

technologies have come together synergistically in the production of automated manufacturing systems for Compact Disks and CD ROMs.

Vadeco's customers include Morton Thiokol, Hercules Aerospace, US Navy, US Air Force, IBM, Canadian Forces, National Bank of Canada, Government of Canada, Ontario Hydro Nuclear, and CN Rail.

**KEYWORDS:** Large Scale Robotics; Robotic Aircraft Painting, Rocket Motor Robotics, Space Systems; Thin Film Deposition; Automation; Optical Monitors; Optical Inspection; Compact Disc Manufacturing; Reverse Vending Machines; Recycling Equipment, Systems Engineering; Off-Line Programming; Underwater Vehicles; Nuclear Repair Equipment; Engineering Consultants; Aircraft Painting; Consulting (Engineering).

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## VARIAN CANADA Inc

**ADDRESS:** Varian Canada Microwave Division  
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**HISTORY:** Varian Canada Inc is a wholly owned subsidiary of Varian Associates of Palo Alto, CA. The Canadian operation, located near Toronto, Ontario, was originally incorporated in 1955 to supply microwave tubes to the Canadian military.

The engineering and manufacturing segment of the company, Varian Canada Microwave Division (VCMD), operates under the umbrella of the Electron Device Group of the parent company, Varian Associates Inc, Palo Alto, CA. This group forms the largest electron tube manufacturing operation in the free world. Since its inception, the Canada Microwave Division has grown steadily and expanded its original charter to include many unique and customized products for worldwide markets (75% of sales are exported). Currently, the product line is split evenly between electron tubes and electronic equipment.

**CAPABILITY:** The following is a brief description of the major products manufactured at Varian Canada Microwave Division. Since many of the products were designed by the Division, full facilities and capabilities exist in-house for customizing to the needs of individual customers. Both MIL and commercial specifications can be met.

- **Travelling Waves Tubes:** These tubes are produced for microwave Line-of-Sight (LOS) Communication applications and cover frequencies ranging from 3.5 GHz to 15 GHz at power levels up to 50 watts. The product line includes a complete selection of conventional technology TWTs as well as metal-ceramic high efficiency and high linearity tubes. The company has the capability to customize existing designs to meet customer's unique requirements, and to develop retrofit packages to upgrade older field installations.

- **Power Klystrons:** This product line consists of a series of power klystrons used primarily as high power amplifiers in satellite earth stations and troposcatter communication applications. These are available at frequencies of 5, 6, and 14 GHz with power levels up to 3 kilowatts. Various channel tuner configurations are available, including a microprocessor-controlled, automatic-channel tuner.

- **Reflex Klystrons:** VCMD has an extensive line of reflex klystrons typically used in communications and radar systems for airborne and ground based applications, plasma diagnostics, spectroscopy, meteorological instrumentation and other experimental and scientific applications. The line ranges from the lower frequency tubes (8 to 25 GHz) with power outputs from 10 to 450 mW up to millimeter reflex klystrons ranging from 30 to 220 GHz with output powers from 5 to 800 mW.

- **Extended Interaction Klystrons:** This product line originated at the VCMD facility and extensive development efforts are continuing. The products address the very high frequency ranges for microwave applications, ranging from 30 GHz to 280 GHz. EIKs are rugged, lightweight, compact and are capable of generating medium rf power levels in either continuous or pulsed modes. The cw power levels of these klystrons range from 1 kW at 18 GHz to 1 watt at 280 GHz. Peak power outputs range from several kilowatts at 30 GHz to 60 watts at 220 GHz. These EIKs are well suited as rf power sources for a wide range of applications such as – Fire control radar; terrain following radar; illuminators; weather radar; plasma heating; radio astronomy; surveillance radar; satellite communications; tracking radar; radar modelling; and fusion diagnostics.

- **Millimeter Wave Subsystems:** VCMD offers a range of millimeter wave transmitter subsystems which consist of a modulator, a power supply and control circuitry driving the Varian line of Extended Interaction Klystrons. These transmitter systems operate in discrete frequency bands ranging from 30 to 220 GHz for pulsed and CW applications and can be designed to meet customer requirements to commercial or MIL specifications.

- **Power Supplies:** The basis of this product line is a complete series of power supplies which complement VCMD's electron tubes. However, in addition, specialized, complex power supplies have been developed and manufactured by the Division to both MIL and commercial specifications, requiring capabilities such as: high and low voltage outputs; DC or AC inputs; multiple outputs; stringent noise and regulation requirements; and unique shapes and sizes. Power levels up to 30 kW and voltages up to 50 kV have been achieved. Power supplies are available for laser and x-ray systems.

VCMD is able to qualify and test to MIL and commercial specifications. Customized products are a specialty of the Division. Organizational and administrative systems are in place to ensure the smooth execution of commercial and military contracts requiring exceptional attention to detail. These include fully computerized and on-line Manufacturing Resources Planning and a complete Quality Assurance system appropriate for MIL requirements.

**AVERAGE WORK FORCE:** Total – 300

**GROSS SALES:** 1986 – \$24M  
1987 – \$20M

**PLANT SIZE:** 100,000 Sq Ft (2 Facilities)

**EQUIPMENT/FACILITIES:** VCMD has, in-house, all of the extensive facilities and capabilities needed for the manufacture of high quality electron tubes and electronic equipment. A few of the facilities which support such precise and delicate design and manufacturing activities are: "Watchmaker accuracy" machine shop; in-house manufacturing of high voltage transformers; test facilities for microwave tubes, subsystems and power supplies; clean rooms; vacuum sealing facilities; electric discharge machining; environmental test facilities; hydrogen and vacuum furnaces; and laser welding.

**EXPERIENCE:** VCMD has in excess of thirty years of experience working with original equipment manufacturers of microwave and satellite telecommunications equipment. The Division has also been involved in various development programs for power supplies and other electronic subsystems to customers' specifications for many years.

Military programs have been a successful part of VCMD's operation. The largest single program lasted three and one-half years and was valued at approximately \$6.0M. In 1979, the company produced a space qualified instrument which was successfully flown on a NASA satellite designed to measure the earth's magnetic field. As well as private industry throughout North America, Europe and the Far East, the clientele also includes the Canadian, US and several European Governments, plus various agencies, laboratories and research institutions associated with these governments.