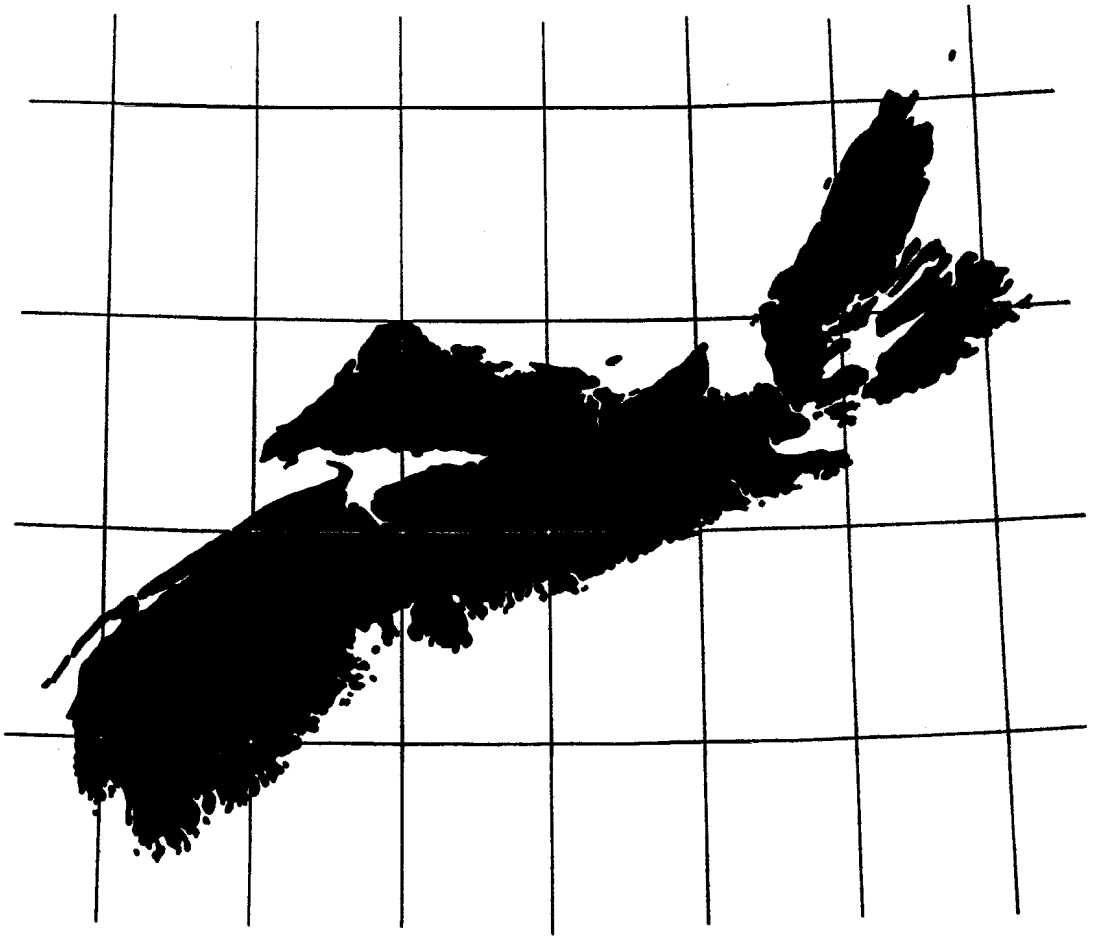
The NOVA SCOTIAN SURVEYOR



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Editor

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14th ANNUAL MEETING

of

THE ASSOCIATION OF PROVINCIAL LAND SURVEYORS OF NOVA SCOTIA

GENTLEMEN: It is with pleasure that I welcome you to this the 14th Annual Meeting of The Association of Provincial Land Surveyors of Nova Scotia.

As you are aware we are in a new location this year and we trust that it will work out accomadatively, socially and financially to our mutual benefit and enjoyment. Due to rising costs we were forced to try a new location more adapted to our size or raise our annual fees, as each year it was becoming necessary to subsidize the Annual Meeting more and more from our dues.

