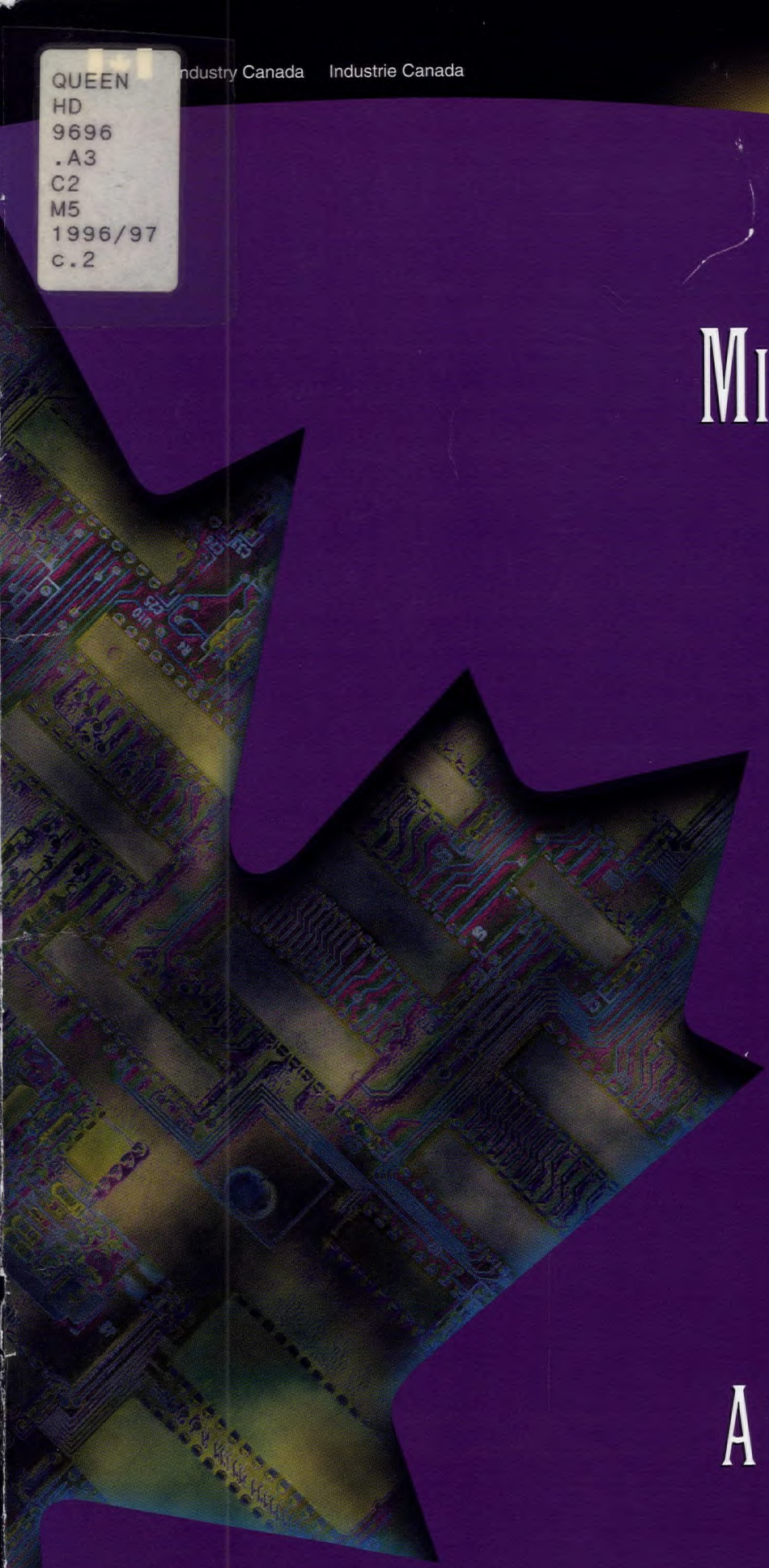
Industry Canada Industrie Canada

THE MICROELECTRONICS INDUSTRY IN CANADA



96-97

A CAPABILITY GUIDE

Canada

FOREWORD

This guide presents a profile of the capabilities of leading companies and federally-funded research centres engaged in microelectronics-related activities in Canada. It is intended for a variety of users — such as information technology corporations in Canada and abroad, computer and communications equipment manufacturers, and electronic systems integrators — who are interested in Canadian capabilities. Company information may also encourage the formation of strategic alliances and cooperative efforts. Applied research information is intended to promote the transfer of technological achievements to Canadian-based firms.

The texts for the profiles were provided by the individual companies, and we wish to thank them for their contribution. The information in this guide is assumed to be accurate, but we cannot be held responsible for any errors or omissions. Other companies may wish to have their profiles presented in a future version of this guide.

Every effort has been made to include all members of the microelectronics community; however, some may have inadvertently been excluded. If these omissions are brought to the Department's attention, they will be included in future editions of the document.

For more information, please contact:

Don Olcheski
Sectoral Analyst
Tel.: (613) 954-3323
E-Mail: olcheski.don@ic.gc.ca

Marion Philippe
Sectoral Analyst
Tel.: (613) 954-2868
E-Mail: philippe.marion@ic.gc.ca

Computers and Components Directorate
Information Technology Industry Branch
Journal Tower North
300 Slater Street
OTTAWA, Ontario
K1A 0C8
Fax: (613) 952-8419

November 1996

INTRODUCTION

Staying out in Front

In the fast-paced world of microelectronics, competitive technology is what it's all about. The convergence of telecommunications, broadcasting, computers, education and many other services and capabilities is being accelerated by the growth in the microelectronics sector. Advanced science, leading-edge engineering, and sophisticated production are only basics in this $150-billion-plus global market. Staying out in front takes more. It requires a spirit of innovation — the ability to turn what *is* into what *could be*. That spirit has always been the strength of Canada's microelectronics industry.

Building on a Solid Foundation

Global experience confirms that the semiconductor industry prospers when driven by large, integrated markets. In Canada, this industry is founded on a communications business that began when Alexander Graham Bell invented the telephone here more than a century ago.

Our vast distances, and our legendary appetite for communications services, have since inspired generations of Canadian scientists and engineers. From personal communication devices and satellite technology to advanced fibre-optic phone systems and automated digital switching equipment, this sector is a major success story globally, with many companies producing leading-edge products.

Communications equipment will continue to push the Canadian microelectronics industry forward. This will be the chief focus of research advances as well, propelled by the industry's key research enterprise — Nortel's Research Centre, one of the world's largest.

"Finishing School" for Ideas

Over the years, the communications industry has served as the nucleus and "finishing school" for an ever-diversifying Canadian semiconductor business. Semiconductor research development, design, and fabrication is heavily concentrated in the Ottawa area, where the presence of Bell Northern Research, the Communications Research Centre (CRC), the National Research Council (NRC) and other laboratories have created the critical mass for the first generation of silicon entrepreneurs.

Today, microelectronics competence flourishes across the nation. The Canadian microelectronics and integrated circuit (IC) packaging and electronic components industries combined for an output of about $4.0 billion in 1995.

Prominence in select niche markets has created a new maturity in Canada's industry. Approximately two-thirds of the value of Canada's production of ICs is manufactured for in-house consumption, and 70 per cent of the rest is exported. There are about 50 companies in Canada engaged in the design, packaging, and fabrication of active components (semiconductor chips) and related engineering services.

Linking the Next Generation

The Canadian microelectronics industry has recognized the need to cooperate to offset limitations of scale and to ensure a strong supply of world-class researchers and engineers in microelectronics technologies. Over 30 Canadian universities have an industrial-quality infrastructure to support the design, fabrication and testing of microchips, and to train students in state-of-the art methodologies. More than 20 universities collaborate in a network of research centres, performing world-class research in microelectronics. These institutions are highly respected in the wider North American university community. They include the University of Toronto and McGill University. According to the recent Gourman (U.S.) report, nine Canadian electrical engineering faculties scored in the top 20 in North America; Toronto was fourth and McGill sixth.

The industry is determined to encourage the growth and vitality of this resource. It has worked with government and the university community to build strong links between researchers across the nation, and to use leading-edge fundamentals and applied research to strengthen the competitive ability of the Canadian microelectronics and

information technology industries. Industrial members are dynamic partners in this collaborative process; they help supply research projects through direct financial contributions and contracts.

Canada's microelectronics industry faces challenges from industrialized countries that are investing vast sums of money in the development of this technology. In order to face the challenges and succeed in the global marketplace, the industry has focused on its areas of strength, particularly in the design of application-specific integrated circuits (ASICs) and their insertion into value-added communications and computer and instrumentation systems.

In Partnership with the World

This technology sector is highly export-oriented, and international customers designing and producing high-value-added products will continue to find Canada a viable and consistent supplier. Many Canadian companies have gained considerable experience working with offshore partners. For Canadian firms, these partnerships mean market opportunities and extended product ranges. International partners have discovered that adaptive Canadian expertise means elegant, innovative and effective problem solving to get better products on the market — fast.

Canadian Quality in Every Shipment

In design and production, Canada competes on the basis of high quality and innovative engineering products. Advanced, highly automated plants, state of the art production techniques, and a highly productive and skilled workforce are the norm throughout the industry. From 1988 to 1994, the average annual growth rate of manufacturing shipments in the Canadian electronics components industry was 21 per cent. The reliability of Canadian circuits, semiconductors and related products is a major selling point with customers around the world. The semiconductor industry is one of the most competitive in the world, and our customers are among the most demanding. Insistence on high-quality, advanced technology has proved one of the Canadian industry's greatest assets.

TABLE OF CONTENTS

INDUSTRY ASSOCIATION

MICROELECTRONICS RESEARCH INFRASTRUCTURE

MICROELECTRONICS INDUSTRY

INDUSTRY ASSOCIATION

STRATEGIC MICROELECTRONICS CONSORTIUM

301 Moodie Drive, Suite 310
NEPEAN, Ontario
K2H 9C4
Tel.: (613) 721-9355
Fax: (613) 721-9528

Contact: Mr. Tony Stansby, Executive Director

Strategic Microelectronics Consortium (SMC) is a not-for-profit corporation committed to the sustainable growth and development of microelectronics in Canada. Member companies range from subsidiaries of multi-nationals to small startups, and collectively account for over 90% of current Canadian microelectronic revenues. SMC membership is open to:

- regular member companies (those whose primary business is the design and/or fabrication of microelectronic devices);
- affiliate member companies who use microelectronics in their products;
- associated academic and government institutions involved in microelectronics research; and
- individual stakeholders in Canadian microelectronics.

Consistent with the general maturing of the microelectronics sector in Canada, SMC has re-vectored its operations during 1996 to become a national focus for industry strategic planning and liaison with the federal government, and a facilitator for networking and collaboration across the entire microelectronics community. Given the fundamental importance to its members of an ample supply of competent people, SMC liaises closely with the Canadian Microelectronics Corporation and Micronet, two of the main Canadian sources of new talent to fuel industry growth.

Collaboration activity is nurtured through several informal common interest groups, on topics chosen by the membership and open to any interested member. Topics of current interest include:

- collaborative research with Canadian Universities and Government Laboratories to lever limited company resources;
- development of multiple informal mechanisms for knowledge sharing and dissemination;
- greater assistance to Canadian companies marketing abroad; and
- development of core competence across the entire microelectronics spectrum within Canada, as the visible symbol of stability needed to attract and retain high-calibre people both in research and within industry.

For more information on SMC's activities and its members please view our web site at **www.smc.ca.**

For information about membership please contact us..

MICROELECTRONICS

RESEARCH

INFRASTRUCTURE

NATIONAL RESEARCH COUNCIL OF CANADA (NRC)

Montreal Road
OTTAWA, Ontario
K1A 0R6
Tel.: (613) 993-9369

Contact: Dr. Peter Dawson

The National Research Council is Canada's leading government research and development (R&D) organization. It has 3,000 employees, and 18 research institutes organized into five technology groups: Biotechnologies; Manufacturing Technologies; Construction Technologies; Infrastructural Technologies; and Information and Telecommunications Technologies.

The objective of NRC's Information and Telecommunications Technologies group is to work in partnership with industry on R&D that will enhance the economic impact of information and telecommunications technologies in Canada. There are two research institutes — the Institute for Information Technology and the Institute for Microstructural Sciences — with a combined staff of over 200.

