PROJECT OUTLINE: INSTRUCTIONS FOR ENTERING DATA

MEUK - suggested SR&ED project description structure

I	**i)**	**State of Existing technology: Benchmarking methods & sources for citings**	**Number of**		***Explanatory notes / results:***
		Internet / Google Searches		internet sites	
		Articles		articles	
		Patent searches		patents	
		Competitive methods		products / processes	
		Similar prior in-house technologies		products / processes	
		Potential components		products	
		Queries to experts		responses	
		Other		___ (specify)	
	ii)	**Objective(s)**			
		Performance measures	Existing benchmark	Units of measure	Performance objective
II)		**Technological Uncertainities**	***Outline top 5 key variables***		
III	**i)**	***for EACH ACTIVITY***	***define fiscal year***		
		Experimentation method	**Number of**		***Explanatory notes: justification of sample size***
	i a)	Analysis / simulation		alternatives	***typically quickest method***
	i b)	Process trials		runs / samples	***typically more time consuming***
	i c i)	Prototypes		samples	***typically most time consuming***
	I c ii)	protoype revisions		revisions	

ii a) **Results - tie to performance objectives in I ii) above**

ii b) **Conclusions - tie to variable(s) in Uncertainties II)**

iii) **Documentation - tie to Activities in III i)**

iv) a) **Costs: labour hours by direct employees - tie to Activities in III i)**
iv) b) **Costs: labour $ via contractor - tie to Activities in III i)**
v) **Costs: materials - consumed or transformed - tie to Activities in III i)**

Project Name:	PROJECT OUTLINE: INSTRUCTIONS FOR ENTERING DATA	**Start Date:**	2009-01-01
Project Number:	100	**Completion Date:**	2011-03-31

Scientific or Technological Objectives:

Measurement	Current Performance	Objective	Has results?
A QUANTIFIABLE OBJECTIVE (#)	1	2	Yes
OBJECTIVE #2 (E.G. COST) ($/UNIT)	100	90	No

THE FIRST STEPS OF THE DOCUMENTATION PROCESS ARE TO;
- ATTEMPT TO DESCRIBE THE OVERALL THE OBJECTIVES IN FEW SENTENCES &
- QUANTIFY OBJECTIVE VS. CURRENT PERFORMANCE

QUANTIFICATION:
THE TAX COURT'S CONTINUALLY REITERATE THE FACT THAT,
"SYSTEMATIC INVESTIGATION MUST INVOLVE EXTREMELY ACCURATE MEASUREMENTS AND SUBSEQUENT ANALYSIS OF THOSE MEASUREMENTS,"

SO WE SHOULD ATTEMPT TO PROVIDE SUCH EVIDENCE WHENEVER POSSIBLE.
QUANTIFIABLE OBJECTIVES COULD INCLUDE; COST, PERFORMANCE, SIZE RESTRICTIONS, ETC.

NOTE: ONCE YOU FILE A CLAIM YOU CAN EMPOWER THE CANADA REVENUE AGENCY (CRA) REVIEWERS WITH ONLINE ACCESS TO SUPPORTING DOCUMENTS & COSTS ONLINE VIA WWW.RDBASE.NET

THIS WILL ALLOW THEM TO QUICKLY ASSESS WHAT INFORMATION MAY BE REQUIRED TO COMPLETE THE REVIEW.

SEE WHAT THE REVIEWER MIGHT SEE BY "LOGGING" IN AS:
USERNAME: CRA@RDBASEDEMO
PASSWORD: 09REVIEWER [ALL CAPITAL LETTERS]

Technology or Knowledge Base Level:

Benchmarking methods & sources for citings:

- Internet searches: 1 sites / articles -- LIST ANY RELEVENT "ARTICLES" OR REPORTS
- Patent searches: 2 patents -- NOT COMMON HOWEVER, IF DONE WE SHOULD SPECIFY SINCE STRONG EVIDENCE
- Competitive products or processes: 3 products -- IDENTIFY LIMITS + IF COMPETITORS HAVE DEVELOPED TECHNOLOGY CLARIFY "METHOD" NOT AVAILABLE TO US
- Similar prior in-house technologies: 4 products / processes -- THIS IS GREAT FOR BENCHMARKING (QUANTIFYING) EXISTING PERFORMANCE LIMITS AND PROBLEMS
- Potential components: 5 products -- OFTEN SUPPLIERS CAN TELL YOU HOW THEIR PRODUCTS MAY PERFORM & PROVIDE GUIDANCE
- Queries to experts: 6 responses -- EXPERT OPINIONS ON THE LIMITS OF TECHNOLOGY INDICATE PROJECTS ARE ELIGIBLE

ARE WE "THINKING OUTSIDE THE BOX"?

THE CRA CLARIFIES THAT;
“COMMONLY AVAILABLE SOURCES OF KNOWLEDGE OR EXPERIENCE ARE THOSE THAT CAN
- REASONABLY BE ASSUMED TO BE
- READILY AVAILABLE TO THOSE WITH BASIC TRAINING OR EXPERIENCE IN THE FIELD OF CONCERN.

THESE RESOURCES ENABLE THEM TO BE SUFFICIENTLY QUALIFIED TO PARTICIPATE IN SR&ED.
THEY ALSO INCLUDE;
- KNOWLEDGE THAT IS AVAILABLE IN THE BUSINESS CONTEXT OF THE FIRM...
- [HOWEVER]...AN ENTERPRISE MAY NOT HAVE
  - PRACTICAL ACCESS TO INFORMATION PROPRIETARY TO A COMPETITOR,
  - OR KNOWN IN SPECIALIST OR ACADEMIC CIRCLES.” [CRA IC 86-4R3 GLOSSARY]

THE GOAL IS TO SHOW THAT;
- REASONABLE STEPS WERE TAKEN TO ENSURE THAT
- THE "METHOD" TO OBTAIN THE OBJECTIVE(S) WAS NOT "READILY AVAILABLE."

WE PROPOSE THAT THE LIST ABOVE REPRESENTS THE MOST COMMON METHODS THAT RESEARCHERS USE TO
- "BENCHMARK" EXISTING KNOWLEDGE
- BEFORE EMBARKING ON DEVELOPMENT PROJECTS.

THE RESULTS OF THIS SEARCH WILL THEN HELP TO DEFINE THE PROJECT'S TECHNOLOGICAL;
- OBJECTIVES &
- RELATED TECHNOLOGICAL UNCERTAINTIES.

Field of Science/Technology:

Mechanical engineering (2.03.01)

Project Details:

Intended Results:	Develop new processes, Develop new materials, devices, or products, Improve existing processes, Improve existing materials, devices, or products
Work locations:	Analysis, Commercial Facility
Key Employees:	Nick Tesla (Electrical technology - CET (2002) / Research Associate), Al Einstein (Physics - PhD. (1938) / Lead Researcher), Isaac Newton (Mechanical engineering - M.Asc. (1974) / Research Manager)
Evidence types:	Project planning documents; Progress reports, minutes of project meetings; Test protocols, test data, analysis of test results, conclusions; Records of resources allocated to the project, time sheets; Samples, prototypes, scrap or other artefacts; Design, system architecture and source code; Project records, laboratory notebooks; Photographs and videos; Design of experiments; Records of trial runs; Contracts

Scientific or Technological Advancement:

Uncertainty #1: Technological Uncertainty - e.g. Equipment variables

THE CRA CLARIFIES THAT;

“SCIENTIFIC OR TECHNOLOGICAL UNCERTAINTY MAY OCCUR IN EITHER OF TWO WAYS:

[SCIENTIFIC UNCERTAINTY] IT MAY BE UNCERTAIN WHETHER THE GOALS CAN BE ACHIEVED AT ALL ; OR

[SYSTEM UNCERTAINTY] THE TAXPAYER MAY BE FAIRLY CONFIDENT THAT THE GOALS CAN BE ACHIEVED, BUT MAY BE UNCERTAIN WHICH OF SEVERAL ALTERNATIVES (I.E.,
- PATHS,
- ROUTES,
- APPROACHES,
- EQUIPMENT CONFIGURATIONS,
- SYSTEM ARCHITECTURES,
- CIRCUIT TECHNIQUES, ETC.)