We are pleased and honoured to have with us distinguished visitors from other Associations and Institutions. We trust that your stay with us will be a pleasant one and that you will come back again next year. If at any point through our meeting you would like to contribute to the discussions please feel free to do so. In any case we will be calling on you a little later to stand and be identified.

As in other years the usual number of Council Meetings were held spaced as follows: November, December, February, July and October. These meetings were well attended at I know a considerable expense of time and effort, especially those who had to come from the further sections of the Province. There were the usual routine matters and a number of complaints to be dealt with, most of which I trust were satisfactorily concluded. Several items required further investigation and were turned over to committees for that purpose.

Following the custom of other years your Association was represented at the Annual Meetings of other Survey Associations by your President who visited the Association of New Brunswick Land Surveyors, held at Fredericton, January 18th and 19th, 1964; the joint meeting of the Association of Ontario Land Surveyors and the Canadian Institute of Surveying held at Ottawa, February 17th to 21st, 1964, and the Massachusetts Association of Land Surveyors and Civil Engineers at Lennox, Mass., on October 2nd and 3rd, 1964.

Mr. J .E. R. March, Director of Surveys, Department of Lands and Forests, and a Councillor of our Association arranged to attend the Annual Meeting of the Association of Newfoundland Surveyors in his official capacity and agreed to represent the Association. However a combination of weather and business committments prevented him from getting there.

Fortunately this did not prevent him from attending the Annual Meeting of la Corporation des Arpentuers-Geometres de la Province de Quebec at Quebec on June 2nd and 3rd, 1964.

At all these functions we were royally entertained and came away feeling that it was good to belong to such fraternal organizations. When one gets to attend these annual meetings of the other Associations, hears the high order of business carried out, listens to the various papers and discussion panels, sees the new, varied and precise types of Instruments, Computers, Plotters etc., coming into use each year, it is then we realize how important it is that we must keep upgrading ourselves and raise our standards to meet the challenges of a fast-growing technical profession. I suggest to you that you owe it to yourselves to make an effort to take in some of these annual events each year. If you go once I am sure you will want to go again.

As your President I also had the privilege of being present at the Closing Exercise of the Nova Scotia Land Survey Institute at Lawrencetown in company with other members of the Council.

To the outgoing members of the Council I wish to express my appreciation of their work during the year past and to the Association for the honour of having been your President.

J. F. ARCHIBALD

LETTER TO MAJOR CHURCH

Apt. 305,
211 Bell St.,
Ottawa 4, Ont.,
Oct., 27th, 1964

Dear Major Church:

Recent readings have prompted me to write some of the following enclosed statements.

If you find them of value to your committee or in publication please feel free to use them.

Hoping you and Mrs. Church are feeling fine and wishing you the best.

Yours turly,
C. B. Carlin.

Mr. Cyril Carlin

is a graduate of the Nova Scotia Institute of Surveying who subsequently served some years with the Legal Surveys in Ottawa.

He then went to U. N. B. and took a course in Advanced Survey, under Professor Konecny, graduating, I believe but perhaps this requires verification, at the head of the class.

He is a perfectionist. - and a real person.

J. A. H. C.

CO-ORDINATE CONTROL

by C. B. Carlin

The following are some thoughts on co-ordinate control systems and their users.

Over the past few years much talk and interest has been generated over the use of Provincial and City Co-ordinate Control Systems. Many cities have had the control established but much work is still required in order that its potential can be fully developed.

One of the primary tasks of the Surveyor is to locate the original monument or to retrace the original line. To do this today requires the expenditure of considerable sums of money in many instances. As members of a profession we should be interested in the expenditure of our resources.

If time and man hours are used in the retracement of surveys and if these are increased due to insufficient evidence left on the ground and poor recording practice then we should be interested in a system which tends to improve the situation.

Our ancestors carried out surveys to the best of their ability. Some of these surveys are more readily retraced due to the evidence they left behind. We today are able to acquire a high relative accuracy in our surveys. Some of these surveys are tied to monuments with a relatively long life while others are tied to monuments with a relatively short life. Our files are becoming filled with neatly drawn plans produced from the efforts of many but many of these plans are going to be of no more value in the future than those of our ancestors because of the inability of being able to correlate them to features on the ground. Thus many maps and plans shall become expensive sketches.

