

GROUND PROCESSING AND CANADIAN CAPABILITIES

The art of converting data into meaningful, objective pictures or information is perhaps the most crucial element in a surveillance system. Raw data is processed, sometimes thematically, to present an illustration which best conveys the information to the analyst and the end user. Very often these pictures are not photographic replicas because false colours and stereoscopic enhancement are used to clarify meaning. Knowing the characteristics of the spacecraft, the target, and even the noise characteristics of the instrument, today's ground processing technology may use image enhancement and image restoration to produce a picture which, in many ways, overcomes the errors introduced by the sensor. Features can be highlighted to aid the interpreter, and information from different sensors can be analyzed in composite. The current development in this art is that "Artificial Intelligence"(AI) software is being used for advanced remote sensing applications. This software is designed to have human-like decision making abilities, using an "expert" knowledge base which is incorporated in the programme.^{1,15}

Several Canadian companies have established worldwide markets for their Landsat image processing systems and are now marketing SPOT compatible systems. One is providing the ground system for ESA's ERS-1 satellite (previously discussed), and their most recently introduced system is at the top end of equipment available from any of the world's suppliers. Another very successful Ontario firm supplies SPOT compatible systems, including sales to China and to Sweden for their SPOT ground station at Kiruna. There are other examples. An advanced "fast" system was developed by an Ottawa firm for CCRS, and recently both a Toronto and a Montreal company introduced low cost systems which operate on a personal computer. And there are over a dozen Canadian companies who specialize in image interpretation for the various natural resource sectors.

SPACECRAFT AND GROUND STATIONS AND CANADIAN CAPABILITIES

Canada has a world class capability to design, build and integrate spacecraft and ground stations. Our largest aerospace firm provided most of the Anik series of satellites as well as Brazilsat, and has been a major contractor on other satellites such as Hermes. Along with a Western Canadian company they have also provided numerous communications satellite ground control and local receiving stations, and they are currently selling world-wide, including

to Nigeria and China. And of the fourteen or so Landsat ground stations throughout the world a Canadian company has been a key participant in all but one. As part of the international Search and Rescue Satellite (SARSAT) programme, an Ottawa firm developed and is now selling the world's leading ground processing system.

Canada has been an active partner in Landsat since the programme's beginning; first by providing a ground station at Prince Albert, Saskatchewan and later adding another at Shoe Cove, Newfoundland to support both Landsat and Seasat. In May 1986, a third station was added in Gatineau, Quebec and it supports SPOT as well. The David Florida Laboratory in Ottawa is one of the most modern satellite test facilities in the world, and the Shirley Bay spacecraft control and tracking facility—at the same site—was used for all five of Canada's scientific and technology development satellites.

CONCLUSION

Satellite remote sensing technology is reaching commercial maturity and the data resolution is now close to that required for a surveillance mission.¹⁷ By 1991 a deluge of high quality data will be available from current commercial systems such as Landsat and SPOT, from the soon-to-be launched systems like Europe's ERS-1, from Japan's SAR equipped satellite system, from the SPOT and ERS upgrades currently in planning or development¹⁸, and possibly from selected US or even USSR national security programmes.

Canada has a mature satellite industry, an experienced remote sensing sector, solid airborne and spacecraft instrument capability, and world class ground receiving and remote sensing data processing technology. Canada also has an international reputation as being fair and able to conduct peace-keeping activities. An objective, internationally administered satellite surveillance organization would fulfill a needed world role, and it is logical to consider Canadian participation. A promising systems approach would be for the organization's technical centre to receive data from all available sources, and if necessary to augment this with data from a dedicated surveillance spacecraft system, designed and operated under the jurisdiction of the organization. The satellite's purpose would be threefold: to provide vital information not otherwise available about specific targets, to authenticate data received from other organizations, and to provide "second look" images of targets.

The most challenging task would likely be on the ground. There, all available data could be correlated, processed, analyzed and objectively interpreted.