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STUDY ON THE REQUIREMENTS OF COMPUTER TRAINING
FOR THE COAL INDUSTRY IN CANADA

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March 1984

For presentation at the 86th Annual General Meeting of the Canadian
Institute of Mining and Metallurgy, April 15-19, 1984 at the Westin
Hotel, Ottawa, Ontario.

ENERGY RESEARCH PROGRAM
COAL RESEARCH LABORATORIES
DIVISION REPORT ERP/CRL 84-15(OP)

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by

B.(Manas) Das* and D. Cross**

SUMMARY

In June 1983, the Computer Applications and Process Control Committee (CAPCC) of CIM circulated a questionnaire to coal mining, exploration and consulting companies in Canada to determine the industry's level of interest in holding a workshop-style meeting to introduce company personnel to "state-of-the-art" computer systems designed to carry out specific technical and management functions. It was necessary to conduct the survey to determine the specific fields of application and the nature of training which are of most interest.

Almost universally the companies expressed interest in computer workshops and training for applications in the Canadian coal industry. The survey showed that all catagories of personnel felt the need for some sort of training. Areas of specific interest identified were: exploration and geology, mine design, reserve calculations, coal mining technology, coal preparation, rock mechanics, ventilation, financial planning, and process simulation. The details of this survey together with an assessment of the significance of computer applications in the Canadian coal industry are presented in this paper.

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ENQUÊTE SUR LES BESOINS DE FORMATION EN INFORMATIQUE DANS L'INDUSTRIE DU CHARBON

par

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En juin 1983, le Comité sur les applications et les procédés de l'informatique de l'Institut canadien des mines et de la métallurgie (ICM) a fait parvenir un questionnaire aux sociétés canadiennes d'exploitation du charbon, aux sociétés d'exploration et d'experts-conseils afin de déterminer à quel degré l'industrie s'intéressait à la possibilité de participer à des ateliers de travail qui permettraient à leur personnel de se familiariser avec les systèmes informatisés conçus pour effectuer des tâches particulières ayant trait à la technique et à la gestion. Il était nécessaire de mener l'enquête afin d'identifier les besoins particuliers des secteurs et le degré de formation nécessaire.

Presque toutes les sociétés ont manifesté de l'intérêt pour les ateliers de travail et de formation en informatique visant l'application des systèmes d'information dans le secteur canadien du charbon. Le sondage a révélé que tous les employés désiraient une formation en informatique. Les secteurs qui présentent un intérêt particulier sont: l'exploration et la géologie, la conception des mines, l'évaluation des réserves, la technologie d'exploitation du charbon, la préparation du charbon, la mécanique des roches, la ventilation, la planification financière et la simulation des procédés. Le document présente le détail de l'enquête ainsi qu'une appréciation de l'importance de la mise en oeuvre des systèmes d'information dans l'industrie canadienne du charbon.

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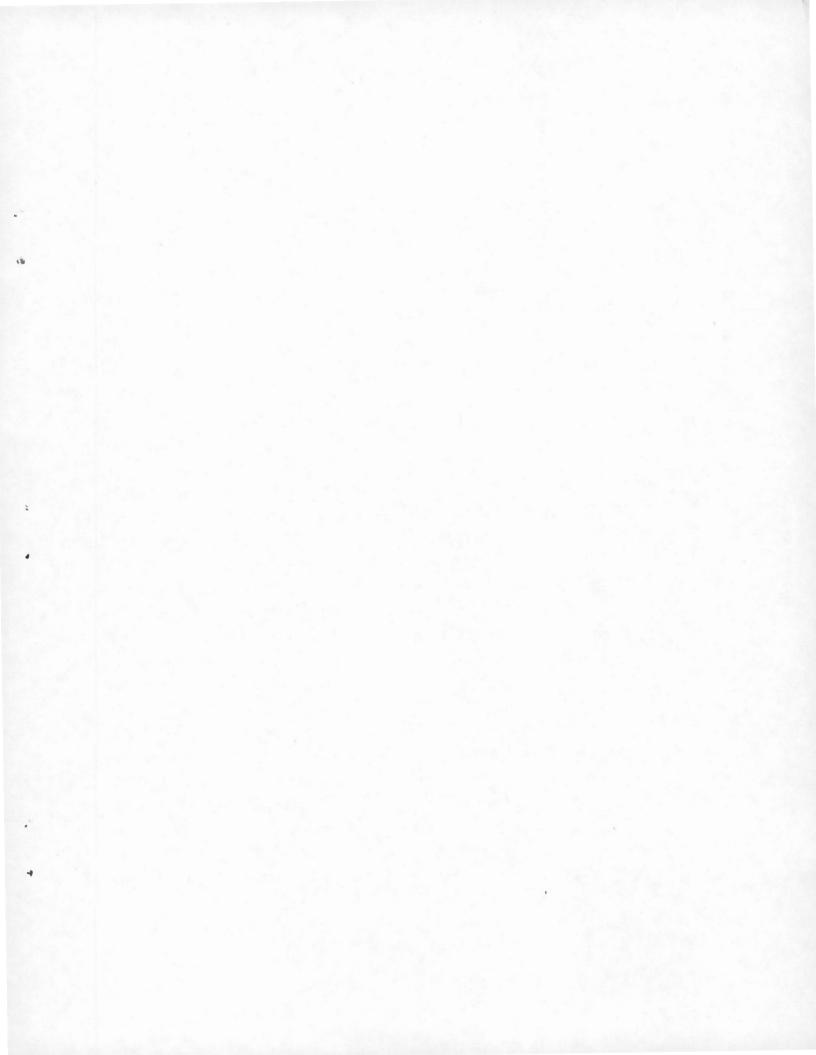
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INTRODUCTION

