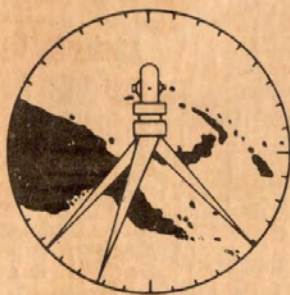


THE JOURNAL

of the

**Association of Surveyors
of Papua and New Guinea**



VOLUME 3

NO. 4.

DECEMBER 1973

THE ASSOCIATION OF SURVEYORS
OF PAPUA AND NDW GUINEA

OFFICE BEARERS 1973-1974

President

J.J. Garrett

Vice President

F. Posanau

Honorary Secretary/Treasurer

P. Jolly (resigned)

A.J. McCarthy

Councillors

G.R. Hole

A. Bale

B.J. Mennis

M.G. Whish-Wilson

I.B. Bryning

J.J. Tierney

ROLL OF PAST PRESIDENTS

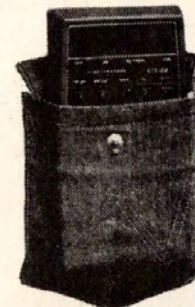
1960-62	C.W. Sparkes-Carroll
1962-64	R.G. Matheson
1964-65	O.G.G. Dent
1965-66	T.W. Richards
1966-67	J.C. Williams
1967-69	T.C. Jackson
1969-70	T.W. Richards
1970-71	J.C. Macartney
1971-72	K. St.C. Matheson
1972-73	M.J. Larmer

Please address all communications
to the:-

Hon. Secretary,
Association of Surveyors of
Papua and New Guinea,
P.O. Box 793,
LAE. P.N.G.

MEASUREMENT & COMPUTATION: AT WORK IN PROBLEM SOLVING

**HP-65 calculator power can be found
in the smallest spaces...**



even a surveyor's shirt-pocket

HP's new greater range of pocket sized calculators now cover every conceivable calculating need. Carry them with you wherever you go, work out your problems on the spot. HP65—Our Newest Addition This is the first pocket sized calculator on the market with full programming capability. HP65's extended memory plus the ability to perform 51 built-in functions enables you to solve multi-step problems with greater ease and in less time than possible with comparable desktop machines. Write and edit your own programmes. This extra convenience still packed into an 11 ounce instrument of shirt-pocket dimensions. Want to know more?

For further information without obligation send this coupon to address below. Please tick appropriate squares.

☐ Please send me further information

☐ HP65

Name.....

Address.....

P/Code.....

Telephone no.....

Publication name.....

HEWLETT  PACKARD

Sales and service from 172 offices in 65 countries.
Australia, 31-51 Joseph Street, Blackburn, 3130, Victoria. Telephone
89 8351. Other Offices: Adelaide, Brisbane, Canberra, Perth and
Sydney. Also Auckland and Wellington, New Zealand

90406/30171

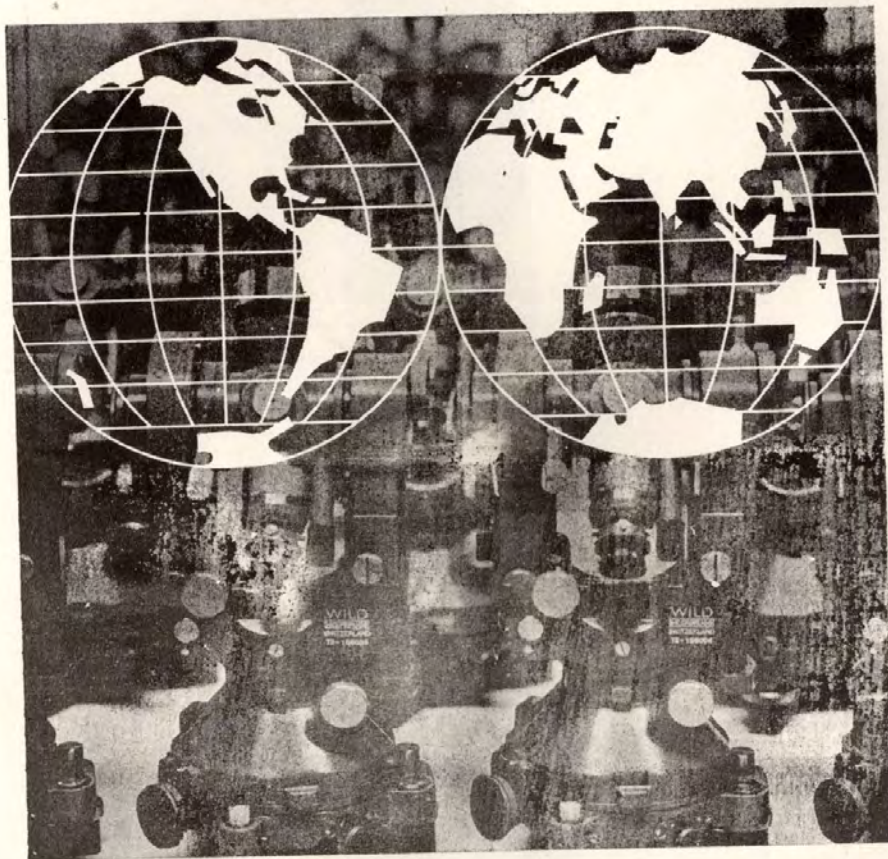
On each kilometre around the equator

we could set up a Wild T2 Universal Theodolite—over 40 000 have been sold since it was first introduced!

The world-wide use of this one-second theodolite is the result of its simple and

efficient design, careful production control and its excellent performance in practically every type of survey work.

Ask for detailed T2 brochure GI 246.



WILD
AUSTRALIA

WILD (AUST.) PTY. LTD.

N.S.W.: 45 EPPING ROAD, NORTH RYDE. PHONE 888 7122

VIC: 5 ERROL STREET, EAST PRAHRAN. PHONE 51 9101

QLD: 11 BUCHANAN STREET, WEST END. PHONE 44 3455

INTERSTATE AGENTS

S.A.: General Equipments Pty Ltd,
9 Osmond Tce, Norwood.

N.T.: Hermes Sales Pty Ltd,
1664 Coonawarra Rd, Winnellie, Darwin

TAS.: J. Walch & Sons Pty Ltd,
130 Macquarie Street, Hobart.
W.A.: Henderson Inst. Co. Pty Ltd,
309 Hay Street, Subiaco.
T.F.N.G.: Brian Bell & Co. Pty Ltd,
Turumu Street, Boroko.



ZEISS



Second-reading theodolite
Nominal accuracy $\pm 1''$

Th 2

Ni 1

Automatic precision level
Nominal accuracy ± 0.2 mm

Micrometer theodolite
Nominal accuracy
 $\pm 3''$ without repetition
 $\pm 1''$ with repetition

Th 3

Ni 2

Automatic engineers' and
precision level
Nominal accuracy ± 0.3 mm

Optical-scale theodolite with terrestrial
telescope
Nominal accuracy $\pm 3''$

Th 42

Ni 22

Automatic engineers' level
Nominal accuracy ± 1.0 mm

Optical-scale theodolite
Nominal accuracy $\pm 3''$

Th 4

Ni 3

Builders' dumpy level
Nominal accuracy ± 3.0 mm

Minute-reading theodolite
Nominal accuracy $\pm 20''$

Th 5

Ni 3K

Builders' tilting level
Nominal accuracy ± 3.0 mm

Reduction tachometer
Nominal accuracy (distance)
 ± 5 cm at 100 m

RTa 4

Ni 4

Automatic builders' level
Nominal accuracy ± 6.0 mm

CARL ZEISS PTY. LTD.



SYDNEY : 569 George Street, N.S.W. 2000.
MELBOURNE : 34 Queens Road, Melbourne, Vic. 3004.
ADELAIDE : 25 Blythwood Road, Torrens Park, S.A. 5062.
PERTH : 30 Wickham Street, East Perth, W.A. 6000.
BRISBANE : 35 Hillside Terrace, St. Lucia, Queensland, 4067.

Tel. 61 8901
Tel. 267 1381
Tel. 71 1324
Tel. 21 4075
Tel. 71 3827



now HP has a scientific calculator for any conceivable application, solving every problem need...

it's the range that counts!

Because you're faced with a wide range of complex scientific calculations, we've designed a wide range of HP calculators. In fact they are more like mini computers with the various tasks that they can handle. Knowing that precise, quick computations have often to be made on the move, we've designed our pocket-sized series — the HP35 and HP45 weighing only 9 ounces. For those needing a large desk-top model we've produced the HP46 and HP9810, which gives a permanent print-out for any complex calculation. If your business borders on science, engineering, surveying or mathematics, Hewlett-Packard have an answer to any of your calculation problems.

*HP 46 — \$712.44; HP 45 — \$356.22.
Both including Sales Tax.

HEWLETT  PACKARD

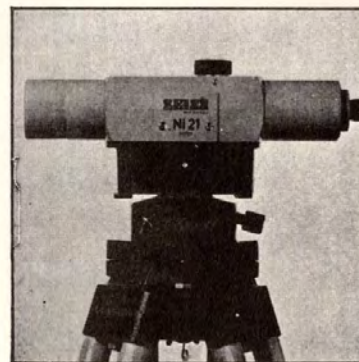
Sales, service and support in 172 centres in 65 countries.
Australia, 22-26 Weir Street, Glen Iris 3146, Victoria. Telephone: 20 1371.
Other offices: Adelaide, Brisbane, Canberra, Perth and Sydney. Also Auckland and Wellington, New Zealand.