- WILL EITHER WORK AT ALL, OR
- BE FEASIBLE TO MEET THE DESIRED SPECIFICATIONS OR COST TARGETS, OR
- BOTH OF THESE…

WORK ON COMBINING STANDARD TECHNOLOGIES, DEVICES, AND/OR PROCESSES IS ELIGIBLE IF
- NON-TRIVIAL COMBINATIONS OF ESTABLISHED (WELL-KNOWN) TECHNOLOGIES AND
- PRINCIPLES FOR THEIR INTEGRATION CARRY A MAJOR ELEMENT OF TECHNOLOGICAL UNCERTAINTY;
- THIS MAY BE CALLED A "SYSTEM UNCERTAINTY.” IC-86R3 PARA. 2.10.2

IDENTIFYING KEY VARIABLES:
FROM A CLAIM PERSPECTIVE WE HAVE FOUND THAT THE MOST SUCCESSFUL CLAIMS ARE THOSE THAT OUTLINE SOME FORM OF "TEST MATRIX" TO LIST THE TOP 3-5, "KEY VARIABLES OF UNCERTAINTY."

EFFECTS ON PROJECT STRUCTURE:
ONCE THE DEVELOPMENT TEAM MEMBERS AGREE ON THE;
- OBJECTIVES (SQUARE) &

- UNCERTAINTIES (TRIANGLES) EACH TEAM MEMBER CAN DOCUMENT HIS OR HER OWN
- ACTIVITIES (CIRCLES).

The most significant underlying key variables are:
VARIABLE #1 - e.g. component selection,
VARIABLE #2 - e.g. component layout,
VARIABLE #3 - e.g. controlling interference

Activity #1-1: Changes to the Equipment (Fiscal Year 2008)

Methods of experimentation:

- **Analysis / simulation**: 2 alternatives - **METHOD 1** - "ANALYSIS OR SIMULATION" TEND TO BE THE **"LEAST"** TIME INTENSIVE "METHODS" OF EXPERIMENTATION.
  - FOR EXAMPLE EACH ALTERNATIVE MAY TAKE 1 MAN-HOUR TO SIMULATE OR ANALYZE.

- **Process trials:** 9 runs / samples - **METHOD 2** - ACTUAL "PROCESS TRIALS" TEND TO BE A **"MODERATELY"** TIME INTENSIVE "METHOD" OF EXPERIMENTATION.
  - FOR EXAMPLE EACH ALTERNATIVE MAY NOW TAKE 10 MAN-HOURS TO TEST ON THE FACTORY FLOOR.

- **Physical prototypes**: 5 samples (with 3 revisions) - **METHOD 3** - DEVELOPMENT OF "NEW PROTOTYPES" TENDS TO BE THE "**MOST" TIME INTENSIVE "METHOD"** OF EXPERIMENTATION.
  - FOR EXAMPLE EACH PROTOTYPE ALTERNATIVE MAY NOW TAKE 1,000 MAN-HOURS TO DESIGN, FABRICATE, TEST AND REMODIFY UNTIL COMPLETE.

PROVIDING THE CRA WITH DETAILS ON
- THE NUMBER OF VARIATIONS CONTEMPLATED (5, 50, 500)
- IF DIFFERENT, HOW SO AND WHY?

WILL ALLOW THE CRA REVEIWERS TO
- VERIFY THAT THE ANSWER WAS NOT READILY APPARENT &
- JUDGE THE "GROSS REASONABLENESS" OF THE RELATED COSTS BEING CLAIMED.

Results:

- A QUANTIFIABLE OBJECTIVE: 1.5 # (50% of objective) -- USERS CAN TRY TO PROVIDE A BRIEF EXPLANATION ON THE "RESULTS" FOR "EACH OBJECTIVE."

GENERALLY SPEAKING IF THERE WERE QUANTIFIABLE RESULTS WE WOULD CLARIFY WHAT WAS ACHIEVED VS. THE OBJECTIVE.

IF THE TESTS WERE INCOMPLETE OR UNSUCCESSFUL WE COULD CLARIFY WHAT FURTHER WORK MAY BE CONTEMPLATED.

Conclusion:

THE CRA CLARIFIES THAT;
"THE SEARCH FOR A MEANINGFUL ADVANCE …
IS SATISFIED WHETHER OR NOT THE ACTIVITY IS SUCCESSFUL.
IN OTHER WORDS, **DETERMINING THAT A HYPOTHESIS IS INCORRECT** ALSO REPRESENTS A SCIENTIFIC OR **TECHNOLOGICAL ADVANCE**." [CRA IC 86-4R3 PARA 2.12]

AN IDEAL DESCRIPTION WOULD;
- PROVIDE CONCLUSIONS ON EACH OF THE STATED VARIABLES OF UNCERTAINTY &
- ATTEMPT TO EXPLAIN ANY UNEXPECTED RESULTS.

Most significant variables concluded on: VARIABLE #1 - e.g. component selection, VARIABLE #2 - e.g. component layout, VARIABLE #3 - e.g. controlling interference

Technical Documents:

- LIST &/OR UPLOAD ANY OF THE 12 EVIDENCE TYPES [LISTED IN "PROJECT DETAILS"]
- What is SR&ED brochure

SR&ED Stage 0.1 - MEUK Brochure - What is SR&ED (2 pages).pdf -- 280199 bytes

Uncertainty #2: Process

NOTE: THE TECHNOLOGICAL UNSERTAINTIES CAN BE IDENTIFIED AT THE
- PRODUCT &/OR
- PROCESS LEVEL.

The most significant underlying key variables are:

VARIABLE #1, VARIABLE #2, VARIABLE #3

Activity #2-1: Influence of moulding process parameters (Fiscal Year 2008)

Methods of experimentation:

- Analysis / simulation: 2 alternatives
- Process trials: 3 runs / samples
- Physical prototypes: 4 samples (with 5 revisions)

Results:

- A QUANTIFIABLE OBJECTIVE: 1.9 # (90% of objective) -- ADDITIONAL COMMENTS REGARDING RESULTS

Conclusion:

Most significant variables concluded on: VARIABLE #1, VARIABLE #2, VARIABLE #3

Activity #2-2: Influence of moulding process parameters - continued (Fiscal Year 2009)

Methods of experimentation:

- Analysis / simulation: 3 alternatives
- Process trials: 5 runs / samples
- Physical prototypes: 4 samples (with 2 revisions)

[THE ACTIVITY CONTINUED INTO THE NEXT FISCAL YEAR. PLEASE CONTINUE WITH DESCRIBING THE WORK PERFORMED]

Results:

- A QUANTIFIABLE OBJECTIVE: 2.1 # (110% of objective) -- ADDITIONAL COMMENTS FOR RESULTS

Conclusion:

Most significant variables concluded on: VARIABLE #1, VARIABLE #2, VARIABLE #3

Key Criteria Summary

R&D Base demo

100 - PROJECT OUTLINE: INSTRUCTIONS FOR ENTERING DATA

Benchmarks:
Internet searches: 1 sites / articles
Patent searches: 2 patents
Competitive products or processes: 3 products
Similar prior in-house technologies: 4 products /
Potential components: 5 products
Queries to experts: 6 responses

Objectives:
A QUANTIFIABLE OBJECTIVE: 2 #
OBJECTIVE #2 (E.G. COST): 90 $/UNIT

Uncertainty: 1 - Technological Uncertainty - e.g. Equipment variables

Key Variables: VARIABLE #1 - e.g. component selection, VARIABLE #2 - e.g. component layout, VARIABLE #3 - e.g. controlling interference

Activity	Testing Methods	Results - % of Objective	Variables Concluded	Hours	Materials $	Subcontractor $	Fiscal Year
1 - Changes to the Equipment	Analysis / simulation: 2 alternatives Process trials: 9 runs / samples Physical prototypes: 5 samples ... prototype revisions: 3 revisions	A QUANTIFIABLE OBJECTIVE: 1.5 # (50 %)	VARIABLE #1 - e.g. component selection VARIABLE #2 - e.g. component layout	250.00	3,195.00	1,540.00	2008

Uncertainty: 2 - Process

Key Variables: VARIABLE #1, VARIABLE #2, VARIABLE #3

Activity	Testing Methods	Results - % of Objective	Variables Concluded	Hours	Materials $	Subcontractor $	Fiscal Year
1 - Influence of moulding process parameters	Analysis / simulation: 2 alternatives Process trials: 3 runs / samples Physical prototypes: 4 samples ... prototype revisions: 5 revisions	A QUANTIFIABLE OBJECTIVE: 1.9 # (90 %)	VARIABLE #1 VARIABLE #2 VARIABLE #3	130.00	1,563.00	3,059.00	2008
2 - Influence of moulding process parameters - continued	Analysis / simulation: 3 alternatives Process trials: 5 runs / samples Physical prototypes: 4 samples ... prototype revisions: 2 revisions	A QUANTIFIABLE OBJECTIVE: 2.1 # (110 %)	VARIABLE #1 VARIABLE #2 VARIABLE #3	125.00	1,400.00	2,999.15	2009

