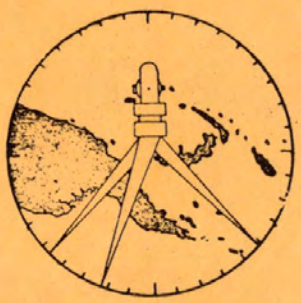
THE JOURNAL

of the

ASSOCIATION OF SURVEYORS OF

PAPUA AND NEW GUINEA



VOLUME 2 NO. 4

OCTOBER

1972

THE ASSOCIATION OF SURVEYORS OF PAPUA AND NEW GUINEA

OFFICE BEARERS 1972-1973

President

M.J. Larmer

Vice President

B.J. Mennis

Honorary Secretary-Treasurer

J.J. Tierney

Councillors

G.G.D. Arman
O.S. Dahl
G.R. Hole
P.E. Jolley
J.C. Macartney
D. Rumble

ROLL OF PAST PRESIDENTS

1960-62 C.W. Sparkes-Carroll
1962-64 R.G. Matheson
1964-65 O.G.G. Dent
1965-66 T.W. Richards
1966-67 J.C. Williams
1967-69 T.C. Jackson
1969-70 T.W. Richards
1970-71 J.C. Macartney
1971-72 K. St.C. Matheson

Please address all communications to the:-

Hon. Secretary,
Association of Surveyors of
Papua and New Guinea,
P.O. Box 5056,
BOROKO. T.P.N.G.

THE JOURNAL

OF THE

ASSOCIATION OF SURVEYORS OF PAPUA & NEW GUINEA

Vol. 2 No. 4

October, 1972

The quarterly journal of the Association of Surveyors of Papua New Guinea, published in the interests of the surveying profession.

BUSINESS MANAGER

A. C. Bassett

EDITOR

G. R. Hole

CONTENTS

(Views expressed herein are those of the authors and not necessarily those of the Association).

Subscriptions - per annum $2.00
per issue £0.50 Aust. Currency

SUB-COMMITTEES

SCALE OF FEES SUB-COMMITTEE

G.G. Arman (Chairman)
J.J. Garrett
P.E. Jolley
I.B. Bryning
G.C. Brown
J.N. Van As
J.J. Tierney
O.S. Dahl
M.J. Larmer

LAND LAWS SUB-COMMITTEE

J.C. Macartney (Chairman)
I.B. Bryning
O.S. Dahl
I.D. Hall
A.C. Bassett
G. Sparkes-Carroll

CONSTITUTION SUB-COMMITTEE

G.R. Hole (Chairman)
A.J. Mail
G.C. Brown
J.M. Papai
B.W. Wells

REPRESENTATIVES - PAPUA & NEW GUINEA SURVEYORS BOARD

G.G.D. Arman
M.D. Kellock
J.C. Williams

DEATH OF DIRECTOR OF PUBLIC WORKS

All Surveyors who knew Tom Crotty will feel a great sense of loss of a dedicated man who, in a discipline allied to our own profession, was an outstanding personage.

His keen interest in Survey work, his recognition of the need for professional advice in the discipline and his enthusiasm and sincerity in supporting his staff was an example that could well be emulated by those heads of Departments, not only in Papua New Guinea, where surveying plays a role in its activities.

Our sincere sympathy goes to his widow, Mary, and their three sons.

Neither Papua New Guinea, nor the Engineering Profession could afford the loss of such a man as Tom Crotty.

E D I T O R I A L

This is the first journal for which your new Editor is responsible and the role is taken on with some trepidation.

First and foremost one must have some misgivings about attempting to continue a role so eminently executed previously by Graeme Arman.

Graeme is a man with whom I often disagree, never violently however; but luckily this freedom to do so is still an inherent right, especially within the bounds of our Association.

No one in their right mind could ever doubt the sincerity of purpose and utter devotion to his Association than that exemplified by Graeme Arman. Apart from the support he has given over the years in numerous ways, the work he put into this Journal, ably aided by his B.M. Mr. Michael Larmer was, alone, an effort that could well be emulated by less active members of this Association.

Then, casually almost, he runs a most successful Congress as Manager, surely one of the most exacting roles a member can undertake.

Unfortunately Graeme, and others such as Ken Matheson, will no longer be residents in this country and our Association will suffer.

I strongly suspect also that there will be few senior Lands Department officers left as resident members in the next few years. The net result is that those of us left, together with newer members, and <u>especially</u> local members, must do more.

So, whilst talking Association over the bar, when you think of saying why don't "they" do so and so, how about substituting "we".

The Graeme Armans of this Association <u>are</u> doing something, are you?

ADDRESS BY OUTGOING PRESIDENT
MR. K.St.C. MATHESON

During the past ten years of my membership of this Association I have derived considerable satisfaction, professionally, socially and personally in being so associated with such a virile and "forward looking" group.

No one can deny that we have advanced remarkably in the short span of our existance. Definitely we are the leading professional organisation in this country and it is my personal hope that we remain so. We have been fortunate in having Administration surveyors who have been enthusiastic and hardworking members and a great deal of the credit for our present status is due directly to them.

Although not all of us are young in body we are all mentally young and have been ever willing to initiate changes, accept them and accommodate to them. During the past 12 months of my presidential year I have been fortunate in having a hard core of energetic councillors to assist and advise me. Evidence of this has been obvious in the past few days of an extremely successful Congress that was ably organised by Mr. Graeme Arman and his committee. I am greatly appreciative of having Mr. John Macartney as my Vice President whose experience and hard earned knowledge of Association procedures have always been readily available.

However I am now slightly apprehensive - for too long this organisation has been kept virile by the work and initiative of a handful of members. Our membership is approximately 132 strong but always it has been left to 9 or 10 people to do the work. It is readily admitted that our Association is hamstrung to a certain extent by a widespread membership and that circumstances have

forced a Port Moresby control on it's functioning. However we are not alone in this problem as Australian State Divisions have had to deal with the same circumstances for many years - and not always successfully. At this moment Lae members have taken the iniative and have formed or are in process of forming a district group and there is no reason why Madang, Rabaul, Kieta and Mt. Hagen could not do likewise. An extension of this could be to require country representatives from some or all of these groups to be attached to Council.

Our difficult years are ahead of us and I am doubtful that the previous easy years behind us have fully prepared us to overcome the problems that are going to arise. The Association is going to need the assistance of every member - expatriate and indigenous - to maintain it in it's present stable form. Some private surveyors have had a difficult 12 months due to a lack of contract survey funds and available work. It has been suggested that cracks are showing in the veneer and that they are attributable to this fact. I doubt that this is essentially correct. This Association needs constructive assistance from the newer members, as well as the older ones, and most definitely we require the active support of our local members. We are all surveyors no matter what our country of origin is and this organisation was formed for the benefit of all of us.

Finally I wish to express my gratitude to my Council for the work and the time they made available over the past 12 months, for their assistance to me and for being able to tolerate me as their President for 12 long months.

To be President is not an honour to be taken lightly and the position requires a dedicated Association Member and so, Gentlemen, it gives me a great deal of pleasure to present to you our new President. A man who is well known to us to have all the attributes required for this position.

Gentlemen, your new President Michael Larmer.

****

Immediate Past President
K. St. C. Matheson

The Deputy Administrator Mr. Newman, with Mrs. Newman being welcomed to the Presidents Cocktail Party by President Ken Matheson (centre) Mrs. Betty Macartney and Vice President John Macartney.

(From left) John Macartney, Mrs. Betty Macartney, Minister for Internal Finance (Mr. Julius Chan) Congress Manager Graeme Arman, Ken Matheson and Mrs. Chan at the Cocktail Party.

The normal "Social description" of the Congress has not been produced in detail as papers are available to most members and the format of the Congress is now well known.

However a report to be sent to relative Ministers and heads of Departments is being finalized and will be printed in the next issue of the Journal.

The Symposium on a Central Survey Authority was not published however and the speakers notes, plus a summary is given herewith.

. . . .

SURVEY CONGRESS A.S.P.N.G.

SYMPOSIUM PANEL

Subject: "Should P.N.G. have a single Survey Authority?"

The Panel consisted of:-

(1) Mr. Brian Wells, Project Surveyor at the Department of Lands, Surveys and Mines.

Mr. Wells is engaged on co-ordinating Lands Department Surveys on projects involving other Departments such as subdivisional works, housing and building requirements etc.

(2) Mr. C.J. McD. Best, Principal Engineer of the Roads and Bridges Division, Department of Public Works.

Mr. Best is the biggest client Division of the Departments Survey Section.

(3) Mr. Ivon Bryning, Private Practicing Surveyor, Lae.

(4) Mr. Campbell Macrae, Distribution Engineer for the Electricity Commission, who organises most of the Commission's survey requirements.

(5) Mr. Brian MacMahon, Establishments Inspector at the Department of Public Service Board.

Mr. MacMahon was involved in Canberra on the Establishment and Functions of the Survey Division of the Department of the Interior and later in P.N.G. with Survey Division of D.L.S.M. and Survey Branch of the Department of Public Works.

The Panel was convened by Mr. G.R. Hole and Mr. W.M. Kennedy, Commonwealth Surveyor General, was Session Chairman.

MR. WELLS

We are all aware of the tremendous acceleration in the development of survey equipment and techniques. The advance in electronic distance measurement since it was first introduced in the mid 1950's has been well documented. Significant advances have also been made in the use of the computor in survey computations, particularly the desk top computor. The refinement of photogrammetric equipment has led us to where the use has become acceptable for cadastral surveys for the breakdown of geodetic control and the provision of cadastral control. The future - well I am not game to predict, some of the innovations I thought worthy of mention under future developments are here on display upstairs so I restrict comment to the fact that without doubt the refinement and improvement in survey equipments will continue at an ever increasing pace.

What of the professional surveyor in this environment; the manipulation of knobs, dials, switches and the photogrammetric machine is basically technicians work, and for the Surveyor to work as a pure technician is wasteful and uneconomic. The surveyor must redirect his professional skills and academic attainments to keep abreast of, and remain the master of, this flood of development. I am not advocating that all surveyors leave the field and position themselves behind large gleaming desks; surveying is a practical art and young academics become land surveyors in the field; but there is much to be done in modernising and improving management and administration. Our survey techniques, field management, survey costs, ordinances and regulations must be constantly under review to keep pace. There must be new and original thought, particularly in Papua New Guinea where survey co-ordination and the central mapping bureau are in

their infancy and formidable technical problems of registration of land currently held under customary tenure loom on the horizon. The rapid rate of urbanisation as discussed earlier in the congress will present us with other problems.

