list? And therein is a  
24 problem that I won't -- but there's a lot of people  
25 keeping lists, and there's not a central repository

1 of -- of issues that get -- need to be triaged,  
2 validated, or rejected.

3 CHRISTINE MAINVILLE: Okay.

4 MICHAEL BURNS: So --

5 CHRISTINE MAINVILLE: Well, let me just  
6 ask you the question: Are you aware of this issue  
7 that I describe around a lack of platform  
8 information or incorrect platform information being  
9 displayed on the driver's display?

10 MICHAEL BURNS: Not on the driver's  
11 displays. I'm aware of an issue with the passenger  
12 information, so the information on the platform  
13 that the public will see, where it's incorrect --

14 CHRISTINE MAINVILLE: Okay.

15 MICHAEL BURNS: -- or it -- there's a  
16 lag where there's either no information or it's the  
17 wrong time shown.

18 CHRISTINE MAINVILLE: So if something  
19 like that happens, is Thales brought in to help  
20 with addressing that?

21 MICHAEL BURNS: In this case, we've  
22 been brought in by RTM, and we've been trying to  
23 determine the source of the problem. My  
24 understanding from the engineering group is that  
25 there's a delay in the update rate, and it becomes

1 a cumulative one, so at some point you will get  
2 this faults or inaccurate report. We've been  
3 struggling with working with the SCADA  
4 subcontractor, Willowglen. They don't appear to  
5 have a very good details to share with us about how  
6 their messages are generated and shared. So it's  
7 going to come down to one of the two parties may  
8 need to make some change to avoid this going  
9 forward, but Thales is involved, and Thales is  
10 participating and supporting RTM.

11 CHRISTINE MAINVILLE: About the second  
12 derailment, I think, in particular --

13 MICHAEL BURNS: This is the September?

14 CHRISTINE MAINVILLE: Yes.

15 MICHAEL BURNS: Okay.

16 CHRISTINE MAINVILLE: 20 --

17 MICHAEL BURNS: '19.

18 CHRISTINE MAINVILLE: -- 19.

19 MICHAEL BURNS: '19? Yes.

20 CHRISTINE MAINVILLE: 2020.

21 MICHAEL BURNS: No, September 2019 was  
22 right after the start of revenue.

23 CHRISTINE MAINVILLE: Yes. No, it --

24 MICHAEL BURNS: And then the next one  
25 was what, November? No, that's when -- that's when

1 the system came back on. That's not fair. You've  
2 got notes. I was told I couldn't have them.

3 CHRISTINE MAINVILLE: That was accurate  
4 information. Yes, 2021. September 2021.

5 MICHAEL BURNS: September 2021.

6 CHRISTINE MAINVILLE: So the Tremblay  
7 Station derailment that led to a longer shutdown.

8 MICHAEL BURNS: Okay. Right. Because  
9 it was after that second derailment that the system  
10 was shut down until November for investigation.

11 CHRISTINE MAINVILLE: And if I'm not  
12 mistaken, I believe that's the one where there was  
13 significant damage done to the track.

14 MICHAEL BURNS: This is where the gear  
15 box under -- the train's gear box dropped down and  
16 damaged hardware -- systems along the hardware,  
17 like our wayside radio unit and antenna were  
18 knocked off.

19 CHRISTINE MAINVILLE: I just don't want  
20 to confuse between the two, but... This is one  
21 related to, I think, improperly torqued bolts.

22 MICHAEL BURNS: Right. And the result  
23 of the improperly torqued bolts is the gear box  
24 fell off.

25 CHRISTINE MAINVILLE: Right. Right.

1                   MICHAEL BURNS: Right. Okay.

2                   CHRISTINE MAINVILLE: So was there not  
3 a potential issue there that you may -- may or may  
4 not be aware of about the trains not -- the train's  
5 systems not identifying faults, the faults in the  
6 train prior to the derailment?

7                   MICHAEL BURNS: I don't -- I can't  
8 imagine there would be any system that would be  
9 able to detect loose bolts. There's --

10                  CHRISTINE MAINVILLE: Do you --

11                  MICHAEL BURNS: Is that what you're  
12 asking?

13                  CHRISTINE MAINVILLE: Well, let me ask  
14 you more broadly. Do you have any understanding of  
15 whether the -- prior to the full derailment whether  
16 it ought to have been noticeable? So whether, for  
17 instance, the driver or the operator of the train  
18 should have been able to notice from the systems  
19 that -- that there was some issue?

20                  MICHAEL BURNS: Oh, I see what you're  
21 saying. I think I -- you're -- you're asking  
22 whether the CBTC system should have -- have  
23 provided some alarm to the train operator or to the  
24 OCC that there was a malfunction. And the answer  
25 is we did, but it -- it's not until the train



1 crossed over a switch, and because of the -- you  
2 know, the gear box that had fallen down or dragged  
3 along, the switch is considered disturbed because  
4 it -- it recognizes something's out of alignment,  
5 and then our system notifies the control centre  
6 that -- and we emergency brake the train, EB the  
7 train.

8           So we wouldn't know initially, but it's  
9 only until we cross over a switch that gets  
10 disturbed that we report that -- otherwise, we  
11 don't have -- we're not sensing everything. We can  
12 only sense what's connected to our system, and in  
13 that case, when the switch sensed -- or when the  
14 switch was determined to be disturbed, the safe  
15 reaction is we command the train to emergency  
16 brake, and then by reviewing the logs, we know when  
17 the emergency brake occurred and what was the  
18 cause, so the logic behind that. We know why it  
19 EBed - that the switch was disturbed, forcing the  
20 train to be emergency braked.

21           CHRISTINE MAINVILLE: Okay. Because I  
22 only have a couple minutes left, I'll just ask you  
23 a couple focussed questions. Do you -- in terms of  
24 the MSF, the maintenance facility, did you observe  
25 any issues with the suitability of that facility in

1 terms of impacting Thales's delivery?

2 MICHAEL BURNS: The suitability? I'm  
3 not sure how to answer that.

4 CHRISTINE MAINVILLE: Was it an  
5 adequate facility for Thales's work?

6 MICHAEL BURNS: Well, Thales has -- the  
7 facility is the facility, and the terms -- the  
8 guideway's the guideway. We've provided  
9 notification to OLRTC that we thought their track  
10 geometry on the expanded yard is too close.  
11 There's a potential conflict where the -- where you  
12 could have a sideswipe of trains, depending on  
13 where the train -- two trains are. So we still  
14 haven't completed the testing to be able to  
15 quantify whether we're going to be able to get the  
16 trains that they expect to be in the shed in far  
17 enough that it doesn't obstruct trains coming out  
18 by the adjacent lanes. So if that -- if that  
19 answers your question. There --

20 CHRISTINE MAINVILLE: That's capacity.  
21 It's a capacity issue.

22 MICHAEL BURNS: It's capacity to some  
23 respects, but that capacity -- they'll either have  
24 to accept a diminished capacity or would have to  
25 relay track to avoid the -- the -- the proximity

1 of -- of where two tracks are -- are too close  
2 together.

3 CHRISTINE MAINVILLE: Would Thales have  
4 any insight into value engineering decisions that  
5 Alstom may have made?

6 MICHAEL BURNS: No.

7 -- OFF THE RECORD DISCUSSION --

8 CHRISTINE MAINVILLE: Did Thales ever  
9 produce a mitigation plan, or was it asked to  
10 produce a mitigation plan to mitigate the impacts  
11 on the schedule?

12 MICHAEL BURNS: Not that I recall.

13 CHRISTINE MAINVILLE: At what point in  
14 time would -- did it become apparent to Thales that  
15 the original RSA deadline, revenue service  
16 availability deadline, would not be met?

17 MICHAEL BURNS: I -- very early I  
18 identified it as a high risk - in 2014 is my guess  
19 or estimate. Definitely by the spring of 2017,  
20 OLRTC appeared to have come to the same conclusion  
21 with the -- the change in the project team, where  
22 they brought in Eugene and a couple of other people  
23 with the -- what appeared to be the objective is to  
24 push -- push it through to try and mitigate as much  
25 as possible, but they were already recognizing that

1 May had gone, and they were hoping to get it  
2 complete by the end of 2018.

3 CHRISTINE MAINVILLE: And was that  
4 specifically because of the delay in the rolling  
5 stock or other aspects of the project?

6 MICHAEL BURNS: All aspects were, I  
7 think, delayed. Rolling stock was one, but they  
8 had their challenges with infrastructure  
9 development as well.

10 CHRISTINE MAINVILLE: Do you have any  
11 sense of how they compare or whether the rolling  
12 stock delay was the most significant delay on the  
13 project? Recognizing that there's some  
14 interrelation between the various pieces.

15 MICHAEL BURNS: No, I -- I don't have  
16 an opinion. Definitely rolling stock impacted  
17 Thales the most -- or was more visible, sorry,  
18 not -- is a better description, but there was a --  
19 when we were still operating on the basis that we  
20 were going to commission the yard first, I remember  
21 having many meetings and -- with OLRTC and having  
22 to challenge the view that they were going to make  
23 the completion date of May, and I -- I argued that  
24 it was impossible, based on the dates that they  
25 were relaying to me.

1                   So there was -- I would say there  
2 was -- there was a reluctance to acknowledge the  
3 risk to May 2018 and incorporate some recovery plan  
4 until much later. They definitely -- the recovery  
5 plan was to do -- to -- this acceleration program,  
6 but at that time they were still looking at  
7 accelerating but knowing the May 2018 had -- was  
8 gone.

9                   CHRISTINE MAINVILLE: And sorry, you  
10 said this is at what point in time did they  
11 recognize they were not meeting May 2018?

12                   MICHAEL BURNS: At -- from my review  
13 of -- of the correspondence, it was October of  
14 2017.

15                   CHRISTINE MAINVILLE: Okay. And do you  
16 know what -- well, first of all, did Thales have  
17 transparency into OLRTC's, you know, broader  
18 schedule, project schedule?

19                   MICHAEL BURNS: I was -- I was --  
20 participated in several scheduling workshops, some  
21 initiated by myself, some by OLRTC, and I would see  
22 their civil design construction schedule. They  
23 never did produce what I would see as a full  
24 integrated schedule. They may have done that, but  
25 that was not shared with me.

1 CHRISTINE MAINVILLE: And the -- what  
2 you did see, do you know whether Alstom was made  
3 privy to that as well?

4 THE WITNESS: I -- I would have no  
5 idea.

6 CHRISTINE MAINVILLE: Okay. Am I right  
7 that Thales primarily dealt with Francis Fitzgerald  
8 at OLRTC with respect to scheduling and seeking  
9 extensions?

10 MICHAEL BURNS: You broke up.

11 CHRISTINE MAINVILLE: Oh, sorry. Am I  
12 right that Thales primarily dealt with Francis  
13 Fitzgerald in terms of scheduling and seeking  
14 extensions?

15 MICHAEL BURNS: No. Frank was there  
16 not for a long time, but he came in I think -- I  
17 think Eugene brought him in along with Tom Burgoyne  
18 as the heavy to try to push everyone along and  
19 commission. I had some interaction with Frank on  
20 extensions but also had more probably with Matt  
21 Slade. So it -- we've been in an incremental  
22 funding mode for several years.

23 CHRISTINE MAINVILLE: How would you  
24 characterize Matthew Slade's level of -- or his  
25 management of -- on the project?

1                   MICHAEL BURNS: I had a very good  
2 relationship with Matt Slade. I thought he -- he  
3 had a good grasp of the challenges. I think he --  
4 you know, he -- he came in -- I think he was  
5 assigned by the executive committee to come in  
6 after Eugene was -- after Eugene left, so the --  
7 the executive committee assigned Matt to step down  
8 from -- he was -- he was sitting on the executive  
9 committee, and he was asked to step down into the  
10 project director role, but I thought he -- he  
11 was -- he was engaged and familiar with the issues.  
12 I had regular meetings with him. I -- I have no  
13 issue with him.

14                   CHRISTINE MAINVILLE: And Thales was  
15 granted an extension, correct, to its ultimate  
16 delivery date?

17                   MICHAEL BURNS: Several extensions.

18                   CHRISTINE MAINVILLE: Several, right.  
19 And do you know whether there was some coordination  
20 by OLRTC in terms of Thales's schedule and Alstom's  
21 schedule?

22                   MICHAEL BURNS: There were -- as part  
23 of one of the extensions of time, because the  
24 extension of time wasn't just commissioning the  
25 yard or the main line, but testing of trains, and

1 some of the extensions of time are for the Stage 2  
2 activities, where -- so our funding for the Stage 2  
3 onboard systems and -- and testing of the Stage 2  
4 trains, we were given -- or shown an Alstom  
5 schedule, like a best-case/worst-case scenario, and  
6 that was the basis of our -- our variation order,  
7 and -- but since then, Alstom has been -- since  
8 then, Alstom has never been able to meet those  
9 schedules.

10                   And just to be clear, I'm stepping into  
11 the Stage 2 realm, but it answers, I think, the  
12 same question. And, like, to this day, we have no  
13 commitment that OLRTC's able to share with me about  
14 when Alstom will deliver the remaining fleet of --  
15 of trains for us to test.

16                   And as it relates to the Stage 1, no,  
17 we -- we never really got credible schedules. We  
18 were shown dates, but they routinely were missed.  
19 So the way we've approached it commercially was  
20 we'll put a test team there exclusively for train  
21 testing, but it's -- it's -- you -- you have to get  
22 the trains to us, and if you don't have the trains  
23 to us, you -- we're -- you're paying for the time  
24 and the -- the testers are -- are deployed in  
25 Ottawa.



1 CHRISTINE MAINVILLE: But do you know  
2 what, if any, coordination there was at OLRTC's  
3 level in respect of those two schedules, Thales's  
4 schedule and Alstom's schedule?

5 MICHAEL BURNS: I'm not aware of what  
6 coordination OLRTC had vis-à-vis Alstom.

7 CHRISTINE MAINVILLE: Okay. Those are  
8 my questions, unless, Fraser, you have anything.

9 FRASER HARLAND: Maybe, actually, just  
10 a couple of -- if that's okay with --

11 MICHAEL BURNS: Yep.

12 FRASER HARLAND: -- Mr. Burns and his  
13 counsel. I just wanted to go back to the ICD  
14 issue, just a couple of pretty specific questions.  
15 I think you had mentioned that the final version in  
16 the original plan schedule was September 2014? You  
17 can correct me if I'm wrong, but can you tell me  
18 when the -- the ICD was actually -- Thales's ICD  
19 was actually finalized?

20 MICHAEL BURNS: I -- off the top of my  
21 head, I don't recall. It would have -- I think it  
22 would be sometime in 2015, but I'm -- it's a --  
23 it's an estimate on my part right now.

24 FRASER HARLAND: And can you just  
25 confirm for me when ICDs were going back and forth

1 between Thales and Alstom, that was via OLRTC; is  
2 that right? Or was there a direct --

3 MICHAEL BURNS: Correct. There was no  
4 direct -- I mean, there was informal communication  
5 with Alstom, so there would probably be emails  
6 between our engineers and Alstom, but the formal  
7 transmission of updates to ICDs were funneled  
8 through OLRTC.

9 FRASER HARLAND: And are you aware of  
10 any issues in terms of timing as to when Thales  
11 would provide its ICD and then when OLRTC would get  
12 that to Alstom and vice versa? Are you --

13 MICHAEL BURNS: I would have no  
14 visibility of when they provided the ICD that we  
15 provided to them and when they sent that to Alstom.  
16 I don't know.