90388/30071



ZEISS Ni 21

The new automatic engineers level, an offspring of the renowned Ni 2-group of levels



For structural work above and below ground, roadbuilding, computations of elevations and setting out

- world-famous ZEISS optics
- ZEISS V-type compensator
- fast levelling
- horizontal circle
- high precision
($\pm 1,0 \text{ mm } \sqrt{S_{\text{km}}}$)



CARL ZEISS PTY. LTD.
114 PYRMONT BRIDGE RD., CAMPERDOWN 2050
Phone: 516 1333



Branches in Melbourne, Adelaide, Perth, Brisbane

THE COUNCIL OF
THE ASSOCIATION OF SURVEYORS OF P.N.G.
WISHES IT MEMBERS
A HAPPY AND PROSPEROUS 1974

TABLE OF CONTENTS

A Crustal Movement Survey in the Upper Markham Valley by A.J. McCarthy	pps. 1-8
Hypothesis on the Evolution of Surveying	pps. 9-11
The Lae Group	p. 12
Personality Corner - Thomas William Richards	pps. 13-14
The Surveying Education Corner by A.J. McCarthy	pps. 15-19
The Ninth Survey Congress Report from the Bougainville Congress Committee	pps. 20-21
The Eighth Survey Congress Report Part 2.	pps. 22-29

A CRUSTAL MOVEMENT SURVEY IN THE UPPER MARKHAM VALLEY

By A.J. McCarthy.

Background

Modern theory on continental drift postulates that the Earth's crust is made up of several large segments, called plates, which are slowly moving over the earth's core. The interface between such plates, called faults, are regions of continuous tectonic activity.

Precise surveying measurements are being carried out in several regions around the world to determine the amount of crustal movement taking place in the vicinity of fault lines. Such knowledge adds to the geological information known of an area and provides further data for planning and development.

The Project

This particular project originated in 1968 when Dr. Denham, from the Bureau of Mineral Resources, pointed out that geological investigations in the Markham Valley showed considerable horizontal and vertical displacement was taking place on both sides of the valley.

David Cook, a senior surveyor with the Division of National Mapping, carried out reconnaissance work in early 1973 and chose the positions of six control stations straddling the Markham Valley between the Kaiapit and Ragitsaria first order trigonometric stations.

The equipment used to survey the positions of the control stations was the Model 8 geodimeter, and Wild T.3 theodolite. Each control station was also precisely levelled.

In August the survey team arrived. The team was led by Brian Murphy and included Steven Bennett, Jim Steed, Bob Bryant, Don Gray, Bill Jeffreys, Andie Rogers and Peter Walkley.

It is not my intention of stealing National Mapping's "thunder" by going into any detail, but a few points can be made.

The Model 8 Geodimeter

The model 8 geodimeter is an e.d.m. system outside the financial range of the average consulting surveyor. It incorporates a highly collimated laser beam giving an increase in the range of previous geodimeters. Under ideal conditions the National Mapping Surveyors hoped to achieve measurements as long as 75 Kms. The geodimeters greatest advantage is the fact that measurements are not so affected by water vapour in the atmosphere as the microwave instruments. For example consider this average set of atmospherics:

A Crustal Movement Survey in the Upper Markham Valley

Dry bulb temperature	25°C.
Wet bulb temperature	20°C.
Atmospheric pressure	1000 m.b.
Length of line	50 Kms.

The refractive index correction for the Model 8 Geodimeter is:

$$D \cdot 10^{-6} \left(308.6 - \frac{107.92 P}{273.15 + t} + \frac{15.02 e}{273.15 + t} \right)$$

D is the length of line.

308.6 is the standard refractive index.

$\frac{107.92 P}{273.15 + t}$ is that part which allows for actual conditions of pressure and dry bulb temperature.

$\frac{15.02 e}{273.15 + t}$ is that part which allows for the amount of water vapour in the air.

$$\begin{aligned} \text{Then } C &= 5.104 \cdot 10^{-6} (308.6 - 271.5 + 0.8) \\ &= 189.5 \cdot 10^{-2} \\ &= 1.895 \text{ metres.} \end{aligned}$$

Notice that the third term in the bracket has very little effect on the final result.

For a comparable microwave instrument the correction formula is:

$$C = D \cdot 10^{-6} \left(325 - \frac{103.49}{273.15 + t} (P - e) - \frac{86.26}{273.15 + t} \left(1 + \frac{5748}{273.15 + t} \right) e \right)$$

The three terms inside the brackets are comparable in meaning to the corresponding three terms for the geodimeter.

$$\begin{aligned} \text{Then } C &= 5.104 \cdot 10^{-6} (325 - 255.1 - 88.3) \\ &= -92 \cdot 10^{-2} \\ &= -0.92 \text{ metres.} \end{aligned}$$

Notice that, while the final correction is smaller, the third term in the bracket has a far greater effect on the final result.

It is the water vapour pressure along the measured line that is difficult to measure with any reliable degree of precision.

A Crustal Movement Survey in the Upper Markham Valley

As an indication of the precision of measurements made with the Model 8, one control line had recorded the following measurements:

14527.515

.513 — 2 hours apart

.520

.513 — more than 1 day apart

.517

.513 — 2 hours apart

.514

.514

The Precise Levelling

The six control stations were connected by a string of Bench Marks passing through the valley and radiating to each control station in turn.

To precisely level from the final bench mark on the river plain and adjacent to the control station, the method of simultaneous reciprocal trigonometric levelling was employed.

Vertical angles were measured by 1" theodolite and slope distances by short range e.d.m.

Reduction of the field observations is best carried out using these formulae:

$$dh = dh' + H_E^A - H_E^B$$

$$dh' = S. \sin \frac{dZ}{2} = S. \sin \frac{ZB - ZA}{2}$$

$$ZB = ZB' - \frac{H_I^B - H_G^A}{S. \text{arc } 1''} + \frac{H_E^B - H_E^A}{S. \text{arc } 1''}$$

$$ZA = ZA' - \frac{H_I^A - H_G^B}{S. \text{arc } 1''} + \frac{H_E^A - H_E^B}{S. \text{arc } 1''}$$

ZA' , ZB' are observed zenith distances at A and B.

ZA , ZB are zenith distances at A and B measured from e.d.m. transmitter to receiver.

H_I^A , H_I^B are heights of theodolite trunnion axes at A and B respectively.

A Crustal Movement Survey in the Upper Markham Valley

H_G^A , H_G^B are the heights of targets set at A and B respectively.

H_E^A , H_E^B are heights of e.d.m. units at A and B respectively.

S is the observed slope distance corrected for refractive index variation.

dh' is the difference in elevation from A to B between the e.d.m. instruments.

dh is the difference in elevation from A to B between the ground marks.

The formulae quoted above enable the observed slope distance to be used directly in the reductions, and for this reason are more preferable than the traditional text book formulae.

The observed zenith distances are corrected from theodolite and target to unit one and unit two of the e.d.m. equipment, i.e. vertical angles and measured slope distance are now directly related. Hence the difference in elevation (dh') between each e.d.m. unit can be calculated, and from dh' it is a simple matter to calculate dh .

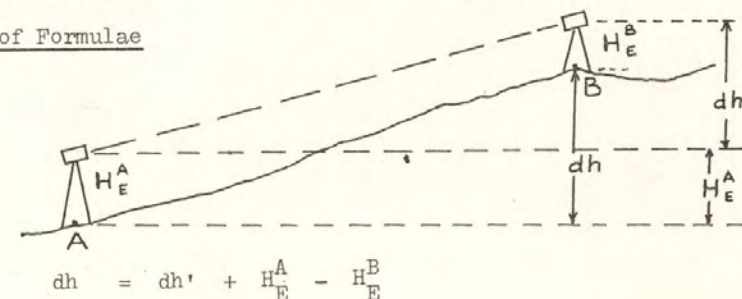
The proof of the formulae are shown below.

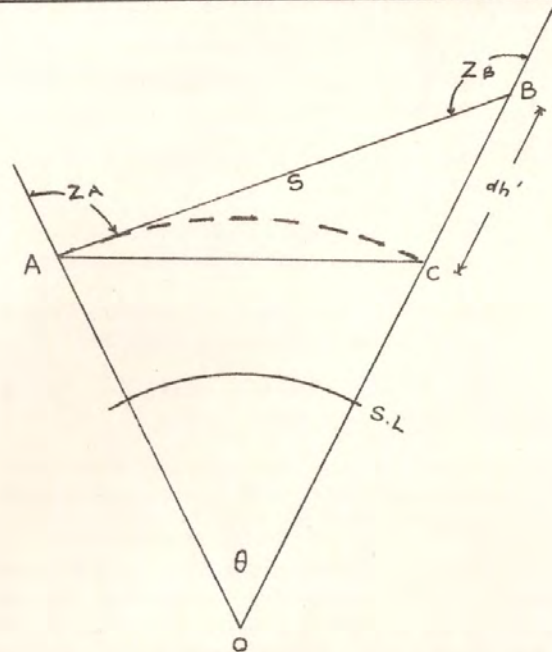
This method of precise levelling gives good results. It is an area of surveying which would bear further investigation.