It follows that if the surveyor in Administration employ is to tackle this challenge he must have the environment the incentive and the time. The time factor can be solved by increasing the surveyor/technician ratio. The environment and incentive would be best provided by the formation of a single and independent survey authority, i.e. separate survey Department with statutory power and finance to superintend all facets of land survey and thus provide a true survey service sector, to the general public.

My concept of such a Department would be a H.Q. unit with complete decentralisation at Regional Office level. Apart from the switch of cadastral survey administration to the regions.

The major change to the existing Department of Lands Surveys and Mines, Survey Division, would be the decentralisation of control surveys which apart from overall planning, design and final computation would be carried out in the Regions. The decentralisation of field survey and Regional Administration must be complete if the H.Q. structure is to be effective in producing the desired environment, in a progressive outlook at top level.

What then of the relationship between the survey Department and other Departments. There are many arguments why surveys should remain a Division within the Department of Lands and there is no doubt of the strong connections and heavy cadastral survey demand. However I feel for the survey authority to gain full status it must be separated from

any possible dominance of other authorities. Of course liason with Lands would of necessity be close but not so as to influence the setting of priorities by any other criterion than by their importance to the country as a whole.

It is assumed that services extended to Lands would include expert advice either technical or legal on matters of land administration.

There are a number of Departments which have or may eventually have their own survey sections. The major ones are Public Works, Forestry, Elcom and Civil Aviation. Survey consideration being that they must be under the control of a professional surveyor. Personally, I would favour the use of surveyors seconded from the survey authority.

This would create maximum liasion with the survey authority thus avoiding duplication of survey work; and guaranteed co-operation through the Survey Co-ordination Ordinance with direct access to the latest developments, and research into, survey methods.

Secondment to other Departments plus the decentralisation already mentioned would have the added advantage of providing a greater variety of survey tasks which would not only help to develop the full potential of the individual surveyor but help shorten the time taken to reach professional maturity; a point worth considering in localisation programmes to come.

Those then, Gentlemen, are my thoughts on the establishment of a single survey authority and in closing I would briefly mention an advantage which would acrue to the profession itself. A single survey authority

would, I'm sure, focus the attention of the general public on survey and it's importance to a developing nation. This awareness of the surveyor and his achievments would in turn result in the upgrading of our status as professionals in the community.

. . . . .

MR. BEST

Mr. Chairman, Ladies and Gentlemen,

First I must thank the Association of Surveyors of Papua New Guinea for inviting me to be a member of the panel to give my views on whether there should be a single survey authority for Papua New Guinea.

Papua New Guinea is a country which has grown at a remarkable rate in the last decade and it will almost certainly continue to do so for many years to come. Up until some eight to ten years ago little consideration was given to the accurate location of property boundaries in many parts of the country. Buildings often were simply built on some available land. Roads were built in rural areas generally without the benefits of surveys. Most often a compass, chain and clinometer would be the limit of surveying equipment on a project. While it can be argued that such methods have caused a number of land disputes, it is also true to say that the country would not have been as well developed today had it waited until more precise surveys could be carried out.

Surveying until about a decade ago had been required mainly for the establishment and recording of property boundaries especially in the main urban areas. Surveys required for engineering investigation and construction

were generally not extensive, often not very accurate, and were usually carried out by unqualified persons. While such engineering surveys were adequate at the time, increasing development has brought the need for more precise location of engineering works. The need for better roads, aerodromes, water supplies and other amenities has meant that more and better survey information is required. Accordingly more qualified and specially trained surveyors were required for engineering projects. There has been a large increase in the number of surveyors required to meet the varied needs of the country and the question as to whether a single survey authority is required needs to be asked.

In my opinion there should not be a single survey authority in this country just as there should not be a single design authority nor a single construction authority. There must be specialist departments.

The surveying of property boundaries and the establishment of trigonometric control and associated cadastral matters must be the responsibility of the Department of Lands, Surveys and Mines. There is much work to be done in this area and has to be done at an increasing rate to minimise future land disputes. Such surveying requires specialisation.

Surveying is not simply measurement. It is much more. The surveyor must know for what purpose his survey is required and his survey must be carried out so that all of the data necessary for the job in hand is accurately taken and recorded. In the case of engineering investigation being performed; e.g. the requirements for the survey of a route for a high voltage power line from the Ramu Hydro-electric scheme to Madang are much

different to those for a water supply scheme for Mt. Hagen or for the extension of the aerodrome at Port Moresby.

Survey standards cannot be established and controlled by persons not closely associated with the surveys. In a small country with little development taking place it may be possible to have a single survey authroity. However, In Papua New Guinea at present there is a wide variety of and a large amount of work in progress and therefore I do not believe that a single survey authority would be able to satisfy the needs of the various survey users. As an example within the Department of Public Works there is constant liaison between the Survey Section and the Design and Construction Divisions on survey matters. Survey procedures are introduced and existing ones modified to suit the particular needs of the Department for the job in hand. When there is a need to liaise with other Departments on survey matters such liaison is carried out by the Survey Section. It would be a much more difficult and less efficient operation if the Design and Construction Divisions had to arrange with another department for all of its survey needs. Similarly there would be many difficulties if the Department of Lands had no survey function and had to arrange for their surveys to be carried out by another Department.

However it is agreed that there must be overall co-ordination of survey work within the country so that maximum benefit can be obtained from surveys. Levelling wherever practicable should be tied to a national bench mark and traverses should be tied into the national system, mapping should be done to agreed standards and scales. The Survey Co-ordination Ordinance, the Mapping Committee and meetings such as this Congress

assist in the overall co-ordination of survey work in Papua New Guinea.

In conclusion this country should be developing a system to make the most effective use of its resources and it is up to the surveyors to work with the administrators, legislators, architects, engineers and land developers in order to achieve this. Centralisation into one survey authority will not help to achieve this but decentralisation as is being done in many spheres in this country will help to achieve this aim.

. . . .

MR. BRYNING

Although I am the only speaker in this Symposium from private enterprise, I will make my comments from the point of view of a reasonably informed taxpayer.

The taxpayer expects Government Authorities to observe two main points as they go about their appointed work.

The Government Authorities must -

(a) adhere to Government policy

(b) perform their duties both economically and organizationally as efficiently as possible.

Of Government policies related to the work of Surveyors we know that the Government is very interested in sorting out land ownership problems and in providing more and better communications facilities of all kinds.

We also know there are still vast amounts of work to be done in these fields, yet much of it has to be done with relatively little money and in as short a time as possible.

Surveyors will be deeply involved in all this work but we must be far more efficient than now. A senior Administration Surveyor told me a few years ago that he considered a Surveyor efficient if that Surveyor had nil or very few requisitions on his surveys after examination.

This very narrow view of efficiency may fit occasionally in Australia but it certainly has no place in a developing country that is very unlike Australia in so many ways.

I consider that survey efficiency is the ability to produce adequate surveys for the lowest cost. By "adequate" I mean surveys which serve their original purposes satisfactorily.

Having decided that we must evolve new survey parameters and methods we then have to determine how the various kinds of survey can be best organized and administered.

One single survey authority appears good in theory. Economies of personnel, equipment, offices, etc., appear possible like, say, a bank.

But unlike most bank operations, surveys are personal things. The Surveyor takes the work through many stages and is responsible for his decisions at all stages. By the nature and location of the work, Surveyors can be very independent and naturally tend to form their own opinions on what is right and wrong in survey.

Any survey organization then consists of a group of these opinionated people; and these opinions often diverge considerably and lead to the formation of factions within the organization.

If the head of the organization is an exceptional administrator, he can probably make use of the differing opinions to develop better methods etc., and keep his staff on their toes as well as keep up a high work output.

It is essential however, that the head of a survey organization be a Surveyor and, as stated here a number of times already this week, Surveyors tend to not be exceptional administrators. The result is that the average survey organization head, when making decisions, is naturally influenced firstly by his own experience and training and only slightly by the opinions of others.

If then, the survey organization is a Government authority formed to make all Government surveys then policies adopted by it will not be agreed to by all employee Surveyors.

The dissident ones in a large organization rarely get much of a hearing so not only are their ideas not tried out, but they are forced to work in a manner which seems wrong to them so their efficiency usually drops considerably.

If, on the other hand, there are more than one Government survey organizations, each with it's own specialty, there will be more than one head man and each organization will be relatively smaller. It is likely then that the different heads will have differing approaches to survey problems and the smaller organizations would provide better opportunities for dissidents to be heard and try out

their ideas. One organization may develop some 'radical' Surveyor's ideas into very pertinent methods and be able to demonstrate and offer these to other survey organizations.

Effect on Private Survey Firms

I think we are all agreed on the need for private firms of Surveyors.

They provide a service for the general public as well as doing work for Government Authorities when those Authorities either are short of staff or have only a limited amount of specialized work.

We work within a basically Capitalist economic structure in this country. One of the best tenets of Capitalism is the principle of competition between the various private members of an industry to get a greater share of the market by improving their production methods etc., such that the cost of the finished product is lower yet the quality the same or even better.

If there was only one single survey authority, it could quite easily limit the number of survey firms it used to assist it getting the work done, as is now done by the Department of Lands, Surveys and Mines. As the Government provides about 80% of private survey firms' work in this country, competition would then be virtually nil and it's large benefits lost.

When there are a number of Government survey organizations then a larger number of firms tend to be used and the way should be open to the evolution of more efficient methods.

At present there is a blockage to more efficient methods in the form of a trade-store style cost/profit ratio mode of

calculating fees. A radical re-construction of the Scale of Fees will do Surveyors and their clients a lot of good.

. . . . .

MR. MACRAE

1. Elcom's Survey requirements fall into three main categories.

(a) Work of a general nature involving boundaries, levels etc.

(b) Survey work for proposed major transmission lines such as the transmission lines to be constructed from the Ramu hydro-electric scheme.

(c) Design Survey work leading to the construction of distribution lines in and around the various towns in the Territory.

Our general requirements could be met from an independent Survey pool, and major transmission line survey work is normally handled on a contract basis.