17 FRASER HARLAND: Okay. And I guess a  
18 final question -- and if you're unable to answer  
19 it, it's fine -- but the level of change that  
20 happened to the ICDs, in your experience, was that  
21 sort of the normal iterative process, or was it  
22 longer and more difficult than -- than it maybe  
23 should have been?

24 MICHAEL BURNS: My experience -- and  
25 it's outside of the signalling business, but

1 looking at -- and I participated in all these  
2 workshops on the ICD development. The parties, if  
3 they know what they need, they should be able to  
4 convey their requirements to the other party in  
5 several meetings, and then the update of the ICD,  
6 you may -- you may find that there's a translation  
7 disconnect. So there may be minor updates, but in  
8 this case it went through, as a newcomer to this  
9 business, far too many iterations, which brought me  
10 to the suspicion - and this is only suspicion -  
11 that there was another motive for delaying or  
12 changing unilaterally the content of the ICD.

13 FRASER HARLAND: And I know I said that  
14 was my last question, but do you have a sense of  
15 whether the ICD process caused I guess what we  
16 could call critical path delay with -- with the  
17 production of the trains, ultimately?

18 MICHAEL BURNS: No, I don't think so,  
19 because the -- the production of the train is  
20 independent of what we're going to put on that  
21 train. The only thing that would inhibit  
22 production of the train is if Alstom hadn't really  
23 finalized their interfaces that they needed, like  
24 did they -- they had to figure out what signals had  
25 to be on dedicated lines and which could be

1 transmitted over ethernet connection.

2 So if they were still developing that  
3 requirement, then it could have had an impact on --  
4 on the production, but they never shared with us  
5 that they were still in an early design phase of --  
6 of the train.

7 FRASER HARLAND: I don't think I have  
8 any other questions, unless, Christine, you have  
9 anything arising out of that.

10 CHRISTINE MAINVILLE: No. Thank you  
11 very much for giving us that additional time. I  
12 think we can go off record.

13 -- Concluded at 2:18 p.m.

14

15

16

17

18

19

20

21

22

23

24

25

1 REPORTER'S CERTIFICATE

2  
3 I, JOANNE A. LAWRENCE, RPR, CSR,  
4 Certified Shorthand Reporter, certify;

5 That the foregoing proceedings were  
6 taken before me at the time and place therein set  
7 forth;

8 That the statements of the presenters  
9 and all comments made at the time of the meeting  
10 were recorded stenographically by me;

11 That the foregoing is a certified  
12 transcript of my shorthand notes so taken.

13  
14 Dated this 31st day of March, 2022.

15  
16 

17 \_\_\_\_\_  
18 NEESONS, A VERITEXT COMPANY

19 PER: JOANNE LAWRENCE, RPR, CSR

20 COURT REPORTER  
21  
22  
23  
24  
25

**WORD INDEX**

**< 1 >**

**1** 4:22 7:8  
29:9 76:11  
103:16  
**100** 76:11  
**11:00** 1:14 3:1  
**19** 93:17, 18, 19

**< 2 >**

**2** 1:7 55:7, 8,  
20 69:16 70:2,  
11 89:4 103:1,  
2, 3, 11  
**2:18** 1:14  
107:13  
**20** 93:16  
**2009** 4:3  
**2013** 5:7 11:16  
14:18, 19 21:13  
27:4 28:14, 23  
29:12 35:19  
42:3 56:8  
**2014** 14:2, 20  
29:16 98:18  
104:16  
**2015** 49:5  
104:22  
**2017** 17:22  
19:24 34:1  
56:7 57:22  
60:1 98:19  
100:14  
**2018** 34:2 59:1  
62:12 99:2  
100:3, 7, 11  
**2019** 93:21  
**2020** 93:20  
**2021** 94:4, 5  
**2022** 1:8, 14  
108:14  
**26th** 27:4

**< 3 >**

**3** 55:8  
**31** 1:8  
**31st** 1:13  
108:14  
**33(vi)** 4:2  
**33(vii)** 4:14  
**3EB** 52:1

**< 5 >**

**5** 4:17 32:9  
33:24

**< A >**

**a.m** 1:14 3:1  
**ability** 70:7  
73:25  
**Absolutely**  
49:10 61:9  
**absolutes** 63:2  
**absorption**  
86:11  
**abundantly**  
19:15 43:23  
**accelerate**  
59:25 70:25  
71:15  
**accelerating**  
100:7  
**acceleration**  
62:10 70:24  
71:14 100:5  
**accept** 36:1  
39:3 97:24  
**access** 15:8  
32:8 70:9 71:2,  
11, 12 72:5  
87:23 88:9  
**accommodate**  
70:5  
**accommodated**  
12:25  
**account** 60:10  
**accurate** 28:13  
94:3  
**accusing** 48:7  
**achieve** 15:16  
48:19  
**achieved** 31:25  
46:8 82:2  
**acknowledge**  
17:21 100:2  
**acknowledgemen**  
**t** 60:1  
**acronym** 20:25  
78:12  
**Act** 4:2, 15, 18  
**activities** 26:12  
71:25 103:2  
**activity** 24:12  
**actual** 77:19  
82:19  
**ad** 52:22  
**adapt** 12:11  
63:15

**adaptation** 9:1  
28:9, 10 31:24  
**adaptations** 9:6  
10:4, 6 86:8  
**adapted** 86:4, 5,  
7  
**adapting** 10:8  
**add** 63:15 70:5  
**added** 47:23  
52:19 63:21  
**additional** 32:19  
62:25 63:20  
71:1 80:13  
107:11  
**address** 59:2  
**addressed** 38:1  
70:22  
**addressing**  
92:20  
**adequate** 97:5  
**adjacent** 97:18  
**advance** 87:2  
**advised** 4:15  
73:3 79:6  
**aerospace** 5:22  
**affect** 79:1  
**after** 3:19 5:5  
7:7 39:4 40:1  
41:8 55:20  
62:3 75:12, 20,  
24, 25 80:3, 4  
93:22 94:9  
102:6  
**agenda** 56:15  
**agree** 26:5  
43:18  
**agreeable** 25:25  
**agreed** 47:25  
**agreement** 5:2,  
6 7:1 9:4  
14:15 15:9  
18:9, 16 21:8,  
17 35:5, 25  
37:8, 10 42:4  
43:3, 25 44:5,  
19 45:15, 17, 22  
46:16 47:5, 16,  
17, 20 82:13  
84:25 85:16  
**agreements**  
15:18 16:6 47:3  
**akin** 42:11  
**alarm** 95:23  
**Alex** 19:25

20:5, 8  
**aligned** 29:22  
**alignment** 96:4  
**allocated** 36:23  
**allow** 7:23 32:3  
75:25  
**allowed** 41:9  
**Alstom** 10:12,  
16, 19, 21 11:1,  
2, 13, 15 12:8  
13:3, 4, 20  
15:16, 24 16:11,  
18 18:13, 20  
20:22 21:7  
22:18, 20, 22  
23:3, 5, 8, 11, 14,  
19, 21, 24 24:8,  
17, 19, 22 25:7  
27:3, 6, 18  
28:14 30:12  
35:2, 3, 7, 18, 25  
36:16 37:10  
39:7, 24 40:11,  
19, 21 41:19  
42:21, 23 43:10,  
14 44:8, 16  
45:2, 15, 17, 23  
46:15, 17, 21, 24  
47:1, 5, 8, 11, 23  
48:15, 21 50:20  
51:9 52:2, 12  
53:7, 15 54:1, 7  
59:6 75:13, 14  
77:11 78:15, 17,  
20 82:18 83:1  
91:13 98:5  
101:2 103:4, 7,  
8, 14 104:6  
105:1, 5, 6, 12,  
15 106:22  
**Alstom/Thales**  
18:18 26:16  
66:22  
**Alstom's** 14:12  
15:5, 7, 9 27:2  
28:5 29:21  
30:4 39:11  
40:13 43:6  
44:20 45:6, 8, 9  
46:2 78:2 81:2  
102:20 104:4  
**alternate** 36:18  
**America** 9:15,  
17 11:3, 12 12:8

**American** 10:22  
11:18 12:1, 12  
30:17  
**amount** 62:13  
70:19  
**analysis** 90:5  
**announcement**  
63:17  
**answers** 25:15  
41:20 97:19  
103:11  
**antenna** 94:17  
**anticipated** 13:8,  
10  
**apparent** 58:3  
98:14  
**appear** 20:3  
93:4  
**appeared** 47:8  
98:20, 23  
**appended** 3:24  
**application** 8:23  
50:11  
**applications**  
10:1  
**appreciate**  
15:25 24:8 73:5  
**appreciation**  
57:14, 15  
**apprised** 33:14  
**approach** 38:16  
62:20 71:14, 21  
72:19  
**approached**  
103:19  
**approved** 71:9  
**approximately**  
33:22  
**April** 5:7 27:4  
28:14, 23 29:3, 9  
**apt** 16:17  
**area** 70:6  
**argued** 99:23  
**arisen** 44:24  
48:25  
**arising** 74:10  
107:9  
**arm** 53:13 54:3  
**arose** 34:22  
**arrive** 22:8  
**article** 38:14  
**articulate** 55:1  
**artifact** 47:20  
**artifacts** 35:4

**ASC** 31:20  
32:10 34:12  
**asked** 4:4 33:4  
42:3 72:25  
80:12, 18 89:20  
98:9 102:9  
**asking** 49:25  
76:24 77:9  
86:11 95:12, 21  
**aspect** 82:10  
**aspects** 20:19  
21:22 50:3  
99:5, 6  
**assemble** 38:7  
43:7  
**assembled** 31:7,  
11 32:1, 2  
**assembling** 43:6  
**assembly** 32:24  
35:6 40:4  
43:21 69:17  
**assess** 31:21  
**assessment**  
46:5 80:18  
81:18 90:17  
**assign** 17:2  
**assigned** 53:15  
87:6 102:5, 7  
**assisting** 50:22  
**associated**  
51:12  
**assume** 45:13  
70:13 78:15  
87:5  
**assuming** 43:9  
**assumptions**  
71:2  
**attached** 53:17  
**attack** 89:16  
**attended** 16:17,  
18 50:21, 25  
56:17  
**attending** 1:13  
**attention** 35:18  
**authority** 56:17,  
22, 24  
**authorize** 62:4  
71:24  
**automated** 69:3,  
5, 20, 22  
**automatic** 31:20  
32:10  
**availability** 76:1  
80:4 98:16

**available** 36:17,  
22 61:20 64:17  
**avoid** 54:5, 11  
91:2 93:8 97:25  
**avoided** 48:12  
**award** 24:23  
**aware** 9:24  
27:1 30:6 52:2  
76:19 78:8, 19  
79:24 80:2, 8  
86:22 91:19  
92:6, 11 95:4  
104:5 105:9  
**awareness** 91:7,  
18  
**< B >**  
**back** 14:14  
16:9 22:22  
23:23 29:8, 9  
32:12 33:19  
34:21 39:20  
46:18 47:5, 6,  
18 52:25 56:1  
57:1 70:1  
72:16 90:18  
94:1 104:13, 25  
**background**  
5:17 20:10  
**backup** 73:5  
**baked** 43:2  
50:14  
**balance** 31:6  
38:3  
**base** 11:5, 8  
39:15 60:9  
**based** 43:5  
99:24  
**basis** 52:22  
99:19 103:6  
**battery** 41:13  
**beginning** 58:20  
**behaved** 79:8  
**behaviour** 54:6  
78:17 90:19, 24  
**behaviours**  
54:21 55:22  
**believe** 15:14  
23:20 24:7  
27:20 49:19  
75:10, 12, 13, 14  
77:3 82:20  
91:12 94:12  
**benefit** 74:15

76:12  
**benefitted** 74:2  
**Bergeron** 48:22  
51:1 57:23  
**best** 45:1 50:11  
**best-case/worst-  
case** 103:5  
**better** 8:9  
44:15 48:10  
62:9 99:18  
**bit** 7:11 17:5  
41:23 50:21  
70:17  
**bits** 44:10  
**black** 21:21  
22:14  
**blocks** 54:3  
**bolts** 94:21, 23  
95:9  
**Bombardier**  
59:7  
**bother** 54:13  
**box** 21:21  
22:14 94:15, 23  
96:2  
**brake** 51:24, 25  
52:5 78:11, 23,  
25 79:7 96:6,  
16, 17  
**braked** 96:20  
**Braker** 2:10  
**braking** 77:24  
78:3, 13, 14, 18  
79:2  
**breakdowns**  
89:25  
**briefly** 5:17  
13:22  
**bring** 59:6  
**bringing** 48:20  
**broader** 48:16  
64:17 100:17  
**broadly** 12:2  
64:1, 3 95:14  
**broke** 101:10  
**broken** 34:24  
37:9, 12 65:21  
**brought** 20:18  
56:8 59:5, 25  
83:5 92:19, 22  
98:22 101:17  
106:9  
**bugs** 74:13  
76:14

**build** 34:16  
43:13  
**building** 43:14  
70:15  
**Burgoyne**  
101:17  
**burn-in** 75:4, 8,  
9, 15, 21  
**BURNS** 1:7 2:9  
3:3 4:20, 24  
5:5, 10, 14, 19  
6:1, 6, 11, 16, 21,  
25 7:5, 14 8:4,  
8, 15, 18, 20  
9:10, 16, 19, 24  
10:6, 13, 17, 25  
11:7, 14 12:3,  
13, 20 13:10, 14,  
25 14:5, 7, 13  
15:2, 6, 14  
16:14, 24 17:8,  
19 18:3 19:6,  
20 20:4, 15, 17,  
24 21:3, 8  
22:10, 24 23:1,  
10 24:6, 18, 21  
25:5, 10, 21  
26:10, 17, 23  
27:5, 12, 15, 20  
28:2, 16, 24  
29:2, 6, 13, 24  
30:3, 11 31:3,  
10 32:7, 21  
33:3, 9, 15, 20,  
25 34:6, 11  
35:2, 11, 19, 22  
36:14 37:4, 8  
38:9 39:10, 19  
40:18, 23 41:2,  
15 42:1 43:2  
44:3 45:8, 13  
46:4, 9 48:13  
49:3, 10, 14, 21,  
24 50:7, 24  
51:20 52:23  
53:4 54:18, 25  
55:5, 12, 19  
56:6, 20, 23  
57:3 58:1, 8, 12,  
19 59:13 61:9,  
13, 18 62:7  
63:1, 6, 13 64:2,  
6, 22 65:18, 20  
66:7 67:1, 21  
68:14 69:4, 9,

