SR&ED TOPIC	APPELLANT	PRIMARY ISSUE	WIN / LOSS	RULING & RATIONALE	IMPLICATIONS & OPPORTUNITIES	SIGNIFICANCE
Technological eligibility						
Claims by Telcom	Allegro Wireless	Whether SR&ED	Win	3 of 3 projects eligible	examples including AI and software	High
Air quality research	Airzone One	How vs. Why factors	Win	4 of 6 projects eligible	cut-off between eligible and ineligible	High
Energy efficiency	Global Sustainable	Technological Uncertainty	Loss	Work routine	compare vs. Airmax case	Moderate
Solar panels	Logix Data	Documentation	Loss	Tests not recorded	good project if documentation	Moderate
Construction	WRD Borger Construction	Systematic Investigation	Loss	Trial & error	business vs. technological problems	Low
Concrete forming	Atelier Béton	Systematic Investigation	Loss	Documenting hypotheses	examples of missing variables by CRA	Moderate
Financial issues						
Loans as government assistance	CAE	If loan reduces SR&ED?	Loss	Related to SR&ED	need to separate R&D vs. non -R&D loans	Moderate

Project Format for tax case analysis

The RDBASE project

I	**OBJECTIVES > STANDARD PRACTICE**	**IDENTIFY**
	STATE of EXISTING KNOWLEDGE	**BENCHMARKING SOURCES**
	OBJECTIVES	**BENCHMARKS VS. OBJECTIVES**
II	**UNCERTAINTIES & HYPOTHESES**	**VARIABLES for EXPERIMENTATION**
	EXPERIMENTS	**CORRELATE**
III	**RESULTS**	**OBJECTIVES**
	CONCLUSIONS	**VARIABLES**

Format for tax case analysis

- Paragraph numbers for quoted text
  - E.g. 54] The judge stated ….
  - Relevant data in project sections
  - PDF downloads available
  - View live at : rdbase.ca / login / demo

SREDStakeholder.CA

2200 - Allegro Wireless (WINS - 3/3 projects telcom)		
BENCHMARKS	**ACTIVITIES BY YEAR**	
	2022	
	'1-1	'2-1
(none)	CRA approved doc system	Roles of Expert witnesses
OBJECTIVES	**RESULTS**	
Throttling mechanism: 64 KB Concurrency : 1000 users supported hand held devices: 500 number supported printers: 300 number		
UNCERTAINTIES & KEY VARIABLES	**CONCLUSIONS**	
1 - Bug vs. Quirk vs. SR&ED		
Bug vs Quirk	Y	
If Quirk - whether SR&ED?	Y	
2 - Backgrounds of Witnesses		
Cost vs. benefit		Y
Exclusionary rules		
Necessity		Y
Proper qualification		Y
Relevance		Y
	METHODS	
Analysis Trials Prototypes Lines of code		
	COSTS	
Hours Materials $ Subcontractor $		

Project Name:	Allegro Wireless (WINS - 3/3 projects telcom)	**Start Date:**	2022-02-01
Project Number:	2200	**Completion Date:**	2024-02-08

Project Details:

Scientific or Technological Objectives:

Measurement	Current Performance	Objective	Has results?
Throttling mechanism (KB)	500	64	No
Concurrency (users)	200	1000	No
supported hand held devices (number)	450	500	No
supported printers (number)	250	300	No

The following example is based on the Tax Court of Canada judgement ALLEGRO WIRELESS CANADA INC., and HER MAJESTY THE QUEEN, March 31, 2021

FACTS:

50] During the relevant years, the Appellant filed claims in respect of SR&ED performed on five separate projects.

1] The Appellant filed appeals in respect of three projects carried out in 2010 and the remaining project carried out in 2011.

2] The CRA accepted portions of 2010 Project 1 and Project 2 as SR&ED.

3] For 2010, the Appellant claimed SR&ED "ITCs" of $279,420 in respect of three projects.

The Minister disallowed $244,208 (87%) of the corresponding ITCs in respect of two projects.

4] For 2011 Taxation Year, the Appellant claimed SR&ED ITCs of $215,567.

The Minister disallowed $162,190 (75%) of the corresponding ITCs.

[101] the Appellant's core product was its platform (software), which it built and constantly improved to accommodate the different idiosyncrasies of various hand-held devices, servers and printers.

Mr. Rupel (the Principal Investigator) testified that the Appellant was trying to develop products that would address issues that arose when dealing with the interactions of numerous complex systems.

At the time, its clients were using numerous hand-held devices and printers that were in the early stages of development.

It also had to design systems that operated with the various servers of its clients and recognize the different environments that each of its clients operated in.

Field of Science/Technology:

Telecommunications (2.02.07)

Project Details:

Intended Results:	Develop new processes, Improve existing processes
Work locations:	Research Facility
Key Employees:	Wesley Rupel (Allegro PI) (Physics - PhD (1985) / President & CTO), Gerald Penn (Allegro Expert Witness) (Computer Science - PhD (1991) / Expert witness)
Evidence types:	Test protocols, test data, analysis of test results, conclusions; Records of resources allocated to the project, time sheets; Design, system architecture and source code; Project planning documents; Design of experiments; Records of trial runs

Scientific or Technological Advancement:

Uncertainty #1: Bug vs. Quirk vs. SR&ED

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[28] The Appellant's core product was its platform (software), which it built to accommodate the different idiosyncrasies of the various hand-held devices used by its clients. The platform had to take into account the different operating systems and the frequent updates to the software controlling the low-level features of the devices. The Appellant's goal was to have one system that all the different applications used in the operation of the devices could be written to.

31] He noted that the Appellant did not have access to the source codes for the various underlying software that operated the hand-held devices. He referred to this software as a black box, something the Appellant could not see the "insides of". He noted that as the Appellant developed its various products, various bugs and quirks occurred.

BUGS:

32] Bugs arose when the underlying tools and software performed as expected and the Appellant made a mistake when writing its software, which it needed to fix.

QUIRKS:

33] Quirks arose when, after looking at the problem, the Appellant could not determine why the event was occurring. It did not make sense to the Appellant. In Mr. Rupel's words, there was something mysterious going on and it required a deeper investigation.

34] Mr. Rupel noted that a quirk may or may not end up on the Appellant's SR&ED claim.

The Appellant made the decision later, after it finished its investigation and hopefully found a solution to the quirk.

It would review the work it had done and determine whether it had conducted a significant amount of experimentation or whether the issue had been relatively straightforward and resolved in a direct manner.

In the latter instance, the work was not included in the Appellant's SR&ED claim.

The most significant underlying key variables are:

Bug vs Quirk, If Quirk - whether SR&ED?

Technology or Knowledge Base Level:

Activity #1-1: CRA approved doc system (Fiscal Year 2022)

Methods of experimentation:

DOCUMENTATION:

46] The Appellant also used bug/quirk tracking software: one called FogBugz and a second called Jira X. This allowed the Appellant to keep track of all bugs/quirks that were reported, when the bug/quirk was fixed and when a quality assurance team reviewed the fix.

47] With respect to determining when the work preformed with respect to quirks constituted SR&ED,

the Appellant, with the help of its Canada Revenue Agency ("CRA") SR&ED technical advisor, Mr. Paul Wong, had set up a system in the bugs/quirks tracking software (particularly Jira X).

This system allowed the Appellant to keep track of the problems it identified as quirks, the things that were not working the way the Appellant expected them to work. When the Appellant's developers were attempting to find a solution to a quirk, they would place information in the bug tracking software with respect to the work they were performing in an attempt to fix the identified quirk.

Results:

Conclusion:

208] On the basis of the evidence just discussed, I have concluded that when the Appellant conducted the projects at issue, it formulated hypotheses specifically aimed at reducing the identified technological uncertainty, followed appropriate procedures on testing, including the formulation, testing, and modification of hypotheses, and maintained a detailed record of

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the hypotheses tested and results achieved as the work progressed.

209] For these reasons, the work performed by the Appellant on the projects identified by the CRA as

TA1/TO1 of 2010 Project 1 (SAMPLE PROJECT 2201, ACTIVITY #1),

TA1/TO1 of 2010 Project 2 (SAMPLE PROJECT 2202),

TA3/TO3 of 2010 Project 1 (SAMPLE PROJECT 2201, ACTIVITY #2) and

TA1/TO1 of 2011 Project 1 (SAMPLE PROJECT 2203)

constitutes SR&ED for purposes of the Income Tax Act.

The appeals from reassessments under the Income Tax Act with respect to the Appellant's 2010 and 2011 taxation years are allowed, with costs.

THE SPECIFIC DETAILS FOR EACH OF THESE PROJECTS IS PROVIDED IN PROJECTS 2201 THROUGH 2203.

Significant variables addressed: Bug vs Quirk, If Quirk - whether SR&ED?

Documentation:

- Offline Documents: Docs

Uncertainty #2: Backgrounds of Witnesses

During the six days of hearings, the Appellant (Allegro) called three fact witnesses, Mr. Wesley Rupel, Mr. Khalid Eidoo, and Mr. Russell Roberts, and one expert witness, Doctor Gerald Penn.

PRINCIPAL INVESTIGATOR (PI)

8] Mr. Rupel described the Appellant's business and the various research projects. During the relevant period, Mr. Rupel and his business partner controlled the Appellant.

9] Mr. Rupel holds an undergraduate degree in physics and mathematics. In 1981, he started a combined Masters and Ph.D. program in physics at the University of California, Santa Barbara. He completed the Masters portion of the program, however in 1985, while his professor was on sabbatical, he took a break from the program and joined Dynamical Systems Research ("Dynamical"), a software start- up company located in Berkeley, California.

10] A year later Microsoft acquired Dynamical. The acquisition allowed Microsoft access to Dynamical's software, which it used when creating the Windows operating system.

11] Mr. Rupel's work at Microsoft focused on increasing the speed of the Windows operating system, which was a significant issue since the first version of the operating system was extremely slow.

12] Mr. Rupel left Microsoft in 1992 and, in his own words, basically retired. He returned to Microsoft in 1998. He joined the Appellant in 2002 and became President and Chief Technology officer in 2004.

The Respondent (CRA) called one fact witness, Ms. Cathy Sporich, and two expert witnesses, Doctor Shrinavensen Keshav and Doctor Shirook Ali. I found all four fact witnesses to be credible.

EXPERT WITNESSES:

67] The test for admissibility of expert opinion evidence is a two-step test as set out by the Supreme Court of Canada in White Burgess Langille Inman v. Abbott and Haliburton Co., 2015 SCC 23 ("Inman"). Inman confirms and clarifies the common law principles previously described by the Supreme Court of Canada in R. v. Mohan, [1994] 2 SCR 9 ("Mohan").