Agriculture - Plant breeding

Scientific or Technological Objectives:

Measurement	Current Performance	Objective	Has results?
Yield improvement (%)	90	100	Yes
Lodging resistance improvement (%)	0	10	Yes
Maintain disease resistance (%)	100	100	Yes
Reduce cost ($ per Kilo)	5	4.5	Yes
maintain time of maturity (days)	45	45	Yes

[NOTE: THIS EXAMPLE IS REPRODUCED FROM THE CRA PLANT BREEDING SEED INDUSTRY SR&ED GUIDANCE PAPER. A COMPLETE COPY OF THIS PAPER IS AVAILABLE FROM THE CANADA REVENUE AGENCY WEBSITE AT WWW.CRA-ARC.GC.CA/TAXCREDIT/SRED/MENU-E.HTML]

The objectives of this plant breeding project are to develop soybean cultivars, for the 2600 to 3000 heat unit areas of Eastern Canada, that offer the following improvements over existing cultivars:
- 10% improved yield over currently available cultivars
- 10% improved lodging resistance over currently available cultivars
- no sacrifice of resistance to leaf disease(s) or Phytophthora root rot.

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YOU CAN SEE WHAT THE REVIEWER MIGHT SEE BY LOGGING IN AS: USERNAME: CRA@RDBASEDEMO, PASSWORD: 09REVIEWER [ALL CAPITAL LETTERS]

Technology or Knowledge Base Level:

Benchmarking methods & sources for citings:
- Internet searches: 18 sites / articles -- Insufficient info
- Patent searches: 2 patents -- examined cultivar techniques from 2 US patents - not applicable due to climate differences
- Competitive products or processes: 14 products -- examined genetic composition of 14 competitive cultivars
- Similar prior in-house technologies: 23 products / processes -- Prior cultivars

a) Initial Standard Practice(s):
Soybeans are typically accompanied by maturity delays or increased susceptibility to lodging and disease(s).

b) Departure(s) from Standard Practice(s):
The scientific/technological advancement expected in this plant-breeding project is the development of a new cultivar that embodies the genetic traits for higher yield and resistance to lodging in a genotypic combination that surpasses the performance features of existing cultivars without compromising disease resistance.

[AUTHOR'S NOTE: IDEALLY, THE TAXPAYER WOULD ATTEMPT TO IDENTIFY THE SPECIFIC METHODS OR VARIABLES WHICH CREATE THE PERCEIVED LIMITATIONS WITH RESPECT TO OBTAINING THE STATED OBJECTIVE(S).]

Field of Science/Technology:

Agriculture (4.01.01)

Project Details:

Intended Results:	Develop new processes, Develop new materials, devices, or products
Work locations:	Research Facility, Commercial Facility
Key Employees:	John Deer (Agriculture - Ph.D. (1981) / Researcher), Mark Seed (Biological Science - B.Sc. (1995) / Researcher), Lou Pasteur (Chemistry - BSc. (1996) / Research Associate)
Evidence types:	Project records, laboratory notebooks; Test protocols, test data, analysis of test results,

conclusions; Records of trial runs

Scientific or Technological Advancement:

Uncertainty #1: Trait isolation combination

The scientific/technological uncertainty relates to the feasibility of combining the desirable genetic traits from different germplasm sources into a superior performing cultivar out of thousands of possible segregating genotypic outcomes resulting from hundreds of crosses.

Need to evaluate the genome-wide gene expression profiles of various cell lines:
(xx) genotypes,
(yy) or
(zz) genotypes.

Determination of genes determines yield vs early maturity.

The most significant underlying key variables are:

optimal methods to transfer genes, genotypes (xx), genotypes (yy), genotypes (zz)

Activity #1-1: Experimental crosses (Fiscal Year 2008)

Methods of experimentation:

- Process trials: 9770 runs / samples - Total number of crosses/lines, as outlined below.

During the current taxation year, the following work was undertaken and progress attained included:

120 new parental crosses were made in the nursery

4500 F3 lines meeting our selection criteria from the 2008 crosses were advanced to F6 by single seed descent using winter nurseries

5000 F6 Lines originating from the 2007 crosses were tested in preliminary yield trials at 2 locations and 200 selected that met the criteria for further advancement

150 advanced lines from the 2006 crosses were tested in advanced trials in 4 locations and 6 elite performers selected for wide area testing

[AUTHOR'S NOTE: IDEALLY, WE WOULD ALSO EXPLAIN "WHY" ANY OF THE ABOVE DECISIONS WERE MADE.]

Results:

- Yield improvement: 95 % (50% of objective)
- Lodging resistance improvement: 8 % (80% of objective)
- Reduce cost: 4.9 $ per Kilo (20% of objective)
- maintain time of maturity : 45 days (100% of objective)

Conclusion:

The enhanced yield trait was more successfully transferred from (xx) genotypes than from (yy) or (zz) genotypes

There was a negative correlation between yield and early maturity (i.e. < 2900 heat units)

Five lines yielded at least 5% above commercial check varieties, with improved lodging and acceptable disease resistance.

[AUTHOR'S NOTE: IDEALLY, WE WOULD COMPARE RESULTS TO INITIAL EXPECTATIONS AND PROVIDE EXPLANATIONS OR "CONCLUSIONS," FOR RESULTS THAT WERE UNEXPECTED AT THE OUTSET OF THE WORK. THESE "CONCLUSIONS" ARE MORE RELEVANT TO DETERMINING SR&ED ELIGIBILITY THAN MERELY LISTING THE "RESULTS" (I.E. WHETHER THE END PRODUCT ITSELF WAS SUCCESSFUL).]

Supporting information must be generated over the course of the work to demonstrate a systematic experimental investigation in SR&ED. The type of records required would be those that would normally be generated in the course of undertaking plant breeding.

As a guideline, some examples of the kinds of supporting information that should be available for on-site review by the Canada Revenue Agency (CRA) may include the following:
1) background literature related to a project objectives and plan
2) record of genetic crosses
3) nursery data books
4) records of field trials
5) notes on experimental procedures
6) project note books and/or quantitative measurement data
7) results of statistical analyses
8) any other relevant material/information (e.g. photos) that substantiates the SR&ED work

Most significant variables concluded on: genotypes (xx), genotypes (yy), genotypes (zz), optimal methods to transfer genes

Technical Documents:

- Lit. Review on Soybean genetics

Soybean_Research_Report.pdf -- 262486 bytes

- Advanced line test results

Soybean_Test_Results.xls -- 44032 bytes

Uncertainty #2: Maintain disease resistance

Additionally, scientific uncertainty relates to the feasibility of achieving this result without sacrificing disease resistance, which is often compromised with yield improvements.

The most significant underlying key variables are:

disease resistance, yield

Activity #2-1: Disease testing (Fiscal Year 2009)

Methods of experimentation:

- Process trials: 40 runs / samples - 5 lines tested at 8 locations.

  5 finished lines originating from the 2007 crosses were tested in pre-commercial trials at 8 locations, and tested in official public registration trials. Official tests will be used to corroborate our disease, quality and performance results and select candidates for registration and commercialization.

Results:

- Lodging resistance improvement: 8 % (80% of objective)
- Maintain disease resistance: 98 % (100% of objective)

Conclusion:

Resistance to soil borne diseases (e.g. Sclerotinia, Alternaria) was influenced more by plant stature (i.e. lodging trait) than the presence of the disease resistance gene itself due to the closer proximity of foliage to the soil in lodged specimens.

[AUTHOR'S NOTE: IDEALLY, WE WOULD COMPARE RESULTS TO INITIAL EXPECTATIONS AND PROVIDE EXPLANATIONS OR "CONCLUSIONS," FOR RESULTS THAT WERE UNEXPECTED AT THE OUTSET OF THE WORK. THESE "CONCLUSIONS" ARE MORE RELEVANT TO DETERMINING SR&ED ELIGIBILITY THAN MERELY LISTING THE "RESULTS" (I.E. WHETHER THE END PRODUCT ITSELF WAS SUCCESSFUL).]