I propose concentrating on the survey work involved in the design of distribution powerlines, which represents the bulk of our survey workload.

2. A typical project of this nature could be the extension of our distribution system to give supply to new consumers, involving the construction of a few miles of overhead powerline passing through an area of unsurveyed native owned land. Once the decision to construct this powerline extension has been made the surveyor would be allocated the project and would procede as follows:-

(a) Visit the area and make a preliminary decision on the best powerline route taking into account the general terrain, any unusual problems, and any future development proposals for the area.

(b) Discuss the proposal with the landowners and clear up any misunderstandings which may exist. The groundwork in this case would have been handled earlier by Administration or Commission Staff.

(c) Organise sufficient vegetation clearing to allow the main survey to proceed.

(d) Carry out a profile survey and peg out pole positions taking full advantage of the terrain to obtain maximum spare distances between pole positions, subject to powerline design and conductor clearance criteria. This is the area where an experienced powerline surveyor can save us money by keeping the number of poles and stays down to a minimum and also arranging his pole positions so that access and construction will be as straightforward as possible. An example here could to change sides of the road at such a position that a pole could be saved further on by taking advantage of higher ground further on.

(e) The surveyor should also be able to have preliminary discussions on Commission policies with prospective consumers along the route.

(f) On his return to the drawing office the surveyor would then prepare route plan of the powerline extension.

3. From this the powerline surveyor emerges as a bit of a specialist if he is to meet all our requirements. In fact to give our surveyors a better background into this type of work I am now arranging for them to complete a portion of our linesman training course.

4. It would be possible for a surveyor without this experience to carry out this type of work but it would then be necessary for our engineering staff to prepare an extensive (and expensive) design brief to lay out all our requirements. I do not consider this practical due to the cost, inconvenience and delay.

5. While a surveying pool has certain advantages and can eleminate an amount of duplication of effort where general survey work is concerned, there would still be cperational problems - For instance:-

(a) Who would the surveyor work for?

(b) Who would make field decisions?

(c) Who would allocate work priorities? (Person who makes loudest noise wo would probably get best service)

6. For these reasons I am <u>not</u> in favour of a Central Surveying Authority and prefer the present system where I know the ability of my surveyors and am in a position to have the work done to my requirements and in accordance with my priorities.

. . . .

<u>MR. MACMAHON</u>

To anyone who appreciates that more than 40,000 people are employed in more than 48 Departments, semi-independent organisations and statutory authorities, the answer to the question is almost automatically yes. Such an authority, vested, with responsibility direct to the A.E.C. through the appropriate minister, would have distinct advantages in a country where funds are limited, staff resources are thin and where localisation has very high priority.

There is a standard trick question which you all know - how many people work in government Departments. The answer of course is half of them. In my opinion the other half are attending meetings, conferences, discussions and courses, all designed to overcome the basic flaw in government administration here, which is excessive fragmentation. People in government departments need to be consistently in touch with other people in other government departments from whom co-operation, approval or assistance is essential to overall efficiency. So many departments and instrumentalities seem to have a share of the cake! Why then, when we talk about surveying should we even entertain the idea of carving up that particular cake between a number of different authorities.

One advantage of a single authority would be that the top men, the senior surveyors, operating in the one organisation would be better informed of the total survey commitment in the country and better prepared in implementing government policy. They may avoid the trap of insular thinking e.g. that housing is the most important single problem in this country today - therefore Housing Commission surveys are paramount; nor would they be saying without electricity this country would

be back to its darkest hour, so Electricity Commission surveys are paramount - and so on. The top men, the senior surveyors and managers of a single survey authority would be better placed to plan, programme and then implement the programme of annual surveys. The fact that such an authority might not observe the priorities of its client departments may be a nuisance to the client but not a disaster to the country as a whole. Delays could well be justified in Papua New Guinea which is not affluent and which cannot accomplish everything at once. Leaving responsibility for survey work in the hands of individual Departments and authorities, could introduce situations where the wrong jobs are funded (I mean wrong for the country) or they are funded in the wrong order, i.e., given wrong priority. There is nothing more impressive than organisations or individuals espousing the importance of their role in a public service. Where there is competition for funds between Departments, especially in Papua New Guinea where rapid development and political change could create a temporary atmosphere of uncertainty, compromises and "arranged understanding" could result in poorly programmed utilisation of funds. One single and therefore more powerful survey organisation could largely rid the scene of confusing and competing demands. The organisation would do its homework for the country as a whole and place carefully determined priorities before the budget committees and politicians.

A single survey authority would handle larger funds, employ more staff, accept greater responsibility and face greater complexities. For these reasons, senior positions may attract higher salary classifications than now exist in Papua New Guinea. Professional surveyors and survey technicians would be more highly concentrated if

placed in the one organisation, promotional prospects could well be rosier and the salary ceilings higher. This may have the desirable result of reducing turnover and improving recrutment potential.

It is possible too, that a single survey authority would exist as a Department in its own right, with a Departmental Head responsible direct to his Minister thereby improving the avenue of approach for more funds, staff, transport, housing and so on.

Again an independent survey department would attract support staff more inclined to seek a career as part of a survey organisation which they would increasingly understand and wherein they would gradually relieve professional and technical staff of more routine and no technical duties. This might not occur if survey establishments continued as mere attachments to other Departments.

Further points can be made in favour of a single survey authority for this country: these include the possibility of making more effective use of equipment, facilities and scarce staff. Also, a large specialist organisation could be more effectively trained the important local officers within the various occupational groups attached to survey activities.

Case against a single survey authority

Before coming here, I felt that other members of the panel would be firmly in favour of retaining a system which permitted individual public organisations to retain control of their own surveys. Hence my attempt to put up a case for the other side. In reality, my personal view is that grave doubts should be entertained about the complete centralisation of surveying in Papua New Guinea, but

rather than sit on the fence, I will hold to the arguments I advanced earlier.

The basic arguments against a single survey authority - at least in my opinion - are that:-

firstly, the Survey Co-ordination Ordinance, Budget Procedures, Works Co-ordination procedures and so on, should allow the effective execution of surveys despite any apparant fragmentation of survey capacity throughout a number of different government organisations.

secondly, any survey tasks should be performed as part only of the total effort involved in subdividing and building on Housing Commission Land, building roads, bridges, locating air-strips and other tasks of course. To take survey expertise away from government organisations vested with responsibility to construct or build in the ways just mentioned, may sap the efficiency of those organisations and add considerably to costs. In fact, added costs could well outweigh any savings possible by means of centralising surveying within the one government organisation.

These are the aspects I would seriously wonder about when grappling with any submission seeking the establishment of a separate or centralised survey authority to serve the public sector and the general community in Papua New Guinea.

Discussion following Speakers

Mr. Hole asked Mr. MacMahon whether in fact the larger authority would have the promotional opportunities as each division would be specialized anyway.

Mr. MacMahon agreed that in expertise that authority would be in "boxes" until the area of administration say at class II or III level was reached.

Mr. Wells, when asked who would allocate the priorities said that he thought this was the most difficult problem but assistance and advice from the client authority would be essential.

Mr. Bryning, in reply to a query as to why he felt there would be less consultant firms in the Territory, replied that the present policy of Lands was to restrict the number of firms allowed to practice and that although the total number of employee surveyors would rise, the number of firms could be reduced, this he added was not a good thing for the country.

Mr. Macrae stated that he preferred to control the surveyor to execute the work to suit the programme of the authority. He was replying to a question from Mr. Hole as to whether he had "too much" control over the survey staff.

Mr. Best questioned Mr. Wells as to how another authority could operate relying on a central authorities finance and shortage of staff when cases had arisen in the past when Transport Department used to hold up capital works projects because of lack of fuel and drivers, and Lands Department could not supply surveyors. Mr. Wells

replied that on a secondment basis and close liaison this would not occur. He then asked Mr. MacMahon about secondment for a period of contract and their promotion prospects within a contract period and the present shortage of staff. "Would this be overcome by the larger back up?"

Mr. MacMahon agreed that this was a good point and would certainly alleviate the shortage of staff in a smaller client authority.

Mr. Larmer from the floor commented that while it sounded good in theory he agreed with Mr. Best on the problems of interdepartmental dealings and said he thought red tape would "crucify" the scheme.

Mr. Macartney said logistic problems would be eliminated because of self accounting.

To Mr. Best he commented that the early days the political requirement was for cadastral surveys and that was the reason for no help from Lands Department to Public Works Department.

To Mr. Wells, he said "we would second people for period of project, not for the period of contract."

Mr. Dahl considered it would be a retrograde step as the engineer could not write a survey brief and it required specialist surveyors in each authority.

. . . .

SUMMARY

The following points against the proposal were made by speakers in the discussion:-

- Centralisation of surveying activities prevented the proper allocation of priorities where there were insufficient resources to meet all the survey requests.

- Centralisation tendered to disperse the special skill required for the various classes of survey work and thereby lowered the standard of service provided.

- The location of survey sections within the various organisations provided for better control, and liaison and led to increased efficiency and innovation of ideas.

The following points were made for the proposal:-

- A completely independent authority would be better placed to allot job priorities on the basis of their overall importance to the country as a whole.

- They were able to allocate staff to the investigation and application of new techniques and equipment, thereby increasing efficiency.

- They provide for provisional supervision of operative and technical staff by professional surveyors whereas this was not always available in organisations with small survey sections.

- The centralisation of survey activities removed the competition for survey staff by professional surveyors whereas this was not always available in organisations with small survey sections.

- The centralisation of survey activities removed the competition for survey staff by Government agencies.

* * * * * *

Overseas delegates and "friend"

Commonwealth Surveyor General Bill Kennedy "pays up" to Geoff Brown.

Tie Holder "Sparkes" assists John Williams to gain his. Ken Matheson encourages.

Arman's "surprise" for jaded surveyors.

N O T I C E

ASSOCIATION BLOCK ENTRY IN PINK PAGES

OF THE TELEPHONE DIRECTORY

Practicing Consulting Members who wish to have their name appear in the Pink Pages should contact the Secretary giving details of how they wish their firms to appear.

Costing is expected to be similar to independant entries.

THE QUEST FOR THE MILLIMETRE

M.D. Kellock, Head of Surveying
Department, Institute of Technology.

