Project Name:	Buhler - Tractor design WIN	**Start Date:**	2023-01-01
Project Number:	2301	**Completion Date:**	2023-09-30

Project Details:

Scientific or Technological Objectives:

Measurement	Current Performance	Objective	Has results?
Power (hp)	425	500	Yes
Emission requirement (tier)	2	2	Yes
Power bulge (%)	5	8	Yes
Torsional coupler spike load capacity (x)	(not set)	(not set)	No
Price ($)	(not set)	(not set)	No

This project description is based on the Tax Court of Canada judgment of BUHLER VERSATILE INC., Appellant, and HIS MAJESTY THE KING, Respondent.Citation: 2023TCC18 Date: 20230206. paragraphs for source data have been [cited].

Introduction/Overview
[1] The appellant is an agricultural equipment manufacturer and specializes in the manufacture of agricultural tractors.

[2] The Minister of National Revenue disallowed the appellant's 2005 SR&ED claim for qualified expenditures totalling $3,591,220 with respect to seven projects.

[3] This hearing commenced in September 2019 and its in-person continuation was postponed three times due to risks/challenges presented by the COVID-19 global pandemic.

[5] The Minister says that the appellant's activities did not meet the definition of SR&ED and were more accurately described as routine testing, quality control, and/or product development.

[15] The appellant's fiscal year-end is September 30th and its 2005 SR&ED claim consisted of seven projects however,

[17] The bulk of the appellant's SR&ED claim is associated with project 5 (4WD Phase D Tier II High HP). During the hearing, both parties focused their respective presentations on this project.

[18] The appellant's goal in this project was to create a line of high-horsepower 4WD tractors which met Tier II emission standards and were suitable for agricultural and commercial construction (e.g. scraping/earth-moving/levelling) applications.

Within this line, they sought to build a 4WD tractor with over 500 horsepower, which would be above industry levels at the time. Mr. Janzen (Buhler, CFO) explained that more powerful agricultural tractors were needed as farms and farm implements had increased in size while the number of farm employees decreased.

Key Witnesses:
Appellant (Buhler)

Willy Janzen Chief Financial Officer
Barry Thompson Professional Engineer (Mechanical) since 1991
Allan Minaker Professional Engineer since 1982 Specializing in Power and Machinery
James Pell Mechanical Engineer with Cummins Inc. (Engine supplier)

Respondent (CRA) Research & Technology Advisor (RTA's)

Scott Lagadyn Professional Engineer since 2015,
Master of Science in Mechanical Engineering
Keith Chrystall Bachelor of Applied Science in Mechanical Engineering
Master of Science in Mechanical Engineering

Field of Science/Technology:

Mechanical engineering (2.03.01)

Project Name:	Buhler - Tractor design WIN	**Start Date:**	2023-01-01
Project Number:	2301	**Completion Date:**	2023-09-30

Project Details:

Intended Results:	Develop new processes, Develop new materials, devices, or products
Work locations:	Research Facility
Key Employees:	Alan Minaker (Buhler) (Machinery - BAsc. PEng. (1982) / Buhler Engineer)
Evidence types:	Test protocols, test data, analysis of test results, conclusions; Records of resources allocated to the project, time sheets; Samples, prototypes, scrap or other artefacts; Project planning documents; Design of experiments; Records of trial runs; Contracts

Scientific or Technological Advancement:

Uncertainty #1: Technological uncertainty

a) Torsional coupler:

[28] The appellant's 425-HP tractor used a version of the torsional coupler referred to as an LCD rubber coupler; Mr. Minaker described it as essentially a very large rubber ring in a metal shell and fairly commonly used in the tractor industry. To accommodate the larger QSX-15 engine, it was necessary to raise the engine which resulted in a 5-degree operating angle between the engine crankshaft and the transmission input shaft (which receives power from the engine). The LCD coupling ordinarily required the crankshaft and transmission input shaft to be in-line (i.e. at a 0-degree angle) so the 5-degree operating angle resulted in a whipping motion that greatly reduced the lifespan of the coupler.

(b) Cooling
[32] The larger QSX-15 engine presented the appellant with multiple challenges in terms of keeping it cool, thereby maintaining Tier II emissions compliance. Either a sufficient airflow must be created or a cooling system devised because insufficient cooling in turn negatively affects emissions. Mr. Minaker explained that a tractor typically operates in much dustier conditions than a highway truck. The dust and debris tend to plug the tractor's cooling system components and make it more difficult to keep the engine cool.

[33] As explained by Mr. Pell, an engine in a vehicle burns fuel to produce power but heat is produced as a by-product. A fast -moving highway vehicle will generate ground air which circulates through the radiator and a cooling stack, all of which serve to cool the engine and prevent overheating. On the other hand, the maximum speed of a tractor is significantly lower than that of a highway vehicle so its movement does not generate the same natural airflow for cooling.

The most significant underlying key variables are:

Cooling system design - dust & low airflow, torsional coupler - whipping,slip joint, materials, turbulent airflow vs. pressure effects, cooler face and shapes

Technology or Knowledge Base Level:

Benchmarking methods & sources for citings:

Benchmark Method/Source	Measurement	Explanatory notes
Competitive products or processes	4 products	No other competitor with 535 HP tractor. 4 main competitors worldwide with potential designs.
Similar prior in-house technologies	2 products / processes	rework of prior design concepts
Suppliers	1 products	Engineer from Engine supplier (Cummins Inc.) provided design input & expert witness
Queries to experts	1 responses	determining why the coupler failed, the appellant consulted with Torsion Control who in turn gave feedback and suggestions

Activity #1-1: Torsion coupler design (Fiscal Year 2023)

Methods of experimentation:

Method	Experimentation Performed

Torsional coupler
It started with spring couplers made by a company called Torsion Control, testing them both in the field and using a dynamometer (an engine-testing device which measures torque). Mr. Minaker explained that a torsional coupler should last over 5,000 hours but it was failing after less than 100 hours with the QSX-15 engine.

[26] Mr. Minaker described the torsional coupler as the connection between the engine and the rest of the powertrain.39 He explained that the QSX-15 engine ran at 2,100 rpm, which produces pressure pulses and exerts vibrational pressure on the crankshaft (which converts linear movement to rotational movement in an engine).

[27] He stated that the transmission (which controls the engine's power) would itself consist of multiple gears, shafts, and bearings rotating at various speeds. He explained that in this system of spinning components, a torsional coupler is needed to isolate and minimize vibration to prevent the vibrations from destroying the system itself. Mr. Lagadyn (CRA) described the purpose of the torsional coupler as that of forcing the power of the engine to go through it, thus providing its dampening effect to the rest of the drive line.

[29] The appellant decided to move away from a rubber coupling and try a spring coupler, i.e. which has no rubber and instead uses a series of springs for dampening. It started with spring couplers made by a company called Torsion Control, testing them both in the field and using a dynamometer (an engine-testing device which measures torque). Mr. Minaker explained that a torsional coupler should last over 5,000 hours but it was failing after less than 100 hours with the QSX-15 engine.