A co-ordinated system of monuments is of value to the surveyor and his client because the surveys executed can be tied to a common system. Thus the entire system has to be demolished before the parts can not be retraced.

When one stops to consider the amount of effort put into surveys during the past 200 years and the proportion of that effort which can be used today, one is confronted with the thought that maybe a little improvement can be made.

If evidence of past surveys was available today it would be of considerable value in the control of aerial photographs. A large percentage of the photogrammetric control established today is used only for the job at hand with no concrete evidence left for its future use. Must we use our efforts to perpetuate a vicious circle or do we have the courage to embark on a spiral which can either rise or fall depending on where we stand?

Numerous government and private agencies carry out surveys. If the work accomplished by those concerned was preserved on a common system a reduction could be made in the duplication of work.

A control system is not only of value to the surveyor but to every engineer and planner who is interested in dealing with land measurements. Under an integrated system of surveys work done by various agencies would be available to all.

The establishment of a control system is not a legal problem and neither is its use a legal problem, but to be of value it must be used by those responsible for the carrying out of surveys of various kinds.

A control system provides a strong network for the orderly development of maps and plans and for the correlation of surveys carried out on an integrated basis.

There is ample material available pertaining to the establishment and use of control systems. A recent article written by Mr. K. Pawson presenting the suryevors' point of view was published in Vol. XVIII, No. 4, September of the Canadian Surveyor.

The people that need convincing of the value of a co-ordinate control system are not the public in general but us in particular for we are responsible to the public.

"Plane Co-ordinates for Surveyors" by J. E. Lilly, Canadian Surveyor, or 1960, pp 100 - 106.

"Plane Co-ordinates for New Brunswick, Stereographic Projection", Geodetic Survey of Canada, 1959.

"The Need for a Co-ordinate System of Survey Control and Title Registration in New Brunswick" by W. F. Roberts, Canadian Surveyor, 1960, pp 302 - 308.

"The Moncton Adjustment" by H. Klinkenberg, Canadian Surveyor, 1962, pp 11 - 23.

"The Use of the Model 4 Geodimeter in Establishing Basic Control in the Province of New Brunswick" by W. F. Roberts and G. Konecny, International Congress of Surveying, Vienna, 1962.

"The Use of Tellurometer Observations in Establishing a Co-ordinate Survey Control System in the Province of New Brunswick, Canada" by G. Konecny and W. F. Roberts, Tellurometer Symposium, London, 1962.

"Electronic Surveys in New Brunswick" by G. Konecny and Willis F. Roberts, Journal of Surveying and Mapping Division, ASCE, Vol. 89, No. SU 3, Proc. Paper 3666, October, 1963, pp 17 - 36.

"Data Processing for the New Brunswick Co-ordinate Survey" by A. W. McLaughlin, paper presented at 1962 Annual Meeting C. I. S.

"Control Surveys by Geodimeter and Tellurometer in Canada" by G. Konecny, paper presented 43 Annual Meeting of Highway Research Board, January 1964, Washington, D. C.

R. R. No. 3, Lawrencetown
Nova Scotia
October 26th, 1964

R. E. Millard Esq., P. L. S.
Editor
The Nova Scotian Surveyor
P. O. Box 1541
Halifax, N. S.

Sir:

Re: Board of Examiners

Judging from the usually small percentage of members of our Association who attend the Annual Meeting, it would appear that the best way to ensure that every

member is appraised of the recent action of the Board is to publish the matter in the Association magazine. I shall be obliged if you can see your way to insert this letter in your next issue.

See Appendix Page 6

In the May 1964 examination, two categories of candidates were examined, viz, Intermediate and 1st Final. There were six papers set for each category and 3 hours was alloted for writing each paper. Of these six papers, five were on subjects common to each category of candidates, the sixth set of papers was for spherical trigonometry Intermediate and legal for the 1st Final.

It appears to be the custom in all Provincial Land Surveyors' Associations that the final examination requires a higher standard of attainment for Final candidates than from the Intermediate. In the Nova Scotia examinations this principle has been abandoned and we find that in the three sets of papers dealing with subjects of peculiar moment to Land Surveyors, other than mathematics, each category is required to answer the same number of questions and in Astronomy 66.7 per cent of questions were identical, in Curves & Survey Methods 62.5 per cent were identical, and in Mensuration & Theory of Instruments 85.7 per cent of questions were identical.