Most significant variables concluded on: disease resistance, yield

Technical Documents:

- Disease Testing results

703 - Agriculture - Plant breeding

Benchmarks:
Internet searches: 18 sites / articles
Patent searches: 2 patents
Competitive products or processes: 14 products
Similar prior in-house technologies: 23 products /

Objectives:
Yield improvement: 100 %
Lodging resistance improvement: 10 %
Maintain disease resistance: 100 %
Reduce cost: 4.5 $ per Kilo
maintain time of maturity : 45 days

Uncertainty: 1 - Trait isolation combination

Key Variables: genotypes (xx), genotypes (yy), genotypes (zz), optimal methods to transfer genes

Activity	Testing Methods	Results - % of Objective	Variables Concluded	Hours	Materials $	Subcontractor $	Fiscal Year
1 - Experimental crosses	Process trials: 9770 runs / samples ... prototype revisions: 5 revisions	Yield improvement: 95 % (50 %) Lodging resistance improvement: 8 % (80 %) Reduce cost: 4.9 $ per Kilo (20 %) maintain time of maturity : 45 days (100 %)	genotypes (xx) genotypes (yy) genotypes (zz) optimal methods to transfer genes	615.00	6,075.00	1,405.45	2008

Uncertainty: 2 - Maintain disease resistance

Key Variables: disease resistance, yield

Activity	Testing Methods	Results - % of Objective	Variables Concluded	Hours	Materials $	Subcontractor $	Fiscal Year
1 - Disease testing	Process trials: 40 runs / samples	Lodging resistance improvement: 8 % (80 %) Maintain disease resistance: 98 % (100 %)	disease resistance yield	580.00	2,295.00	1,200.00	2009

Machinery - improve compounding equipment:

Scientific or Technological Objectives:

Measurement	Current Performance	Objective	Has results?
Temperature variance (Deg C)	5	2	Yes
Output (output/minute)	100	120	Yes
Shear (tons/sq.inch)	10	12	Yes
Improve Dispersivity (mm)	0.5	1	Yes
Maximum cost increase (%)	0	15	Yes

[AUTHOR'S NOTE: THIS DESCRIPTION IS BASED ON THE CRA'S INFORMATION CIRCULAR 94-1: PLASTICS INDUSTRY APPLICATION PAPER, NEW EQUIPMENT, EXAMPLE 2]

[AUTHOR'S NOTE: IDEALLY THE TAXPAYER WOULD ATTEMPT TO QUANTIFY THE OBJECTIVES THEY ARE TRYING TO ACHIEVE. QUANTIFIABLE OBJECTIVES HAVE BEEN ADDED ABOVE, TO ILLUSTRATE.]

This project offers an example of modifying older equipment (the Gelimat) to produce a unique form of compounding equipment with advantages such as:
-high output rates,
-high dispersivity,
-absence of shear,
-ease of cleaning as changes are made from one compound to another, and
-low capital cost relative to conventional systems.

NOTE: ONCE YOU FILE A CLAIM YOU CAN EMPOWER THE CRA REVIEWERS WITH ONLINE ACCESS TO SUPPORTING DOCUMENTS & COSTS ONLINE VIA WWW.RDBASE.NET

YOU CAN SEE WHAT THE REVIEWER MIGHT SEE BY LOGGING IN AS: USERNAME: CRA@RDBASEDEMO, PASSWORD: 09REVIEWER [ALL CAPITAL LETTERS]

Technology or Knowledge Base Level:

Benchmarking methods & sources for citings:

- Internet searches: 33 sites / articles -- Identified 18 articles on mix variation effects on temperature + limits of thermocouples
- Patent searches: 2 patents -- 2 method to use thermocouples for control process - neither applicable our environment
- Potential components: 14 products -- 14 products from 4 different thermocouple suppliers and differences in performance
- Queries to experts: 2 responses -- Spoke with 2 machine designers to identify with respect to control methods

[AUTHOR'S NOTE: IDEALLY THE TAXPAYER WOULD OUTLINE THE CURRENT INDUSTRY STANDARD PRACTICE, AND ATTEMPT TO IDENTIFY THE SPECIFIC METHODS OR VARIABLES WHICH CREATE THE PERCEIVED LIMITATIONS WITH RESPECT TO OBTAINING THE STATED OBJECTIVE(S). EXAMPLE BENCHMARKS HAVE BEEN PROVIDED ABOVE, TO ILLUSTRATE.]

Field of Science/Technology:

Applied mechanics (2.03.02)

Project Details:

Intended Results:	Improve existing materials, devices, or products
Work locations:	Analysis, Lab, Research Facility, Commercial Facility
Key Employees:	Al Nobel (Chemical Engineering - P.Eng. (1989) / Research Associate), Al Einstein (Physics - PhD. (1938) / Lead Researcher), Nick Tesla (Electrical technology - CET (2002) / Research Associate)
Evidence types:	Design of experiments; Project records, laboratory notebooks; Progress reports, minutes of project meetings; Test protocols, test data, analysis of test results, conclusions

Scientific or Technological Advancement:

Uncertainty #1: Temperature Control

Although mechanical development such as changes in the angles of the rotating blades and increased speed permitting timely fluxing of most plastics without any external application of heat has been explored, uncertainty remained as to practical ways to sense and control the temperature. A fraction of a second too long near the fluxing point could lead to an increase of over 50ºC, and hence the potentially catastrophic degradation of plastics such as P.V.C.

The most significant underlying key variables are:

optimal measurement devices, device locations, vibration - locations and intensity (unresolved)

Activity #1-1: Thermocouples (Fiscal Year 2008)

Methods of experimentation:

- Analysis / simulation: 12 alternatives - Examined 12 alternate configurations of Thermocouples & vibration techniques
- Process trials: 36 runs / samples - Performed 3 runs at differing pressures for each of the 12 alternate configurations

All trials were recorded in a test matrix.

[NOTE: THE DESCRIPTIONS PROVIDED IN THE CRA'S EXAMPLE DID NOT INCLUDE SUFFICIENT DETAILS ABOUT TESTING PERFORMED. THE DATA ABOVE (# TRIALS/ALTERNATIVES) IS PROVIDED TO ILLUSTRATE SOME OF THE ADDITIONAL DETAILS THAT WOULD IDEALLY BE INCLUDED.]

Results:

- Temperature variance: 4 Deg C (33% of objective)
- Output: 100 output/minute (no improvement)
- Shear: 50 tons/sq.inch (2000% of objective)
- Improve Dispersivity: 0.6 mm (20% of objective)

Conclusion:

Attempts at control by techniques such as by vibration and by thermocouples proved inadequate.

[AUTHOR'S NOTE: IDEALLY THE TAXPAYER WOULD ATTEMPT TO QUANTIFY SOME OF THE INTER-RELATIONS WHICH WERE OBSERVED AND ANY RELATED TECHNICAL CONCLUSIONS TO EXPLAIN THESE RESULTS.]

Most significant variables concluded on: device locations, optimal measurement devices

Technical Documents:

- Test data

New words for 2009.doc -- 30720 bytes

- AUTHOR'S NOTE: USERS CAN UPLOAD ANY FORM OF DOCUMENT TO R&DBASE

Memo - Thermocouple tests.doc -- 19456 bytes

- Vibration & thermocouple test results from 140 samples June 11-22

Activity #1-2: Fibre Optic system (Fiscal Year 2008)

Methods of experimentation:

- Analysis / simulation: 6 alternatives - Identified a potential system using fibre optics.
- Process trials: 90 runs / samples - Performed 5 runs and compared measurements under differing pressures (90 - 120 PSI) , temperatures (45-55 Deg. C) and 5 deployment locations.
- Physical prototypes: 1 samples (with 2 revisions)

[AUTHOR'S NOTE: THE DESCRIPTIONS BELOW WERE PROVIDED IN THE CRA'S EXAMPLE. THE DATA ABOVE (# TRIALS/ALTERNATIVES) IS PROVIDED TO ILLUSTRATE SOME OF THE ADDITIONAL DETAILS THAT WOULD IDEALLY BE INCLUDED.]

Eventually, the development of a (patented) glass fibre-optics temperature-control system based upon sensing at millisecond. Intervals of the infrared radiation given off by the material as it was heated permitted the fine temperature control (+/- 2 C) to process even P.V.C. to within a few degrees of its degradation temperature.

[AUTHOR'S NOTE: IDEALLY THE TAXPAYER WOULD FURTHER ATTEMPT TO ILLUSTRATE A "HYPOTHESIS, DESIGN, TEST, & MODIFY" CYCLE RELATED TO THE ABOVE EXPERIMENTATION.]

