

THE JOURNAL

of the

Association of Surveyors
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VOLUME 4

No. 3

SEPTEMBER 1974

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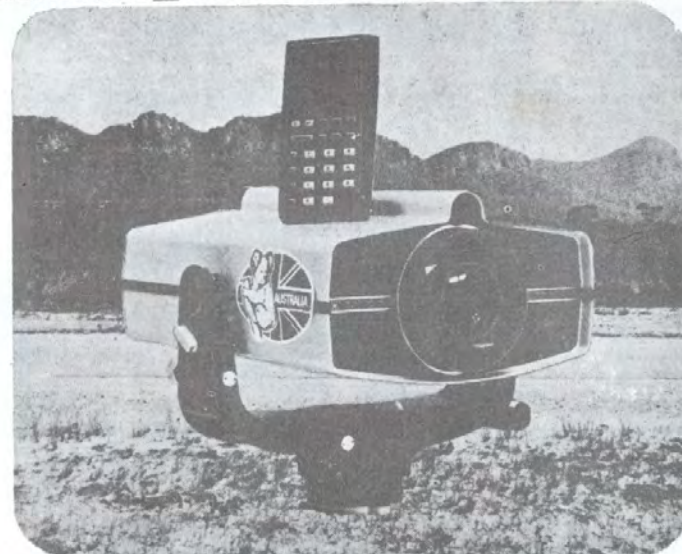
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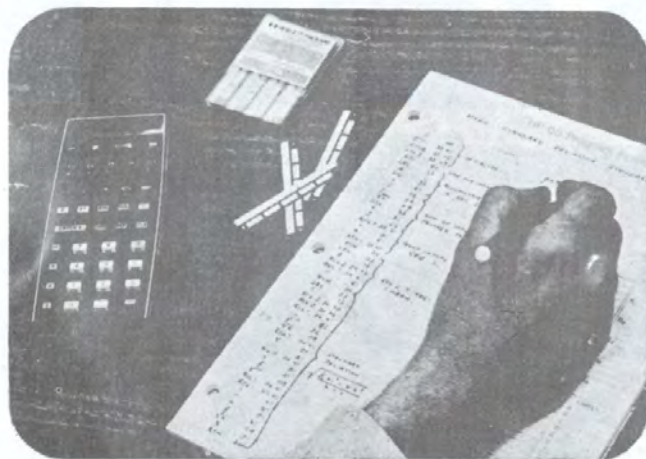
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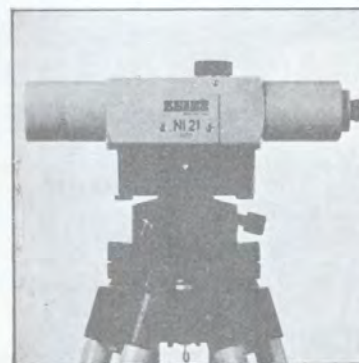
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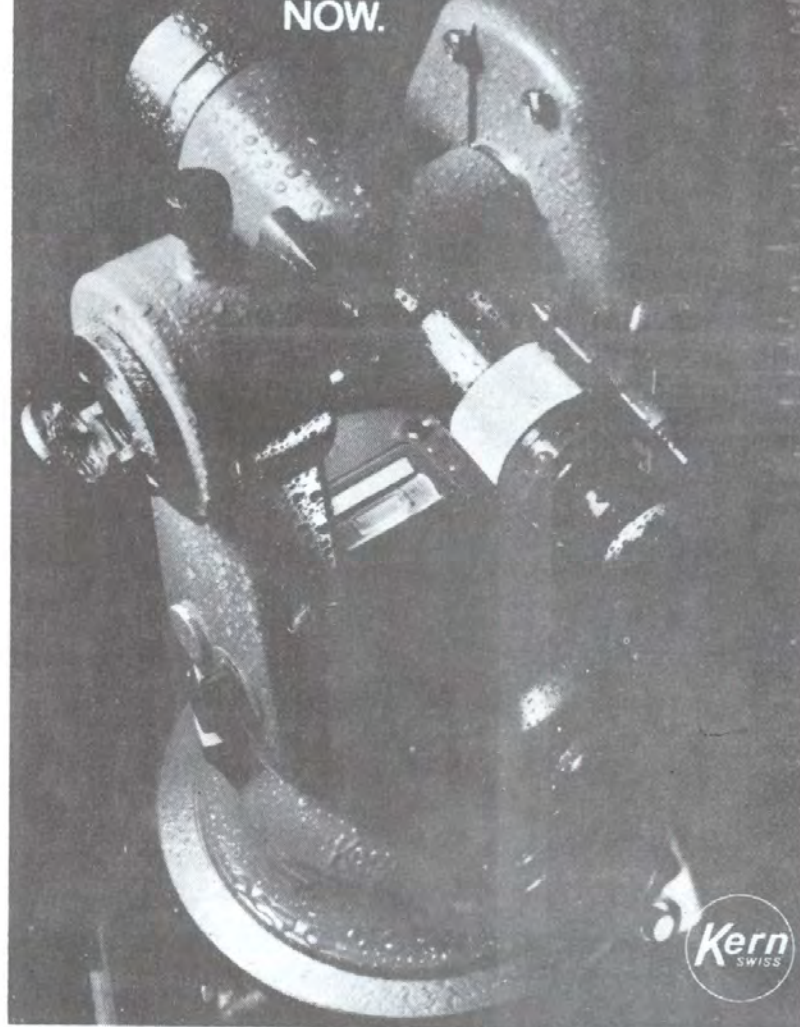
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The Journal

OF THE

ASSOCIATION OF SURVEYORS OF PAPUA NEW GUINEA

Vol. 4

September 1974.

No. 3.

Editor
A.J. McCarthy

Business Manager
K.F.J. Aschhoff

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OF PAPUA NEW GUINEA

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1973-74	J.J. Garrett

Please address all communications
to the:-

Hon. Secretary,
Association of Surveyors of
Papua New Guinea,
P.O. Box 1324,
LAE. P.N.G.

EDITORIAL

The 1974 Survey Congress saw the annual changeover of Presidents of the Association. Jason Garrett retired and Brian Mennis was elected to the position.

The Association is fortunate in that it can continually call on members of ability and long experience to guide the Surveying profession. Jason must be complimented for his sage diplomacy when handling matters of the Association, while Brian brings to the Council an ability to work hard and with an eye to the betterment of the vocation.

It was pleasing to see the manner in which this year's survey congress on Bougainville demonstrated how close-knit is the brotherhood of the Association. This speaks well for our ability to succeed. Acclamations for those people who presented papers to the convention, a chore which involves hours of hard labour. Acclamations also to the Congress Committee, ably led by Brian McLennan, for staging such a successful congress.

On the matter of Surveying education the University awaits the presentation of the Gris Report to Cabinet. If some matters contained in the Report are approved, we may see student study regularly interspersed with periods of field training. Judging from some of the comments made during the last survey congress, the implementation of this recommendation may be very desirable. It is hoped that sub-committees of Council will continue to be active in making constructive criticisms of the courses, the activity of the Scale of Fees sub-committee could be a useful example.

COUNCIL NEWS

At its 79th Meeting Council called for a resolution by postal ballot to amend the Constitution.

At its 80th Meeting, Council agreed that members should be requested to report to Council all incidents encountered, in which the surveyor was confronted by violence or threats of violence while carrying out his duties; giving details of time lost, injury, threat of injury, witnesses, etc.

Council was informed that the 1975 Congress organisation was in capable hands and that Mr. R.G. Matheson had accepted the office of Congress Manager, and that the Congress date had been fixed as July 21 to July 25, 1975.

Council is now awaiting a report from the Scale of Fees Committee regarding the adoption of a base and index for fee adjustments.

Council invites all members to comment on any aspect of the Scale of Fees due to be released in the very near future.

New postal address: P.O. Box 1324, Lae. P.N.G.

Address unknown:

The Hon. Secretary, P.O. Box 1324, Lae would be pleased to learn the address of each of the following gentlemen:

Kenneth Thomas Blaik
Robert Charles Bakewell
Oscar Sydney Dahl
John Graeme Edmonstone
John Norton Ginn
Ian David Hall
David Calder Harrison
James Venning Lawson
Noel Oliver
Graeme Sparkes-Carroll

EXTRACTS FROM THE FIFTEENTH ANNUAL GENERAL MEETING

Fellows and Corporate Members present:

J.J. Garrett (President)	B.J. Mennis (Incoming President)
F.P. Posanau (Vice-President)	J.J. Tierney (Incoming Vice-President)
A.J. McCarthy (Hon. Sec-Treas.)	I.E. Naughton (Incoming Hon Sec-Treas.)
G.C. Brown	S.P. Low
C.H. Carson	R.A. Machin
A.J. Cullum	R.G. Matheson (Fellow)
D.C. Forster	R.N. Moody
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D.R. Johnstone	P. Salaiau
P.E. Jolley	S. Scriven
G.D. Kendall	N.J. Sharp
M.J. Larmer	D.T. Smith
N.T. Leet	M.G. Whish-Wilson (Fellow)
W. Loratung	J.R. Wood

Associates and Students:

A.J. Quick J.A. Sipuman

The Retiring President's Address:

Gentlemen, I do not know how many of you would agree with me when I say that the number one problem facing this profession in our country today is the training of Papua New Guineans as Registered Surveyors.