This state of affairs is unfair to the candidates presenting themselves for examination and is proof positive that the Board of Examiners have lost control of the situation under the conditions of operation as at present existing. Manifestly in all three papers dealing with survey matters any Final candidate can pass on the standard required for the Intermediate, which is an innovation if nothing else.

The situation of our Association is desperate; should the Delegating Authority, the Provincial Government, enquire into the matter, there is no valid defense to be offered. This requires no knowledge of survey on mathematics, it is merely a question of the more advanced students being examined on the identical questions set for the less advanced.

The fault is that of each and every member of the Association because during the formative period of our Association the burden fell perforce upon the metropolitan members and we sat back complacently letting them shoulder the burden. The only remedy is that each of us must be ready to co-operate with Council in the overhaul of the Board of Examiners so that this vital part of our work may be put on a reasonable footing.

If anyone requires proof of our lack of interest, a perusal of the back numbers of the Nova Scotia Surveyor will go far towards convincing him. If each of us refuses tc submit to the discipline entailed by working for our Association, he can not expect it to continue to exist.

Yours faithfully,
James A. H. Church, P. L. S.
Registration No. 20

APPENDIX

MAY 1964 EXAMINATIONS

SUBJECT	NO. OF QUESTIONS			COMMENT
	Intermediate	Final	Identical In Both Categories	
1. Algebra	5	5	Nil	Inter. — Within capacity Grade XI A two hour paper Final. — A two hour paper
2. Astronomy	6	6	4 66%	Inter. — Ambiguity No. 1, 2 (c) and (D) No solution as set No. 4
3. Curves and Survey Methods	8	8	5 62.5%	May well be regarded as an aptitude test for Dept. Highways
4. Legal	Nil	Not Known	Nil	Candidates sitting at Lawrencetown were issued with one sheet of questions, six in number. Balance of paper not available.
5. Mensuration & Theory of Instruments	7	7	6 85.7%	Question No. 1 (in both) contains a gross error due to lack of proof reading
6. Spherical Trigonometry	5	Nil	Nil	A 2 hour paper below standard of B. C. preliminary.
7. Trigonometry	5	5	Nil	Inter. — A 2 hour paper Final. — A 1½ hour paper

"SATELLITES"

by M. W. BURKE-GAFFNEY

AT 14th ANNUAL MEETING OF THE ASSOCIATION
OF PROVINCIAL LAND SURVEYORS OF
NOVA SCOTIA

NOVEMBER 7th 1965 AT THE

CITADEL MOTEL
HALIFAX, NOVA SCOTIA

After I had been asked to speak to you about satellites, I asked myself the question "What have satellites to do with Land Surveying - with 'pieces and parcels of land'?", and I came up with the answer: "Nothing - that I know of."

However, satellites have had, and are having, a role in Geodetic Surveying, so I thought that I might commence there.

There is, at hand, a recent example, - the story of which goes back to the 19th century. In the 19th century the British Admiralty determined the geographical position of Bermuda. In 1937, the Admiralty decided to check the position, and by astronomical observations found that it was not precisely where it had been thought to be. In 1943, the United States established bases on Bermuda, and decided to check precisely their positions. A double check was made. - The U. S. Navy made its observations and the U. S. Coast and Geodetic Survey made its observations. The two sets of observations led to different results which were different from both the British Admiralty 19th century results and its 1937 results. The average of the 1943 results were taken and called the Bermuda Datum 1943.

In 1957, the U. S. Naval Oceanographic Office carried out various experiments on sub-oceanic gravity and came up with a new position of Bermuda: the 1957 Datum.

In 1959, the U. S. Air Force got into the act, and by simultaneous observations from different positions in the air came up with the Bermuda 1959 Datum.

This year, the U. S. Coast and Geodetic Survey, rechecked, using the Satellites Echo I and Echo II. From Bermuda, Maryland and Florida simultaneous observations of Echo I were made, when its position (at a height of about 1,000 miles) was well known and checked from other stations. These observations alone, (which were made when the satellite was over a point between Bermuda and the coast), would have been very good alone. But other observations were made on Echo II (at a height of about 800 miles). And still further observations on each of the satellites as they were visible in the sky the same night, a short time apart.