[30] In the process of determining why the coupler failed, the appellant consulted with Torsion Control who in turn gave feedback and suggestions. Mr. Lagadyn (CRA) succinctly summarized the appellant's approach as follows:

The appellant created a bench test apparatus. The apparatus, or test bed, featured a flywheel and a driveshaft operating at an angle. The intent of the test was to first fail the coupler and observe the baseline reliability, and then test improved coupler designs to measure the incremental reliability gained, if any. However, during bench testing, the appellant recognized that the testing was not matching the failures seen in the field. The appellant considered that the bench testing was creating steady state loads, whereas in the field the loads would be intermittent spike loads.

The appellant also considered the possibility that the coupling might be failing due to axial thrust loads on the coupler. The driveshaft contained a slip joint which would in theory prevent thrust loads. The appellant considered that high torque might be creating enough friction to prevent the slip joint from slipping as intended.

The appellant considered the thrust loading could be occurring on the coupler from relative movement between the engine and transmission (due to the engine and transmission shifting on their elastomer mounts). The appellant pursued the measurement of actual in-service loads and movements on the coupler and driveshaft on a full scale loaded tractor. The tractor driveshaft was outfitted with a strain gauge arrangement to measure the torque passing through the coupler and driveshaft.

Results:

[31] Mr. Minaker testified that the end design was one piece with 12 sets of springs (up from 9), which was larger and heavier but also more durable and more expensive.

Conclusion:

JUDGES RULING & RATIONALE:

[64] The appellant was focused and methodical in the way it uncovered, recognized, and resolved the issues involving cooling and the torsional coupler, as two examples of the larger challenges. It did not always know whether a specific theory would successfully resolve a particular issue but it always knew why it was testing that theory.

[65] For example, the appellant moved away from rubber couplers to spring-based ones because the rubber was breaking; however, the appellant did not know that the spring couplings would work. The appellant then eventually moved away from a 2-piece welded design to a one-piece design.

Significant variables addressed: torsional coupler - whipping,slip joint, materials

Documentation:

Offline Documents: docs

Activity #1-2: Cooling system design (Fiscal Year 2023)

Project Name:	Buhler - Tractor design WIN	**Start Date:**	2023-01-01
Project Number:	2301	**Completion Date:**	2023-09-30

Methods of experimentation:

[38] For maximum cooling, the appellant was challenged by the need to accommodate the physical size of the components while achieving proper fin-spacing; each component had protrusions called fins to increase their surface area for cooling.

Mr. Minaker explained that the tighter the fin-spacing, the better the heat rejection but the worse the airflow, and the appellant only had a limited amount of tractor face area to work with. He testified that it was important to keep the tractor at a reasonable size but they ultimately had to widen it twice in order to house the components.

[39] The appellant tested the cooling system using the dynamometer (called dyno testing) as well as doing field testing. Mr. Minaker stated that the dyno testing took place in a test cell which was a large enclosed room. The tractor would run at full throttle for 6 to 8 hours at a time and approximately 30 variables such as temperatures, pressures, and flows would be measured to determine how the cooling system was working.

[41] Another challenge involving the cooling system involved the charge air cooler itself. Mr. Minaker stated that Cummins had a very tight system specification called the intake manifold temperature differential (IMTD); it required that the air be cooled by at least 63 degrees Fahrenheit while the engine was operating at maximum horsepower.

The appellant changed the design of the charge air cooler to create a turbulent airflow which increased cooling but simultaneously reduced the air pressure inside the charge air cooler to an unacceptable level. Conversely, increasing the air pressure inside the charge air cooler led to an unacceptable IMTD.

The appellant ultimately increased the face area of the charge air cooler to compensate but in turn had to reduce the size of the oil coolers mounted underneath.

[42] Additional testing
The appellant put its tractors through a suite of other tests such as noise levels, steering, rollover protection system (called the cab test), braking, air conditioning, power train, manual transmission, bump track (involving random speed bumps),hydraulic system, and air seeder fans.

Results:

- Power: 500 hp (100% of goal)
- Emission requirement: 2 tier (100% of goal)
- Power bulge: 8 % (100% of goal)

[43] A limited number of these tractors went into production in late 2005. Mr. Janzen testified that at the time, this 4WD tractor was known to have the highest horsepower in the world. He stated that when its product life ended in 2014, the appellant sold the intellectual property associated with it for $2.6M in 2017.

Conclusion:

JUDGE'S RULING & RATIONALE:

[57] I am of the view that the technological uncertainty in this case fits squarely under the description of a system uncertainty. In other words, the integration of nontrivial combinations of established (well-known) technologies and principles carried a major element of technological uncertainty. When all the individual parts were combined, their individual uncertainties were merged into a system uncertainty and the system uncertainty was the entire tractor. All of the constituent parts needed to function in unison to achieve the appellant's objective.

RULING ON COSTS:

[77] The 535-HP tractor was one of three models in that 4WD line and as indicated earlier, I consider the 435-HP and 485-HP models to lack the necessary system uncertainty to qualify for SR&ED absent specific evidence.

[78] As a principled basis, I would allow one-third of $2,916,197 as qualified SR&ED expenditures, i.e. $972,065.67 (rounded to $972,066) based on the 535-HP tractor being one of three models in the line.

Significant variables addressed: cooler face and shapes, Cooling system design - dust & low airflow, turbulent airflow vs. pressure effects

Project Name:	Canafric - food development WIN	**Start Date:**	2023-02-01
Project Number:	2302	**Completion Date:**	2023-10-31

Project Details:

Scientific or Technological Objectives:

Measurement	Current Performance	Objective	Has results?
Shelf life (days)	5	10	Yes
reduce salt (%)	(not set)	(not set)	No
increase protein (%)	(not set)	(not set)	No
maintain taste (%)	(not set)	(not set)	No
freeze / thaw credibility (%)	(not set)	(not set)	No
Cooking time (%)	100	80	Yes
Use of chemical preservatives (%)	30	0	Yes

This project description is based on the Tax Court of Canada judgment of CANAFRIC INC., Appellant, and HIS MAJESTY THE KING, Respondent. TCC 2023 108 Date: July 26, 2023

[1] This is an appeal by Canafric Inc. (“Canafric”) disallowing Scientific Research and Experimental Development (“SR&ED”) expenditures and the corresponding Investment Tax Credits (“ITCs”) for the 2013, 2014, 2015 and 2016 taxation years

[2] Canafric operates a food manufacturing business specialized in developing frozen pies mainly for the Canadian and the United States markets. During the Taxation Years, Canafric carried on various projects and activities aimed at developing new or advancing pre-existing products.