1. INTRODUCTION:

Clause 9.8 of the Survey Directions, 1970, states, inter alia,

> "The actual measured lengths of boundary lines shall be adjusted and shown in the field book and on the plan as follows:
>
> (i) in urban surveys to the nearest millimetre;
>
> (ii) in rural surveys to the nearest centimetre.
>
> These adjusted bearings and distances will be accepted as the correct description of the boundaries measured."

I have argued, in a different context, that millimetre precision cannot be achieved in practice and that compliance with Clause 9.8 required the Surveyor to infer considerably higher standards of precision and accuracy than he can possibly achieve.

The purpose of this paper is to acquaint surveyors with the magnitude of the errors introduced by uncertainties in field data and by less than rigorous measurement techniques. Specifications are prescribed which, in theory, would be necessary to ensure errors of less than 0.5 millimetres, thus allowing results to be legitimately shown to a precision of one millimetre. It is apparent from a perusal of these specifications that measurements of the type normally made by the surveyor cannot be shown to the nearest

millimetre without rendering the profession liable to harsh and well deserved criticism. In fact, it is doubtful whether present field techniques are adequate to substantiate even a claim to centimetre precision.

2. SPECIFICATIONS OF STEEL BANDS:

For simplicity, I shall consider only the measurement of a 100 m. line with each of two steel bands. I shall then examine the linear errors introduced by incorrect data or techniques.

Consider, initially, the following specifications applicable to two 100 m. survey bands, one of width 3 mm. (1/8 inch), the other 1.5 mm. (1/16 inch).

Length of band	100 m.
Standard temperature	$65^{o}F$ or $18^{o}C$.
Standard tension	15 lb. or 7 kg.
Cross-sectional area	1.6×10^{-6} m^2 for 3mm. band
	0.8×10^{-6} m^2 for 1.5mm band
Weight	1.250 kg/100m. for 3mm. band
	0.625 kg/100m. for 1.5mm. band
Co-efficient of linear expansion of steel	6.45×10^{-6} per ^{o}F.
	or 11.61×10^{-6} per ^{o}C.
Young's Modulus for steel	2.11×10^{10} $kg.m.^{-2}$

3. STANDARDISATION OF STEEL BAND:

Clause 9.5 of the Survey Directions requires the surveyor to certify, for each survey, that his survey band has been compared with and agrees in length with a standard steel band (more correctly called a subsidiary standard), such comparison to have been made no more than twelve months prior to the survey. It should be noted also that each subsidiary standard must be reverified at least once in every two years in order to be accepted as a subsidiary standard.

The procedure for verification of a subsidiary standard band at the Brisbane Survey Office is as follows:

1. Each graduated section (usually 20m.) of the subsidiary standard is measured, under the standard tension, to a precision of 0.0001 m. with a certified accuracy of 1:50,000 at a temperature of $68^{\circ}F$.

2. The temperature at which the total length of the band will be exactly 100.0000 m. is computed and the length of the band is certified at that temperature.

An examination of a number of subsidiary standard certificates reveals that, although the overall length of the band is correct at the certified temperature, the lengths of individual 20 m. sections may be in error by more than one millimetre.

Many surveyors, when standardising their working band against a subsidiary standard, compare only the whole length of the band. It is usually assumed that any discrepancy from the standard is distributed uniformly

along the band and a new standard temperature is computed at which the length of the working band is exactly 100.000 m. This is not necessarily a valid assumption and should be verified by checking each appropriate section of the working band against the marked sections of the subsidiary standard. Failure to do so may well introduce errors well in excess of the elusive millimetre.

4.APPLICATION OF SLOPE CORRECTION:

The formula for slope correction is

$$C = -L\,(1 - \cos\ )$$

where L = slope distance,

= slope angle.

For a small error, in the slope angle, the corresponding error in the slope correction is

$$= -\,L \sin$$

From this relationship we may compute the error introduced by an error of one minute of arc in various slope angles and thus the precision with which these angles should be observed in order to ensure a precision of one millimetre.

Observed Slope Angle for 100m.	Error in Slope Correction for angular error of one minute of arc.	Angular precision required to ensure correction precision of one millimetre.
$1^{\circ}00'$	0.0005 m.	$00^{c}\ 01'\ 00''$
$5^{\circ}00'$	0.0025 m.	00 12
$10^{\circ}00'$	0.0050 m.	00 06
$15^{\circ}00'$	0.0075 m.	00 04

5. APPLICATION OF TEMPERATURE CORRECTION:

The formula for temperature correction is

$$C_t = L.k.t.$$

where K is the co-efficient of linear expansion of steel,

t is the excess of band temperature over standard temperature.

Extensive investigation by Campbell (1) has shown that, under test conditions with calibrated thermometers, temperatures of the band may differ by as much as $3^{o}C.$ ($5^{o}F.$) from the temperature determined by a thermometer in air. It is likely that, under field conditions, the difference could be even greater. It is of interest to note that a batch of ten new chaining thermometers recently purchased by the Institute of Technology exhibited a range of $4^{o}F.$ This is a potential source of error additional to that referred to above.

For an error t in the determination of temperature, the error introduced into the temperature correction is

$$C_t = L.k.\ t$$

An error of $3^{o}C$ in the assumed temperature of the band will introduce an error of 3.5 millimetres in the temperature correction. In order to introduce an error no greater than 0.5 mm. the temperature must be determined to a precision of $0.4^{o}C.$ ($0.8^{o}F.$)

6. CORRECTION FOR TENSION:

The normal field procedure is to apply the standard tension to the steel band in order to avoid the need to apply tension correction. If, however, the spring balance is incorrectly calibrated or if the tension is

applied carelessly, the band will stretch by more or less than the requisite amount and an error will be introduced.

The amount by which a steel band will stretch under a given tension (or increase in tension) is

$$C_p = \frac{TL}{AE}$$

where T = tension (or increase in tension),

A = cross-sectional area of band,

E = Young's Modulus for steel.

From this relationship it may be computed that an increase or decrease of 0.5 mm. in the measured length of a 100 m. line may be introduced by an error in the applied tension of

$\pm$ 0.34 kg. (0.74 lb) for a 3 mm. band

$\pm$ 0.16 kg. (0.37 lb) for a 1.5 mm.band

It should be remembered that, in order to achieve the required precision, the standard tension must be applied, within the above tolerances, for every measurement, whether in sag or in full support.

7. MEASUREMENT IN CATENARY:

The surveyor has a choice of two techniques when using the steel band in full catenary. He may either apply a catenary correction or use a "normal" tension, i.e., a tension at which catenary and tension correction sum to zero. Each of these will be considered in turn.

7.1 APPLICATION OF CATENARY CORRECTION:

For a steel band in catenary, the correction to a measured distance is

$$C_c = \frac{-W^2 L}{24T^2}$$

where W is the weight of the length of band used in the measurement,

T is the applied tension.

7.1.1 ERROR IN THE APPLIED TENSION:

The effect on the computed catenary correction of an error T in the applied tension is given by

$$C_c = \frac{W^2 L.}{12T^3} T$$

It is of particular note that this is the most critical of all of the corrections, in that a relatively small error in tension leads to a relatively large error in the computed correction.

In order to ensure an error no greater than 0.5 mm. in the computed catenary correction, the tension must be applied with a tolerance no greater than

$\pm$0.01 kg. (0.03 lb) for a 3 mm.band.

$\pm$0.05 kg. (0.11 lb) for a 1.5 mm.band.

7.1.2. ERROR IN THE ASSUMED WEIGHT OF THE BAND:

The accurate computation of catenary correction is dependent on a knowledge of the weight per unit length of the steel band. Consider the effect on the correction of an error in the assumed weight of the band.

$$C_c = - \frac{W L.}{12T^2} W$$

where W is the error in the assumed weight.

The error in the assumed weight which will cause an error of 0.5 mm. in the computed correction is

$\pm$ 0.002 kg.(0.005 lb.) for a 3 mm.band

$\pm$ 0.005 kg.(0.010 lb.) for a 1.5 mm.band

Expressing each of these errors as a percentage of the weight of the band, the appropriate tolerances are

$\pm$ 0.16% for a 3 mm. band

$\pm$ 0. 8% for a 1.5 mm. band

Thus if catenary corrections are to be made, it is essential that the weight of each individual steel band be observed to the above precision.

7.2 THE USE OF NORMAL TENSION:

At a tension, T, in excess of the standard tension, the steel band will stretch by an amount

$$C_p = \frac{L (T - To)}{AE}$$

where To is the standard tension.

Furthermore, the catenary correction will become

$$C_c = \frac{W^2 L}{24T^2}$$

Normal tension is defined at that tension at which

$$C_p + C_c = 0$$

$$\text{i.e. } \frac{L\,(T - T_o)}{AE} - \frac{W^2 L}{24T^2} = 0$$

$$\text{i.e. } T^2\,(T - To) = \frac{W^2 AE}{24}$$

Assuming the specifications adopted in para. 2 above, the normal tension is

15.8 kg.(35 lb.) for a 3 mm. band

9.9 kg.(22 lb.) for a 1.5 mm. band

7.2.1 ERROR IN ASSUMED CROSS-SECTIONAL AREA:

However, the computation of normal tension with precision requires a precise knowledge of the cross-sectional area of the band.

Since $C_p = \frac{TL}{AE}$,

a small error A in the assumed cross-sectional area of the band will introduce an error

$$C_p = -\frac{TL.}{A^2 E} \quad A$$

the values of A which will give rise to an error of 0.5 mm. are

$\pm$ 4 x 10^{-8} m.^{2} for a 3 mm. band

$\pm$ 1 x 10^{-8} m.^{2} for a 1.5 mm. band

Expressing these as a percentage of the cross-sectional area of the band,

$\pm$ 2.5% for a 3 mm. band

$\pm$ 1.2% for a 1.5 mm. band

In practice it is far preferable to use an empirical method to determine the normal tension. The value of the produce AE may be determined from

$$AE = L\,\frac{(T - T_o)}{L}$$

by field test where the observed stretching, L, is measured carefully for several values of T in excess of the standard tension T_o A precisely calibrated spring balance should be used.