Vacation Employment

The third and fourth year surveying students from the University of Technology joined the National Mapping Survey team for two weeks during the August vacation. Experience gained from watching the surveyors in action, and giving minor assistance where possible, was very appreciated.

Proof of Formulae





Consider the Triangle ABC

$$\hat{BAC} = 180 - ZA - 90 + \frac{\theta}{2} \quad \text{Straight line AO}$$

$$\hat{BAC} = 180 - 180 + ZB - 90 - \frac{\theta}{2} \quad \text{Triangle ABC}$$

Adding, $2\hat{BAC} = ZB - ZA$

$$\hat{BAC} = \frac{ZB - ZA}{2}$$

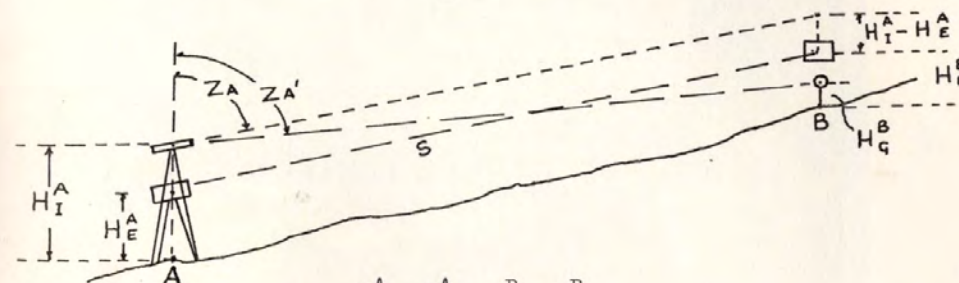
By sine rule

$$\frac{S}{\sin (90 + \frac{\theta}{2})} = \frac{dh'}{\sin \frac{ZB - ZA}{2}}$$

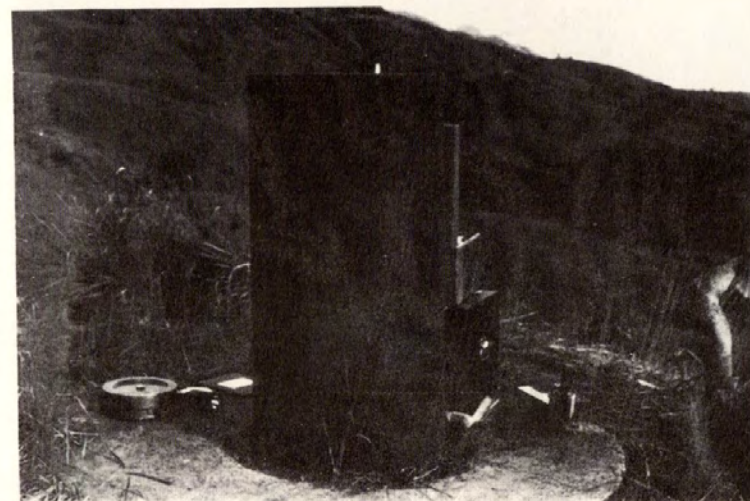
$$dh' = S \cdot \sin \frac{ZB - ZA}{2} \cdot \sec \frac{\theta}{2}$$

For a line 100 Kms long $\theta/2$ for P.N.G. approximately equals $27'$. $\sec \frac{\theta}{2} = 1.00003$. If the difference in elevation is 1000 metres the error caused by ignoring $\sec \theta/2$ will be 3 cms.

$$\therefore dh' = S \cdot \sin \frac{ZB - ZA}{2}$$



$$\begin{aligned} ZA &= ZA' - \frac{H_I^A - H_E^A + H_E^B - H_G^B}{S \text{ arc } 1''} \\ &= ZA' - \frac{H_I^A - H_G^B}{S \text{ arc } 1''} + \frac{H_E^A - H_E^B}{S \text{ arc } 1''} \end{aligned}$$



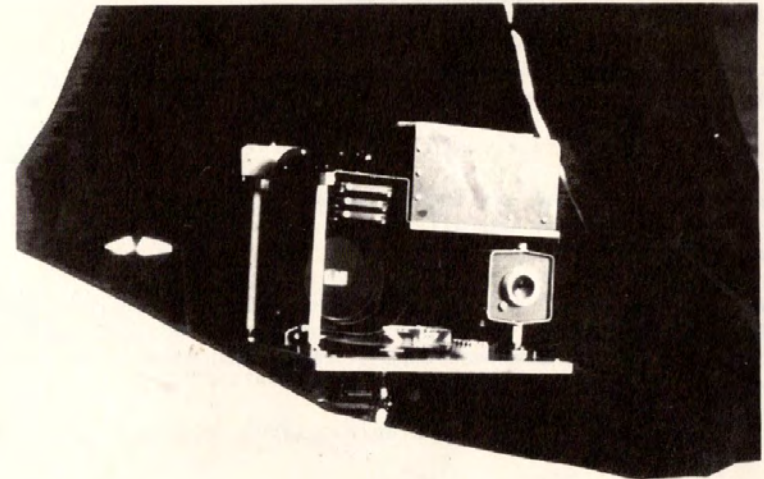
A crustal movement survey control station.



The Model 8 Geodimeter Reflector.



A laser beam across the Markham Valley at dusk.



The Model 8 Laser Geodimeter.

HYPOTHESIS ON THE EVOLUTION OF

S U R V E Y I N G
(the first 7 days)

1st Day

In the beginning the Lord created Adam and Eve.

Adam was wild and untamed and there was much disarray within his head; and the ghost of darkness was within him. The light did not want to come and the chaos in his mind was great.

The Lord spoke:

"There shall be a system to the chaotic disarray and its name shall be "mathematics".

- thus, plus and minus made up the first day -

2nd Day

And the earth gave birth to straight lines, circles, ellipses, parabolas and other curves with and without single points.

- thus from straight lines and curves
the 2nd day emerged -

3rd Day

The fertile earth generated numbers and letters with and without indices, round, straight and other brackets, and

the Lord put his blessings upon them and spoke:

"Be fertile and multiply!"

- thus, from equal and unequal,
the 3rd day emerged -

4th Day

And the Lord spoke:

"The earth shall give birth to formulae and definitions to that extent that their number will be infinite and Adam shall be their slave so that he may pass his time with them."

- thus, the 4th day was made up of
thousand-and-one proof (control) -

Hypothesis on the Evolution of Surveying

5th Day

Co-ordinate systems grew in polar and orthogonal disorder squeezing out logarithms and angular functions; and long rows of logarithms paraded in all their transcendental beauty.

- thus, from sine and cosine
emerged the 5th day -

6th Day

On the 5th day, however, an earthquake of great magnitude transformed the wellshaped earth; first into an ellipsoid and then into a shape of no math. definition called geoid and there was no end to the confusion.

- thus, from up and down, the
6th day emerged -

7th Day

And the Lord decreed:

"Let us bring back order and survey the earth!"

The valleys filled themselves with water exactly to mean-sea-level and the levelled survey marks grew like mushrooms.

Triangulations from 1st to 4th order generated themselves across mountains and valleys.

The Lord contracted Adam and said:

"You shall survey all of the earth and I will give you the whole of the mathematical paradise to do it with.

You may multiply and divide; use the numbers with and without exponents and take square roots with all numbers in this paradise - b u t - you are not allowed to divide by ZERO, because it is a creation of the devil!"

However, the snake - being cunninger than all other animals - spoke to Eve:

"ZERO is not a creation of the devil but if one divides by 0, one will learn to distinguish between right and wrong."

Hypothesis on the Evolution of Surveying

The woman thought that it was easy to divide by 0 and that it was a funny No.

So she spoke to Adam:

"Divide by ZERO, can't you see how it simplifies the equation?"

Adam took all his courage and divided by Z E R O.

However, he was ashamed of his doing and hid behind a first order trigonometrical point.

The Lord was angry with him and decreed:

"Because you have disobeyed my commandment, I will eliminate you from the mathematical paradise.

Your work shall be damned and you shall for time coming survey the earth

from Coonabarabran to Mt. Hagen to Berlin,
from the Antarctic to the Arctic including
the new World that will be discovered by Columbus.

All your surveys shall be prone to errors, and with sweat behind your ears you shall remeasure, remeasure, remeasure

You shall adjust your surveys over and over again and your hands will be swollen from interpolation work on the slide rule.

But never shall you be able to project the earth's surface simultaneously correct in length, angles and areas.

The noise of the hand calculator shall haunt you on every day of your life.

Survey marks shall hide from you and in all climates you shall always, always be thirsty."

- - - - -

Happy New . Year
to all members of the Association - from

Heiko Steenken.

THE LAE GROUP

The cultural standard of the group has again risen with the arrival of another New Zealander - welcome to Ken Massey, wife Elaine and two children.

Groucho Marx is back, much to the pleasure of the shareholders of little green bottles.

The bikpela has gone; word has it that they stepped off the Boeing in the sunshine state and rowed to the terminal building.

John Hastings has been sporting a sickly grin after he and Faye spent leave in and around worldly Stockholm.

In the consulting world a speedy surveyor will earn lots of brass. Tony Quick joins the group from Adelaide, accompanied by long-haired lovely Heather.

Tony Naughton went to the Australian Congress but doesn't remember much about it.

PERSONALITY CORNER

Thomas William Richards

Tom Richards undoubtedly is one of the real characters of the profession. He is a founding member of the Association holding membership certificate No. 4, and has been President of the Association for two separate terms.