The 2013 SR&ED Claim included five projects, two of which, projects 1304 and 1306, were selected for a joint technical and financial review. These two projects were discussed at length during the September 14, 2015, on-site meeting.

Canafric’s customers outlined specific targets which included a higher shelf life without artificial preservatives, reducing salt and fat contents, increasing protein levels, maintaining product integrity during the freeze / thaw process. These targets were to be achieved without affecting the taste of the product. During his examination in chief, Mr. Zhou acknowledged that projects 1304 and 1306 posed a technological uncertainty.

[92] The 2014 SR&ED Claim included projects 1306, 1401 and 1402. Projects 1401 and 1402 were new products with specific requirements including salt and fat reduction, the replacement of potato flakes with “real potatoes”, using free from antibiotics meat, reducing cooking time.

[93] The 2015-2016 SR&ED Claim included seven projects, two of which, projects 1501 and 1502, were discussed during the March 8, 2018, meeting. The main challenges were to conceive a thicker filling, use a flaky pie crust that is compatible with all the fillings, reduce fat and salt contents, achieve a 21-day shelf life without any artificial preservatives and use halal products while preserving the taste profile of the products.
[

Field of Science/Technology:

Food and beverages (2.11.01)

Project Details:

Intended Results:	Develop new processes, Develop new materials, devices, or products
Work locations:	Research Facility
Key Employees:	Suvrut Pandya (Unknown - No technology background ? / CEO)
Evidence types:	Test protocols, test data, analysis of test results, conclusions; Samples, prototypes, scrap or other artefacts; Design of experiments; Records of trial runs

Scientific or Technological Advancement:

Uncertainty #1: Technological uncertainty

PER THE JUDGE:

[94] Based on the challenges described by Mr. Pandya, projects 1304, 1306, 1401, 1402, 1501 and 1502 posed a technological uncertainty which could not be resolved by routine engineering or standard procedures. Canafric attempted to create recipes in order to meet client objectives for their products. Each project consisted of a new or improved product which meant there was no information available on how to achieve these goals.

A major source of disagreement for all SR&ED Claims was David Zhou's (CRA) position that each breakthrough was transferrable from one product to the other. For example, Mr. Zhou said that salt and fat reduction techniques could be replicated in different products.

Mr. Pandya clearly demonstrated that this was not the case because the ingredients will react differently when used in different products. Canafric was unable to achieve all of its targets.

The most significant underlying key variables are:

methods to reduce fat & salt, transferability of methods, cooking techniques to reduce time, effects of no anitbiotics on meats

Technology or Knowledge Base Level:

Activity #1-1: 2013 - 2/5 projects denied (Fiscal Year 2023)

Methods of experimentation:

2013 Taxation Year
[50] The 2013 SR&ED Claim was not completely denied. Some of the projects were accepted as filed. Only projects 1304 and 1306 were selected for a joint technical and financial review. Mr. Papadopoulos admitted that projects 1304 and 1306 had "some potential for SR&ED eligible activities" but they lacked the necessary supporting documentation accounting for the work performed.

[3] For the 2013 taxation year, Canafric claimed SR&ED in respect of five projects (the "2013 SR&ED Claim"):

i.1302: Mortimer's brand Saffron Garden
ii.1303: Loblaw's PC Scotch beef pie
iii. 1304: Metro Irresistible Asian Style dinners - X
iv.1306: Costco deli chicken pie fill - X
v.1307: Costco crustless quiche

[4] Projects 1304 and 1306 were selected for a joint technical and financial review by the Minister. By Notice of Reassessment dated May 13, 2016, the Minister disallowed SR&ED expenditures in the aggregate amount of $90,682 and corresponding ITCs in the aggregate amount of $22,183 in relation to these two projects.

2013 Taxation Year
[18] For the 2013 taxation year, the CRA reviewed projects 1304 and 1306.

(1) Project 1306
[19] Project 1306 was a pie filling developed for Costco, which was meant to follow a specific cooking process. Canafric would boil the filling to 165 degrees Fahrenheit to eliminate all bacteria. Canafric would then freeze the filling and pack it in 10 pound bags which were sent to Costco. Costco would make its own pies using the filling and bake it in the oven before displaying it in its refrigerator.

[20] In addition to the usual fat and salt reduction requirements, Costco wanted a pie filling that could achieve a 10-day shelf life including transportation time without using artificial or chemical preservatives. The challenges were to maintain product integrity and taste after three bakes, one freeze and two filling phases, achieve the targeted shelf life without artificial preservatives and increase protein levels in the filling by 35%.

[21] Canafric was unable to achieve a 10-day shelf life. Mr. Pandya testified that product samples were sent to an external laboratory for testing. The results established the product became unsafe for human consumption after six days. No plant trials took place for project 1306.

(2) Project 1304
[22] Mr. Pandya testified that "Metro Irresistibles Asian Style dinner" was not a new product. The customer simply wanted improvements to an existing product.

[23] Mr. Pandya described the main challenges as reducing salt and fat contents while preserving the taste profile of the items, maintaining the freeze / thaw credibility as well as maintaining shelf life without using artificial preservatives. According to Mr. Pandya, these improvements made the product “as good as new”.

Results:

- Shelf life: 6 days (20% of goal)
- Use of chemical preservatives: 20 % (33% of goal)

[25] Mr. Pandya testified that all the challenges relating to projects 1304 and 1306 were described to David Zhou during the meeting. David Zhou told Canafric’s representatives, including Mr. Pandya, that reducing fat and salt contents was not a technical challenge since salt and fat reduction techniques are transferrable from one product to another.

Conclusion:

Significant variables addressed: methods to reduce fat & salt, transferability of methods

Documentation:

- Offline Documents: docs

Activity #1-2: 2014 - 3/3 projects denied (Fiscal Year 2023)

Methods of experimentation:

For the 2014 taxation year, Canafric claimed SR&ED expenditures and ITCs in respect of the following three projects (the “2014 SR&ED Claim”):

i.1306: Costco deli chicken pie fill - X
ii.1401: Costco and Metro Irresistible Shepard’s Pies - X
iii. 1402: Loblaw’s Free from Chicken & Beef Pot Pies - X

[6] By Notice of Reassessment dated July 28, 2017, the Minister disallowed the entirety of the claimed SR&ED expenditures and corresponding ITCs in relation to Project 1306, Project 1401 and Project 1402.

2014 Taxation Year
[29] For the 2014 taxation year, the CRA reviewed projects 1306, 1401 and 1402.
[30] Mr. Pandya explained that Project 1306 ran into the 2014 taxation year because of the potentially lucrative contract it could have led to if Canafric could overcome the challenges.

(1) Project 1401
[31] In project 1401, the main challenges were to replace potato flakes with “real potatoes”, use leaner beef (from 75% muscle and 25% fat to 85% muscle and 15% fat) as well as the usual fat and salt reduction. Project 1401 was successful.