However, judging by the comments I have heard on Peter Davies' excellent paper "Reflections on the Development of Surveying Courses", it is to me obvious that many of you are displeased and concerned at our results in this field.

I know very little of the training programs underway in this country today and I am certainly no expert in this field; maybe there are more of you like myself and if so we can commence by admitting that the sorry state of our affairs may be partly due to our own lack of knowledge in this field. Centring my address to you on this problem I can only qualify my statements by my thirteen years of experience in cadastral surveying in this country.

We do have Papua New Guinean surveyors, registered, who do have administrative capabilities; we will require many more for executive and

Extracts from the Fifteenth Annual General Meeting

administrative positions but sooner or later we will require many many registered Papua New Guinean surveyors obtaining survey data to the required limits of accuracy and should that accuracy be 1 in 8,000 then they should be trained primarily to survey to that accuracy and not to 1 in 50,000 and I assume here that we are not throwing away the survey tape.

Do our graduates of today recognise the value, the importance of time? Time taken to collect the survey data necessary - not more than is necessary and certainly not less than is necessary.

I'd bet that second year students at the RMIT are well and truly aware of the importance of this time element. Why? Because I suspect their projects, being limited by time, are so designed that a second glance at a passing pretty girl would put them behind their schedule.

Fortunately, modern calculators do save time. Yes, I say, throw away the books of tables now.

We can't wait for William Thomas to reduce the HP45's price to \$100 and thus reduce his profit to 200% but we might get a government subsidy for these items if issued to students.

Provided that when travelling these calculators are not put in a suitcase and lost, there would be a fair chance of a student trading it in on a later model every six months.

I state the problem to be:

That when a graduate of our University becomes registered he is insufficiently trained in practical surveying for Papua New Guinea conditions and I say that without making any comparison to his better educated Australian counterpart trained for conditions as they exist in the various states of Australia.

Where might lie the causes of this problem?

Do they lie in standard of education at level Form 4? OR

Do they lie in the University of Technology? OR

Do they lie in the Registered Surveyor who is supposed to provide training after graduation be he (a) a Lands Department Officer, (b) another Government Officer, (c) a surveyor in private practice? OR

Do they lie in the Surveyor's Board? OR

Do they lie in Government policies?

Extracts from the Fifteenth Annual General Meeting

Taking each of these areas separately and considering the following comments I believe all these possibilities contribute to the cause or will in the future contribute to the cause.

Surely the standard of our existing education level Form 4 is sufficient for what should be the not-too-technical training of a registered surveyor for Papua New Guinea conditions.

Papua New Guinea is a country that requires an immense number of locally trained surveyors, the majority of whom will be engaged on the measuring of new land boundaries.

But I ask you to consider what will be the standard of level Form 4 in 1980? That standard will depend greatly on the ability of the Papua New Guinea Government to hold existing overseas teachers and on their success in recruiting further overseas teachers.

Coming now to the University of Technology. If our greatest need is to have more surveyors to measure on the ground and mark new boundaries, then does the university have a policy directed towards this need?

I say to you: do not throw away the measuring tape at our university but rather lock up for ten years whatever EDM equipment that might be there. Why? Because I say that existing EDM is still slower and less practicable than the tape for cadastral surveys and will be until such time as a short short range EDM meter of minute (by comparison) size, weight and cost is readily available and proven. This is apparently not too far distant although I have my doubts about a realistic price yet this no doubt will come, after competing makers have taken a good look at the initial model.

Is our university overtraining the students in difficult mathematical problems?

Is the present standard of training in subjects such as Astronomy and Geodesy really necessary?

How many of our locally qualified surveyors will need to know any more of astronomy than how to take a sun observation and reduce it on a HP 45? Is the answer to this question 100% or 5% or 1%?

In Papua New Guinea would you agree to the registration of a surveyor with such limited knowledge of Astronomy?

I certainly would.

Is it feasible to extend the university course a further year to provide full time practical training in that year in a field fitting to the needs of the country?

Is it really necessary in this country for each registered surveyor to have had exactly the same training at graduation?

Extracts from the Fifteenth Annual General Meeting

Let us suppose that our government's requirements in the science of photogrammetry were estimated at say two graduates per year. It may be advantageous in the long run to have those two graduates stumbling and fumbling with cadastral re-instatements at practical examination time, but surely it is more important that their confidence is not lost and that they concentrate on their skills in photogrammetry.

Similarly the twenty graduates per year that the government may require for final surveys of demarcated lands should not be humbugged about with theory or practical examinations in areas of survey outside their chosen field.

Today's problems of staff transfers, communications and staff shortages do not assist the government and private surveyors to give perhaps as much time to the graduate surveyor as we would like to in that period between graduation and registration. For those same reasons the Surveyor's Board has had difficulty in maintaining up to date information on selected surveys for practical examination and the difficulty graduates have in presenting completed surveys on time makes the assessment of his ability all the more difficult.

The small number of graduates so far produced is I feel in no way the responsibility of the University or of this profession but rather the lack of government planning in the past.

It is not sufficient for us today to be calling for a huge intensification of our training programs unless we can change our existing methods.

Government should give thought to the possibility of utilising the facilities and the experience of private consulting firms in the training of surveyors in some fields of surveying.

Perhaps gentlemen, this address may indicate areas of change necessary in our education system and further investigation of such changes might be incorporated in this Association's report on the report of Commission of Enquiry into Land Matters. I hope so.

Finally gentlemen, but not least, I have to thank my Committees of this year for the very long hours they have put into work for your Association. I think our minutes will reveal that some of our meetings finished up after 2 a.m. There was a great deal of work carried out; we had our meetings scattered throughout the country in Lae, Madang and Moresby and I am very proud of your Committee Members in their attendance at meetings.

I am also very proud of our past secretary who left us in January - Peter, I thank you personally very much for your work.

When our new secretary took on the job I expressed the view that he would not be capable of doing the job properly as well as turning out the Journal.

Extracts from the Fifteenth Annual General Meeting

He didn't take very long to prove that I was completely in error and turned out the fattest Journals and the fattest minutes that this Association has seen. Tremendous credit to you Alan, and it is a great loss to our Association that you are not continuing as secretary this year; I infer no pre-judgement on our incoming secretary.

Now it gives me much pleasure gentlemen to close this address, but before doing so to welcome your new President, Brian Mennis. I think you all realize what a good surveyor Brian is, his conscientiousness to this Association, the hard work that he has put in in the past on committees, and it certainly gives me great pleasure Brian to hand over to you this year. Thank you.

The Incoming President's Address:

Gentlemen, it is indeed an honour to be made President of the Association. I think this honour is even greater in as much as this year Papua New Guinea will become an independent country. This could be sooner than later going by this morning's paper and this is certainly an exciting time for this country and all the people who live in it.

However, I don't know whether some of our newer members are aware that this Association is some eight years ahead of the politicians. We have been a completely independent body devoted entirely to surveying in Papua New Guinea since 1965.

When we originally started our Association in 1960 there was some talk with the Institution of Surveyors, Australia, regarding the formation of a Division. In the end we decided to remain on our own as a completely independent body. With all due respect to the Australian Institution, I think that this is the best decision we ever made. We were the first professional association formed in Papua New Guinea and for quite some time we were the only one and it is only in the last year or two that we have lost the distinction of being the only professional association. Certainly, although we are no longer the only one, I would say that we are the strongest, and the most active.

I think our Congress, so ably organised by Brian McLennan and the Bougainville Group, and also the spread in the Post Courier last Monday organised by Jeff Tierney, are very indicative of the strength and activity of our Association.

In the future we have three main tasks. The first is laid out by Jason in his address - I wholeheartedly endorse that as something that we are going to have to look at very, very seriously.

Extracts from the Fifteenth Annual General Meeting

The next one is the main duty also that we owe to the country, and that is to do all we can to attract young Papua New Guineans to the profession. We are hoping that Jeff Tierney's spread in the paper will have some effect in this direction. Time alone will prove whether this is actually correct or not.

It behoves every one of us to do all we can in talking to young Papua New Guineans at school to attract as many people as possible to the profession. Certainly our training needs to be looked at, but at the present time we are just not getting the numbers we need to the profession; even if every one of them goes through the university, we would still be short of surveyors.

We need numbers, and therefore I think it is one of our main tasks to do whatever we can to publicise the profession. Even just working along the road, when you see Papua New Guinean boys looking at what you are doing, take two minutes off from earning your sixteen (sorry eighteen) dollars an hour and explain to him what you're doing; even whip a HP 45 out of your hip pocket and show it to him. I did this in KarKar only a matter of a couple of months ago with a young chap who is in Form 3 or Form 4. He knew nothing about surveying but I think that after I'd spent about five minutes with him he was very, very interested in surveying, he knew what surveyors did, he knew that there was perhaps an exciting, interesting future for him in surveying. While he didn't make a decision in that five minutes, there is no doubt that I generated in him an interest in and an awareness of surveying.