Results:

- Temperature variance: 1 Deg C (133% of objective) -- tolerance proved achievable only via fibre optic system
- Output: 112 output/minute (60% of objective)
- Shear: 13 tons/sq.inch (150% of objective)
- Improve Dispersivity: 0.9 mm (80% of objective)
- Maximum cost increase: 20 % (133% of objective)

Conclusion:

This new mixing technology proved successful for the compounding of P.V.C. and other shear-sensitive and/or temperature-sensitive plastics.
[NOTE: AN IDEAL TECHNICAL DESCRIPTION WOULD INCLUDE A CONCLUSION DISCUSSING WHAT WAS LEARNED FROM THE EXPERIMENTATION AND RELATE IT TO THE UNCERTAINTY.]

Most significant variables concluded on: device locations, optimal measurement devices

Technical Documents:

- Test matrix - temp vs. pressure vs. location

New words for 2009.doc -- 30720 bytes

- Testing Fibre Optics

Copy of Fibre Optics Test Results.xls -- 15872 bytes

- Notes on possible controllers

Fiber Optic Temperature Control Notes.doc -- 19968 bytes

- Monitoring temperature every 0.001 seconds - Test Results

More Fibre Optics Test Results.pdf -- 30416 bytes

- Fibre-optic preliminary investigation notes from technical meetings June 23-28
- Prototype drawings of 4 fibre optic options - June 29 - July 17
- Prototype construction procedures and test results - July 18-27

Activity #1-3: Fibre Optic System Optimization (Fiscal Year 2009)

Methods of experimentation:

No experimentation methods have been recorded for this Activity.

[ANY SR&ED WORK PERFORMED IN THE NEXT (2009) FISCAL YEAR WOULD BE RECORDED HERE, IN THE 2009 ACTIVITY AND CLAIMED WITH THE 2009 CORPORATE INCOME TAX. EACH USER CAN ENTER INFO IN REAL TIME AS THE DEVELOPMENTS ARE UNFOLDING, ELIMINATING NEED FOR ANY WRITEUPS AT YEAR END AND MISSING FILING DEADLINES.]

Results:

No results have been recorded for this Activity.

Conclusion:

x

801 - Machinery - improve compounding equipment

Benchmarks:
Internet searches: 33 sites / articles
Patent searches: 2 patents
Potential components: 14 products
Queries to experts: 2 responses

Objectives:
Temperature variance: 2 Deg C
Output: 120 output/minute
Shear: 12 tons/sq.inch
Improve Dispersivity: 1 mm
Maximum cost increase: 15 %

Uncertainty: 1 - Temperature Control

Key Variables: device locations, optimal measurement devices, vibration - locations and intensity

Activity	Testing Methods	Results - % of Objective	Variables Concluded	Hours	Materials $	Subcontractor $	Fiscal Year
1 - Thermocouples	Analysis / simulation: 12 alternatives Process trials: 36 runs / samples	Temperature variance: 4 Deg C (33 %) Output: 100 output/minute (0 %) Shear: 50 tons/sq.inch (2000 %) Improve Dispersivity: 0.6 mm (20 %)	device locations optimal measurement devices	1,334.00	20,000.00	39,750.00	2008
2 - Fibre Optic system	Analysis / simulation: 6 alternatives Process trials: 90 runs / samples Physical prototypes: 1 samples ... prototype revisions: 2 revisions	Temperature variance: 1 Deg C (133 %) Output: 112 output/minute (60 %) Shear: 13 tons/sq.inch (150 %) Improve Dispersivity: 0.9 mm (80 %) Maximum cost increase: 20 % (133 %)	device locations optimal measurement devices	1,015.00	9,849.00	8,000.00	2008
3 - Fibre Optic System Optimization	(none)	(none)	(none)	1,013.00	1,280.00	1,200.00	2009

FRANCAIS Machinerie - Améliorer l’équipement de préparation de mélange (des matières plastiques:

Scientific or Technological Objectives:

Measurement	Current Performance	Objective	Has results?
Variance de température (Deg C)	5	2	Yes
Production (unités/minute)	100	120	Yes
Force de cisaillement (tonnes/p²)	10	12	Yes
Améliorer la dispersivité (mm)	1	2	Yes
Hausse max. de coût (%)	0	15	Yes

[NOTE DE L’AUTEUR : CETTE DESCRIPTION EST BASÉ SUR LE CIRCULAIRE D’INFORMATION NO.94-1, LE 4 FÉVRIER 1994, APPLICATION DE LA LOI À L’INDUSTRIE DES MATIÈRES PLASTIQUES, NOUVEAUX ÉQUIPEMENTS, EXEMPLE NO.2].

[NOTE DE L’AUTEUR : IDÉALEMENT, LE CONTRIBUABLE ESSAIERAIT DE QUANTIFIER LES OBJECTIFS QU’IL VEUT RÉALISER. LES OBJECTIFS QUANTIFIABLES ONT ÉTÉ INSÉRÉS CI-DESSUS À TITRE D’EXEMPLE.]

Ce projet représente un exemple de modification d’équipement ancien (la gélifileuse Gelimat) en vue de produire un type unique d’équipement de préparation de mélanges qui offre ces avantages :

- des taux de production élevés,
- une dispersivité élevée,
- l’absence de cisaillement,
- un nettoyage facile au moment du passage d'un mélange à un autre
- et des coûts en immobilisations faibles par rapport à celui des systèmes traditionnels

Technology or Knowledge Base Level:

Benchmarking methods & sources for citings:

- Recherches sur l'internet: 22 sites/articles -- --18 articles ont été identifiés sur l’impact des variations de mélange sur la température et les l
- Recherches de brevets: 2 Brevets -- – Deux méthodes d’utilisation de thermocouples afin de contrôler le procédé, mais les deux sont ina
- Produits ou procédés compétitifs: 14 produits -- – Examiner 14 produits de 4 fournisseurs differents et les différences de performance

[NOTE DE L’AUTEUR : IDÉALEMENT, LE CONTRIBUABLE RÉSUMERAIT SOMMAIREMENT LES PRATIQUES COURANTES DE L’INDUSTRIE ET IL ESSAIERAIT D’IDENTIFIER LES MÉTHODES OU VARIABLES SPÉCIFIQUES QUI, SELON LUI, L’EMPÈCHE D’ATTEINDRE LES OBJECTIFS ÉNONCÉS. VOIR LES EXEMPLES DE BENCHMARKS CI-DESSUS.]

Field of Science/Technology:

Mechanical engineering (2.03.01)

Project Details:

Intended Results:	Improve existing processes
Work locations:	Analysis
Key Employees:	Isaac Newton (Mechanical engineering - M.Asc. (1974) / Research Manager), Lou Pasteur (Chemistry - BSc. (1996) / Research Associate), Prototype Line (Unknown / General Labour)
Evidence types:	Photographs and videos

Scientific or Technological Advancement:

Uncertainty #1: Contrôle de la température

En dépit de développements mécaniques tels que la modification des angles des lames rotatives et l'augmentation de la vitesse, qui ont permis d'obtenir une plastification rapide de la plupart des matières plastiques sans application de chaleur externe, on était toujours en présence d'une incertitude technologique quant aux moyens pratiques de détection et de contrôle de la température. Une fraction de seconde de trop aux environs du point de plastification pouvait entraîner une hausse de température de plus de 50 °C, ce qui pouvait se traduire par une dégradation désastreuse des matières plastiques comme les CPV.

Les variables clés sous-jacents les plus significatifs sont :

Angle, vitesse, température, sensibilité, et temps

The most significant underlying key variables are:

Angle, vitesse, température, sensibilité,, et temps

Activity #1-1: Thermocouples (Fiscal Year 2009)

Methods of experimentation:

- Analyse/simulation: 12 alternatives - Examination de 12 configurations alternatives de thermocouples et techniques de vibrations
- Essais de procédés: 36 Série de tests/échantillons - 3 essais ont été fait à différentes pressions pour chacun des 12 configurations alternatives

[NOTE DE L'AUTEUR : LES DESCRIPTIONS FOURNIES DANS L'EXEMPLE DE L'ARC NE COMPRENNENT PAS DE DÉTAILS SUFFISANTS SUR LES ESSAIS QUI ONT ÉTÉ FAIT. LES DONNÉES CI-DESSUS (#D'ESSAIS/ALTERNATIVES) SONT FOURNIES AFIN DE MONTRER QUELQUES DÉTAILS ADDITIONNELS QU'IDÉALEMENT SERONT INCLUS]

Results:

- Variance de température: 4 Deg C (33% of objective)
- Production : 100 unités/minute (no improvement)
- Force de cisaillement: 11 tonnes/p² (50% of objective)
- Améliorer la dispersivité: 2 mm (100% of objective)
    - Variance de temperature: 4 deg C(33% de l'objectif)
    - Production : 100 unités/minute (sans amélioration)
    - Cisaillement : 11 tonnes/pouce² (50% de l'objectif)
    - Dispersivité améliorée : 2 mm (100% de l'objectif)

Conclusion:

Cette nouvelle technologie de mixage a réussi dans le domaine du mélange des CPV et d'autres matières plastiques sensibles au cisaillement ou à la température.