7.2.2. ERROR IN THE APPLIED TENSION:

It should be realised that, even when normal tension is applied, the precision with which it is applied is still critical although less critical than when standard tension is applied. From the formula in para. 7.1.1,

$$C_c = \frac{W^2 L.}{12T^3} \quad T$$

where T is the normal tension, 15.8 kg. and 9.9 kg. respectively for the 3 mm. and 1.5 mm. bands; the error in applied tensions which will cause an error of 0.5 mm. in the measured length is

$\pm$ 0.15 kg. (0.3 lb.) for a 3 mm. band.

$\pm$ 0.15 kg. (0.3 lb.) for a 1.5 mm. band.

8. TABULATION OF ALLOWABLE ERRORS IN DATA:

8.1 SPECIFICATIONS FOR MILLIMETRE PRECISION:

The following tabulation summarises the errors in observed or assumed data which will give rise to an error of 0.5 mm. in each of the applied corrections to linear measurements.

Source of Error	Error in data which will result in linear error of 0.5 mm. in a measured distance of 100 m.	
	3 mm. Band	1.5 mm.Band
Standardisation:	The subsidiary standard may have compensating errors of the order of one millimetre. The working band may thus have larger errors.	
Slope Angle: 1°	± 00° 01' 00"	
5°	00 12	
10°	00 06	
15°	00 04	
Band Temperature:	±0.3 kg.(0.7 lb);	±0.2 kg(0.4lb)
Catenary Measurement:		
- Tension Error:	±0.01 kg(0.03 lb);	±0.05kg(0.11lb)
- Assumed Weight:	±0.16% or 2 gram;	±0.8% or 5gram
Application of Normal Tension:		
- Tension Error:	±0.15 kg(0.3lb);	±0.15kg.(0.3lb)
- Error in Assumed Cross-sectional Area:	± 2.5%	± 1.2%

Source of Error	Error in data which will result in linear error of 0.5 mm. in a measured distance of 100 m.	
	3 mm. Band	1.5 mm. Band
Standardisation:	The subsidiary standard may have compensating errors of the order of one millimetre. The working band may thus have larger errors.	
Slope Angle: 1°	± 00° 01' 00"	
5°	00 12	
10°	00 06	
15°	00 04	
Band Temperature:	+0.4°C. (0.8°F.)	
Tension:	±0.3 kg.(0.7 lb.):	±0.2 kg.(0.4 lb)
Catenary Measurement:		
- Tension Error:	±0.01 kg.(0.03 lb.):	±0.05kg.(0.11 lb)
- Assumed Weight:	±0.16% or 2 gram:	±0.8% or 5 gram
Application of Normal Tension:		
- Tension Error:	±0.15 kg.(0.3 lb.):	±0.15kg.(o.3 lb)
- Error in Assumed Cross-sectional Area:	± 2.5%	± 1.2%

8.2 SPECIFICATIONS FOR CENTIMETRE PRECISION:

The following tabulation summarises the errors in observed or assumed data which will give rise to an error of 0.5 cm. in each of the applied corrections to linear measurements.

Source of Error	Error in data which will result in linear error of 0.5 cm. in a measured distance of 100 m.	
	3mm. Band	1.5mm.Band
Slope Angle: 1°	± 00° 10' 00"	
5°	02 00	
10°	01 00	
15°	00 40	
Band Temperature:	± 4°C. (8°F.)	
Tension:	± 3 kg. (7 lb.)	± 2 kg.(4 lb.)
Catenary Measurement:		
- Tension Error:	± 0.1 kg(0.3lb):	± 0.5 kg(1.1lb)
- Assumed Weight:	± 1.6% or 20 gram:	±0.8% or 50 gram.
Application of Normal Tension:		
- Tension Error	± 1.5 kg.(3 lb)	± 1.5 kg.(3 lb)
- Error in Assumed Cross-Sectional area:	± 25%	± 12%

8.2 SPECIFICATIONS FOR CENTIMETRE PRECISION:

The following tabulation summarises the errors in observed or assumed data which will give rise to an error of 0.5 cm. in each of the applied corrections to linear measurements.

Source of Error	Error in data which will result in linear error of 0.5 cm.in a measured distance of 100m.	
	3 mm. Band	1.5 mm. Band
Slope Angle: 1°	±00° 10' 00"	
5°	02 00	
10°	01 00	
15°	00 40	
Band Temperature:	± 4°C. (8° F.)	
Tension:	± 3 kg.(7 lb.)	± 2 kg.(4 lb.)
Catenary Measurement:		
- Tension Error:	± 0.1 kg. (0.3 lb)	± 0.5 kg. (1.1 lb.)
- Assumed Weight:	± 1.6% or 20 gram	± 0.8% or 50 gram
Application of Normal Tension:		
- Tension Error	± 1.5 kg.(3 lb.)	
- Error in Assumed Cross-sectional area:	± 25%	± 12%

9. CONCLUSIONS:

A consideration of the above figures demonstrates most clearly that, if the surveyor is to achieve even centimetre precision of measurement, his ancillary equipment plays a vital role.

1. It is essential that spring balances and thermometers be precisely calibrated and used with great care;

2. The various constants for a steel band must be individually verified;

3. Slope angles must be observed to a high precision when they are of the order of 10 degrees or more:

4. A much more reliable method of determination of band temperature must be developed.

I submit, for the consideration of members of the Association, that the Surveyor is doing himself and his profession a disservice by allowing Clause 9.8 of the Survey Directions to stand without protest.

Reference:

(1) Campbell, A.H. "The Dynamics of Temperature in Survey Bands and Tapes of Steel and Invar.", Proceedings of 15th.Survey Congress, The Institution of of Surveyors, Australia, Newcastle, 1972.

.....

PERSONAL ITEMS

Very little news has been received from our erst while correspondents for areas outside Port Moresby. However some info. is to hand.

Graeme Matheson is due back after long leave in Australia, watch for the reshuffle at Lands.

Brother Ken is in and out of Papua New Guinea like a Yank Tourist.

Peter Jolley, wife Jan, and daughters are back after swanking around Europe, informing us that the beer is questionable but the wine divine.

Graeme Sparkes-Carroll (see photo) shared the Territory Corsair sailing championship at Papua Yacht Club during the National Day weekend. It was surveyors on the water with Ben Hall, Dave Johnston, Clive Bassett, Kin Gudgin all at sea and Allan Mail, with Don Eggleson as crew, and your Editor providing official boats (i.e. those that stayed upright). Graeme Arman watched from the Bar, having helped break a mast during the "A" Class yacht race the previous day. (NOTE: Sparkes shared the 1st. with T.O. Charles Williams, of P.W.D. Survey Section).

Baby competition contestants attended a fine dinner party at the Tabu Restaurant, hosted by winner Geoff Tierney. A great night of merriment we hear; (watch for another one in nine months).

John Kronenburg has returned from leave to his native place Holland and a swank through Europe.

Work this out for probabilities:-

There at X number of jewellers shops in Brisbane, Y number of surveyors from P.N.G. in Brisbane at same time, Z number of watches repaired and $\frac{I}{Y}$ buying engagement rings.

And guess who walked in to a random selected jewellers shop to have his watch repaired at the same time as his associate was furtively selecting an engagement ring? Ask Max Muller.

Any way Max congratulations to you and Coral and the best for the future.

We all hope you don't cross paths again in a baby wear shop in the future. (So does Ken).

* * * * * *

THE PROFESSIONS IN THE DEVELOPING COMMONWEALTH

Part Two of the paper by

Robert Steel, B. Sc., FRICS

5. COMMONWEALTH COLLABORATION

5.1 Collaboration on a Commonwealth scale, therefore, benefits all who take part and widens their horizons. In this respect, collaboration within the Commonwealth is usually more effective than collaboration on a world scale, because the similarities of training, traditions and objectives that characterise many of the professions within the Commonwealth provide a closer identity of interest.

5.2 The fields for profitable collaboration will vary between different professions. But one that probably affects all professions is the cultivation of a better public understanding of professional functions and a better appreciation of their potential contribution to the public well-being. In this endeavour, any profession has a formidable task at the best of times; and the problem is all the greater for small societies. A Commonwealth Association can therefore help by producing appropriate literature for use by its member-societies, and can help in improving contacts with governments and universities. In the CAA and CASLE, the Officers and Committees have done much to support their member-societies in making their professions better known; and the breadth of their collective experience enables them to advise on the wider aspects of professional education and the justification for

public investment in developing the relevant skills.

5.3 Most of the developing countries actively seek advice on educational problems; and the ways in which Commonwealth Associations can be of service are described in the Seminar paper by Mr. Colchester. Through these consultations, a country can draw on a wide range of experience, and can gain access to academic advice which may not be available locally in the particular discipline concerned. This activity complements the work of bodies like the Inter-University Council for Higher Education, which also provide advice on manpower and training requirements.

5.4 Other subjects or opportunities for help and co-operation which have come to my notice include -

(i) the definition of 'standards' in education, professional practice and codes of conduct; and their application to local circumstances;

(ii) recruitment to the profession;

(iii) the role and qualifications of technicians, and the 'ladder' of advancement from technician to professional status;

(iv) the supply of teachers for professional education;

(v) refresher courses in mid-career;

(vi) reciprocal recognition of qualifications (and whether this is a good thing, in assisting mobility; or a bad thing, in facilitating a brain drain);

(vii) statutory registration of the profession;

(viii) the scope of professional activities;

(ix) the development of information services; and

(x) the provision of books for libraries and the exchange of professional journals.

These are only some of the fields where the exchange of information or experiences can be very helpful. Individual associations can no doubt cite other examples of fruitful co-operation.

5.5 Some associations are also actively fostering collaboration within their professions on a regional basis. This is particularly apposite for dealing with problems that have a regional flavour, or to which solutions may have to be evolved in a regional context. The scope for collaboration in education has already been mentioned; and other fields might include (i) the study of technical problems that are common to neighbouring countries (like the 'land' problem in Africa); (ii) the sponsorship of research; (iii) the production of a professional journal or news-sheet; and (iv) the local standardisation of codes of good practice and codes of conduct.

5.6 One constraint that always arises in co-operative enterprises, at both Commonwealth and regional levels, is the problem of finance. Those Commonwealth associations that have embarked on the kind of programmes I have mentioned inevitably incur substantial expenditure that is difficult to finance out of voluntary subscriptions from their member-societies. Indeed some associations do not levy subscriptions at all; of those that do,

CAA and CASLE both raise more than £5.000 a year, but this meets only a fraction of the cost of their activities, which would have been impossible without the help which the Foundation has generously provided. The associations are very grateful for the help they have received.