68] The first step of the test requires the party putting the proposed expert forward to establish that the evidence satisfies the following four threshold requirements (the so-called Mohan factors):
- Relevance;
- Necessity in assisting the trier of fact;
- The absence of any exclusionary rule; and
- A properly qualified expert.

69] The second step requires the trial judge to conduct a cost-benefit analysis to determine if otherwise admissible expert

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evidence should be excluded because its probative value is overborne by its prejudicial effect. This requires the trial judge to consider such things as consumption of time, prejudice and the risk of causing confusion.

The judge only relied on the expert evidence of Doctor Penn.

The most significant underlying key variables are:

Relevance, Necessity, Proper qualification, Cost vs. benefit, Exclusionary rules (unresolved)

Technology or Knowledge Base Level:

Activity #2-1: Roles of Expert witnesses (Fiscal Year 2022)

Methods of experimentation:

5] During the six days of hearings, the Appellant called three fact witnesses, Mr. Wesley Rupel, Mr. Khalid Eidoo, and Mr. Russell Roberts, and one expert witness, Doctor Gerald Penn.

The Respondent called one fact witness, Ms. Cathy Sporich, and two expert witnesses, Doctor Shrinavensen Keshav and Doctor Shirook Ali.

JUDGE COMMENTS:

[99] After reading each of the export reports and hearing from the two experts, ... neither of the two experts called by the Respondent (CRA) had a sufficient understanding of the Appellant's business, products or procedures that would allow them to give opinions that would help the Court.

Both Mr. Rupel and Doctor Penn testified that the difficult technological environment that the Appellant was attempting to operate in caused the various technological issues encountered by the Appellant.

Results:

6] I found all four fact witnesses to be credible. For reasons I will discuss, I have only relied on the expert evidence of Doctor Penn.

Conclusion:

JUDGE CONCLUDED:

[120] The Appellant was attempting to develop a new product (its platform) that would work seamlessly with a multitude of devices using different operating systems and operating on various client operating systems.

Neither Doctor Ali nor Doctor Keshav was aware of this difficult environment. As a result of this weak factual foundation, especially when compared to Doctor Penn's factual foundation for his opinion, I have given no weight to the expert reports of Doctor Ali and Doctor Keshav.

The only expert report that I have placed any reliance on is the expert report of Doctor Penn.

Significant variables addressed: Cost vs. benefit, Necessity, Proper qualification, Relevance

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2201 - Allegro - Protocol Compliant Methods to Extend Bluetooth Functionality	
BENCHMARKS	**ACTIVITIES BY YEAR**
Internet searches: 10 Articles	
Patent searches: 5 patents	
Competitive products or processes: 2 products	2022
Similar prior in-house technologies: 3 products / processes	'1-1
Queries to experts: 2 responses	year 1
OBJECTIVES	**RESULTS**
Maximum buffer use: 64 K	62
Fidelity (relevant info retained): 90 %	83
UNCERTAINTIES & KEY VARIABLES	**CONCLUSIONS**
1 - Technological uncertainty	
“lossy-type scenario” (less data)	Y
buffer overrun - speed vs. clearing	Y
proprietary systems - blackbox issues	Y
throttling - time vs. rate vs. % compression	Y
transparent compression methods	Y
	METHODS
Analysis	14
Trials	6400
Prototypes	
Lines of code	
	COSTS
Hours	650
Materials $	
Subcontractor $	

Project Name:	Allegro - Protocol Compliant Methods to Extend Bluetooth Functionality	**Start Date:**	2022-01-01
Project Number:	2201	**Completion Date:**	2023-08-31

Project Details:

Scientific or Technological Objectives:

Measurement	Current Performance	Objective	Has results?
Maximum buffer use (K)	256	64	Yes
Fidelity (relevant info retained) (%)	100	90	Yes

The following example is based on the Tax Court of Canada judgement ALLEGRO WIRELESS CANADA INC., and HER MAJESTY THE QUEEN, March 31, 2021.

126] Project 1 as follows: “the implementation of a throttling mechanism to prevent overruns when sending more than 64KB across a Bluetooth printer connection (overcoming specific Bluetooth printing implementation limitations).”1

127] Mr. Rupel described in some detail the technological obstacles the Appellant had to overcome, the work it performed and the results it obtained with respect to the TA1/TO1 portion of 2010 Project 1.

128] He noted that the printers in questions were small printers that were used by approximately 20% of its clients and that hung on the belt of the client’s employees. The printers printed documents, such as receipts, based upon information that was transferred via Bluetooth from the hand-held device to the small printer. Microsoft wrote the software used to communicate with the small printer (referred to as the “Bluetooth stack”). The Appellant was not able to “look inside” the software to see how it worked or to adjust how it worked.

129] The problem the Appellant faced was that the small printers had a 64 KB buffer which stored the information sent from the hand-held device to the printer until the printer was able to use the information to print the document. The problem was that if too much information was sent, then the buffer was exceeded and some or all of the information was lost. This meant that its client could not get a proper printout of the document.

Field of Science/Technology:

Telecommunications (2.02.07)

Project Details:

Intended Results:	Improve existing processes
Work locations:	Research Facility
Key Employees:	Wesley Rupel (Allegro PI) (Physics - PhD (1985) / President & CTO), Gerald Penn (Allegro Expert Witness) (Computer Science - PhD (1991) / Expert witness)
Evidence types:	Progress reports, minutes of project meetings; Test protocols, test data, analysis of test results, conclusions; Records of resources allocated to the project, time sheets; Design, system architecture and source code; Design of experiments; Records of trial runs

Scientific or Technological Advancement:

Uncertainty #1: Technological uncertainty

130] The fact that the Appellant’s different clients had Bluetooth stacks from different companies and printers and hand-held devices from different manufacturers compounded the problem. The Appellant needed to write software that would work on all of these systems.

131]Mr. Rupel noted that the problems placed the Appellant in a situation that was outside the bounds of normal engineering. He noted that with normal engineering one is working with systems that do not have buffer overruns, systems that work.

The Appellant was required to work with someone else’s system that had bugs and did not work properly, a system that was basically a black box.

The most significant underlying key variables are:

proprietary systems - blackbox issues, throttling - time vs. rate vs. % compression, transparent compression methods, “lossy

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-type scenario" (less data), buffer overrun - speed vs. clearing

Technology or Knowledge Base Level:

Benchmarking methods & sources for citings:

Benchmark Method/Source	Measurement	Explanatory notes
Internet searches	10 Articles	
Patent searches	5 patents	cholar&oq=(Maximum+buffer+use)+%26+bluetooth
Competitive products or processes	2 products	Based on prior work of Mr. Rupel as one of the original 10 developers in the Microsoft Windows team.
Similar prior in-house technologies	3 products / processes	The 3 current projects are all built upon Allegro core device management technology
Queries to experts	2 responses	Input from Dr. Russ Roberts (PhD) & Dr. Gerald Penn (PhD)

Activity #1-1: year 1 (Fiscal Year 2022)

Methods of experimentation:

Method	Experimentation Performed
Analysis / simulation:	14 alternatives
Trials:	6400 runs / samples

132] Mr. Rupel stated that the Appellant experimented with three different solutions to the problem, doing a "lossy-type scenario", using a transparent compression method and using a throttling mechanism.

He noted that the Appellant a "lossy-type scenario", using a transparent compression method and using a throttling mechanism. He noted that the Appellant was looking for creative solutions that would allow it to work around the problem while using the standard interfaces.

133] The "lossy-type scenario" involved sending less data in order to avoid exceeding the 64 KB buffer. Mr. Rupel explained that this meant that one does not have complete fidelity in the document being printed, in the sense that the information being passed to the printer is incomplete in some manner, which may be acceptable depending on the application. The document that is printed may not look as good as the original, but it may be acceptable to the user.

134] Compressing the data meant using one of numerous available methods. It appears that one of the methods the Appellant tried was to create a JPEG image. The JPEG image would have all the text that needed to be transferred but in a compressed format.

135] He noted that the Appellant tried to develop a transparent compression method. This meant that that the Appellant was trying to compress and then decompress the data without the intervening software being aware that this was happening.

It had to develop software to "dig" into different places in the Bluetooth stack to try to inject compression in a way that would avoid the 64 KB buffer overrun.

Results:

- Maximum buffer use: 62 K (101% of goal)
- Fidelity (relevant info retained): 83 % (170% of goal)

136] Neither of these methods proved to be successful. However, the Appellant was able to overcome the problem by developing a throttling mechanism. A throttling mechanism is a way to control the speed at which the data is being pushed through the system. Mr. Rupel noted that, through experimenting, the Appellant was able to find an optimum speed that allowed the Bluetooth printer to clear out its buffer fast enough that it would never overrun the buffer.

Conclusion:

138] Doctor Penn concluded that the work performed by the Appellant with respect to TA1/TO1 of 2010 Project 1 was experimental development and applied research.

140] His actual conclusions were as follows:
The application of throttling and compression can only be achieved by setting certain quantitative parameters that are inherent in these techniques, such as lengths of time and targetted transfer rates or percentages of compression.

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While setting or optimizing the settings of these parameters for a fixed pair of devices could be considered routine in different circumstances, this project dealt with interoperability across a range of mobile devices that were not manufactured by Allegro.

I know of no readily assessable knowledge base, now or in 2010, with which Allegro's engineers could have set these parameters merely through due diligence. This was a painstaking, experimental diversion from ordinary software development activities that no reasonable software engineer would call routine.

141] (Judge then stated) Doctor Penn's opinion is an example of the importance of knowing the technological environment that the Appellant faced when conducting experiments in an attempt to improve its products.

Significant variables addressed: "lossy-type scenario" (less data), buffer overrun - speed vs. clearing, proprietary systems - blackbox issues, throttling - time vs. rate vs. % compression, transparent compression methods

Documentation:

- Offline Documents: docs

Activity #1-2: year 2 + ineligible activity (Fiscal Year 2023)

This Activity is addressed in Fiscal Year 2023.