21, 25 70:23  
72:13, 15, 21, 24  
73:10, 16 74:3,  
11 75:7, 19  
76:2, 7, 20 77:5,  
14, 20 78:4, 7  
79:14, 21 80:5,  
8, 14, 17, 24  
81:5, 22 82:1, 9  
83:7, 15, 20, 24  
84:2, 11, 16  
85:6, 15 86:1,  
17, 22 87:20  
88:4, 8, 11, 17,  
25 90:4, 12, 15  
91:14, 19 92:4,  
10, 15, 21 93:13,  
15, 17, 19, 21, 24  
94:5, 8, 14, 22  
95:1, 7, 11, 20  
97:2, 6, 22 98:6,  
12, 17 99:6, 15  
100:12, 19  
101:10, 15  
102:1, 17, 22  
104:5, 11, 12, 20  
105:3, 13, 24  
106:18  
**business**  
105:25 106:9  
**< C >**  
**cab** 36:18, 19  
39:12  
**cabin** 36:7  
**cable** 45:3  
**calipers** 78:23  
79:1, 8  
**call** 31:20  
67:10, 25 106:16  
**called** 8:2 44:5  
52:1 73:11  
79:22  
**CANADA** 1:7  
2:9 4:17, 25  
6:17  
**capable** 58:2  
**capacity** 17:16  
97:20, 21, 22, 23,  
24  
**care** 43:17  
**careful** 84:7  
**case** 25:3  
75:18 89:7

92:21 96:13 106:8 <b>cases</b> 18:6 82:18 <b>catenary</b> 71:16, 19 <b>caught</b> 53:12 <b>caused</b> 67:5 106:15 <b>CBTC</b> 5:1 7:10, 17 8:6, 12, 14 9:22 22:9 27:3, 10, 13 89:15 95:22 <b>ceiling</b> 36:6 <b>central</b> 91:25 <b>centre</b> 7:23 68:5 85:2 87:25 96:5 <b>centres</b> 64:19 <b>certain</b> 3:9 32:15 50:3 84:23 <b>certainly</b> 69:14 83:1 <b>CERTIFICATE</b> 108:1 <b>certification</b> 62:5 73:18 79:18 80:19 <b>certified</b> 38:12 73:22 75:20 79:4, 23 108:4, 11 <b>certify</b> 64:13, 15 75:13 108:4 <b>challenge</b> 25:24 89:1 99:22 <b>challenges</b> 25:18 30:14 99:8 102:3 <b>change</b> 31:10 33:8 42:18 51:8 52:12 54:14 93:8 98:21 105:19 <b>changed</b> 16:7 51:10 <b>changes</b> 30:19 36:9 50:13 63:4, 11 79:24 <b>changing</b> 89:18 106:12 <b>channels</b> 15:24	<b>characterize</b> 75:8 101:24 <b>cheaper</b> 43:10 <b>check</b> 73:7 <b>checkout</b> 39:23 <b>choice</b> 19:4 <b>choose</b> 62:9 84:21 <b>Christine</b> 2:3 3:2 4:21 5:3, 8, 12, 16, 24 6:3, 8, 13, 18, 22 7:3, 9 8:1, 5, 13, 17, 19 9:5, 14, 18, 20 10:3, 11, 14, 24 11:4, 9, 23 12:5, 16 13:7, 11, 21 14:3, 6, 8, 24 15:3, 10 16:8, 21 17:4, 17 19:17 20:1, 12, 16, 20 21:1, 5 22:5, 21, 25 23:6 24:2, 15, 20 25:2, 6, 17 26:5, 14 27:1, 9, 14, 16, 24 28:12, 21 29:1, 5, 10, 20 30:1, 9, 24 31:8 32:5, 18, 22 33:7, 12, 18, 21 34:3, 9, 20 35:9, 16, 20 36:11, 24 37:5 38:5 39:7, 16 40:16, 20, 24 41:11, 21 42:24 43:22 45:5, 10 46:1, 6 48:9 49:1, 6, 11, 17, 23 50:6, 18 51:18 52:20, 25 54:16, 22 55:2, 11, 16, 25 56:13, 19, 21, 25 57:18 58:6, 11, 14 59:9 61:6, 10, 15 62:6, 22 63:3, 9, 23 64:5, 20 65:14, 19 66:3, 20 67:15 68:11 69:1, 6, 19, 23 70:16 72:10, 14, 20, 22 73:8, 13, 24	74:5 75:3, 17, 22 76:4, 17 77:1, 13, 15, 22 78:6 79:11, 16 80:2, 6, 11, 15, 20, 25 81:19, 25 82:8 83:4, 12, 16, 22, 25 84:9, 13 85:3, 12, 22 86:16, 19 87:15 88:2, 6, 10, 13, 21 89:23 90:9, 14 91:6, 16 92:3, 5, 14, 18 93:11, 14, 16, 18, 20, 23 94:3, 6, 11, 19, 25 95:2, 10, 13 96:21 97:4, 20 98:3, 8, 13 99:3, 10 100:9, 15 101:1, 6, 11, 23 102:14, 18 104:1, 7 107:8, 10 <b>circuit</b> 53:16 <b>circum</b> 91:2 <b>circumstances</b> 53:23 91:3 <b>Citadis</b> 10:22 11:6, 8, 16 <b>City</b> 12:10 89:9, 13 <b>City's</b> 89:20 <b>civil</b> 4:7 50:5 57:12 59:12 66:18 67:2 100:22 <b>claimed</b> 44:17 <b>cleaner</b> 43:12 <b>clear</b> 15:15 19:15 26:14 35:24 37:13 43:24 57:20 58:13 63:24 64:6 66:12 67:16, 20 74:6 103:10 <b>clearer</b> 41:23 44:24 <b>clearly</b> 66:16 <b>close</b> 91:4, 5 97:10 98:1 <b>closed</b> 53:11 <b>closes</b> 53:25	<b>closing</b> 90:21 <b>cocounsel</b> 3:8 <b>Co-Lead</b> 2:3 <b>collaboration</b> 20:22 21:12 <b>collaborative</b> 3:7 <b>come</b> 15:3 16:9 25:25 27:10 29:20 34:20 43:16 57:23 83:9 93:7 98:20 102:5 <b>comes</b> 48:22 53:22 <b>coming</b> 16:2 23:15 47:19 55:7 78:23 97:17 <b>command</b> 46:13 51:24 53:17, 19 96:15 <b>commands</b> 31:22 52:6 55:21 78:19 <b>commence</b> 3:16 <b>commencing</b> 3:1 <b>comment</b> 33:4 35:7 76:3 77:21 <b>comments</b> 108:9 <b>commercial</b> 19:24 <b>commercially</b> 103:19 <b>COMMISSION</b> 1:6 2:1 3:13 59:14 68:22 89:3 99:20 101:19 <b>commissioned</b> 68:24, 25 69:8 <b>commissioning</b> 70:12 102:24 <b>Commission's</b> 3:5, 14, 18 <b>commitment</b> 29:15 103:13 <b>commitments</b> 13:17 <b>committed</b> 29:11 <b>committee</b> 62:4	64:12 102:5, 7, 9 <b>common</b> 39:14 <b>communicated</b> 30:4 <b>communication</b> 13:5 15:20, 23 26:2 65:7, 10 105:4 <b>Communication-</b> <b>based</b> 8:15 <b>communications</b> 13:2 65:12, 23 <b>companies</b> 13:6 15:13 25:4 <b>COMPANY</b> 108:18 <b>compare</b> 23:12, 13 99:11 <b>competent</b> 87:6 89:5 <b>competitor</b> 24:9 25:7 81:7 <b>complete</b> 13:4 34:24 37:14 38:2, 14 50:9 57:5 71:15, 18 99:2 <b>completed</b> 40:4 41:7 65:24 67:12 71:4 97:14 <b>completely</b> 47:7 <b>completing</b> 30:22 59:15 <b>completion</b> 34:7 66:5, 19 69:17 99:23 <b>complex</b> 5:22 26:11 42:6 64:17 <b>complexities</b> 32:19 <b>complicated</b> 76:10 <b>complication</b> 24:7 69:13 <b>comply</b> 11:18 <b>component</b> 8:21 14:16 22:3 <b>components</b> 21:25 34:25 <b>composed</b> 8:6 <b>compounding</b> 69:15
---	--	---	---	---



<p><b>compressed</b> 61:7 70:20 <b>computer</b> 7:15 13:18 68:6 <b>computers</b> 68:9 <b>conceptual</b> 14:17 <b>concern</b> 17:20 30:10, 12 52:11 56:8 57:4 61:7 64:23 78:21, 25 81:9, 11, 15, 16 82:9 83:2 84:14 <b>concerns</b> 56:11 57:1 73:14 81:2 <b>concluded</b> 29:18 107:13 <b>conclusion</b> 86:13 98:20 <b>condition</b> 52:3, 17 <b>conditions</b> 13:19 61:21 62:1 71:2, 3, 5 77:3, 19, 25 <b>conduct</b> 61:25 <b>conducted</b> 65:15 87:4 <b>conducting</b> 55:3 88:1 <b>confirm</b> 77:23 104:25 <b>conflict</b> 97:11 <b>conflicts</b> 18:14 37:16 <b>confuse</b> 94:20 <b>confusion</b> 48:12 <b>connected</b> 37:2, 6 96:12 <b>connecting</b> 37:19 <b>connection</b> 37:21, 22 53:8 90:11, 16 107:1 <b>connections</b> 38:24 39:5, 8, 14, 17 40:7, 10 <b>connector</b> 39:14 45:21, 24 <b>CONOPS</b> 84:8 <b>consequence</b> 66:11 <b>consider</b> 9:9 <b>considered</b> 32:23 33:1 96:3</p>	<p><b>consortium</b> 17:10 49:18 56:9 58:3 <b>constraints</b> 58:24 <b>construction</b> 49:8 59:16, 18 66:13, 18 67:2 68:15 70:3 100:22 <b>construction- centric</b> 57:13 <b>consultant</b> 89:14 <b>consumed</b> 61:3 <b>contact</b> 30:4 <b>content</b> 106:12 <b>continuation</b> 30:15 <b>continue</b> 68:20 <b>contract</b> 5:6 6:19, 23 14:24 15:8 17:1 20:6 24:23 26:21, 24 28:5 31:17 36:16 40:19 45:11 68:23 <b>contracted</b> 7:10 18:4 <b>contractor</b> 16:25 <b>contractual</b> 85:14 <b>Contractually</b> 85:15 <b>control</b> 7:18, 23 8:10, 16 21:19 31:20 64:19 65:8 68:5 87:25 88:6 96:5 <b>controller</b> 65:8 <b>controls</b> 16:20 64:14 <b>conversely</b> 13:3 26:2 46:23 51:9 <b>convey</b> 23:22 85:17 106:4 <b>conveyed</b> 17:5 56:5 63:15 <b>coordinate</b> 87:22 <b>coordinated</b> 50:25 <b>coordination</b> 50:23 102:19</p>	<p>104:2, 6 <b>core</b> 67:8, 9 <b>correct</b> 3:21 6:21 8:4 10:12, 13 15:2 16:17 26:16, 17 27:11 28:22, 25 44:3 64:21 80:24 83:7, 14, 15 102:15 104:17 105:3 <b>corrections</b> 3:19, 24 <b>corresponded</b> 15:4 <b>correspondence</b> 100:13 <b>cost</b> 51:12 <b>COUNSEL</b> 2:1, 3, 4 3:10 104:13 <b>counterpart</b> 19:18 <b>counterparts</b> 19:19 <b>countless</b> 16:4 <b>countries</b> 86:9 <b>couple</b> 96:22, 23 98:22 104:10, 14 <b>course</b> 62:18 <b>COURT</b> 108:20 <b>cover</b> 83:17 87:13 <b>Creamer</b> 19:22 56:6 59:24 <b>Creamer's</b> 62:10 <b>create</b> 37:16 <b>credible</b> 103:17 <b>criteria</b> 63:10, 11 <b>critical</b> 13:15 19:16 81:14 106:16 <b>cross</b> 96:9 <b>crossed</b> 96:1 <b>Crown</b> 4:8 <b>CSR</b> 108:3, 19 <b>cumulative</b> 93:1 <b>current</b> 80:19 85:20 <b>curves</b> 78:13 <b>cyber</b> 89:13, 16, 19 <b>cycle</b> 61:3</p>	<p><b>&lt; D &gt;</b> <b>damage</b> 94:13 <b>damaged</b> 94:16 <b>danger</b> 81:5 <b>data</b> 78:12 <b>date</b> 62:12 99:23 102:16 <b>Dated</b> 108:14 <b>dates</b> 99:24 103:18 <b>David</b> 56:10 <b>day</b> 1:13 62:17 76:11 103:12 108:14 <b>deadline</b> 98:15, 16 <b>dealt</b> 101:7, 12 <b>debate</b> 43:19 54:13 <b>decision</b> 32:23 51:12, 13 65:25 68:21 70:2 <b>decisions</b> 23:18, 23 98:4 <b>declaration</b> 3:5 <b>decline</b> 76:3 <b>dedicated</b> 106:25 <b>deem</b> 83:9 <b>deemed</b> 4:3 28:19 36:17 82:23 <b>defaulted</b> 18:12 <b>defence</b> 5:23 <b>deferred</b> 80:3, 15 <b>deficiencies</b> 88:23 91:18, 23 <b>deficiency</b> 91:11, 15, 17 <b>define</b> 45:20 <b>defined</b> 21:6 28:17 29:12 35:25 <b>defines</b> 21:19, 22 <b>definitely</b> 20:4 24:11 28:7, 17 30:6 45:18 80:17 83:20 84:23 98:19 99:16 100:4 <b>delay</b> 59:11 66:5, 15, 21, 25</p>	<p>68:13 92:25 99:4, 12 106:16 <b>delayed</b> 99:7 <b>delaying</b> 106:11 <b>delays</b> 12:23 30:22 57:19 59:10, 12, 15 62:21 66:4, 8, 18 67:16 68:18 <b>deliver</b> 7:10, 12, 15 13:24 27:3 37:22 39:3 44:11 50:15 103:14 <b>deliverable</b> 8:2 15:9 37:18 <b>deliverables</b> 14:21 15:5, 7 30:5 57:16 <b>delivered</b> 9:8 28:13 31:5 34:23 36:25 85:4 <b>delivery</b> 34:4 37:3, 7 97:1 102:16 <b>demand</b> 79:25 <b>demarcation</b> 37:13 44:25 <b>demobilize</b> 82:3 <b>demonstrated</b> 15:16 57:14 <b>depend</b> 19:20 <b>dependent</b> 68:2 77:25 <b>Depending</b> 53:4, 5 56:15 97:12 <b>deploy</b> 71:6 <b>deployed</b> 9:13 103:24 <b>deploying</b> 70:25 <b>deployment</b> 76:10 <b>derailment</b> 93:12 94:7, 9 95:6, 15 <b>Derek</b> 27:7 <b>derivative</b> 10:22 <b>describe</b> 14:10 28:13 92:7 <b>described</b> 12:7 22:6 27:18 91:22 <b>describes</b> 46:24</p>
--	---	---	---	--

**description** 8:9  
16:17 99:18  
**descriptions**  
41:16  
**design** 10:23  
11:17, 18 12:6  
14:13, 15, 17, 19,  
21, 23 15:1  
16:10 17:14  
22:23 29:16, 18  
30:17, 23 32:14  
43:1 49:8 50:5,  
10, 16, 17 56:17,  
22, 24 57:12  
59:15 90:23  
100:22 107:5  
**designed** 11:20  
60:20, 21  
**designers** 49:13  
**designing** 11:2  
17:13 48:5  
**detailed** 21:10  
**details** 13:3  
22:12, 15 80:9  
93:5  
**detect** 95:9  
**detection** 7:21  
68:1  
**determination**  
51:15  
**determine** 92:23  
**determined**  
79:7 96:14  
**develop** 25:14  
34:16 58:22  
84:4  
**developed** 8:24  
21:4 23:20  
31:23 84:20  
86:3  
**developing** 84:8  
107:2  
**development**  
9:1 14:22  
16:15 22:13  
23:2 24:13  
28:11 29:17  
32:13, 14 46:19  
50:11 58:23  
99:9 106:2  
**devised** 91:12  
**devising** 14:11  
**diagram** 15:22  
16:2 22:3 46:12