(2) Project 1402
[32] Regarding project 1402, he described the main challenges as using “free from antibiotics” animals and reducing cooking time by 20 to 50%.

Mr. Pandya explained that the elimination of antibiotics created challenges with the “quality of the protein”. Since each animal has different immunity levels, chickens and whole cattle beef differed in quality and in texture. As for the cooking time, it led to microbiology concerns since it was not sufficient to reach the usual 165 degrees Fahrenheit, which ensures elimination of bacteria.

Results:

- Cooking time: 85 % (75% of goal)

Conclusion:

Significant variables addressed: cooking techniques to reduce time, effects of no anitbiotics on meats

Activity #1-3: 2015 - 3/7 projects denied (Fiscal Year 2023)

Methods of experimentation:

[7] For the 2015 taxation year, Canafric claimed SR&ED expenditures and ITCs in respect of the following seven projects (the “2015 SR&ED Claim”):

i.1303: Loblaw’s PC Scotch beef pie

ii.1307: Costco crustless quiche.
iii. 1401: Costco and Metro Irresistible Shepard's Pies - X
iv.1501: Mortimer's Hand Held Pies "On the Go" - X
v.1502: Mortimer's Halal Kitchen Frozen Entrée - X
vi.1503: National Foods Frozen Dinner Entrée
vii. 1504: Swiss Chalet & Cara Foods Frozen Entrée

[8] By Notice of Reassessment dated August 9, 2019, the Minister disallowed SR&ED expenditures totalling $97,895 and the corresponding ITCs totalling $15,476 in relation to projects 1401, 1501 and 1502.

The Minister conducted a joint review for the 2015 and 2016 SR&ED Claims.
(1) Project 1501

[34] Project 1501 aimed to develop twelve pocket-sized frozen pies that could be safely consumed after being heated in a microwave or an oven.

[35] The main challenges were to conceive a thicker filling, use a flaky pie crust that is compatible with all the fillings, reduce fat and salt contents and achieve a 21-day shelf life without any artificial preservatives.

[36] Mr. Pandya also outlined the challenges relating to the packaging of the product. He explained that Canafric had to use paper coated with chemicals to ensure the product could be microwaved in a minute. The lamination inside the paper allowed the microwave heat to be transferred 100 times faster than it would have been with normal paper.

[37] Mr. Pandya explained that project 1501 was not successful because the product was not firm enough to be hand-held. This was mainly due to the filling leaking moisture into the pastry. Canafric was also unable to achieve the required shelf life.

(2) Project 1502
[38] Project 1502 involved the development of a series of halal products. In cross-examination, Mr. Pandya admitted that this was not their first experience with halal products since Project 1501 also involved some halal products. Mr. Pandya explained that the halal requirement created challenges regarding the raw materials which had to be halal-based and the shortenings which could not be animal based.

Results:

CRA POSITION:

[41] The challenges were described to David Zhou during a March 8, 2018, on-site meeting that took place regarding the 2015-2016 SR&ED claims. Mr. Pandya testified that the meeting was originally meant to review two projects (1501 and 1502), but David Zhou chose to focus on project 1501.

[42] During the meeting, David Zhou took the position that only the first product in project 1501 (the butter chicken) created a technical challenge because he was of the view that Canafric could apply the knowledge it gained during the product development for that product to overcome the similar challenges it encountered for the eleven other products.

Conclusion:

Activity #1-4: 2016 - 3/6 projects denied (Fiscal Year 2023)

Methods of experimentation:

For the 2016 taxation year, Canafric claimed SR&ED expenditures and ITCs in respect of the following six projects (the "2016 SR&ED Claim"):

i.1501: Mortimer's Hand Held Pies "On the Go" - X
ii.1502: Mortimer's Halal Kitchen Frozen Entrée - X
iii. 1503: National Foods Frozen Dinner Entrée
iv.1504: Swiss Chalet & Cara Foods Frozen Entrée
v.1601: Alimentation Couche-tard Chilled Pies
vi.1602: Longo's Savoury Pies - X

[10] By Notice of Reassessment dated August 9, 2019The Minister disallowed SR&ED expenditures totalling $154,872 and the corresponding ITCs totalling $23,304 in relation to projects 1501, 1502 and 1602.

(3) Project 1602
[39] Project 1602 aimed to develop nine meat and vegetable pies for Longo's. The customer specified the pastry should not contain lard. At least 10% of the shortening had to be made of real butter. The customer also wanted the pies to come in two sizes, which meant Canafric had to elaborate a different heating process for each pie. Salt and fat content reduction was not

a requirement for this project.

[40] Mr. Pandya testified that David Zhou rejected the claim regarding project 1602 saying, “a pie is a pie what is the big deal about it”.

Results:

Conclusion:

Activity #1-5: Judges ruling and rationale (Fiscal Year 2023)

Methods of experimentation:

Results:

JUDGE'S RULING & RATIONALE: 5 criteria per NW Hydraulics case:

I) TECHNOLOGICAL UNCERTAINTY
[87] The first criteria, whether there is a technological risk or uncertainty, stems from the words of paragraph 248(1) ITA, namely the requirement for a technological advancement. A technological advancement is needed when it is unknown or uncertain whether a certain objective can be accomplished, due to a lack of scientific knowledge.

II) HYPOTHESIS
[102] Mr. Pandya described Canafric’s development process as follows:
i.The client requests a product with specific features.
ii.Canafric elaborates a recipe designed to meet the client’s requirements.
iii.The recipe is tested to ensure it meets the requirements.
iv.The product is sent to a “taste panel” to evaluate its taste.

[104] This process meets the second criterion. Canafric formulated hypothesis specifically aimed at achieving its various goals.

III) SCIENTIFIC METHOD
As for the third criterion, whether the process accorded with the scientific method, the CRA’s position was that Canafric relied on a “trial and error” approach by trying various recipes to reach its targets and without attempting to explain or analyze the reason why each recipe did not work.

I disagree with this position. When it found a recipe could not meet client requirements, Canafric’s main takeaway was not simply that it did not work. Canafric conducted analyses in order to understand which requirement was not met and modified specific parts of the recipe in order to address the issue. In doing so, Canafric was limited by its clients’ demands regarding which ingredients to use.

IV) TECHNOLOGICAL ADVANCEMENT [NOT CITED IN JUDGEMENT]

V) RECORDS & NATURE OF SUPPORTING DOICUMENTATION

[105] The fifth criterion, whether the claimant kept a detailed record of the hypotheses tested and results as the work progressed

[110] Documentary evidence is not mandatory. Testimonial evidence may be presented in support of a claim. In this case, Canafric provided both documentary and testimonial evidence in support of its various claims.

[111] On September 14, 2015, an on-site meeting took place regarding the 2013 SR&ED Claim and specifically projects 1304 and 1306. Mr. Pandya testified that all the technical information regarding these projects was explained orally to Mr. Zhou during the meeting. This was corroborated by Mr. Zhou himself.