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2202 - Allegro - Optimize TCP Services over Cellular Networks		
BENCHMARKS	**ACTIVITIES BY YEAR**	
	2022	
	'1-1	'2-1
Internet searches: 20 Articles	Activity 1	Supporting Activity
OBJECTIVES	**RESULTS**	
Scalability: %		
Throughput: MB		
Reduce TCP timeouts: number		
Reduced data vs TCP: 55 %	52	
supported devices: 500 number	500	
Minimum timeout : 1 minutes	2	
UNCERTAINTIES & KEY VARIABLES	**CONCLUSIONS**	
1 - Byte array pool		
causes low package througput		
eliminating buffer under runs	Y	
parameters relevant to digital audio transmission	Y	
unsafe attributes checking vs speed	Y	
2 - Synchronous event wrapper		
firewall and deep packet inspection		Y
packet loopback process		Y
parallel session process		Y
redesign legacy hardwire code for wireless		Y
sync vs async events		Y
	METHODS	
Analysis	3	
Trials	14000	
Prototypes		
Lines of code		
	COSTS	
Hours	500	550
Materials $		
Subcontractor $		

Project Name:	Allegro - Optimize TCP Services over Cellular Networks	**Start Date:**	2022-02-01
Project Number:	2202	**Completion Date:**	2022-11-30

Project Details:

Scientific or Technological Objectives:

Measurement	Current Performance	Objective	Has results?
Scalability (%)	(not set)	(not set)	No
Throughput (MB)	(not set)	(not set)	No
Reduce TCP timeouts (number)	(not set)	(not set)	No
Reduced data vs TCP (%)	60	55	Yes
supported devices (number)	500	500	Yes
Minimum timeout (minutes)	5	1	Yes

The following example is based on the Tax Court of Canada judgement ALLEGRO WIRELESS CANADA INC., and HER MAJESTY THE QUEEN, March 31, 2021.

TA1/TO1 of 2010 Project 2

142] As discussed previously, the CRA split the 2010 Project 2 into three components. Mr. Rupel explained to the Court a number of general terms/concepts that applied to the entire 2010 Project 2.

143] The technological objective of 2010 Project 2 was to:

. . . develop methods and techniques to improve the scalability and throughput of TCP (Transmission Control Protocol) services transmitted over IP (Internet Protocol) on cellular networks. In particular, the objective was to develop methods to enable more efficient streaming of digital audio, connection-handling mechanisms to translate UDP to TCP and reduce the overhead related to TCP timeouts.3

144] Mr. Rupel explained to the Court the meaning of UDP and TCP. He also explained what is meant by a load balancer, session control and caching.

145] He noted that TCP is a protocol for internet communication. TCP is built on top of the internet protocol and provides a reliable way for the vast majority of things on the internet to communicate.

146] UDP is another protocol that is also built on top of the internet protocol, similar to TCP. UDP is a very lightweight protocol when compared to TCP, but TCP does a number of things that are not done by UDP.

147] Mr. Rupel explained that when a large amount of data is being sent over the internet, it gets broken down into pieces (packets) and each packet is sent separately through the internet protocol.

148] He noted that the advantages of TCP include the fact that it guarantees that the packet of information sent over the internet actually arrives at its destination. If the packet does not show up at the destination, TCP sends a notice to the sender of the information identifying which packet did not arrive. It also has a feature that ensures that packets of data, once received, are placed in the correct order.

149] UDP does not have these features but since it does not have as much “overhead” it can be faster than TCP. The Appellant created a UDP protocol that allowed its clients to reduce their data usage on the wireless cellular networks, which significantly reduced the clients’ costs. Mr. Rupel emphasized that at the time the cost of bandwidth on cellular networks was very expensive.

150] When the Appellant created the UDP protocol, it worked very well, however at some point problems developed. It determined that the problems were being caused by the interaction between its UDP protocol and new firewalls that were being installed by its clients.

151] Another problem related to load balancers. Clients that had a large amount of traffic on their networks and multiple servers used these load balancers. The purpose of the load balancers was to balance the usage of each of the servers.

152] The Appellant encountered problems with the interaction of load balancers and session control. Session control refers to managing sessions between a server and a specific user (referred to as a client). Instead of the client having to send all of the same information repeatedly to the server, the server stores some of the information until the session is completed. This is referred to as caching. A problem arose when load balancers caused portions of the information transferred to be stored on different servers.

153] Because of these issues, the Appellant was required to abandon its UDP protocol. It then worked to deve

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protocol that would work better than its UDP protocol and still reduce the client's data usage.

Field of Science/Technology:

Telecommunications (2.02.07)

Project Details:

Intended Results:	Improve existing processes
Work locations:	Research Facility
Key Employees:	Wesley Rupel (Allegro PI) (Physics - PhD (1985) / President & CTO), Gerald Penn (Allegro Expert Witness) (Computer Science - PhD (1991) / Expert witness)
Evidence types:	Test protocols, test data, analysis of test results, conclusions; Design, system architecture and source code; Design of experiments; Records of trial runs

Scientific or Technological Advancement:

Uncertainty #1: Byte array pool

154] Mr. Rupel discussed the portion of 2010 Project 2 identified by the CRA as TA1/TO1.

155] The Appellant's CRA filing described the technological advancement that the Appellant was trying to achieve with respect to the TA1/TO1 portion of the 2010 Project 2 as follows,

"the implementation of a non-disposable byte array pool

into which digital audio was compressed for transmission

completely eliminating audio breakup caused by buffer under runs

(the under runs were in turn caused by insufficient packet throughput)."

156] When switching from a UDP protocol to a TCP protocol the Appellant encountered a problem with audio files.

They were not being sent fast enough and only a portion of the audio file could be played when first accessed by the recipient of the audio files.

The most significant underlying key variables are:

causes low package througput (unresolved), unsafe attributes checking vs speed, parameters relevant to digital audio transmission, eliminating buffer under runs

Technology or Knowledge Base Level:

Benchmarking methods & sources for citings:

Benchmark Method/Source	Measurement	Explanatory notes
Internet searches	20 Articles	Client searches did not yield any existing library of required info.

Activity #1-1: Activity 1 (Fiscal Year 2022)

Methods of experimentation:

Method	Experimentation Performed
Analysis / simulation:	3 alternatives
Trials:	14000 runs / samples

156] When switching from a UDP protocol to a TCP protocol the Appellant encountered a problem with audio file

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not being sent fast enough and only a portion of the audio file could be played when first accessed by the recipient of the audio files.

157] The Appellant began experimenting with different ways to compress the audio files. At first, the methods it tried were not successful.

158] It then began experimenting with what is known as unsafe attributes. Mr. Rupel explained that the software language that the Appellant was using had a managed environment. Basically, it ensured that the various source code being used operated properly. However, the code used to do this slowed things down.

159] The Appellant tried writing so-called unsafe attributes by adding code that was not going to be managed. Mr. Rupel described the effect of unsafe attributes as follows:
. . . You don't have a safety net underneath you anymore, you're walking across the tightrope hoping that you don't have any bugs at that point because if you do it's not going to catch them, it's not going to prevent you from hurting yourself.5

160] He noted, however, that it resulted in less overhead, which meant that the Appellant could hopefully push data through quickly enough to solve the problem.

Results:

- Reduced data vs TCP: 52 % (160% of goal)
- supported devices: 500 number (100% of goal)
- Minimum timeout : 2 minutes (75% of goal)

161] The use of unsafe attributes did not work. The ultimate solution involved going back into the so-called managed world and using a hybrid solution where the Appellant was "doing things that [were] a little bit unsafe but not particularly unsafe."

162] Mr. Rupel provided a detailed technical description of the solution. It involved reusing certain of the objects that had been transferred. This saved enough overhead that the Appellant was able to solve the problem with the audio files. The solution worked for whatever audio was sent and on the approximately 500 different devices it encountered.

Conclusion:

165] In his expert report, he (Dr. Penn) stated the following:

. . . Programming with audio is a very niche expertise that most software engineers lack. This observation, combined with the increasing demand for smartphones over the last seven years, has led to a commodification of audio processing hardware and audio processing APIs within the mobile device industry that has greatly consolidated during the interval.

In 2010, however, there was still a considerable variance among handheld mobile devices in the range of supported audio formats, audio codecs, available audio transfer rates and supported functionality for audio in vendor-supplied APIs.

In the present component, these audio-specific parameters were underlying technological uncertainties in an ecology of foreign devices that Allegro's platform developers would have had to adapt their product to. ...characterizing the distribution of parameters relevant to digital audio transmission in 2010,

Significant variables addressed: eliminating buffer under runs, parameters relevant to digital audio transmission, unsafe attributes checking vs speed

Documentation:

- Offline Documents: docs

Uncertainty #2: Synchronous event wrapper

TA3/TO3 of 2010 Project 2
166] The Appellant's CRA filing described the technological advancement that it was trying to achieve with respect to the TA3/TO3 portion of 2010 Project 2 as follows: "The development of an [sic] synchronous event wrapper capable of timing out a process quickly, eliminating an average wait of 5-8 minutes for a TCP timeout from a mobile device".10

167] Mr. Rupel explained what a synchronous event was by distinguishing between a synchronous event and an asynchronous event.

A synchronous event occurs when, in the course of communication, the system sends a request for information and then waits until it receives the answer.

An asynchronous occurs when the systems sends a request for information and then does other things while another part of

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the system waits for the answer.

168] Mr. Rupel noted that with a synchronous event the whole system is waiting for the response and with an asynchronous event it is not waiting for the response. The synchronous method is used when the system cannot move forward in the logic of the program until the system receives an answer.

169] The problem the Appellant faced was that Microsoft had built a five-to-eight- minute timeout into its software that controlled the low-level features of the hand- held devices. The Appellant had no control over this timeout. Problems occurred in the TCP communication when a request was going out for information and no information was coming back. The Microsoft software would then take at least five to eight minutes to reset. This was a problem for the Appellant, which was trying to make devices that worked in real time, i.e., were always connected to the network.

170] Mr. Rupel described the problem as a software problem that occurred because Microsoft developed the software using protocols from a wired network and the devices were now being used on a wireless network.

He noted that the designers of the software never envisaged a situation where the device would be connected but could not send data, but this is a common occurrence for a device on a wireless network. An example of this type of situation is when a device is taken into a parking garage with poor reception.

171] While it was a design feature of the Microsoft software, the Appellant had to fix the problem without access to the code used by Microsoft, while operating in a very complex system.

The most significant underlying key variables are:

sync vs async events, redesign legacy hardwire code for wireless, firewall and deep packet inspection, packet loopback process, parallel session process

Technology or Knowledge Base Level:

Activity #2-1: Supporting Activity (Fiscal Year 2022)

Methods of experimentation:

172] Mr. Rupel described three methods that the Appellant tested in an attempt to solve the problem.

173] The first method involved using a firewall and deep packet inspection to terminate long-running connections that were waiting for a response. The Appellant was trying to deal with the situation where the software would tell it that it was connected, but there was actually a problem and the device was not communicating.