**dictated** 9:4  
45:24  
**difference** 67:22  
**different** 11:20,  
21, 22 18:11  
24:3, 22 38:20  
44:7, 17 47:7  
62:25 77:24  
78:18, 24  
**differently** 89:9  
91:22  
**difficult** 28:6  
37:22 105:22  
**dimensions**  
36:12, 15  
**diminished**  
97:24  
**direct** 37:21  
85:14 88:3  
105:2, 4  
**directly** 36:1  
56:6 85:13, 21  
87:19  
**director** 19:23  
56:10 72:25  
102:10  
**disable** 54:15  
**disclosed** 52:2  
91:2  
**disconnect** 28:3  
106:7  
**discover** 60:7  
**discovered** 53:7  
54:8  
**discoveries**  
60:22  
**discrepancies**  
23:17  
**discussed**  
19:22 23:15  
33:1 44:16 48:2  
**discussion**  
16:15 45:18  
78:9 98:7  
**discussions**  
16:11 24:23  
37:23 45:19  
**display** 36:20  
68:7 91:10 92:9  
**displayed** 91:9  
92:9  
**displays** 92:11  
**dispute** 39:20  
51:4

**distinction** 22:6  
**distortion** 39:1  
**distractions**  
58:18  
**disturbed** 96:3,  
10, 14, 19  
**divided** 37:15  
**division** 39:21  
41:22 43:24  
59:22  
**document**  
21:19 22:17  
28:17 46:22, 24  
**documents**  
21:20 23:25  
47:18 50:16  
**doing** 30:7  
39:17 41:12  
43:15 51:15  
52:8, 9 62:16  
**door** 53:8, 10,  
11, 19, 23, 24  
54:2 90:10, 21  
91:4  
**doors** 54:4 88:4  
**Dooyeweerd**  
56:24  
**doubled** 72:7  
**downtown** 67:5,  
9  
**D-PICO** 75:13  
**D-PICOed** 79:4  
**draft** 28:14, 19  
**dragged** 96:2  
**drawings** 50:8  
**drawn** 58:9  
**driver** 95:17  
**drivers** 82:17  
**driver's** 91:10  
92:9, 10  
**dropped** 94:15  
**dwell** 53:21, 22  
**dynamic** 32:4  
40:3, 8 41:4, 10  
63:25 64:21, 23  
65:2  
  
< E >  
**earlier** 16:9  
22:2 29:15  
34:1 44:16  
50:19 60:11  
90:13  
**early** 11:15  
13:8 15:11

21:13 24:4  
27:22 28:15  
34:2 42:3, 17  
48:11 56:7  
62:10 98:17  
107:5  
**EB** 96:6  
**EBed** 96:19  
**edge** 54:2  
**effect** 7:7  
**effective** 48:23  
**effectively**  
12:18 54:23  
58:15 83:3  
**effort** 47:16  
**efforts** 17:6  
45:18  
**EJV** 50:3  
**electrical** 21:22,  
24 31:18  
**electrically** 13:2  
**electromechanic  
al** 7:20 75:10  
**elevation** 50:13  
**elevator** 66:10  
**EllisDon** 50:3  
**emails** 105:5  
**embedded** 82:15  
**emergency**  
51:24 52:5  
78:11 96:6, 15,  
17, 20  
**emerging** 89:19  
**enable** 53:8, 11  
**encompasses**  
14:20  
**ended** 5:11  
39:16  
**enforced** 52:16  
**engaged** 102:11  
**engineer** 6:2  
49:12 55:10  
74:21  
**engineering**  
5:25 20:18  
22:12 35:8  
49:13 80:18  
92:24 98:4  
**engineers** 56:16  
105:6  
**engineer's** 46:11  
**entails** 8:12  
**enter** 3:13  
**entered** 3:19, 23  
6:19, 23 7:1

**entire** 40:25  
53:21 65:17  
67:2  
**entirety** 14:17  
**entities** 18:11  
**entity** 6:24  
18:21 46:25  
**envelope** 40:12  
**environment**  
9:2 60:9, 19  
86:6  
**environmental**  
77:11  
**equipment**  
12:25 13:1  
22:15 36:10  
37:3 42:22  
43:7 59:19  
67:18, 19, 23  
68:8  
**equivalent**  
22:20 23:3  
**errors** 3:22  
23:17  
**essentially**  
14:25  
**establish** 4:6  
**established** 86:3  
**estimate** 98:19  
104:23  
**ethernet** 107:1  
**Eugene** 19:22,  
23 20:4 56:6  
59:24 62:9  
98:22 101:17  
102:6  
**Eugene's** 71:20  
**Europe** 11:13  
30:16  
**European** 10:22  
**event** 53:19  
**events** 68:23  
91:3  
**eventually** 38:6  
**evidence** 3:4,  
14, 20, 23 4:10,  
13, 17  
**evolved** 63:14  
**exactly** 88:22  
**example** 18:18  
42:23 44:22  
46:10 47:15, 22  
50:11 51:21  
53:6 70:19  
85:2 89:12, 17

<p><b>examples</b> 15:18 51:6 <b>exception</b> 51:1 <b>exchange</b> 50:17 <b>exclusively</b> 103:20 <b>execute</b> 17:16 31:14, 17 <b>executed</b> 82:17 <b>execution</b> 22:18 <b>executive</b> 102:5, 7, 8 <b>executives</b> 56:9 <b>exercise</b> 55:3 <b>existed</b> 8:24 <b>existing</b> 9:12 <b>expanded</b> 97:10 <b>expect</b> 25:23 41:25 65:4 97:16 <b>expectation</b> 26:20 35:18 44:17, 22 51:2 53:25 <b>expectations</b> 13:12 29:21, 22, 24, 25 35:24 44:23 <b>expected</b> 24:3 35:11 36:2 42:17 46:14 65:9, 12 <b>expecting</b> 42:9 54:19 <b>experience</b> 5:18, 21, 25 6:4 26:4, 11 88:14, 16, 18 105:20, 24 <b>experienced</b> 30:11 67:4 74:16 89:24 <b>experiences</b> 25:22 <b>experiencing</b> 88:18 <b>explain</b> 4:21 11:10 24:9 30:25 35:3 46:9, 12 <b>explained</b> 19:9 38:22 70:10 <b>explaining</b> 90:18 <b>explanation</b> 45:4 <b>express</b> 30:10 80:22</p>	<p><b>expressed</b> 35:2 42:16 57:3 <b>extend</b> 70:4 74:22 <b>extension</b> 52:18 58:9 77:7 102:15, 24 <b>extensions</b> 101:9, 14, 20 102:17, 23 103:1 <b>extent</b> 89:11 <b>externally</b> 22:18 <b>extra</b> 41:18 <b>extremes</b> 67:7  &lt; F &gt; <b>faced</b> 24:7 <b>facilitate</b> 20:21 <b>facilitated</b> 24:12 <b>facility</b> 31:12 32:2 96:24, 25 97:5, 7 <b>fact</b> 12:6, 18 29:9 33:1 53:1 <b>factory-tested</b> 38:12 <b>failed</b> 72:1 <b>fair</b> 32:21 34:5 42:24 45:7 48:9 52:22, 23 66:5 80:23 94:1 <b>fallen</b> 96:2 <b>familiar</b> 11:5, 7 59:8 66:8 80:10 102:11 <b>Fasken</b> 2:11 <b>faster</b> 24:13 <b>faults</b> 93:2 95:5 <b>feedback</b> 86:18 <b>feedbacks</b> 36:8 <b>fell</b> 94:24 <b>field</b> 61:24 <b>figure</b> 106:24 <b>fill</b> 57:21 <b>final</b> 14:19 29:15, 18 37:19 66:17 104:15 105:18 <b>finalized</b> 22:8 27:3, 25 104:19 106:23 <b>finalizing</b> 12:23 30:12 48:21 <b>finally</b> 32:1 52:16</p>	<p><b>find</b> 48:1 56:2 57:21 67:9 74:24 106:6 <b>findings</b> 90:18 <b>fine</b> 4:18 105:19 <b>finish</b> 57:10 <b>finished</b> 43:14 68:15 <b>finishing</b> 66:18 <b>Firm</b> 2:11 <b>fit</b> 25:25 61:3 73:18 83:9 <b>Fitzgerald</b> 101:7, 13 <b>fixed</b> 38:18 <b>fleet</b> 70:14, 15 103:14 <b>float</b> 70:15 <b>focus</b> 58:5 <b>focussed</b> 6:9, 12 96:23 <b>focussing</b> 58:2 <b>follow</b> 18:25 <b>followed</b> 14:18 <b>following</b> 79:17, 19 91:7 <b>follow-up</b> 3:10 <b>Fonger</b> 86:25 <b>forced</b> 40:13 67:7 <b>forcing</b> 96:19 <b>foregoing</b> 108:5, 11 <b>formal</b> 105:6 <b>forth</b> 104:25 108:7 <b>forward</b> 51:17 59:6 93:9 <b>found</b> 53:15 75:1 85:19 <b>fourth</b> 14:1 <b>fragmented</b> 67:14 <b>frame</b> 33:22 <b>France</b> 23:20, 23, 24 24:1 31:4, 6, 13, 25 32:1, 24 47:5, 14 <b>Francis</b> 101:7, 12 <b>Frank</b> 101:15, 19 <b>Fraser</b> 2:4 17:23 18:25 26:18 43:23</p>	<p>104:8, 9, 12, 24 105:9, 17 106:13 107:7 <b>front</b> 30:19 <b>frozen</b> 27:25 <b>frustrating</b> 47:13 <b>fulfill</b> 17:2, 16 20:8, 10 26:25 46:22 51:2 71:3 <b>fulfilled</b> 20:19 <b>fulfilling</b> 17:21 19:10 57:2 <b>full</b> 46:7 47:4 55:4 65:16 95:15 100:23 <b>fully</b> 29:11 35:12 46:2 53:1 56:3 57:5, 25 <b>function</b> 53:8 71:9, 11 <b>functions</b> 32:15 <b>fund</b> 89:20 <b>fundamentally</b> 51:14 <b>funded</b> 38:2 62:14 70:25 <b>funding</b> 101:22 103:2 <b>funneled</b> 105:7 <b>future</b> 54:12  &lt; G &gt; <b>gap</b> 37:25 <b>gear</b> 94:14, 15, 23 96:2 <b>GEBR</b> 78:12 <b>general</b> 76:8 <b>generally</b> 12:12 13:22 25:8 36:21 75:6 <b>generate</b> 47:2 <b>generated</b> 93:6 <b>generic</b> 47:8 76:9 <b>geometry</b> 97:10 <b>give</b> 28:6 80:12 86:17 <b>given</b> 3:20 4:9 9:6 10:18 17:18 27:17 32:8 45:23 47:14 52:21 55:6 60:13</p>	<p>70:18 85:13 103:4 <b>giving</b> 4:13 107:11 <b>goal</b> 58:25 <b>good</b> 52:8 61:1 93:5 102:1, 3 <b>Goudge</b> 30:4 <b>grades</b> 77:24 <b>grant</b> 71:12 <b>granted</b> 72:8 102:15 <b>graphic</b> 45:4 <b>grasp</b> 102:3 <b>great</b> 19:5 <b>ground</b> 4:5 <b>group</b> 17:2, 9 46:24 86:24, 25 92:24 <b>guaranteed</b> 78:10 <b>guess</b> 23:24 53:17 56:8 98:18 105:17 106:15 <b>guidance</b> 84:5 <b>guideway</b> 7:22 10:7 50:9 60:10 67:8 68:7 71:22 97:8 <b>guideway's</b> 97:8  &lt; H &gt; <b>half</b> 29:12 55:8, 20 64:11 <b>hand</b> 37:14 <b>handbooks</b> 85:4 <b>handoff</b> 42:13 <b>happen</b> 48:4 <b>happened</b> 31:9 40:17 47:22 51:21 77:7 81:12 105:20 <b>happens</b> 92:19 <b>hardware</b> 8:22 9:12 11:22 41:14 94:16 <b>Harland</b> 2:4 3:8 17:23 18:25 26:18 43:23 104:9, 12, 24 105:9, 17 106:13 107:7 <b>head</b> 51:7</p>
---	---	--	--	--