Computers are increasingly being applied in the Canadian coal industry. This can be considered as a logical step in view of the development of computer applications in the mineral industry in the world (Weiss, 1980; Barnes, 1980; Sanford and Parrot, 1982). The role of computers in the coal industry in the world is also becoming more and more important (Wang and Sanford, 1983; Cline, 1981). Applications of robotics in mining have also become quite visible (Adbelmalek, 1983). It is expected that the role of computers in the coal industry will increase.

Production, productivity and safety in coal mining can be boosted through computer controlled automation and mechanization. Mining hazards can be better analyzed and understood so that measures can be taken to minimize or eliminate them. This may substantially reduce the cost of production which will contribute to the survival of the Canadian coal mining industry in the competitive world. A drop in the cost of production may make up for the additional cost required for long distance transport and infra-structure development needed in the remote coalfields so common in Canada. Therefore, the significance of computer applications in the Canadian coal industry can hardly be refuted.

In order to render computer applications most effective in the Canadian coal industry, it will be necessary to evaluate the factors affecting them e.g. availability of suitable hardware and software, development of effective sensors and appropriate computer training. Although more and more sophisticated computer hardware is being developed, the coal mining industry has not fully utilized the potential of existing hardware. There are two aspects to software: (a) suitable languages, (b) development of programs in keeping with the needs of the industry. Here also, the potential of the existing languages has not been exhausted and there are many programs available in the market. Unfortunately, most of these programs are not very useful to Canadian coal mining, as they have been developed without a clear understanding of the real national problem in coal mining (Das, 1981). Thus, either new programs have to be developed or the existing programs have to be modified to render them suitable for coal mining applications. Also, the CIM computer survey indicated a lack of reliable sensors for continuous and

accurate real time input. This problem seems to be more pronounced in the hostile environment of underground coal mines.

It appears that the degree of success of any computer application in coal mining boils down to two factors: (a) suitable programs, (b) reliable sensors. In order to develop suitable programs and sensors or to contribute to their development and use, it will in turn require some training in computers in relation to coal mining applications. The mineral industry computer survey carried out by the Computer Applications and Process Control Committee (CAPCC) of the Canadian Institute of Mining and Metallurgy (CIM) during 1981-82 pointed out the need for computer training and the shortage of qualified personnel (Das et al., 1983).

The results of a survey conducted in this respect have been analyzed and presented in this paper.

DIFFERENT ASPECTS OF COMPUTER TRAINING IN THE COAL INDUSTRY

Any problem related to the coal industry is, above all, a coal industry rather than a computer problem. The problem, in principle, can be solved without a computer as an engineering exercise, but often the large amount of data to be handled and the very large number of mathematical and logical steps to be performed make it extremely difficult or almost impossible to deal with the exercise effectively. At this stage, one can realize the significance of computers and computer training in tackling problems effectively. This matter has been discussed at length by (Das, 1981). The various aspects of computers and computer training are stated below:

(a) Basic principles of a computer, its scope and limitations.

(b) Computer hardware.

(c) Sensors including their development.

(d) Computer software:

- Computer languages
- Principles of programming.

(e) Computer operation.

(f) Nature of computer applications in coal industry:
- Data processing and analysis
- Process control
- Technology development

(g) Areas of computer applications in coal industry:
- Exploration and geology
- Reserve assessment
- Mine design
- Surface mining
- Underground mining
- Rock mechanics and strata control
- Mine environment and ventilation
- Material handling
- Coal preparation
- Financial planning
- Office work.

COMPUTER TRAINING FOR DIFFERENT CATAGORIES OF EMPLOYEES IN THE COAL INDUSTRIES

Computers have become a very useful tool in science, in engineering, and in other areas. Universities have started providing computer courses from the traditional engineering and science to other disciplines and many courses are also offered by other establishments. This may be taken for for an indication of usefulness of and the need for computer training in general.