5.7 It is important to remember, however, that most Commonwealth associations have only recently been formed and are still consolidating their work. At the outset of any programme for Commonwealth development, fairly intensive effort is essential in order to identify the problems and to enable an association to decide how best it can help in solving them. In time, it may be possible to reduce the number and frequency of Commonwealth-wide meetings, and to concentrate effort at regional level. But some activity at Commonwealth level will still be necessary, if benefit is to be derived from the exchange of information and experience, and from acquaintance with the advancing technologies of other countries.

5.8 Both CAA and CASLE make some provision in their modest budgets to support regional activities. Even this small provision outstrips the total subscriptions accuring from the developing countries, and is subsidised from the other income of each association, which (up to now) has included an annual grant from the Foundation. If, as is contemplated, the Foundation's grants are gradually reduced and ultimately withdrawn, the total incomes of the associations are likely to be substantially curtailed. The U.K. members of the two asscciations already contribute about 65% and 85% respectively of their total incomes from subscriptions and donations; and it would be expecting a great deal of those members to suggest that they should make still higher contributions.

There is no obvious solution to this problem, but a solution must be found if the work on which these and similar associations have embarked is to be continued for the general benefit of the Commonwealth as a whole.

6. NATIONAL PROFESSIONAL CENTRES

6.1 However fruitful Commonwealth collaboration proves to be, the extent to which it benefits a profession in a particular country will depend on the vitality of that profession itself. It is essential that the profession should be well established, and - ideally - it should have its own premises and permanent staff and have the resources to promote its own activities, provide its own library, produce its own publications, and promote essential research and development. In the developing countries, very few professional societies are yet in this position. The only courses open to them are either to struggle on in a modest way with the resources they have, or to co-operate with other professions so that together their combined efforts and resources can be more effective. The latter is clearly the preferable arrangement; and a local professional centre will often provide the best means of achieving it. For that reason, Commonwealth associations have actively supported the initiative of the Foundation in sponsoring local centres to serve all the professions, or such of them as choose to participate. In some cases, the more affluent professions have preferred to stand alone, which creates difficulties for the others and may result in a loss of advantage to all because some of the potential activities of a centre will have the greatest impact if all the professions take part.

6.2 Other contributors to the Seminar will speak from first-hand knowledge of their own centres, and it is unnecessary for me to dwell on their activities at any length. But, on the basis of my observations in a number of countries, and from my knowledge of what the centres have been able to do for professions with which I am acquainted, I should like to emphasise the importance of their role in providing each profession with a base from which to operate. Among the beneficial services which a centre can provide are (i) a secretariat which can deal promptly with correspondence and with the servicing of committees; (ii) a programme of publicity and public relations activities; (iii) a place for meetings; and (iv) a home for a library. Above all, it provides a continuity of administration that is difficult to achieve if a profession has to rely entirely on the voluntary work and enthusiasm of its members. By these means the centre can help each profession to make maximum use of its resources in developing its own activities.

6.3 On a wider plane, the centre can also be a force for bringing the professions together and for sustaining and promoting the professional concept. There are many national problems in developing countries, such as the control and improvement of the human environment, which spread across professional frontiers and in which many professions have a contribution to make. Professional centres provide a forum in which collaboration between the professions can be fostered when ever it is necessary or beneficial. Equally, the maintenance of the professional concept is essential if the individual professions are to maintain their status, attract the right kind of recruit, provide the right level of education

and training, and maintain high levels of competence and integrity - all of which are necessary to produce the quality of service that this paper has suggested every country needs.

6.4 Professional centres therefore have a dual role to play. They can act on behalf of the participating professions collectively, in all matters of common interest; and they can provide invaluable administrative support for each participating profession in the conduct of its own affairs. But individual societies retain their own separate identities; they are primarily responsible for the development of their respective professions, and they will normally look to any Commonwealth association of which they are members for advice on matters pertaining to their own particular skills.

6.5 The activities of Commonwealth associations and local professional centres are therefore complementary parts of a single strategy for fostering the growth of the professions; and each local society is the catalyst which harnesses, for the assistance of its own profession, the support of the two organisations to which it belongs. In turn, the local centre is the catalyst which co-ordinates the endeavours of all its participating professions, for the benefit of the local community as a whole.

7. CONCLUSION

7.1 I realise that the general propositions of this brief discourse may not fit the circumstances of every profession, nor reflect the attitudes of all Commonwealth associations. Nevertheless, they do represent my expectations of what such associations can

achieve and my faith in the concept of professional centres as a means of reinforcing the local efforts of individual professions in those developing countries where the professions are not yet able to stand on their own feet.

7.2 There is a great wealth of professional knowledge and experience in the Commonwealth. It is also noteworthy that the standards of competence and integrity in most professions are higher in the Commonwealth than they are elsewhere. There are many historical reasons for this, including long-standing traditions of education and training, and - in the case of the landed professions, for example - the legal framework within which they operate and the general attitude to the use and development of land. Indeed, this has resulted in the emergence within the Commonwealth of particular skills for which there are no precise parallels in other countries. But the scope and standard of individual skills are not uniform in all countries, and one of the main benefits to be derived from Commonwealth collaboration is the exchange of knowledge and information about professional activities, which enables each country to develop the full potential of its own professional resources.

This Appendix has been compiled from information published in 'Professional Organisations in the Commonwealth', edited for the Foundation by Sir James Currie KBE, CMG	ACCOUNTANCY	ARCHITECTURE	DENTISTRY
1. AUSTRALIA Ø	1928	1930	1928
2. BAHAMAS	-	1968	-
3. BARBADOS	1966	1967	-
4. BERMUDA	-	1962	-
5. CANADA Ø	1902	1907	1902
6. CEYLON	1959	1957	1931
7. CYPRUS	-	1956	-
8. FIJI	-	1957	1953
9. GHANA	1963	1954	-
10. GIBRALTAR	-	1954	-
11. GUYANA	1966	1957	-
12. HONG KONG	1947	1956	1948
13. INDIA	1949	1917	1946
14. JAMAICA	1965	1957	1928
15. KENYA Ø	1949	1967	1943
16. MALAWI	1969	-	-
17. MALAYSIA	1967	1920	-
18. MALTA	1942	1920	1935

ENGINEERING civil or general	LAW	MEDICINE general	PHARMACY	SURVEYING land	SURVEYING quantity	SURVEYING land economy	TOWN PLANNING	VETERINARY SURGEONS
1919	1933	1961	1907	1952	1953	1926	1956	1931
1961	1954	-	-	-	-	-	-	-
-	1954	-	1948	-	-	-	-	-
-	-	1950	-	-	-	-	-	-
1887	1914	1867	1907	1882	1959	1960	1923	1947
1906	1947	1888	-	1926	-	-	-	1953
1956	1955	-	-	-	-	-	-	1955
-	1957	1953	1967	-	-	1953	-	-
1968	1940	1958	1935	1970	1970	1970	-	1963
1958	-	-	-	-	-	-	-	-
1968	-	-	-	1919	1969	1969	-	-
1947	1907	-	1949	*	*	*	-	-
1920	1958	1928	1940	1950	1950	1950	1951	1922
1959	1919	1890	-	1928	1959	-	-	1940
1946	1949	1963	1964	1946	1967	1969	-	1966
-	1965	1938	-	-	-	-	-	-
1958	1947	1960	-	1961	1961	1961	-	1939
1920	1877	1967	1961	1969	-	-	-	1966

	ACCOUNTANCY	ARCHITECTURE	DENTISTRY
19. MAURITIUS	1938	1959	-
20. NEW ZEALAND	1908	1910	1905
21. NIGERIA	1965	1960	1965
22. PAKISTAN	1961	1957	1948
23. PAPUA & NEW GUINEA	-	1966	-
24. SIERRA LEONE	1960	-	-
25. SINGAPORE	1963	1926	1966
26. SOLOMON ISLANDS	-	-	-
27. SWAZILAND	-	-	1958
28. TANZANIA Ø	1949	1948	1943
29. TRINIDAD & TOBAGO	1949	1955	-
30. UGANDA Ø	1949	1966	1943
31. UNITED KINGDOM	1880	1834	1890
32. ZAMBIA	-	1954	-

Ø Dates are for Federal bodies in Australia and Canada; state and provincial societies were formed earlier and still exist. In Kenya, Tanzania and Uganda, some societies are national and others are regional.

England and Wales

* Represented in CASLE by the Hong Kong Branch of The Royal Institution of Chartered Surveyors.

ENGINEERING civil or general	LAW	MEDICINE general	PHARMACY	SURVEYING land	SURVEYING quantity	SURVEYING land economy	TOWN PLANNING	VETERINARY SURGEONS
1948	1957	1964	-	1970	1970	1970	-	-
1914	1869	1882	1890	1888	1943	1938	1951	1928
1959	1950		-	1934	1969	1969	-	1940
1948		1948	1951	-	-	-	-	-
-	-	-	-	1960	-	-	-	-
-	1926	-	-	-	-	-	-	-
1966	1967	1959	1906	1967	1967	1967	-	1964
-	-	-	-	1968	-	-	-	-
-	1961	1958	-	-	-	-	-	-
1946	1955	1965	1966	-	-	-	-	-
1959	1897	1831	1925	1948	1962	-	-	-
1946	1914	1913	-	1968	1968	1968	-	-
1818	1825	1832	1841	1868	1868	1868	1914	1882
1955	1957	1964	-	1958	-	-	-	1949

APPENDIX B

COMMONWEALTH PROFESSIONAL ASSOCIATIONS

Existing associations which have links with the Commonwealth Foundation

1. Commonwealth Association of Architects

Established: 1963
Membership: 27 societies
Subscription and donations: about £7,425 pa.
Secretary: T. Colchester CMG, based in London (full-time)
Activities: Conference (every 2 years); Executive Committee; Commonwealth Board of Architectural Education: advice on education; regional meetings; news-letters; advice on practice, registration, etc.

2. Commonwealth Association of Surveying and and Land Economy.

Established: 1969
Represents: land surveying, quantity surveying, land economy.
Membership: 30 societies; correspondents in 12 countries which have no societies.
Subscriptions: about £5,000 p.a.
Secretary: Robert Steel, based in London (part-time).
Activities: General Assembly (every 4 years); Executive Committee; regional seminars; publications; advice on education, practice, etc: travelling scholarships.

