

The Whittle Story

A Live Book

Jeff Whittle – A Career Outline

When Jeff was made an Officer of The Order of Australia (AO), he was asked to give a talk about his career to his local Probus group. Probus is an international association for retired professional and business people. Ruth and Jeff are members of their local group of the Australian branch. This is the text of that talk, and it includes a summary of his career.

Speech to Probus, May 2018

I am, of course, very honoured to receive this award – who wouldn't be? However, I don't for a moment think that I earned it on my own. Many other people were involved, and I'll come back to that.

I was working as an experimental physicist when I started programming in 1962. When I got my first program right first time, I figured that maybe this was something that I was good at, and, over a period of about five years, I did more and more computing and less and less physics. I gradually changed from being an experimental physicist to what I now jokingly call a "computerist".

For those who don't know, perhaps I should take a moment to explain what a computer program is, because that is central to what I will talk about. A computer program is a list of instructions - we call them lines of code - which each tell the computer what to do next. A computer program is a bit like a recipe – with each line of code like a step in the recipe.

However, unlike a recipe, computer programs typically have a few thousand steps, and millions of steps a second can be executed. Complicated programs can deal with complicated problems.

So, having started programming in 1962, in 1967 I joined the new computer centre at Monash University where I worked with a group of very bright and creative people. This was still the early days, and we worked on every aspect of computing. It was a wonderful learning opportunity, and I still use techniques today that I learned in the ten years I was at Monash.

In about 1980, I got a job with Newmont Mining Corporation. My first task was to convert a quarter of a million lines of computer code written for an old computer to run on a new computer. This involved changes of meaning and of syntax. From what I had learned at Monash, I wrote a translator which would input the old computer code and output the new code. This was much quicker and more accurate than doing it by hand. Over the next few years I worked on a range of programs for Newmont, each of which aimed to make mining easier, and more efficient.

To get at the ore, the mining industry uses two methods. If the ore is reasonably close to the surface, they get it out by digging an open pit. That is, a big hole which is open to the sky. If the ore is deep underground, they dig a shaft down to near the ore, and then dig tunnels out from the shaft to extract it.

Open pits can be very big, and they typically cost hundreds of millions of dollars to dig. As an example of a really big pit: in the early 80s Ruth and I visited a pit in Utah that was two miles in diameter at the top and half a mile deep. It was awesome to stand at the bottom and look up! With such huge costs involved, the mining industry needed a computer program to work out the best shape for an open pit. This is actually a very complicated problem, because it must take into account the shape of the ore body – which can be very irregular - the variation of quality of the ore body – which can also be irregular, the hardness of the rock etc. But, if we could save even a small fraction of the cost of mining by improving the design, that would be millions of dollars.

While at Newmont, I had learned that a method had been published in the 60s that would find the mathematically best shape for an open pit, but people had had great difficulty programming it. By the 80s, I had had about twenty years of programming experience, and I figured I could do it, so I offered to write it for Newmont. However, Newmont didn't want to spend the money. So, Ruth and I decided to develop the program as a private venture.

That was the start, and over about thirty years I wrote a series of ever more complicated programs to find the most profitable ways of doing more and more aspects of mining, not just designing pit shapes.

There are now two companies – Whittle Programming and Whittle Consulting. Whittle Programming, which we no longer own, has sold programs I have written to several thousand mining companies throughout the world. Whittle Consulting uses a later program I have written, in its consulting. This can find the most profitable way of operating a whole mining complex, which might consist of multiple open pit and underground mines. For your interest this program contains 35,000 lines of code.

We have often been asked how much the mining industry has gained from our work, and that is very hard to estimate. However, as an absolute minimum, the value of a mine will be increased by ten percent by using these programs. If you apply that to the thousands of mines where our software has been used, the total improvement has to be many billions of dollars.

I said at the beginning that I didn't earn this award on my own. Just writing programs isn't enough. If the business is to succeed, someone must get out and sell the programs. Over the years, many people have been involved in selling our programs and spreading the word, and the first one to do that was Ruth. Although she had never done any marketing or selling before, she got out there and sold the programs in many countries, before handing the marketing over to a team. That is something I could not have done. Marketing is a skill I do not have.

Over the years we have been lucky to have had a lot of very talented and enthusiastic people working with us, and this has allowed us to grow the whole enterprise.

So, finally, I wrote the programs, but many other people have been involved, and continue to be involved. Without their efforts, I would not be standing here.

To read Jeff's detailed Curriculum Vitae please scroll to the next page..