The last main aim of our Association and while I place it last in number, it is certainly equal with all the others, and that is to encourage our national members to take part in the running of the Association.

Although predictions are that overseas expatriate members will remain here in quite a large number for quite a few years yet to come, the sooner we have our national members taking a very active part in the running of the Association, the better.

This year on Council we have four national members and I'm very, very pleased to see this. Conversely while it is up to us to encourage our national members to take this interest, it is very definitely up to the national members to take an interest in the Association and work actively for it. In this way, they can acquire the skills necessary in the years to come when there will no longer be a preponderance of expatriate members to take over the burden of running the Association. I look forward to the day when all the people at the head of this table will be national surveyors.

One last point I want to make and this is made particularly to our national members, that our Council Meetings are not closed sessions; they are open to anybody with comparatively minor exceptions, that is when we are discussing particular arguments. They are open to anybody who cares to come along.

Extracts from the Fifteenth Annual General Meeting

Admittedly we don't publicise them perhaps as well as we could, but when we meet in a particular centre I would certainly like to see particularly national members come along and see how the Council operates, what we do, what we discuss, so that if they are nominated for Council in a subsequent year, they do know what is involved.

This year our Council is predominantly Moresby, some in Lae, and we will be alternating our meetings I think between Moresby and Lae. We have quite a lot of local members in Lae, particularly Student Members. There is no objection to Student Members coming along. Having availed themselves of that opportunity I trust that they will make full use of it.

I thank you gentlemen, once more, for electing me to this position, and I will now give you your Council for the forthcoming year.

Office Bearers and Councillors for 1974-75:

President Mr. B.J. Mennis announced the following:

J.J. Tierney	Vice President (Port Moresby)
A.E. Naughton	Hon. Secretary Treasurer (Lae)
A. Bale	Councillor (Port Moresby)
I.B. Bryning	" (Lae)
S.P. Low	" (Kimbe)
K. Pochapon	" (Port Moresby)
D.T. Smith	" (Kieta)
F.P. Posanau	" (Port Moresby)

Tenth Survey Congress

PORT MORESBY

JULY 21 - 25 1975

The Tenth Survey Congress will be held in Port Moresby from 21st to 25th July, 1975. The theme of the Congress will be "Backsight and Foresight".

The Congress Committee thinks that the first year of independence is an appropriate time to reassess the past and to attempt to plan the future, and we invite any member who feels that he may like to contribute something by written papers or discussion points to write to the Congress Manager care of P.O. Box 1036, BOROKO. The Committee will require a brief outline of any proposed paper before December and, if accepted, a final draft by mid April, 1975.

The Committee is sure that everyone appreciates that this is probably the most important Congress, in terms of the future of the profession in this country, that we have held, and looks forward to being "overwhelmed with advice".

R.G. Matheson,
Congress Manager.

A TRIBUTE TO AN OVERSEAS CONTRIBUTOR

The first paper presented at the Bougainville Congress was by Brian Murphy. Brian has taken an interest in matters concerning the Surveying Profession in Papua New Guinea and the Journal has pleasure in publishing this extract from "Traverse".



Brian Thomas Murphy joined the Victorian Department of Crown Lands and Survey on 3 March 1945, at the age of 17 years. He was awarded a Public Service Free Place at the University of Melbourne in February 1948, and the following year was one of the first two students to be admitted to the course for the degree of Bachelor of Surveying. He qualified for that degree in 1952, served under articles of indenture in the Lands Department and was registered as a Licensed Surveyor in 1954. He then worked in the Geodetic and Photogrammetric Sections of the Lands Department until May 1955.

Mr. Murphy joined the staff of the University of Melbourne as a Lecturer in Surveying in May 1955, and four years later was promoted to Senior Lecturer. In 1960 he was awarded the degree of Master of Surveying for research into Geodetic Survey Adjustment, and in 1964 he was appointed to the position of Head of the Department of Surveying on the retirement of Associate-Professor Thornton-Smith. He was promoted to the position of Reader-in-Charge of the Department in May 1966. Mr. Murphy has written more than twenty research publications which have been published in the Survey Review, the Australian Surveyor and other journals. He has presented two papers to Congresses of the Institution of Surveyors, Australia, and has written booklets and brochures for the guidance of trainee surveyors, including "Some Aspects of Field Astronomy" and a Careers in Science and Technology booklet entitled "Surveying".

Mr. Murphy was one of the Victorian representatives on the Panel of Educationists which met in Melbourne in May 1965 and he was elected chairman of the meeting. His lucid reports upon this meeting have proved most valuable to the Reciprocating Surveyors Board and to the Institution of Surveyors, Australia.

In 1959, he was appointed as the Representative of the Melbourne University on the Surveyors Board of Victoria, in which capacity he still serves. He is a Member of the Survey Advisory Board of the Royal Melbourne Institute of Technology, and for some time, was a part-time member of the staff of that Institute.

A Tribute to an Overseas Contributor

Mr. Murphy was elected a student member of the Institution of Surveyors, Australia, in April 1949, a Corporate Member in June 1956 and a Fellow in January 1966. He has been an active member of committee and of several sub-committees of his Division for many years. He was a Federal Councillor of the Institution from 1970 to 1972, and is currently President of the Victorian Division, which is celebrating the centenary of its inauguration this year.

Brian and his wife Pat last visited Papua New Guinea in 1970 and attended the Survey Congress at Lae.

The Cartographer continued from page 14.

In addition, an increase in the output of cadastral maps will be required to record details of land ownership, land transfers, etc.

Maps are a fundamental means of communication, and as such, will be required by people and organisations who have ideas to distribute, information to publish - such people as educationalists, economists, geographers, ecologists and so on.

The cartographic profession in Papua New Guinea has a very active programme ahead, and cartography graduates from this University can look forward to a busy and satisfying vocation in the years to come.

THE CARTOGRAPHER

What is he, and what is his role in Papua New Guinea?

By: G.E. Flegg

Introduction:

In 1967 the Department of Lands, Surveys and Mines and the Department of Forests jointly developed a training course in Cartography. In 1968 this course was transferred from Port Moresby to the P.N.G. Forestry College in Bulolo, where better training facilities were available. At the beginning of 1973 the course was again transferred for similar reasons and is now conducted within the Department of Surveying at the P.N.G. University of Technology.

What is a Cartographer?

Despite the abundance of cartographic material which exists in the world today, the term "Cartography" is not generally well understood. Cartography has been defined as:

- (1) The science or art of making maps. (Websters Dictionary)
- (2) The making of charts or maps. (Oxford Dictionary)

In an attempt to bring these definitions up to date, the International Cartographic Association further defines Cartography as:

"The art, science and technology of making maps, together with their study as scientific documents and works of art. In this context maps may be regarded as including all types of maps, plans, charts and sections, three-dimensional models and globes representing the earth or any heavenly body at any scale."

The British Cartographic Society adds to this definition the following words:

"In particular, cartography is concerned with all stages of evaluation, compilation, design and drafting required to produce a new or revised map document from all forms of basic data. It also comprises all stages in the reproduction of maps. It encompasses the study of maps, their historical evolution, methods of cartographic presentation, and map use."

The definition appears rather cumbersome, but it is not unduly so in the light of scientific and technological developments which have influenced cartography in the last two decades.

The Cartographer

Electronic distance measuring equipment, remote sensing apparatus (e.g. satellite photography), computerised map data storage, automated plotting machines, etc., are some of the fields in which today's cartographer is required to have an ever increasing knowledge.

In view of the foregoing, a Cartographer may be defined as "one who practices cartography".

The Cartographer's Role in Papua New Guinea

In attempting to outline the role of Cartographers in Papua New Guinea, it is necessary to decide firstly whether there is a need for mapping in this country.

In December 1972, The Chief Minister Mr. Somare, outlined his government's aims with regard to this country's development. Included in these aims was the:

"Decentralisation of economic activity, planning and government spending, with emphasis on agricultural development, village industry, better internal trade and more spending channelled to the local and area bodies."

The above statement indicates a need for considerable planning and therefore a need for the basic tool in development planning - a map.

In a further statement, referring to the "Skai Piksa" project being carried out by the Australian Army and the R.A.A.F., the Chief Minister said:

"We badly need better maps of this country so that we can plan development projects such as roads, hydro-electric and water supply schemes, and airfield and port development. New maps will also help people studying agricultural development."

In practically every country in the world today, whether developed or under-developed, the demand for maps increases faster than they can be supplied. Papua New Guinea is one such country. Calls are repeatedly being made for more, or better maps - especially at large and medium scales. These maps are required primarily for development planning, ie. agricultural development, timber investigations, designing communication links, mineral exploration, civil defence and so on.