[NOTE: IDÉALEMENT, LA DESCRIPTION TECHNIQUE DEVRAIT COMPRENDRE UNE CONCLUSION MENTIONNANT CE QU'ON A APPRIS DE L'EXPÉRIMENTATION ET LE RELIER À L'INCERTITUDE TECHNOLOGIQUE]

Les variables les plus significatives dont on a conclus en sont : angle, sensibilité, vitesse, température et le temps.

Most significant variables concluded on: Angle, et temps, sensibilité,, température, vitesse

Technical Documents:

- Documents technologiques retenus

Sunset.jpg -- 71189 bytes

Activity #1-2: Fibres optiques (Fiscal Year 2009)

Project Name:	FRANCAIS Machinerie - Améliorer l'équipement de préparation de mélange (des matières plastiques)	**Start Date:**	2009-01-01
Project Number:	801	**Completion Date:**	2010-12-01

Methods of experimentation:

- Analyse/simulation: 1 alternatives - L'identification d'un système possible utilisant les fibres optiques.
- Essais de procédés: 15 Série de tests/échantillons - 5 essais ont été fait à différentes pressions.

[NOTE DE L'AUTEUR: LES DESCRIPTIONS CI-DESSOUS ONT ÉTÉ FOURNIS DANS L'EXEMPLE DE L'ARC. LES DONNÉES CI-DESSUS (# D'ESSAIS/ALTERNATIVES) SONT FOURNIS AFIN DE MONTRER QUELQUES DÉTAILS ADDITIONNELS QU'IDÉALEMENT SERONT INCLUS.]

Results:

- Variance de température: 1 Deg C (133% of objective)
- Production : 112 unités/minute (60% of objective)
- Force de cisaillement: 13 tonnes/p² (150% of objective)
- Améliorer la dispersivité: 2 mm (100% of objective)
- Hausse max. de coût : 20 % (133% of objective)

  - Variance de température : 1 deg C (133% de l'objectif)
  - Production: 112 unités/minute (60% de l'objectif)
  - Cisaillement: 13 tonnes/pouce² (150% de l'objectif)
  - Dispersivité améliorée : 2 mm (100% de l'objectif)
  - Hausse max. du coût d'immobilisation : 20 % (133%de l'objectif)

Conclusion:

Cette nouvelle technologie de mixage a réussi dans le domaine du mélange des CPV et d'autres matières plastiques sensibles au cisaillement ou à la température.

[NOTE: IDÉALEMENT, LA DESCRIPTION TECHNIQUE DEVRAIT COMPRENDRE UNE CONCLUSION MENTIONNANT CE QU'ON A APPRIS DE L'EXPÉRIMENTATION ET LE RELIER À L'INCERTITUDE TECHNOLOGIQUE]

Les variables les plus significatives dont on a conclus en sont : angle, sensibilité, vitesse, température et le temps.

Most significant variables concluded on: Angle, et temps, sensibilité,, température, vitesse

Technical Documents:

- Documents technologiques retenus

Activity #1-3: Integration (Fiscal Year 2010)

Methods of experimentation:

No experimentation methods have been recorded for this Activity.

Results:

No results have been recorded for this Activity.

Conclusion:

No conclusion has been recorded for this activity.

801 - FRANCAIS Machinerie - Améliorer l'équipement de préparation de mélange (des matières plastiques)

Benchmarks:
Recherches sur l'internet: 22 sites/articles
Recherches de brevets: 2 Brevets
Produits ou procédés compétitifs: 14 produits

Objectives:
Variance de température: 2 Deg C
Production : 120 unités/minute
Force de cisaillement: 12 tonnes/p²
Améliorer la dispersivité: 2 mm
Hausse max. de coût : 15 %

Uncertainty: 1 - Contrôle de la température

Key Variables: Angle, et temps, sensibilité,, température, vitesse

Activity	Testing Methods	Results - % of Objective	Variables Concluded	Hours	Materials $	Subcontractor $	Fiscal Year
1 - Thermocouples	Analyse/simulation: 12 alternatives Essais de procédés: 36 Série de tests/échantillons	Variance de température: 4 Deg C (33 %) Production : 100 unités/minute (0 %) Force de cisaillement: 11 tonnes/p² (50 %) Améliorer la dispersivité: 2 mm (100 %)	Angle et temps sensibilité, température vitesse	1,684.00	7,300.00	10,000.00	2009
2 - Fibres optiques	Analyse/simulation: 1 alternatives Essais de procédés: 15 Série de tests/échantillons	Variance de température: 1 Deg C (133 %) Production : 112 unités/minute (60 %) Force de cisaillement: 13 tonnes/p² (150 %) Améliorer la dispersivité: 2 mm (100 %) Hausse max. de coût : 20 % (133 %)	Angle et temps sensibilité, température vitesse	1,071.00	1,280.00	3,990.00	2009
3 - Integration	(none)	(none)	(none)	255.00	3,659.68	1,258.75	2010

Software - Data Warehouse Development:

Scientific or Technological Objectives:

Measurement	Current Performance	Objective	Has results?
CPU Utilization (% busy)	95	70	Yes
Response Time (seconds)	60	15	Yes
Data to Compression (: 1 ratio)	5	15	Yes
Optimize Query Success Rate (%)	25	90	Yes

[NOTE: ONCE YOU FILE A CLAIM YOU CAN EMPOWER THE CRA REVIEWERS WITH ONLINE ACCESS TO SUPPORTING DOCUMENTS & COSTS ONLINE VIA WWW.RDBASE.NET]

[YOU CAN SEE WHAT THE REVIEWER MIGHT SEE BY LOGGING IN AS: USERNAME: CRA@RDBASEDEMO, PASSWORD: 09REVIEWER [ALL CAPITAL LETTERS]

[NOTE: THIS EXAMPLE IS REPRODUCED FROM, "GUIDANCE ON ELIGIBILITY OF SOFTWARE PROJECTS FOR THE SR&ED TAX CREDITS," AS PUBLISHED BY THE CRA IN CO-OPERATION WITH CATA & THE SOFTWARE INDUSTRY (1999).]

[AUTHOR'S NOTE: IDEALLY THE TAXPAYER WOULD ATTEMPT TO QUANTIFY THE OBJECTIVES THEY ARE TRYING TO ACHIEVE. A QUANTIFIABLE OBJECTIVE HAS BEEN ADDED ABOVE, TO ILLUSTRATE.]

It was understood that achievement of these objectives would entail the development of a custom dictionary and related techniques to characterize the data.

We want to develop an automated General SQL Query System that meets or exceeds our Response Time requirements of 15 seconds.

The objective requires us to work around the contraints of our legacy system. Cost vs. benefit is a factor.

Technology or Knowledge Base Level:

Benchmarking methods & sources for citings:

- Internet searches: 33 sites / articles -- 33 sites & 14 resulting artciles reviewed
- Competitive products or processes: 6 products -- no methods to characterize non-uniform, dynamic data
- Similar prior in-house technologies: 2 products / processes -- benchmarks for CPU utilization, Response & Compression
- Potential components: 100 products -- over 100 potential components reviewed (open source & proprietary)
- Queries to experts: 3 responses -- no methods to characterize non-uniform, dynamic data

The primary technological constraints were attributed to the fact that we could find no relevant methods to characterize non-uniform, dynamic data of this environment. We currently create custom SQL queries which achieves a 60 second response time. Our automated process is limited and can only handle 25% of our production queries. The system is not suitable in achieving the desired performance objectives and need to increase automation to 90%. Our DB engine has a 32K memory allocation size limitation per SQL query. There is a 32K buffer limit for displaying SQL query selection summaries with our DB web development product HtmlDB. The license is free and want to be able to continue to use our database engine and HtmlDB as cost is an issue.