During his fourteen years of membership of the Association Tom has presented papers to Survey Conferences held by the Association on two separate occasions. They were:

The Role of the Private Surveyor in a Developing Country -
Fourth Survey Congress - Port Moresby 1969.

Conception and Birth - Eighth Survey Congress - Lae 1973.

Tom was a regular Councillor of the Association, when not President, during its formative years.

A brief history:

Born Surrey Hills, Melbourne.

Joined Citizen Force of Aust. at 18, transferred to AIF May 1940 - 2nd First Survey Regiment as a gunner.

Transferred to 2/14 Field Regiment with hopes of becoming a Survey Officer. Endured the first bombing raid on Darwin, and survived 53 following raids before proceeding to Sydney.

January 1944 to New Guinea, Finschhafen to Hannsa Bay.

Transferred to Angau November 1944 as Patrol Officer - OIC Mumeng Post November to April 1945. Leave in Sydney then posted OIC Kaiapat Markham Valley.

Discharged AIF March 1946, then joined Civil Administration as Patrol Officer Morobe District.

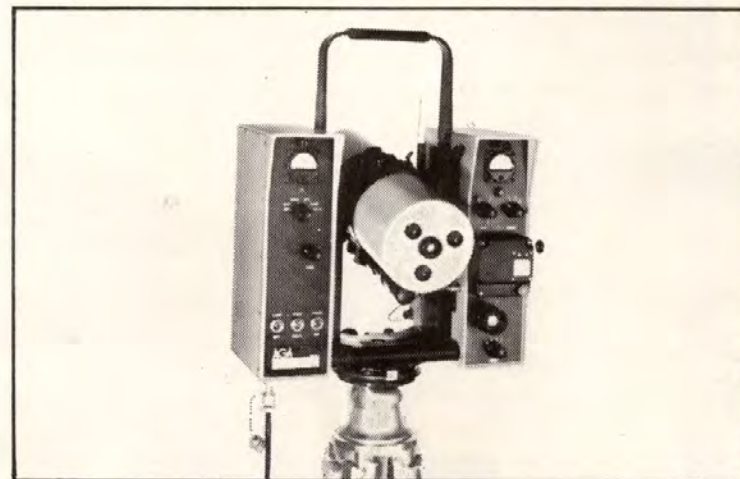
Transferred to Public Work Department, became Town Engineer Port Moresby March 1947. Then transferred to Lae as Engineer in Charge of Wau Labu Road Project - rebuilding the Wau road.

Late 1947 became Engineer in Charge Roads, Bridges, Aerodromes and Wharfs on Mainland of New Guinea - with CDW and Housing.

Sat for Survey Exams August 1948 - passed 8 out of 9 subjects. (Became Licensed Surveyor 1954) - went to Australia, worked at Woomera until May 1949 - spent two years in Darwin gravel washing for Berrima Silica Mining Company - then to South Australia, and back to Sydney to work for MacDonald Constructions.

For the Survey Office that wishes to be more flexible:—

AGA GEODIMETER—Model **6BL**



The Model 6BL Geodimeter measures from 15 metres to 25km with an accuracy of 5mm + 1p.p.m. Measuring time depends on the distance—800 metres may take 1½ minutes—20km may take 3 minutes.

Other features of the Geodimeter model 6BL are:—

1. A visible laser beam for easy target sighting.
2. A weight of 15kg.
3. A low power consumption of 26w.
4. Greater penetration in conditions of mist and haze.
5. 6 km to 3 prisms (16 km to one prism have been recorded).

For demonstrations or further information please contact
AGA Products Australia Pty. Ltd.

SYDNEY: 275 Harbord Rd., Brookvale 2100. P.O. Box 223 Brookvale 2100. Telephone 938 2333. Cables Agafaros Sydney.
MELBOURNE: Simar, 573 Burwood Rd., Hawthorn, Vic. 3122. Phone 81 5527. **ADELAIDE:** K. W. Mayer & Co., 246 Angus St., Adelaide 5000. Phone 223 2055. **BRISBANE:** Herba & Co., 21 Jesays St., Bowen Hills, Brisbane, Qld. 4006. Phone 52 1245.
PERTH: Associated Instrumentation Pty. Ltd., Morley W.A. 6062. Phone 76 4119.



AGA.125

Introducing the
 AGA Geoplane — Model 300

- a completely new rotating laser beam for the Precise and Simultaneous setting out of levels over the entire work site
- without special crew.



ADVANTAGES

1. Saves at least one man for other work.
2. No expensive preparation e.g. batterboards.
3. Has a range of 800 feet which means fewer set-ups.
4. Provides a working area of 220,000 sq. yds.
5. Levels required out of sight of Geoplane are taken using a vertically adjustable Photo-detector mounted on a graduated Rod.

APPLICATIONS

Earth and rock moving, Surfacing, Trenching, Pouring footings, Grading, Pouring floors, Setting elevations for foundations and floors, Footing Piers, Steel floor elevations, Setting "Wet screeds", Setting lintels, Openings in walls, etc.

For demonstrations or further information please contact
AGA Products Australia Pty. Ltd.

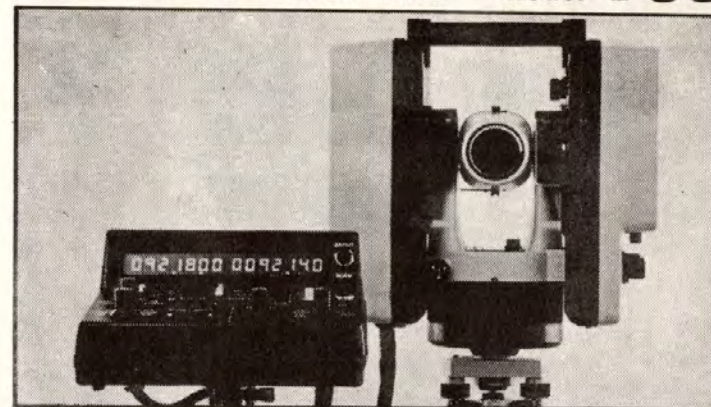
SYDNEY: 275 Harbord Rd., Brookvale 2100. P.O. Box 223 Brookvale 2100. Telephone 938 2333. Cables Agafaros Sydney.
MELBOURNE: Simar, 573 Burwood Rd., Hawthorn, Vic. 3122. Phone 81 5527. **ADELAIDE:** K. W. Mayer & Co., 246 Angas St., Adelaide 5000. Phone 223 2055. **BRISBANE:** Herba & Co., 21 Jeays St., Bowen Hills, Brisbane, Qld. 4006. Phone 52 1245.
PERTH: Associated Instrumentation Pty. Ltd., Morley W.A. 6062. Phone 76 4119.



AGA.130

The fastest and most economical
 combined function instrument in the world —

 AGA Geodimeter — Model 700



The AGA model '700' can be operated in 3 ways:

1. As a 1" Theodolite, with a display of horizontal and vertical angles, or
 2. With a continuous display of vertical angle and slope distance, or
 3. With a continuous display of bearing and automatically reduced horizontal distance.
- any of the three displays obtainable with the flick of a switch.

Field tests prove, compared with a conventional theodolite with attached distance meter:

4. Any setting out work is completed in 1/3 the time.
5. Any traversing is completed in just over 1/2 the time.
6. Any detail work is completed in 1/12 the time.

Other features are:

7. A range of 5 km.
8. An accuracy of $\pm 5\text{mm} + 1\text{ppm}$.
9. Measurements unaffected by temporary beam interruption.
10. Measuring time 10 — 15 seconds.
11. Up to 300 m, a 1" diameter plastic reflector only need be used.
12. Distances displayed in feet or metres with the flick of a switch.
13. Optional 5 or 8 channel paper tape punch for direct data recording, and hence standardising of field notes.

For demonstrations or further information please contact
AGA Products Australia Pty. Ltd.

SYDNEY: 275 Harbord Rd., Brookvale 2100. P.O. Box 223 Brookvale 2100. Telephone 938 2333. Cables Agafaros Sydney.
MELBOURNE: Simar, 573 Burwood Rd., Hawthorn, Vic. 3122. Phone 81 5527. **ADELAIDE:** K. W. Mayer & Co., 246 Angas St., Adelaide 5000. Phone 223 2055. **BRISBANE:** Herba & Co., 21 Jeays St., Bowen Hills, Brisbane, Qld. 4006. Phone 52 1245.
PERTH: Associated Instrumentation Pty. Ltd., Morley W.A. 6062. Phone 76 4119.



AGA.128

Meet the latest and most efficient E.D.M.

AGA Geodimeter – Model 76



The AGA Geodimeter – Model 76 is simple and direct.

It offers:

1. Built in solid state electronics to display distances of more than 3000m in a few seconds.
2. A visible laser beam for easy target sighting.
3. Measurements unaffected by temporary beam interruption.
4. Distances in feet or metres with the flick of a switch, automatically corrected for atmospheric conditions.
5. An accuracy of $\pm 10\text{mm} + 1\text{ppm}$.
6. A lightweight metal construction of only 19 lb. weight.

For demonstrations or further information please contact
AGA Products Australia Pty. Ltd.