104:21 <b>hear</b> 38:5 <b>heard</b> 88:19 <b>hearings</b> 3:6, 14, 15, 16 <b>heat</b> 36:5 <b>heavy</b> 38:25 101:18 <b>Heckert</b> 2:17 <b>heightened</b> 26:8 <b>Held</b> 1:12 <b>help</b> 17:24 19:4 48:20 92:19 <b>hidden</b> 30:14 <b>high</b> 98:18 <b>higher</b> 85:9 <b>hired</b> 5:19 89:13 <b>historical</b> 25:22 <b>history</b> 10:18 <b>hoc</b> 52:22 <b>homeroom</b> 46:18 50:2 <b>hoping</b> 99:1 <b>hours</b> 62:18 71:7, 8, 9, 11, 12 72:7 <b>housed</b> 13:2 <b>human</b> 19:11 <b>hundreds</b> 68:3 <b>hurry-up</b> 72:18 <b>Hurst</b> 27:7 <b>hypothetical</b> 76:12  < I > <b>IC</b> 28:14 <b>ICD</b> 22:4, 6, 7, 10 23:3, 18, 24 28:14, 15, 20, 22 29:4, 6, 7, 9, 12, 25 30:12, 15 37:23 47:6, 15, 24 48:3 54:1, 7 78:9 90:23, 24 104:13, 18 105:11, 14 <b>ICDs</b> 22:22 23:7, 11, 12, 19 46:2, 8, 17 47:2 53:1 54:21 104:25 105:7, 20	<b>ice</b> 77:7 <b>idea</b> 101:5 <b>ideal</b> 67:13 <b>ideally</b> 58:19 <b>identical</b> 47:2 <b>identically</b> 74:19 79:8 <b>identified</b> 35:5 98:18 <b>identify</b> 23:16 58:23 <b>identifying</b> 95:5 <b>ignoring</b> 84:22 <b>imagine</b> 87:9 95:8 <b>immediately</b> 21:13 54:4 73:7 <b>impact</b> 12:20 17:25 18:3, 11 34:4, 7 53:2 59:11 70:7, 17 90:7 107:3 <b>impacted</b> 32:12 61:11 66:6, 25 67:17 68:12 99:16 <b>impacting</b> 97:1 <b>impacts</b> 70:21 98:10 <b>implemented</b> 9:22 <b>implication</b> 69:2, 7 <b>implications</b> 12:17 57:4 61:12 <b>impose</b> 69:10 <b>impossible</b> 99:24 <b>improper</b> 91:8 <b>improperly</b> 94:21, 23 <b>improvement</b> 89:17 <b>improvements</b> 88:24 89:7 <b>inaccurate</b> 93:2 <b>incident</b> 83:18, 20 91:4 <b>incidents</b> 85:19 90:3 <b>included</b> 14:15 48:3 <b>incorporate</b> 100:3	<b>incorrect</b> 92:8, 13 <b>incremental</b> 101:21 <b>incrementally</b> 64:16 <b>incriminate</b> 4:6 <b>independent</b> 106:20 <b>indicated</b> 6:19 7:9 <b>indication</b> 56:1 <b>Indirectly</b> 36:1 <b>indiscernible</b> 41:12 <b>individuals</b> 47:14 82:22 <b>industry</b> 5:23 42:6 59:4 <b>inefficiencies</b> 67:11 <b>influence</b> 12:15 <b>informal</b> 21:16 105:4 <b>information</b> 15:17 24:10 25:19 56:4 63:17 91:9, 21 92:8, 12, 16 94:4 <b>infrastructure</b> 50:8 59:11 66:23 82:21 99:8 <b>inherent</b> 76:11 <b>inhibit</b> 106:21 <b>initial</b> 31:16 42:3 58:23 63:10 <b>Initially</b> 18:7 20:7 28:4 41:24 96:8 <b>initiated</b> 90:20 100:21 <b>inputs</b> 57:9, 16 60:14 78:16 <b>Inquiries</b> 4:2, 15 <b>inquiry</b> 4:3, 9 <b>inside</b> 40:10, 12 <b>insight</b> 98:4 <b>Insofar</b> 66:7 <b>install</b> 44:11 68:10, 15 <b>installation</b> 38:8, 10 43:11, 17 67:18 72:3	<b>installed</b> 22:16 39:5 40:6 59:21 61:24 67:24 <b>installing</b> 59:18 <b>instance</b> 4:8 9:21 37:2 54:17 86:2 90:10 95:17 <b>instructed</b> 41:19 <b>instructing</b> 51:16 <b>integral</b> 8:11 12:22 <b>integrate</b> 58:21 <b>integrated</b> 24:16 35:12 57:6, 8 100:24 <b>integration</b> 15:12, 16 16:23 17:16 20:19 23:7 24:12 26:11, 22 46:7 48:11 55:4 58:17 <b>integrator</b> 16:25 17:3, 11 18:2, 8, 12, 24 19:2 20:9 24:4, 11 26:13, 25 48:15, 17 49:7 51:14 56:3 57:22 <b>intended</b> 10:9 <b>intends</b> 3:13 <b>interaction</b> 87:16, 18, 24 88:14, 20 101:19 <b>interchangeable</b> 38:17 39:2 <b>interface</b> 12:22 13:15 14:11 15:1 16:12, 20 18:5 19:24 20:23 21:19, 21, 24 22:14, 20 23:2, 5, 20, 22 25:3, 12, 20 26:6, 16 28:11 37:20 41:14 42:8, 13, 20 43:1, 13 45:3 46:25 49:12 50:15 51:5 58:7, 9 66:22 90:2	<b>interfaced</b> 10:15 49:15, 25 50:2 <b>interfaces</b> 12:23, 24 16:16 24:13 25:14 29:17 42:7 47:9 48:21 55:15 63:14 106:23 <b>interfacing</b> 26:9 42:22 <b>interfere</b> 66:14 <b>internal</b> 22:17 61:23 <b>internally</b> 22:11 46:22 61:23 62:3 <b>interpretation</b> 28:4 <b>interpreted</b> 28:19 <b>interpreting</b> 51:3 <b>interrelation</b> 99:14 <b>intervene</b> 3:8 <b>interview</b> 3:3, 7, 11, 12 4:19 <b>investigate</b> 73:7 89:5 <b>investigation</b> 53:14 54:9 89:21 94:10 <b>invisible</b> 82:21 <b>involved</b> 6:13, 16 10:20 17:15 34:15 40:12 49:8 50:16 51:2 88:23 93:9 <b>involvement</b> 5:9 <b>involving</b> 16:12 <b>IO</b> 15:21 16:2 22:2 46:12 <b>issue</b> 18:22 19:3 20:2, 3 24:16 25:7, 8 33:13 34:17, 22 40:9 46:21, 23 51:5, 16 52:21 68:12 73:6 78:1, 20 85:9 87:10 88:20 91:7, 20 92:6, 11 95:3, 19 97:21 102:13 104:14
---	---	--	--	---

**issues** 30:18  
48:25 51:19, 20  
58:4, 18 74:1,  
10, 17 75:25  
89:24 90:8, 10  
92:1 96:25  
102:11 105:10  
**iterations** 106:9  
**iterative** 14:25  
23:2, 13 27:17  
34:12 46:14  
105:21

< J >

**Jacques** 48:22  
51:1 57:22 59:4  
**Jennifer** 2:10  
**Joanne** 2:16  
108:3, 19  
**joined** 5:7  
**jump** 17:23  
**June** 14:18  
**jurisdiction**  
11:20

< K >

**keeping** 91:25  
**kept** 20:13 57:1  
**key** 22:3  
**kind** 82:3  
**knew** 24:24  
**knocked** 94:18  
**knowing** 57:10  
81:10 100:7  
**knowledge**  
86:20  
**known** 28:8  
36:15 45:6  
54:23

< L >

**lab** 60:19  
**labs** 77:12  
**lack** 8:9 19:2  
81:13 92:7  
**lag** 47:19  
91:21 92:16  
**lanes** 70:5  
97:18  
**largely** 59:6  
71:4 78:16  
**late** 58:4, 16  
59:17, 22  
**launch** 87:23

**Lavalin** 17:10  
49:16  
**Law** 2:11  
**Lawrence** 2:16  
108:3, 19  
**lay** 90:22  
**layout** 60:12  
**lead** 19:23  
**leading** 68:17  
**leads** 32:15  
**learning** 48:4  
**leaving** 61:4  
**led** 32:18 33:8  
34:18 91:3 94:7  
**left** 16:19  
82:24 96:22  
102:6  
**legitimate** 81:10  
**Leila** 2:17  
**letter** 79:6  
**letters** 90:17  
**level** 40:3  
50:22 55:5  
69:17 74:24  
85:9 86:12  
87:18 88:14  
101:24 104:3  
105:19  
**liability** 4:7  
**LIGHT** 1:6  
**limited** 70:9  
88:18  
**limits** 60:13  
**lines** 106:25  
**lists** 91:18, 25  
**Litigation** 2:4  
**live** 88:15  
**load** 78:13  
**located** 36:4  
**locations** 36:5,  
18, 19  
**locked** 88:5  
**logic** 43:4, 9  
96:18  
**logs** 54:9 90:6  
96:16  
**long** 52:16  
66:11, 12 71:10  
76:21 101:16  
**longer** 94:7  
105:22  
**looked** 36:17  
**looking** 20:13  
100:6 106:1

**loose** 95:9  
**lost** 48:24  
**lot** 16:14 48:23  
50:1 59:15, 18  
60:3 61:3 70:4  
78:8 83:1 90:5  
91:24  
**Lowell** 30:4  
**low-floor** 9:23  
10:1  
**low-voltage**  
41:14  
**LR** 33:23  
**LRT** 4:22 6:10,  
12, 15 48:18  
50:5  
**LRV** 7:18 9:23  
10:8, 9, 21, 25  
12:22 14:23  
26:7 48:5  
**LRVs** 7:16  
10:11, 16 14:5,  
12 24:17 25:4  
32:6 89:24

< M >

**machines** 68:1  
**made** 3:19, 24  
17:6 19:4, 15  
23:19 32:23, 24  
34:14 39:6  
40:10 51:13  
53:8 54:10, 11,  
14 60:22 63:4  
90:19 98:5  
101:2 108:9  
**main** 8:2 10:4  
19:18, 24 65:20  
66:1, 21 67:22  
70:14 102:25  
**maintain** 70:13  
82:6 83:3  
**maintainability**  
38:19  
**maintainer** 89:6  
**maintainers**  
82:19  
**Maintenance**  
7:2, 4, 6 72:4  
82:6, 10, 17, 19  
83:1, 14 96:24  
**Mainville** 2:3  
3:2 4:21 5:3, 8,  
12, 16, 24 6:3, 8,  
13, 18, 22 7:3, 9

8:1, 5, 13, 17, 19  
9:5, 14, 18, 20  
10:3, 11, 14, 24  
11:4, 9, 23 12:5,  
16 13:7, 11, 21  
14:3, 6, 8, 24  
15:3, 10 16:8,  
21 17:4, 17  
19:17 20:1, 12,  
16, 20 21:1, 5  
22:5, 21, 25  
23:6 24:2, 15,  
20 25:2, 6, 17  
26:5, 14 27:1, 9,  
14, 16, 24 28:12,  
21 29:1, 5, 10,  
20 30:1, 9, 24  
31:8 32:5, 18,  
22 33:7, 12, 18,  
21 34:3, 9, 20  
35:9, 16, 20  
36:11, 24 37:5  
38:5 39:7, 16  
40:16, 20, 24  
41:11, 21 42:24  
43:22 45:5, 10  
46:1, 6 48:9  
49:1, 6, 11, 17,  
23 50:6, 18  
51:18 52:20, 25  
54:16, 22 55:2,  
11, 16, 25 56:13,  
19, 21, 25 57:18  
58:6, 11, 14  
59:9 61:6, 10,  
15 62:6, 22  
63:3, 9, 23 64:5,  
20 65:14, 19  
66:3, 20 67:15  
68:11 69:1, 6,  
19, 23 70:16  
72:10, 14, 20, 22  
73:8, 13, 24  
74:5 75:3, 17,  
22 76:4, 17  
77:1, 13, 15, 22  
78:6 79:11, 16  
80:2, 6, 11, 15,  
20, 25 81:19, 25  
82:8 83:4, 12,  
16, 22, 25 84:9,  
13 85:3, 12, 22  
86:16, 19 87:15  
88:2, 6, 10, 13,  
21 89:23 90:9,

14 91:6, 16  
92:3, 5, 14, 18  
93:11, 14, 16, 18,  
20, 23 94:3, 6,  
11, 19, 25 95:2,  
10, 13 96:21  
97:4, 20 98:3, 8,  
13 99:3, 10  
100:9, 15 101:1,  
6, 11, 23 102:14,  
18 104:1, 7  
107:10  
**major** 38:11  
71:16  
**making** 39:8  
51:15 58:25  
**malfunction**  
95:24  
**managed** 16:13  
70:20  
**management**  
6:4 18:23 26:9  
101:25  
**manager** 4:25  
5:4, 13, 15 20:6  
86:24  
**managing** 16:15  
42:6  
**mandate** 58:2  
**Mantas** 2:10  
**manual** 85:20  
**manually** 69:12  
**manuals** 85:4, 8,  
16, 18 86:6  
**manufactured**  
30:20 31:4  
**manufacturer**  
25:11  
**manufacturing**  
31:2  
**map** 58:20  
**MARCH** 1:8, 14  
108:14  
**Maria** 2:10  
**market** 11:3  
**material** 86:7  
**materialize**  
60:17  
**materially** 79:1  
**materials** 44:11,  
12 87:2  
**mating** 45:24  
**Matt** 78:22  
101:20 102:2, 7

**Matthew** 73:1  
101:24  
**maturity** 55:6  
**McAleer** 2:10  
**meant** 47:12  
59:23 72:6  
**mechanical**  
21:22 31:18  
**mechanically**  
22:14  
**mechanism**  
20:21 21:10  
22:8  
**mechanisms**  
78:3  
**mediating** 51:3  
**meet** 9:2 11:21  
18:15 30:17  
46:11 103:8  
**MEETING** 1:7  
50:25 100:11  
108:9  
**meetings** 11:15  
16:3, 6, 7, 18  
21:14 23:5  
27:7 47:3 48:1  
50:19, 20 56:12,  
15, 18 99:21  
102:12 106:5  
**meets** 62:1  
**Member** 2:3, 4  
**members** 49:18  
**memorandum**  
21:1, 17  
**mention** 48:14  
**mentioned** 9:7  
27:6 29:15  
50:18 60:10  
104:15  
**message** 13:5  
**messages**  
15:25 16:1  
21:25 22:1 93:6  
**met** 18:10  
36:21 42:2  
98:16  
**M-hm** 55:11  
58:11 59:9  
62:6 67:15  
72:20 86:16  
88:10  
**MICHAEL** 1:7  
2:9 4:20, 24  
5:5, 10, 14, 19  
6:1, 6, 11, 16, 21,

25 7:5, 14 8:4,  
8, 15, 18, 20  
9:10, 16, 19, 24  
10:6, 13, 17, 25  
11:7, 14 12:3,  
13, 20 13:10, 14,  
25 14:5, 7, 13  
15:2, 6, 14  
16:14, 24 17:8,  
19 18:3 19:6,  
20 20:4, 15, 17,  
24 21:3, 8  
22:10, 24 23:1,  
10 24:6, 18, 21  
25:5, 10, 21  
26:10, 17, 23  
27:5, 12, 15, 20  
28:2, 16, 24  
29:2, 6, 13, 24  
30:3, 11 31:3,  
10 32:7, 21  
33:3, 9, 15, 20,  
25 34:6, 11  
35:2, 11, 19, 22  
36:14 37:4, 8  
38:9 39:10, 19  
40:18, 23 41:2,  
15 42:1 43:2  
44:3 45:8, 13  
46:4, 9 48:13  
49:3, 10, 14, 21,  
24 50:7, 24  
51:20 52:23  
53:4 54:18, 25  
55:5, 12, 19  
56:6, 20, 23  
57:3 58:1, 8, 12,  
19 59:13 61:9,  
13, 18 62:7  
63:1, 6, 13 64:2,  
6, 22 65:18, 20  
66:7 67:1, 21  
68:14 69:4, 9,  
21, 25 70:23  
72:13, 15, 21, 24  
73:10, 16 74:3,  
11 75:7, 19  
76:2, 7, 20 77:5,  
14, 20 78:4, 7  
79:14, 21 80:5,  
8, 14, 17, 24  
81:5, 22 82:1, 9  
83:7, 15, 20, 24  
84:2, 11, 16  
85:6, 15 86:1,

17, 22 87:20  
88:4, 8, 11, 17,  
25 90:4, 12, 15  
91:14, 19 92:4,  
10, 15, 21 93:13,  
15, 17, 19, 21, 24  
94:5, 8, 14, 22  
95:1, 7, 11, 20  
97:2, 6, 22 98:6,  
12, 17 99:6, 15  
100:12, 19  
101:10, 15  
102:1, 17, 22  
104:5, 11, 20  
105:3, 13, 24  
106:18  
**milestones** 15:9  
**mimic** 68:6  
**mind** 48:23  
55:9 58:13  
81:14  
**minimize** 61:14  
**minimum** 87:25  
**minor** 91:11, 16,  
22 106:7  
**minuted** 21:15  
46:16  
**minutes** 96:22  
**mirror** 22:20  
  
**misinterpretation**  
42:14  
**missed** 103:18  
**mistaken** 94:12  
**misunderstandin**  
**g** 42:9, 10  
**misunderstandin**  
**gs** 37:16 42:14  
44:23  
**mitigate** 62:13,  
20 98:10, 24  
**mitigated** 70:18  
**mitigation** 98:9,  
10  
**mix** 74:18  
**mode** 101:22  
**model** 11:5, 8,  
12 12:19 26:8  
78:14  
**modelling** 78:16  
**modification**  
54:11 60:23  
**modifications**  
11:17, 24 90:19  
**modified** 90:22