Since it is apparent that maps are needed in P.N.G., it is then the cartographer's task to provide them.

Initially, maps are required at medium scales (say 1:100,000) for general planning use, and at larger scales (1:50,000, 1:25,000 and 1:10,000) for more detailed investigation work.

(continued on page 12)

RECENT TRENDS IN TOPOGRAPHIC MAPPING WITHIN THE DIVISION OF NATIONAL MAPPING

By: O.J. Bobroff

A paper presented to the Ninth Survey Congress, Bougainville.

Abstract

Together with other mapping Authorities, the Division of National Mapping is updating its procedures, both in the field and in the office with a view to producing better maps, quicker. Greater use is being made of orthophotography and automated plotting, whilst in the field, increasing use of airborne techniques for data acquisition is evident.

Introduction

An examination of mapping trends occurring during the last few years reveals two main streams of development. They are somewhat related, and both have eventuated because of outside pressures, being more or less inevitable solutions to the problems created. As could be expected, the approaches are similar and resolve themselves in a greater utilisation of automated processes and mechanical aids.

It is common knowledge that, for our population, we have a disproportionately large area to map and that conventional techniques are inadequate with the present work force, if up-to-date maps are to be published. Secondly, to compound matters further, land proprietors have developed, of late, a new attitude towards the inviolability of the environment, and an increasing reluctance to interfere with it. This fashionable pre-occupation of land holders increases the problems of the field surveyor and makes ground acquisition of data more difficult. More and more owners are becoming less co-operative to necessary clearing operations and station monumentation and there is an increasing opposition to free access and camping on site.

The problematic areas can be split logically into two areas of consideration, one in the office and the other, in the field.

Office Developments

In order to expedite the production of maps and to shorten the production period itself, less emphasis is being given to the development of conventional line mapping techniques which are well understood, and more to other processes which increase the per capita output. More orthophoto-maps are being produced, some being published as such, while others are used as the basis for line maps. The production of line maps from orthophotomaps is virtually a tracing operation and can be done very rapidly.

Recent Trends in Topographic Mapping
Within the Division of National Mapping

Two systems are being currently used for the production of orthophotomaps, the Zeiss TOPOCART with its ORTHOPHOT attachment and the Wild B8 STEREO-MAT. Each has its virtues, and although initially the Topocart produced a much superior image, being an optical instrument, it can now be fairly stated that the output of the electronic Stereomat is now quite compatible in quality of definition with it. The compatibility is now such, that prints from either or both can be intermixed with whole-photo rectified prints with a high degree of success. This means that the terrain to be mapped can be inspected and split up into categories and fed to that instrument which can cope with it most economically. Very flat country is handled by rectification, undulating country by the Topocart and the more difficult mountainous terrain by the most expensive equipment - the Stereomat. In Australia, it is common to have a combination of two of these approaches on one 1:100,000 scale map sheet, sometimes, of all three.

The Stereomat has been digitized and all contours are now extracted and drawn by automated flat bed data plotters. The Topocarts are in the process of being digitized, but as yet do not have this capability.

Increasing use is being made of large flat-bed plotters to produce base sheets for manual slotted template assemblies and to plot control data derived from analytical block adjustments. It has been found that automated plotting is quicker and somewhat more accurate than conventional drafting methods. The GERBER Model 2032S drafting and digitizing machine of the Department of Manufacturing Industry has been used.

This approach has been so successful that programmes have been modified to produce outputs for orthophotomapping, abthymetric plot charts and manuscripts sheets, Antarctic mapping etc. Briefly, grid co-ordinates for drawing the graticule and positioning the grid of the adopted projection are obtained in punched card output from the CDC 7600 computer run by C.S.I.R.O. Control point descriptions and co-ordinates and/or the co-ordinates of photogrammetric points are punched by hand except where there has been an analytical block adjustment of photogrammetric points, in which case, punched card output is available, by using a simple transformation programme. This information is then fed onto disc storage and parameters defining the required graticule and grid are extracted and punch tapes are made to drive the plotter and draw the required information on stable base sheet.

Before the advent of automation, manual plotting of one sheet required something like one man day. The Gerber plotter can produce approximately 40 sheets per day. As data preparation for a block takes about the same time as for hand plotting and the additional computer time and tape preparation is very small, the cost of the Gerber plotter at \$25/hour is very attractive.

Recent Trends in Topographic Mapping
Within the Division of National Mapping

Field Developments

As mentioned earlier, there is a current climate of deteriorating co-operation with land holders. This same climate is permeating the many newly created authorities which have proliferated in recent years. It seems that wherever one needs a survey, there is an authority with an interest in preservation to whom one must apply for permission to do the work.

Inevitably, we have sought the answer in the air. To date, no one has questioned our right to fly over the country and very few letters or forms are required. The trend began about 1963 when the decision was taken to densify the geodetic control net for mapping control purposes by using an airborne electronic distance measuring system - the "Aerodist".

This proved so successful that a similar approach was used for the acquisition of vertical control and the Airborne Laser Terrain Profiler was produced. Once again, the equipment was tailored to fit a small twin engined aircraft to permit the use of short airstrips. In practice, it has been all that we had hoped, and in three years of operation it has produced 150,000 line/kms of profiles, controlling 90 1:250,000 areas.

Since the introduction of the Laser Terrain Profiler there has been a steady development of the equipment and of the techniques used in flying. The tracking strip camera has been improved, both in angle of coverage and in definition. The auto pilot has been fitted with a remote control which enables the navigator to make small corrections to the flight path, with a substantial increase in the accuracy of profile positioning in relation to bench marks. Pitch and roll gyros with electrical read-outs have been installed and these provide attitude information which is used for correcting the measured height.

Continuing the airborne philosophy, a beginning has been made on the production of an equipment which, it is hoped, will provide mapping control without the necessity of having to visit the points on the ground. The present state of the art can continuously position an aircraft in flight and provide co-ordinates of the survey camera at each exposure. It is proposed to complete the link with the ground by using a precise attitude reference platform to provide angular information of the attitude of the camera at the moment of exposure. In other words, not only is the position of the camera in space known, but its attitude in relation to the plumb line as well.

The positional information is to be provided by the "Aerodist" equipment used in the "tri-lat" mode in which simultaneous measurements are made to three established ground stations. Measurements to three known stations enable the height of the aircraft to be determined also.

Recent Trends in Topographic Mapping
Within the Division of National Mapping

The "Camera Attitude Indicator", as it is proposed to call the system, together with the Aerodist distance measuring equipment, will also enable controlled mapping photography to be taken of islands and offshore reefs which would be difficult to control for conventional photogrammetric mapping. Additional, and if required, continuous edge control can be provided for blocks of map sheets and used either for slotted template assemblies or analytical adjustments.

To ascertain the feasibility of the approach, preliminary tests were carried out in the Aerodist aircraft using a small format Hasselblad camera fitted with bubbles suitably graduated. Photographs were taken of control points and encouraging results have been obtained with errors of about 10 to 15 metres. Other fixes have been made of uncontrolled points with a variation of approximately 13 metres between the values for the same point. However, because of the relative crudity of the equipment, only about 20% of the photographs taken could be used.

In supplying the missing link between the aircraft camera and the ground, the C.A.I. may well open other avenues for the economic utilisation of aircraft for survey purposes.

Another area which lends itself to the airborne approach is the field completion and inspection of map sheets, before they are published. Because of the time lag which exists between the taking of the aerial photography used in preparing the map and actually publishing the end product, it has been found that substantial changes can occur in the cultural detail, particularly in the more densely settled areas.

For convenience, the additional information is obtained by using two aircraft, one, a small single engined aircraft fitted with a 70 mm Hasselblad and the other, a twin in which a conventional survey camera, a Wild RC9, has been installed.

A colour proof of the map compilation is taken into the field and is examined by flying the small aircraft in parallel strips at about 5000 metre intervals across the map sheet at an altitude of about 1700 metres. From the information gathered on these flights and annotations made on the compilations, supplementary photography for the survey camera aircraft is planned and flown where required, usually at about 3000 metres altitude.

Where the amount of supplementary detail is small, and lengths of new roads short, the inspection aircraft usually takes the supplementary photography with the 70 mm Hasselblad.

Nomenclature is checked by officers visiting the relevant authority of the state in which the area under consideration lies, prior to the commencement of flying. Anomalies are checked by visits on the ground to the proprietors or local authorities and any discrepancies resolved.