174] He explained that deep packet inspection meant that the Appellant was “peeking” into places that it would not normally be expected to go, namely the network buffers where the information was coming in through the TCP network.

175] Since the firewalls monitored the system traffic and knew exactly what was passing through the network, the firewall could be used to find information on what was going through the network.

176] Testing using the deep packet inspection and firewalls did not lead to a solution to its problem.

177] The second method it tried involved experimenting with a loopback process which involved sending a packet out through the networking layers with instructions that the place it should go is back to the point where it originated.

178] It hoped to avoid the five-to-eight-minute timeout problem by killing the network session, which, theoretically, would cause everything to immediately reset.

The problem it encountered was that it was only able to kill one side of the session (such as the device side) but was not able to kill the session on the other side (the server side). This left the system in what Mr. Rupel referred to as an inconsistent state, which caused a problem.

Results:

179] The problem was resolved by developing a two-pronged mechanism to eliminate the issue. Mr. Rupel described the process as follows:

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. . . by creating another process we created a parallel situation where we could start a new session for -- the original session, which is where everything is still happening, all the important stuff is still going on there, but we create this other process that then creates a new session with the server, and then we have to basically keep track of what's happening over there but we can use that channel then to do our communication until that five-to-eight-minute timeout finally times out.

And so we have sort of a temporary communication channel that we set up during the period of time that the five-to-eight-minute window is blocking us.

Conclusion:

Doctor Penn's Opinion - SUPPORTING ACTIVITY VS. SEPARATE PROJECT

181] Doctor Penn does not believe that TA3/TO3 of 2010 Project 2 by itself constituted experimental development or research. However, he believes that TA3/TO3 supported the other parts of 2010 Project 2, which he believes constituted experimental development or research.

In effect the part of 2010 Project 2 that the CRA identified as TO3/TA3 supported the other portions of 2010 Project 2 in such a way that it contributed to the overall aims of an experimental development project.

He questioned whether it made sense for the CRA (or anyone) to split the Appellant's 2010 Project 2 into three components.

182] He stated the following in his expert report:
. . . This project's [2010 Project 2] description proposes one overarching technological advancement: a TCP-based application protocol that surpasses UDP in throughput and scalability. Whether or not this could be achieved was a technological uncertainty.

To achieve that advancement, there are certain design features of TCP that are inconsistent with its use in this application protocol. One of those, TO3, is the long timeout delays that are typically built into TCP stacks.

It is a defect of the subproject terminology, "TA3/TO3", that it implies such a limited scope of work as to preclude the identification of a TA or TU for just this one component. This component shares in the technological advancements and uncertainties of the project to which it contributes. . .

. . . I am unable to reasonably ascertain that a systematic investigation was conducted as part of this component's work on the basis of the documents and interviews available to me. I am, on the other hand, reasonably certain that Project 2 as a whole did consist of research and experimental development alongside some inevitable routine development that took place in support of the project's overall research programme. I also find it reasonably probable that the work described in TA3/TO3 and the associated technical content by itself was sufficiently novel to serve as the basis for a standardized extension to the TCP protocol for low-latency communication on unreliable networks. What is unclear to me is whether the realization of TA3/TO3's research potential in fact took place.

Significant variables addressed: firewall and deep packet inspection, packet loopback process, parallel session process, redesign legacy hardwire code for wireless, sync vs async events

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2203 - Allegro - Multi-point Integration Platform for Mobile Applications	
BENCHMARKS	**ACTIVITIES BY YEAR**
	2022
	'1-1
Internet searches: 10 Articles	Activity 1
OBJECTIVES	**RESULTS**
distributed transaction timeout: 1 1= yes/ 0 = no	1
intelligent packet routing: 1 yes = 1 / no = 0	1
UNCERTAINTIES & KEY VARIABLES	**CONCLUSIONS**
1 - necessary wait times	
filtering methods vs. latency vs. ...	Y
timeout length vs. queuing mechanisms	Y
	METHODS
Analysis	
Trials	1400
Prototypes	
Lines of code	
	COSTS
Hours	820
Materials $	
Subcontractor $	

Project Name:	Allegro - Multi-point Integration Platform for Mobile Applications	**Start Date:**	2022-04-12
Project Number:	2203	**Completion Date:**	2022-12-30

Project Details:

Scientific or Technological Objectives:

Measurement	Current Performance	Objective	Has results?
distributed transaction timeout (1= yes/ 0 = no)	0	1	Yes
intelligent packet routing (yes = 1 / no = 0)	0	1	Yes

The following example is based on the Tax Court of Canada judgement ALLEGRO WIRELESS CANADA INC., and HER MAJESTY THE QUEEN, March 31, 2021.

58] Only the portion of 2011 Project 1 identified by the CRA as TA1/TO1 is before the Court. The CRA accepted that the portion it identified as TA2/TO2 qualified as SR&ED. The Appellant conceded during the hearing that the portion of 2011 Project 1 identified as TA3/TO3 did not constitute SR&ED.

TA1/TO1 of 2011 Project 1

183] The Appellant described the technological advancements it was trying to achieve for all of Project 3 as follows:

184] The technological objective of this project was to develop an integration platform for mobile devices that enables dynamic multiple endpoints.

Specifically, the objective was to develop methods to enable mobile data packets to be intelligently routed to different applications without the need for setting up specific end points or messaging agents for each integration point.

185] With respect to TA1/TO1 of Project 3, the Appellant hoped to achieve a technological advancement by developing a connection timeout mechanism for distributed transactions initiated by a mobile device.

Field of Science/Technology:

Communication engineering and systems (2.02.06)

Project Details:

Intended Results:	Improve existing processes
Work locations:	Research Facility
Key Employees:	Wesley Rupel (Allegro PI) (Physics - PhD (1985) / President & CTO), Gerald Penn (Allegro Expert Witness) (Computer Science - PhD (1991) / Expert witness)
Evidence types:	Test protocols, test data, analysis of test results, conclusions; Records of resources allocated to the project, time sheets; Design, system architecture and source code; Records of trial runs

Scientific or Technological Advancement:

Uncertainty #1: necessary wait times

185] The technological obstacle the Appellant faced was related to mobile transaction timeouts. The Appellant noted that the main purpose of its system was to provide data to client devices such as mobile devices. This required data to be sent across high-latency cellular networks. Because of the latency of cellular networks, it is not easy to determine whether a connection has timed out.

186] Mr. Rupel noted that people confuse bandwidth with latency. Latency is another aspect of speed or timing. He noted that information may pass through a system at a high speed (high bandwidth) and still be delayed in arriving at its destination (high latency).

187] He explained that cellular networks are high latency when compared with wire networks.

In a cellular network,

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"there's a lot more handshaking that has to go on with decoding what's in the radio waves and the layers of technology that has to filter through in order to just get where you're going with it that initial delay is worse on a wireless network, especially on a cellular network."

188] The timeout was the same as in 2010 Project 2, but the timeout in 2011 Project 1 caused a different problem.

Mr. Rupel explained that the Appellant's system bundled up business logic messages and sent it through the system. As discussed previously, the messages are broken up into pieces and sent through in little packets, which are reconstructed on the other side.

The process has what is referred to as a queuing mechanism. The Appellant's software handles what is in the queue to feed the information through the underlying black box and then reconstruct it on the other side. The timeouts were causing problems in the fidelity of the Appellant's queuing process.

189] For example, the timeout may cause the system to reset. Once it resets it feeds all the information sitting in the queue into the system at such a fast rate that it overwhelms the device.

The most significant underlying key variables are:

filtering methods vs. latency vs. ..., timeout length vs. queuing mechanisms

Technology or Knowledge Base Level:

Benchmarking methods & sources for citings:

Benchmark Method/Source	Measurement	Explanatory notes
Internet searches	10 Articles	Client could not find any libraries of necessary wait times for the proposed application.

Activity #1-1: Activity 1 (Fiscal Year 2022)

Methods of experimentation:

Method	Experimentation Performed
Trials:	1400 runs / samples

190] As a result, the Appellant had to conduct tests on application timeouts to determine the optimal timing.

Mr. Rupel noted that there are a lot of trade-offs in the timing in that if you make it too short, you have one set of problems, if you make it too long, you have another set of problems.

It was trying to find the "sweet spot", complicated by the fact that it was working with black boxes and had no way to know if the individual problems that occurred on one extreme or the other were going to become unacceptable from a business standpoint.

Results:

- distributed transaction timeout: 1 1= yes/ 0 = no (100% of goal)
- intelligent packet routing: 1 yes = 1 / no = 0 (100% of goal)

Conclusion:

191] He (Dr. Penn) provided the following opinion in his written report:

. . . the development of a mechanism that waits a specified period of time before resetting a network connection is standard practice, and the experimentation required to set the wait time often involves only a trivial amount of experimentation. . . . however,

knowing how long to wait when developing a product within an ecology of foreign devices and on multiple cellular networks is not routine.

Allegro were building just such a knowledge base

[knowledge of necessary wait times]

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that would have been of value to members of the broader community of mobile software developers, including those who had never intended to purchase Allegro's products. This was the result of applied research.

Significant variables addressed: filtering methods vs. latency vs. ..., timeout length vs. queuing mechanisms

Documentation:

- Offline Documents: docs

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2211 - Airzone - WIN Optimizing Passive Monitoring of Low-Concentration Compounds	
BENCHMARKS	**ACTIVITIES BY YEAR**
Internet searches: 5 Articles	2022
Suppliers: 1 products	'1-1
	Activity 1
OBJECTIVES	**RESULTS**
Detectable compounds: 52 number	52
single protocol for 8 items: 1 protocols	1
UNCERTAINTIES & KEY VARIABLES	**CONCLUSIONS**
1 - Technological uncertainty	
chromatographic variables	Y
extraction times	Y
solvent polarity vs. aromatic hydrocarbons	Y
	METHODS
Analysis	
Trials	10
Prototypes	
Lines of code	
	COSTS
Hours	870
Materials $	3370
Subcontractor $	

Project Name:	Airzone - WIN Optimizing Passive Monitoring of Low-Concentration Compounds	**Start Date:**	2022-02-01
Project Number:	2211	**Completion Date:**	2022-10-31

Project Details:

Scientific or Technological Objectives:

Measurement	Current Performance	Objective	Has results?
Detectable compounds (number)	44	52	Yes
single protocol for 8 items (protocols)	8	1	Yes

[37] In prior years, Airzone had success in establishing a detection protocol for a suite of 44 types of airborne compounds that may be present in a home environment at low levels of concentration.

[38] According to Mr. Fellin, Airzone undertook the experimental work on this project to increase the range of detectable compounds from 44 to 52. Airzone did so to stay abreast of its competition in this highly specialized field.