**modify** 52:17  
60:8  
**module** 86:14  
**modules** 38:16,  
25 39:2, 4, 13  
**moment** 64:4  
**money** 43:5  
**monitor** 7:17, 24  
**month** 27:22  
**monthly** 33:16  
**motivation**  
44:21  
**motive** 106:11  
**MOU** 20:20  
21:3, 4  
**mounted** 36:6  
**mounting** 39:12,  
14  
**move** 32:13, 23,  
24 33:14 38:20  
57:19 77:6  
**movement** 7:18,  
25 66:14  
**movements**  
7:21 65:6 68:8  
69:12  
**moves** 62:10  
**moving** 39:24  
52:1, 10, 14 65:1  
**MSF** 96:24  
**multibus** 37:22  
**multiple** 15:23  
87:3  
**MVB** 37:21  
  
< N >  
**natural** 37:13  
**nature** 34:12  
**necessarily**  
50:16 66:15  
76:14 84:19  
**necessary** 7:17  
22:12 62:23  
**needed** 13:3, 4,  
15 27:10 28:8,  
9 47:2 50:9  
61:1 72:2 73:1  
78:9 106:23  
**needing** 72:5  
**needs** 15:24, 25  
16:5 18:8  
25:20 26:2  
31:23 34:14  
46:17

**NEESONS**  
108:18  
**network** 48:18  
**new** 8:23 31:12  
32:2, 24 42:5, 6  
47:23 48:1 83:5  
**newcomer** 106:8  
**news** 78:5  
**night** 42:5, 19  
**non-**  
**typographical**  
3:24  
**normal** 53:23  
88:16 105:21  
**North** 9:15, 17  
10:21 11:2, 11,  
18 12:1, 7, 11  
30:17  
**notes** 94:2  
108:12  
**notice** 95:18  
**noticeable** 95:16  
**notification**  
33:5 97:9  
**notified** 68:19  
**notifies** 96:5  
**notify** 4:1  
**November**  
93:25 94:10  
**NRC** 77:12  
**nuances** 60:16  
**number** 30:18,  
19 32:9 36:8  
37:2 51:6 52:5  
57:11 64:8  
69:15 71:15  
72:4 77:8 83:8  
85:1, 19 89:9  
  
< O >  
**object** 4:16  
**objected** 4:4  
40:22  
**objective** 7:19  
98:23  
**observe** 96:24  
**obstruct** 97:17  
**obstructed**  
64:10  
**obstructionist**  
48:6  
**obstructions**  
36:3 67:11  
**obtain** 3:4

**OC** 7:24 69:11  
70:10 84:2, 8,  
10, 20 85:11  
87:19  
**OCC** 87:21  
95:24  
**occasion** 23:18  
**occasions** 83:8  
**occupying** 69:18  
**occurred** 74:14  
96:17  
**October** 100:13  
**offer** 19:7 33:4,  
10 35:4 73:19  
80:18 83:10  
**offered** 20:8  
36:3 44:18  
51:7 74:18  
**office** 17:11, 12  
49:15  
**officially** 81:16  
**OLRT** 7:4  
**OLRTC** 5:2  
6:20 13:23  
16:12, 16, 25  
17:20 18:4  
19:15 20:13  
22:18 23:11, 12  
26:24 27:2, 7  
33:13, 19 37:25  
38:22 40:13  
42:2, 16 44:2  
48:19 49:20  
50:21 51:7  
52:16 56:1  
59:17 61:3  
62:20 67:24  
68:9 71:3, 12,  
14 72:1 75:14  
78:15, 21 79:6  
82:13 83:13  
85:5, 10, 16, 17  
86:15, 23 91:12  
97:9 98:20  
99:21 100:21  
101:8 102:20  
104:6 105:1, 8,  
11  
**OLRTC's** 18:15  
81:20 82:14  
100:17 103:13  
104:2  
**onboard** 7:15  
8:10 13:17  
31:15 42:22

43:7 49:2 68:4  
103:3  
**ones** 23:7  
**ongoing** 82:11  
87:24  
**onwards** 28:23  
**open** 53:11, 21  
54:4  
**opening** 81:4  
**opens** 53:10, 23,  
24  
**operate** 7:25  
9:3 69:12 84:21  
**operating** 36:20  
48:19 50:14  
52:4 65:9  
66:10 72:18  
74:17 83:18  
84:1, 5, 10 99:19  
**operation** 55:7  
73:23  
**operational**  
54:9 76:13 90:1  
**operations** 7:21  
55:22 69:14  
70:14 76:15  
83:13, 17, 23, 24  
85:2  
**operator** 7:23,  
24 88:14 95:17,  
23  
**operators** 69:11  
82:16 85:24  
87:17, 19, 22  
88:20  
**opinion** 24:14  
26:4 33:5 35:3  
42:5 73:17, 20  
80:22 99:16  
**opinions** 50:17  
**opportunity**  
3:20 42:8  
**opposed** 12:1,  
10 34:24 58:6, 8  
**order** 3:16  
103:6  
**organization**  
82:16, 24  
**origin** 70:1  
**original** 31:1  
98:15 104:16  
**originally** 11:12  
67:3  
**originals** 79:8

**OTTAWA** 1:6  
6:12, 15 8:23,  
24 11:1 12:6  
31:7 56:12  
62:15 72:25  
73:5 86:4, 5  
89:2 103:25  
**Ottawa's** 4:22  
6:10  
**ought** 82:4  
95:16  
**output** 21:14  
**outside** 66:21  
105:25  
**overall** 8:11  
18:9 32:16  
80:23  
**overarching**  
18:23  
**overcommitted**  
19:12  
**overhead** 71:16,  
19  
**oversee** 16:23  
**oversight** 47:13  
**overt** 16:15  
**owned** 23:24  
  
< P >  
**p.m** 1:14  
107:13  
**Pacific** 49:19  
**parameters** 9:4  
**part** 6:24 8:11  
12:8 23:1 35:4  
40:9 49:20  
51:22 68:1  
78:9 85:6  
88:25 102:22  
104:23  
**participants**  
1:13 2:7 3:23  
**participate**  
56:14 72:23  
73:4 89:20  
**participated**  
16:16 57:11  
100:20 106:1  
**participating**  
73:14 93:10  
**participation**  
50:22 73:2  
**particular** 11:25  
12:9, 19 26:7

38:18 53:9, 19  
68:16 93:12  
**particularly**  
11:13 34:12  
78:10  
**parties** 16:5, 20  
18:4, 7 21:10,  
11 24:24 44:10,  
13 48:25 51:3,  
16 65:13 93:7  
106:2  
**party** 42:9, 10  
106:4  
**pass** 85:10  
**passed** 40:1  
86:15  
**passenger**  
63:17 91:20  
92:11  
**path** 18:19, 20  
51:16 106:16  
**Paul** 56:11, 24  
**paying** 103:23  
**peaks** 60:12  
**penetration**  
89:15  
**people** 48:20  
50:1 73:10  
85:1 91:24  
98:22  
**perceived** 81:6  
**percent** 76:11  
**perfect** 42:23  
43:3 44:13  
62:24  
**perform** 10:10  
33:23 39:25  
40:19, 21 41:4,  
17 56:2, 4  
57:25 60:14, 20,  
21 61:5 70:9  
74:19 75:12  
78:18 80:13  
83:9  
**performance**  
19:8 31:18, 24  
34:13 53:2  
60:14 78:13  
79:2 88:24  
**performed** 33:2  
40:17 41:17  
65:7 74:25  
**performing**  
40:22

**performs** 41:3,  
8 65:3, 4  
**period** 14:7  
52:6 53:24  
74:8 75:5, 16,  
21 76:21  
**periodically** 91:8  
**peripheral** 7:16  
13:1  
**perjury** 4:13  
**permit** 46:10  
**permits** 3:9  
**person** 4:8  
49:7 63:22  
**personally** 76:5  
**personnel** 38:6  
**perspective**  
17:25 18:1  
65:21 77:16  
**Peter** 2:10  
**phase** 107:5  
**physical** 8:21  
9:2 12:24 39:1  
**physically** 36:9  
**pick** 68:16  
**PICO** 63:25  
64:21, 23  
**piece** 68:15  
**pieces** 37:19  
67:14 68:17  
99:14  
**place** 4:12  
20:21 24:4, 17  
31:2 82:12  
108:6  
**placed** 61:21  
76:5, 6  
**plan** 16:22  
17:7, 9 31:1  
59:2 98:9, 10  
100:3, 5 104:16  
**planned** 14:10  
31:14 67:3  
77:5 80:9  
**planning** 13:9  
16:10 48:10  
**platform** 11:17  
91:8, 9 92:7, 8,  
12  
**play** 87:10  
**played** 90:3  
**plug** 35:14  
**plug-and-play**  
35:1, 15

<p><b>point</b> 17:20 38:8 39:14 93:1 98:13 100:10 <b>policy</b> 19:4 <b>populated</b> 38:15 <b>populating</b> 38:25 39:13 <b>portion</b> 61:2 <b>position</b> 57:25 77:20 79:9 81:17 <b>possible</b> 55:21 98:25 <b>posted</b> 3:17 <b>post-installation</b> 39:23 <b>post-opening</b> 88:22 <b>postpone</b> 32:9 <b>potential</b> 24:24 53:6 66:14 95:3 97:11 <b>potentially</b> 74:9 <b>power</b> 39:24 71:19 <b>preceding</b> 81:13 <b>precondition</b> 41:6 <b>predated</b> 6:17 66:19 <b>preferred</b> 73:15 <b>prelaunch</b> 51:23 <b>preliminary</b> 14:18 <b>prematurely</b> 53:12 <b>prepared</b> 81:8 <b>prerequisites</b> 87:8 <b>PRESENT</b> 2:14 46:11 <b>presenters</b> 108:8 <b>president</b> 27:6 <b>press</b> 90:5 <b>pretty</b> 104:14 <b>previous</b> 47:25 <b>previously</b> 41:18 79:23 <b>prewire</b> 37:18 38:23 <b>prewiring</b> 38:3 <b>primarily</b> 6:11</p>	<p>101:7, 12 <b>primary</b> 7:19 <b>prime</b> 16:24 <b>Prior</b> 5:20 14:9 16:6 19:24 26:21 37:6 38:10 56:7 60:18 95:6, 15 <b>priority</b> 70:9, 11 <b>privy</b> 101:3 <b>problem</b> 17:21 18:19 19:11, 16 20:5 25:1 52:15 60:2 67:6 76:14 91:24 92:23 <b>problems</b> 19:10 58:24 75:2 90:1 <b>procedural</b> 3:15 <b>procedure</b> 40:5 <b>procedures</b> 39:22 47:1 83:18 84:1, 4, 5, 10, 19 <b>proceed</b> 70:2 <b>proceedings</b> 4:7, 11 108:5 <b>process</b> 14:10, 25 23:13 24:3 27:17 84:24 105:21 106:15 <b>processes</b> 47:1 <b>procured</b> 10:12 57:7 <b>procurement</b> 6:14 <b>produce</b> 98:9, 10 100:23 <b>produced</b> 21:18 23:4 25:4 <b>producing</b> 21:23 <b>product</b> 8:25 21:14, 18 23:4 30:22 <b>production</b> 13:17 106:17, 19, 22 107:4 <b>products</b> 10:20 <b>profiles</b> 78:2 <b>profound</b> 70:6 <b>program</b> 82:12 85:7 86:9 100:5 <b>progressive</b> 14:15, 22</p>	<p><b>project</b> 4:22, 25 5:4, 9, 10, 13, 14, 18, 20 6:4, 5, 7, 24 7:13 9:4, 8 11:25 12:6, 10 14:14 18:2, 9, 15 19:23 22:18 26:15 56:10, 17, 22 63:19 82:3 88:19 98:21 99:5, 13 100:18 101:25 102:10 <b>projects</b> 5:22 19:12 25:9 42:7 <b>prolongated</b> 70:19 <b>prolongation</b> 34:19 62:14 70:24 <b>proper</b> 58:17 <b>properly</b> 20:16 56:3 <b>proposed</b> 36:9 83:8 <b>propulsion</b> 79:1 <b>prosecution</b> 4:12 <b>prototype</b> 13:20 <b>prototypes</b> 31:5 37:18 <b>protracted</b> 26:4 28:11 54:13 61:1 76:21 <b>protraction</b> 32:16 <b>provide</b> 17:10 38:6 45:12 68:9 85:13 87:2 105:11 <b>provided</b> 6:14 7:19, 22 13:9, 22 14:25 23:10, 11 27:21 28:7 29:3 30:8 39:22 41:24 44:19 47:24 52:18 73:17 82:13 84:6 85:20, 25 86:15 89:10 95:23 97:8 105:14, 15 <b>provider</b> 25:13 <b>provides</b> 22:12, 15 67:24</p>	<p><b>providing</b> 5:1 13:18 24:10 28:5 29:11 43:8 59:20 65:10 84:22 <b>provision</b> 13:19 <b>proximity</b> 97:25 <b>public</b> 3:6, 14, 18 4:2, 15 92:13 <b>pure</b> 19:13 <b>purpose</b> 3:3 22:11 <b>purposes</b> 22:11 <b>pursuant</b> 4:1 80:13 <b>push</b> 98:24 101:18 <b>pushed</b> 32:12 <b>pushing</b> 32:14 <b>put</b> 15:11 20:21 22:7 36:7, 19 42:25 43:20 47:15 52:12 62:15 74:7 103:20 106:20  &lt; Q &gt; <b>qualification</b> 77:9 <b>quantify</b> 97:15 <b>quantity</b> 64:8 <b>quarter</b> 14:1 <b>question</b> 4:4, 17 12:4 17:24 25:16 28:25 41:20 42:19 63:7 81:15 82:4 92:6 97:19 103:12 105:18 106:14 <b>questions</b> 3:9, 10 96:23 104:8, 14 107:8 <b>quickly</b> 13:16 <b>quite</b> 87:21  &lt; R &gt; <b>rack</b> 34:24 36:4, 13, 15, 25 38:7, 13, 15, 23, 24 39:1, 3, 9, 12, 15, 18 40:10 43:20</p>	<p><b>racks</b> 13:24 38:3 <b>radio</b> 94:17 <b>radios</b> 67:25 <b>RAIL</b> 1:6 6:5, 6 <b>raise</b> 33:13 <b>raised</b> 17:20 33:16 78:20, 21, 25 <b>raising</b> 57:1 <b>Randy</b> 86:25 <b>rate</b> 78:11 92:25 <b>reach</b> 84:17 <b>reached</b> 15:19 16:6 47:3 <b>react</b> 53:20 60:8 91:1 <b>reaction</b> 10:7 31:22 46:13 52:14 53:7 54:3, 10, 15, 19 90:20 96:15 <b>read</b> 90:4 <b>readiness</b> 80:23 81:2, 3, 20 <b>reads</b> 68:4 <b>ready</b> 39:3 43:16 73:20 81:23 82:5 <b>real</b> 60:16 77:2 <b>realistic</b> 27:18 <b>really</b> 19:14 61:19 63:21 81:9 103:17 106:22 <b>realm</b> 103:11 <b>real-world</b> 60:8, 22 <b>reason</b> 37:6 52:8 <b>reasons</b> 17:17 <b>recall</b> 13:25 21:9 28:16 29:10, 13, 14 33:15, 20, 21, 25 35:16 49:1 51:6 89:8 98:12 104:21 <b>receipt</b> 50:15 <b>receivable</b> 4:10 <b>receive</b> 23:2 27:19 30:2 <b>received</b> 23:14</p>
--	--	--	--	--