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Jeff Whittle Curriculum Vitae



PERSONAL DETAILS

Full Name: Jeffrey Whittle

Qualifications: BSc Hons Physics (Manchester), UK

Appointment: Adjunct Professor
W.H. Bryan Mining Geology Research Centre
University of Queensland, Brisbane

Memberships: Member of the Australian Computer Society (ACS)

Fellow of the Australian Institute of Mining and Metallurgy (AusIMM)

Born: 1930 in England

Citizenship: Australian citizen

Marital status: Married with 6 children, now adults.

Wife: Ruth Whittle BA Hons French (London) UK

WORKING CAREER

** ENGLAND **

1951-53 National Service in REME
Commissioned Officer

1953-55 Atomic Energy Research Establishment - Harwell
Classified work as experimental physicist.

1955-61 Medical Research Council Radiobiological Research Unit - Harwell
Experimental physics work on neutron irradiation of biological specimens. In charge of small particle accelerator.

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**** MELBOURNE, AUSTRALIA ****

1962-67 Defence Standards Laboratory

Initially worked on the physics of Xerography and wrote a series of Monte-Carlo programs to model electron transport through solids. The first was written for a Ferranti Sirius computer in Sirius Autocode. Others were written in FORTRAN for an IBM 7090 and the CSIRO Control Data computer in Canberra.

Finally worked on laser development project. Used Monte-Carlo techniques again, this time on photon transport.

1967-77 Monash University Computer Centre

Established and headed the Computing Contracts Group, which grew from two people to twelve. The group consistently made a profit for the University by providing computing services to outside users. Customers included:

1. Victorian Universities and Schools Examination Board, which ran the Victorian Matriculation examination (later HSC). The group provided a complete computing service, from enrolment through to printing certificates and results reports. Some 200 programs were involved. The work was done to very tight deadlines, which were never missed.
2. The Australian Council for Educational research (ACER), which ran the Commonwealth Secondary Scholarship Examination. A complete service was provided for all States except NSW using about 100 programs.

Undertook a number of other projects personally:

1. Development of the (often-misunderstood) automatic scaling program for the HSC marks in Victoria. This scaled all subjects to 'equal' difficulty.
2. Development of the University Selection program which permitted a fair allocation of places.

(Both of the above programs had been believed to be impossible to write for the equipment then available.)

3. Development of a program to translate CDC 3200 FORTRAN to BURROUGHS ALGOL!
4. Conversion of an operating system and compiler written as a research project for processing student jobs on a PDP 11/10 into a marketable product.

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(For the last two years at the University, was at the top of the Computing Systems Officer 5 range.)

June 1977 Formed Whittle Programming Pty Ltd and began to work on a contract basis

1977-79 Victorian Hospitals and Charities Commission

Headed a small team which wrote a comprehensive on-line chemical pathology system for a major public hospital. The system involved 65,000 lines of Business Basic and a very complex data base. There were 56 logical files with different structures, and all data base software, including transaction logging, and automatic recovery, had to be designed and written.

1979-85 Newmont Holdings Pty Ltd (now Newcrest Mining Ltd)

Undertook a nine-month contract with this mining and exploration company to convert 200,000 lines of technical FORTRAN from an IBM 1130 to a Data General S130. The conversion, and a good deal of other work, was completed within the nine months, but the contract was repeatedly extended and then became indefinite. A complete software support service was provided.

The conversion was done by first developing lexical analysis and parsing tools, and then using them to direct the alteration of the code. Only one line in about every 500 required manual action, and this was found automatically. This approach saved a great deal of time and money.

Wrote many large programs including three specialized data entry and editing systems, a suite of geostatistical programs, an automatic archiving system and a specialized mixed integer programming program.

This latter Operations Research work produced a mining schedule with a net present value which was several million dollars higher than the previous best known schedule. This sparked his interest in optimization in mining.

1985-2003 Whittle Programming Pty Ltd

With his wife Ruth, developed the company into a specialist mining optimization software house.

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The company's products **Three-D**, **Four-D**, **Four-X** and **Opti-Cut** are known throughout the mining industry and are used in 54 countries. Mining engineers often refer to “Whittling” their pits when they use this software to design them. For ten years the company had no competition in this field world-wide.