SYDNEY: 275 Harbord Rd., Brookvale 2100. P.O. Box 223 Brookvale 2100. Telephone 938 2333. Cables Agafaros Sydney.
MELBOURNE: Simar, 573 Burwood Rd., Hawthorn, Vic. 3122. Phone 81 5527. **ADELAIDE:** K. W. Mayer & Co., 246 Angus St., Adelaide 5000. Phone 223 2055. **BRISBANE:** Herba & Co., 21 Jeays St., Bowen Hills, Brisbane, Qld. 4006. Phone 52 1245.
PERTH: Associated Instrumentation Pty. Ltd., Morley W.A. 6062. Phone 76 4119.



AGA.129

Returned to New Guinea 1954 to work for Hastings Deering, after termination for that company formed T.W. Richards and Associates – the first private surveyor in Papua New Guinea.

Was the conceiver of the Hydro Electric Scheme Ramu Valley – has had several business enterprises associated with surveying – Taraka Estate being the first private development in Papua New Guinea.

Some two years ago formed a construction company with indigenous participation and has high hopes of continuing in this line of occupation for some time.

Has a yen for geological exploration, and has several prospecting authorities in the Morobe District.

Hopes to retire at Arona – and live on a houseboat when the lake is available there.

On many a still night one can still hear the sound of upraised voices issuing forth from the old ComWorks Club –

"Where have all the swamp buggies gone"



Tom Richards in typical pose under the admiring eyes of a bevy of onlookers.

THE SURVEYING EDUCATION CORNER

General

1973 saw a lot of changes in the Surveying Department. Courses in Survey Technician, Valuation and Cartography transferred from Rabaul, Rabaul and Bulolo respectively, and came under the auspices of the Surveying Department.

Those involved in teaching the courses prior to 1973 also came to Lae, and the teaching strength of the Surveying Department was expanded with the arrival of Alan Frith and Mick Eccleston in Valuation, Karl Aschhoff in Survey Technician and Gary Flegg and Murray Day in Cartography.

Student numbers expanded correspondingly and new and continuing enrolments in 1974 gave the following numbers.

Surveying Degree:

Fourth year	11
Third year	18
Second year	16
First year	22

Valuation Diploma:

Third year	5
Second year	9
First year	16

Survey Technician Certificate:

Third year	16
First year	20

Cartography Diploma and Certificate:

Third year	5
Second year	9
First year	9

Total students for the Surveying Department = 156.

For interest, and comparison, other disciplines may also be listed.

Civil Engineering	130
Electrical Engineering	95
Mechanical Engineering	96
Architecture and Building	62
Commerce, Accounting and Business Studies	232

The Surveying Education Corner

Bruce Forster, Acting Head of the Surveying Department during 1973, produced a valuable document for submission as a thesis towards the Degree of Master of Surveying in December 1973. The thesis is titled "The Mapping Needs of Papua New Guinea". It is 250 pages long and contains a lot of good material for those involved with mapping and education.

Alan Frith was instrumental in preparing a submission presented to the government proposing the establishment of a four year course in Land Administration. Government department officers were pleased with the idea of such a new course, but the Government were not prepared to give the course any sanction as a four year course, on the grounds that adequate (in knowledge) graduates could be turned out after three years.

Bruce Forster will be away on Study Leave during 1974; Mike Kellock returns from Study Leave and the Department welcomes new lecturer, Ken Massey, a surveyor from New Zealand.

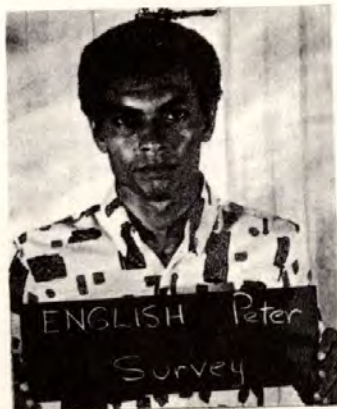
Graduates

The Surveying Degree course produced two graduates at the end of 1973. Our congratulations go to Peter English and Vaki Vailala.

At present Peter is working with the Geodetic Section of Lands Department in Port Moresby, while Vaki is with Lands in Madang.



The photograph above shows Vaki receiving his degree certificate and congratulations from Dr. Matheson, Chancellor of the University.



Peter English may shortly go to Delft for their international course in Photogrammetric Engineering.

The Surveying Department hopes to produce nine graduates this year. The students undertaking the final subjects are:

Aipos Amevo	-	Kainantu
Sam Bilak	-	Rabaul
Akiris Dion	-	Finschhafen
Ray Gadabu	-	Nauru
Jan Hubner	-	Australia
Tony Luben	-	Kavieng
Peter Livuna	-	Honiara
Lionel Paisawa	-	Alotau
Bindum Salamo	-	Finschhafen

Surveying Education

Since the establishment of a land surveying course in 1966 the syllabi of various subjects and the teaching techniques necessary for Papua New Guinean students has undergone a slow transition.

By far the greatest change that has taken place is a recognition of the abilities of our students, and emphasis on developing skills which are so necessary for the trained technologist.

These cognitive skills are numerous. They include understanding of specific ideas, of abstract ideas, the ability to act on such ideas (comprehension, analysis, evaluation), to be able to easily relate to and understand people from different ethnic groups, creative thinking and so on.

By far the best type of education is self education, and accordingly projects are carried out which thrusts the responsibility of the exercise at the student. Sometimes the results are not very encouraging, but in the Papua New Guinean situation, where the "baby" must sink or swim, it is the fastest possible process. In the Australian situation who has ever heard of a Surveyor General in his early twenties and only qualified for a few years?

An interesting exercise was conducted for a few practical periods late in 1973. The third year topographical surveying class had to carry out trigonometric levelling over a twenty-four hour period between two control stations. These stations are about 6 Kms. apart, Mt. Lunamen and Atzera. As a check on their results, and revision in spirit levelling, the line joining the two stations was divided into four, there being eight students. Eight labourers were hired from the exchange to act as staffmen, and when they arrived by truck at the meeting point, both groups eyed each other apprehensively. The students responded quickly, and soon each team was working competently on their particular section. Such a situation can be a large problem for many young graduates.

Another problem in Surveying Education is for the student to see how the work of the Surveyor fits into the overall scheme of a mapping or engineering project. Again careful choice of projects helps this situation. For example to resurvey photo control stations near a hydro-electric scheme, and then visit the mapping organisation responsible for flying the area and producing the maps, and finally visiting the engineering department and seeing how the maps will be utilised, brings all the parts of the project into proper perspective.

Finally the curriculum must be continuously appraised against government requirements. This means close co-operation between teaching staff at the University and the various government departments. Unfortunately attempts to investigate the needs of the departments is sometimes viewed as interference by those "b.... academics".

The Surveying Department has slowly about faced its ideas on the use of computational aids. A few years ago it was felt by the majority that the student should only use logs. until the end of second year, then he was allowed to advance to the hand calculator and finally to the electric calculator. Programmable calculators were for staff only and when not in use were locked away. Now the student may find occasion to be using electric calculators in the first year of his course, and will advance quickly to the more sophisticated calculators which are available.

The area of computational surveying is where the most difficulty is encountered. It has been my own experience that when faced with an interesting project our students have no peers in their field-work enthusiasm, their ability to understand the theory work is good, and then they appear to experience real difficulty when making non-repetitious calculations necessary to convert the data into a required form.

In a study of student progress at the University R. Hind, a lecturer in Chemistry, showed that no student has graduated in surveying whose mark in first year mathematics was less than 56%.

It must be recognised by all that in four brief years only the foundations of making a good Surveyor can be laid; armed with theoretical knowledge the graduates' real training begins after the final exams.

Under the executive guidance of the Regional Surveyor, Bougainville, the organisation of the 9th Survey Congress to be held at Kieta, is proceeding with clockwork smoothness and efficiency.

With the devoted assistance of every practising surveyor on the island, the watering places are being examined with meticulous thoroughness to ascertain their suitability as venues for the varied entertainments and diversions designed to please the most discriminating delegate.

Committee member, Colin Hard, has been despatched to Sydney to study the latest techniques in organisation, congress management and crowd control, and his new-found skills will certainly be utilised upon his return.

It is rumoured that Steve Hudson in Brisbane has had a crash course in hydrographic and underwater surveys and could well write a paper (with his Schaeffer Snorkel) to be delivered along with the host of other brilliant tomes expected at the forthcoming congress.

Stewart Scriven's dissertation on "Pornographic interpretations of aerial photos" could well be the highlight of the numerous papers promised by some of the profession's most learned members.

A comprehensive tour of Papua New Guinea's biggest income earner (after Don Smith) will be a feature of your week on Bougainville, and no stone will be left unturned to make your stay here a pleasant and valuable one.

Register early!

Lae, July 1973

Part Two

Edited Transcripts from the Symposiums

1. Fees and Standards - Chairman, Mr. B.C. Forster.

Speakers: M.J. Larmer, Private Practitioner, Port Moresby.
R.G. Matheson, Surveyor General, Port Moresby.
D.T. Smith, Private Practitioner, Bougainville.
A.E. Naughton, Lecturer in Surveying, Lae.

Mr. Forster began by introducing the speakers, he pointed out that the panel had spent altogether 52 years in Surveying in Papua New Guinea.

With self government and independence just around the corner the profession had to carefully consider whether:

- 1.1 The country can afford to pay the current fees, or otherwise.
- 1.2 The desirability of two scales of fees.
- 1.3 By reducing standards, costs of surveys may be lessened.
- 1.4 If standards are reduced, will there be a monetary saving in the long term?