Market and Technology Drivers of the R&D Program

- Microelectronics
- Increase of bandwidth
- Portable, universal access to communications
- Organization, storage and retrieval of information
- Multimedia hardware and software
- Intelligent network management

Core Competencies

- Optoelectronics/photonic integration
- Semiconductor process technology
- Thin film technology
- Acoustics
- Artificial intelligence applications
- 3-dimensional modelling and image acquisition
- Software engineering

Semiconductor-Related Programs

- Advanced process development
- Epitaxial growth
- Process control optimization
- Silicon-germanium-based devices
- Optoelectronics WDM transmitter and receiver chips
- Optical thin film technology

Interacting with Industry

- Collaborative R&D with firms or consortia
- Licensing of intellectual property
- Secondment of industry staff to NRC for technology transfer or training
- Contract research
- Provision of highly qualified personnel experienced in targeted research

Interacting with Universities

- Collaborative projects, often with industry
- Access to NRC facilities for professors and students

COMMUNICATIONS RESEARCH CENTRE (CRC)

3701 Carling Avenue
P.O. Box 11490, Station "H"
OTTAWA, Ontario
K2H 8S2
Tel.: (613) 998-2266
Fax: (613) 990-8369
rene.douville@crc.doc.ca

Contact: René Douville, Director, Antennas and Integrated Electronics

The Communications Research Centre (CRC) is the Government of Canada's major facility dedicated to research in advanced telecommunications and information technologies. Its particular strengths are in wireless systems, including satellite systems. With a staff of over 220 scientists and engineers, it conducts R&D programs in the areas of:

- wireless, mobile and satellite communications
- TV and radio broadcast technologies
- radio propagation and prediction
- antenna technologies
- microelectronics
- optoelectronics and photonics

In 1974, CRC designed the first microwave GaAs MESFET amplifier to fly in space. Other technological achievements include advanced GaAs and silicon digital IC and multichip module designs for high-speed signal-processing functions such as FFTs, complex multipliers, and wideband digital receivers; microwave and millimeterwave integrated circuits; miniature hybrid microwave integrated circuits (MHMICs); surface acoustic wave design and fabrication; and multiwavelength optical network components.

Microelectronics-Related Expertise and Services Provided

- High-speed DSP ASICs and multichip module design
- Microwave and millimeterwave ICs using monolithic and miniature hybrid technologies to 60 GHz in both GaAs and SiGe
- Planar and integrated active microwave and millimeterwave antennas
- Optoelectronic devices and components for integrated circuit (OEIC) applications
- System design for wireless telecommunications and broadcast applications

CRC boasts a modern microelectronics fabrication facility with full capability for prototyping and packaging of thin-film miniature hybrid circuitry and GaAs optoelectronics devices. It has a full complement of the latest in microwave circuit design, electromagnetic simulation, and antenna design softwares, and uses a suite of Mentor-based digital IC design tools.

Business Description CRC carries out contract R&D, generally in support of Canadian industry. It also accepts contracts from offshore in areas of expertise where capabilities complement or do not reproduce existing national industrial capability. It maintains a database of licensable technology, and licences may be negotiated. CRC's facilities and expertise may be accessed through its Technology Incubator program, which is aimed at small and medium-sized companies. Clients have daily contact with our skilled researchers, and have access to centralized research support services, including a technical library, graphic arts and technical design facilities, a model shop, and a PC board prototyping facility. The CRC has a large number of collaborative agreements with companies, universities, and research organizations in Canada and abroad. It can link its clients with these organizations for potential collaboration or for access to technologies.

NATURAL SCIENCES AND ENGINEERING RESEARCH COUNCIL OF CANADA (NSERC)

Constitution Square, Tower II
350 Albert Street
OTTAWA, Ontario
K1A 1H5
Tel.: (613) 995-5992
Fax: (613) 943-0742
http://www.nserc.ca

Contact: Mr. Leo Derikx

The Natural Sciences and Engineering Research Council of Canada (NSERC) is the national instrument for making strategic investments in Canada's science and technology capabilities. NSERC supports basic university research through grants, and project research through partnerships of universities with industry. It also supports the advanced training of highly qualified people in both areas.

Budget In 1966-97, NSERC will invest $450 million in university-based research and training for all the natural sciences and for engineering. The Council supports excellent research and training for over 8,000 researchers in 60 Canadian universities.

Excellence through Expert Review NSERC uses expert review to adjudicate applications. All funding is awarded competitively, and excellence is always a criterion for funding. Each year more than 500 experts from the university, industry and government sectors across Canada serve on NSERC's policy and expert review committees. These experts volunteer over 13,000 person-days of work annually.

Research Partnerships Program NSERC Research Partnerships Program funding levers more than 160 per cent of additional funding from industry, universities and government. Over 1,000 Canadian companies have participated in the Research Partnerships Program to date, and over $300 million has been levered by NSERC funding. Industry has helped Canadian universities to establish more than 200 research positions in the past 12 years, using NSERC's Industrial Research Chairs.

Networks of Centres of Excellence (NCEs) NCEs are successful partnerships between universities, industries and governments, bringing together researchers in different fields to focus on common problems. In a country with a dispersed population and institutions, the NCEs create intellectual critical masses of researchers to work on significant problems, but still leave the scholars in their own institutions to teach students and to help industry in their regions. Fourteen networks constitute a proven Canadian concept, in focusing researchers on areas of potential economic and social benefit. NSERC supports 10 NCEs, including two in partnership with the Social Sciences and Humanities Research Council and two in partnership with the Medical Research Council. NSERC chairs both the NCE Steering and Management Committees.

Strategic Investment for Canadians NSERC is a key partner in the nation's research and training effort. Its funding:

- leads to important scientific and engineering advances;
- creates new knowledge to enhance the well-being of Canadians;
- trains highly qualified people;
- transfers new technologies to industry;
- encourages industry to invest in university research;
- provides access to international technologies, knowledge and expertise;
- leads to process and product innovation;
- creates new companies and industries; and
- creates jobs.

CANADIAN MICROELECTRONICS CORPORATION

210A Carruthers Hall
Queen's University
KINGSTON, Ontario
K1L 3N6
Tel.: (613) 530-4666
Fax: (613) 548-8104
info@cmc.ca

Contact: Mr. Dan Gale, Vice-President

The Canadian Microelectronics Corporation (CMC/SCM) is a not-for-profit corporation constituted to support Canadian universities in their pursuit of excellence in research and scholarship in all aspects of microelectronics, and to assist industry in accessing and effectively applying microelectronic technology. It delivers a $10-million annual program with technology resources contributed by industry, funding by the National Science and Engineering Council, and a small but growing revenue stream generated by R&D services. Membership includes 35 universities and 18 industrial organizations, each of which has a member representative as the main liaison with CMC/SCM.

Technology Services

CMC/SCM services, which are primarily directed to researchers (faculty and graduate students) at its member universities, include the following:

- Coordinating access to seven fabrication technologies
- Negotiating special licensing arrangements or directly distributing selected CAD tools, and providing user support
- Loaning and maintaining computing and test equipment
- For selected fabrication technologies, preparing and distributing design kits for the primary CAD tools (Cadence Design Framework II design tools and Synopsys Synthesis tools) supported by CMC/SCM. Full libraries and engineering support are available for
    - Nortel 0.8-micron BiCMOS — Cadence, Synopsys
    - Nortel 0.8-micron SAGRF GaAS — Cadence
    - MITEL 1.5-micron CMOS — Cadence, Synopsys
    - Gennum bipolar linear array — Cadence
    - FT14 bipolar linear array — Cadence
    - Hewlett-Packard 0.5-micron CMOS — Cadence
    - Rapid Prototyping Board — Mentor, Synopsys, Xilinx
- Providing training support for the above tools and technologies, including on-line tutorials about design flows. Current instructional materials include:
    - Tutorial on Digital IC Design Flow
    - Design Flow for Scan-based DFT
    - Physical Test of a Digital IC (CMC/SCM Test Head and VXI)
    - System Design and Rapid Prototyping Training Workbook
    - Rapid Prototyping Board Design Flow Overview and User Guide
    - An Introduction to Micromachining: Results of Projects Using Mitel's 1.5-micron CMOS Technology to Develop a Canadian MEMS Process

Faculty and Students

On an annual basis CMC/SCM programs are used by more than 400 academic faculty and almost 700 PhD and MSC students in areas related to microelectronics research. In 1995, 118 graduate-level courses in microelectronic subject areas were delivered at Canadian universities.

MICRONET

10 King's College Road
University of Toronto
TORONTO, Ontario
M5S 3G4
Tel.: (416) 978-1638
Fax: (416) 978-4516
micronet@vrg.utoronto.ca
http://www.utoronto.ca/micronet

Contact: Mr. Maher Bitar, Manager

Major Achievements

- The Micronet Network was instrumental in the creation of two SME spin-off companies resulting from the Precompetitive Research Program.
- Over the past 18 months, the Network generated 68 MSC's and 53 Ph.D.'s, 80 per cent of whom are employed in Canada.
- Direct industrial cash contributions to the Network's Precompetitive Research Program increased from zero in Year I to $100K in Year II and $720K in Year III.

Company Background Micronet is a collaborative network comprised of 20 universities, 32 companies; and four provincial/federal organizations. Over the past 18 months, the industrial membership of the Network has increased by 63 per cent. The majority of new members are small or medium-scale enterprises that contribute financially to the Precompetitive Research Program.

Business Description Micronet's mission is to mobilize Canada's research talent in the academic, private and public sectors, and to apply this talent to strengthen the competitive ability of the Canadian microelectronics and information technology industries. Micronet's objectives are: to stimulate leading-edge fundamental and applied research in areas critical to Canada; to train world-class scientists and engineers in technologies essential to Canada's productivity and economic growth; to accelerate the exchange of research results within the Network; to enhance Canada's industrial competitiveness in the microelectronics sector; and to manage multidisciplinary, multisectoral research programs of nationwide scope.

Microelectronics Research Micronet includes 20 universities, which all together have 81 professors and approximately 300 graduate students and other research personnel across Canada. The universities involved in Micronet are:

•Carleton University	•Concordia University	•Ecole Polytechnique	•I.N.R.S.
•McGill University	•McMaster University	•Memorial University	•Queen's University
•Simon Fraser	•T.U.N.S.	•University of Montreal	•University of Alberta
•University of B.C.	•University of Calgary	•University of Manitoba	•University of Ottawa
•University of Toronto	•University of Victoria	•University of Waterloo	•University of Windsor

CANADIAN INSTITUTE FOR TELECOMMUNICATIONS RESEARCH (CITR)

McGill University
3480 University St.
Suite 633
MONTREAL, Quebec
H3A 2A7
Tel.: (514) 398-7116
Fax: (514) 398-3127

Contact: Dr. Maier Blostein

The Canadian Institute for Telecommunications Research (CITR) is a distributed research institute devoted to enhancing Canada's telecommunications industry through university-based research. It is managed jointly by 21 universities and specialized research centres in collaboration with 18 industrial companies. It involves more than 60 professors and 220 postgraduate students.

Research CITR is a broadband network of the future that provides the resources needed for ubiquitous connection between people, between machines, and between people and machines. It is a telecommunications services environment offering subscribers virtually instant and transparent access to any type of voice, data or multimedia service and service. It gives service access from anywhere — home, work, or any moving plane, train, or car.

Research Program

- Broadband Network Resources Management
- Distributed Multimedia Broadband Services
- Optical Backplane Architecture and Technology
- Broadband Wireless (Indoor)
- Broadband Wireless (LMCS)
- Broadband Satellite Communications
- Integrated Multi-Service Wireless Access Network for PCS at 1.9 GHz

MICROELECTRONICS

INDUSTRY

ALBERTA MICROELECTRONIC CENTRE

11315 87th Avenue, Room 318
EDMONTON, Alberta
T6G 2T9
Tel.: (403) 492-3914
Fax: (403) 492-1643
lumb@amc.ualberta.ca

200, 3553 - 31 St. NW
CALGARY, Alberta
T2L 2K7
Tel.: (403) 289-2043
Fax: (403) 289-2047

Contact: Chris Lumb, President and Chief Executive Officer

Major Achievements

- AMC markets a microelectronics process simulator called SIMBAD (Simulation by Ballistic Deposition), which was developed by AMC and university researchers and is being sold worldwide.

- AMC has designed and developed applications for a variety of industries, resulting in new products and enhanced tools for the Canadian and international market. The Centre's activity in microelectronics materials research, and its research collaboration with universities, has led to several patent applications, development of new products, and improved processes in the semiconductor field.

Company Background Alberta Microelectronic Centre has locations in both Edmonton and Calgary and employs about 40 people, the majority of whom are engineers, scientists and technologists. The Edmonton location houses one of North America's foremost commercial micro-electro-mechanical and thin film fabrication facilities, with 1,200 square feet of clean room space. AMC's total revenue for 1996 is predicted to be near $4 million.