Mr. Papadopoulos and Mrs. Hassanein, while they could not speak to the specifics of the discussion, confirmed that a “lengthy technical discussion” took place between Canafric’s representatives and Mr. Zhou.

Conclusion:

Project Name:	ACBK Thermal Storage LOSS	**Start Date:**	2023-03-01
Project Number:	2303	**Completion Date:**	2023-10-31

Project Details:

Scientific or Technological Objectives:

Measurement	Current Performance	Objective	Has results?
Efficiency (%)	80	90	No

This project description is based on the Tax Court of Canada judgment of ACBK Management Inc. vs. The king Date : 2022-09-29, Neutral reference : 2022 CCI 94, File number : 2015-3974(IT)G

8] André Roy (“Mr. Roy”) was the president and sole director of Hydro LMR during the relevant period. He is an electromechanical by training and specializes in automation/. mr. Roy's work consisted mainly of designing, installing and programming automated systems in the food industry.

9] On an unspecified date before the year in question, Dominic Laperle (“Mr. Laperle”) had installed a system called

“hydrodynamic system for the energy-efficient assistance of a building, construction methods and corresponding uses" in a residence in Saint-Césaire, in the province of Quebec. Mr. Laperle obtained a patent for this system.

According to Mr. Roy's testimony, Mr. Laperle's system makes it possible to reduce the effect of a building on the environment by making it self-sufficient in energy.

[10] After the construction of the residence was completed and the hydrodynamic system was installed, Marc Brunet (“Mr. Brunet”), of the Center de recherche industrielle du Québec (“CRIQ”), contacted Mr. Roy to to ask him if he could improve Mr. Laperle's system. To this end, Mr. Brunet asked him to accompany him on a visit to the residence in Saint Césaire.

Following the visit, Mr. Roy became interested in Mr. Laperle's system and decided, through Hydro LMR, to purchase land in Saint Alphonse de Granby, in the province of Quebec, to build a triplex and install an improved version of Mr. Lapierre's system.

[11] To this end, Hydro LMR created a project called "Study and Analysis of a Thermal Storage System"

Field of Science/Technology:

Applied mechanics (2.03.02)

Project Details:

Intended Results:	Improve existing processes
Work locations:	Commercial Facility, Research Facility
Key Employees:	Andre Roy (ACBK) (Unknown - TECHNICAL BACKGROUND NOT DISCLOSED (2000) / Presdient)
Evidence types:	Test protocols, test data, analysis of test results, conclusions; Records of resources allocated to the project, time sheets; Samples, prototypes, scrap or other artefacts; Project planning documents; Photographs and videos; Design of experiments; Records of trial runs

Scientific or Technological Advancement:

Uncertainty #1: Technological uncertainty

[28] According to Mr. Roy, in order to design his “life-size” prototype, he used Mr. Laperle's notes and patent. However, he identified a major design problem in Mr. Laperle's system. According to him, the temperature of the water in the tanks was not adequate; it was way too cold and freezing.

This prevented the pump that was used to transport water to the solar panels installed on the roof of the building from working properly. Still according to Mr. Roy, the causes of the problem were the size of the tanks, the absence of a probe to measure the temperature and the programming of the control panel.

[29] Mr. Roy testified that when designing his system, he faced two technological uncertainties, namely the size of the water tanks and the temperature of the water they contained.

The most significant underlying key variables are:

tank size (unresolved), water temperatures (unresolved), basin orientations (unresolved)

Technology or Knowledge Base Level:

Benchmarking methods & sources for citings:

Benchmark Method/Source	Measurement	Explanatory notes
Patent searches	1 patents	work aims to improve on existing patented process

Activity #1-1: Activity 1 (Fiscal Year 2023)

Methods of experimentation:

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

[26] In this case, in order to be able to install an improved version of Mr. Laperle's hydrodynamic system on the triplex, Mr. Roy first purchased Mr. Laperle's patent for the system. He also used Mr. Laperle's handwritten notes to design and install this second prototype of the triplex hydrodynamic system.

Before construction of the triplex began, Mr. Roy met with Daniel Rousse (“Mr. Rousse”), researcher holding the Industrial Research Chair in Energy and Efficiency at the École de technologie supérieure (“ÉTS”), to to carry out a numerical simulation of its system. After this meeting, Mr. Roy obtained the ÉTS report with the results of the simulation. Subsequently, Mr. Roy decided to build a “life-size” prototype of his system, which he integrated into the triplex.

[27] The system designed by Mr. Roy included, among other things, solar panels installed on the roof of the building, concrete water tanks filled with gravel buried under the concrete floor of the basement of the building, a heat pump , a radiant floor system, a control panel (computer) and probes to measure the water temperature in the tanks.

[29] Mr. Roy testified that when designing his system, he faced two technological uncertainties, namely the size of the water tanks and the temperature of the water they contained.

In order to solve these problems, with the help of the data contained in the ÉTS report, Mr. Roy changed the size of the pools and installed probes to measure the temperature as well as additional valves. He therefore changed the size of the basins used by Mr. Laperle, in addition to inserting the smaller of the two basins inside the larger one.

In addition, he installed a third basin (a conventional water heater) outside the building and connected it to the system. Finally, he also installed and programmed the control panel which also controls the water pump.

According to Mr. Roy, these uncertainties could not be eliminated using standard procedures or standard techniques.

Results:

CRA arguments:

[31] In addition, according to Mr. Desmarais' testimony, Mr. Roy used known thermodynamic principles to measure energy exchanges in a system. Still according to Mr. Desmarais, it was possible to measure the heat exchanges between the basins and to model the system envisaged by using equations and mathematical concepts known at the time in order to estimate the adequate dimensions of the basins. A scale model could also have been used to test it.

[32] Finally, Mr. Desmarais also indicated that Mr. Laperle's patent referred to other prior patents relating to thermal storage, which enabled him to conclude that there were systems similar to the one designed by Hydro LMR since the 1980s.

Project Name:	ACBK Thermal Storage LOSS	**Start Date:**	2023-03-01
Project Number:	2303	**Completion Date:**	2023-10-31

Conclusion:

JUDGES RULING & RATIONALE:

[30] The evidence shows that Mr. Roy used standard techniques to try to resolve the two technological uncertainties he was facing. During his testimony, Mr. Roy did not describe precisely the techniques he used to try to overcome these uncertainties, whether during the design or the construction of his system.

The evidence does not show that the modification of the sizes of the pools, the installation of probes for measuring the temperature, the installation of valves and the design and installation of the control panel required the use of practices which were not not commonly used at the time.

[33] The appellant has not demonstrated that the technological uncertainties faced by Hydro LMR during the design and installation of its hydrodynamic system could not be eliminated by current techniques or by usual procedures.

The Court concludes that Mr. Roy used standard techniques to try to resolve the two uncertainties he faced.

