COMPUTER SYSTEM FOR AVALANCHE HAZARD ANALYSIS AT ROGERS PASS, BRITISH COLUMBIA

Bob Malenko[1], Dave Skjonsberg[2]

ABSTRACT

A vast amount of information is gathered each year around the world by avalanche safety and control operations. Data which was formally stored in field books and other "hard copy" sources is now often archived on some type of computer media. To make this information useable by the avalanche forecaster, a modern computer must be combined with efficient, effective software.

For the purposes of avalanche control, acquisition of meteorological information from remote locations using a telemetry system was pioneered in Canada by the Snow Research and Avalanche Warning Section (SRAWS) in Mount Revelstoke and Glacier national parks (best know as Rogers Pass). From its rudimentary beginnings, the system has evolved into an indispensable avalanche hazard forecasting tool.

The earlier systems produced simple visual displays of the acquired telemetry data. The information was used subjectively, much the same as any other field observation. Later systems were used as a means of data storage in addition to managing the telemetry acquisition of data. Data storage led to the concept of comparing present meteorological and snowpack conditions to archived data.

The present system was installed in 1991 and consists of a powerful PC with custom designed, Windows based software. Due to the long term involvement (fifteen years) of the developers of the system, data integrity, storage format, graphical display and system priorities have remained constant. New generation computers and software combine speed and ease of operation with flexible database management, timely relational comparisons of weather and snowpack parameters and sophisticated graphics.

---

[1]Vice President of Engineering, Cirlog Corporation, Winnipeg, Manitoba, Canada

[2]Chief, Avalanche Control, Mount Revelstoke and Glacier national parks, Canadian Parks Service, Environment Canada, Revelstoke, B.C., Canada

INTRODUCTION

The Avalanche Forecasting System (AFS) was developed for SRAWS to provide: communication to remote weather data collection platforms (DCPs); a storage medium for archiving telemetry and manually inputted data from study plots, avalanche occurrences and snow profiles; full editing and manipulation of all archived data; various graphical displays of archived data; and an alarm monitoring capability for current weather parameters.

PRESENT AVALANCHE FORECASTING SYSTEM

The overall system was designed to allow for future expansion and currently incorporates the following features:

Data Acquisition

Present weather data is acquired automatically over a telemetry link from all the DCPs every 10 minutes. The incoming signal, data, and messages from the DCPs are monitored and verified for correctness. Received weather data from all stations is retransmitted to a remote printing station. Manual interrogations of an individual DCP can be performed at any time.

Data Processing and Storage

Incoming data is converted into data storage, data display, and data print values. The data is displayed on the system monitor and printed on the local printer. The data is stored as hourly averages in the Telemetry database and as data which can be graphed as the last 72 hour trends.

Data Manipulation

Databases have been developed for the entry and manipulation of telemetry, study plots, avalanche occurrences, and snow/ram profiles. All databases can be edited, sorted, searched, and printed. Each database can hold up to 1 billion records. As an example, with an average of 2000 avalanches per year, 100 years of data needs only 200,000 records.

Relational Query By Example

Relational Query By Example is a method for searching through a database to create "what if" and "find similar to" scenarios. English phrases can be used to create a query that will search through the database and look for matches in the data then put that data in either a table for browsing, a new database, or a report. A query can be saved and run again by just selecting its name. This is very quick and useful if only one or two parameters are changed to narrow or broaden the scope of the search.

Graphing and Plotting

Custom graphs, designed by SRAWS can be graphed and printed to display weather data for the last 72 hours for all DCPs. Stored study plot and stored telemetry data can also be displayed on

the system monitor or plotted on the laser printer.