Business Description AMC is active in the design, development, and small-scale manufacturing of microelectronics or micromachined devices, and of electronic products and specialized software. The Centre's work includes assisting clients with design, developing prototypes, manufacturing and production, and assisting with technology commercialization. Target markets are medical and resource industries, telecommunications industries, and electronics manufacturers.

APPLIED MICROELECTRONICS INC.

1046 Barrington Street
HALIFAX, Nova Scotia
B3H 2R1
Tel.: (902) 421-1250
Fax: (902) 429-9983
mcfadden@appliedmicro.ns.ca
http://www.appliedmicro.ns.ca

Contact: Justin McFadden, Account Representative

Major Achievements

- FM Exciter — Applied Microelectronics' conversion of Nautel's analog FM Exciter to digital, using state of the art Digital Signal Processing and Direct Digital Synthesis technology, has enabled Nautel's FM Exciter to become a market leader. Sophisticated signal-processing algorithms permitted the replacement of costly high-performance parts with low-cost components, with no loss of performance. The Digital FM Exciter was named "Hot New Product" at the 1995 NAB trade show in Las Vegas.

- Next Generation Signal Processor (NGSP) — Developed for the Canadian Department of National Defence (DND), the NGSP boasts the largest ASIC ever developed in Canada (563,000 gates), as well as Scalable Coherent Interface (SCI) technology. The NGSP currently offers the best price per GigaFlop of any available multiprocessing system on the market.

Company Background Since 1981, Applied Microelectronics' technical expertise and creative initiatives have resulted in the development of numerous internationally competitive electronic-based products. With a team of over 35 designers, and state of the art technical resources, Applied Microelectronics has enabled its customers to improve their competitive position by ensuring that the technology in the new product is right for the market at the time it is introduced.

Business Description Applied Microelectronics works in close collaboration with clients to produce pre-production prototype electronics systems. The company's experience with RF transmitters and receivers, acoustic telemetry, digital audio, and satellite subcarrier communications is current and ongoing. Applied Microelectronics has been involved in the Multimedia field in applications such as Cable Television equipment, video processors and systems, broadcasting, and real-time data compression.

ATI TECHNOLOGIES INC.

33 Commerce Valley Drive East
THORNHILL, Ontario
L3T 7N6
Tel.: (905) 882-2600
Fax: (905) 882-9339
jseto@atitech.ca

Contact: Jim Seto, Design Manager

Major Achievements

- ATI is a leading board manufacturer, participating in both the component and board segments. Participation in the board business gives ATI a competitive advantage by providing strong market presence and brand-name recognition.
- ATI has an excellent reputation at the retail level. This reputation is reinforced by the company's aggressive marketing strategy, which is designed to create brand preference for its products.
- ATI has the ability to offer customized solutions for its Original Equipment Manufacturers customers. The company works in close partnership with OEMs to tailor product development schedules to customer needs early in the design cycle.
- ATI's commitment to research and development has enabled the company to develop its current series of modular products, which will allow users to expand and extend the performance of their existing equipment.

Company Background Founded in 1985, ATI is recognized as a world leader in supplying affordable high-quality products for the personal computer enhancement market. These products include graphics accelerators — both boards and components — as well as communications and multimedia hardware and software. The company's primary objective is to maintain its leading position by continually introducing a wide range of easy-to-use, technically superior products known for their excellent price and performance. ATI employs more than 600 employees worldwide and is based in a modern 145,000-square-foot headquarters just outside Toronto.

Business Description The firm has offices in Canada, the United States, Germany and the United Kingdom, and works with distributors and resellers worldwide. ATI provides software drivers, marketing collaterals, product manuals, packages, and technical information in a variety of languages. Currently ATI has "localized" its products for French and German markets. Localization is under way for nine other international markets.

ATMOS SEMICONDUCTOR INC.

CRC Innovation Centre
Box 11490, 3701 Carling Avenue
OTTAWA, Ontario
K2H 8S2
Tel.: (613) 829-9538
Fax: (613) 829-0172
71214.3622@compuserve.com

Contact: Dr. C. Paul Slaby, President

Major Achievements

- Atmos Semiconductor Inc. offers the services of Quick-Turn ASIC and rapid and economical ASIC design and production.
- Atmos Semiconductor Inc. specializes in low-volume short-series solutions, IC prototyping services, redesign of semi-obsolete parts, and IC reverse engineering.

Company Background Atmos Semiconductor Inc. is a microelectronics start-up incorporated in 1995 to provide rapid and economical ASIC design/production services. To share financial and technical responsibilities of the development work, initial alliances were established with Mitel Semiconductor, Intertech, and Semiconductor Insights. Atmos is a member of the Strategic Microelectronics Consortium (SMC), through which it is receiving financial support toward its R&D effort. Current funding consists of private investment, as well as grants from External Affairs and Industry Canada. The company is in the process of raising additional seed-capital financing.

Business Description Atmos has already started initial work on the design of gate arrays for the Laser Direct Write system, and is in the process of expanding its technical staff. Atmos features gate arrays in cost-effective production volumes of as low as 10 units per shipment, low NRE costs comparable to those for the FPGAs, single-wafer processing providing rapid delivery of 1–3 days, seamless migration using a single design and the same base wafer, and the lowest cost per ASIC for small quantities of up to 5,000 units.

CADABRA DESIGN LIBRARIES INC.

Suite 260, 36 Antares Drive
NEPEAN, Ontario
K2E 7W5
Tel.: (613) 226-7046
Fax: (613) 226-5276
mcl@cadabra.ca

Contact: Martin Lefebvre, President

Major Achievements

- Cadabra Design Libraries Inc. has developed the LILA family of layout synthesis products, which provide a 10-times speed-up in the library development process for IC design and manufacturing companies. The products are in daily use in major semiconductor companies around the world.

- There are many key benefits to the LILA family, such as the ability to quickly develop cell libraries in order to carry out architectural optimization analysis, and the ability to efficiently re-target a library to a new process.

Company Background Cadabra was founded in May of 1994 by Prof. Martin Lefebvre of Carleton University. The company has 12 full-time employees and continues to grow at a rapid pace. The LILA product family includes the LILA-SC for layout synthesis of standard cell, the LILA-GA for gate arrays, and the LILA-IO for IO synthesis.

Business Description Cadabra's LILA family features easy technology adaptation, user control over synthesis algorithms, interactive editing capability for placement and routing, and fully automated synthesis from SPICE netlist to layout. In addition, LILA provides batch capability for complete library generation, layout quality competitive with manual designs, and easy integration into customers' existing tool flows.

CELESTICA INC.

844 Don Mills Road, 28/107
NORTH YORK, Ontario
M3C 1V7
Tel.: (416) 448-4524
Fax: (416) 448-5895

Contact: Larry Smith, Marketing Manager

Company Background Celestica is a world-class multi-billion dollar company with more than 80 years' experience in the production of electronic assemblies for the computer and communications industries. We employ more than 2,500 talented, highly skilled Canadians, and we are one of North America's largest contract electronics manufacturers. We are a primary provider of customer products and integrated manufacturing services to many of the world's leading technology companies.

Distinct services we can offer our customers include:

- design and layout
- design for manufacturability
- prototype build
- test process development
- system build
- miniaturization capabilities
- energy management solutions
- component procurement
- environmental stress testing
- distribution

Business Description Celestica's business is divided to service three areas:

1. Contract Manufacturing. We offer a wide range of process capabilities across all technologies, including:
   - pin-through hole
   - ball and column grid arrays
   - chip-on-board
   - flax
   - surface mount technology
   - tape automated bonding
   - flip chip attach
   - multi-chip modules

2. Power Systems. Celestica Power Systems designs, develops and manufactures ultra-high reliability, high-density AC/DC and DC/DC converters, energy management systems, and analog control systems. We offer a growing line of flexible, modular products that can be easily tailored to meet our customers' requirements. Our line of AC/DC power supplies range from 200 to 2,000 watts, and our DC/DC converters range from 10 to 300 watts.

3. Memory Solutions. Celestica is one of the largest consumers of DRAM in North America. We manufacture memory products for a variety of systems ranging from portable devices to mainframe computers, including:
   - PCMCIA, JEDIA, and JEDEC memory cards, including DRAM(3.3V,5V), FLASH and SRAM
   - industry-standard and custom SIMMS
   - ultra-high-density memory packaging for large system arrays and subsystems

Celestica is ISO 9001-certified and is accredited as a National Testing Laboratory, capable of testing CSA, UL, BABT, and other international standards. This allows significantly faster product certification than is usual in our industry.

CHIPWORKS

3865 Richmond Road
OTTAWA, Ontario
K2H 5B7
Tel.: (613) 237-4484
Fax: (613) 237-4485
info@chipworks.com

Contact: Mr. Peter Chapman, Director, Marketing and Sales

Major Achievements

- The staff of Chipworks is experienced in patent interpretation and knowledgeable in a broad range of devices and technologies.
- Chipworks is dedicated to providing technical information on semiconductor technology to professionals working in the field of intellectual property development (designers) and protection (lawyers).

Company Background To help designers create higher-performance chips, Chipworks provides technical information on competitive and historic products, as well as expert patent interpretation reinforced with technical documentation to strengthen licensing professionals' positions. Chipworks' experience, along with its large international network of experts, has given it an outstanding reputation for acquiring and delivering information quickly and accurately. The experts provide crucial information on potential patent infringements, as well as independent analysis of design performance and reliability. They also facilitate design or licensing projects through identification and review of patents.

Business Description Chipworks has the facilities and expertise for full reverse engineering: sample procurement and preparation, circuit extraction and analysis, microstructural investigation and characterization, and technical review and documentation. In addition to design and licensing support, Chipworks documents semiconductor technology through a widening scope of Standard Products.

C-MAC INDUSTRIES INC.

3000 Industriel Blvd.
SHERBROOKE, Quebec
J1L 1V8
Tel.: (819) 821-4524
Fax: (819) 348-0782
dmarch@cmac.ca
http://www.cmac.ca

Contact: Denis Marchand, Vice President, Business Development

Company Background C-MAC is a Canadian manufacturer of advanced electronic systems, subsystems and microelectronic modules, supporting many applications in a variety of end markets: telecommunications, industrial, automotive, instrumentation, medical, aerospace and military. C-MAC operates 14 manufacturing facilities located in five countries: Canada (5), USA (3), UK(4) France (1) and China (1).

Company Description The C-MAC structure, four manufacturing Divisions and one System Design Group, reflects its wide technological base and extensive expertise:

- Thick film microcircuits and multi-chip modules (MCM)
- Video filters (pre and post filters)
- 1553 & 3910 Databus products for avionics applications
- DC/DC converters (commercial and military applications)
- Quartz crystal frequency control devices: oscillators (TCXO, VCXO, OCXO), resonators, filters, SAW filters and SAW oscillators
- Interconnect products (backplanes, card cages, cabinets, connectors), including VME backplanes and card cages
- Electronic manufacturing services (EMS)
- Energy management products & systems and highly efficient electronic thermostats

COM DEV LTD.

155 Sheldon Drive
CAMBRIDGE, Ontario
N1R 7H6
Tel.: (519) 622-2300
Fax: (519) 622-1691

Contact: Mary Dubeck, Marketing Administrator

Company Profile

Com Dev, a Cambridge-based company, designs and manufactures products for communications, remote sensing, and space science satellites. Founded in 1971, the company is renowned for its multiplexer subsystems, which have been installed on over 170 spacecraft in more than 40 international programs.

Com Dev has six major divisions:

Multiplexers: designs and manufactures input and output multiplexer hardware for communications satellite payloads.

Switches: designs and manufactures waveguide and coaxial microwave switches for satellite payloads.

IT Processors: designs and manufactures Surface Acoustic Wave (SAW) filters, SAW-based filter modules, and complete SAW-based IF processors for communications satellite payloads.

Antennas: designs and manufactures antennas for communications satellite payloads.

Payload Electronics: designs and manufactures active electronics components, subsystems and instruments for remote sensing and space science satellites. Capability includes digital, software, optics, mechanisms, and active RF.

R&D: invests in new technology and process development in a market-driven fashion, directly supporting the needs of the operating division.

The company's major product lines include: integrated satellite multiplexers and switching subsystems; subsystems for earth observation and remote sensing satellites; IF and digital signal processors; Ka-band repeaters and millimetre-wave subsystems; specialized antennas and beamforming networks; ferrite products; and space-borne radar receivers, transmitters, and chirp generators.