3. Commonwealth Association of Planners

Established: 1971 (in formation); interim Executive Committee appointed.
Subscriptions: £770 pa (estimated)
Secretary-designate: P.R. Rathbone, based in London (part-time)

4. Commonwealth Geographical Bureau

Established: 1969.
Membership: no formal structure; Committee of Management elected from Commonwealth countries on regional basis.
Subscriptions: none at present.
Secretariat: Bureau in Montreal.
Activities: liaison with groups of geographers in Commonwealth countries; news-letter; regional conferences.

5. Commonwealth Legal Bureau

Established: 1970
Membership
Subscriptions:
Secretariat: Bureau in Canada.
Activities: developing communications and liaison between Commonwealth Bar Associations and Law Societies; conferences; advice on education and training.

6. Commonwealth Magistrates Association

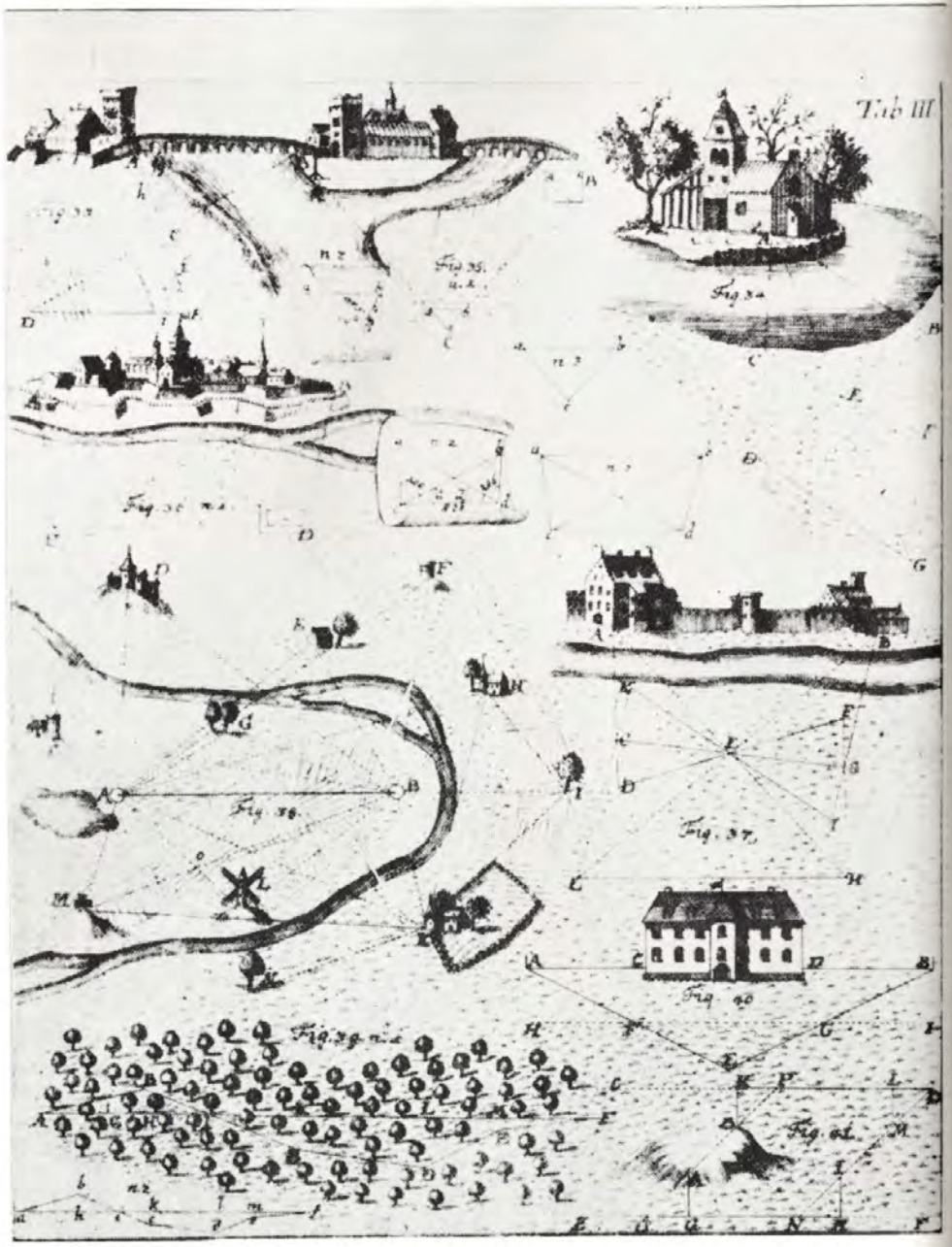
Established: 1970.
Membership 6 societies at present.
Subscriptions: £250 each society.
Secretariat: based in London.
Activities: only recently formed.

Reproduced on the next pages are some very interesting prints from a publication loaned by the good offices of Kim Gudgin.

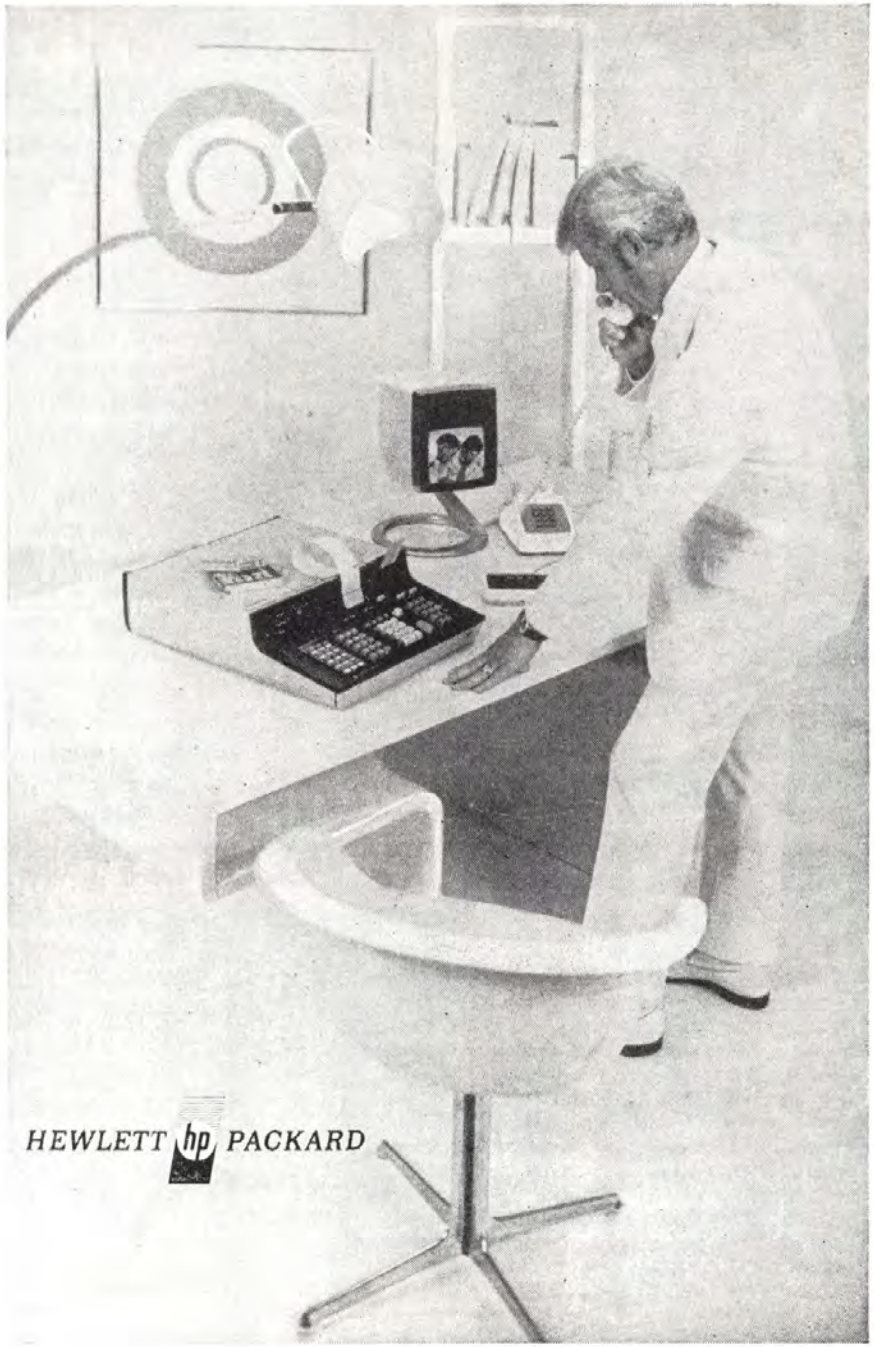
The prints are from old etchings of survey work, apparently executed in 18th century France.

The statue is one found in the ruins of Pompeii and now domicile in the National Museum of Science, Milan.

The actual size of the statue is not known.



Plotting trigonometrical points.
The above copperplate engravings are taken from *L'Art de lever les Plans* by DUPAIN DE MONTESSON, 18th century.



TECHNICAL NOTES

The Co-ordination Sub-Committee is going hot and strong in Lae. Some very real progress has been made, and it is hoped to publish interim reports in future issues. Watch for the preliminary report next issue.

The programmable desk top computor is "the" thing now for Government survey authorities and many private consultants as well. Strongest in the field is Hewlett Packard with Lands, Public Works and Forests all sporting at least one. Hitec has a 9820 on order. Including the earlier 9100's, there are now about 11 H.P.'s in the country, and we are promised that servicing facilities are on the way. The new Model 9810 is probably the best in it's field for pure survey calculations but those interested on other applications or contemplating outside service to non survey users could well look at the higher powered 9820. If Survey Co-ordination comes, (and why shouldn't it) Regional offices are the place where we should see more. Although some basic survey requirements are, sadly, missing from it's array of inbuilt sub-routines when compared to the "10"and the "20"'s capacity is such that they can easily be programmed in. "Polar Rectangular" and "are" keys are examples of surveyor needs not incorporated in the "20",

Interesting exercise at Public Works was laying down 100m and 900m bases using steel bands, invar, and a range of EDM for comparison. (Only EDM used on the 900m). The Wild Distomat, Geodimeter, Zeiss SM11 and Hewlett Packard 3500B were tested over both bases, all agreeing very closely. Night measurements with steel bands and invar during the day all verified results on the

100m bases. Hewlett Packard's 3800B was spot on within its specification over the 900m but seemed to be slightly out in the short range. The Distomat and AGA Geodimeter 6B and SM11 on the 100m base were within .005 of the MPV (Range +005 to 002) of the base as taped. Some early problems with the SM11 were evident but were rectified, in fact it showed a variation of only .002 from MPV, the closest result. Also appears that reflectors of different makes may be utilized although the index error must be determined first (up to .04); Further information is available from Department of Public Works Survey Section.