The net result is that the U. S. Coast and Geodetic Survey is satisfied that Bermuda is 220 feet North and 105 feet West of where the U. S. Air Force reckoned it to be in 1959. (U. S. Coast and Geodetic Survey, 1964).

The more commonly accepted opinion is that previous observations were not so good. The suggestion that Bermuda has changed its position is unacceptable to most geophysicists. Why this is so, I shall now, endeavour to explain.

Before any Sputniks had been launched, astronomers foretold how they would move. If launched in a polar orbit, that is at right angles to the equator, the elliptical orbit in which a satellite would travel would be stationary in space. The earth would rotate underneath this stationary orbit, giving the satellite a seeming westward motion in the sky.

If launched in a South-Easterly direction, (as are satellites launched from Cape Kennedy), the plane of the orbit would not be stationary, because the satellite would be constantly drawn towards the bulge in the earth's surface at the equator. The seeming westward motion in the sky, due to the rotation of the earth (observed when a satellite was travelling in a polar orbit), would be reduced by an easterly precession.

The first Sputniks were found to accord pretty closely to theory. But their motion was not quite as smooth and regular as anticipated.

As early as 1959, observations showed that the eccentricity (or flattening) of the elliptical orbit of the Vanguard satellite had a periodic variation.

The explanation of the variation has been graphically described as saying that the earth is pear-shaped. (O'Keefe, Eckels and Squires, 1959). The explanation was derived from a mathematical analysis of the third zonal harmonic of the satellites orbit (O'Keefe, 1960).

Before the Space Age, the earth was considered to be an oblate spheroid, that is like an orange, which was pressed down, so that it had a noticeable bulge in the middle. When the earth is said to be pear-shaped, we have to consider the North Pole to be where the stem of the pear is, and then the pear to be pressed down so that it bulges and has its distance from pole to pole less than its equatorial bulge.

For purposes of study, measurements of the earth's size and shape are compared with an ellipsoid, which is conceived as being generated by the revolution (around its minor axis) of an ellipse with a semi-major axis of length 6,378.17 Km. and an ellipticity (or flattening) of 1/298.26 (Allen, 1963).

The notion that the earth was an ellipsoid fitted in very nicely with the theory that it was a plastic body which owed its shape to its rotation, mass and gravitational pull towards the centre.

However, even before the Space Age, gravitational measurements, in various places on the earth, were found to disagree noticeably from what would be expected if the earth was ellipsoidal. Also, the discrepancies were too great to be accounted for by nearby topographical variations (such as mountains or valleys). The geophysicists realized that they were hampered, in reaching conclusions, by want of evidence. All their gravitational measurements were made on land. Now, only about one-fifth of the earth's surface is land, so there was about 80 per cent of the earth's surface from which they had no measurements.

The launching of satellites has proved to be a great boon. Since the launching of the first Sputnik in 1957, there have been launched more than 300 satellites which have made more than 20,000,000 orbits. There has been ample opportunity to study their orbits, and the variations in the gravity pull to which they are subjected as they circle the earth. Studies suggested that the earth resembles a pear, not only in having greater sphericity at the north pole than at the south pole, but also that it has dimples and moles around its equator.

Detailed analysis of the gravitational variations around the equator of the earth, shows that the equator differs from a circle of radius 6,378.17 Km. in having a rise of 9 meters at longitude 0 degrees (in the Atlantic south of Ghana), a dip of 59 meters at longitude 75 degrees E., (in the Indian Ocean), a rise of 57 meters at longitude 150 degrees E., (in the Pacific Ocean, north of the eastern tip of New Guinea) and a dip of 20 meters at longitude 240 degrees E., (in the Pacific Ocean, south of California and west of Ecuador).

These anomalies indicate variations in gravity which depend upon the distribution of mass within the planet. They imply that the interior of the earth is not in hydrostatic equilibrium (Jastrow and Cameron, 1964).

Evidence of the absence of hydrostatic equilibrium within the earth was obtained also from satellites sent up to measure the infra-red radiation being given off by the earth.