The high-power microwave switching circuits are used on the European ERS-1 satellite, and many of the company's microwave and signal-processing subsystems will contribute to the unique performance of the proposed Canadian RADARSAT Synthetic Aperture Radar (SAR). Other significant contributions include: the supply of an infra-red radiometer instrument called MOPITT for space-borne pollution measurement, to be flown on the NASA EOS satellite; the supply of extremely complex SAW-based IF processor (Switchboard in the Sky) for all five Inmarsat 3 spacecraft; the supply of Ka-band crosslink and gateway antennas for the Motorola Iridium personal communications satellite system; the supply of a space science ion-optics instrument destined for Mars on a Japanese spacecraft called "Planet B"; and the supply of multiplexer and switching equipment for the Intelsat 8 series of communications satellites.

Since 1986, COM DEV Europe, which is fully equipped with laboratories and workshops, has provided an access base for the European space and defence markets.

In 1992, COM DEV Atlantic, located in Moncton, New Brunswick, began operation, developing space science instruments and volume manufacturing of microwave devices.

COMPAS ELECTRONIC INC.
EPITEK MICROELECTRONICS DIV.

100 Schneider Rd.
KANATA, Ontario
K2K 1Y2
Tel.: (613) 592-2240
Fax: (613) 592-9449

Contact: Robert Corson, President and Chief Executive Officer

Major Achievements

- Epitek has developed and implemented a process for high-volume manufacturing of chip-on-board (COB) assemblies using fully automated gold-wire bonding.
- Epitek is a quality- and service-oriented company. Its delivery performance is 98 per cent of product delivery within one day of the committed date.

Company Background Epitek Inc. was founded in 1969 and was one of the first merchant hybrid houses in Canada. The company went public in the early 1980s and is currently traded on the Toronto Stock Exchange. In the spring of 1990, the senior management team became majority owners by taking over the interests previously held by a venture-capital firm.

Business Description Epitek's prime business is the supply of hybrids and surface-mount assemblies and COB devices custom-designed and manufactured for specific customers.

Epitek designs and manufactures these custom thick-film hybrid circuits, COB devices, and surface-mount board assemblies for customers who produce telecommunications, automotive, medical, computer, test instrumentation, and consumer electronics products.

CREATION TECHNOLOGIES

3938 N. Fraser Way
BURNABY, British Columbia
V5J 5G1
Tel.: (604) 430-4336
Fax: (604) 430-4337
dave@creation.portal.ca

Contact: David Pettigrew, Sales & Marketing Manager

Major Achievements

- Creation Technologies' experience with automatic pattern recognition wirebonding equipment allows it to maintain its throughput capabilities while achieving the highest quality standards.
- Creation Technologies Inc. is committed to meeting the highest standards through design, project management, quality assurance, and on-time delivery.
- Creation's employees are constantly seeking innovative solutions to meet their customers' needs.

Company Background Creation Technologies Inc. began operations in 1991 with a strong core of technically experienced people and a broad base of surface-mount and hybrid process capability. It is a privately owned full-service electronic contract manufacturer, with four full-time owner-managers and an additional 65 employee shareholders.

Business Description Creation Technologies' services include circuit design, design for manufacturability, component sourcing and procurement, board level assembly, full board level functional testing, box level or mechanical assembly, and final shipment to the end customer. Its technical capabilities include throughhole, mixed technology, and surface mount on standard PCB, high-temp PCB, Flex and ceramic, as well as chip and wire on PCB, Flex and ceramic (gold and aluminium wire bonding).

DALSA INC.

605 McMurray Road
WATERLOO, Ontario
N2V 2E9
Tel.: (519) 886-6000
Fax: (519) 886-8023
sgc@minerva.uwaterloo.ca

Contact: Savvas Chamberlain, President

Major Achievements

- Dalsa's annual growth was more than 30 per cent over the last four years.
- Dalsa has a worldwide customer base, with agent representation throughout Europe, Asia, and Israel. Its customers include companies such as DuPont, IBM, AT&T, QuadTech, Royal Mail, Philips, and Siemens.
- Dalsa scientists and engineers have written and published over 250 technical papers.
- Dalsa's CCD image sensors and cameras are used worldwide in document scanning, image capture, surveillance, process monitoring, and manufacturing inspection.

Company Background Founded in 1980, Dalsa Inc. is a University of Waterloo spinoff with the goal of commercializing advanced CCD technology. Dalsa engages highly specialized technical staff, including seven employees at the Doctorate level, 11 at the Master's level, and 24 at the Bachelor's level. Since 1990 alone its staff has grown by over 400 per cent. Dalsa specializes in manufacture, design, research, and development of CCD image sensors and modular expandable cameras.

Business Description Dalsa's products and services include Image Sensors, Variable Scan Cameras, Custom Camera Design and Manufacture, and Custom Image Sensor Design and Manufacture. DALSA harbours strong interdepartmental ties, and fosters structured management plus flexible coordination activities between groups. Because of internal R&D expansion to meet new product needs, as well as rapid growth in the manufacturing sector, Dalsa's 1996 sales are expected to be $20–25 million.

DESIGN WORKSHOP

Suite 400, 4226 St. John's
D.D.O., Quebec
H9G 1X5
Tel.: (514) 696-4753
Fax: (514) 696-8351
fmarquis@designw.com

Contact: François Marquis, President

Major Achievements

- Design Workshop has developed unique and innovative software for the engineering community. Its products include layout editor, verification tools, CAD-oriented programming language and support libraries, lithographic conversion and preparation software.
- Design Workshop's products run on many popular platforms, ranging from laptops to the most powerful workstations. It has been cited as having the best performing database in the industry.
- Design Workshop has also developed custom proprietary software to meet very specific demands from its customers.

Company Background Design Workshop was founded in 1988 as a publishing house with an R&D entity. The R&D side of the business used the revenues from the publishing sector to finance long-term projects; and then fed the publishing division with innovative and profitable new products. This long-term strategy proved to be a quick success, as the first product — the dw-2000 — was a major hit. The company concentrated on this from then on. Today, the R&D is the core of Design Workshop's activities, which are aimed at improving and growing the dw-2000™ line of products.

Business Description As the CAD/CAM/CAE market is small and is permanently saturated with new products, Design Workshop has developed expertise in vertical segments where everything is still left to conquer. Those fields include nano-lithography, high-performance routing, and extraction. Design Workshop is also a consultant to its customers on very specific layout project strategies.

FOCAM TECHNOLOGIES INC.

3050, Cartier Ouest
LAVAL, Quebec
H7V 1J4
Tel.: (514) 687-4883
Fax: (514) 687-4875
dan.mercille@focam.com

Contact: Daniel Mercille, Executive Vice-President

Major Achievements

- Focam Technologies Inc. is a dynamic, efficient, microelectronics design engineering company.
- Its fully integrated libraries of cells, chips and components allow it to simulate and then integrate into a design the latest and most up-to-date electronic capabilities available.
- Clients include Quantum (U.S.A.), Mitel, IBM, Ceratel (New Zealand), Miranda, ABL, Econowatts, and Alroma.

Company Background During the course of its work, Focam Technologies Inc. has developed vertical expertise in multimedia hardware design in the areas of Audio, Video, Graphics and Compression Techniques for data transmission and storage, both at the system level (PCB) and the IC level (FPGA/ASIC/MCM). Focam Technologies Inc.'s group of design engineers is made up of seasoned and dedicated individuals who possess both technical know-how and practical industrial experience. Together, they cover a wide range of Electronic Design disciplines.

Business Description Focam Technologies Inc. is a microelectronics design engineering firm that specializes in analog, digital and mixed-signal technologies. Its corporate objectives are focused on using the most advanced design software tools running on today's most powerful workstations.

FORD ELECTRONICS MANUFACTURING CORPORATION

7455 Birchmount Road.
MARKHAM, Ontario
L3R 5C2
Tel.: (905) 475-8510
Fax: (905) 470-3296

Contact: Kenny Tam, Quality Services/Quality Assurance Lab Manager

Major Achievements

• Ford Q1 Award	1988
• Ford Total Quality Excellence (TQE) award	1992
• Canadian Award for Business Excellence	1993
• Shingo Prize Award	1994
• Mazda AA1 Preferred Customer Award	1991–1993, 1995
• Mazda AA1 Zero Defect Award	1995
• ISO 9001 certification	
• We are also seeking to achieve QS 9000 and ISO 14001 certification in 1997	

Company Information Our plant is located 35 km north of downtown Toronto. Built in 1984, the plant is a worldwide manufacturing focal point for Ford Electronics safety, security, vehicle controls, driver information, and powertrain products. Markham has set its sights high — to be a "World Leader" in the electronics manufacturing industry. The emphasis is directed toward simultaneous engineering of products and processes, reduction of manufacturing cycle times, and achieving the "Best in Class" quality. All these goals are being reached through the skill, innovation, and team participation of the people at Markham.

Business Description Our plant is 290,000 sq. feet in size. As a high-volume electronic module producer, we use state of the art processes and equipment to manufacture the following:

- top side and bottom side SMD placement
- robotic placement of odd-shape components
- inert gas (environmentally friendly) soldering
- top side radial and axial component insertion
- sonic welding
- gauge winding
- elective soldering

With time management as an important part our operation philosophy, we have decreased our manufacturing cycle time from 13 days in 1988 to 9.5 hours in 1996. Our quality reject level at our customer site decreased by over 90 per cent. Production yield increased from an average of 88.6 per cent to 96 per cent over the same time period.

Customer/Quality Focus All of Markham's manufacturing personnel are familiar with the use of statistical process control (SPC). This allows every person to monitor numerous process indicators and to react to a situation before quality is compromised.

We also have ongoing reliability testing. Continuous sampling of production lots is done in the QC lab on a daily, weekly, semi-annual, and yearly basis. Rigorous life testing, electrical stressing, and other procedures can also be performed in the QC lab to ensure product reliability and quality.

The plant ensures customer satisfaction through improvement teams at customer sites, customer surveys, a customer hotline, and an extensive set of measurables to ensure product quality. A team approach to solving problems and enhancing quality is a way of life at Ford.

Our major customers are Ford Body and Assembly plants and Ford Automotive Component Division plants, Mazda, Nissan, KIA Motors, and other automotive component companies around the world.

We have developed a "partnership" relationship with all our suppliers to achieve a year-over-year quality improvement in purchase parts. With the Just In Time (JIT) program, our supply base quality has improved from small percentages to the parts-per-million level. Our passion to "Be the Best", and our commitment to customer satisfaction, is evident in the quality of the products that we build.

GENESIS MICROCHIP INC.

200 Town Centre Blvd., Suite 400
MARKHAM, Ontario
L3R 8G5
Tel.: (905) 470-2742
Fax: (905) 470-2447
rob@genesis-microchip.on.ca
http://www.genesisus.com

Contact: Robert P. Hunter, Communications Specialist

Major Achievements

- Genesis has developed and perfected breakthrough, full-motion (real-time) video/image DSP technology that is realizable in ICs.
- The resulting chips offer an order-of-magnitude improvement in the silicon area for a given image quality. These specialized ICs, called the "Genesis Scaling" series of Image Resisting Engines, are hardwired, pipelined processors capable of executing billions of operations per second.
- These ICs can perform image shrink and zoom, and contain fully separable finite impulse response (FIR) filters for the vertical and horizontal dimensions. All the memory required for the vertical filtering is contained on chip. These are Genesis exclusives.

Company Background Genesis was founded in 1987 and is an established "fabless" semiconductor company. It focuses on the development and marketing of proprietary real-time video/image DSP ICs (growth opportunity), as well as R&D-intensive and DWP-oriented ASICs (core business).

Genesis has recently introduced its initial products (Image Resizing Engines) to the market. These parts use: breakthrough video/image DSP algorithms and architectures licensed on an exclusive worldwide basis; internally-developed proprietary silicon building blocks; and IC realization technology.

Business Description Genesis markets real-time (full-motion) video/image digital-signal processing (DSP) IC products — the "Genesis Scaling" family of Image Resizing Engines that can perform high-quality 2-D filtered image resizing (shrink and zoom) at full-motion video rates. Breakthrough, patented proprietary technology makes cost-effective low-chip-count solutions possible. These chips satisfy the fundamental need to manipulate images that exist in almost all real-time imaging systems.

GENNUM CORPORATION

P.O. Box 489, Station A
BURLINGTON, Ontario
L7R 3Y3
Tel.: (905) 632-2996
Fax: (905) 632-2055
corporate@gennum.com
http://www.gennum.com

Contact: Michael R. Fielding, Vice President, Marketing & Sales

Major Achievements

- Gennum is the world leader in the design and manufacture of integrated circuits and associated miniature packages for the hearing instrument market.
- Gennum was the first to provide off-the-shelf dual-channel, Wide Dynamic Range Compression sound-processing technology.
- Gennum was the first to offer high-performance, broadcast-quality, video crosspoint integrated circuits to the video broadcast industry.
- Gennum was the first IC manufacturer to recognize the special needs of the professional video broadcast industry, by providing a monolithic serial digital interface (SDI) and by developing an SDI chipset capable of achieving 360Mb/s, which set the industry standard.