Field of Science/Technology:

Computer hardware and architecture (2.02.08)

Project Details:

Intended Results:	Improve existing processes
Work locations:	Analysis, Lab, Research Facility, Commercial Facility
Key Employees:	Al Einstein (Physics - PhD. (1938) / Lead Researcher), Lou Pasteur (Chemistry - BSc. (1996) / Research Associate), Al Nobel (Chemical Engineering - P.Eng. (1989) / Research Associate)
Evidence types:	Project records, laboratory notebooks

Scientific or Technological Advancement:

Uncertainty #1: : Non-uniform dataset determination

We are uncertain as to how and whether it is possible to develop a method to identify and exploit the unique properties of non-uniform data sets. We are also uncertain whether we can use compressed data blocks vs entire tables to traverse the database and how much of a performance improvement this will result in.

The most significant underlying key variables are:

Methods to characterize non-uniform data (unresolved), Optimal use of compression dictionary, Definition and construction of data blocks, CPU utilization

Activity #1-1: Develop generic data model (Fiscal Year 2008)

Methods of experimentation:

- Analysis / simulation: 23 alternatives - identified most common frequency values & evaluated use of column value frequencies to create prototype compression dictionary - using a relational dbase environment

Results:

No results have been recorded for this Activity.

At the end of this first phase we found that a reasonably accurate data set model could be created. This was further tested and the data set model accuracy was verified and validated against several concrete smaller-sized relational databases available to us in the data warehouse.

Conclusion:

Model proved feasible - developed table-wide list of most frequent values for compression dictionary

Most significant variables concluded on: Definition and construction of data blocks

Technical Documents:

- CRA Software Guidelines

CRA software guidelines.pdf -- 213172 bytes

- CRA project description examples

T661-ex-08e[1] - CRA EXAMPLE OF COMPLETED SR&ED PROJECT FORM.pdf -- 106169 bytes
T661- CRA SOFTWARE EXAMPLE WITH MEUK COMMENTARY.pdf -- 43141 bytes
T661-CRA SOFTWARE EXAMPLE REWRITTEN BY MEUK.pdf -- 34843 bytes

Activity #1-2: Develop compression methods (Fiscal Year 2008)

Methods of experimentation:

- Physical prototypes: 10 samples - Developed test scripts to compared CPU utilization, integrity and data throughput for operations including: parallel load, delete/update operations, full table scan & access by row.

Results:

No results have been recorded for this Activity.

Conclusion:

We determined it is best to restrict query/refresh options to compressed blocks vs. entire tables

Most significant variables concluded on: CPU utilization, Definition and construction of data blocks

Activity #1-3: Compression algorithm with dynamic techniques (Fiscal Year 2008)

Methods of experimentation:

- Process trials: 143 runs / samples
- Physical prototypes: 3 samples (with 12 revisions) - Examined use of buffer cache to organize & control compression dictionaries when calls made to uncompress multiple blocks

Results:

- CPU Utilization: 66 % busy (116% of objective)
- Response Time: 22 seconds (84% of objective)
- Data to Compression: 31 : 1 ratio (260% of objective)

In August 2008, a final prototype was selected for widespread commercial implementation ending this aspect of the experimental development.

Conclusion:

This development lead to the discovery that we could use the column value frequency of initial tables rows to create an effective block-based compression dictionary. Use of the buffer cache also proved successful and resulted in reduced response times by 80% when uncompress multiple blocks.

Most significant variables concluded on: CPU utilization, Definition and construction of data blocks, Optimal use of compression dictionary

Technical Documents:

- Project records

RDBAse design Nov 2008.xls -- 35328 bytes

Activity #1-4: Extend data compression methods (Fiscal Year 2008)

Methods of experimentation:

- Process trials: 102 runs / samples - Used external consultant - exploration into use of the implemented compression prototype for data backup and recovery operations

Results:

No results have been recorded for this Activity.

As the result of this work it was found out and further documented that the prototype provided measurable performance improvements [QUANTIFY] when applied to very large databases in excess of 2.5 million rows (1.3 GB) such as those typically encountered in data warehouses.

Conclusion:

Success attributed primarily to compression dictionary vs. data blocks

Most significant variables concluded on: CPU utilization, Definition and construction of data blocks, Optimal use of compression dictionary

Uncertainty #2: Automate Query Process using HTML DB

We are uncertain how to overcome development constraints and integrate a new General SQL engine with the current data base components.

We are uncertain how to overcoming HtmlDB coding constraints as well as eliminating failures with 100% accuracy in an asynchronous (stateless) environment. We will experiment how to reduce SQL queries to blocks of less that 32K each while optimizing the HTML DB query system.

Part of our time will be spent on revising our code and running process trials. Our memory allocation constraint will also be addressed in order to support the front end of our system. The structure of our tables, parsing of queries but we are unsure which memory allocation methods / protocols would optimize this system [The structure of tables, parsing of queries into < 32K blocks, use of memory, etc.)

The most significant underlying key variables are:

Accuracy, # of Failures, 32K Memory Limits

Activity #2-1: First Prototype Data Model (Fiscal Year 2008)

Methods of experimentation:

- Analysis / simulation: 12 alternatives - There were 4 iterations for using memory collections and 5 iterations for writing the selection criteria to disk and 3 iterations for the SQL engine.
- Process trials: 389 runs / samples - Testing HTML objects to overcome 32K limitations in attempt to display the queried result.
- Physical prototypes: 1 samples (with 34 revisions) - Developed a method to parse data into object of less than 32K and run as multiple simultaneous queries. Lines of code in stored procedure used to process selection critera - 893

Results:

No results have been recorded for this Activity.

Conclusion:

We discovered that if the HTML object was coming back greater than 32K, it would not display the queried result. We were unable to reduce the number of failures during this phase of the project and as a result could not maintain any level of accuracy during the I/O process.

Most significant variables concluded on: # of Failures, Accuracy

Technical Documents:

- SQL ENGINE DEVELOPMENT - 1st PROTOTYPE
- Lab Notes - Testing phase and issues

Activity #2-2: Second Prototype Data Model / SQL Engine (Fiscal Year 2009)

Methods of experimentation:

- Analysis / simulation: 9 alternatives - After investigating HtmlDB user forums and querying experts, we found that many other experts have experienced the same constraints when using memory collections with HtmlDB and offered no solution to this issue. We are unable to develop a method to consistently write the data to disk using memory collections (vs. storing in actual database tables) and this approach was abandoned. We attribute this shortcoming to the inability to restrict the nature of user queries given the asynchronous, stateless nature of the web application.
- As a result of these findings mentioned above, we were only able to achieve a 50% improvement in the Automated Query Success Rate. We have no other alternative but to redesign our data model.
-
- Process trials: 89 runs / samples
- Physical prototypes: 1 samples (with 64 revisions) - Lines of code in stored procedure used to display selection critera - 1142

Prototype adapted the data model to meet the limitations of HtmlDB. Experimented w/ 4 different data designs where we looked at storing the saved search criteria on one row verus multiple rows. Specificially, we looked at how and when this data would be stored and eventually fed to the SQL engine. As part of these multiple designs, we also looked at how the data design would ensure that the SQL engine would be generic and be able to handle any number of selections from the user.
5 different methods were tested for displaying data in multiple columns. Different iterations included the use of temporary tables, the SQL floor commands and SQL MOD commands.

Results:

- Optimize Query Success Rate: 75 % (76% of objective)

Conclusion:

We were able to develop a database model design to be sufficient in supporting the required selection criteria and as a result the SQL engine was capable of handling generic queries and any number of user selections. We also developed a mechanism to avoid the 32K memory limit. We could not meet our objective of 25 minute I/O time but were able to maintain a 45 minute I/O time average. We plan to continue to improve this response time in a future project. We did achieve a 75% Automated Query Success Rate which was very close to objective. Due to cost and time constraints, we decided that the results were sufficient for our requirements at this stage. We were able to find a solution that allowed us to display data in multiple columns which were sorted by vertically by column. This solution also allowed to handle the case where the number of items were not divisible by the number of columns.

