

EXCHANGING DIGITAL BASE MAPPING DATA

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The Surveys and Mapping Branch of the Canadian federal Department of Energy, Mines & Resources; and the Surveys and Mapping Division of the Land Registration and Information Service, an agency of the Council of Maritime Premiers; both produce base maps. The federal maps are naturally at a smaller scale than the regional maps, and have different level of content etc. as well. Digital technology has been used in the production of both these series, the federal one since late 1970's, and the regional ones since 1984. In 1985, the two agencies agreed to exchange their digital data with a view to decreasing the cost to both agencies of completing the coverage for which they were responsible. This paper describes the process that resulted in this agreement, and the administrative and technical changes which are necessary to carry it out.

INTRODUCTION

The Canadian federal Department of Energy, Mines and Resources, Surveys and Mapping Branch, and the Land Registration and Information Service of the Maritime provinces are both producers of base maps, and both have a mapping mandate in the Maritime provinces. When base mapping was carried out traditionally, using analogue stereoplotter instruments, the amount of cooperation between the two agencies was limited to sharing of coordinate data for photo control points, and some sharing of technical expertise. Now that digital technology is being used by both agencies, a project was undertaken to share digital data, and thereby reduce costs of data collection to both agencies. A description of the process that led to this project, and some of its results, are given here.

HISTORY

The Surveys and Mapping Branch of the federal department of Energy, Mines and Resources has been producing maps since the early 1950's. These maps were mostly at a small scale (1:50 000 or smaller) although some 1:25 000's were also produced. These maps are fairly typical of a national series -- they contain topographic information, manmade and natural features, place names, hydrography and places of historical and military significance. The maps were produced as colored sheets, which were stocked in various retail outlets across the country. The department is responsible for coverage of all Canada, with priority to the settled portion, and there has been a heavy emphasis of late on the lands in the north. A fairly recent change in policy relieved the department of the responsibility of producing anything at a scale larger than 1:50 000.

In the 1970's the department began developing digital techniques to produce its maps. Since then it has acquired 12 Intergraph workstations, and produces with inhouse and contract efforts, 50 per cent of its data digitally. The main users of the federal series are federal departments, particularly the military, and provincial and regional agencies.

The Land Registration and Information Service is an agency of the Council of Maritime Premiers, and was formed in 1973 to provide for the three Maritime provinces, New Brunswick, Nova Scotia and Prince Edward Island, a comprehensive land information base of control surveys, base mapping, property mapping, and assistance with improved systems of recording land conveyancing. To fulfill the base mapping mandate it produced a series of "resource maps" -- maps at a scale of 1:10 000 which were orthophotos, enhanced with hydrography, contours and place names. In addition, it produced a series of "urban maps" -- at scales of 1:4 800, 1:2 400, and 1:1 200 (subsequently replaced with metric equivalents). These were black and white line maps. Masters were lodged in local offices, and were reproduced on demand from white printing machines. Some specialty products (plastics, photographic quality paper, etc.) were available from a central office as well. The 1:10 000 coverage was for all the Maritimes. The urban series covered only the populated communities.

In 1983 and 1984 LRIS acquired 7 CARIS workstations and began to produce maps digitally. This time the resource series is a line map rather than an orthophoto, and contour information is no longer collected, although DTM's are collected for some map sheets. All maps produced by LRIS are now produced digitally. There is not sufficient funding

to permit contracting out very much of the data collection, but when that is possible, digital data will be required of contractors. The users of the LRIS series are mainly other government departments and regional engineering and consulting firms.

BEGINNING THE PROCESS OF DATA EXCHANGE

Although both agencies acquired digital mapping technology independent of any commitment to exploit this technology to reduce compilation costs, there were several reasons for discussing data exchange. Both agencies experienced cutbacks in funding to their programs. At the same time, both agencies were being pressed to produce maps more quickly. Staff in both agencies were confident that if digital data could be exchanged effectively, compilation costs to both agencies could be reduced. Consequently, a series of meetings was begun to discuss the proposal of exchanging data, problems likely to occur, and ways to resolve these problems. An agreement was signed by both parties in 1985 which states:

- 1) EM&R and LRIS intend to exchange digital topographic data of 40, 1:10 000 map sheets in New Brunswick. The areas for compilation to be agreed upon by the two parties after consultation.
- 2) EM&R intends to provide LRIS as much positional topographic data as feasible to meet LRIS requirements.
- 3) LRIS intends to provide EM&R as much positional topographic data as feasible to meet EM&R requirements.
- 4) EM&R intends to provide LRIS as much data intelligence as possible to fulfill LRIS specifications.