Company Background Established in 1973, the original company name was Linear Technology Inc. In 1987 the name was changed to Gennum Corporation. Gennum employs over 270 people and maintains a branch office in Tokyo, Japan. It has two locations in Burlington; they include facilities for wafer fabrication, hybrid manufacturing, packaging and product testing. Gennum markets products worldwide through a company-direct sales force and area-specific representatives and agents.

Business Description Gennum Corporation designs, manufactures and markets silicon ICs and thick-film hybrid circuits for specialty markets that have unique performance and packaging requirements. Gennum's in-house fabrication capabilities include low-volt BiFET (1.0V) and high-density Bipolar. Gennum is a leading supplier to both the hearing instrument market and the video and broadcast market. In the hearing instrument area it provides high-performance, low-voltage, low-power audio components. In the video and broadcast area it offers digital and analog ICs that are targeted for, but not limited to, the specific needs of high-performance video equipment manufacturers and end users.

GOAL ELECTRONICS

Suite 700, 307 Ste Catherine
MONTREAL, Quebec
H2X 2A3
Tel.: (514) 842-0808
Fax: (514) 842-4600
gord@goalasic.com
http://www.goalasic.com

Contact: Gord Harling, President

Major Achievements

- CMOS cell libraries in processes from 0.8 micron to 4 micron, 1.2V to 25V mixed signal.
- Creation of a large well-supported library of functions ranging from simple analog cells to complex digital functions.
- Contract design work on custom Digital Signal Processors, embedded microprocessors, and analog signal conditioning circuits.
- Shared wafer services in 1.5-micron double poly metal for very low-cost prototyping on a regular basis.

Company Background Founded in 1992, Goal Electronics employs 10 designers using Cadence and Viewlogic tools. Employees have performed consulting work on integrated circuit processing and design, created numerous standard cell libraries, and completed IC designs ranging from small analog filter circuits to 16-bit DSP engines.

Business Description Goal Electronics, an ASIC design company, specializes in mixed-signal circuits in CMOS processes. It has developed a wide variety of circuits and cells in processes ranging from 1.2V operation to 25V operation, using Cadence and Viewlogic tools to provide cost-effective design services. Goal's engineers have intimate knowledge of the CMOS processes run by our foundries, and can draw maximum performance whether requirements call for high speed, low power, or low noise.

IBM CANADA LTD.

23 Airport Blvd.
BROMONT, Quebec
J0E 1L0
Tel.: (514) 534-6920
Fax: (514) 534-6800
dwoo@brmvm1.vnet.ibm.com

Contact: David Woo, Manager, New Business Development

Major Achievements

- The IBM Bromont plant is a co-winner of the 1992 Canadian Export Award for the country's largest exporter.
- The Plant is ISO 9002 certified since 1993.

Company Background IBM Bromont is a manufacturing plant located near Montreal, Canada. It was established in 1972, employs 1,500 people, and occupies 750,000 square feet. The plant is part of IBM Canada.

Business Description This technology plant packages most of IBM's semiconductors for the North American market. The chips use various technologies (CMOS, Bipolar and BiCMOS) for several applications such as Memory, ASICs, Microprocessors and Specials. We use wirebond, flip chip or thermocompression techniques to attach the die to chip carriers such as leadframes (Alloy 42 or Copper), ceramic substrates (thick film, thin film or multi-layer) or organic substrates (tape or laminate). We also offer different interconnects for card assembly such as pins (Copper, Kovar, CuSil), formed leadframes (J-leaded or Gullwing), or Surface Mount Solder Balls or Columns. Finally, we perform all test and burn-in of the completed module before shipment in trays or reels to our customers.

IBM Bromont's technologies are thin film sputtering on ceramic or glass (ITO, Al) plating on ceramic or cards, especially electroless gold for high-density applications and high-volume wirebond.

IBM Bromont's products are conventional plastic modules (SOJ, SSOP, PQFP), thermally enhanced PQFP with a moulded heatsink (MHS), high-density plastic modules with a ceramic enterposer, ceramic modules for pin-through-hole applications (Paste, MC, MLC), and ceramic modules for surface-mount applications such as the PowerPC 601 carrier (CQFP) or with Ball/Column Grid arrays.

The plant vision is to satisfy the customers in every aspect. We have had ISO 9002 certification since May 1993. We welcome the opportunity to work with potential customers to build existing applications at very competitive cost and at world-class quality, to create future applications that we can work on together to find the best solution.

INTRONIC SEMICONDUCTOR CO.

15 Rue Buteau, Suite 230
HULL, Quebec
J8Z 1V4
Tel.: (819) 770-1468
Fax: (819) 770-1573
intronic@globalx.net

Contact: Don McCarthy, President/Design Manager

Major Achievements

- Intronic Semiconductor Co. provides technical services such as standard cell and gate array design, system partitioning, alternate source netlist and test vector translation, custom cell/ASSP development, and VHDL/HDL ASIC synthesis

Company Background Intronic Semiconductor was established in 1991 by Don McCarthy in response to a growing need in the semiconductor industry for independent ASIC design services with an applications background. The engineering staff at Intronic combines over 25 years of hands-on experience with ASIC devices. Intronic began its business as an automotive ASIC design house, and has since completed several key automotive ASIC designs currently in production at Chrysler and General Motors Corporation. In 1993 the business expanded into the Hard Disk Drive and PC/Workstation markets, developing chips for customers in the Rocky Mountain region, where Intronic maintains an office (in Boulder, Colorado) to provide ongoing support for its U.S. customers.

Business Description Besides supporting customers throughout the production life cycle of the ASICs which have been developed at Intronic, the company provides a complete design service for new projects and customers, including front- and back-end development. Intronic currently supports the complete suite of Compass Design Automation tools, which run on a SPARC station platform. HSPICE analog simulations are also supported on an IBM Pentium platform. Intronic also provides behavioural models and portable netlist models for compiled cells, so that customers can perform simulations in their own environment. Communication is supported through a high-speed SLIP data link for file transfer and remote login, to further provide customers with 24-hour bilateral access to the design database.

ITS ELECTRONICS INC.

200 Edgeley Blvd., Unit #24-26
CONCORD, Ontario
L4K 3Y8
Tel.: (905) 660-0405
Fax: (905) 660-0406

Contact: Ilya Tchaplia, President

Major Achievements

- One of Canada's largest manufacturer of low-noise amplifiers.
- Major manufacturer of solid state products for new solid state radars used in air traffic control.
- HMIC manufacturing and MMIC design capability.
- Large-scale production of LNA/Diplexers for INMARSAT terminals.

Company Background ITS Electronics Inc. was founded in 1987. It manufactures solid state amplifiers and frequency translation products, which are used in a wide variety of growing fields such as telecommunications, satellite communications, distance education, and wireless communication systems.

Business Description ITS Electronics serves the largest global corporations in the telecommunications, communications and defence sectors. The company exports about 70 per cent of the products it manufactures to areas such as the United States., Asia, Europe, India, China, and Singapore. Its HMIC (hybrid microwave integrated circuit) manufacturing capabilities and MMIC (microwave monolithic integrated circuit) design capability are highly specialized technologies. ITS provides the following products and services: standard components from a diversified product line; custom design and manufacturing of microwave components and subsystems; build-to-spec and build-to-print RF and microwave components and subsystems; and design and consulting services on a system and subsystem level in the following applications: in areas of RF, microwave and millimetre wave-based systems.

LOGICVISION SOFTWARE (CANADA) INC.

Suite 404, 1525 Carling Avenue
OTTAWA, Ontario
K1Z 8R9
Tel.: (613) 722-0854
Fax: (613) 722-4164

Contact: Michael Howells, V-P of Engineering & Product Development

Major Achievements

- LogicVision is the first company to focus exclusively on developing Built-In Self-Test (BIST) technology to automate the testing of entire systems. BIST directly addresses both the technical and economic disadvantages of external testing. BIST is a complete test generation, application, and comparison facility for each major block in a design. For ICs, this includes BIST of random logic and embedded memories, and the IEEE 1149.1 standard for boundary scan.

Company Background LogicVision was founded in 1992 with the goal of becoming the leader in delivering BIST technology to the electronics industry. The company's mission is to realize the vision of fully self-testing and diagnosing systems. Its BIST technology is essential for automating the development of high-quality self-testing systems, boards, Multi-Chip Modules and ICs, thus reducing both test costs and design cycles. LogicVision is a California corporation based in San Jose with its Canadian headquarters in Ottawa.

Business Description LogicVision technology will be deployed across a vertically integrated family of solutions that work together throughout all levels of the design process. The company is currently developing a fully hierarchical test-automation technology that will extend tests across an entire system, thus realizing the full potential and vision of self-testing and diagnosing systems. Released in March 1995, LogicVision's ICBIST technology offers a complete test strategy for ASICs and complex ICs, and is the next step in LogicVision's realization of Electronic Systems Test Automation.

LogicVision's target users include design, Design-For-Test (DFT) and test engineers, as well as system architects at electronic companies in telecom, computer, semiconductor, automotive, consumer, and aerospace. The company also partners with ASIC vendors, fabless semiconductor vendors, and third-party intellectual property developers, to create customized BIST solutions.

MATROX GRAPHICS INC.

1055 St. Regis Blvd.
DORVAL, Quebec
H9P 2T4
Tel.: (514) 685-3630
Fax: (514) 685-2853

Contact: Gordana Stock

The New Standard in Graphics Acceleration

Matrox Graphics Inc., based in Montreal, is a major designer and manufacturer of graphics and video hardware for the PC. It has received international recognition as a leader in graphics technology with its MGA Series of 64-bit graphics accelerators — the first of its kind in the PC market. Today, Matrox Graphics Inc. ensures its position as leader in the international market with offices in London, Munich, Paris, Milan, Hong Kong, and major U.S. cities.

Matrox Graphics Inc. is a developer and manufacturer of graphics accelerator boards for the mainstream and professional markets. It was formerly the graphics division of Matrox Electronic Systems. On April 1, 1994, Matrox Graphics Inc. became an independent company undertaking all development, production and marketing activities related to the MGA Series of 64-bit graphics accelerators. Matrox has gained a reputation as an industry leader in bringing innovative, leading-edge technology to the graphics industry for nearly two decades. Benefiting from Matrox Electronic Systems' 20 years of experience in developing graphics solutions for high-end PCs and workstations for industry leaders such as IBM, Compaq, Gateway and NEC, Matrox Graphics Inc. now brings this technology to the consumer market at affordable prices.

Award-winning technology: Its proven experience and skills played a vital role in Matrox being the first company to develop and introduce a 64-bit graphics accelerator engine for the PC. Since its introduction in 1993, Matrox's MGA Series of 64-bit graphics accelerators has gained a worldwide reputation for setting a new standard in the industry.

MATROX ELECTRONIC SYSTEMS, LTD.

1055 St. Regis Blvd.
DORVAL, Quebec
H9P 2T4
Tel.: (514) 685-7230
Fax: (514) 685-2853

Contact: Catherine Overbury

Matrox Electronic Systems, Ltd.: 20 Years of Excellence

The year 1996 marks 20 years of innovation for Matrox in imaging, graphics, video and networking. We were building boards long before the PC was born; and since, we have mastered the art of designing PC products. Our customer list reads like a "Who's-Who" in high technology; and they consistently stay with us over multiple generations. Matrox thrives on the synergy that exists between our divisions; each group is able to deliver the best price/performance in their respective market.

Imaging Products Group

OEMs and integrators worldwide use Matrox imaging solutions to build cost-effective PC-based systems for machine vision, image analysis and medical imaging. The Group offers high-performance PCI hardware and device-independent software tools. The complete hardware line ranges from basic standard grabbers to powerful, fully flexible products integrating acquisition, processing and display. For more information call 1-800-804-6243 or visit our web site at www.matrox.com/imaging.

Video Products Group

Matrox Video Products Group designs, manufactures and markets broadcast-quality digital video hardware and software development tools to OEMs and systems integrators in the television broadcast, cable and post-production industries. Developed with the concepts of modularity and PC-based open architecture in mind, Matrox video products are the perfect building blocks to enable professional video system vendors to get their products to market quickly. For more information call 1-800-361-4903 or visit our web site at www.matrox.com/video.