Field of Science/Technology:

Meteorology, atmospheric sciences & climatic research (1.05.07)

Project Details:

Intended Results:	Improve existing processes
Work locations:	Research Facility
Key Employees:	Mr Fellin (Chemistry - BSc. (1972) / Airzone One President)
Evidence types:	Test protocols, test data, analysis of test results, conclusions; Records of resources allocated to the project, time sheets; Design, system architecture and source code; Design of experiments; Records of trial runs

Scientific or Technological Advancement:

Uncertainty #1: Technological uncertainty

[39] To obtain reliable measurements of these additional eight compounds, Airzone believed that it could not rely on the extraction and identification protocol that it had established for the initial 44 compounds.

41] Extraction techniques are known to fail because compounds are not separated from each other in a way that allows for the measurement of the concentration levels of each compound.

After failing to obtain reliable data through a variation of extraction times, Airzone decided to test the hypothesis that a more polar solvent would improve measurement of the concentration levels of the additional eight compounds.

47] The evidence shows that standard methods, procedures and equipment may reach their detection limits when contaminants are present in low levels of concentration. Some compounds have similar attributes.

In other cases, the attributes of compounds in an air sample may be quite diverse. Extraction procedures can cause compounds to co-elute, which prevents reliable identification and quantification of each sample.

According to Mr. Fellin, this was the challenge that Airzone sought to resolve. An improved extraction and identification process was required. This new process could not be established without systematic scientific investigation.

49] Additionally, part of the uncertainty itself was creating a single protocol that could detect all 52 compounds. As Mr. Fellin explained, had Airzone used a separate device or protocol for the eight additional compounds, it would have doubled the cost for any potential client.

In this regard, rather than use a new solvent specifically for the eight additional compounds, Airzone purposely sought to modify the solvent used for its existing suite of 44 compounds. This came with its own host of challenges.

The previous 44 compounds were simple aromatic hydrocarbons. Therefore, they could all be treated in the same way.

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Project Name:	Airzone - LOSS Solving Combustion Issues to Develop Artificial Smouldering	**Start Date:**	2022-03-01
Project Number:	2212	**Completion Date:**	2022-11-30

Project Details:

Scientific or Technological Objectives:

Measurement	Current Performance	Objective	Has results?
measure emissions (% expected)	(not set)	(not set)	No

72] During summer months, coal piles that were stored at a shipping terminal were prone to spontaneous smouldering. Airzone was engaged to identify and measure the compounds emitted from the smouldering coal piles.

Field of Science/Technology:

Environmental sciences (1.05.06)

Project Details:

Intended Results:	Improve existing processes
Work locations:	Lab
Key Employees:	Mr Fellin (Chemistry - BSc. (1972) / Airzone One President)
Evidence types:	

Scientific or Technological Advancement:

Uncertainty #1: Technological uncertainty

72] The evidence shows that because of the risks associated with spontaneous combustion, neither Airzone nor its partner in this project could undertake direct sampling at the coal face using traditional monitoring to do so.

The most significant underlying key variables are:

identify compounds

Technology or Knowledge Base Level:

Activity #1-1: Activity 1 (Fiscal Year 2022)

Methods of experimentation:

Method	Experimentation Performed
Trials:	25 runs / samples
Physical prototypes:	1 samples

73] Faced with this difficulty, Airzone decided that the identification and quantification of the compounds had to be measured in a testing device. Airzone designed a testing chamber and used that chamber to collect representative emissions from various types of stored coal.

The testing chamber that was designed for this purpose allowed oxygen delivered into the chamber to be controlled so that the smouldering process could occur over a two-hour period without full ignition of the coal. Oxygen levels were controlled to prevent full combustion of the coal.

Mr. Fellin explained that burning coal releases fewer emissions than smouldering coal because the fire itself consumes the contaminants typically released by smouldering coal.

75] a large part of the work undertaken in this project concerned the design of the testing chamber and the use of the chamber to mimic smouldering coal.

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76] The smouldering process generated substantial water, which interfered with the measurement of other emissions by the continuous monitors. However, Airzone was nonetheless able to measure these emissions using different monitors, called integrated samplers.

Once the emission compounds were measured, Airzone used an existing computer model developed by the United States Environmental Protection Agency to estimate the level of exposure at various locations around the terminal.

Results:

JUDGE COMMENTS:

75] In my opinion, the testing chamber, although a little more sophisticated, was not that different from a home use barbecue.

Conclusion:

76] Secondly, unlike the three projects undertaken in 2014, there is no evidence in the record that shows that Airzone had difficulty establishing the identification and quantification of the emissions generated from different types of coal once the smouldering process was started.

I am of the opinion that Airzone has not demonstrated that the work undertaken in connection with this project was undertaken to achieve a technological advancement. Rather, I believe that Airzone knew what methods or processes could be used to mimic emissions from a smouldering coal pile and knew how to measure the emissions once the smouldering process was undertaken.

What Airzone did was measure emissions using standard methods and techniques typically employed when contaminants are released in a testing chamber.

Significant variables addressed: identify compounds

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2212 - Airzone - LOSS Solving Combustion Issues to Develop Artificial Smouldering	
BENCHMARKS	**ACTIVITIES BY YEAR**
	2022
	'1-1
(none)	Activity 1
OBJECTIVES	**RESULTS**
measure emissions: % expected	
UNCERTAINTIES & KEY VARIABLES	**CONCLUSIONS**
1 - Technological uncertainty	
identify compounds	Y
	METHODS
Analysis	
Trials	25
Prototypes	1
Lines of code	
	COSTS
Hours	323
Materials $	2750
Subcontractor $	

Conversely, the eight new compounds had different properties (such as polar groups). This meant that the different compounds could not be extracted from the same medium with the same efficiency.

Additionally, because the previously used solvent had been modified, Airzone had to adjust the chromatographic conditions for both the existing suite of 44 compounds and the eight new additional compounds. It was not simply a matter of adding new protocols to its existing methodology. Airzone had to develop a completely new protocol.

The most significant underlying key variables are:

extraction times, chromatographic variables, solvent polarity vs. aromatic hydrocarbons

Technology or Knowledge Base Level:

Benchmarking methods & sources for citings:

Benchmark Method/Source	Measurement	Explanatory notes
Internet searches	5 Articles	46] Data on how to extract the full slate of compounds was not publicly available.
Suppliers	1 products	3M methodology referred to by CRA

Activity #1-1: Activity 1 (Fiscal Year 2022)

Methods of experimentation:

Method	Experimentation Performed
Trials:	10 runs / samples

40] Airzone first experimented with extraction times. The hypothesis that the work was conducted under was that the modification of the
solvent used to extract the additional eight compounds would compromise the analysis of the existing suite of compounds.

each set of tests for each compound included modifying extraction times, solvent mixtures, solvent modifiers (to alter polarity), and chromatographic conditions with different chromatography machines.
. . .

41] Mr. Fellin explained that Airzone, rather than replace the solvent that it typically utilized, experimented with modifying the solvent with additives to attain the desired extraction efficiency for the additional compounds while retaining detection efficiency for the other 44 compounds.

While this proved successful overall, further analysis of the experimental data led Airzone to conclude that butanol proved most successful because of the higher recovery efficiency. Airzone continued experimentation with a solvent combining carbon disulphide with 5% butanol to confirm that the solvent would work efficiently for the full suite of compounds.

42] Mr. Fellin indicated that additional experimentation was then necessary to adjust the chromatographic variables typically utilized to analyze each compound.

These variables include temperature, column length, column type, flow rate through the column, carrier gas, and injection volume.

Airzone carried out experiments with each variable to improve its detection abilities.

Results:

- Detectable compounds: 52 number (100% of goal)
- single protocol for 8 items: 1 protocols (100% of goal)

CRA argument for denial:

43] After completing his technical audit, Mr. Melnyk recommended that Airzone's SR&ED claim be disallowed for this project

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for the reasons set out below

"The work involved optimizing established detection techniques and applying commercially available passive monitoring tools (3M brand) ....
methods rather than the development of new methodologies to detect each compound. ....

there was no generation of new scientific knowledge or advancement in technology related to airborne contaminant detection."

49] In the end, Airzone was successful, except for two compounds.

Conclusion:

Judges ruling & Rationale:

45] I was surprised when I read the CRA's reasons for disallowing Airzone's SR&ED claim considered in light of what CRA's published guideline describes as eligible experimental development. The most recent CRA guideline is dated August 13, 2021.

The "Why" requirement in the context of experimental development

46] .... There were too many variables or unknowns for Airzone to be able to accurately detect and measure the full slate of 52 compounds.

Data on how to extract the full slate of compounds was not publicly available. Airzone did not have this technical knowledge at the outset. It conducted tests to establish a reliable identification and quantification method.

Significant variables addressed: chromatographic variables, extraction times, solvent polarity vs. aromatic hydrocarbons

Documentation:

- Offline Documents: docs

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Key Criteria Summary

2215 - Global Sustainable - Efficient home - LOSS	
BENCHMARKS	**ACTIVITIES BY YEAR**
	2022
	'1-1
(none)	House construction
OBJECTIVES	**RESULTS**
Enneguide efficeincy rating: 90%	91%
UNCERTAINTIES & KEY VARIABLES	**CONCLUSIONS**
1 - Technological uncertainty	
effects of natural force interactions	
	METHODS
Analysis Trials Prototypes	1

Project Name:	Global Sustainable - Efficient home - LOSS	**Start Date:**	2022-04-01
Project Number:	2219	**Completion Date:**	2022-11-30

Project Details:

Scientific or Technological Objectives:

The following example is based on the Tax Court of Canada judgement 6398316 CANADA INC operating as Global Sustainable, and HER MAJESTY THE QUEEN, Mar. 4, 2021.

1] determinations pertain to the Appellant's 2012 and 2013 taxation years... These claimed expenditures were incurred in connection with a construction project carried on by the Appellant during those two years. The construction was of a house, in southern Ontario, intended to be uniquely energy efficient while staying within the price range of a "regular home".

Evidence:

8] At the opening of the hearing, Appellant's counsel stated that his client's total of claimed SR&ED expenditures for the 2012 taxation year had now been reduced by $3,485.65 to the amount of $139,631.67; and likewise the 2013 taxation year total had now been reduced by $34,032.69 to the amount of $61,752.60.

9] The corporate Appellant called one witness – Mr. Cory Smith (CS). At all material times CS was the Appellant's president. Neither party called any expert evidence and the Respondent called no witnesses. CS

10] CS testified that he has experience in house construction and has earned various training certifications relating to house construction. They include a 2008 certificate from Sir Sanford Fleming College marking completion of a six month study program in "sustainable building design and construction".