Big joke from Australia is that, considering entering the metric field for the first time they have fixed on .002 for PEG ON ROAD SURVEYS after x number of committees; As Henry Werner puts it, are they to fit micrometer blades on their dozers?

John Macartney has replied to the criticism of his proposed use of Laser with a letter from Noel Walder of Laser Electronics.

REF: ADAPTION OF LASERS TO CADASTRAL SURVEY METHODS

In reply to Mr. Forster -

I hasten to place this subject back on line.

The concept bears further explaining and is included for orientation.

Briefly the principle is to project a laser vertically and detect its position by traversing an electronic detector mounted on a theodolite telescope in a horizontal plane to yield an angle reading from a reference point to the laser beam.

The feasibility is dependent on several factors and system dictations.

These are:

1. Detectors

   (a) Must be mounted coaxially on sighting scope.

   (b) Must not restrict instrument's normal capability.

   (c) Must be battery operated and be of minimum size and low power requirements.

2. Laser Transmitter

   (a) Must be field portable.

   (b) Self Plumbing automatically

   (c) Must provide minimum beam divergence.

   (d) Must provide sufficient power to provide detection at say 5km of mie scattered light from atmospheric particles.

   (e) And should be pulsed operation to assist in the peak power emmission, and for detector discrimination from abient light.

A prototype system has been developed and field tested meeting the above requirements. Explanation of the system is as follows:

HeNe lasers are of course not suitable because of CW emmission and difficulty in pulsing, also because of very limited powers. Ruby or YAG solid state lasers are suitable because of Q-Switching pulsed operation which provides Mega Watts power output at moderate power requirements (30 watts) and can be operated at moderate repition rate (20Hz) with air cooling.

Ruby has a slight advantage in that it provides better Mie scattering (Scatter from large particles) than the larger wavelength YAG (1.06 microns). It provides also the advantage of visual light .69u where as YAG is IR.

Several LIDAR instruments are commercially available which detect back scatter from cloud, smoke and chimney effulent at 5 km and yield particle size, population density as well as range. Many laser range finders are available with ranges up to 20 km which do not require co-operative reflectors and rely on back scatter for detection. The statistical probability of scatter direction is well known and would yield similar reflection from target particles of random size and shape in a near spherical pattern.

To provide an automatic plumb, a ruby laser is mounted in a gimble within a case readily detachable from a tripod. The verticality is repeatable to 3 arc seconds. Power is supplied by NiCad rechargeable cells and provides for intermittent duty expected in an 8 hour day without recharge or replacement. The beam has a fixed infinity focus but diverges approximately 30mm per kilometer due to atmospheric dispersion. A back or downward beam emerges to enable location over a ground survey point to within 1/8".

The detector "sees" each pulse and integrates these to provide a D.C. voltage meter readout. Traversing the detector/telescope across the beam location will provide a maximum readout at beam centre independent of beam divergence since the energy distribution across the beam approximates Gaussian.

Detector power requirements in the order of 18 milli amps at 12 volts providing hundreds

of hours from pencil size Ni Cad or conventional batteries. Alignment check of the detector is achieved by a mirror manually reflecting sunlight from a fixed point at any range on which the sighting scope is centred. Detector field of view is .5 milliradians to exclude stray ambient light. Intermittent ambient signals are rejected by the intergrator and do not appear in the DC maximum readout due to controlled sampling and pulsed rate.

Since we proposed this system a similar system is undergoing field trials in the U.S.A. by the New York Forestry Service and current reports appear to confirm the system feasibility and usefulness.

It is felt that a locally produced system could have considerable application in the TPNG survey tasks which pose special problems for conventional methods.

ED NOTE: A "Learner's Guide" service to explain the elements of those interested in the functioning of any type (not Brand) of equipment is proposed. Please indicate (if you can bother licking a 7¢ stamp) which line to follow up e.g., Memory Capacity V Cost on Desk Top Calculators or "The Principles of Laser".

The aim being to provide a service to the "non Boffin". Indigenous Surveyors please note, this is for you too!

'Hitec' staff also note. Your help will probably be required.

The Editor,
The Journal of the Association
of Surveyors of Papua New Guinea,
PORT MORESBY.

Subject: ONE PLUS ONE EQUALS TWO
The Journal issue - July 1972, Page 47.

Dear Sir,

Would an Angel comment on an Archangel if the latter happened to commit an intolerable blunder?

Would an Associate Member dare to comment on a Corporate member? Perhaps he might be forgiven if he would do it in verse;

With the help of Jonathan Swift I'll try to reply to my professional Senior Brother Ken.

Ken, Thou pompously art resolved
Some strange arcana to unfold,
But Thy genius has perhaps a knack
Of trudging in a beaten track.
With my Muse of Verse on borrowed wings
emerging
And Thy Muse of Maths who as yet is a
virgin
And for notions too abstracted
No more fit is than a crackt head,
Thou strangely will let us know
What all the world knew long ago.
All Thy functions that are hyperbolic,
Useless to Surveyors except alcoholics,
Could still be an object to admire
And each line would shine like daggers
or fire,
But Thy "e"-exponent has a defect
That any mortal could correct.
If Thy "zet" is tending towards zero
Then Thou art no longer a hero.
Then let us both in time grow wise,
Nor higher, than our talents, rise.

P.S. For prosaic brethren herewith a note on dangers of using any other method than one's own fingers in order to add one to one.

$$e = \lim_{z \to \infty} \left(1 + \frac{1}{z}\right)^{z}$$

But anyone who prefers to tend towards "o" and still wants to get his exponent number "e", should place his nymph "zet" in a different pose:

$$e = \lim_{z \to 0} \left(1 + z\right)^{\frac{1}{z}}$$

M.F. CICHOCKI

28th.August, 1972.

ZEISS

Second-reading theodolite Nominal accuracy ± 1"	Th2	Ni1	Automatic precision level Nominal accuracy ± 0.2 mm
Micrometer theodolite Nominal accuracy ± 3" without repetition ± 1" with repetition	Th3	Ni2	Automatic engineers and precision level Nominal accuracy ± 0.3 mm
Optical-scale theodolite with terrestrial telescope Nominal accuracy ± 3"	Th42	Ni22	Automatic engineers' level Nominal accuracy ± 1.0 mm
Optical-scale theodolite Nominal accuracy ± 3"	Th4	Ni3	Builders' dumpy level Nominal accuracy ± 3.0 mm
Minute-reading theodolite Nominal accuracy ± 20"	Th5	Ni3K	Builders' tilting level Nominal accuracy ± 3.0 mm
Reduction tacheometer Nominal accuracy (distance) ± 5 cm at 100 m	RTa4	Ni4	Automatic builders' level Nominal accuracy ± 6.0 mm

CARL ZEISS PTY. LTD.

CARL ZEISS WEST GERMANY

569 George Street, SYDNEY. Tel. 61 8901

Branches at Melbourne, Adelaide, Perth

SOLE AGENTS FOR T.P.N.G.

CARL ZEISS WEST GERMANY

BRECKWOLDT & CO. PTY. LTD.

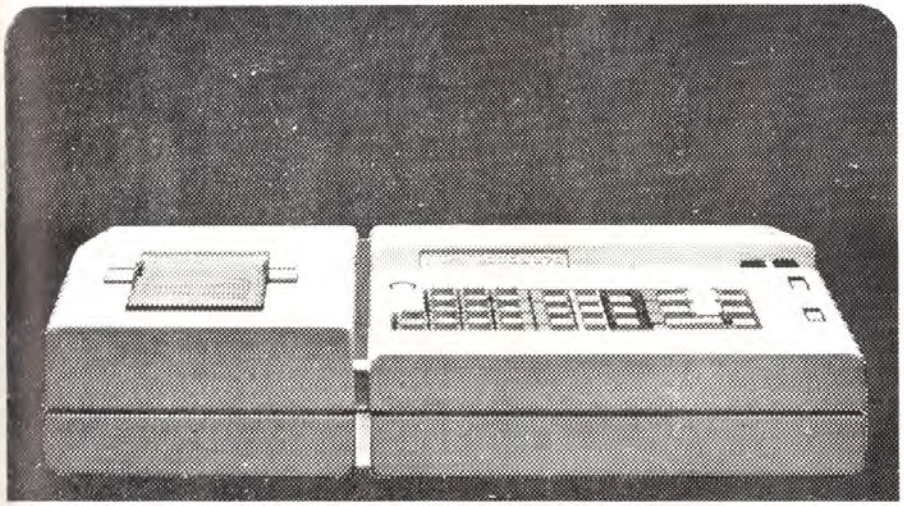
Rabaul, Port Moresby, Lae, Madang, Kieta, Mount Hagen, Wewak.

STOCKS HELD NI2 & TH4 ENQUIRIES WELCOME

Olivetti Logos 250/270

Would you consider buying an adding machine without printout? What about electronic calculators?

Olivetti who produce one out of every three figuring machines know the answer. In fact Olivetti have known it for a long time. The new LOGOS 250 & 270 offer a remarkable solution to the problem of providing instant, accurate answers to calculations that are both simple and complex. Within a compact unit, instant printout provides for proof of both factors and answers. The result of mating an advanced IC logic unit and a quick 30 character per second printer. Three independent totals, square root, automatic percentage markup or discount, storage of intermediate answers all help to make Logos the simpler, faster and safer machine to calculate with. Remember, if it prints you don't have to do it again.



olivetti

Pioneer Office & Scientific Supply Pty. Ltd.

Kaawi Street, Gordons, P.O. Box 3144, BOROKO. Phone P.M. 54780. Morobe Avenue, LAE. P.O. Box 387, LAE. Phone LAE 2626. P.O. Box 21 and 138, KIETA.