

Canada dominates the world market for a particular part of this market: satellite remote-sensing reception and processing systems.

The space segment of remote sensing consists of meteorological satellites, which had a fairly constant market of about \$600 million per year between 1986 and 1992, and earth observation satellites, which had a market growth of \$325 million to \$800 million per year in the same period. Although space budgets are under pressure around the world, the importance of satellite data for understanding environmental problems continues to shield this portion of national budgets from significant cuts.

Even if the recent rapid growth of remote-sensing satellite systems slows, the stage has been set for considerable future activity in the ground segment and in the user community (hardware, software, processed data, education, consulting). The market will be strongest in equipment to receive data and in activities that add value to the data, such as services and equipment that convert data to usable information.

Space Infrastructure and Robotics

The International Space Station (ISS), led by the United States and involving Canada, Japan and the ESA, is an important infrastructural element for space science. It is closely controlled by participating governments through their space agencies, for reasons of national prestige. There are two levels of "competition" for space station work: direct contracts to national agencies, and contracts to prime contractors or their subcontractors. It is extremely difficult for Canadian companies to become direct contractors to foreign national agencies in the absence of a directly associated Canadian government agreement. Canada's share in the multibillion-dollar ISS program is about 2.5 percent, primarily for the construction of the Mobile Servicing System (MSS). Russia has been invited to become a partner in the ISS, and negotiations are under way; an agreement is expected to be signed early in 1995.

By virtue of an intergovernmental agreement, the primary ISS market for each partner is essentially its own contribution to the project. There are a number of other identifiable markets, including maintenance and further enhancements of the existing MSS, spinoff opportunities into other space robotics markets, and diffusion of technology into other markets, especially the terrestrial market.

Terrestrial market opportunities are substantial. Nuclear waste handling has been specifically identified as a near-term, \$20-billion market, with more to follow. Other terrestrial markets are also developing, especially in the resource-harvesting area, where hazardous or difficult conditions attract the use of robotics. While identification of these markets is softer, they are likely to develop over the next decade and should be worth hundreds of millions of dollars per year.

Space market opportunities will also be great, and will be developed as we prepare to explore and exploit the solar system further. However, these markets will only become apparent well past the turn of the century.

Space Science

A measure of market size for space science is the amount that governments are prepared to spend in support of such activities. Space science is driven by scientists' continuing need for broad-based knowledge, often unfettered by near-term economic considerations. Industrial development and commercial interests also need knowledge derived from space science. However, revenue-generating commercial activities resulting from space science programs take longer to develop, and are more difficult to predict and compute than those generated by the other major space segments. Annual spending on space science by the United States, the ESA and Japan runs at approximately \$3 billion, with Canada spending about \$25 million per year. Programs are invariably sponsored by governments, and market opportunities exist for the provision of specialized equipment.