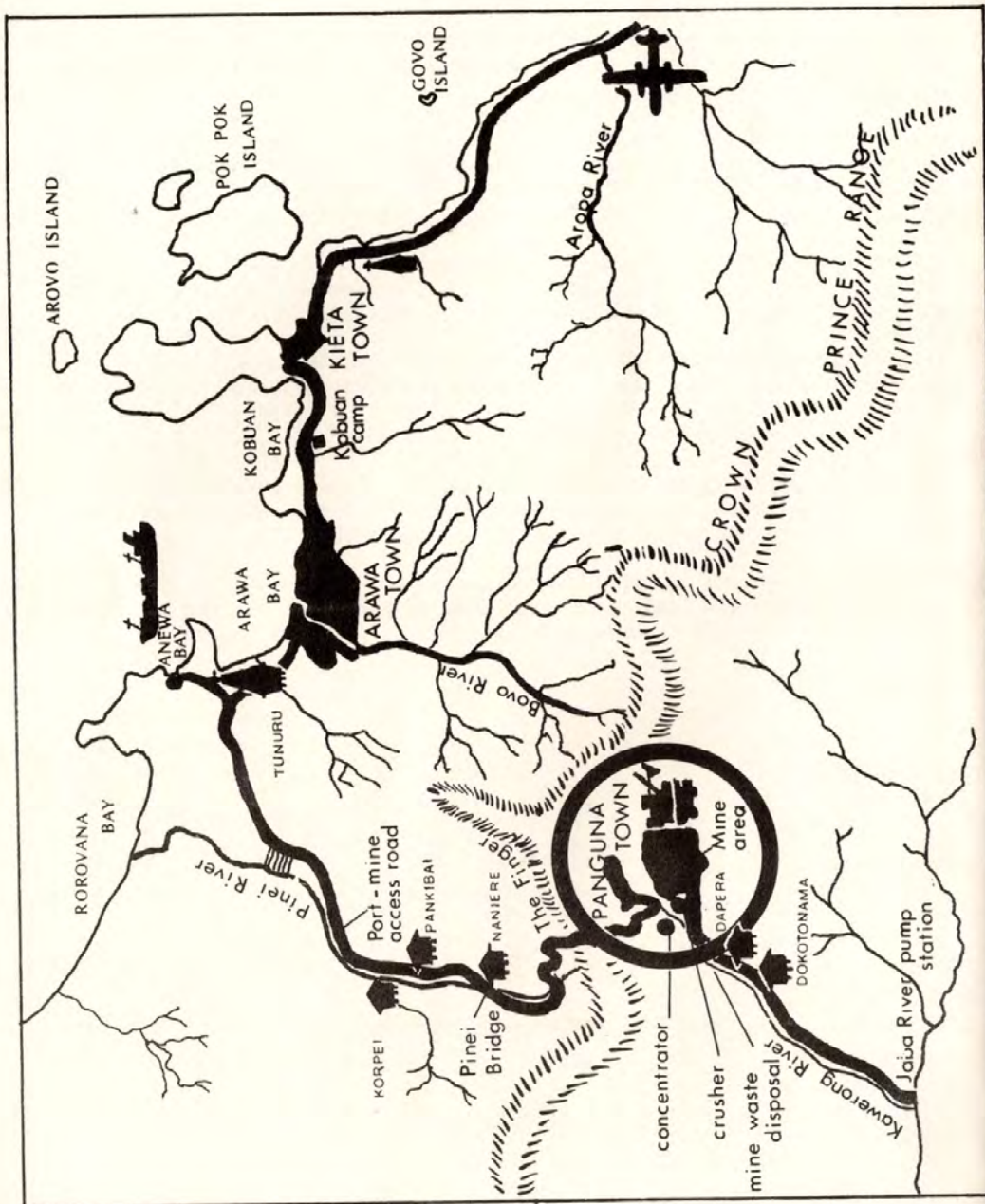
Also with the use made of control stations, whether it would be preferable for government agencies to redefine mathematical standards of accuracy from the present linear representations to positional representations.

The first speaker - Mr. Don Smith.

When preparing this short talk I have attempted to take into account the major facts which came from the seminar held in Port Moresby last April. The government is concerned with the cost of surveys, particularly those associated with low-cost housing development and surveys in subsistence economy areas.

Survey costs are now a large percentage of engineering project costs. It was stated that we, as Surveyors, should do something about this. I had the impression the message ended "or else". Several members suggested that costs are high because standards are high, and these standards are set by the Government Departments concerned.

I think that most of us here have had our fingers burnt by attempting to use assistant surveyors working under the supervision of a qualified surveyor. My experience has been that if you had about three assistant



surveyors, then your whole time is spent just looking after them, and in the long run it would have been more economical to have done the work yourself. Also the work that they have carried out is suspect anyway, not a good legacy to hand on.

A suggestion put forward at the congress is to have the country covered with a sufficiently dense framework of control stations that the work by the assistants may be continuously checked. A good idea but at the moment survey control only exists in the major towns and it is still a big job to check the assistants.

The provision of control is certainly not cheap. One wonders if a country that cannot afford existing standards can afford to engage in a co-ordination programme. Well, it is my opinion that it has to. The overall benefits have been illustrated in many papers at this congress and at previous congresses. When the system is implemented, then ideally the government will be able to relax its standards, which will then mean the greater use of technicians, a decrease in costs. Until this happens I suggest that we maintain our present standards, and give Papua New Guinea the start of a decent survey system. Thank you very much.

The second speaker - Mr. Tony Naughton.

The Scale of Fees and Standards for Surveys have a very strong inter-dependence. We can either relax standards or effectively reduce the scale of fees by getting a greater value for money. The only positive step if we are going to increase this value for the dollar, will be in cutting down the amount of action by the registered surveyor and increasing the participation of the technical officers to something like seventy to eighty percent. This idea has been put forward; it has been put back by the previous speaker; the decision will rest I think with this Association or with the people responsible when the technical officers that we are producing actually show their shape.

The seminar held recently in Port Moresby on the scale of fees and standards produced several recommendations. One recommendation was that a dual scale of fees would be unacceptable in this country. I think that the opposite may be the answer, that a dual scale of fees based purely on a salary basis and overhead will better meet the situation. Naturally as the indigenous surveyor members grow, the more highly paid expatriate will be phased out.

An alternative suggestion to the dual scale of salaries and a dual scale of fees is the possibility of introducing a dual taxation. When the expatriate in the country is given a much greater taxation concession, maybe salaries over \$5000 should be taxed very heavily, but the expatriate if he is required to work here, is given the concession and to all intents and purposes everything would be coming out in the wash.

I think that if any real solution is to be produced on the Scale of Fees and Standards of Surveys, that a fairly extensive research programme is called for. The various government departments already hold information by accounts for previous surveys, the relationship between linear and hourly rates, a comparison between the experienced graduate surveyor and the expatriate surveyor, and the general experience of other recently emerged countries may throw some light on this subject.

The third speaker - Mr. Graham Matheson.

I think if we are going to talk about fees, costs and standards we are talking about cadastral work. Mapping standards are accepted world wide and costs are consequently more or less fixed.

Why do we carry out cadastral surveying?

Following the good Australian pattern, we carry out a survey to provide a person first with a description of his land so that he can have a registered title and his interests protected. Secondly so that he doesn't fight with his neighbours because he knows where his boundaries are.

In a lot of countries, particularly in Europe, cadastral surveys are carried out for another reason, that is taxation. This throws an entirely different light onto costs of surveys.

So first of all if we're carrying out surveys for title registration purposes, we must consider that survey costs have to be related to the potential value of the land. Now to enlarge on this I'll give an example of survey work here for land settlement purposes. The making of surveys for small-holder blocks in rain forest country costs approximately \$25.00 a hectare. Now if this land is going to be used for garden purposes or a reason such as this you can look at the original value of the land and say, it's worth maybe \$5 or \$6 a hectare, and laugh at this survey cost. If it is to be used for oil palm, in four or five years time that land will be worth thousands of dollars a hectare. \$25.00 a hectare to survey this and to provide an insurance scheme as a once only payment is cheap. It could be three times that price.

The big problem is when this cost comes in. Nobody questions a real estate agents 10% when he transfers an allotment because he is taking his money out at the time when the seller is obtaining money from the purchaser. The survey cost comes in before the land reaches its potential value. Now, if the survey is done for taxation purposes the cost of that survey can be obtained in taxation within two or three years and from then on the government makes a profit.

Now standards - reduction in standards are not reflected in costs. The reduction of standards by reducing the competence of the person carrying out the survey is the first side of it. The actual salary of the surveyor or a technician is a very small proportion of the cost of carrying out that survey. Once you reduce the standards you raise costs

in other respects, you raise costs in your office in examining that survey, in providing competent draftsmen to interpret the field notes. So overall I can't see that the cost of a survey is reduced considerably by reducing the qualifications of the person carrying it out.

Secondly the standards that we've already set are quite easily obtainable. They're easily obtainable by any technician produced by the University of Technology. 1:8000 is quite readily obtainable with a theodolite and chain by anybody who knows what he is doing.

The main point that comes up here is the availability of competent technicians. Most of the technicians being produced here are basically people that can accurately traverse between fixed points, plot what they've done and do the simple calculations connected with it.

Any improvement on this, any increase in the use of technicians, we produce somebody that can get out and re-instate boundaries and this is not being done at the moment. So we must look in a separate way, in a new way at the standard of technicians.