<p>50:8 65:13 <b>receives</b> 42:11 <b>receiving</b> 22:1, 22 25:19 <b>recertification</b> 80:1 <b>recertified</b> 79:5, 10 <b>recertify</b> 79:17, 18, 22 <b>recognize</b> 72:1 100:11 <b>recognized</b> 37:25 62:11 <b>recognizes</b> 96:4 <b>recognizing</b> 98:25 99:13 <b>recollection</b> 33:3 <b>reconcile</b> 18:8 <b>record</b> 81:8 98:7 107:12 <b>recorded</b> 108:10 <b>records</b> 29:8 <b>recourse</b> 90:25 <b>recover</b> 59:25 <b>recovery</b> 100:3, 4 <b>redesign</b> 12:8 <b>refer</b> 21:16 29:7 64:24 <b>referencing</b> 63:25 <b>referred</b> 15:21 21:21 22:2 78:11 <b>referring</b> 27:21 44:1 66:9 <b>reflect</b> 47:2 54:21 60:24 86:7 <b>reflected</b> 47:7, 18 84:25 <b>reflections</b> 10:7 <b>refusal</b> 40:14 <b>refused</b> 40:11 41:20 <b>regard</b> 17:6 <b>regarding</b> 16:12 34:22 <b>regardless</b> 41:3, 8 59:3 <b>regroup</b> 35:23 <b>regular</b> 52:5</p>	<p>56:12 102:12 <b>regularly</b> 30:3 <b>reinvestigating</b> 55:14 <b>reject</b> 36:1 <b>rejected</b> 92:2 <b>rejection</b> 36:21 <b>related</b> 7:3, 5 26:15, 18 42:22 58:4, 10 63:12 94:21 <b>relates</b> 5:18 12:21 63:5 66:23 103:16 <b>relating</b> 81:2 <b>relationship</b> 21:7 24:19 88:3 102:2 <b>relay</b> 97:25 <b>relaying</b> 99:25 <b>release</b> 48:3 <b>released</b> 61:24 <b>releases</b> 34:16 <b>reliability</b> 53:3 72:12 <b>reluctance</b> 15:17 100:2 <b>remain</b> 53:20 <b>remaining</b> 103:14 <b>remember</b> 64:8 99:20 <b>remotely</b> 1:13 <b>removed</b> 36:7 47:10 <b>reopening</b> 55:13 <b>repairs</b> 79:20 <b>repeat</b> 12:3 <b>repeatedly</b> 17:19 27:6 <b>repercussions</b> 34:10 72:11 <b>replaced</b> 47:11 82:25 <b>replacement</b> 79:7 <b>replacements</b> 87:13 <b>replacing</b> 78:23 79:3 <b>report</b> 26:23 33:16 93:2 96:10 <b>reported</b> 91:10</p>	<p><b>Reporter</b> 108:4, 20 <b>REPORTER'S</b> 108:1 <b>reporting</b> 91:20 <b>repository</b> 91:25 <b>representative</b> 23:21 46:15 <b>request</b> 40:14 <b>requesting</b> 15:18 <b>requests</b> 22:23 47:5 <b>require</b> 51:8 60:6, 7, 22 <b>required</b> 4:14 22:25 25:14 27:2 44:16 85:8 <b>requirement</b> 76:23 107:3 <b>requirements</b> 11:25 12:9 16:19 18:9, 16 28:7, 18 30:17 45:6, 8 47:23 48:2 63:4 106:4 <b>requires</b> 18:22 <b>requisite</b> 20:10 <b>reservation</b> 87:14 <b>resolution</b> 35:22 52:21 <b>resolve</b> 16:4 18:14, 22 51:5, 10 58:18 <b>resolved</b> 13:16 35:21 37:24 51:19 <b>resolving</b> 88:23 <b>resorted</b> 73:9 <b>resource</b> 17:2 19:11 <b>resources</b> 19:3 20:18 56:16 72:7, 24 <b>respect</b> 12:10 26:22 50:19 101:8 104:3 <b>respective</b> 23:7 <b>respects</b> 9:21 97:23 <b>respond</b> 10:9 73:11 <b>responds</b> 51:25</p>	<p><b>response</b> 33:19 42:18 57:1 83:18, 21 <b>responsibilities</b> 39:21 <b>responsibility</b> 17:12 39:11, 25 41:22 43:25 45:23 47:14 82:5 <b>responsible</b> 37:10, 17 44:10 59:17 68:9 <b>restate</b> 74:3 <b>restricted</b> 72:9 <b>restrictions</b> 69:10, 13 <b>result</b> 12:11 26:6 73:25 94:22 <b>resulted</b> 25:1 <b>results</b> 32:11 40:2 62:2 64:11 86:14 <b>reticence</b> 24:10 <b>retired</b> 49:5 <b>retrain</b> 83:5 <b>retraining</b> 87:13 <b>retrofits</b> 79:19 80:3, 6, 9, 16 <b>revenue</b> 7:8 66:1 68:24 70:14 73:19, 21, 22 76:1 80:4 81:23 82:2 88:15 89:25 93:22 98:15 <b>reversals</b> 23:18 <b>review</b> 3:21 14:17, 18, 19 29:16, 19 46:14 84:15 100:12 <b>reviewed</b> 62:3 <b>reviewing</b> 96:16 <b>reviews</b> 14:15, 22 <b>Revision</b> 29:9 85:9 <b>revisions</b> 28:22 30:15 <b>Rideau</b> 7:2 66:10 82:6 <b>risk</b> 39:1 76:11 98:18 100:3</p>	<p><b>risks</b> 58:25 <b>robust</b> 82:11 <b>rocks</b> 81:6 <b>role</b> 4:22, 24 5:4 6:24 16:25 17:2, 11, 22 19:10 20:6, 9, 11, 19 26:25 48:14 49:7 56:3 57:22, 25 59:5 88:22 90:3 102:10 <b>rolling</b> 25:11, 12 81:3 99:4, 7, 11, 16 <b>roof</b> 36:8 <b>room</b> 65:8 88:7 <b>routinely</b> 89:4 103:18 <b>RPR</b> 108:3, 19 <b>RSA</b> 98:15 <b>RTGEJV</b> 49:12 <b>RTM</b> 7:6 69:11 70:10 82:17 85:11, 13, 14, 18, 21 89:20 92:22 93:10 <b>RTM's</b> 69:14 <b>run</b> 73:25 75:15 <b>running</b> 5:21 71:17 72:23 73:3, 4, 15 74:8 <b>rush</b> 86:23 <b>rushed</b> 86:20  &lt; S &gt; <b>safe</b> 54:3 73:21 78:14 96:14 <b>safety</b> 51:23 52:3, 8, 11 54:5 61:21 62:1, 4, 5 64:12 71:23 79:17 83:19 <b>satisfied</b> 62:4 <b>satisfy</b> 61:22, 23 62:1 74:25 <b>SCADA</b> 63:16 93:3 <b>scenario</b> 53:10 54:5 103:5 <b>scenarios</b> 55:21 <b>schedule</b> 13:16, 19 31:16 44:6 45:14 57:4, 6, 8,</p>
---	--	--	---	--

<p>10, 11, 15, 19 59:7, 10, 14 67:2 70:17, 20 87:1 98:11 100:18, 22, 24 102:20, 21 103:5 104:4, 16 <b>schedules</b> 103:9, 17 104:3 <b>scheduling</b> 66:6 100:20 101:8, 13 <b>scope</b> 44:25 84:18 <b>screwdriver</b> 43:20 <b>seasons</b> 77:8 <b>Section</b> 4:2, 14, 17 65:4 <b>secure</b> 88:8 <b>security</b> 89:14 <b>seek</b> 62:10 <b>seeking</b> 101:8, 13 <b>segmented</b> 60:5 <b>send</b> 87:3 <b>sending</b> 15:25 21:25 <b>senior</b> 56:10 <b>sense</b> 19:1 96:12 99:11 106:14 <b>sensed</b> 96:13 <b>sensing</b> 96:11 <b>sensor</b> 54:2 <b>separate</b> 7:1 8:8 44:6 68:22 <b>September</b> 14:19, 20 29:12, 16 93:13, 21 94:4, 5 104:16 <b>series</b> 40:8 91:3 <b>serious</b> 60:2 <b>serves</b> 22:10 <b>service</b> 7:8 42:12 68:25 75:24 76:1 80:4 81:24 82:2 88:16 89:25 98:15 <b>set</b> 64:16 108:6 <b>settlement</b> 52:18 <b>severely</b> 72:8 <b>shake</b> 76:13 <b>shaken</b> 55:23</p>	<p><b>share</b> 37:9 38:1 42:20 44:5 45:14, 22 93:5 103:13 <b>shared</b> 3:22 40:2 54:7 56:11 78:15 93:6 100:25 107:4 <b>sharing</b> 15:17 <b>shed</b> 97:16 <b>ship</b> 38:24 <b>short</b> 52:6 <b>shortcut</b> 62:8 <b>shortcuts</b> 62:7 <b>Shorthand</b> 108:4, 12 <b>Shortly</b> 5:5 <b>shown</b> 92:17 103:4, 18 <b>shows</b> 44:6 <b>shut</b> 94:10 <b>shutdown</b> 94:7 <b>side</b> 36:7 <b>sideswipe</b> 97:12 <b>signal</b> 15:21 16:2 22:3 34:24 46:12 53:16, 18 54:10 <b>signalling</b> 8:3, 11 15:19, 20 20:7 21:24 47:8, 10, 11 105:25 <b>signals</b> 106:24 <b>signed</b> 5:6 26:21 <b>significant</b> 8:20 34:4 94:13 99:12 <b>similar</b> 5:21, 22 25:18 <b>simple</b> 65:11 <b>simulation</b> 76:19 77:11, 18 <b>single</b> 45:3 62:16 <b>single-rack</b> 35:6 <b>sinkhole</b> 67:4 <b>site</b> 34:7 <b>sitting</b> 102:8 <b>Slade</b> 73:1 78:22 101:21 102:2 <b>Slade's</b> 101:24</p>	<p><b>slide</b> 38:13 39:4 <b>slower</b> 76:13 <b>small</b> 64:15 <b>SNC</b> 17:10 49:16, 18, 19 <b>snow</b> 77:6 <b>soft</b> 75:24 <b>software</b> 8:21, 22, 23, 24, 25 9:2 10:9 22:13 31:23 32:13, 14 34:15, 17 46:18, 20, 24 50:10, 11, 14 51:8, 10 52:13, 17 54:11, 15, 20 60:5, 8, 9, 23 73:18, 21 86:5 <b>sole</b> 24:7 <b>solemn</b> 3:4 <b>solution</b> 51:7 <b>solve</b> 18:19 51:15 <b>solved</b> 52:15, 16 <b>something's</b> 96:4 <b>somewhat</b> 48:23 <b>Sorry</b> 8:19 15:19 20:24 35:23 56:20 74:5 91:14 99:17 100:9 101:11 <b>sort</b> 51:23 75:24 105:21 <b>source</b> 36:5 56:4 68:16 92:23 <b>sources</b> 34:19 66:21 <b>space</b> 12:24 36:16, 21, 23 <b>spare</b> 38:20 <b>speak</b> 5:17 7:11 13:12 17:4 25:21 44:20 50:21 53:1 59:10 70:24 72:16, 17 75:19 76:6, 8 77:23 81:20 86:12 87:18 <b>speaking</b> 30:25</p>	<p><b>specific</b> 11:25 21:10 41:16 64:7 75:5 77:6 78:20 86:2 104:14 <b>specifically</b> 4:23 5:20 18:18 19:18 21:20 37:1, 24 42:21 63:16 72:25 76:24 99:4 <b>specification</b> 27:3, 21 <b>specifications</b> 22:9 27:10, 12, 19 <b>specified</b> 28:5 87:8 <b>specifies</b> 26:24 <b>speculate</b> 10:2 30:13 43:5 <b>speculating</b> 48:7 49:4 <b>speculation</b> 19:13 33:11 <b>speed</b> 31:20 52:5 60:13, 14 78:2 <b>spend</b> 64:4 <b>SPICO</b> 39:17, 22, 23, 25 40:5, 11, 15, 18, 21, 25 41:7, 12, 16 <b>Spirit</b> 11:6, 8, 16 <b>spoke</b> 41:21 46:3 66:4 67:17 <b>spoken</b> 25:6 <b>spring</b> 98:19 <b>Stage</b> 4:22 7:8 43:1 69:16 70:2, 11 72:4 89:4 103:1, 2, 3, 11, 16 <b>stages</b> 13:9 16:10 <b>stakeholders</b> 72:5 <b>stand</b> 8:14 <b>standard</b> 9:9, 11 10:5 83:18, 25 <b>standards</b> 11:19, 21 12:1, 12</p>	<p><b>standpoint</b> 71:23 <b>start</b> 4:18 5:4 6:17 7:8 59:23 60:15 75:24 93:22 <b>started</b> 10:18 21:13 82:3 <b>starting</b> 76:13 <b>starts</b> 52:1 <b>State</b> 31:12 32:25 <b>statements</b> 108:8 <b>static</b> 39:23 <b>station</b> 53:22 66:8, 19 94:7 <b>stations</b> 66:6 <b>Stenographer/Tra nscriptionist</b> 2:16 <b>stenographically</b> 108:10 <b>step</b> 14:14 102:7, 9 <b>stepping</b> 103:10 <b>steps</b> 66:17 91:5 <b>stock</b> 25:11, 12 81:3 99:5, 7, 12, 16 <b>stop</b> 52:7 <b>storage</b> 70:6 <b>streamlined</b> 32:20 <b>strict</b> 61:21 <b>strong</b> 26:8, 12 <b>struggled</b> 17:1 30:18 71:12 <b>struggling</b> 93:3 <b>students</b> 86:12, 13 87:6, 11 <b>style</b> 84:24 <b>subassemblies</b> 38:11 <b>subcontract</b> 5:1 13:23 27:2 35:5 44:1, 4, 18 45:2, 3 <b>subcontracted</b> 18:10 <b>subcontractor</b> 44:25 93:4 <b>subcontractors</b></p>
--	--	--	--	--

