Appendix D - 1993 Survey Questionnaire

Advanced Technology Sections

Question 6 : Advanced Technology Use

6.1 For EACH item or class of software listed below, and currently used in your operations, please enter the approximate number of years in use; if NOT currently used, please indicate (✓) which description best reflects plans for use.

TECHNOLOGY	Used in Operations	Not currently used		
	Approximate Number of Years in Use	Plan to use within next 2 years ✓	No plans to use	
			No Application ✓	Not Cost effective ✓
FUNCTION: DESIGN AND ENGINEERING				
Computer aided design (CAD) and/or computer aided engineering (CAE)				
CAD output used to control manufacturing machines (CAD/CAM)				
Digital representation of CAD output used in procurement activities				
FUNCTION: FABRICATION AND ASSEMBLY				
Flexible manufacturing cell(s) (FMC) or systems (FMS)				
Numerically controlled and computer numerically controlled (NC/CNC) machine(s)				
Materials working laser(s)				
Pick and place robot(s)				
Other robots				
FUNCTION: AUTOMATED MATERIAL HANDLING				
Automated storage and retrieval system (AS/RS)				
Automated guided vehicle systems (AGVS)				
FUNCTION: INSPECTION AND COMMUNICATIONS				
Automated sensor-based equipment used for inspection/testing of:				
• incoming or in-process materials				
• final product				
Local area network for technical data				
Local area network for factory use				
Inter-company computer network linking plant to subcontractors, suppliers and/or customers				
Programmable controller(s)				
Computer(s) used for control on the factory floor				

6.2 For EACH item or class of software listed below, and currently used in your operations, please enter the approximate number of years in use; if NOT currently used, please indicate (✓) which description best reflects plans for use.

TECHNOLOGY	Used in Operations	Not Currently Used		
	Approximate Number of Years in Use	Plan to use within next 2 years ✓	No Plans to Use	
			No Application ✓	Not Cost Effective ✓
MANUFACTURING INFORMATION SYSTEMS				
Materials Requirement Planning (MRP)				
Manufacturing Resource Planning (MRP II)				
INTEGRATION AND CONTROL				
Computer integrated manufacturing (CIM)				
Supervisory control and data acquisition (SCADA)				
Artificial intelligence and/or expert systems				

Question 7 : Acquisition of Advanced Technology

For the purposes of this section of the questionnaire please refer to the functional grouping of technologies in Q.6.1. You are asked to answer for each such functional group. If none of the technologies listed in Q.6.1 are in current use in your operations, please answer only questions 7.14, 8.1, 8.2, and 8.3.

7.1 Please indicate (✓) the range that best reflects this plant's total investment in technologically advanced equipment and software for the period 1989-1991. Please EXCLUDE education and training but INCLUDE plant modifications, construction, integration, and equipment and software purchased or developed.

PLEASE ANSWER SEPARATELY FOR EACH FUNCTIONAL GROUP.

COST CATEGORY	Design and Engineering	Fabrication and Assembly	Automated Material Handling	Inspection and Communications
Less than $100,000				
$100,000 to less than $1 million				
$1 million to less than $5 million				
$5 million to less than $10 million				
$10 million or more				
Not applicable				

7.2 For each functional technology group, please specify the percentage of total investment made up of technologically advanced equipment and software.

PLEASE ANSWER SEPARATELY FOR EACH FUNCTIONAL GROUP.

	Design and Engineering	Fabrication and Assembly	Automated Material Handling	Inspection and Communications
Percentage of total investment				

7.3 Please indicate (✓) any factors that had particular significance over the last three years (1989-1991) in HAMPERING or DELAYING your acquisition of technologically advanced equipment and software from CANADIAN sources.

PLEASE ANSWER SEPARATELY FOR EACH FUNCTIONAL GROUP.

FACTORS	Design and Engineering	Fabrication and Assembly	Automated Material Handling	Inspection and Communications
Overall cost				
Cost of technology acquisition				
Cost of education and training				
Worker uncertainty				
Time to develop software				
Cost to develop software				
Increased maintenance expense				
Need for market expansion				
Lack of financial justification				
Lack of technical support from vendors				
Other				
Not applicable				

7.4 Please indicate (✓) any factors that had particular significance over the last three years (1989-1991) in HAMPERING or DELAYING your acquisition of technologically advanced equipment and software from FOREIGN sources.

PLEASE ANSWER SEPARATELY FOR EACH FUNCTIONAL GROUP.

FACTORS	Design and Engineering	Fabrication and Assembly	Automated Material Handling	Inspection and Communications
Overall cost				
Cost of technology acquisition				
Cost of education and training				
Worker uncertainty				
Time to develop software				
Cost to develop software				
Increased maintenance expense				
Need for market expansion				
Lack of financial justification				
Lack of technical support from vendors				
Other				
Not applicable				

7.5 Please indicate (✓) any factors that had particular significance over the last three years (1989-1991) in HAMPERING or DELAYING your acquisition of technologically advanced equipment and software.

PLEASE ANSWER SEPARATELY FOR EACH FUNCTIONAL GROUP.

FACTORS	Design and Engineering	Fabrication and Assembly	Automated Material Handling	Inspection and Communications
Overall cost				
Cost of technology acquisition				
Cost of education and training				
Worker uncertainty				
Time to develop software				
Cost to develop software				
Increased maintenance expense				
Need for market expansion				
Lack of financial justification				
Lack of technical support from vendors				
Other				
Not applicable				

7.6 Please indicate (✓) any factors that have particular significance for your acquisition of technologically advanced equipment and software.