Matrox Networks

Matrox Networks boasts an innovative line of Switched Ethernet and Fast Ethernet products. Our products provide the ideal solution to cost-effectively increase performance for Local Area Networks and servers that perform bandwidth intensive applications (i.e.: CAD, multimedia, Intranet). The product line consists of specialized PCI Server cards, switches, traditional hubs and SNMP-based management. For more information call 1-800-837-3611 or visit our web site at www.matrox.com/networks.

MAYA HEAT TRANSFER TECHNOLOGIES LTD.

4999 St. Catherine St. West
Suite 400
MONTREAL, Quebec
H3Z 1T3
Tel.: (514) 369-5706
Fax: (514) 369-4200
info@mayahtt.com

Contact: Arnold Free, Vice President

Major Achievements

- MAYA's Electronic System Cooling software is designed to simulate 3-D air flow and heat transfer in electronics. It can model individual components, multi-chip modules, heat sinks, and PC boards, as well as complete electronic systems.
- MAYA's software and services help its customers to develop superior quality products, to lower product development costs, and to reduce time to market.

Company Background MAYA is a relatively new firm that provides solutions in electronic systems packaging to various U.S. and Canadian corporate clients. These clients have included organizations such as the Canadian Space Agency, to whom MAYA has provided advanced solutions.

Business Description MAYA Heat Transfer Technologies Ltd. develops top-flight mechanical computer-aided engineering thermal and fluid flow simulation software for aerospace, electronics, transportation and manufacturing industries. MAYA is dedicated to providing engineering analysis software solutions and services. Its products and services are used by hundreds of engineers and scientists worldwide to simulate the performance of products and processes. MAYA has developed extensive expertise in thermal and fluid flow analysis. It develops two thermal analysis products: TMG Thermal Analysis, and Electronic System Cooling (ESC). It also offers SDRC's I-DEAS Master Series™ — a leading mechanical computer-aided engineering (CAE) design-analysis software package. All our tools are designed to meet our customers' needs, and then built and tested to excellent reliability and quality standards.

MIRANDA RESEARCH INC.

5695 Saint-Francois Road
SAINT-LAURENT, Quebec
H4S 1W6
Tel.: (514) 333-0202
Fax: (514) 333-6914
ctrembla@miranda.com

Contact: Christian Tremblay, President

Major Achievements

- Miranda develops, manufactures and markets the latest in leading-edge digital video products through a worldwide distribution network.
- Miranda has several advanced R&D projects, including a contract with the Canadian Space Agency for a multiple-image high-definition television (HDTV) workstation.
- Miranda is a third-party developer for the Matrox Studio desktop video system, for which we have developed "Titania", a 3-D special-effects card.
- Miranda products are sold on a OEM basis by well-known companies such as Barco (Belgium), Getris (France), and Chyron (United States).

Company Background Founded in 1989 by five engineers specialized in digital image processing, the company is 100%-owned by its management team. Miranda Research is responsible for R&D activities, and Miranda Technologies manufactures and markets the products. The two companies together form the Miranda Group. Miranda Technologies owns 50 per cent of TMI Technologies Inc., a joint venture responsible for the development of video DSP chips.

Business Description Miranda manufactures interface products for larger equipment such as cameras, videotape recorders, and production switches. It has become a specialist in converting video formats from analog to digital, serial to parallel, component to composite, and vice versa. Miranda's products are characterized by high quality at affordable prices (less than $10,000).

MITEL SEMICONDUCTOR

Head Office:
360 Legget Drive
KANATA, Ontario
K2K 1X3
Tel.: (613) 592-2122
Fax: (613) 592-4784
ellen_brayton@mitel.com

Contact: Ellen Brayton, Marketing Coordinator

Plant Location:
18 Airport Blvd.
BROMONT, Quebec
J0E 1L0
Tel.: (514) 534-2321
Fax: (514) 534-2168
bertrand_masse@mitel.com

Contact: Bertrand Massé, Plant Manager

Major Achievements

- Pioneered analog switches, delivering the first 8 x 4 analog switch.
- Developed ST-BUS, the first open standard telecom component interconnect bus.
- Introduced the first PCM digital crosspoint switch.
- Developed the first 2B+D echo cancellation transceiver using biphase technology.
- Developed the first 3V 8-pin DTMF receiver.
- Developed the first integrated primary rate framer.
- Received the Canada Export Award in 1994.

Company Background Founded in 1976, Mitel Semiconductor designs, manufactures and markets integrated circuits and thick film hybrids. It specializes in telecoms, analog line and real-time networking. Mitel Semiconductor components provide high performance and high value in PBX, central office, telephony, high-speed networking, data communications, wireless, computer telephony integration, and real-time interactive multimedia applications. The company also provides Custom Wafer foundry services for mixed signal CMOS to 1.5µm, CCD and high-voltage applications.

Business Description For the past 20 years, Mitel Semiconductor has been supplying state of the art telecommunications systems solutions. Designing and manufacturing in Canada and the United Kingdom; to the relevant ISO 9000 quality standards, Mitel Semiconductor is acknowledged as a true world leader in the telecommunications industry.

MOSAID TECHNOLOGIES INCORPORATED

P.O. Box 13579
KANATA, Ontario
K2K 1X6
Tel.: (613) 836-3134
Fax: (613) 831-0796
gillingham@mosaid.com

Contact: Peter Gillingham, Director, Strategic Marketing

Major Achievements

- Mosaid has 26 patents in the field memory design.
- Mosaid's 4M and 16M DRAM and SDRAM designs are produced in high volume.
- Mosaid is actively involved in 16M and 64M DRAM and SDRAM designs.
- Mosaid was awarded first prize in Electronic Test Readers' Choice Awards, Memory Testers category.
- Mosaid established a partnership arrangement with a large U.S.-based chip manufacturer, and jointly developed a specialized production of wafer probe test system.

Company Background Mosaid Inc. was formed in 1975 as a privately owned and operated R&D engineering company specializing in the technology of memory ICs. Mosaid Systems Inc. was formed in 1982 when the design of a tester product for internal purposes led to a commercial opportunity. Mosaid Inc. and Mosaid Systems consolidated in 1991 under the Mosaid Technologies umbrella. The group exports virtually 100 per cent of its products, and has been active in the Far East for more than 15 years.

Business Description Mosaid designs and licenses JEDEC-standard DRAM and SRAM chip designs, as well as embedded Application Specific Memory macrocells. Current designs are 1M, 4M and 16M DRAM, 16M and 64M SDRAM and PSRAM, 1M SRAM, and core cells for colour graphics chips.

Mosaid provides product engineering support to ensure smooth integration of design and process, faster yield attainment, and shorter time to market.

Mosaid manufactures and distributes memory-test equipment for engineering applications.

MPB TECHNOLOGIES INC.

151 Hymus Boulevard
POINTE-CLAIRE, Quebec
H9R 1E9
Tel.: (514) 694-8751
Fax: (514) 695-7492
ghosh@hymus.mpbtech.qc.ca

Contact: Asoke K. Ghosh, Director, Space & Photonics Division

Major Achievements

- MPB Technologies Inc. was awarded MERCURIADES '92: Research and Development Award, and Business of the Year Award by the Quebec Chamber of Commerce.

- MPB Technologies Inc. was also the winner of: the Canada Export Award; Prix MICA 1990 - Export and Business of the YearAward; and Canada Awards for Business Excellence - Entrepreneurship and Innovation in 1990.

Company Background Federally incorporated in late 1976, MPB Technologies Inc. commenced operation at the beginning of 1977. Starting from an initial staff of eight, the company has grown to a strength of just under 200 full-time employees. MPB Technologies Inc.'s personnel are a unique combination of physicists, electronic and mechanical engineers, and technical staff, backed by experienced, efficient project management. Approximately 30 per cent of the professional staff members have Ph.D. degrees.

Business Description MPB Technologies Inc. specializes in high-technology products and systems, research and development, and measurement services. Company activities encompass communications, electromagnetics, fusion, lasers, natural resources instrumentation, space technology, and telerobotics. Products include lasers, devices and accessories for scientific and industrial applications, high-speed communication terminals, timing and supervisory systems, SONET/SDH to PDH Conversion Modems, special antennas, transponders, "hot" loads, and dichroic plates.

NANOWAVE TECHNOLOGIES INC.

425 Horner Ave., Unit #1
ETOBICOKE, Ontario
M8W 4W3
Tel.: (416) 252-5602
Fax: (416) 252-7077

Contact: Justin Miller, Ph.D., President & CEO

Major Achievements

- Manufacture Nanowave Solid State Amplifiers and Frequency Converters to MIL-Q-9858 quality. These offer an unsurpassed combination of low-noise, high-power efficiency and reliability.
- Design Low Noise Amplifiers up to the 40 GHz range.
- Design Solid State Power Amplifiers up to the 30 GHz range.

Company Background Nanowave Technologies has more than 17 years' experience in microwave components and subsystem design, as well as in manufacturing and testing of GaAs devices. All manufacturing, testing and design is done in-house for a host of national and international clients.

Business Description Nanowave Technologies Inc. services include: thin film services such as thin film deposition and MHMIC foundry services; assembly and test; and hermetic laser sealing of aluminum packages. Nanowave does custom contract assembly and tests hybrid modules to customers' specifications. The company has extensive capability in thin film metallization on material such as alumina, quartz and ferrites.

NATIONAL OPTICS INSTITUTE

369 Franquet Street
STE.-FOY, Quebec
G1P 4N8
Tel.: (418) 657-7006
Fax: (418) 657-7009
rcorrivo@ino.qc.ca

Contact: Robert J.L. Corriveau, V.P., Technology and Business Development

Major Achievements

- NOI has strategically positioned itself to efficiently develop a broad range of microdevices in addition to bolometers and micromirrors, by developing the expertise required for both the design and fabrication of key MEMS "building blocks".
- NOI is currently developing hybrid parallel information-processing systems (optics/electronics) to be used in designing high-speed image processing and pattern recognition systems, among others.

Company Background NOI is a private non-profit corporation founded in 1985. Its mission is to be an international leader in optics and photonics R&D, promoting economic expansion in the country by providing assistance to companies seeking to be more competitive. It employs over 65 researchers, 35 technicians, and 13 management and administrative employees. Its facilities cover 8,300 m^2 of which 5,300 m^2 are occupied by laboratories. Its equipment has a current value of more than $22 million.

Business Description NOI emphasizes commercializing research and development (R&D) through technology transfers, feasibility studies, specialized components, prototype production, short production runs, and industrial problem solving. The company has special expertise in the area of microfabrication, such as standard thin film material processing, bulk micromachining of silicon, surface micromachining of silicon, and laser-assisted processing.

NORTEL ADVANCED COMPONENTS

185 Corkstown Road
P.O. Box 3511, Station C
OTTAWA, Ontario
K2H 8V4
Tel.: (613) 763-2238
Fax: (613) 763-8946
nortel.semi@nt.com

Contact: John Hartin, Director, Internal Communications

Major Achievements

- Canada's premier silicon fabrication facility, offering a full range of CMOS, BiCMOS, and high-speed (25 GHz, 0.5µm) Bipolar capability optimized for wireless and broadband applications
- Chip-on-Flex technology, used by Nortel's Advanced Packaging Team to achieve a three-to-one shrink in the size of a microwave module
- Highly integrated cellular base station modules
- High-speed Transmit and Receive modules and optical amplifiers for OC192 broadband networks
- Canada's only electron beam photomasking manufacturer

Company Background For over 30 years Nortel Advanced Components has been a world leader in the design, development and manufacture of leading-edge telecom products and process technologies. With facilities in Canada, the United States, the United Kingdom and China, Nortel has positioned itself to provide full semiconductor and optoelectronic design and manufacturing services to a global marketplace.

Business Description Nortel Advanced Components comprises three divisions, serving Nortel and external customers in the following key areas:

- **Nortel Semiconductors** — silicon design and manufacturing services using state of the art Bipolar, CMOS and BiCMOS process technologies
- **Nortel Microwave Modules** — design and manufacture of high-frequency microwave modules, using GaAs integrated circuits; world-class design and manufacturing capability for surface acoustic wave (SAW) filters
- **Nortel Optoelectronics** — optoelectronics products, including high-speed semiconductor-based optical transmitters, receivers, amplifiers and detectors

OMEGA TELEMUS INC.

95 Hines Road
KANATA, Ontario
K2K 2M5
Tel.: (613) 592-2288
Fax: (613) 592-8855

Contact: Monica Borg

Major Achievements

- Omega Telemus fully understands the evolution of electronic warfare and advanced radar technology, and the global trends that influence future system design and production.
- Omega Telemus has the ability to develop and apply advanced high-speed digital and signal processing technology to the real needs of the world's defence equipment users.
- Omega Telemus uses a wide variety of proprietary and in-house software packages, which include significant modelling and simulation tools.