So if we are going to use professionals and the country is not producing these people, they must be imported from overseas. They must be brought here on salaries compatible with the countries they come from, or otherwise they won't come.

So if you are going to have a few local surveyors who can compete with these people then good luck to them, let them get that remuneration as well. The country cannot reduce the salaries of its professionals until it can produce the professionals it needs. This is an unlikely situation in Papua New Guinea for some years, possibly for ever. So just in summary, it seems that in the near future surveys will be carried out at expatriate costs and at the standards currently laid down, but because of the high cost of these surveys the surveys must be restricted either to land with a potential value only, or land where there is a political reason, such as tribal warfare, for marking the boundary, or finally for introducing a land taxation system which covers the cost of survey and thereafter the government makes a profit. Thank you.

The fourth speaker - Mr. Michael Larmer.

I agree that the cutting down in standards from 1 in 8000 to 1 in 2000 won't save any money at all. The only reason that this figure of 1 in 8000 came into being was to give reliability of boundary definition by measurement. I think that monumentation is far more significant than measurement. As long as this country has good monuments put in the ground then these best define the boundaries.

Surveys must justify themselves on economical grounds.

I would like to reiterate one point which was made at the April seminar and that is the Administration would prefer to pay for surveys on a linear basis. I don't think this will work in P.N.G. The costs of a professional man to a client should be based on what that man is worth in salary, which in turn is based on his expertise. The government appears to be worried that a salary will be set by the consultant too high for a surveyor, and that the suggested formula of 2.17 times annual salary will give unrealistic costs.

The Minister for Lands, Mr. Kiki, talked about this briefly the other day, and I am sure that he talks for the government and the Chief Minister when he says that a dual scale of fees is most unacceptable. I further agree with Mr. Matheson when he says that a lot of surveyors are needed in P.N.G. to keep the survey programme going. These people have to be appropriately remunerated. Thank you.

Mr. Forster, "Thank you Mick, could we have questions from the floor now please?"

Mr. Valentine. "Mr. Chairman, I don't wish to ask any questions. I would like to make a few statements.

First of all don't begin two Scale of Fees. There is no body better able to assess its own worth than the body itself. You might look at some of the practitioners around who might look as wealthy as J. Paul Getty and say well all practitioners are making a fortune. But just remember this, these practitioners might be the ones who are running their practices as successful businesses, and these days practices are businesses. The continuing survey being carried out by the Accountants at the Armidale University, it was proven that the survey practitioners in Australia were getting two thirds of what they should have been getting compared with other professions, and compared with the comparative salaries of his counterparts in government. You have matters of risk insurance, overheads, 10% interest on his money that he has invested in his practice.

May I also say in respect to Mr. Matheson's statement that survey fees have to be related to the value of the land, why particularly is it the surveyor that has to contribute to the survey of this cheap land?

Having set these fees no practitioner should be asked to prostitute himself by working to a second scale of fees. No other professions have two scales, so why us? Because we certainly give value for work. Thank you."

Mr. Richards. The point I would like to make is for a single scale of fees, but emphasis placed where the more experienced skills of the expatriate surveyor can be used. By this I mean that the skills of the expatriate surveyor, which in most cases are considerably more than the local surveyor, due to a more intensive education and simply having been alive longer and obtained more experience.

I would suggest for consideration that the Scale of Fees should be graduated so that any fees related to control form one part, and that Engineering and Cadastral Surveys should be downgraded in fees so that technicians can be used but always allowing that there is the control to check on these technicians. So that instead of the dual scale of fees and having a European getting more for the same work, we could be using the skills where they are best applied. Thank you.

Mr. Matheson. I just want to make a quick comment on what Mr. Valentine said. When I suggested that survey fees had to be related to the value of the land I meant that we must consider whether the land was worth surveying if it could not support the full professional fee.

Mr. Brown. I believe that the only economic fee must be based on hourly rates, in turn based on the surveyors salary.

Professor Angus Leppin. Mr. Chairman, I would just like to say that it is economic realism to look at the value of land whether you are considering whether to survey it. I think that we must remember that practically every form of surveying and mapping can be applied to cadastral surveying and we should look at the whole range of techniques as possible ways for carrying out cadastral surveys.

If the surveys are postponed until the development has taken place how much time clearing would this save at this later stage?

Mr. Matheson. This question is not easily answered because of the variety of circumstances.

My own view in relating survey cost to the value of the land when the development is usually being financed by some organisation like the world bank is to make the survey costs part of the original loan, and they can then be paid off over a period of time in a similar manner to the loan.

Mr. Mennis. Mr. Chairman, my question is directed to Mr. Matheson who has just returned from an extensive tour of South East Asia, including some countries whom in the near recent past have been through the same transition that now faces P.N.G. Are there expatriates in these countries still doing consulting work, and how does their economic situation compare with P.N.G.?

Mr. Matheson. In Malaysia to be a surveyor you must be a national, and likewise in Singapore. Registered surveyors are hard to come by and they are highly paid. The average income for such a surveyor is \$2500 to \$3000 Malaysian per month, \$A12000 per year. These people get their qualifications overseas. Most of the field work is carried out by highly trained technicians and one qualified surveyor may supervise 7 to 8 technicians. These technicians are trained in local polytechnics and are paid around \$800 Malaysian per month. (\$3.3 Malaysian is \$A1). The cost of living in these countries does not vary considerably from Australia.

Mr. Carson. This initial idea of introducing a lowering of standards voiced in my paper has been carefully discussed and I would now agree with the consensus of opinion which is for maintaining the present standards.

I do not agree with Mr. Richards' idea that control surveys require more expertise and should be chargeable on a higher fee.

Finally I also favour hourly rates as more economic to the government than linear rates.

Mr. Hole. I am tired of hearing this talk that surveys are too expensive. I pay the bills on one hand for a Department, but I am sick and tired of this business, especially from the Housing Commission who have said "Look, we want a cheap block of land, a cheap survey on a block of land, but we still want a title guaranteed." Now you can't have it both ways, and I cannot see any reason why everyone is sitting sniping at the Surveying profession when some of the other professions which are raking it off the top, and doing a tremendous amount of operations in their field by technicians incidentally, and this includes draftsmen and architectural draftsmen. Then it's about time the surveyors turned around to the government and said, "Well look you either want the system or you don't, and if you want it then you are going to have to pay for it." It might well pay for the government to counter costs in some other positions and not just surveying.

Mr. Forster. If there are no more questions? Well I will summarise what the various people have had to say. There seems to have been two main issues.

One is the employing of technicians to reduce costs and a number of surveyors have indicated that this not saving money in the long run.

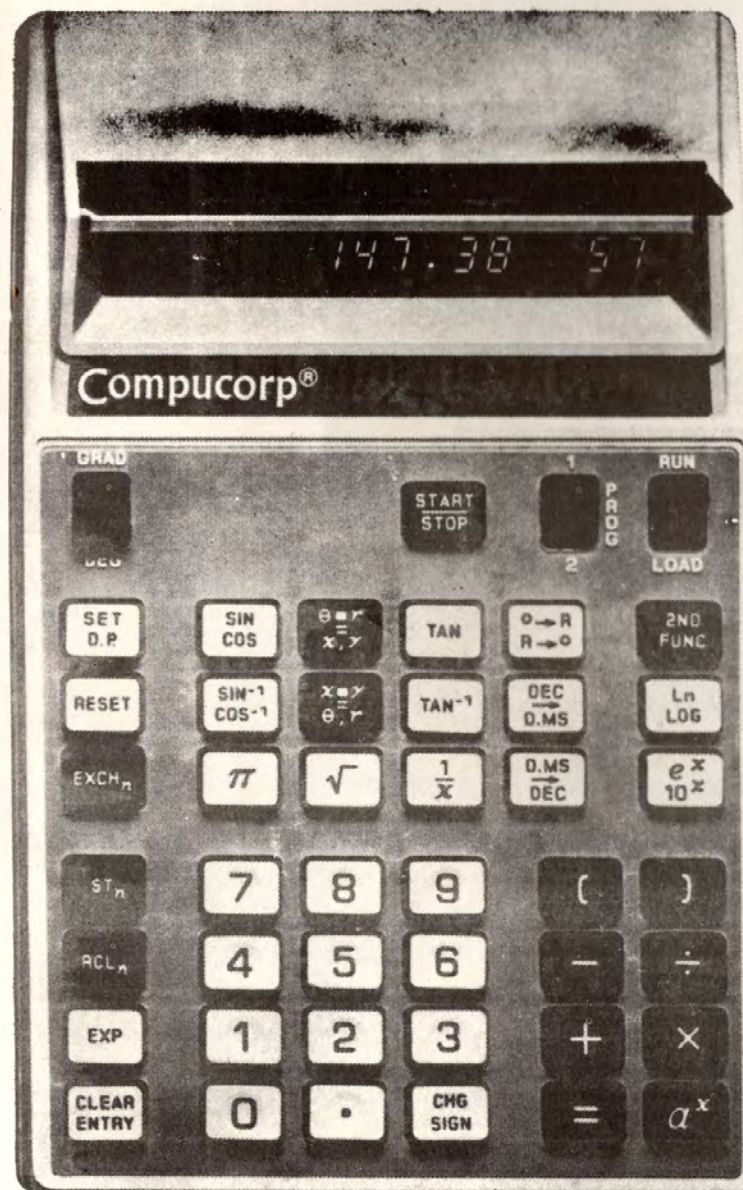
Various methods have been proposed for a dual scale of fees system. Mr. Matheson has pointed out that qualified surveyors in South East Asia are well paid but most of the field work is carried out by technicians working under supervision.