PLEASE ANSWER SEPARATELY FOR EACH FUNCTIONAL GROUP.

FACTORS	Design and Engineering	Fabrication and Assembly	Automated Material Handling	Inspection and Communications
Lower price				
Internal familiarity with the technology				
Better technical support				
Lower maintenance expense				
Lower costs and shorter time of development of supporting software				
Ease of communication				
Faster delivery time				
Higher risk in dealing with unfamiliar sources				
Special arrangements				
Other				

7.7 How would you compare* your production technology with that of your most significant competitors in Canada and outside of Canada?

** 1: Much less advanced; 2: Less advanced; 3: About the same; 4: More advanced; 5: Much more advanced*

PLEASE ANSWER SEPARATELY FOR EACH FUNCTIONAL GROUP.

COMPETITORS	Design and Engineering	Fabrication and Assembly	Automated Material Handling	Inspection and Communications
Other Canadian producers				
Producers abroad				

7.8 Please indicate (✓) your principal INTERNAL sources of ideas for the adoption of technologically advanced equipment and software.

PLEASE ANSWER SEPARATELY FOR EACH FUNCTIONAL GROUP.

INTERNAL SOURCE	Design and Engineering	Fabrication and Assembly	Automated Material Handling	Inspection and Communications
Research				
Experimental development				
Design work				
Production engineering				
Operating staff				
Management				
Corporate Head Office				
Other				

7.9 Please indicate (✓) your principal EXTERNAL sources of ideas for the adoption of technologically advanced equipment and software.

PLEASE ANSWER SEPARATELY FOR EACH FUNCTIONAL GROUP.

EXTERNAL SOURCE	Design and Engineering	Fabrication and Assembly	Automated Material Handling	Inspection and Communications
A related firm (with same parent firm)				
An unrelated firm				
Government laboratories				
University laboratories				
Provincial research organization				
Industrial research firms				
Research consortia				
Consultants and service firms				
Joint ventures and strategic alliances				
Publications				
Trade fairs, conferences				
Customer firms				
Supplier firms				
There was no significant external input				
Other				

7.10 Please indicate (✓) the principal REGIONAL sources of your present technologically advanced equipment and software.

PLEASE ANSWER SEPARATELY FOR EACH FUNCTIONAL GROUP.

REGIONAL SOURCE	Design and Engineering	Fabrication and Assembly	Automated Material Handling	Inspection and Communications
Canada				
United States				
Europe				
Pacific Rim*				
Other (please specify)				

** Pacific Rim is defined here as : Hong Kong, Indonesia, Japan, Malaysia, Singapore, South Korea, Taiwan, Thailand.*

7.11 Please indicate (✓) the average length of time between your becoming aware of the technologically advanced equipment and software that you eventually acquired and its implementation.

PLEASE ANSWER SEPARATELY FOR EACH FUNCTIONAL GROUP.

TIME PERIOD	Design and Engineering	Fabrication and Assembly	Automated Material Handling	Inspection and Communications
Less than 1 year				
1 - 3 years				
3 - 5 years				
5 - 10 years				
More than 10 years				

7.12 Please indicate (✓) whether the adoption of technologically advanced equipment and software led to any of the following results.

PLEASE ANSWER SEPARATELY FOR EACH FUNCTIONAL GROUP.

RESULTS	Design and Engineering	Fabrication and Assembly	Automated Material Handling	Inspection and Communications
An improvement in productivity				
LOWER PRODUCTION COSTS BY REDUCING:				
. Labour requirements				
. Material consumption				
. Energy consumption				
. Product rejection rate				
OTHER IMPROVEMENTS:				
Improvement in product quality				
Reduced set-up time				
Greater product flexibility				
Improved working conditions				
Reduced environmental damage				
Reduced skill requirements				
Reduced capital investments				
Increased skill requirements				
Increased capital requirements				
Increased equipment utilization rate				
Lower inventory				
Other				

7.13 Please indicate (✓) any plans to acquire technologically advanced equipment and software for this plant over the next three years.

PLEASE ANSWER SEPARATELY FOR EACH FUNCTIONAL GROUP.

EXTENT OF PLANNED TECHNOLOGY ACQUISITION	Design and Engineering	Fabrication and Assembly	Automated Material Handling	Inspection and Communications
Total replacement (75% or more)				
Major upgrade (25% to less than 75%)				
Minor upgrade (less than 25%)				
Under consideration, but no firm plans				
None				

Question 8 : Acquisition of Advanced Technology : Impediments

8.1 Please indicate (✓) which of the following factors have particular significance to your firm as IMPEDIMENTS to technology acquisition.

IMPEDIMENT	Source of Technology	
	CANADIAN	FOREIGN
COST-RELATED PROBLEMS		
Cost of capital		
High cost of equipment		
Costs to develop software		
Increased maintenance expenses		
Cost of technology acquisition		
Lack of financial justification		
Tax regime: R&D investment tax credits		
Tax regime: capital cost allowances		
Government regulations/standards		
LABOUR-RELATED PROBLEMS		
Shortage of skills		
Training difficulties		
Labour contracts		
ORGANIZATION/STRATEGIC PROBLEMS		
Difficulties in introducing important changes to the organization		
Management attitude		
Worker resistance		
OTHER PROBLEMS		
Lack of scientific and technical information		
Lack of technological services (e.g. technical and scientific consulting, tests, standards)		
Lack of technical support from vendors		
Other		