Company Background Omega Telemus Inc. is a Canadian company and a member of the OMEGA Technologies Group of companies. The OMEGA Technologies Group, founded in 1978, is today a major supplier of advanced electronic warfare, radar, microwave, and training systems and technology. Omega Telemus Inc. has maintained a worldwide reputation for innovative technology. Continuous company-funded development of ELINT technology has resulted in the filing of file patents/patents pending in Canada, the United Kingdom, and the United States.

Business Description For over 10 years, Omega Telemus scientists and engineers have brought an analytical approach to every project by assessing facts, functions and trade-offs, and by determining which technologies and architectures best address effectiveness, reliability, and economy in their designs. Telemus staff have conducted considerable analysis in the design of special receivers for dealing with the complex emitter environment, specific complex emitters, and radar intrapulse characteristics. Customers include DND, the U.S. Navy and Air Force, NATO, the U.K. Ministry of Defence, Ericsson, Fujitsu, and Hughes.

OPTEM ENGINEERING INC.

100 Discovery Place One
3553 – 31st Street NW
CALGARY, Alberta
T2L 2K7
Tel.: (403) 289-0499
Fax: (403) 282-1238
jpoltz@acs.ucalgary.ca

Contact: Joan Beckett, Product Marketing Manager

Major Achievements

- In 1992 OptEM introduced its first product, OptEM VLSI. This software extracts nets from IC layout data and calculates R, L, C, and G parasitic values for lossy, lossless, coupled, or uncoupled nets. In addition, it generates interconnect SPICE models for circuit simulators, and Standard Delay Format (SDF) models for timing simulators.

- OptEM introduced its own interconnect design and circuit simulation software, called OptEM Interconnect Designer (OptEM ID), in 1993. This tool is the first to incorporate both circuit and statistical analysis methods for the design of high-speed digital interconnects.

- OptEM recently opened its first U.S. sales office in Santa Clara, California.

Company Background OptEM Engineering Inc. was incorporated in February 1992 with a mission to optimize the electromagnetic performance of electronic circuit interconnects through the development of quality software products and a commitment to customer service. OptEM's principal product, OptEM VLSI, was originally developed for VLSI designers of high-performance integrated circuits in Japan. The founders of OptEM Engineering worked together for several years, developing general purpose CAE software tools before branching off to pursue VLSI circuit analysis software.

Business Description OptEM designs, manufactures and markets several CAE software tools dedicated to the emerging needs of EMC and signal integrity engineers. These tools allow designers of high-speed digital systems to identify and solve problems early in their design cycle. OptEM's tools provide solutions to problems such as crosstalk, ground bounce, time delay, signal/noise distortion, EMC/EMI, and other design issues. The company also offers a variety of technical seminars, consulting services, and product training programs.

OPTIMIZATION SYSTEMS ASSOCIATES INC.

P.O. Box 8083
DUNDAS, Ontario
L9H 5E7
Tel.: (905) 628-8228
Fax: (905) 628-8225
j.bandler@ieee.org

Contact: Dr. John Bandler, President

Major Achievements

- Optimization Systems Associates (OSA) are pioneers in a wide range of systems, such as software architecture for IC design, yield and tolerance optimization, robust parameter extraction, and EM-based design.

- OSA Inc.'s areas of expertise include harmonic balance simulation techniques, robust and statistical modelling of active and passive devices, statistical estimation of production yield, powerful performance and yield optimization algorithms, customized optimizers for large-scale problems, and software architectures for integrated approach to design.

Company Background Selected users of OSA technology include Alcatel, CRC, COMSAT, France Telecom, Rockwell, Siemens, and Schrack Aerospace. The research carried out at OSA is proprietary, commercially driven, highly original and state of the art. OSA has reached many technical milestones since 1994 — such as EM design of HTS microwave filters, breakthrough Geometry Capture, aggressive Space Mapping for EM design, explosion of development and use of optimization-based technology for automated circuit design with EM simulators, and Datapipe connection of OSA90/hope with Arndt's waveguide component library.

Business Description Optimization Systems Associates are currently concerned with Empipe Version 3.1, a powerful and friendly software system for automated EM design optimization; OSA90/hope Version 3.1, pertaining to general nonlinear circuit simulation and optimization; and HarPE Version 2.0, involving device characterization, simulation and optimization.

OPTO-ELECTRONICS INCORPORATED

2538 Speers Road, Unit #9
OAKVILLE, Ontario
L6L 5K9
Tel.: (416) 827-6214
Fax: (416) 827-6216

Contact: Brian K. Garside, President

Nature of Business Opto-Electronics Incorporated is a major supplier of high-speed fibre-optic test and measurement instrumentation to leading high-technology companies and laboratories involved in industrial and military applications. The company product line is based on its ability to generate and detect picosecond time-scale optical pulses, as well as to design and manufacture the high-speed signal processing electronics needed to take full advantage of this highly specialized capability. Major markets are in the characterization of short-haul optical-fibre local-area communications, multisensor networks, and fibre-optic component analysis.

Major Achievements Opto-Electronics Incorporated is the original manufacturer of the world's fastest photodetectors and diode laser light sources, and the company has become one of the leading fibre-optic test and measurement instrument manufacturers in the world. The Opto-Electronics Millimetre Resolution OTDR (Optical Time Domain Reflectometre) was a recipient of the 1988 Photonics Circle of Excellence Award. The TDR30 photon counting high-resolution OTDR system was similarly honoured in 1990 by *Photonics* Magazine.

Company Profile Sales Volume: $2 million per year
Employees: 20 people; R&D: 9

Company Background Opto-Electronics Incorporated is the original manufacturer of the world's fastest picosecond/gigahertz photodetectors and diode laser light sources. Established in 1976, the company has become one of the leading fibre-optic test and measurement instrument manufacturers in the world.

Opto-Electronics' first product, the PD-10 picosecond photodetector, was introduced in 1979. This detector was the fastest commercially available device at that time. It was also the forerunner of an ever-expanding line of fibre-optic test and measurement instrumentation, ranging from ultra-fast fibre-optic receivers and transmitters to signal-processing instruments and systems, such as the unique millimetre resolution OTDR and the multi-gigahertz bandwidth tester.

Business Description

- Millimetre Resolution OTDR (Reflection Mode): available with a wide range of options at wavelengths from 0.68 microns to 1.55 microns as plug-in units to a rack-mountable mainframe system.
- Fibre Bandwidth Measurement Instruments: especially suitable for high-speed data links and local area networks at 0.85 microns and 1.3 microns.
- Fibre Cable Strain Measurement Instrument: based on the millimetre resolution OTDR instrumentation.
- Photon Counting OTDR System: with a 30 db increase in sensitivity that has enabled the detection of Rayleigh backscattering from optical fibres with an unprecedented cm-scale resolution.
- Portable Optical Fibre Monitor: a completely self-contained field portable Fresnel reflection OTDR for short-haul applications having a zero deadzone and a distance resolution measured on a millimetre scale.
- Stand-alone picosecond laser diode source and semiconductor detector instruments.
- Ranging and dimensional measurement through the atmosphere with submillimetre resolution using the basic technology of the high-resolution OTDR system.

OPTOTEK LTD.

62 Steacie Drive
KANATA, Ontario
K2K 2A9
Tel.: (613) 591-0336
Fax: (613) 591-0584
optotek.ltd@uniboard.synapse.net

Contact: Dr. David Kennedy, President

Major Achievements

- LED and GaAs MMIC products are supported through a combination of local representation, direct engineering sales support from home office, and selective "capability" advertising.
- The CAE software is supported by local representation and direct sales (telemarketing), complemented by extensive advertising.

Company Background Incorporated in 1977, Optotek operates a 36,000-square foot-facility on Steacie Drive in Kanata. The company designs and manufactures optoelectronic and semiconductor components and subsystems. These include customized light-emitting diode (LED) displays, associative drive electronics, and test equipment. The company also supplies specialized software to the wireless and microwave industry for computer-aided circuit design, test and analysis; these comprise MMICAD, a linear simulator, and SALSA, a transistor modelling and extraction software.

Business Description Optotek designs and manufactures application-specific GaAs MMICs for military and communications requirements, as well as high-resolution microwave integrated circuits. The company has also developed and released for commercial sale its microwave computer-aided engineering software (MMICAD) for design, analysis and test applications.

PHILSAR

81 Metcalfe Street, 3rd floor
OTTAWA, Ontario
K1P 6K7
Tel.: (613) 567-4604
Fax: (613) 567-5578
cloutier@philsar.com

Contact: Mark Cloutier, Director of Engineering

Major Achievements

- The engineers at Philsar have created an analog to digital transceiver that fits on an integrated circuit of less than 10 square millimetres. They accomplished this in a world-class IBM 0.8 micron BiCMOS mixed-signal process.
- Philsar's product applications include BiCMOS digital radio IC design, which consists of modem chipsets (QAM, VSB, QPSK), data converters and RF for digital radio, and broadband converters for PCs and video.

Company Background Philsar Electronics Inc. is a private corporation founded in 1993 by Luc Lussier. It has eight full-time and 15 part-time employees who are postgraduate electrical engineers, RF systems and component engineers, and mixed-signal semiconductor engineers. Philsar's capabilities include system modelling and simulation, schematic simulation, IC design and layout, IC Post Layout simulation, IC testing, and product support.

Business Description Philsar's core expertise is found in the areas of base technologies for wireless, RF and video systems, Digital RF interface and integrated circuit manufacturing. The company offers services such as full custom IC design, RF and mixed-signal systems design, cost-reduction analysis, gate array or standard cell design, and FPGA conversion services. Philsar's base technologies are Delta-Sigma Converters, Amplifiers, Oscillators, Mixers, AGCs, switched-capacitor and DSP filters, system simulation expertise, and mixed signal circuitry.

PMC-SIERRA INC.

8501 Commerce Court
BURNABY, British Columbia
V5A 4N3
Tel.: (604) 668-7300
Fax: (604) 668-7301
info@pmc-sierra.bc.ca
http:\\www.pmc-sierra.com

Contact: Gregory Aasen, Chief Operating Officer

Major Achievements

- PMC-Sierra is one of the leading companies in the development and supply of Asynchronous Transfer Mode, T1/E1 and SONET/SDH chips for the merchant market.
- PMC-Sierra has designed over 30 ICs for communications equipment manufacturers around the world.
- PMC-Sierra was the first company to market fully integrated T1 transceivers with integrated digital and analog circuitry on the same chip.
- PMC-Sierra has developed a telecommunications design library of more than 60 telecom-system blocks. These have enabled the company to develop new designs twice as fast as can be done using traditional design methods.
- PMC-Sierra's track record as an ATM chip pioneer dates back to 1993 with the introduction of the first 155-megabit-per-second ATM PHY, the S/UNI-155.

Company Background PMC-Sierra, a wholly-owned subsidiary of Sierra Semiconductor, is a leader in networking component solutions emphasizing broadband ATM, SONET/SDH and T1/E1 applications. The company's quality system is registered with the Quality Management Institute to the ISO 9001 standard. As co-founder of the SATURN Development Group, PMC-Sierra works with over 40 other member companies to define and develop interoperable, standards-compliant components for ATM-based applications. Headquartered near Vancouver, British Columbia, PMC-Sierra also offers local technical and sales support in Ontario, Massachusetts, California, Europe and Asia.

Business Description PMC-Sierra's mission statement: to provide superior broadband networking component solutions to facilitate the development of the information superhighway.

SDL OPTICS

6703 Rajpur Pl.
SAANICHTRON, B.C.
V8M 1Z5
Tel.: (250) 544-2244
Fax: (250) 544-2225

Contact: Grant Rogers, V.P., Market Development

Company Profile

SDL Optics designs, manufactures and markets fibre-coupled laser diodes for a wide range of single-mode and multi-mode fiber-optic applications. These products are used in telecommunications, CATV, optical sensing and various industrial and scientific applications.

The major product lines are high-power 980 nm laser modules for erbium-doped fibre amplifiers (EDFA), 1550 nm DFB laser modules, 500 mW single-mode master-oscillator power-amplifier (MOPA) modules, and low-power connectorized lasers and detectors.

SDL Optics has pioneered the use of fibre Bragg gratings by developing grating-stabilized laser diode modules for pumping erbium-doped fibre amplifiers (EDFA). These stabilized modules are state of the art in high-power pump modules. In addition, SDL Optics has complete fibre grating research and manufacturing facilities on site.

SDL Optics is a subsidiary of SDL. Inc. (San Jose, CA), the world's leading supplier of reliable high-power laser diodes.