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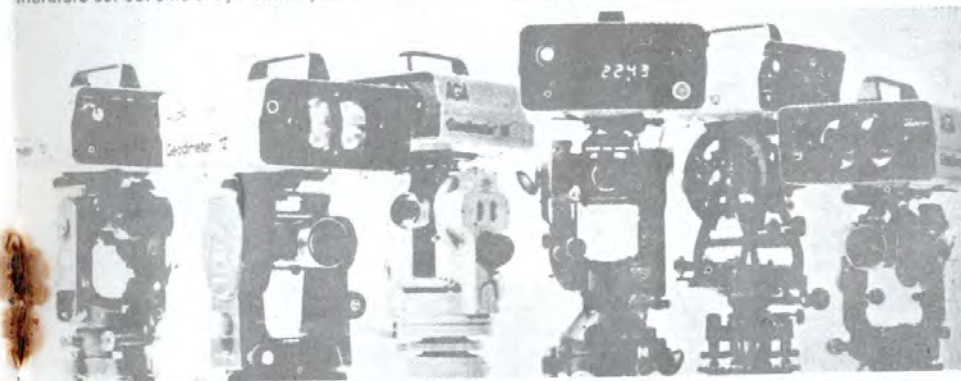
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GEODIMETER-MODEL 710

NEW FEATURES.

The MODEL 710 is a development of the MODEL 700. The new instrument gives a continuous indication of *Height difference* (ΔH) and of *horizontal distance*, slope distance, vertical angle, horizontal angle automatically in digital form *up to 4.8 Km*, to one second of arc and 5 mm accuracy. Under favourable conditions the MODEL 710 *will measure up to 9 Km*. The 710 has a light-weight fibreglass transport case and a continuous power supply.

APPLICATIONS.

Any survey, big or small, viz:- all setting out work, all traversing; construction work; urban and rural subdivisions; detail surveys; breaking down triangulation nets; supplementing cartographic work; trigonometric height measurements; underground measurements in mines and tunnels; photo control; Tacheometry, etc.

WITHOUT AUTOMATIC RECORDER.

The MODEL 710 is available with or without automatic recorder for collection of data or observations. The 710 can be used for all phases of subdivision work. Picking up detail and contouring for design purposes can be completed in $\frac{1}{10}$ th the time required by a conventional theodolite with attached distance meter. Similarly traversing is completed in $\frac{1}{2}$ the time and setting out in $\frac{1}{3}$ rd of the time. From the control points, the surround boundaries can be redefined, detail and contouring completed, road centre-lines and angle points in the subdivision can be pegged and levelled. **160 points** can be set-out in one day. Once the subdivision and control is co-ordinated, the 710 can be set up *anywhere* on the subdivision and the unknown instrument station co-ordinated three dimensionally in three minutes by resection. This technique of "random set-up" can be used on many surveys. Three dimensional setting-out can be performed on construction sites. With the target height at the same height as the instrument the difference in level is immediately displayed

WITH AUTOMATIC RECORDER.

The GEODAT 700 punch tape is attached to the MODEL 710 and used to record and code all observations. With the GEODAT 700 punch tape comes the GEOCLEAN program which reduces, cross-checks and lists the punched information under station numbers in polar co-ordinate form. Some examples:-

1. A punch tape containing **500 observations for contouring** can be read and reduced ready for plotting in **3 minutes**. A plot of the 500 observations can be automatically plotted in 30 minutes. This includes time required to specify points, e.g. type of tree and diameter. Contour intervals, not normally obtainable by photogrammetric methods are obtained, apart from being cheaper, more convenient and quicker. **Over 600 observations** can be recorded in a day.
2. **Cross sections** can be punched, reduced and plotted, and earthworks quantities produced very quickly.
3. **Terrain models** can be stored for future mass calculations and can be compiled quickly and inexpensively and updated at any time.
4. The horizontal distance and bearing displayed by the 710 can keep up with an object moving at 37 Km/hour (23 mph) so it is ideal for **hydrographic work** and saves time consuming intersections and plotting.

For demonstrations and further information on applications, please contact AGA or any of AGA's interstate agents. The Model 700 geodimeter is still available at special prices.

THE MODEL 710 CHANGES WEEKS TO DAYS AND DAYS TO HOURS.



AGA2355

Recent Trends in Topographic Mapping Within the Division of National Mapping

The supplementary information thus obtained is transferred, where sufficient control exists, by simple sketchmaster transfer, otherwise more sophisticated plotting equipment is employed.

Additional coastal photography is flown by the RC9 aircraft at 3000 metres altitude at predicted times to determine mean high water mark. Black and white infra red emulsion is used and flights are restricted to the period up to an hour before and after the calculated time, beach gradients being taken into account, where possible. This appears to be a realistic compromise.

Last, but certainly not least in interest and technical complexity is the equipment being currently used by the Bathymetric Branch of the Division for the acquisition of data for underwater sea bottom charting. Here a combination of a Satellite Navigation System is supplemented by a Doppler Velocity Sensor.

The system employed, the Navy Navigation Satellite System (NNSS), operates on the fundamental principle that the relative motion between a transmitting and receiving station will introduce an apparent frequency shift in the transmitted signal. Use of this doppler effect led to the development of a world-wide, all-weather navigation aid, utilising satellite transmitted data to compute a position fix. The NNSS differs from other similar positioning systems only in the basic geometry of instrumentation. The satellite system consists at present of six solar powered satellites in circular polar orbits at a nominal altitude of 600 nautical miles. The orbital planes of the satellites intersect the earth's rotational axis and were originally spaced at 45° intervals. Each satellite orbits the earth in about 108 minutes. The user-system consists of a Satellite Navigation receiver which is interfaced to a small computer.

The Satellite Navigation Receiver on board the survey vessel automatically locks on to the satellite signals which are relayed to the associated computer and teletypewriter, thus providing information from which the geographical co-ordinates of the ship's position can be computed at frequent intervals.

Accurate course and speed information is provided by the Doppler Velocity Sensor, operating off the sea bottom from transducer emitted signals. The continuously updated ship's position "dead reckoning", as well as speed and heading and the distance the ship is off the desired track is displayed on a small C.R.T. which information enables the surveyor to systematically traverse the continental shelf at predetermined intervals of 1500 or 3000 metres. The desired interval is dependent on seabed topography. Positioning information supplemented by water depths obtained from echo sounding equipment are then available for preparation of manuscript map sheets from which the Bathymetric maps are finally produced.

Recent Trends in Topographic Mapping
Within the Division of National Mapping

By: B.C. Forster

Development of new skills and, particularly, of new equipments is seldom a painless undertaking. It can, however, be most rewarding once the travail of the birth is past, and, to carry the analogy a little further, the successful termination of each project builds increasing confidence with which to face the next. Once the idea of change and progress is planted, and accepted by all concerned, an atmosphere is generated even in a map making factory, in which ideas flourish and new projects are greeted with enthusiasm.

The Control Requirement for Mapping continued from page 22.

This would seem far more economical than the establishment of approximately eighty additional height points.

The research is continuing and should lead to a much more refined approach to the question of control placement with its obvious cost savings in Papua New Guinea.

Phototriangulation or aerotriangulation may be defined as the method of establishing supplementary horizontal and vertical control through the geometric relationship of adjacent aerial photographs. The relating of the geometry on one photograph to an adjacent photograph may be accomplished analytically or mechanically. However, it is only since the introduction of electronic computers that photogrammetric triangulation has reached anything like its full potential and only in the last few years have surveyors achieved a significant understanding of the errors of block triangulation.

The best known application of photogrammetric triangulation lies in the fixing of control points for mapping, where there is a trend towards larger blocks with hundreds, even thousands, of photographs to be simultaneously computed.

As field control for aerial triangulation accounts for a large proportion of the total cost of a mapping project, it is critical that only the minimum amount of control that will satisfy the map accuracy is used in the triangulation process.

A significant amount of research has been carried out relating the theoretical errors from aerial triangulation to the control pattern and also to the size of the block (ie. number of photographs or of models, where a model is an overlapping stereoscopic pair of photographs). However, little or no research has been carried out to give an overall solution in practical block triangulation.

From an analysis of available theoretical studies and individual practical projects the following two empirical formulae have been derived:

$$xy = 17 \frac{(1 + 0.35 S)}{10,000} (C_p - 1)^{-0.38} (M)^{0.20} \dots\dots(1)$$

and

$$z = 64 \frac{(0.5 + 0.7 S)}{10,000} (C_p + 1)^{-0.97} (C_i + 1)^{-0.31} (M)^{0.55} \dots\dots(2)$$

Equation (1) allows the calculation of the standard planimetric error at photograph scale in microns and equation (2) the standard vertical error at photograph scale for various combinations of scale, control and block size where

S = photograph scale denominator

C_p = number of perimeter control points

The Control Requirement for Mapping Using Aerial Triangulation

C_i = number of internal control blocks in the block

M = number of models making up the block.

These formulae have been derived for a standard method of triangulation. This includes the use of analogue independent triangulation, wide angle photography, 20% sidelap between strips of photographs, and pretargetted ground control.

The use of more sophisticated triangulation procedures, super wide angle photography and 60% sidelap between strips, will considerably reduce the standard error for both planimetric and vertical.

In the mapping process individual stereoscopic models are formed in a plotting machine and the details and contours for the topographic map are taken from these. Each model, however, must be absolutely oriented to the terrain co-ordinate system. The co-ordinates of the terrain points needed to allow this connection are determined in the aerial triangulation process.