Whittle Programming and its software won a number of awards. Shortly after its release in 1987, **Four-D** won the AITA Software Product of the Year Award. It gained the 1992 Australian Design Award and subsequently had the distinction of being accepted into the permanent collection of the Powerhouse Museum in Sydney, Australia. A chapter entitled ‘. . . when your name becomes a verb’ was accorded to Whittle Programming in the book ‘Computer Excellence’ (Beaumont Press, 1991) and **Four-D** is also included in the book ‘Tomorrow’s World’ (APC, 1993) which features more than 300 currently commercially available ‘world first’ and ‘world best’ Australian products and technologies. In 1993, Whittle Programming received an international award at the XXIV APCOM Symposium in Montréal, Canada, for the successful implementation and development of the Lerchs-Grossmann algorithm. In 1995, three separate awards were conferred on Whittle by prestigious organisations representing the Australian Information Technology industry. In 1995/96, Whittle’s mining software was used as an example of Australian innovation by the Federal Government’s thrust into Eastern Asia in an extensive advertising campaign by MARKET AUSTRALIA.

Mining consultants repeatedly stated that the estimated Net Present Value for a mine designed with this software was typically ten per cent higher than if the same mine was designed by traditional methods. On this basis, the software led to an increase in the Net Present Value of Australian mines alone of at least two billion dollars.

The company employed ten people, including his son David, and had sales in excess of \$1,000,000 per year.

This company was sold to a Canadian mining software company, Gemcom, in 2003.

2003-
present

Whittle Consulting Pty Ltd

Although now retired, he continues to enhance and extend the advanced mine scheduling software that he developed and which is used by his son Gerald in this company.

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This software optimises the long-term scheduling of very large mining projects consisting of hundreds of open pits, multiple different processing plants and blending of mined and processed material to strict specifications. The fact that the quality of the material in each mine varies with depth and must be mined in sequence from the top, makes the problem much more complex than merely blending from stockpiles. In OR terms it is a massive mixed integer non-convex quadratic problem with hundreds of thousands of variables and hundreds of thousands of constraints. No standard software is available that will solve such a problem.

The largest improvement obtained for a project so far was obtained when the software was applied to a two billion dollar project for which a schedule had already been agreed. The new schedule increased the Net Present Value by fourteen per cent

[Click Here](#) to download a copy of Jeff's Whittle Consulting profile

TECHNICAL PAPERS & PRESENTATIONS

A Procedure for Allocating Students to Courses of Study – J Whittle and CJ Bellamy, Proceedings of Fourth Australian Computer Conference, Adelaide, 1969

A Technique for Automatic Contouring of field survey data – G Lodwick and J Whittle, Australian Computer Journal 1970

Application of Lerchs-Grossmann Pit Optimization to the Design of Open Pit Mines - C G Alford & J Whittle - AusIMM Large Open Pit Mining Conference, OCT-86 (*THREE-D*)

Beyond Optimization in Open Pit Design - J Whittle - First Canadian Conference on Computer Applications in the Mineral Industry, MAR-88 (*FOUR-D*)

The Facts and Fallacies of Open Pit Optimization - J Whittle, JAN-89
(*OVERVIEW OF OPTIMIZATION TECHNIQUES*)

Open Pit Optimization - J Whittle - Chapter in "SURFACE MINING" 2nd Edition 1990, published by SMME USA (*OPTIMIZATION TECHNIQUES*)

Open Pit Design in the 90s - J Whittle & L I Rozman - Mining Industry Optimization Conference Sydney, JUN-91 (*FOUR-D CASE STUDY*)

Optimizing Cut-Off Grades - J Whittle and C L Wharton - Optimizing with Whittle Conference MAR-95 (*CUT-OFF OPTIMIZATION*)

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Optimización de la Ley de Corte - J Whittle and C L Wharton - Optimizing with Whittle Conference
MAR-95 (*CUT-OFF OPTIMIZATION - Spanish Translation*)

Optimizing Cut-Offs Over Time - J Whittle and C L Wharton - APCOM XXV Conference JUL-95
(*CUT-OFF OPTIMIZATION*)

The Future of Computing in Mining - J Whittle - Third Regional APCOM Symposium, Kalgoorlie
DEC-98 (*KEYNOTE ADDRESS*)

A Decade of Open Pit Mine Planning and Optimization - The Craft of Turning Algorithms into Packages - Jeff Whittle -APCOM 28th International Symposium, Colorado School of mines, USA
OCT-99 (*KEYNOTE ADDRESS*)

Optimisation In Mine Design

A three-day seminar given first at the WH Bryan Mining Geology Research Centre UQ in 1997, and then repeated many times in various forms in Australia, North America and Chile.

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