Radiation given off by the earth is partly reflected sunlight, and partly infra-red radiation; which comes, originally, from the interior. As these two radiations are of separate wavelengths, they are readily distinguished, one from the other.

Four of the eight Tiros satellites launched in the past four years carried a set of infra-red detectors. These detectors found that over the Indian Ocean, where the equator is depressed, the infra-red radiation is greater than average, and over the elevation in the Pacific the infra-red radiation is less than average. The average flow of heat outwards through the crust of the earth, in ergs per cubic centimetre per second is 60. Over the Indian Ocean it is 80, and over the Pacific 40. These measurements fit the theory that the infra-red radiation comes from the deep interior of the earth. They also suggest that the nearer to the core of the earth that the surface of the earth is at any place, the greater is the infra-red heat at that place.

The average flow of heat through the crust of the earth is higher than was anticipated. This result suggests that the crust of the earth is thicker than it was thought to be.- As a consequence, the theory of continental drift is now difficult to sustain (MacDonald, 1964).

This brings us back to Bermuda. The differing values for the latitude and longitude of Bermuda, which have been accepted, at different times, during the past hundred years, do not indicate that Bermuda is drifting. We like to think that our methods of measuring are improving, and that for Geodetic Survey, the satellites are the best measuring instruments at present available.

The Tiros satellites were launched, primarily, to study cloud cover. They have gathered information not available from ground observations.

The energy balance of the earth-atmosphere system is the difference between the incoming solar radiation, mostly in the visible region of the spectrum, and the outgoing terrestrial radiation in the infra-red.

The primary effect of clouds, in this connection, is to reflect the incident visible solar radiations. But they are also strong absorbers of infra-red radiations.

A diagram of the average cloud covering over the earth (Arking, 1964), based on Tiros III photographs shows that it reaches a maximum of about 70 per cent near latitude 55 degrees N. It falls off to about 43 per cent at 23 degrees N., and then rises to about 52 per cent at 10 degrees N., - after which it falls off to its minimum of 43 per cent again, and rises to its maximum of 70 per cent near latitude 55 degrees S. The secondary maximum, at 10 degrees N., occurs at what was already known, from ground observations, as the average position of the 'thermal equator' during the period from mid-July to the end of September. (Telegadaes and London, 1954).

The combined infra-red heat and solar heat on the surface of the earth is a maximum at 23 degrees N., of the geographical equator and 4 degrees S. The bulge of the equator reduces the infra-red radiation.

Two years before the first Sputnik was launched, the launching of satellites was planned. They were planned as part of the I. G. Y., to study the upper part of the atmosphere, known as the Ionosphere. -

Before the Space Age, about all that was known about the Inosphere was that it was made up of charged particles called ions, and that it seemed to have three layers, named D, E and F. D went from 40 to 50 miles up, E 50 to 85 and F 85 to 600. The ordinary broadcast waves could be bounced off D at night. In daytime D disappeared,

and the broadcast waves from about 750 metres down to 180 metres were bounced off E. The short-wave broadcasts (180 to 15) were bounced off F. When attempts using shorter waves were made they just wouldn't bounce. They went thro' the Ionosphere into space.

We are very happy about this now. Satellites which go off beyond the 600 mile limit, use wavelengths less than 15 metres, and their signals pass through the Ionosphere to us.

Satellites which go beyond the Ionosphere have discovered that the Sun and other stars broadcast on all wavelengths. Any wavelength greater than 15 metres coming from the Sun or other stars is bounced off the top of the Ionosphere, and is reflected back into space. Wavelengths less than 15 metres, coming from space pass through the Ionosphere, but if they are less than about 1 millimeter they get absorbed by our lower or ordinary atmosphere, unless they be as short as from 4 to 7 ten thousandth of a millimeter. These wavelengths get thro' to us, and are known as visible light. Shorter wavelengths, such as ultra violet, x-rays and gamma rays react with the atoms at the top of our atmosphere, - indeed the ultra-violet radiation is mainly responsible for the ions which go to make up the Ionosphere.