An analysis of the situation in the Canadian coal industry will indicate that:
- Computers are used in various places, e.g. office, mine, preparation plant, etc.
- Different categories of employees, e.g. office clerk, technician, engineer, etc. are directly involved in computer use and many others are indirectly involved.
- Computers as well as computerized devices are used in the Canadian coal industry.

- Installation and repair of hardwares are generally done by the
  vendors with or without any help from the coal industry people.
- Softwares are purchased as well as developed in-house.

From what has been stated above one can get some idea on the
requirements of computer training for personnel in the Canadian coal industry.

THE SURVEY AND ITS RESULTS

In June 1983, the Computer Applications and Process Control Committee
circulated a questionnaire to coal mining, exploration and consulting
companies in Canada to determine the industry's level of interest in holding
aworkshop-style meeting to introduce company personnel to "state-of-the-art"
computer systems designed to carry out specific technical and management
functions. It was necessary to conduct the survey to determine the specific
fields of application and the nature of training which are of most interest.
The results of this survey together with some aspects of computer
applications/training in the Canadian coal industryare presented in this
paper.

The mailing list for the survey included some 54 companies in coal
mining, exploration and consulting. In was deemed necessary to conduct such a
survey to determine the specific fields of greatest interest, length and the
location of the workshop, potential attendance and registration fees.

A total of 22 completed questionnaires was received by the Committee
within 60 days of mailing which is an overall response rate of 41 percent.
Those companies that responded represent about 70 percent of the total 1982
production of coal in Canada. As well, 10 major companies with proven coal
reserves or significant exploration programmes responded. Of the 22 companies
that replied to the questionnaire 21 expressed an interest in sending one or
more representatives to a workshop.

The following represents a summary of responses to the individual
questions.

Table 1 – Primary areas of interest for computer workshop in the Canadian coal industry

Area of interest	Number for each area for each priority					Total points*
	1(High)	2	3	4	5(Low)	
Exploration and Geology	7	1	1	1	0	(44)
Mine Design	6	6	1	1	1	(60)
Reserve Calculation	6	4	1	2	0	(53)
Surface Mining	3	4	1	0	4	(38)
Coal Preparation	2	2	5	1	0	(35)
U/G Mining	1	3	2	0	0	(23)
Financial Planning	0	3	3	1	0	(23)
Process Control	1	2	0	0	1	(14)
Rock Mechanics	1	0	1	2	1	(12)
Graphics	1	1	2	2	0	(19)
Management Tools	1	0	2	2	1	(15)
Ventilation	0	2	0	2	1	(12)
Equipment Simulation	0	1	3	3	3	(22)
Computer Aided Design	0	1	1	0	0	(07)
Other: Truck dispatch	0	1	0	0	0	(04)

*The basis of total points calculation is as shown below:

Priority	1	2	3	4	5
Points alloted	5	4	3	2	1

QUESTION 1: WOULD YOUR ORGANIZATION SEND REPRESENTATIVES TO A "WORKSHOP" WHICH DEALS WITH COMPUTERIZATION IN MINING AND IN WHICH AREAS?

The order of priority for the questionaaire was computed by awarding 5 points to priority one, 4 points to priority two, 3 points to priority three, 2 points to priority four and 1 point to priority five (see Table 1).

"Exploration and Geology" received the greatest number of priority one responses because there exists a large number of exploration oriented firms. This may be attributed to the fact that during the exploration phase of a project a vast data base consisting of surface and drill hole geology, structure, coal quality and engineering information is developed. Computer manipulation and pictorial representation of the data on a graphics terminal represents a significant savings in man-hours of work to produce final plots.

On a total points basis both "Mine Design" and "Reserves Calculation" rank above "Exploration and Geology". However, a greater number of priority one responses was given by respondents to "Exploration and Geology". Any data base that is to be used for "Mine Design" and "Reserves Calculation" must necessarily be generated and maintained on computer files during the exploration phase of a project. For these two reasons "Exploration and Geology" is ranked first.

Mine Design and Reserves Calculation are synergistic areas requiring on-going access to the data base and periodic updating when new data are acquired. These two factors govern to a very great extent the economic status of a project. Their accurate and timely assessment aids management in making major decisions.

Because many factors affect the eventual outcome of the mine layout or reserves it is a simple process to enter these new values into the computer and ask it to calculate the final effect. Certainly with the use of computers in these areas significant benefits are derived in the forms of time saving with quicker turn-around of data and greater flexibility in dealing with the data to yield more information.

"Surface Mining" occupies the fourth position with 38 points. Planning and monitoring of surface mining is another area in which computerization can prove to be of valuable assistance. Approximately 90 per cent of Canada's 1982 coal production was derived from surface mining. Overburden removal, scheduling of blocks to be mined, truck dispatch, recovery

and mining rate can all be monitored by computers which yield information, very often instantaneously.