[34] Consequently, the Court concluded that the activities ... do not constitute SR&ED activities within the meaning of the ITA.

AUTHORS NOTE - POTENTIAL STEPS ON HOW TO TURN THIS JUDGEMENT INTO A WIN

- Get expert opinions or testimony - e.g. testimony from Marc Brunet (“Mr. Brunet”), of the Center de recherche industrielle du Québec (“CRIQ”), who had contacted Mr. Roy to to ask him if he could improve Mr. Laperle's system.

- perform more detailed prior art review - for example review of initial patent & correlation of current analysis to issues cited

Documentation:

Offline Documents: docs

Project Name:	Mold Leaders Mold designs LOSS	**Start Date:**	2023-04-01
Project Number:	2304	**Completion Date:**	2023-10-31

Project Details:

Scientific or Technological Objectives:

Measurement	Current Performance	Objective	Has results?
units before misalignment (cycles)	200	10000	No
Hardness (hrc)	40	55	No

This project description is based on the Tax Court of Canada judgment of MOLD LEADERS INC., Appellant, and HIS MAJESTY THE KING, Respondent Citation: 2023 TCC 127, Date: August 21, 2023, Docket: 2019-3354(IT)G

[9] Mr. David Duong was the primary witness for the appellant, ML. He is ML's owner and president. I found him knowledgeable and credible. He testified in English - his fourth language. Following high school, he graduated from a two-year mechanical technician program at Humber College in Toronto. He there learned CAD/CAM design and CNC machining.

[10] CAD/CAM means computer-aided design and computer-aided manufacturing. CNC means computer numerical control machining. Mr. Duong worked for five years with a company that introduced him to mold making, and where he became head of the CNC machining department.

[11] He moved from there to a newly established company that grew quickly in the business of mold making. In turn, in 2002 this prompted Mr. Duong to start his own mold maker company, being the appellant, ML.

[52] ML called one other witness, being Mr. Amit Saini. He is a professional engineer and certified professional accountant. Also, he is president of National R&D Inc. (National R&D). Neither he nor National R&D had any involvement with the subject projects while being worked on by ML.

The Eight Projects:

ML spent much time in high- precision machining in the making of molds and related items. In the relevant years of 2016 and 2017, ML engaged in approximately 320 projects brought to it by customers. The projects were not carried on with SRED in mind. But, subsequently eight of these projects were claimed for SRED and are at issue in this appeal.

For illustrative purposes we will examine the first of the 8 projects then summarize the basis for judges denial of the claim.

Project 1: this project commenced with a 2016 contract ML had with a customer, Dynaplas, for ML to design and make a 4-cavity mold for production of a particular valve for use in anti-lock braking systems in the automotive industry.

[16] The mold was to open and eject the part once solidified. Initially H13 steel was used for making the mold. The part was plastic but hardened with 30 percent glass, which made the plastic harder than ML was used to. The first mold made with H13 steel was not acceptable. The customer's testing of the mold revealed that it misaligned after a short period. After further work ML and Dynaplas agreed that W360 steel be used, having a higher hardness rating than H13 steel. ML did not itself have experience with W360 steel. ML obtained the W360 steel from a European company.

Field of Science/Technology:

Materials engineering & metallurgy (2.05.01)

Project Details:

Intended Results:	Develop new processes
Work locations:	Commercial Facility
Key Employees:	David Duong (Mold Leaders) (CNC machining - mechanical technician (2000) / President)

Project Name:	Mold Leaders Mold designs LOSS	**Start Date:**	2023-04-01
Project Number:	2304	**Completion Date:**	2023-10-31
Evidence types:	Design of experiments; Test protocols, test data, analysis of test results, conclusions; Records of resources allocated to the project, time sheets; Samples, prototypes, scrap or other artefacts; Photographs and videos; Records of trial runs		

Scientific or Technological Advancement:

Uncertainty #1: Technological uncertainty

[17] ML had to learn to work with W360 steel, with which it was unfamiliar. W360 steel was harder to cut and grind, i.e. mill. Ultimately, eight versions of the mold were tested by the customer (not ML) and sent back to ML six times with comments for improvement. Ultimately, a mold was accepted.

Technology or Knowledge Base Level:

Benchmarking methods & sources for citings:

Benchmark Method/Source	Measurement	Explanatory notes
Internet searches	1 Articles	examples of key issues in machining hard metals

Activity #1-1: Activity 1 (Fiscal Year 2023)

Methods of experimentation:

Method	Experimentation Performed
Physical prototypes:	8 samples

[18] ML's counsel, in his direct examination of Mr. Duong, asked him what ML achieved "in terms of technology" through its work on this project:

Q: But in terms of technology, what did you advance? What did you achieve, what did you advance? [underlining added]

A: So we learned that the hard milling processing is like - - it's just like a science, you put too many - - so many things together then you can achieve it.

Q: Okay. But at the beginning you said you had - - you know, you would be able to go and give it a shot. But how - - what did you anticipate the problems being versus what the problems were? Was it - - how relatively - - how hard was it relative to what you anticipated?

A: We did not expect that we were going though [sic] these issues. It was some kind of - - something is just pulling you, that caught us off guard. But it's the way that we wanted to - - we don't want to keep doing those projects that we are not going anywhere.

So we like to delegate certain jobs that we should take challenges or take a new approach to bring out our experience, so to compete in this (inaudible). So we learned in a hard way, yes, that's what - - have to say that [sic].

Q: You learned the hard way?

A: Yeah.

Results:

The judge noted:

[19] In answering what was achieved, Mr. Duong did not identify a technological advance. Of note also is ML counsel's reference to the ML work as, "all this trial and error".

[54] I note also that as its first witness in this matter ML called an individual seeking his acceptance as an expert witness knowledgeable of the plastic injection molding industry.

A voir dire was conducted on the first day of the hearing into whether he could be accepted as an expert. I rendered an oral decision finding based on the voir dire that the individual did not have sufficient background in the plastic injection molding industry to be qualified as an expert in that industry.

Accordingly, he was not accepted as an expert and his expert report was not admitted into evidence.

Project Name:	Mold Leaders Mold designs LOSS	**Start Date:**	2023-04-01
Project Number:	2304	**Completion Date:**	2023-10-31

Conclusion:

RULING & RATIONALE: LOSS

The judge commented;

[59] Here there was not evidence as to the overall industry state of knowledge in the context of any of the eight projects.

[60] It is pleaded “the Appellant did not identify or encounter any technological uncertainty which could not be removed by the Appellant’s knowledge base”. This assumption was not disproven.

The fact that no evidence was called as to the state of knowledge in the mold making industry generally made it difficult to know if and when a “challenge” for ML did or did not constitute a technological risk or uncertainty.

[61] The above extracts from Mr. Duong’s testimony for the eight projects generally reflect that ML’s success or advancement as to those projects involved a routine engineering and standard practices approach, using methodology familiar to ML.