For the 1:50,000 mapping at 20 metre contour interval being undertaken in Papua New Guinea, the horizontal error in the points established for the mapping process should have a standard error of about 6 metres and vertical error of about 2 metres.

The Royal Australian Army has recently commenced photographing the whole of Papua New Guinea at a scale of 1:100,000. On the mainland of Papua New Guinea the largest area without control can be covered by approximately twenty stereoscopic models. The perimeter control of this block would amount to ten points.

Using the empirical formulae, these figures result in an error of 6 metres for horizontal points and 24 metres for vertical points. This latter value, however, can be reduced by 1.7:1 because the 1:100,000 photography used was super wide angle. This gives 14 metres for the vertical error. It can therefore be seen that the horizontal requirement will be satisfied but the vertical requirement will not.

The vertical accuracy could be improved by using 60% sidelapping photography, which would reduce the error to about 4 metres. This would necessitate the flying of additional strips of photography between those that have already been taken. As well, the establishment of an additional 5 perimeter height control points and 5 internal points would be necessary to reduce the error to the acceptable 2 metres.

(continued on page 20)

PERSONALITY OF THE PROFESSION

Oswald George Gordon Dent

Oswald Dent has been a District Surveyor in Papua New Guinea for the past 16 years.

In 1958 he established the first permanent Survey Office in Wewak and was responsible for the initial town design surveys of Maprik, Angoram, Aitape and Vanimo as well as the development of Wewak and environs.

Always keen to teach survey techniques, he encouraged local chainmen and was the first Administration Surveyor to run wholly indigenous survey parties.

In 1962 together with the Chief Surveyor of Dutch New Guinea (Ir. C. Roggeveen) he led a joint Australian/Dutch expedition to fix the international border on the Fly River. He has vivid recollections of flooded swamps and fast flowing currents which necessitated using bush platforms around tree stumps as instrument pillars and sinking 44 gallon drums filled with cement to make a foundation for a border marker! It is an historical fact that the Joint Declaration prepared for respective Government approval as to the border location, was thrown out by the Indonesian authorities because positions fixed by a Dutchman could not be accepted!

Os joined the 2nd AIF at an early age and saw service in Artillery Survey units in the Middle East and New Guinea. He qualified in NSW in 1946 and would have come straight to PNG but marriage and family ties kept him battling in Private Practice in Taree, N.S.W.

One of his professional aims was to establish a Division of the Institute of Surveyors Australia in this country but the profession opted for an independent Association of which he is a foundation member and a Past President. His main professional interest over the years has been to promote an integrated survey system and large scale mapping as the logical tool for resolving the land management problems of this country. His technical papers, letters and sometimes emotional submissions have generally fallen on deaf ears in our profession, still tied to the old theodolite and chain technique and dominated by the government bureaucracy.

Ossie obtains his relaxation by playing bowls and working for the welfare of Returned Ex-Servicemen. He has represented Papua New Guinea in lawn bowls at Edinburgh 1970, Worthing England 1972 and Christchurch N.Z. in 1974.

His family consists of wife Betty, daughter Cecily and son Chris, who now reside in Lae and the latest news is that daughter Cecily and her husband John Odgers are expecting a multiple family very soon.

Personality of the Profession

It would appear that an additional interest for grandfather Os will then be baby sitting.



Oddie Dent and family.

LAHARA PROGRAMME FOR SURVEY TECHNICIANS

By: K.F.J. Aschhoff

During the 1974 Christmas holidays the Department of Surveying, Papua New Guinea University of Technology is conducting an eight week refresher course for ten serving Technical Officers from the Lands Department.

The aim of the course is to provide additional training for these officers in those technical and administrative topics in which they have shown weaknesses during their employment in industry.

Mr. Francis Posanau, the Associate Assistant Surveyor General, worked in close liaison with the instructors of the Surveying Certificate Course to get this Lahara Session off the ground.

Mr. A.J. Tinker is the Surveying instructor conducting the programme and will be overall responsible for the running of the course as well as instructing in the surveying subjects. Officers from the Lands Department in Lae will instruct the students on technical and administrative procedures of that department. Mr. R. White, Head of the Department of Languages and Social Science at the University is undertaking the teaching of how to read Survey instructions and briefs, and how to write survey reports.

A careful study was made by the senior officers of the Survey Division, Lands Department and the instructors of the Surveying Certificate Course as to the practical value of such a two months Lahara programme. It was agreed that a study session of this nature would be of significant value as it would give some necessary formal training to:

- (a) officers who have never attended a full time course of studies,
- (b) officers who only spent four to six months at the Rabaul Survey School before the syllabus of that school was upgraded and the duration of the course extended to one year,
- (c) officers who attended the upgraded certificate course but have shown weaknesses in certain aspects of surveying and administration.

During the two months that this group will spend with each other and experienced instructors, language teachers and administrators it is agreed that a common high standard of efficiency and proficiency will be reached by the students.

Some of the topics envisaged for studying are: Survey report writing, office procedures, Survey Rules and Regulations, recording of field notes,

Lahara Programme for Survey Technicians

solar observations and the calculation of a fourmil bearing, introduction to new E.D.M. equipment and electronic calculators.

However, during the first two days detail discussions will be held with the students and they themselves will decide on the ultimate study programme that will be followed for the duration of the course. Whatever extra training is needed will be given, so that at the end of the course the Lands Department will benefit from the advanced knowledge that these officers have gained.



THE EFFECT OF THE COMMISSION OF INQUIRY INTO LAND MATTERS REPORT ON OUR PROFESSION

By: K. Pochapon.

Extracts from a paper presented at the Ninth Survey Congress, Bougainville by K. Pochapon, Associate Surveyor General for Papua New Guinea.

Abstract

My main intention for writing this paper is to bring to the notice of this Association some of the major issues outlined in the Commission's Report which may affect the Surveying Profession.

It will be advantageous to seek and discuss our views relating to the report when we would be the organisation charged to implement this particular aspect of the Report.

The Report

Below, I have copied the recommendations from Chapter 13 of the Report.

"Recommendation 113

More survey staff and facilities should be available to meet the needs of land registration. Necessary land registration should not be held up for want of survey facilities, but neither should land registration be pursued at a pace that over-strains reasonable supply of survey staff and facilities.

Recommendation 114

- (A) Papua New Guinean villagers should be involved as much as possible in the actual work on their own land, including cutting of lines and ground marking preparatory to aerial photography.
- (B) Training of surveyors and survey technicians should include training in how to involve village people in the work.

Recommendation 115

Pilot projects of systematic survey of rural land by photogrammetry should be carried out in order that a full evaluation of the method can be made.

Recommendation 116

Efforts to train Papua New Guinean Government survey staff should be intensified to relieve the present heavy reliance on private contract surveyors. A course of in-service training is suggested as an alternative to full-time courses at the University of Technology.

The Effect of the Commission of Inquiry
Into Land Matters Report on our Profession

Recommendation 117

All local field staff engaged in land work, a number of school leavers, and some of the official mediators of land disputes in each district should be trained in simple survey methods, in order to help in cases of sudden need when survey technicians are not available.

Recommendation 118

A variety of survey techniques should be made available and the degree of expense and accuracy employed be related to the benefit expected to come from a survey.

Recommendation 119

- (A) Villagers should be expected to pay a share of the cost or perform a sufficient amount of the ground work on surveys connected with the registration of their land.
- (B) A person given registered title should be required to plant his boundaries within one year. (Failure to do so could weaken his claim in a dispute.) The planting could be followed by survey by photogrammetry, especially after systematic registration of an area. "

What are our Views?

It should be appropriate at this stage to consider our own views relating to this Chapter of the report.

I have at this stage, not given a lot of thought as to how we may be able to implement these recommendations. In principle I would go along with the recommendations of the Report relating to Surveying. In practice it may be a little harder to see how we could effectively carry out the recommendations.

Need for Changes

It is my view that whilst the status of our Surveying profession is something we need to be proud of, there will need to be quite a number of changes that have to take place within our own systems before these Government recommendations can be effected.

Laws, Ordinances and Directions

It is the recommendation of this Report (C.E.L.M.) that to make changes possible a lot of the existing Land Ordinances will have to be repealed and in some cases may not be used at all. I see that our Survey Ordinance, Regulations and Direction may need to be reviewed to cater for the changes that are coming.

The Effect of the Commission of Inquiry
Into Land Matters Report on our Profession

Education and Training

Various training and educational institutions would be charged with the relevant forms of education and training for the type of manpower requirement needed.

The report recommends that whilst there is need to continue producing professional, sub-professional and technicians, a lot of emphasis is placed on in-service and practical training.

Since the output of professional and sub-professional surveyors is still at a minimum, there will need to be some changes in the structure of courses where more emphasis will be placed on work-study situations. This, together with some other related recommendations, will be made more increasingly the case in the next two to three years if the Report of the Committee of Enquiry into University Development is accepted.

One small fact is that whilst these methods of approach to training and education are recommended, it can be seen that the Public Service Board's requirements are always based on formal educational qualifications.