"Coal Preparation" placed fifth in the list of priorities. Coal mining operators concerned with coal quality, washing, blending and outloading of product expressed an interest in this area.

The remainder of the categories contained in the priority list reflect computer functions dealing with smaller more specialized areas of the coal business. A logical progression exists in the list wherein the phased sequence of events leading to mine development and commission is seen. Of highest priority is "Exploration and Geology" which represents a first step in discovering exploitable reserves of coal. With exploration success the determination of coal reserves and mine design is followed by mining and preparation of saleable product. Computerization of operating coal mines must begin at the exploration stage to build a viable data base upon which more specialized computer functions can be executed.

QUESTION 2: WHAT LEVEL OF EMPLOYEE WOULD YOU SEND? HOW MANY?

In question 2, the respondents were asked about the level as well as the number of employees that would be attending the workshop. In most cases the engineer/professional and his manager would be delegated to attend. The engineer/professional is likely to be the key person resposible for introducing the computer system into the company's infrastructure. He would then supervise its operation once it is installed and being run by technicians or technologists. Ten managers expressed an interest in attending since they would be responsible for selling the idea to management and monitoring its effectiveness and cost.

QUESTION 3: WHAT TYPE OF PRESENTATION WOULD YOU PREFER?

About 57 percent of respondents indicated an interest in a workshop meeting (1 day or more) wherein computers could be seen and their operation explained. Others favoured the following: Half a day demonstration (13.3%), seminar - 1 day or less (10%): course (1 or 2 days per week for a few weeks (6.6%)): displays (6.6%); luncheon meeting (3.3%) and field visit (3.3%).

QUESTION 4: WHAT DURATION OF MEETING WOULD YOU PREFER FOR A WORKSHOP?

A duration of a couple of days for the training seems to be favoured by most (50%). One day and three days were supported evenly (20% in each case). Week long or a couple of hours were least favoured (5% in each case).

QUESTION 5: WHAT REGISTRATION FEE WOULD YOU BE PREPARED TO PAY?

A fee of $100.00 for training appears to be the price considered by about 50% of the participants. This may partly be attributed to the poor economic status in general and in the Canadian coal industry in particular. Others were ready to pay $200.00 (27.6%) and over $200.00 (16.6%). Free training funded by government was suggested by 5.5% of the replies.

QUESTION 6: IS A PARTICULAR TIME OF YEAR MORE SUITABLE TO YOU? SPECIFY.

A majority of the replies favoured fall/winter for training (73%). Summer and spring were equally favoured (9% in each case) and no preference was the response in 9% of cases.

QUESTION 7: WHAT LOCATION WOULD YOU PREFER?

Calgary was overwhelmingly supported as the location for training (72.5%). With so many coal companies having their head offices in Calgary one could easily appreciate the overwhelming support for Calgary. The other locations favoured are: Vancouver (11%), Edmonton (5.5%), Tumbler Ridge (5.5%) and Sydney (5.5%).

QUESTION 8: DOES YOUR ORGANIZATION PRESENTLY MAKE USE OF COMPUTERS? IS NO, DO YOU PLAN FUTURE USE? IN WHAT AREA?

The survey indicates that all the companies excepting one use computers and have future plans for extended applications.

CONCLUSION

1.   The survey indicates that virtually all the coal producers in Canada are using computers and have also future plans for it. This emphasizes the timeliness of current CIM activities.

2.   The Canadian coal industry is already interested in computer training. This may be concluded from the following:

- In spite of the fact that survey was made during the summer holiday period, the response to the questionnaire within 60 days from the day of mailing was quite high.

- All but one company expressed an interest in sending one or more representatives to a workshop in spite of the economic downturn in the coal industry.

3.   This high degree of interest in computer training may be due to the following:

- Coal industry sees more applications of computers.

- There is a lack of suitably trained computer personnel and also of suitable courses.

4.   Not only the personnel who will be working with computers but also various categories of people, e.g. technologist, engineer, manager, executive, etc. need some sort of computer training.

5.   The three areas of highest priority are: exploration and geology, mine design and reserve calculations. This may be considered as logical in Canada where there are many virgin coalfields under exploration for development by different companies.

6.   There is an interest in workshop type training where computers could be seen in action and their operation explained.

7.   Computers are a relatively new tool on the scene in project and mine management. Many existing Canadian mines are run quite well completely without the use of computers. It is interesting to note that a greater emphasis is placed by the respondents upon the introduction of computers into the upstream end of the coal production cycle rather than the operating end where established mines had been operating long before the introduction of computers. This emphasis may also be attributable to a new generation of professionals in the coal industry with their intimate ties to the petroleum industry where computers are an accepted tool.

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