When he was asked by ML’s counsel for each project what had been achieved or learned, the answers did not reveal or identify technological uncertainties being addressed in a scientific manner.

This is not compatible with technological risk or uncertainty intended in a SRED context. Routine engineering and standard practices includes a trial and error approach, although not a scientific approach of forming and testing hypotheses.

[68] The appeal will be dismissed, with costs. ML did not establish that four of the five requirements for establishing SRED for each of the eight projects were met.

Documentation:

Uploaded to RDBASE.NET: MachinabilityFactors-wp.pdf (385KB)

Offline Documents: docs

Project Name:	Daves Diesel - injector design LOSS	**Start Date:**	2023-05-04
Project Number:	2305	**Completion Date:**	2023-10-31

Project Details:

Scientific or Technological Objectives:

Measurement	Current Performance	Objective	Has results?
remanufacture injectors (number)	0	3	No

This project description is based on the Tax Court of Canada judgment of Dave's Diesel Inc. v. The Queen Date 2022-06-10 Neutral citation 2022 TCC 62 File number 2018-1618(IT)G

The Nature of the Project
[6] The Appellant called Mr. Rushi Dave as its only witness. Mr. Dave was General Manager of the Appellant in 2013 and 2014. He was one of four individuals who worked on the project.

[7] Mr. Dave did not study mechanical engineering and has no degree, certificate or designation in the field. However, he did study business and marketing and worked for a large advertising, marketing, and public relations firm before joining the Appellant 15 years ago.

[8] Mr. Dave's father established the Appellant's business in Brampton, Ontario a decade before starting the project. Although Mr. Dave described the Appellant as a fuel injection shop for the diesel engine industry, it was not a mechanic shop as no mechanics worked there.

[9] Before starting the project, the Appellant remanufactured components of used mechanical fuel injection systems for dealers under warranty programs offered by the manufacturers of the injectors. The Appellant went about remanufacturing components of used mechanical fuel injectors in the following way:

The process was to receive the component from an engine shop, like the dealership, then we would disassemble it, do an assessment of its failures, and then reassemble it with brand new components, and put it on a test stand to recalibrate [it] to [the] provided manufacturer specifications. [3]

[10] By 2007 or 2008, electronic fuel injection systems began to replace mechanical fuel injection systems in diesel engines. The Appellant found itself in difficulty as manufacturers would no longer pay the Appellant to remanufacture components of their used fuel injection systems. Presumably, they wanted their customers to purchase new units as replacements. In any event, the Appellant needed a new source of income.

[11] The Appellant, therefore, set out to find a way to remanufacture injectors on its own. Those injectors were found in diesel-powered trucks, generators, marine equipment, and construction and farm equipment. The Appellant studied three types of injectors as part of the project:

(a) Delphi 4 Pin (an electronic fuel injector used in certain Volvo diesel engines);

(b) C7 (an electronic fuel injector used in certain Caterpillar diesel engines); and

(c) ISX (a mechanical fuel injector used in certain Cummins diesel engines).

Field of Science/Technology:

Mechanical engineering (2.03.01)

Project Details:

Intended Results:	Develop new processes
Work locations:	Commercial Facility
Key Employees:	
Evidence types:	Records of resources allocated to the project, time sheets; Samples, prototypes, scrap or other artefacts; Photographs and videos; Design of experiments; Records of trial runs

Project Name:	Daves Diesel - injector design LOSS	**Start Date:**	2023-05-04
Project Number:	2305	**Completion Date:**	2023-10-31

Scientific or Technological Advancement:

Uncertainty #1: Technological uncertainty

[26] The Appellant says that the relevant “technological uncertainty” was whether it could successfully develop a process to remanufacture the three different types of injectors. [11]

The most significant underlying key variables are:

shim thickness (unresolved), spring pressure (unresolved)

Technology or Knowledge Base Level:

Activity #1-1: Activity 1 (Fiscal Year 2023)

Methods of experimentation:

Method	Experimentation Performed
Trials:	22 runs / samples
Physical prototypes:	3 samples

21] Most of the diary entries are rather concise. The following are some of the more descriptive ones (square brackets indicate the type of injector tested):

January 4, 2013

Broke [Delphi 4 Pin] injector trying to understand how it comes apart.

January 23, 2013

Purchased and tested 12 [C7] cores and found all to be operating differently and having leaks from different sections of injector.

February 25, 2013

Received prototype [C7 adapter] from machine shop and installed. The thinner O ring would not stand up to the pressure and kept breaking.

March 6, 2013

Continued [ISX] trials and documenting results. Not ideal and still not operating as expected. No atomization.

March 15, 2013

Used a thin steel punch and applied pressure from the top of the [Delphi 4 Pin] injector and popped out the terminal insulating sleeve and seal.

.....

September 12, 2013

Run [Delphi 4 Pin] trials with different shim thicknesses.

September 25, 2013

Spring pressure trials [Delphi 4 Pin].

[22] The Appellant also produced a partial record of a single test performed on a C7 injector in 2013 (Exhibit A-2 reproduced at Appendix “A”) and a partial record of a single test performed on the same type of injector in 2014 (Exhibit A 1 reproduced at Appendix “B”).

[23] As Mr. Dave presented his oral evidence, he showed the Court a series of colour photographs illustrating the machines and tools used in the project.

Was a detailed record of the hypotheses, tests, and results kept as the work progressed?
[43] The Appellant has not satisfied its onus to demonstrate that it recorded, in respect of any particular test performed in 2013 and 2014:

(a) the formulation of a hypothesis;

(b) the testing of that hypothesis; and

(c) the modification of that hypothesis in light of the results of the test.

[44] Take the shim thickness test of September 12, 2013 or the spring pressure test of September 25, 2013 as examples.

What shim thicknesses were tested? What were the results of each test? Which shim thicknesses passed the test?

What was the standard selected for passing the test?

For the spring pressure test, what pressures were applied and for how long? What were the results of each test at each pressure and for each duration? At what pressure, and at what point, did each spring fail?

There is no record of the answers to these questions.

Results:

1. Was there a technological risk or uncertainty that could not be removed by routine engineering or standard procedures? The phrase “routine engineering” describes techniques, procedures and data that are generally accessible to competent professionals in the field.

[27] The fact that a small group of non-engineers and non-mechanics, including two unskilled labourers, did not know whether they could remanufacture three types of used fuel injectors tells us nothing about whether it was “technologically uncertain” that those fuel used injectors could have been remanufactured by a competent professional in the field.

[36] An example will illustrate the point. Here is the diary entry for February 25, 2013:

February 25, 2013

Received prototype [C7 adapter] from machine shop and installed. The thinner O ring would not stand up to the pressure and kept breaking.

[37] The hypothesis to be tested might have been: “An O-ring 5 mm. thick should withstand pressure of 50 lb/ft. as effectively as an O-ring 7.5 mm. thick”. That hypothesis would have been the subject of the test. The results of the test would have been recorded and analyzed and modifications made to the hypothesis in light of the test results.

