

than any other major space-faring country. Exports have grown from about \$10 million in 1977 (17 percent of sales) to an estimated \$230 million in 1991 (37 percent of sales). As major Canadian space programs started to wind down in 1993, the ratio of exports was expected to increase.

Many Canadian companies are niche players, with specialized areas of expertise. Examples are COM DEV's multiplexers/switches; SED/Calian's telemetry, tracking and control equipment; MPR Teltech's ground station network technology; MPB Technologies's expertise and unique capabilities in space photonics; CAL Corporation's mobile satellite aeronautical equipment and in remote sensing; MacDonald, Dettwiler and Associates (MDA) earth stations; and Intera's aerial radar mapping. COM DEV, MDA and Intera are world leaders in their respective fields.

Spar Aerospace, as the prime contractor for the Canadian space program, has developed systems integration skills and payload capability. As well, Spar produces and exports satellite subsystems such as antennas, solar panels and electronic systems. Spar is pursuing world markets for end-to-end communications satellite systems including both the space and ground segment. It is also pursuing new opportunities in small satellites and remote-sensing instruments.

In communications, the challenge for the industry is how to exploit the space and ground segments of fixed satellite-based, overseas telephony markets, and how to market both hardware (space and ground) and service segments of the new global mobile networks. Canada's lead role in developing the *Mobile Communication Satellite (MSAT)* has positioned industry to pursue the rapidly growing mobile satellite communications products and services market.

Market opportunities in remote sensing are related to ground equipment, software and value-added services for both radar and optical data. Canadian firms are already established world leaders, based on optical data, in ground station

and processing system design as well as in value-added products and services. MDA has provided systems for 80 percent of the present installed base of remote-sensing reception facilities worldwide. Canadian companies lead the development of value-added products and services, and now supply about 10 percent of the world market, with value-added sales of about \$85 million in 1993, estimated to grow to \$240 million by 1998.

At present, all remote-sensing data is provided by satellites of other countries, but when *RADARSAT* is launched in 1995 Canada will become a remote-sensing satellite operator. *RADARSAT* data will be marketed internationally by Radarsat International, which has already begun to negotiate reception agreements with ground station operators, usually government-funded national facilities. *RADARSAT* provides the opportunity for Canadian industry to maintain and further its lead in the expected large world markets for receiving, analyzing and interpreting radar data. Canadian expertise in natural resource management, environmental monitoring, mapping and remote sensing can be a valuable tool to increase sales of related products and services.

In space robotics, Canada has developed some unique capabilities. There are huge emerging markets for the handling of contaminated waste which require specialized hardware and software systems. While space robotics hardware is not appropriate for terrestrial applications, the merging of space software with existing terrestrial hardware could place Canada in an advantageous position. The U.S. represents a near-term market (some \$20 billion over 20 years), but similar requirements will eventually emerge in eastern Europe. Although large opportunities in space for space robotics (i.e. satellite servicing) will likely emerge, market size is unquantifiable and at least 10 years away.

National preferences dominate space-science activities. Canadian government participation in foreign programs is usually required to obtain work for Canadian companies. Bristol Aerospace