<p>18:13 57:9, 17 <b>subject</b> 61:19 <b>submitted</b> 30:6 78:14 <b>subsequent</b> 16:7 28:22 34:10 36:2 88:2 <b>subset</b> 14:21 40:14 <b>successful</b> 40:7 <b>successfully</b> 40:1 41:7 <b>sufficiency</b> 85:23 <b>sufficient</b> 77:18 85:25 <b>suitability</b> 96:25 97:2 <b>suited</b> 78:2 <b>summary</b> 10:25 32:21 <b>summation</b> 52:24 <b>supplier</b> 78:24 <b>suppliers</b> 72:2 <b>support</b> 7:6, 18 73:1 76:16 88:1 <b>supported</b> 7:20 <b>supporting</b> 76:15 93:10 <b>supportive</b> 89:11 <b>supposed</b> 14:1 64:14 68:23, 25 <b>surfaces</b> 90:25 <b>surprise</b> 35:7 <b>surprises</b> 55:18 <b>surprisingly</b> 68:19 <b>suspicion</b> 106:10 <b>swap</b> 38:19 <b>switch</b> 68:1 96:1, 3, 9, 13, 14, 19 <b>system</b> 5:1 7:8, 11, 17 8:3, 7, 9, 10, 11 9:3, 7, 8, 9, 11, 22 10:5 16:25 17:3, 10, 13, 14, 16 18:2, 8, 12, 23 20:9 24:11, 16 26:7, 22, 25 27:13 34:18, 23 35:1,</p>	<p>15 43:16 47:10, 11 48:15, 17, 18 51:14 53:3 57:2, 21 61:22 63:12, 16, 18 64:14 65:10 68:4 71:17 72:12, 17 73:20 75:10 76:10, 14, 25 77:23 79:19 80:23 82:7 83:17, 22, 24 84:21 89:8, 15, 16 90:6 94:1, 9 95:8, 22 96:5, 12 <b>systems</b> 7:15, 16, 20, 23 9:12, 17 10:15 13:5, 18 15:12, 21 18:15 19:2 24:4 25:3 31:15, 19 36:23 38:2, 4 43:12 48:11, 18 49:6 56:2 57:6 58:17, 21 68:6 71:16 72:18 75:6 83:3 90:11 94:16 95:5, 18 103:3 <b>system's</b> 55:6  &lt; T &gt; <b>table</b> 44:4 <b>tag</b> 68:2, 5 <b>tailored</b> 8:22 <b>takes</b> 60:10 <b>talk</b> 43:24 46:6 70:17 <b>talking</b> 19:21 48:17 63:24 <b>tasked</b> 89:4, 7 <b>tasks</b> 44:7 <b>team</b> 35:8 62:15, 16 71:1, 6 82:4 89:2 98:21 103:20 <b>teams</b> 71:6 89:2 <b>Technician</b> 2:17 <b>techs</b> 73:5 87:21 <b>tend</b> 4:5, 6 <b>term</b> 35:14 67:23</p>	<p><b>terminating</b> 39:13 45:21 <b>terms</b> 14:11 17:6 19:7 22:22 24:18 25:19 27:25 29:23 30:2 31:1 36:25 50:22 57:3 59:10 63:9, 24 65:11 66:4, 23 67:23 76:8, 17 77:2, 16, 23 96:23 97:1, 7 101:13 102:20 105:10 <b>test</b> 31:14 32:3 33:23 38:7 40:5 41:3, 7 44:12 51:23 52:1, 9 54:18, 22 60:3, 4, 25 61:18 62:15, 16 65:16 70:7 71:11 72:7 77:6 89:3 103:15, 20 <b>tested</b> 30:21 31:5 38:17 54:17 60:18 65:24 69:17 73:22 77:2 86:13 87:4 <b>testers</b> 103:24 <b>testing</b> 31:14, 17, 20, 21 32:4, 6, 10, 11, 14, 15, 17 33:2 34:7, 8, 10, 12, 13, 19, 21 39:17 40:4, 8, 21, 25 41:1, 4, 10, 13 43:15 49:9 54:20, 21 59:23 60:1, 6, 7, 16 61:11, 14, 17, 23 62:11, 14, 16, 23, 25 63:4, 5, 10, 13, 25 64:1, 7, 9, 18, 19, 21, 24 65:3, 15, 25 66:15 67:6, 7, 12 68:20 70:11, 19 71:7, 8 72:3 74:9, 12, 23, 24 75:11 76:18, 19,</p>	<p>21, 22 77:7, 10, 19 80:4, 13 87:20 88:3 97:14 102:25 103:3, 21 <b>testings</b> 65:22 <b>tests</b> 38:14 39:25 40:1, 11, 15, 18 41:16, 18, 19 61:5, 25 62:17, 19 63:16, 20 64:1, 3, 8, 25 65:2, 5, 6 70:9 88:1 89:15 <b>Tetreault</b> 56:11 <b>THALES</b> 1:7 2:9 4:25 5:6, 11, 19 6:14, 17, 19 7:10, 12 9:1, 8, 9, 18, 19, 22 10:19 12:21 13:4, 14 14:14 15:14, 24 16:11, 18 18:13, 19 20:8, 22 21:18, 23 23:8 24:9, 10, 19, 22 25:10, 19 26:2, 21 27:8, 11, 22 28:4, 8, 13, 22 29:3, 11 33:2, 13, 22 35:3, 24 36:3, 17 37:11 38:6, 16 39:22 40:2, 10, 14, 17, 20 41:3, 12 42:21 43:12, 16 44:1, 9, 18 45:2, 6, 15 46:17, 22, 23 47:2, 9, 10 48:16, 22 49:11 50:20 51:22 58:9 61:5, 7 62:14, 24 63:15 64:3 65:15, 21 66:6, 11, 15, 25 67:9, 17, 24 70:18 72:17, 22 73:2, 13 74:1, 8, 25 75:11, 21 76:5 79:12, 16 80:11 81:1 83:4, 12 84:14 85:3, 12 87:17, 19, 21 88:15</p>	<p>90:6 92:19 93:9 97:6 98:3, 8, 14 99:17 100:16 101:7, 12 102:14 105:1, 10 <b>Thales/Alstom</b> 90:2 <b>Thales's</b> 10:5, 15 12:14 13:12, 23 14:21 18:1 19:8 21:6 22:13, 17 24:16 25:3 26:7 29:22 34:23 35:17 37:3 46:2 59:12, 19 63:5, 12 64:1 67:18 75:6 77:16 84:18 88:22 90:11 97:1, 5 102:20 104:3, 18 <b>thing</b> 106:21 <b>things</b> 37:11 48:1, 4 60:7 89:5, 9 <b>thinking</b> 50:4 63:16 84:7 <b>thirdly</b> 7:22 <b>thought</b> 15:11 42:25 47:4, 16 77:9 97:9 102:2, 10 <b>thoughts</b> 42:4 <b>threat</b> 89:19 <b>throw</b> 71:21 <b>throwing</b> 81:6 <b>tied</b> 39:20 <b>tighten</b> 43:21 <b>time</b> 3:9 7:1 9:22 10:15, 19 12:19 14:7 28:1 33:17, 22, 23 34:16 35:21 42:12 43:4, 8 48:24 52:6, 16, 18 53:22, 24 55:17 56:10 58:16 59:4 60:3, 25 61:2, 4, 16, 18, 20 68:24 71:23 73:1 75:16 76:21 78:22 81:3</p>
---	---	--	--	--

86:23 87:1 92:17 98:14 100:6, 10 101:16 102:23, 24 103:1, 23 107:11 108:6, 9 <b>time-consuming</b> 64:18 <b>timeline</b> 27:18 29:23, 25 32:16 58:22, 23 61:4 63:20 <b>timelines</b> 34:5 61:8 <b>timing</b> 105:10 <b>title</b> 20:6 <b>today</b> 48:19 55:3 75:20 87:10 <b>today's</b> 3:3 <b>told</b> 19:7 68:20 78:17 94:2 <b>tolerance</b> 61:19 <b>Tom</b> 101:17 <b>top</b> 51:6 104:20 <b>topic</b> 16:3 <b>topics</b> 83:21 <b>torn</b> 70:4 <b>Toronto</b> 23:21 <b>torqued</b> 94:21, 23 <b>touched</b> 90:12 <b>track</b> 32:3 41:5, 6 50:13 60:12 64:18, 20 65:4, 16 66:11 71:10 94:13 97:9, 25 <b>tracks</b> 66:24 68:3 70:4 98:1 <b>train</b> 7:21 8:16 12:24 13:1 16:1, 2 22:1 25:13, 25 26:1, 3 28:10 30:16, 23 31:1, 19 32:8 34:13 37:20, 21 38:18 39:6, 9, 12 40:7 41:5 43:6 45:25 51:24 52:1, 3, 7, 9, 13 53:21 55:22 59:20 60:15 64:7, 12, 13, 14, 15, 24 65:3, 6	66:14 67:19 68:2, 4, 8 69:12 75:15 77:10 78:17 79:2, 23, 25 82:16 90:7, 21 95:6, 17, 23, 25 96:6, 7, 15, 20 97:13 103:20 106:19, 21, 22 107:6 <b>trained</b> 82:23 83:13 87:13 <b>trainer</b> 87:3 <b>trainers</b> 82:14, 23 83:6, 13 87:3 <b>training</b> 82:11, 13, 15, 18, 20 83:9, 17 85:7, 23, 24 86:2, 6, 8, 14, 20, 24 87:1, 4, 7, 8, 12 <b>trains</b> 7:25 13:20 14:16 25:15 30:20 31:3, 6, 11, 13, 15, 25 32:4 33:6 43:13 46:19 58:4 59:8 60:4, 11 64:16 65:1 69:15, 16 70:2, 5, 12, 15 71:17 73:25 74:8, 16, 18, 19 75:6, 12, 20, 24 76:25 77:2, 6 79:3, 10 80:7 87:23, 24 89:3, 4 95:4 97:12, 13, 16, 17 102:25 103:4, 15, 22 106:17 <b>train's</b> 31:21 94:15 95:4 <b>trans</b> 82:5 <b>transcribed</b> 3:12 <b>transcript</b> 3:13, 17, 21, 25 108:12 <b>transfer</b> 82:5 <b>Transit</b> 7:2 82:6 <b>translation</b> 42:12 106:6 <b>transmission</b> 105:7 <b>transmitted</b> 107:1	<b>transparency</b> 81:14 100:17 <b>Transpo</b> 7:24 69:11 70:10 84:2 85:11 87:19 <b>transponder</b> 68:2 <b>Transpo's</b> 84:8, 10, 20 <b>Tremblay</b> 94:6 <b>triaged</b> 92:1 <b>trial</b> 4:11 72:23 73:2, 4, 14 <b>troubleshoot</b> 74:1, 9 <b>troubleshooting</b> 75:25 <b>true</b> 46:4 <b>trying</b> 25:24 48:6 59:6 71:14, 18 89:2, 3 92:22 <b>tuning</b> 34:14 <b>tunnel</b> 17:13, 14 <b>Turner</b> 19:25 20:5 <b>turnkey</b> 43:11 <b>turnover</b> 83:1 85:1 <b>type</b> 45:21 67:23 77:17 <b>Typically</b> 56:17 <b>typos</b> 3:21  < U > <b>ultimate</b> 58:25 102:15 <b>ultimately</b> 23:8 40:17, 25 51:19 61:11, 16 72:11 106:17 <b>unable</b> 31:13 57:5 105:18 <b>unaware</b> 53:9, 18 <b>uncertain</b> 82:11 <b>underneath</b> 71:18 <b>understand</b> 6:3 11:10 14:9 15:4, 24 16:1 20:2, 3 29:8, 21 34:21 36:11 37:1 43:4	62:22 76:18 78:1 <b>understanding</b> 11:11, 14 12:14 15:15 17:8 19:3 21:2, 17 23:15 24:22 47:21 92:24 95:14 <b>understood</b> 13:14 20:5 21:12 44:14, 15 <b>undertake</b> 40:14 41:9 <b>undertook</b> 9:1 <b>unexpected</b> 74:1, 9 90:19, 20 <b>unilaterally</b> 106:12 <b>union</b> 84:25 <b>uniquely</b> 86:4 <b>unit</b> 37:14 94:17 <b>unnatural</b> 39:21 41:22 43:24 59:22 <b>unnaturally</b> 37:15 <b>unsafe</b> 71:24 <b>update</b> 30:7, 15 47:6 85:8, 9 92:25 106:5 <b>updated</b> 85:17 <b>updates</b> 23:25 105:7 106:7 <b>updating</b> 47:15 <b>uploading</b> 34:17 <b>user</b> 85:11 <b>users</b> 72:2  < V > <b>validate</b> 34:17 38:23 64:11 <b>validated</b> 8:25 92:2 <b>validates</b> 47:21 60:19 <b>validating</b> 79:15 <b>validation</b> 47:25 76:23, 24 <b>validity</b> 80:19 <b>valleys</b> 60:13 <b>value</b> 55:3, 13 74:7, 22, 23 75:9, 23 98:4	<b>Vancouver</b> 17:11 49:15 <b>variable</b> 31:22 <b>variation</b> 103:6 <b>variety</b> 36:3 <b>various</b> 36:4 60:5 99:14 <b>vehicle</b> 10:1 20:7 22:16 42:23 58:5, 10 <b>vehicles</b> 66:22 <b>ventilation</b> 17:13, 14 <b>verbally</b> 19:8 <b>verify</b> 79:12 <b>VERITEXT</b> 108:18 <b>versa</b> 22:2 105:12 <b>version</b> 28:15, 20 29:7 104:15 <b>versions</b> 23:3 <b>vice</b> 22:1 27:6 105:12 <b>Videoconferenci ng</b> 1:12 <b>view</b> 12:17 36:2 37:12 74:12 75:4, 23 77:17 80:12, 21 84:10, 11, 12, 20 85:23 86:2 90:2 99:22 <b>Virtual</b> 2:17 <b>vis-à-vis</b> 28:10 104:6 <b>visibility</b> 81:18 105:14 <b>visible</b> 59:16 99:17 <b>vital</b> 53:16 <b>VOBC</b> 8:7, 9 13:24 35:6, 12 38:1, 4, 10, 15 39:18 40:13 43:16 64:13 <b>VOBCs</b> 38:21  < W > <b>walk</b> 46:11 88:12 <b>wall</b> 68:7 <b>wanted</b> 36:5, 6 61:17 62:13, 24
--	--	--	---	---

<p>77:18 89:9, 14 104:13 <b>wanting</b> 36:4 <b>washed</b> 74:13 <b>wayside</b> 67:25 94:17 <b>weather</b> 77:25 <b>weaving</b> 57:15 <b>website</b> 3:18 <b>week</b> 62:18 64:10, 11 71:7 <b>weeks</b> 87:1 <b>weight</b> 39:2 <b>well-established</b> 86:8 <b>well-intentioned</b> 57:24 <b>White</b> 56:10 <b>Willowglen</b> 93:4 <b>winter</b> 76:18, 22, 23 77:19 <b>wired</b> 35:13 38:15 39:3, 12 <b>wires</b> 37:2 <b>withstand</b> 89:16 <b>witness</b> 4:3, 6, 9 56:14 101:4 <b>woman's</b> 53:12 <b>wondering</b> 58:15 <b>won't</b> 91:24 <b>words</b> 62:9 <b>work</b> 6:14 16:19 18:10 21:11 37:9, 25 42:20 43:10 44:5 45:14, 22 59:1, 12, 22 63:12 67:10 79:20 97:5 <b>worked</b> 77:23 <b>workers</b> 71:18 <b>working</b> 24:25 93:3 <b>workshop</b> 23:22 47:19 50:19 <b>workshops</b> 16:4, 9 23:5, 16 57:12 100:20 106:2 <b>world</b> 9:13 43:3 44:13 45:1 60:16 62:24 67:13 86:10</p>	<p><b>wrong</b> 47:13 92:17 104:17  &lt; Y &gt; <b>yard</b> 59:14 66:4 67:16, 22 68:13, 21, 22, 25 69:2, 4, 18, 19, 21 70:3, 12 89:3 97:10 99:20 102:25 <b>yeah</b> 13:13 36:14 82:9 88:8 <b>year</b> 19:21 89:13 <b>years</b> 5:21 49:5 55:7, 8, 20 81:13 101:22 <b>yep</b> 8:19 104:11 <b>York</b> 31:12 32:2, 25  &lt; Z &gt; <b>zone</b> 65:8, 22 <b>zones</b> 60:5 65:22, 23 <b>Zoom</b> 1:12</p>			
--	--	--	--	--