[38] As Justice Sommerfeldt has noted, a hypothesis is “a statement to be tested by an experiment or a trial.” [16]

[39] In respect of any particular test performed in 2013 or 2014, the Appellant has failed to show:

(a) the formulation of a hypothesis (e.g., in respect of the O-ring on February 25, 2013, or the shim thickness on September 12, 2013, or the spring pressure on September 25, 2013, etc.);

(b) the testing of that hypothesis; and

(c) the modification of the hypothesis in light of the results of that test.

Conclusion:

[29] The onus was on the Appellant to demonstrate that it was “technologically uncertain” that the used fuel injectors could have been remanufactured by a competent professional in the field – a mechanical engineer, for example. [13]

[30] But even if I had found the requisite “technological uncertainty”, I would still have no basis on which to decide whether

the steps taken by the Appellant were anything other than “routine engineering” for a competent professional in the field.

There was no evidence that taking a fuel injector apart without breaking it was anything other than “routine engineering” for such a professional. Similarly, there was no evidence that understanding how the fuel injectors worked was anything but “standard procedure” for a competent professional in the field.

Documentation:

- Offline Documents: docs

Project Name:	JEC Distributors - welding LOSS	**Start Date:**	2023-06-01
Project Number:	2306	**Completion Date:**	2023-11-30

Project Details:

Scientific or Technological Objectives:

Measurement	Current Performance	Objective	Has results?
Sensors (per gun vs per cell) (number)	1	12	No

This project description is based on the Tax Court of Canada judgment of JEC Distributors Inc. v. The King Date 2022-12-28 Neutral citation 2022 TCC 170 File number 2019-1422(IT)I

[1] The Appellant is a manufacturer and distributor of products for the auto industry. It primarily focuses on welding products and technology. The Appellant is what is known as a Tier 2 manufacturer.

[2] When the Appellant filed its tax return for its taxation year ending September 30, 2016, it claimed scientific research and experimental development expenditures of $91,537 in respect of three different projects. The Minister of National Revenue denied that claim and the Appellant has appealed.

Testimony
[3] Three of the Appellant's employees testified: Joe Ruggiero, Paul Lichaa, and Bill Dodge. I found each of them to be credible witnesses. They provided very helpful descriptions of the Appellant's work and the work involved in the projects in question.

[4] I also heard the testimony and cross-examination of Jason Sousa from the Canada Revenue Agency. I found him to be a credible witness but his evidence was of little assistance to me.

[8] There are three projects in issue. Each of them relates to the Appellant's resistance welding products.

We will analyze the first of these projects:

C. Project 1
[9] The first project was called the "Data Link Flow Monitor". The Appellant's witnesses explained that the Appellant's welding guns have two welding tips that close over the metal to be welded like a jaw.

[10] During the welding process, the tips become very hot. Water is run through the guns to help cool the tips. It is important that the water is the appropriate temperature and that it flows at an appropriate rate. If the water becomes too warm or stops flowing properly, the welds will not work properly or the tips will fuse to the metal they are welding and be pulled off the guns. In either case, the Appellant's customers will have to shut down their manufacturing lines which will cost the customers time and money.

[11] The purpose of Project 1 was to develop a system of sensors that could be applied to each welding gun to monitor the flow and temperature of the water to that gun.

[12] A welding cell is an area on a manufacturing line containing one or more welding guns. Existing temperature and flow systems measured the water flowing to the entire welding cell. The Appellant believed that a system that monitored each gun individually would allow its customers to pinpoint which gun in the welding cell was causing a problem and thus reduce the amount of shut down time.

Field of Science/Technology:

Materials engineering & metallurgy (2.05.01)

Project Details:

Intended Results: Develop new processes

Project Name:	JEC Distributors - welding LOSS	**Start Date:**	2023-06-01
Project Number:	2306	**Completion Date:**	2023-11-30
Work locations:	Commercial Facility, Research Facility		
Key Employees:			
Evidence types:	Records of resources allocated to the project, time sheets; Samples, prototypes, scrap or other artefacts; Contracts		

Scientific or Technological Advancement:

Uncertainty #1: Technological uncertainty

[13] To gather data from each gun, the Appellant also needed to find a way to connect each welding gun's temperature and flow monitors to the customers' manufacturing computer systems, preferably using Ethernet connections. This presented challenges because different customers operated different systems.

[14] Finally, the Appellant believed that, if it could gather enough data from the welding guns, it could develop algorithms that would help to predict when a problem was going to arise. This would allow the Appellant's customers to anticipate problems and possibly fix them before they happened.

The most significant underlying key variables are:

electrical noise mitigation (unresolved), communication protocols (unresolved)

Technology or Knowledge Base Level:

Benchmarking methods & sources for citings:

Benchmark Method/Source	Measurement	Explanatory notes
Suppliers	1 products	approached supplier of flow monitoring methods

Activity #1-1: Activity 1 (Fiscal Year 2023)

Methods of experimentation:

[15] The witnesses explained that the Appellant tested a number of different sensors to monitor flow and temperature. It kept changing the technologies until it found something that it thought would work not only in the lab but also on the manufacturing line.

[16] After encountering problems with standard flow monitoring technology, the Appellant asked a company with expertise in flow monitoring to develop a custom solution for them. However, it had problems connecting those monitors to the customer's systems because it could not get access to the relevant proprietary software.

Results:

[17] Ultimately, the biggest problem for the Appellant was that there was a lot of electrical noise on the manufacturing line and it interfered with the sensors. This electrical noise is well known to be an issue with resistance welding.

[18] The Appellant also found that the sensors could not withstand the dirt and contamination present in a welding cell.

Finally, there were challenges with communication protocols. The Appellant had problems finding a way of sending so many different signals to and from the welding cell at the same time without slowing down the other communications that need to happen on the line.

[19] To date the Appellant has been unable to overcome any of the above problems

Conclusion:

22] However, it is not enough for the Appellant to prove that it could not remove the risks and uncertainties through routine engineering or standard procedures. The test is an objective test, not a subjective test. The Appellant must show that the risks could not be overcome by routine engineering or standard procedures generally accessible to competent professionals in the field. The Appellant did not do so.

[23] The Appellant's expertise is in welding technology. I have no way of knowing, for example, whether an electrical engineer or even a skilled electrician could have proposed a routine solution to prevent the electric noise from reaching the sensors. Similarly, I have no way of knowing whether a computer engineer or a technician with networking expertise could have employed standard networking procedures to connect the sensors to the Appellant's customers' networks.

[24] Based on all of the foregoing, I find that Project 1 does not meet the first test.

[25] I note that, as the Appellant never proceeded to the stage of attempting to develop algorithms, I have not considered whether that part of Project 1 would have met the first test.

Documentation:

- Offline Documents: docs