It will be of some significance if a School of Surveying and Land Studies (as suggested by Mike Kellock in 1972) is established since this will cover all the existing related courses and the recommendation of the Land Report to establish Diploma and Degree courses in Land Management.

Aspects of Survey Costs - The Need for Greater Participation of Nationals

It is recommended by the Report in basic terms that:

- (i) Village people be involved in the actual work on their own land.
- (ii) That there be intensive efforts to train Papua New Guinean Surveyors and Technicians to relieve heavy reliance on expatriate staff.

This, I see, is the main hope of the Report in cutting down survey costs.

It may be advantageous to cast our thoughts back on the paper presented by the "Hagen Trio" (Forster, Jolley & Carson) in the 1973 Congress. This particular paper supported the recommendation of fully utilising local survey personnel in order that costs could be reduced.

They believed that this could be achieved and still maintain the required standards if certain required accuracies are lowered.

The Effect of the Commission of Inquiry
Into Land Matters Report on our Profession

I feel there may be need to move in the direction expressed in that particular paper (Hagen Trio's) with a hope of achieving this particular recommendation.

I quote their concluding sentence:

"Gentlemen, as members of the Surveying Profession, surely this is worthy of your future consideration."

I feel the future has come.

Conclusion

It would have to be the role of this Association and other related ones in close co-ordination and relationship with the Educational Training Institutions and the Government of the day to see that the end products of our process of implementing the aims of such reports are of relevance to the National need.

To do this, our aim is to assess our professional manpower requirements, the provision of appropriate educational facilities and the development of strong local organisations which would be able to foster the advancement of the profession and its professional skill.



Kisokau, sitting on the extreme right,
listens to comments from Jason Garrett.

SURVEYING EDUCATION

Report by A.J. McCarthy

Over the August vacation third and fourth year Surveying degree students accompanied by Ted Nacino and myself journeyed up the Markham Valley to Mutsing and then on to Yonki and Goroka.

The aims of the excursion were threefold.

Firstly at Mutsing the students were to spend a week remeasuring the National Mapping control system between the Kaipit and Ragitsaria trig. stations. Aims were to gain practice with 1" theodolites and the CA1000 tellurometer. Also they were to experience the logistical problems of running topographic surveying field parties. While not a lot of work was achieved during the week the above aims were certainly realised.

Second on the agenda was a visit to the 4 Field Survey Squadron based in Goroka under the command of Major Ricketts. The aims of this visit were to bring to the attention of the students the techniques and operations carried out by the Army in their work of establishing horizontal and vertical photogrammetric control for the 1:100000 mapping series.

This visit proved extremely worthwhile. Major Ricketts and Lieutenant Birn ran the students through the various phases of establishing position for photo control stations by the conventional techniques of airborne tellurometer, slope corrections by barometric techniques and height control by barometric levelling.

We were introduced also to the newer concept of establishing geocentric position by the analysis of a Doppler shift from signals received from one of a pair of navigational satellites, the instrument used is the Geociever. Shortly to arrive from W.R.E. in South Australia is the Laser Airborne Profile Recorder as a new means of obtaining vertical control.

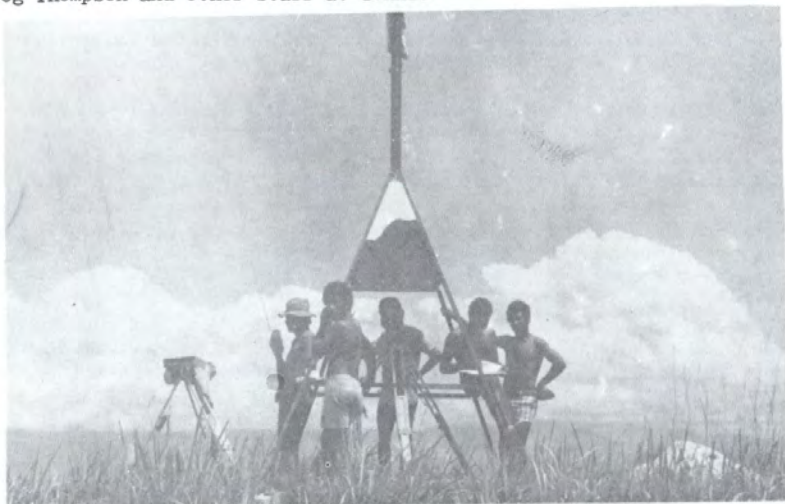
Finally we journeyed back to Yonki to visit the Ramu hydro-electric scheme. Our aims here were to introduce the students to some special applications of Engineering surveying techniques, and the surveying problems associated with a hydro-electric construction project.

The resident consultant surveyor at Yonki is Greg Thompson. Everybody was a little overawed with the apparent complexity of the construction plans and the massive cavern 230 metres below ground level. Again the students were treated to the best hospitality and two weeks work were nicely rounded off.

I would like to take this opportunity to extend through the journal the sincere appreciation of the students and staff for the time and effort

Surveying Education

given by Major Ricketts, Lieutenant Birn and other army personnel at Goroka, and Greg Thompson and other staff at Yonki.

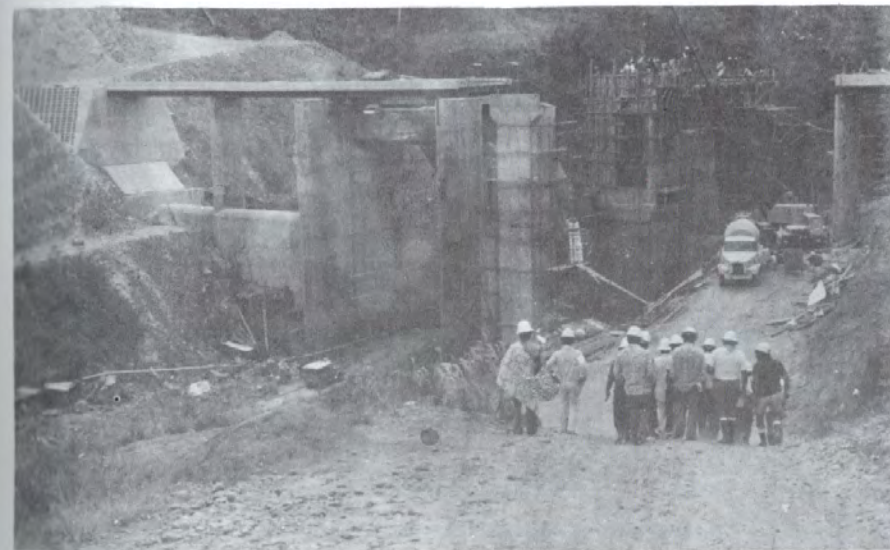


Third and Fourth Year Surveying degree students at Kaiapit.



Students are shown the aerial camera for spot photography of control stations.

Surveying Education



The Ramu Hydro-electric Scheme



Greg Thompson illustrates some Engineering Surveying.

THE NINTH SURVEY CONGRESS REPORT

Registrants at the Conference

Mr. & Mrs. C. Hard	Mr. & Mrs. F. Timms
Mr. & Mrs. D. Smith	Mr. J. Hewett
Mr. & Mrs. A. Cullum	Mr. & Mrs. M. Gray
Mr. & Mrs. B. McLennan	Mr. & Mrs. P. Niag
Mr. B.T. Murphy	Mr. S. Low
Mr. M. Lenz	Mr. N. Leet
Mr. & Mrs. S. Scriven	Mr. C. Carson
Mr. F. Posanau	Mr. P. Jolley
Mr. & Mrs. A.E. Naughton	Mr. & Mrs. J. Garrett
Mr. G. Matheson	Mr. K. Pochapon
Mr. & Mrs. A. Quick	Mr. D. Forster
Mr. B. Thomas	Mr. D. Johnstone
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Mr. J. Hastings	Mr. & Mrs. G. Brown
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Mr. & Mrs. N. Atkinson	Mr. J. Sipuman
Mr. J. Van As	Mr. & Mrs. J. Hunter
Mr. M. McCaskill	Mr. & Mrs. E. Palaitis
Mr. & Mrs. K. Barden	Mr. & Mrs. W. Taian
Mr. & Mrs. J. Weber	Mr. & Mrs. R. Jones
Mr. M. Larmer	Mr. T. Jackson
Mr. M. Eccleston	Mr. & Mrs. R. Moody
Mr. J. Gautam	Mr. & Mrs. Whish-Wilson
Mr. & Mrs. D. Beatson	Mr. G. Shaw
Mr. A. Springhall	Mr. A. McCarthy
Mr. A.C. Bassett	Mr. B. Mennis
Mr. R. Machin	Mr. & Mrs. T. Richards
Mr. A. Machin	Mr. O. Bobroff
Mr. I. Powell	Mr. C. Sparkes-Carroll
Mr. P. Davies	Mr. W. Loratung

The Technical Programme

1. "The Adjustment of Single Traverses" - B.T. Murphy, Head, Department of Surveying, University of Melbourne.
2. "The Maximum Retrieval of Information from Photogrammetry" - I.T. Powell, Manager, Capricorn Aerial Mapping Pty. Ltd.
3. "Use of Automation for Surveys" - W.D. Kennedy, Surveyor General for Australia.