Field of Science/Technology:

Civil Engineering (2.01.01)

Project Details:

Intended Results:	Improve existing processes
Work locations:	Commercial Facility
Key Employees:	Cory Smith (re. Global) (Home building - College certificate (2008) / President)
Evidence types:	Samples, prototypes, scrap or other artefacts; Photographs and videos

Scientific or Technological Advancement:

Uncertainty #1: Technological uncertainty

12] As a first step, the Appellant engaged a company knowledgeable in passive house design to render formal, computer software generated design plans for the small house.

13]These design plans were generated in full consultation with CS and allowing for elements and concepts he wanted included. CS testified that the aspects of the project upon which the SR&ED claim was based were various natural force interactions such as thermal mass, thermal bridging, passive cross-ventilation, passive heating and cooling, and air sealing.

Thermal mass is the ability to absorb and store heat energy – here in the building's concrete footings. In winter, warmer daytime temperature warmth would be released throughout the colder night.

Thermal bridging is the movement of heat across an object more conducive to that than surrounding materials. For example, warm air can relatively readily migrate though wood framing from indoors to outdoors, resulting in heat energy loss.

Passive ventilation is manipulating air movement within the building environment entirely or mostly absent the use of active ventilation sources, such as a furnace.

Passive cross-ventilation, a term coined by CS, refers he said to an even, passive distribution of hot air and cold air.

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26] In oral submissions, Appellant's counsel addressed these two steps. He submitted,

The hypothesis is I can build a house that doesn't need a furnace, at a price point that's similar to a regular home.

That's the hypothesis and the technical [sic: technological] uncertainty is the cost. [

The most significant underlying key variables are:

effects of natural force interactions (unresolved)

Technology or Knowledge Base Level:

Activity #1-1: House construction (Fiscal Year 2022)

Methods of experimentation:

A prototype house was built. A base design was purcahsed and then various decisions were made on levels of insulation and modifications of this base design.

Results:

24] The home as built received an "Energuide" efficiency rating of 91 out of 100. The Energuide document (Ex. A-17) provides inter alia that the "typical rating" for a "New house built to minimum building code standards" would be "65 to 70". It provides that the typical rating for its top category, being a "Highly energy-efficient house", would be "80 or more".

Conclusion:

Judge's comments:

27] Thus the Appellant's position is not that there was any technological issue vis-à-vis the various aspects of construction referred to in CS's testimony in constructing this energy efficient home. And I would agree with that.

None of these various aspects, including extra insulation of the footings and foundation, walls and attic, extra taping of gaps and seams, and as well development of the modified ground loop as a cheaper and less energy efficient geothermal system, were described by CS as reflecting new technological knowledge. That is, none of these various aspects that CS testified to reflected development of technological knowledge new to the home construction industry.

28] Furthermore the Appellant presented no expert evidence as to the state of technological knowledge within this industry, that might suggest that the Appellant had broken new technological ground in constructing this energy efficient house.

No supposedly new knowledge was identified by CS, let alone by an expert witness, as having been sought or developed in the construction of this house.

COST AS A BASIS FOR ADVANCEMENT:

30] Conceptually there is no technological aspect implicit in the notion of an item costing or priced at 'x' rather than 'y' dollars. Of course one might envisage that the cost (or price) of an item could be reduced in the event of some particular technological advancement.

But the relevant question for SR&ED purposes would remain – what is that contemplated technological advancement itself, that could lead to the achieving the commercial objective of lowered pricing, comparable to that of standard code constructed housing.

Documentation:

- Offline Documents: docs

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Key Criteria Summary

2216 - Logix Data (solar panels) - LOSS	
BENCHMARKS	**ACTIVITIES BY YEAR**
	2022
	'1-1
(none)	Activity 1
OBJECTIVES	**RESULTS**
Cost: $ Performance: 250 W/m2 Snow load: kg Windload: km/h	
UNCERTAINTIES & KEY VARIABLES	**CONCLUSIONS**
1 - Technological uncertainty	
	METHODS
Analysis Trials Prototypes Lines of code	 10 2

Project Name:	Logix Data (solar panels) - LOSS	**Start Date:**	2022-05-01
Project Number:	2216	**Completion Date:**	2022-10-31

Project Details:

Scientific or Technological Objectives:

Measurement	Current Performance	Objective	Has results?
Cost ($)	(not set)	(not set)	No
Performance (W/m2)	200	250	No
Snow load (kg)	(not set)	(not set)	No
Windload (km/h)	(not set)	(not set)	No

The following example is based on the Tax Court of Canada judgement, LOGIX DATA PRODUCTS INC.,and HER MAJESTY THE QUEEN, May 14, 2021.

1] The issue in this appeal is whether expenditures the Appellant, Logix Data Products Inc., incurred in its taxation year ending June 30, 2013 qualify as “SRED”.

The Appellant is an information technology services company.

2] The activity in question is work the Appellant undertook to develop what it describes as a dual purpose solar shingle – that is, a solar panel that could replace shingles. The concept is that the solar shingle would serve as a source of power and be mounted directly on the roof so that shingles would not be necessary.

Company Background:

28] The Appellant is an information technology services company that develops microcomputers, including for the fast food restaurant business (its original business), provides IT services (including computer hardware and software sales, network administration, and development of software and computer systems20), and provides internet services across Canada (i.e., is an internet service provider (ISP)).

29] Robert Baird is the President and CEO of the Appellant. In the early 80s, Mr. Baird started working in technology, initially as an employee of Pizza Pizza but then on his own as a sole proprietor, before incorporating the Appellant in 1986.

Initially the Appellant’s business was microcomputers but it expanded its offerings over the first decade of operation to include the other computer technology services it provides today.

The Appellant is not in the power business or the solar panel business. So how did the Appellant decide to pursue the development of a solar shingle?

Background to the Solar Shingle Project

31] Silfab S.r.l. (“Silfab”) is an Italy-based solar panel manufacturer that decided to establish a manufacturing plant in Canada. Mr. Baird explained that the Appellant was engaged by Silfab to work with it in an IT capacity, to develop Silfab’s IT infrastructure for its Canadian manufacturing plant.

The Appellant’s work commenced when the Silfab building in Canada was empty and carried on until Silfab produced its first solar panel in Canada.

Mr. Baird said that the Appellant continues to provide IT services to Silfab. Silfab produces solar panels for utility power generation at that plant.

32] Mr. Baird said that it was through the IT work with Silfab that he learned a lot about the design and production of solar panels, “basically how they work and what they are used for”.

Field of Science/Technology:

Electrical and electronic engineering (2.02.01)

Project Details:

Intended Results: Develop new processes, Improve existing materials, devices, or products

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Project Name:	Logix Data (solar panels) - LOSS	**Start Date:**	2022-05-01
Project Number:	2216	**Completion Date:**	2022-10-31
Work locations:	Research Facility		
Key Employees:	Robert Baird (Logix Data) (computer science - n/a (1986) / President)		
Evidence types:	Samples, prototypes, scrap or other artefacts; Design of experiments; Records of trial runs		

Scientific or Technological Advancement:

Uncertainty #1: Technological uncertainty

Experience of People involved in the Solar Shingle Project

35] Mr. Baird said that he and three other employees of the Appellant were involved in the Solar Shingle Project.

36] Mr. Baird describes himself as a computer engineer. He holds certifications from several manufacturers of computer hardware and software systems but these are vendor or product specific qualifications.

Mr. Baird has not taken any programs or courses at college or university.

Mr. Baird has not taken any courses or training in engineering (including mechanical or electrical engineering).

Mr. Baird did not explain what it was about his experience working on the IT installation project that gave him the requisite knowledge.

37] Two of the other three individuals Mr. Baird described as involved in the Solar Shingle Project are IT technicians. The third is a sales consultant.

67] Appellant's counsel asked Mr. Baird to describe the uncertainties the Appellant faced. Mr. Baird suggested the following: Whether the solar shingles could be placed directly on the roof in place of shingles?

The durability of the solar shingle, i.e., would a smaller solar panel without a frame break because it had less rigidity and would moisture leak into the edge?

How would the power be "bussed out" of the shingles because smaller panels (i.e., shingles) required more panels to cover the same area as traditional solar panels requiring more connectors?

Whether the smaller panels (shingles) could achieve a target power yield of 250 watts per square meter given greater (non-productive) space needed to connect them together?

Whether the solar shingle could be scaled up in size and achieve the same results?

(i) What was the knowledge in the industry at the time?

74] What is particularly troubling is that the Research Summary suggests solar shingles did exist.51 Mr. Baird also described seeing Tesla advertisements for solar shingles. He said he did not believe they were available for purchase at the time, but rather were in development, expressing the view that the advertisements were intended to create demand in advance of the shingles actually being available.

Mr. Baird also suggested the picture in the Tesla advertisement implied a flexible solar shingle that, he said, is not as efficient as solid solar cells. He said when the Appellant commenced the Solar Shingle Project in 2011, there was no viable commercial product, though some enterprises were talking about it.

Technology or Knowledge Base Level:

Activity #1-1: Activity 1 (Fiscal Year 2022)

Methods of experimentation:

COMMENTS BY JUDGE:

107] The test description documents lack significant detail. None specifies the purpose of the test (what is the problem or technical uncertainty the test seeks to address) and none states a hypothesis. None states the observations made in, or conclusions drawn from, the prior version of a test which led to the revision.

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None includes an explanation about why the proposed revision might assist with solving the observed problem.

108] There is no explanation of why the particular test equipment was selected, where measurements were to be taken, why the test was set up the way it was, how many times it was to be repeated,79 or over what period it was to be done.

109] In each case, the description of the test procedure lacks precision. Let me give some examples.

110] The list of equipment for Revision 1 and 1.1 of the thermal performance test includes volt meter, amp meter, resistor and digital thermometer.

None of this equipment appears on the schematic for the test, yet the test procedure instructions state little more than: set up test as outlined in drawing; using amp, volt meters and thermometer measure power output and temperature at 15 minute intervals until the single temperature ceases to increase; report results.

Nowhere does it specify how or where the measurements are to be taken.

Mr. Baird testified they discovered the shingle was hottest in the centre and so they decided to measure the temperature there, but that is not specified anywhere. Revision 1.1 (aluminum mesh) states nothing more than “Re-run tests using aluminum/rubber mesh backing sheet.” The details of that backing sheet are not described.