The Satellites flying above 600 miles found that our ionosphere did not end there. That height is the end of ions formed from the heavier elements of the atmosphere such as Oxygen and Nitrogen. Above that was found a hydrogen belt extending out to 1200 miles. It was thought to start at the 600 miles level, until an analysis of the drag on Echo 1, flying at 1,000 miles, suggested that it was flying thro' helium. A short time later it was verified that there is a Helium layer, below the hydrogen layer and above the oxygen-nitrogen layer.

The satellites flying below the 1200 miles limit have filled out our knowledge of the Ionosphere, and what goes on there. Those which fly higher have made discoveries.

The first great discovery was a Van-Allen belt at a height of about 2,000 miles, and then another at a height of about 10,000 miles. The inner belt is predominately protons, and the outer electrons. Later explorations (mainly by the Explorer 10 and 12 satellites in 1961) show that there is really only one belt, but with its peak levels of radiation at the places where it was first found. Furthermore it has been found by these Explorer satellites the belt stretched out to about 44,000 miles, (71,000 Km.), where they merge with interplanetary space.

The explanation of these belts are that they are electric particles which have come from the sun and are trapped in our magnetic field. This incidentally indicates that our magnetic field stretches this far. The satellites found that the belt is being continually buffeted by a rain of particles, called solar wind, from the sun, which tends to compress the belt on the sunlit side, and to blow it away from us on the dark side. On the dark side it has been found to be blown off to 100,000 miles, at which height some particles escape, but they are being replaced on the other side.

In the past three months there have been launched a few satellites which will increase still more our knowledge of the earth on which we live. On August 28, there was launched an improved weather satellite, Nimbus, which is in a polar orbit at a mean height of about 415 miles. It was designed to send back 2,000 photos a day, covering the entire 200,000,000 sq. miles of the earth's surface. - Nimbus works seven days a week. - The problem of studying its 14,000 photos a week may result in our learning six months from now what it discovered yesterday.

On September 4th there was launched an Orbiting Geoghysical Observatory. It moves out to nearly 93,000 miles from earth and comes back to within 175 miles of us. Unfortunately, one of its sensors view of the earth was impaired by the failure of two

boons to deploy, but sufficient data is being received for 15 out of its 20 experiments to be profitable. (Sky and Telescope, 1964).

On September 17th, a satellite which had lost its voice regained it. - It was launched in November 1963, and has lived up to the name then given to it: Imp. - It goes out to nearly 123,000 miles from us, and was launched to investigate all that is measurable in the space between the Van-Allen belt and the moon. - This is a region beyond the orbital limit of this paper on the Satellites and Our Earth.

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IN MEMORIAM

January 28, 1965

OTTAWA (CP) — Henry West, 66, head of Technical Information Services with the Federal Department of Mines and Technical Surveys, died of a heart attack Tuesday night. An officer with the Royal Canadian Engineers during the Second World War, he was a past president of the Canadian Institute of Surveying and contributed in large measure to map - making in Canada.

As we go to press we regret to announce the sudden passing of a Valued Member of the Surveying Profession in Canada.

Reprinted from The Engineering Journal. February 1964 issue

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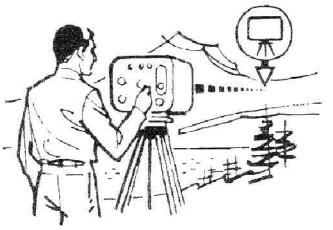

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- Only 3 main operating controls.
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MALAWI CALLS FOR CANADIAN LAND SURVEYORS

The newly formed East African State of Malawi (formerly Nyasaland) has asked Canada for technical assistance in land surveying. Since local survey assistants will require several more years of training before they reach the professional standards maintained by expatriates during Colonial Rule, technical assistance from abroad is urgently needed. Canadian foreign aid advisers will mainly be concerned with cadastral surveys in the field and with the drawings and computations of the same while they are training their local counterparts to take over their responsibilities as soon as possible. The four Canadian surveyors requested will be stationed in Blantyre, where the recipient Government will provide married/single quarters with basic furniture. Candidates selected will contact with the External Aid Officer in Ottawa for one year initially with the possiblity of extension to two or three years. Fees and allowances are attractive; generous leave arrangements and free travel to duty station for advisor and dependents. For further information contact External Aid Officer, Advisor Section, 75 Albert Street, Ottawa 4, 613 - 992 - 0455.