THE PROBLEMS ENCOUNTERED

Five sorts of problems were identified. The first was the difference in hardware and software between the two agencies. EM&R uses the Intergraph system, version 8. Data from the system is in IGDS format. LRIS's system is CARIS, and uses the NTX format.

The two series of maps are produced on different geodetic datums and projection systems. EM&R maps are based on the NAD27 Datum and the UTM projection, LRIS maps are produced on the ATS77 Datum and have separate projections for each province.

There was a major difference in data collection philosophy. EM&R collected z values (height information) for more data than did LRIS. However, LRIS collected intelligence for much of its data (many area and line features were tagged with information as to type of feature on left or right side of the line). EM&R had difficulty in ensuring that intelligence of data stayed correct beyond the editing stage.

There were differences in content -- EM&R collected a number of different military and historical features which were not included in the LRIS series. On the other hand, such features as river width were more precisely defined in the LRIS series because of the lower flying height associated with the larger series.

The other major concern was how much the manipulation of data from one system to another, from one projection to another, etc., was likely to cost.

RESOLUTION OF THESE PROBLEMS

The idea was to agree on a common data base. Each agency would collect data into the common base and then construct their own map series from this. The following options for exchange were explored:

- 1) Gibbons-Masry Format - the software to go from IGDS to CARIS existed but the CARIS to IGDS link required some development.
- 2) ISIF (Intergraph Standard Interchange Format) - the IGDS end of this format was available but CARIS to ISIF and ISIF to CARIS were not.
- 3) DLG (Digital Line Graph, USGS) - LRIS already had CARIS to DLG and DLG to CARIS software at their disposal. At the time of the negotiations it was not known if an IGDS to DLG and DLG to IGDS translator existed. In the interim, this software had been located at the US Geological Survey and a subsequent request to the USGS for the translator was made.

- 4) CCSM Standard - The CCSM standard was under review and a usable standard was not envisaged in time for the pilot project.

It was agreed that as an interim measure, both parties would provide data to the other in the DLG format.

Various computations were done on approximate equations for the datum and projection conversion, to determine when the map data was likely to be significantly degraded by an approximate conversion rather than a more rigorous one. A subcommittee dealing with datum differences between the EM&R and LRIS organizations was created in April 1985. It was determined that differences between datums could be corrected by a simple transformation from one set of coordinates to another. In fact, transformation from MAY 76 to NAD 83 adjustment could be a straight forward task. North American Datum 1927 (NAD 27) on which some maps have been based, has not been adjusted globally (as MAY 76 and NAD 83) which means that systematic errors caused distortions in the network and a simple transformation could not be used. These distortions could have been corrected by using special geodetic programs (ESTPM, for example). Estimates indicated that the use of ESTPM for digital mapping purposes would be a prohibitively expensive method of transfer. Approximate methods (plane transformation) were tested. It was decided to use a similarity transformation.

Although LRIS had decided not to pick up z information for most planimetric features on its provincial series, for the pilot project it agreed to include this information for all features. Similarly, EM&R agreed to include intelligence information, tag it to the data being collected, and monitor any errors that might occur during the editing process.

Both agencies picked up all data required by the other. This meant that LRIS doubled the number of feature codes it used. EM&R also doubled the number of feature codes.

A careful accounting is being kept of the costs of this exchange. We expect the additional costs of exchange are significant, but hope the overall savings are large enough to warrant serious pursuit of further joint mapping.

CONCLUSIONS

The prospect of using digital technology to reduce the overall costs of base mapping looks promising. The LRIS-EM&R exchange could well have been abandoned because of the number of differences in data between the two agencies - scale, data format, datum, projection, map content, and approach to intelligence of data. However, because of a commitment to resolve these differences, rather than dwell on the difficulties, the exchange was pursued and proved successful.