117] The wind resistance test equipment list includes edge clamps and a wind meter. Neither appears in the schematic yet the procedure refers to the schematic for test set up. The test procedure provides for testing at several wind speeds, but nowhere are the wind speeds indicated.

The test procedure does not specify the placement of the fan (distance from the shingle and/or centered or otherwise along the shingle edge).

In testimony Mr. Baird said that the schematic for the wind resistance test was not the correct perspective. If this is so, where is the set up explained? The test procedure states that effects on the shingle should be measured at the 0-25 mm gaps with the vernier. The nature of the measurements is not specified, although the vernier suggests deflection.

139] Finally, I note that the jurisprudence indicates that the documentation should be contemporaneous. The reasons are obvious. I confess that my impression is that the schematics and test descriptions the Appellant provided were not prepared before the tests were conducted, and as revisions were made, but rather subsequently when the CRA asked the Appellant for supporting documentation.

I have a similar impression of the Testing Summary. It appears to “lift” many of the point form notes from the meeting minutes and is undated. It was provided to the CRA after several requests for documentation. I am not convinced it was prepared in 2013 as the work was done.

Results:

Analysis of Expert Witness report:

14] The Amended Report is stated to be the expert’s “independent expert opinion on whether Project 1 constitutes scientific research and experimental development.” The opinion expressed is that:

Project 1 constitutes experimental development in the field of mechanical engineering specific to the semi conductor and photovoltaic industries that was performed by a competent researcher in this field.

15] With respect, this is not the purpose of an expert report. ...the expert’s role is limited to providing the court with a set of prescription glasses through which the technical information may be viewed before being analyzed and weighed by the trial judge.

16] Report states several opinions without explaining the facts and assumptions on which those opinions are founded8 or the reasons for the opinions expressed.

Nowhere in the Amended Report are the relevant facts and assumptions described. The Amended Report consists largely of conclusory statements - statements without explanation, context or support.

19] An expert has an overriding duty to assist the Court impartially. They must be independent and not be an advocate for a party.

Conclusion:

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75] Mr. Baird acknowledged he did not contact Tesla or look at any online engineering forums to see what might have been developed or have been under development by Tesla or otherwise. He did not speak with the manufacturers, suppliers or installers of the solar shingles referred to in the Research Summary, any other manufacturers of solar panels, or any other experts in the field of solar energy.

The only people he said he spoke with were employees of Silfab, an enterprise that was neither manufacturing, nor interested in manufacturing, solar shingles.

His description of those conversations did not suggest a particularly robust inquiry about technological issues.

141] The Appellant bears the burden of establishing that it conducted activities that constituted SR&ED by leading evidence to rebut the Respondent's assumptions. It has failed to do so. Accordingly, the appeal is dismissed.

142] Costs of the motions and the appeal are awarded to the Respondent.

Documentation:

- Offline Documents: docs

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Key Criteria Summary

2217 - WD Borger - Pressure activated removable plugs for large box culverts	
BENCHMARKS	**ACTIVITIES BY YEAR**
	2022
	'1-1
(none)	Activity 1
OBJECTIVES	**RESULTS**
(none)	
UNCERTAINTIES & KEY VARIABLES	**CONCLUSIONS**
1 - Technological uncertainty	
hoop stress	
water head pressure	
	METHODS
Analysis Trials Prototypes Lines of code	 2 1

Project Name:	WD Borger - Pressure activated removable plugs for large box culverts.	**Start Date:**	2022-06-01
Project Number:	2217	**Completion Date:**	2022-12-30

Project Details:

Scientific or Technological Objectives:

2] The appellant claimed two SRED projects that year, one entitled “Improved sealing between submerged, rough cast surfaces” and the other entitled “Pressure activated removable plugs for large box culverts.”

The Minister of National Revenue says that the activities relating to the second project did not meet the definition of SRED and therefore, disallowed the related SRED expenditures.

4] The appellant is part of the Borger Group of Companies, established in 1919. The appellant’s general manager Ahmed Kalaf testified that it specializes in deep utility servicing, earthmoving and more recently, transportation.

15] Mr. Kalaf testified that he has a Bachelor of Science degree earned in 2007 and acknowledged that he is not a civil engineer

Field of Science/Technology:

Civil Engineering (2.01.01)

Project Details:

Intended Results:	Improve existing materials, devices, or products
Work locations:	Commercial Facility
Key Employees:	Ahmed Kalaf (WD Borger) (? - BSc. (2007) / GM)
Evidence types:	Test protocols, test data, analysis of test results, conclusions; Records of resources allocated to the project, time sheets; Records of trial runs

Scientific or Technological Advancement:

Uncertainty #1: Technological uncertainty

6] Mr. Kalaf testified that culverts are generally installed above water level so in this instance, it was a particular challenge that the invert (i.e. the bottom of the interior) of the box culvert was approximately 4 metres below the pond’s surface. He explained that the pond water would exert a head pressure (i.e. pressure caused by its weight) on any blocking device they might use.

Therefore, the blocking device would have to be able to withstand 4 metres (i.e. 13 feet) of head pressure. He also stated that draining the pond was not an option in this instance because they were not permitted to disturb its vegetation.

He added that the base of the pond was also uneven because there was a layer of riprap, which is a rock product used to protect the pond’s inlets and outlets from erosion.

7] Another physical consideration was hoop stress, which Mr. Kalaf explained to be the stress exerted on a cylindrical device (i.e. in this case, the culvert itself and the inflatable bladder dam discussed below). For the purposes of this appeal, it is relevant that hoop stress is affected by the amount of pressure on the cylinder, the width of the cylinder, and the thickness of the cylinder wall; for example, thickening the cylinder wall lowers the hoop stress.

INDUSTRY STANDARDS:

8] Mr. Kalaf stated that the appellant made inquiries within their industry as to how/whether others had encountered this situation, as well as conducted internet research.

He testified that both lines of inquiry yielded minimal information, and that the appellant ultimately tried both a water-filled inflatable bladder dam (also known as an inflatable or portable cofferdam) as well as a rigid cap as blockage devices.

The most significant underlying key variables are:

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water head pressure (unresolved), hoop stress (unresolved)

Technology or Knowledge Base Level:

Activity #1-1: Activity 1 (Fiscal Year 2022)

Methods of experimentation:

20] The appellant tried existing dewatering procedures in terms of the inflatable bladder dam and a rigid cap. The appellant ultimately used the concrete cap, inserted physical objects to block any remaining gaps, and controlled ongoing seepage by using pumps.

Results:

Conclusion:

Judges comments & ruling:

21] I would consider the use of physical objects and pumps in this manner to be within the scope of their standard usages.

22] As an example of trial and error, the appellant purchased the 8-foot x 50-foot inflatable bladder dam whose manufacturer's specifications indicated that it could control 6 feet of still water. The culvert itself was 2.4 metres x 2.4 metres (i.e. 7.8 feet x 7.8 feet) with 4 metres (i.e. 13 feet) of head pressure exerted by the pond water.

Even though the culvert's interior surface was not smooth, the appellant informed the seller that there were no objects present which could potentially damage the dam's interface.

Given these parameters and contraindications, it seems that success was very unlikely from the outset. The effort also did not reach the level of disproving a scientific hypothesis because the bladder dam was used for its created purpose (i.e. blocking water) and the variables exceeded the capabilities already set out by its manufacturer.

24] there was no advancement in the field of civil engineering for the purposes of the SRED provisions

25] The appeal is dismissed, without costs.

Documentation:

- Offline Documents: docs

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Key Criteria Summary

2221 - Beton - transportable concrete modular panels		
BENCHMARKS	**ACTIVITIES BY YEAR**	
	2022	
	'1-1	'2-1
(none)	Claimant arguments	Expert witness rebuttal
OBJECTIVES	**RESULTS**	
Thickness: 0.5 inches Strength: 100 %		
UNCERTAINTIES & KEY VARIABLES	**CONCLUSIONS**	
1 - As claimed = LOSS		
additives		
casting process		
fibres types - weight, porosity, strength		
ingredient proportions		
2 - Documentation weaknesses		
	METHODS	
Analysis Trials Prototypes Lines of code	3	

Project Name:	Beton - transportable concrete modular panels	**Start Date:**	2022-05-09
Project Number:	2221	**Completion Date:**	2022-11-30

Project Details:

Scientific or Technological Objectives:

Measurement	Current Performance	Objective	Has results?
Thickness (inches)	1	0.5	No
Strength (%)	100	100	No

The following example is based on the Tax Court of Canada judgement BETON WORKSHOP INC., and HER MAJESTY THE QUEEN, Jan 27, 2022.

e) the objective of the project claimed by the appellant was to manufacture transportable concrete panels, the thickness of which was to be reduced by half compared to that manufactured conventionally, and this:

without warping;

without generation of fractures;

with equal or greater compressive strength than panels made with conventional concrete;

with superior physical properties in terms of finish quality, porosity and mechanical strength;

Field of Science/Technology:

Civil Engineering (2.01.01)

Project Details:

Intended Results:	Develop new processes
Work locations:	Research Facility
Key Employees:	Frederic Tremblay (Beton Workshop) (History & Geography - BA (1990) / President of Beton)
Evidence types:	

Scientific or Technological Advancement:

Uncertainty #1: As claimed = LOSS

f) to carry out this project, the appellant encountered technical uncertainties with respect to the choice of:

proportions of ingredients for concrete formulation;

chemical additives;

fiber types to achieve the desired surface finish and mechanical properties such as weight, porosity, compressive strength;

the method of making panels;

16] In order to achieve these objectives, the appellant had to overcome the following two major challenges:

a) develop a mixing and casting process so as to eliminate the formation of cracks and

b) determine chemical and physical parameters allowing to control the appearance of surface aggregates and to better control the color and the uniformity of the surface.

The most significant underlying key variables are:

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ingredient proportions (unresolved), additives (unresolved), fibres types - weight, porosity, strength (unresolved), casting process (unresolved)

Technology or Knowledge Base Level:

Activity #1-1: Claimant arguments (Fiscal Year 2022)

Methods of experimentation:

(g) in an attempt to resolve the aforementioned technical uncertainties, the appellant used a trial and error (deduction) approach, involving the testing and experimentation of:

different concrete mix formulations by applying different types of chemical and fiber additives, such as nylon, metal, cardboard, glass sand, etc.;

a basic formulation using a new type of very thin fiber purchased in Japan;

different methods of preparations;

h) the work claimed by the Appellant also includes:

the making of a polymer mold for a hundred castings;

mold modifications;

addition of a standard cure sheet;

watering during the cure;

demoulding time

application of a release agent;

added sealant to prevent warping after 3 weeks;

thickness reduction to minimize internal stresses;

[17] During 2015, the Appellant carried out the following work, which is described in the CRA's SR&ED review report:

development of different concrete formulations by changing the percentage of ingredients;

development of a concrete recipe with few surface aggregates;

modification of the formulation by adding the additive which is the super plasticizer;

modification of the formulation by adding fly ash;

modification of the formulation by adding the shrinkage reducer;

design testing and concrete pour testing on a commercial site;

analyzes of results obtained in the laboratory and on a commercial site;

[18] While carrying out research activities, the appellant encountered the following technical problems, also described in the CRA's SR&ED review report:

the choice of the proportions of the ingredients for the formation of the concrete to obtain a polished surface, without cracking and of good color;

the choice of chemical additives;

the choice of casting method to obtain the desired results in terms of appearance and mechanical properties.