Most significant variables concluded on: # of Failures, 32K Memory Limits, Accuracy

Technical Documents:

- SQL ENGINE DEVELOPMENT - 2nd PROTOTYPE

Project Name:	Chemicals - Optimize DA Catalyst Recipe	**Start Date:**	2008-08-01
Project Number:	803	**Completion Date:**	2009-12-31

Chemicals - Optimize DA Catalyst Recipe:

Scientific or Technological Objectives:

Measurement	Current Performance	Objective	Has results?
Catalyst Efficiency (kgPE/gTi.h)	91	169	Yes
Reduce Bulk Density Variation (g/cm^3)	0.05	0.02	Yes
Powder Morphology (cm^2/g)	4830	4900	Yes
Minimize cost of production ($ per liter)	3.79	3.7	Yes

NOTE: ONCE YOU FILE A CLAIM YOU CAN EMPOWER THE CRA REVIEWERS WITH ONLINE ACCESS TO SUPPORTING DOCUMENTS & COSTS ONLINE VIA WWW.RDBASE.NET

YOU CAN SEE WHAT THE REVIEWER MIGHT SEE BY LOGGING IN AS: USERNAME: CRA@RDBASEDEMO, PASSWORD: 09REVIEWER [ALL CAPITAL LETTERS]

[AUTHOR'S NOTE: IDEALLY THE TAXPAYER WOULD ATTEMPT TO QUANTIFY THE OBJECTIVES THEY ARE TRYING TO ACHIEVE. QUANTIFIABLE OBJECTIVES HAVE BEEN ADDED ABOVE, TO ILLUSTRATE.]

The goal of this on-going project is to minimize catalyst batch-to-batch variability in order to increase the consistency of our resin. This will be achieved through the development of a correlation between catalyst fabrication conditions and HDPE powder properties. For each batch the plant catalyst is tested on the lab-scale reactor. The powder properties (e.g. catalyst efficiency, bulk density, and powder morphology) will be correlated to the catalyst fabrication conditions.

The information will be used to:
(a) eliminate Lab Scale Reactor testing of catalyst batches by R&D personnel;
(b) determine whether a batch is "in control" with respect to parameters of interest; if out of control, the batch will be scrapped;
(c) predict the effect of catalyst batch on reactor operation and powder-drying system;
(d) develop specific plans for improvements to catalyst fabrication hardware.

The primary objective this year was to experimentally develop new and improved analytical procedures for the chemical analysis of various metals in 2A and DA catalyst systems.

A secondary objective was to successfully deploy a fibre optics probe and commission a new lab-scale reactor. The experimental work will require the application of these sophisticated tools to develop an empirical correlation between plant catalyst preparation conditions and polymer properties. This is the first such study of its kind in the shop-floor environment (see Activities).

Technology or Knowledge Base Level:

Benchmarking methods & sources for citings:

- Internet searches: 33 sites / articles -- found 4 articles of interest
- Competitive products or processes: 7 products -- looked at 7 products - all different princples. Data from 2 years of process operation plus models

[AUTHOR'S NOTE: THIS SR&ED PROJECT IS BASED ON EXAMPLES DEVELOPED BY A CHEMICALS INDUSTRY & CANADA CUSTOMS & REVENUE AGENCY (CRA) JOINT COMMITTEE ENTITLED, "CHEMICALS GUIDANCE DOCUMENT 108 - SHOP FLOOR SR&ED." THIS DOCUMENT IS AVAILABLE FROM THE CRA WEBSITE AT WWW.CRA-ARC.GC.CA/TAXCREDIT/SRED/MENU-E.HTML]

Field of Science/Technology:

Chemical engineering (plants, products) (2.04.01)

Project Details:

Intended Results:	Improve existing materials, devices, or products
Work locations:	Analysis, Research Facility, Commercial Facility
Key Employees:	Al Einstein (Physics - PhD. (1938) / Lead Researcher), Al Nobel (Chemical Engineering - P.Eng. (1989) / Research Associate), Isaac Newton (Mechanical engineering - M.Asc. (1974) / Research Manager)

Project Name: Chemicals - Optimize DA Catalyst Recipe **Start Date:** 2008-08-01
Project Number: 803 **Completion Date:** 2009-12-31
Evidence types: Project records, laboratory notebooks

Scientific or Technological Advancement:

Uncertainty #1: Modeling of catalyst fabrication conditions

From a technological point of view, it was not clear which catalyst fabrication conditions would have an impact on the powder properties of interest or if there would be any statistically significant correlation of value for an empirically-based mathematical model.

The most significant underlying key variables are:

zinc concentration, metal ratio, catalyst efficiency, bulk density, powder morphology

Activity #1-1: Catalyst test trials (Fiscal Year 2008)

Methods of experimentation:

- Analysis / simulation: 10 alternatives - Analysis based on results of process trials. A preliminary correlation was developed.
- Process trials: 10 runs / samples - Plant catalyst tested on the new lab scale reactor. Used DOE to set up testing matrix.

[AUTHOR'S NOTE: THE DESCRIPTIONS BELOW WERE PROVIDED IN THE CRA'S EXAMPLE. THE DATA ABOVE (# TRIALS/ALTERNATIVES) IS PROVIDED TO ILLUSTRATE THE ADDITIONAL DETAILS THAT WOULD IDEALLY BE INCLUDED.]

1. Plant catalyst tested on the new lab scale reactor
[NOTE: NUMBER OF TESTS SHOULD BE SPECIFIED AND RESULTS SHOULD BE BRIEFLY OUTLINED]

2. Powder properties (12, 110 and bulk density) were control charted using a computer program
[NOTE: STATE NUMBER OF TESTS AND GENERAL TREND FOUND AND WHY]

3. Catalyst preparation conditions (i.e. metal ratio, Zn concentration, OH/Cl ratio) were also control charted
[NOTE: STATE NUMBER OF TESTS AND GENERAL TRENDS FOUND AND WHY]

4. A preliminary correlation was developed
[NOTE: SHOULD BRIEFLY STATE WHAT THIS CORRELATION WAS]

5. Improvements were made to the sampling system
[NOTE: SHOULD DISCUSS IMPROVEMENTS MADE AND WHY THEY WERE MADE - NUMBER OF ITERATIONS, WHAT WAS DIFFERENT BETWEEN ITERATIONS AND WHY SUBSEQUENT ITERATIONS HAD TO BE DONE]

6. Manufacturing installed a new meter to control the alkyl halide addition
[NOTE: EXPLAIN WHY]

7. Lab scale reactor bulk density and powder morphology information was used to predict drying problems in the unit.

Results:

- Catalyst Efficiency: 140 kgPE/gTi.h (62% of objective) -- 60% Met
- Reduce Bulk Density Variation: 0.45 g/cm^3 (no improvement) -- Exceeded Goal by 16%
- Powder Morphology: 4900 cm^2/g (100% of objective)
- Minimize cost of production: 3.72 $ per liter (77% of objective)

Conclusion:

Results from this project have provided us with a better understanding of which catalyst fabrication conditions (such as metal ratio, zinc concentration, OH/Cl ratio) would have an impact on the powder properties of interest (i.e. Catalyst efficiency, bulk density, and powder morphology).

The information garnered from the various control charts was successfully used to plan the following year's R&D and Manufacturing activities, e.g. new meters for catalyst raw material metering, increase frequency of side stream analysis, refinements to catalyst database, etc.

In addition, the preliminary database was used to successfully predict V100 efficiency and powder morphology, which is a significant technology advance within the company. We also learned that coarse lab scale reactor powders often resulted in drying problems within the plant based on the study which showed correlations between various powder parameters and drying properties.

Most significant variables concluded on: bulk density, catalyst efficiency, metal ratio, powder morphology, zinc concentration

Technical Documents:

- Project examples

Chemical Projects Examples for MEUK website.doc -- 172787 bytes

- Technical Document

Technical Document.doc -- 24064 bytes

803 - Chemicals - Optimize DA Catalyst Recipe

Benchmarks: Internet searches: 33 sites / articles
Competitive products or processes: 7 products

Objectives: Catalyst Efficiency: 169 kgPE/gTi.h
Reduce Bulk Density Variation: 0.02 g/cm^3
Powder Morphology: 4900 cm^2/g
Minimize cost of production: 3.7 $ per liter

Uncertainty: 1 - Modeling of catalyst fabrication conditions

Key Variables: bulk density, catalyst efficiency, metal ratio, powder morphology, zinc concentration

Activity	Testing Methods	Results - % of Objective	Variables Concluded	Hours	Materials $	Subcontractor $	Fiscal Year
1 - Catalyst test trials	Analysis / simulation: 10 alternatives Process trials: 10 runs / samples	Catalyst Efficiency: 140 kgPE/gTi.h (62 %) Reduce Bulk Density Variation: 0.45 g/cm^3 (-1333 %) Powder Morphology: 4900 cm^2/g (100 %) Minimize cost of production: 3.72 $ per liter (77 %)	bulk density catalyst efficiency metal ratio powder morphology zinc concentration	1,030.18	420.00	750.00	2008