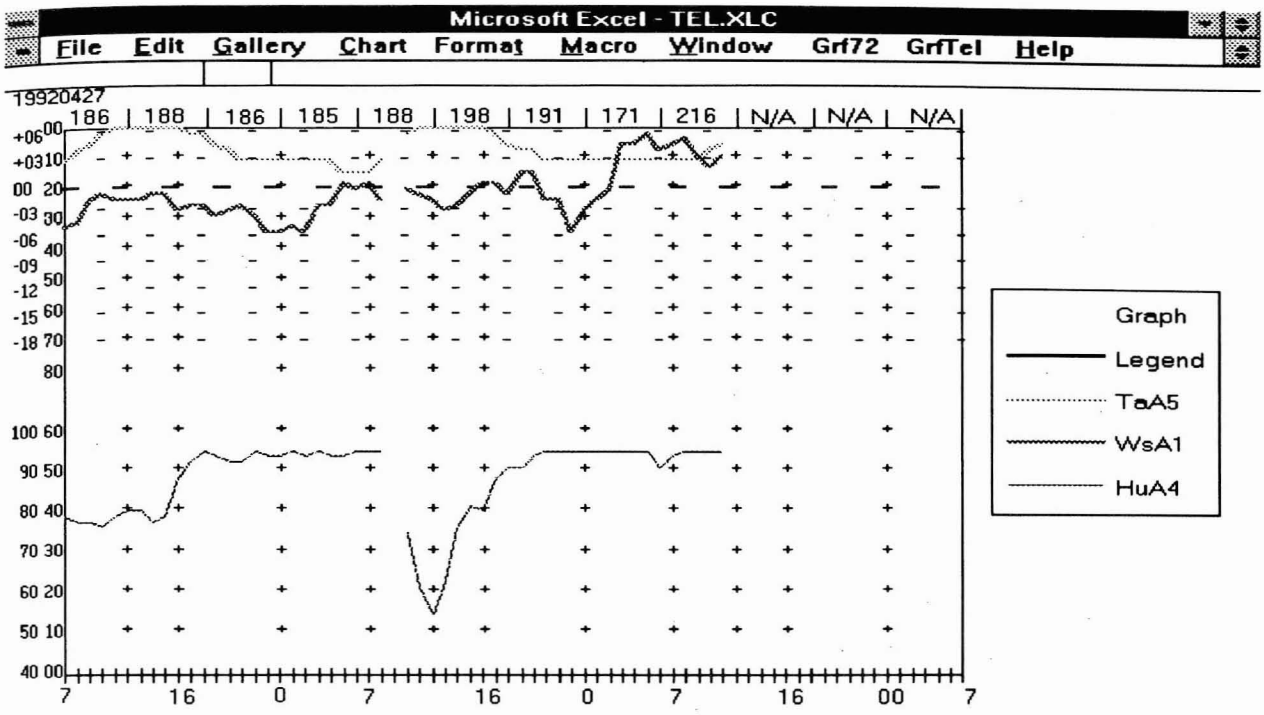

Figure 1 - A typical 72 hour trend graph

Alarm Monitoring

The alarm feature permits the forecaster to select weather trends and conditions to be monitored by the computer. These conditions can be combined in a variety of AND/OR formulas to make up complex combinations of weather trends, immediate occurrences, and accumulations. If the incoming data or accumulations match the preset formulas and values then an alarm is activated.

Remote Access and Analysis

Using a portable notebook computer and telephone modem, avalanche forecasters can access the main computer at any time from any location serviced by telephone. Current and archived data can be downloaded and "alarm" variables can be monitored. Analysis tools, equivalent to those on the main computer, can be used with this portable computer to evaluate hazard potential.

CONCLUSION

The AFS has evolved into a sophisticated analysis tool for the SRAWS group. It provides automatic and unscheduled telemetry access to remote DCPs; verification of communication signal and data; retransmission of data to a remote location; data translation for display, storage and printing; full database manipulation of data; graphing and plotting of data; an alarm system for monitoring trends and accumulations; and remote telephone access with a portable computer. Future expansion includes providing a traffic monitoring utility, improving the DCP technology, incorporating snow profile graphs, and providing comparisons of historical snow profile data.