Results:

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IN THE JUDGES VIEW:

(i) the Appellant has not identified or encountered any limitation of current technology and/or science in the development of concrete mixes and concrete panel manufacturing methods;

(j) the current state of science or technology, in the field of civil engineering, was sufficient to overcome the technical uncertainties encountered by the appellant;

(k) in its test log, the appellant made observations, for each of the tests, which do not demonstrate any measurement, hypothesis or analysis of a scientific or technological nature concerning, among other things:

warpage as a function of time;

the method of incorporating unknown compounds;

the relationship between the science or technology underlying the development of concrete panels and the unsatisfactory results of such testing;

Conclusion:

Uncertainty #2: Documentation weaknesses

Technology or Knowledge Base Level:

Activity #2-1: Expert witness rebuttal (Fiscal Year 2022)

Methods of experimentation:

[25] More specifically regarding the modular panels project, Mr. Migneault (CRA expert witness) made the following comments:

the panel that the appellant is seeking to develop is a larger version than the one it already displayed in its available products (fibre-reinforced "concrete" panels measuring 2' x 4' and ½ or ¾ thick inches);

with the materials available, in particular at the level of adjuvants, the knowledge publicly available for the cure and the experience acquired by the appellant during the development of previous products, the appellant could obtain a panel with the targeted dimension of 4 x 8 feet with a thickness of ½ to ¾ inches;

at each stage of its work, the appellant proceeded by applying known solutions to resolve the technical problems encountered, without making assumptions aimed at addressing an uncertainty;

for lack of resources, the appellant did not examine the possible causes of failures;

the appellant did not produce statements concerning the flexural strength of its panels;

the series of tests aimed at determining the quantity of fibers are found in the experiment sheets without each test described being accompanied by quantitative measurements as to the effect of the addition of fibers in the cement formula; fiber types are also not identified in these tests;

the type of cement used for the tests is indicated in the readings but varies throughout the tests between three types and a combination of two of them without explanation of what is sought in these changes, with one exception;

the appellant did not seek to find the cause of the lack of durability of the moulds;

no quantitative measures are reported in the project description or in the experience sheets;

the methods of measuring the mechanical resistance (in compression and in bending) have not been identified and the values have not been reported;

for several tests, the formulation (quantity of cement, water and fibers) is not provided. In most cases, only the amount of cement (in terms of pockets) is indicated.

Results:

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Project Name:	Beton - transportable concrete modular panels	**Start Date:**	2022-05-09
Project Number:	2221	**Completion Date:**	2022-11-30

Conclusion:

Judge concluded:

[39] The analysis of the evidence reveals that the appellant did not adopt a scientific method in carrying out its research activities within the framework of its two projects. Rather, the appellant proceeded to resolve its technical problems by trial and error methods without trying to understand or solve the problems associated with the technology used.

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Key Criteria Summary

2222 - Beton - mixing and pouring concrete floors		
BENCHMARKS	**ACTIVITIES BY YEAR**	
	2022	
	'1-1	'2-1
Suppliers: 2 products	Claimant arguments	Expert witness critique
OBJECTIVES	**RESULTS**	
Compressive strength: 50 mPa		
UNCERTAINTIES & KEY VARIABLES	**CONCLUSIONS**	
1 - As Claimed = LOSS		
additives		
casting methods		
2 - Ideas per Expert witness		
cement types		
fibre types		
setting times		
super plasiticers & foaming agents		
water types and amounts		
	METHODS	
Analysis Trials	20	

Project Name:	Beton - mixing and pouring concrete floors	**Start Date:**	2022-04-17
Project Number:	2222	**Completion Date:**	2022-11-23

Project Details:

Scientific or Technological Objectives:

Measurement	Current Performance	Objective	Has results?
Compressive strength (mPa)	30	50	Yes

The following example is based on the Tax Court of Canada judgement BETON WORKSHOP INC., and HER MAJESTY THE QUEEN, Jan 27, 2022.

m) the objective of the project claimed by the appellant was to improve the process for mixing and pouring polished concrete floors in order to reduce the visibility of aggregates while:

respecting the compressive strength of 30-50 MPa;

eliminating the formation of cracks;

controlling the appearance of surface aggregates, surface color and uniformity, etc.;

Field of Science/Technology:

Civil Engineering (2.01.01)

Project Details:

Intended Results:	Improve existing processes
Work locations:	Research Facility
Key Employees:	Frederic Tremblay (Beton Workshop) (History & Geography - BA (1990) / President of Beton)
Evidence types:	Samples, prototypes, scrap or other artefacts; Records of trial runs

Scientific or Technological Advancement:

Uncertainty #1: As Claimed = LOSS

n) the appellant encountered uncertainties of a technical nature in relation to the choice of:

proportions of ingredients for concrete formulation to obtain a polished surface, without cracking and of good color;

chemical additives;

the casting method to obtain the desired appearance and mechanical properties;

The most significant underlying key variables are:

additives (unresolved), casting methods (unresolved)

Technology or Knowledge Base Level:

Activity #1-1: Claimant arguments (Fiscal Year 2022)

Methods of experimentation:

Method	Experimentation Performed
Trials:	10 runs / samples

o) in an attempt to resolve the aforementioned technical uncertainties, the appellant used a trial and error appro

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involving, among other things:

the development of:

different concrete formulations by changing the percentage of ingredients;

a concrete recipe with few surface aggregates;

the modification by adding:

the additive which is the super plasticizer;

fly ash;

shrinkage reducer;

testing of different formulations and different casting processes in the laboratory;

concrete design and pour testing on a commercial site;

Results:

- Compressive strength: 50 mPa (100% of goal)

Conclusion:

Documentation:

- Offline Documents: docs

Uncertainty #2: Ideas per Expert witness

[26] Regarding the project for the mixing and pouring of polished concrete floors, Mr. Migneault made the following comments:

DEFINING KNOWN OR STANDARD INDUSTRY PRACTICES

concrete floors, even polished, do not represent a new product on the market. This area is also regulated. Public knowledge and the standards in force provided enough information to carry out the development of a manufacturing process or the improvement of this type of product;

from the starting formulation established by what is known in the field, the appellant then made educated guesses in order to achieve the desired characteristics for the product, polished concrete floors;

in order to increase the fluidity of the concrete, the appellant decided to add a super plasticizer. Super plasticizers have the property of making the concrete more fluid (plasticizing effect) and of increasing the strength of the concrete (compressive strength) thanks to the reduction of water that their use allows. The use of the product designed for this purpose gives the expected result and does not constitute an advancement;

in test # 7 , the fly ash was removed from the formulation and replaced with a shrinkage reducing agent, a product known to also reduce the formulation of cracks;

the cement mainly used (FA-56) seems to contain an air entrainer (foaming agent). The shrinkage-reducing agent will reduce this effect, but is not sufficient on its own, hence the use of a cure sheet. Therefore, the problems of cracks on the surface of the concrete and pores observed have been resolved with solutions known in the field and do not represent an advancement;

the type of super plasticizer used, naphthalene type, is a second generation plasticizer for concrete with an intermediate water reduction capacity.

Third-generation water reducers already existed back then. They provide superior water reduction while increasing the compressive strength of concrete. This type of concrete is called UHP (Ultra High Performance) concrete and is used today by the appellant.

The appellant increased knowledge base of products available on the market and of handling concrete.

The most significant underlying key variables are:

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fibre types (unresolved), cement types (unresolved), water types and amounts (unresolved), setting times (unresolved), super plasiticers & foaming agents (unresolved)

Technology or Knowledge Base Level:

Benchmarking methods & sources for citings:

Benchmark Method/Source	Measurement	Explanatory notes
Suppliers	2 products	The expert witness clarified that third generation plasticizers already on market to solve problems cited

Activity #2-1: Expert witness critique (Fiscal Year 2022)

Methods of experimentation:

[26] Regarding the project for the mixing and pouring of polished concrete floors, Mr. Migneault made the following comments:

FACTORS INDICATING LACK OF SYSTEMATIC INVESTIGATION:

from the starting formulation established by what is known in the field, the appellant then made educated guesses in order to achieve the desired characteristics for the product, polished concrete floors;

the problems encountered were of a technical nature. Some have been resolved by solutions known in the field: the use of a shrinkage reducing agent and curing sheets for the reduction of surface cracks. Other solutions, such as adding fly ash causing unwanted staining, were simply circumvented or abandoned;

for this project, the type of client used is not indicated anywhere. Looking at the invoices, most of the cement purchased for the projects is a specialized type of cement for exterior structural repairs;

the type of water used during the tests is not indicated;

the bleeding observed during the first test can have several causes: too much water, poor handling after pouring, too long a setting time for cold weather. Only one cause has been explored: water reduction;

in tests no . 5 and no . 6, fly ash is added to reduce cracking. Invisible color develops as it dries. The appellant did not attempt to determine the cause of the problem and decided to simply remove the ingredient from the product formulation;

for the reproducibility tests carried out, experiment sheets are not provided and no results are reported;

the appellant acknowledges, for lack of resources, that all the possible causes of the failures were not examined;

Results:

As a result the expert proposed:

This is an apprenticeship that does not constitute an advancement;

the work was intended to support the appellant's learning in the manufacture of an existing product on the market, namely polished concrete floors;

although a register exists (experiment sheets), it does not contain hypotheses, nor all the measurements allowing to establish a relation of cause and effect in the parameters explored;

several important measurements, such as setting time, time between casting, measurement of surface hardness and concrete strength (compressive strength are not reported or are missing).

Conclusion:

Judge concluded:

[40] The appellant succeeded in developing modular concrete panels and polished concrete floors meeting the desired characteristics, but the appellant succeeded in doing so by using known technologies to solve the technical problems encountered. The comprehensive approach adopted was not aimed at achieving scientific or technological advancement.

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