Report - The Eighth Survey Congress

The final point from Mr. Hole is that if the government wants a title which may be guaranteed, then a professional fee must be paid.

It seems that while there is not enough control for integrated surveys we must not lower the 1 in 8000 standards. The Association must press for a denser control framework to be extended over the country.

I thank the four speakers for giving their point of view, they represent a lot of years of experience in Papua New Guinea and their comments have certainly been worthwhile.



**The familiar
face that is still
unique!**

Compucorp 322:

80 program steps
10 registers

Compucorp 324:

160 program steps
10 registers
(can hold two independent programs simultaneously)

Portable, programmable, battery and mains power. Batteries, charger and carrying case supplied.

The survey programs supplied at no extra cost now cover the complete range of problems from closes and areas to traverse adjustments and resections.

*The new prices
are something
else; check
them by calling
one of our
Branches.*

Branch offices in:
MELBOURNE — Ph. 51-0676
582 St. Kilda Road.
BRISBANE — Ph. 29-1811
445 Upper Edwards Street.
CANBERRA — Ph. 95-0593
66 Maryborough Street,
Fyshwick.



Compucorp Calculators sold and
serviced in Australasia by

DATADYNAMICS Pty Ltd,

66-76 Dickson Ave., Artarmon 2064. Tel: 439 4344

Compucorp is a registered trademark of Computer Design Corporation, Los Angeles, Calif. U.S.A.

A. G. BARKER & ASSOCIATES PTY. LTD.

113 HOWARD STREET
NORTH MELBOURNE 3051, VIC.
30 1056.

Australian and P.N.G. agents for:

KERN Surveying Instruments.
THEIS Surveying Instruments.
K & E Drafting Films and Papers.
K & E Drawing Office Supplies.
KERN Drawing Instruments.
LEOPOLD & STEVENS Hydrographic Instruments.

Surveying Accessories:

Field Books, Plumb Bobs, Ranging Poles,
Compasses etc.

First Class Workshop Repairs:

Available for all makes of surveying instruments

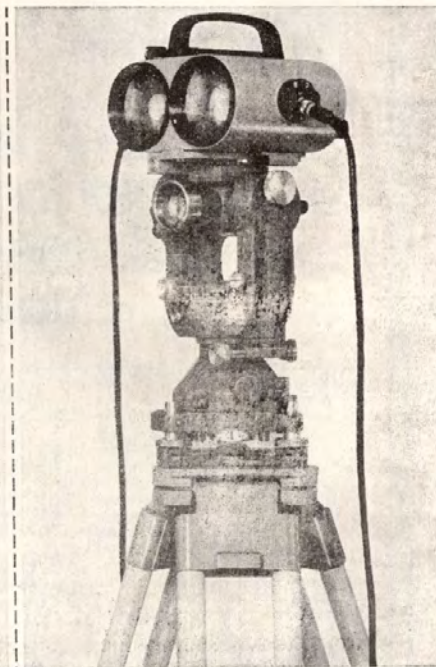
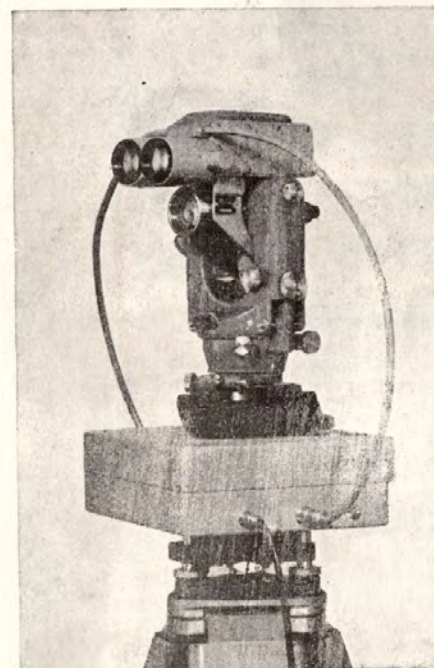
**ALL ORDERS DESPATCHED BY AIR
IMMEDIATELY**

Partners in progress Wild Distomats DI3 and DI10

Two highly efficient surveying systems in combination
with Wild T1A, T16 and T2 theodolites

Wild DI 3 IR reduction tachometer with fully automatic distance measurement, for short-range work up to 300 m. Displays horizontal distance and difference in height after tapping in the vertical angle. The solution for complex survey tasks in developed areas. Ideal for urban surveys, engineering projects, setting out irrigation, land consolidation, cadastral surveys, detail work, contouring, volumes studies, etc.

Wild DI 10 IR tachometer tried and tested by thousands of satisfied users. Distance runs in automatically and display follows up reflector movement for setting out. Range up to 2000 m. Perfect instrument for control surveys, precise traversing, trigonometrical heighting, photogrammetry control determination. Also suitable for polar co-ordinate method for precise fixation and even for detail and contour surveys. Versatile, general purpose instrument for practically every type of task within the 2 km range.



WILD
AUSTRALIA

WILD (AUST.) PTY. LTD.

N.S.W.: 45 EPPING ROAD, NORTH RYDE. PHONE 888 7122
VIC.: 5 ERROL STREET, EAST PRAHRAN. PHONE 51 9101
QLD: 11 BUCHANAN STREET, WEST END. PHONE 44 3455

INTERSTATE AGENTS

S.A.: General Equipments Pty Ltd,
9 Osmond Tce, Norwood.

N.T. Hermes Sales Pty Ltd,
1664 Coonawarra Rd, Winnellie, Darwin.

TAS.: J. Walch & Sons Pty Ltd,
130 Macquarie Street, Hobart.
W.A.: Henderson Inst. Co. Pty Ltd,
309 Hay Street, Subiaco.
T.P.N.G.: Brian Bell & Co. Pty Ltd,
Turumu Street, Boroko.

MEASUREMENT & COMPUTATION: AT WORK IN PROBLEM SOLVING



Now HP has a scientific calculator for any conceivable application, solving every problem need...

It's the range that counts!

Because you're faced with a wide range of complex scientific calculations, we've designed a wide range of HP calculators. In fact they are more like mini computers with the various tasks that they can handle. Knowing that precise, quick computations have often to be made on the move, we've designed our pocket-sized series — the HP35 and HP45 weighing only 9 ozs. For those needing a large desk-top model we've produced the HP46 and HP9810, which give a permanent

print-out for any complex calculation. If your business borders on science, engineering, surveying or mathematics, Hewlett-Packard has an answer to any of your calculation problems.

Send this coupon to the address below for additional information and prices on any one or all of our calculators without obligation. Please tick appropriate square/s.

☐ HP35 ☐ HP45 ☐ HP46 ☐ HP9810

Name
Address
P/Code
Telephone no.
Publication name

90401A 30138



Sales and service from 172 offices in 65 countries.
Australia, 22-26 Weir Street, Glen Iris 3146, Victoria. Telephone 20 1371. Other offices: Adelaide, Brisbane, Canberra, Perth and Sydney. Also Auckland and Wellington, New Zealand.

A.M.P. SOCIETY

COST FREE SURVEY NO OBLIGATION



Brian Sullivan Ron Hall & Associates

UNITED CHURCH BUILDING
DOUGLAS ST., PORT MORESBY
P.O. BOX 599 PHONE 2528

If you are not completely satisfied that the following insurance and assurance needs are completely covered, please indicate by a tick.

SUPERANNUATION
PARTNERSHIP
FAMILY SECURITY
CHILDRENS ADVANCEMENT
EDUCATION
ENDOWMENT
PROBATE

FIRE
WORKERS COMPENSATION
HOUSEHOLDERS &
HOUSEOWNERS
ALL RISKS
COMPREHENSIVE MOTOR
VEHICLE
COMPULSORY THIRD PARTY
PUBLIC LIABILITY AND
ALL OTHER CLASSES OF
GENERAL BUSINESS

NAME
ADDRESS

A.M.P. Society

WILD
HEERBRUGG

Surveying Instruments

FOR ALL APPLICATIONS



ELECTRONIC DISTANCE MEASURING

DISTOMAT

Range 55 yards to 95 miles.
Digital read out.



LEVELS

For Builders, Surveyors and Engineers. Dumpy, Tilting, Automatic, with or without horizontal circle.



LEVELLING STAVES

Precision Invar,
folding, telescopic
and self computing.



DRAWING INSTRUMENTS

Stainless chromium steel. Individual instruments or complete sets.

GYRO COMPASSES & CLINOMETERS

Prismatic, geological
and boat compasses.



FIELD BOOKS PLUMBOBS RANGING POLES OPTICAL SQUARES

TRUE NORTH INDICATOR

Attachment for
Standard Theodolite.



THEODOLITES and TACHEOMETERS

With full range of accessories. STURDY CONSTRUCTION designed for Compass Traverses, Cadastral Surveys, Triangulation, Building construction, Mining, Topographic and Astronomical applications.

YOUR WILD MAN IN PNG.

BRIAN BELL & CO. PTY. LTD.

TURUMU STREET, BOROKO, P.M.
BOX 1228, BOROKO, PAPUA