SEMICONDUCTOR INSIGHTS INC.

36 Steacie Drive
KANATA, Ontario
K2K 2A9
Tel.: (613) 599-6500
Fax: (613) 599-6501
jacq@semiconductor.com

Contact: Jacqueline McKenzie, Director of Marketing

Major Achievements

- More than 95 per cent of sales since company inception have been to export markets.
- Revenues have expanded 2.5-fold in the last two fiscal years.
- SI has provided technical support for the largest patent-licensing programs in the semiconductor industry.
- SI was recently recognized by the Financial Post and Arthur Andersen as one of "Canada's Fifty Best Managed Private Companies".
- SI has developed proprietary technology that will perform automated analysis of future generations of microchips.

Company Background Semiconductor Insights was established as an independent company in July 1989. In March 1994, the company was repatriated from U.S. owners through a management-led leveraged buy-out. Being employee-owned helps provide strong focus, and ensures SI's complete independence while performing analysis of clients' needs.

Business Description Semiconductor Insights is an internationally recognized microelectronics consultancy. It specializes in the analysis of the design and process technology contained in state of the art semiconductor devices, technical analysis of semiconductor patents, and provision of product design services. The company's clients are the world's leading semiconductor and information technology corporations in the Far East, Europe, and North America. Semiconductor Insights' rapidly growing staff of engineers, physicists, technical specialists, and support personnel provide a broad range of consulting services; covering essentially any type of semiconductor device in any major manufacturing process.

SIBORG SYSTEMS INC.

24 Combermere Cres.
WATERLOO, Ontario
N2L 5B1
Tel.: (519) 888-9906
Fax: (519) 725-9522
siborg@siborg.ca
http://www.siborg.ca

Contact: Dr. Michael S. Obrecht, President

Major Achievements

- Developed multinational main product, MicroTec: the semiconductor TCAD Calculator for a PC. MicroTec allows 2-D semiconductor process modelling (including implantation, diffusion and oxidation) and 2-D steady-state semiconductor device simulation (MOSFET, DMOS, JFET, BJT, IGBT, Schottky devices, etc.). In many instances MicroTec outperforms existing commercial tools, and it is remarkably robust and easy to use.

- Developed SibLin: a highly efficient linear solver for symmetric and non-symmetric matrices with a band structure. This product has been licensed to Northern Telecom in Ottawa and to Waterloo Hydrogeologic Inc.

- Developing ResCu: Resident Scientific Calculator for the IBM PC. ResCu is one of the most easy to use and compact softwares of its kind.

Company Background Siborg was established in February 1994. Its main objective is the development and production of different kinds of scientific/engineering software tools, primarily for microelectronics and electrical engineering. Siborg has more than 21 years of experience in computational physics and more than 13 years in semiconductor device modelling.

Business Description Siborg's main product is MicroTec: the semiconductor TCAD Calculator. MicroTec is a tool for two-dimensional semiconductor process/device simulation. During the last couple of years, Siborg licensed MicroTec to a number of companies and universities in the United States, the United Kingdom, Japan, Korea, Holland, Germany, Singapore, South Africa, India, Venezuela and other countries. Siborg will also develop custom-designed scientific/engineering software tools.

SIGE MICROSYSTEMS INC.

301 Moodie Dr., Suite 310
Nepean, Ontario, K2H 9C4
Tel.: (613) 721-9686
Fax: (613) 721-9528
info@sige.com

Contact: Mr. John Roberts, President

SiGe Microsystems is a market-driven company established to build a business related to the design and production of high-performance low-power digital wireless circuits and related sub-assemblies, capitalizing on our strengths in silicon germanium ("SiGe") processing technology. The company expects to achieve in excess of 100 million dollars in sales per annum over a 5–7 year time-frame.

Our process capability is used by companies intending to introduce very high-performance SiGe Bipolar and BiCMOS products in the RF and high-speed digital areas. In the design area, we provide tile wafer designs, SiGe device modelling and proprietary designs for design partners and systems companies needing very high-performance devices. The company also intends to introduce carefully selected standard products.

There are two distinct but interrelated facets to SiGe Microsystems' operations:

- Development and marketing of RF and other high-performance integrated circuits and modules that offer significant benefits from the inclusion of SiGe deposition in circuit fabrication;
- The deposition of SiGe on customer-supplied wafers using state of the art production and measurement equipment located at the National Research Council.

SiGe Microsystems' present core competencies are in the deposition of SiGe on silicon wafers and in the design of bipolar integrated circuits and modules.

SiGe Microsystems has signed a five-year agreement with the National Research Council (NRC) for sole commercial use of the Leybold Ultra High Vacuum - Chemical Vapour Deposition ("UHV-CVD") facility, one of only two such production-sized machines in the world. SiGe Microsystems also has access to NRC's world-class characterization facilities. We draw on NRC's ten years in SiGe processing experience, including two years of operating experience with the stable and reliable UHV-CVD equipment. To this capability has been added RF and digital design experience in specific application areas where SiGe technology holds considerable commercial promise.

SILCOM RESEARCH LIMITED

Suite 201, 308 Palladium Drive
KANATA, Ontario
K2V 1A1
Tel.: (613) 591-1342
Fax: (613) 591-1329
76716.1403@compuserve.com

Contact: J. Peter Williams, President

Major Achievements

- Designed a complete radio-paging receiver for digital-alphanumeric services.
- Developed a high-speed optical data interface IC.
- Developed a very low-power 1-GHz radio.
- Developed an 0.8-micron CMOS digital-data signal-processing and system support for radio-paging applications.
- Established a joint venture with a major North American telecommunications company.

Company Background Silicom Research Limited (SRL) was founded in 1989 to provide communications-operating companies with complete solutions for their own unique marketing plans. The founders have strong R&D and business backgrounds in the development, production, and marketing of ICs, digital radio-paging products, and wireless systems.

Business Description SRL designs radio-frequency ICs for a wide variety of different types of radio systems. These include direct conversion, superhethrodynes, low-power transmitters, and novel radio systems. SRL develops individual semiconductor components or, if required, it can develop complete systems, including custom silicon, to optimize the design and cost criteria.

SINGMIN ENTERPRISES

9 Milne Crescent
KANATA, Ontario
K2K 1H7
Tel.: (613) 592-7739
Fax: (613) 592-3058

Contact: Dr. Andrew Singmin, President

Major Achievements

- Compilation of Industry Canada "Canadian Advanced Materials Expertise Guide".
- ISO 9000 and quality assurance electronics procedural advisory service.
- Development of training course on "Introductory Statistical QA Methods for the Semiconductor Industry".
- Development of tutorial seminar on "Semiconductor Failure Analysis & Statistical QA Techniques".
- MIL 217 MTBF semiconductor reliability prediction analysis.
- Semiconductor radiation technology strategic business plan.
- Development of Electronic Low Frequency Air Flow Detector.

Company Background Singmin Enterprises was founded in April 1992 by Dr. Andrew Singmin. Its capabilities include project management of scientific, technological and engineering programs; development and implementation of quality assurance programs; development of ISO 9000 implementation procedures for corporations; independent investigation of scientific studies; strategic analysis and optimization of corporate business plans; and technical writing assignments.

Business Description Singmin Enterprises can provide immediate capability in the science & technology sectors, to assist clients before they commit to the hassle of recruitment agencies, advertisement searches for staff, etc. Products include covert surveillance tracking and monitoring systems, audio sound systems for musicians, white noise generators for masking sound, low-frequency air flow detectors, and custom design universal prototyping PCB.

SSPA MICROWAVE CORPORATION

450 Matheson Blvd. E.
Units 59–64
MISSISSAUGA, Ontario
L4Z 1R5
Tel.: (905) 890-4501
Fax: (905) 890-4673
sspa1@ibm.net

Contact: Andrew Leung, Operations Manager

Major Achievements

- Developed the first solid state power amplifier (SSPA) capable of over 100 watts of linear power.
- Provides SSPAs for various technology industries on a global scale.
- Was the first in Canada to introduce high-power cellular and inmarsat bipolar amplifiers.
- Specializes in producing power amplifiers in the frequency range of 1 GHz to 18 GHz, with an output power of from one watt to 300 watts.

Company Background SSPA Microwave Corporation is a recognized leader in the microwave Solid State Power Amplifier industry. It has over 22 years of experience in researching, developing and manufacturing SSPAs for the aerospace, military and telecommunications industry worldwide.

The company's leadership took form when the founder of SSPA Microwave developed the first solid state power amplifier capable of over 100 watts of linear power — twice that of the closest competitor. Since that time, it has maintained its leadership position by offering an extensive product line and customized solutions. SSPA solidified its leadership with the recent introduction of high-power cellular and inmarsat bipolar amplifiers, another first in the Canadian SSPA industry.

Business Description SSPA Microwave, with headquarters in Toronto, stands ready to design amplifiers to clients' specifications and interface requirements quickly and efficiently. Facilities at its disposal include microwave design and test laboratories capable of producing both thick and thin film circuits, and multiple state of the art CAD/CAM systems to assist with the production of mechanical components.

TASK MICRO-ELECTRONICS INC.

1603 Saint-Regis Boulevard
DOLLARD-DES-ORMEAUX, Quebec
H9B 3H7
Tel.: (514) 685-8275
Fax: (514) 685-6811

Contact: Nick Tasker, President

Company Overview

Task Micro-Electronics Inc. has established itself in a very short time as one of Canada's few specialists in microelectronics packaging, with satisfied customers ranging from military to consumer markets, and from large corporations to start-ups.

Services currently offered to military, aerospace, medical, telecommunications, industrial and some commercial markets include the design, development, and production of

- complex thick-film hybrids
- chip-and-wire hybrids
- surface-mount and mixed technology boards, including Personal Computer Memory Card International Association (PCMCIA)
- chip-and-wire assemblies on most materials (FR-4, Flex, etc.)

TUNDRA SEMICONDUCTOR CORPORATION

603 March Road
KANATA, Ontario
K2K 2M5
Tel.: (613) 592-0714
Fax: (613) 592-1320
ricko@tundra.com

Contact: Richard O'Connor, Director of Marketing and Business Development

Major Achievements

- Tundra has seen revenues grow by more than 50 per cent annually for the past three years.
- Tundra is a leading developer of PCI and VME "bus-bridging" chips.
- Tundra has the broadest selection of data security chips available on the market.

Company Background Tundra Semiconductor Corporation (was Newbridge Microsystems for the past five years, a division of Newbridge Networks Corporation) commenced operating as a privately held independent developer of integrated circuits in December 1995. Tundra joins a growing list of Newbridge-affiliated companies.

Business Description As an international fabless semiconductor company, Tundra is focusing on two key niche markets: industry standard bus-bridging components that control the flow of data between different bus architectures used in computer or embedded systems, and data security components ensuring secure transmission of sensitive data. A third product line addresses the commercial requirement for industry standard "legacy" peripheral components, used primarily in commodity applications such as garage door openers, toys and pagers.

V^3 SEMICONDUCTOR CORPORATION

250 Consumers Road, Suite 901
NORTH YORK, Ontario
M2J 4V6
Tel.: (416) 497-8884
Fax: (416) 497-1160

Contact: John Zambakkides
President

Major Achievements

- V^3 Corporation has concluded negotiations with a major distributor active in North America and Europe, to distribute the entire Integrated Circuit (IC) product line. This distribution channel will increase exposure in AMD, ICT and Motorola accounts, and will enhance the company's ability to address procurement demands.
- The mainstay of the board division is the Pc/La logic analyzer offered in two models. Currently, Pc/La products are distributed and sold in more than 16 countries around the world, and are used by a prestigious list of clients that include NASA, Xerox, Westinghouse, General Electric, the California Institute of Technology, and the Massachusetts Institute of Technology.
- The Integrated Circuit product lineup includes a family of Memory and Peripheral Controllers for the AMD Am29000, the Intel i960 CA/CF, and the IDT 3051 and Motorola Mc68040 families of processors.

Company Background V^3 Corporation is an electronics design and engineering company that began operation in 1987. A privately owned Canadian company, V^3 Corporation's ownership and senior management are experienced scientists and engineers who bring a technical focus to the strategic direction of the company. V^3 Corporation has positioned itself in the marketplace to be able to take advantage of niche product opportunities. Market presence has been developed and expanded through a strategy of forming corporate alliances with respected and established industry leaders.

Business Description V^3 Corporation has two distinct product directions. First is the semiconductor division. This section of the organization has produced an extensive line of processor-specific memory and peripheral controllers that are direct companions to present market-leading high-performance RISC and CISC microprocessors. Secondly, there is a board-level division that produces and sells a high-performance logic analyzer, as well as other boards for V^3's IC devices.