The Ninth Survey Congress Report

4. "Freehold Land in Papua New Guinea - An Alien Concept" - M.J. Eccleston, Principal Instructor Valuation, P.N.G. University of Technology.
5. "The Effect of the Commission of Inquiry into Land Matters Report on our Profession" - K. Pochapon, Associate Surveyor General for Papua New Guinea.
6. "Recent Trends in Topographic Mapping within the Division of National Mapping" - O.J. Bobroff, Supervising Surveyor, Control Survey Branch, Division of National Mapping, Australia.
7. "A Review of Survey Aspects of the Bougainville Copper Project" - A.J. Cullum, Chief Surveyor, Bougainville Copper Limited.
8. "The History of the Bougainville Copper Project" - J.D. Erickson, Assistant General Manager, Production, Bougainville Copper Ltd.
9. "Reflections on the Development of Surveying Courses" - P.F. Davies, Principal Lecturer, Department of Surveying, Royal Melbourne Institute of Technology.
10. "The Role of the Calculator - Past, Present and Future" - W.R. Thomas, Calculator Sales Manager, Hewlett Packard Australia Pty. Ltd.

Bound copies of papers may be obtained from the Secretary, Mr. A.E. Naughton at \$10 per copy. Special consideration will be given to educational establishments.

It is appropriate at this stage to thank Mr. Murray Day, Senior Technical Instructor with the PNG University of Technology, who did an excellent job with the survey drafting and cover design for the bound congress papers.

The Social Programme

It is now generally accepted that the social functions for P.N.G. Survey conventions excel themselves, and become better year by year. Bougainville was no exception. Messrs. Smith, Hard, Cullum and McLennan and their ladies are to be complimented for their efforts this year for a job well done.

Highlight of the programme was the day spent at Panguna under the auspices of Bougainville Copper. Registrants were treated to a tour of the mine, a smorgasboard luncheon of fair proportion and a steak and salad dinner. Following are photographs taken by Roger Machin at the Annual Dinner.

Ninth Survey Congress - Bougainville



This year's oyster tie champion, Tom Richards,
Examines the tray.



The lovely Elizabeth Brown - and Clive Carson.

Ninth Survey Congress - Bougainville



Tom Richards in action again
under the watchful eye of
Congress Manager Bryan McLennan.

Visitor from Brisbane Peter
Jolley makes a comment to the
amusement of Geoff Brown.



Ninth Survey Congress - Bougainville



Francis Posanau relinquishes the "Stirrers Paddle" to Graham (Scruffy) Kendall.

Greg Thompson makes a small donation.



Ninth Survey Congress - Bougainville



Maurice Whish-Wilson surrounded by lovely ladies.



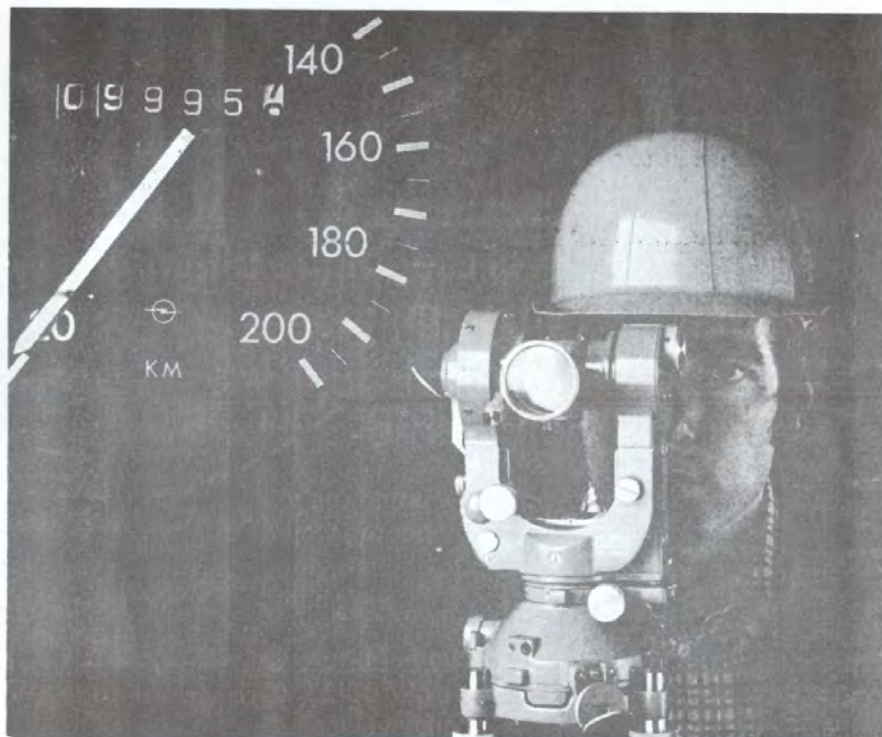
Jeff Tierney stands for a bottle of red.

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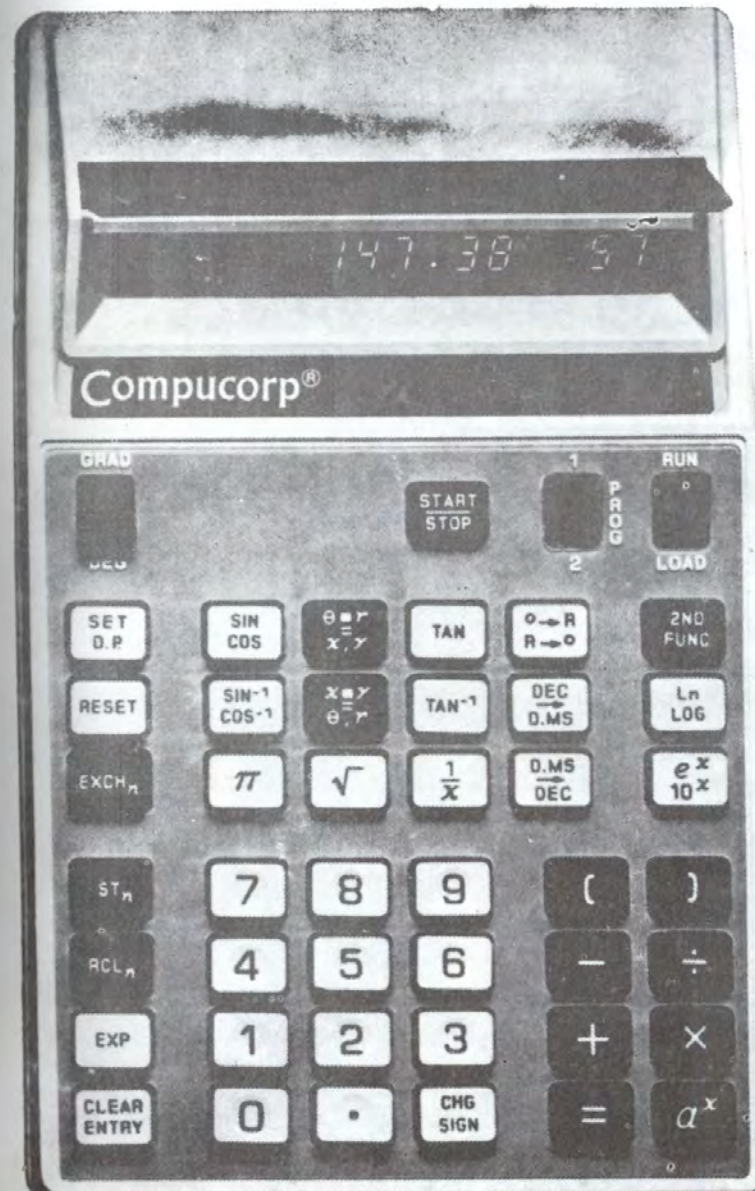
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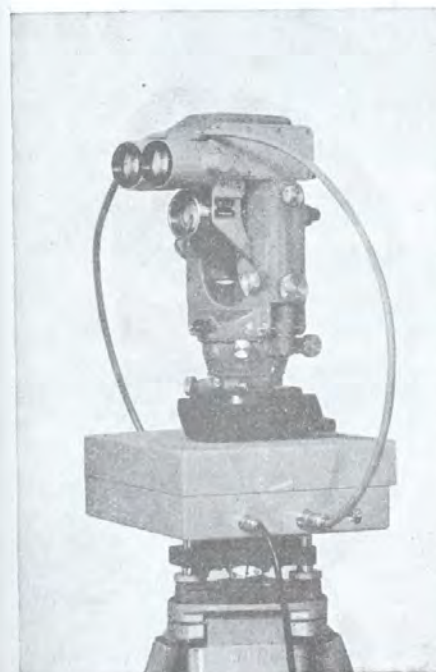
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