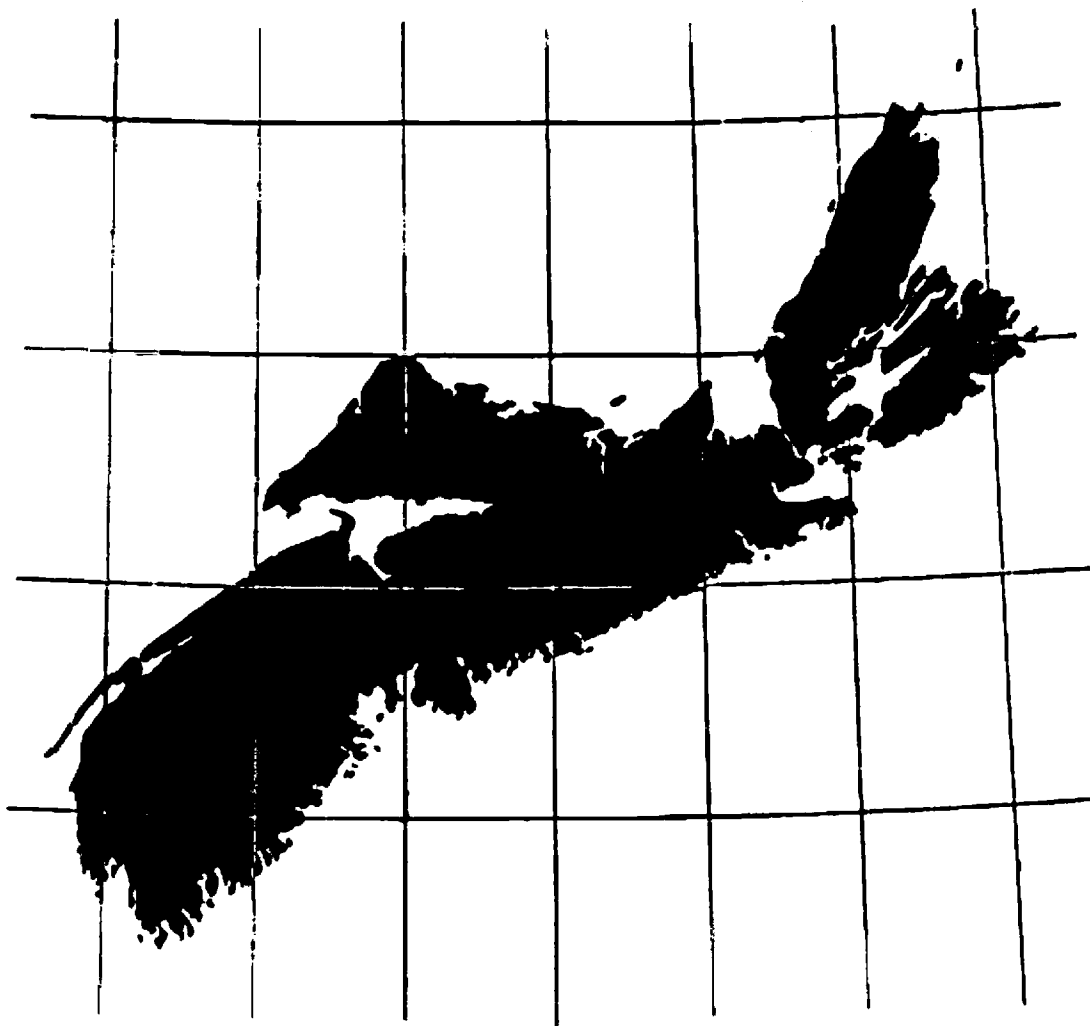


The NOVA SCOTIAN SURVEYOR



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J. RONALD CHISHOLM
President

EDWARD P. RICE
Secretary-Treasurer

Volume 14

R. E. MILLARD
Editor

Number 36

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(Editorial Yell in an Amateurish Vein)

Recently one morning after returning from a week's vacation, on going to the Post Office I found the mail box stuffed full and also a slip from the Postmaster asking me to call at his office. I did, only to find a very irate man; who immediately acquainted me with the privilege of having a private mail box and who showed me a mountain of mail bags all addressed to me as Editor of the Nova Scotian Surveyor, and he told me in clear unmistakable language, what he expected me to do about it and do it yesterday.

I acceded to his wishes and securing the services of a large truck moved the mountain of mail to my home where it occupied one whole room.

I opened bag after bag of articles for the next issue of the Surveyor, all of top priority, which if all printed would make a book 15 feet thick; they were all excellent and worthy of presentation to our Association. I grabbed the phone and dialed members in this area, who have volunteered to help me, only to find them all gone away. Then to top it all the Postmaster called me, also the Station Master called me, both demanding that I pick up the accumulating piles of mail. Then, those who sent me the materials began calling, collect, by phone and by telegraph, demanding to know if their articles would be in the next issue and to top it all, one member began pounding me on the shoulder and repeatedly insisted that it was time to get going if we were to do the work and get time to go fishing, also finally I got my eyes open and realized that the whole thing was a dream and that my son, ten years old, wanted to go fishing at 6.00 a.m. and I still had to find 12 pages of copy even if 2nd hand for the next issue of the Surveyor. So will some kind soul please send me an article or two for the next issue, so that at least I won't be a liar.

R. E. MILLARD, P. L. S.,
Managing Editor, N. S. L. S.

Surveyors, Engineers and Education

December 1962, Vol. XXII, No. 4, by Richard R. Mayer, Surveyor, 95N, Main St., Fort Atkinson, Wis.

I think the article, "Some Observations of Four-year Professional Surveying Curricula in Western Europe," by Professor Milton O. Schmidt, in June 1962 issue of *Surveying and Mapping*, was very good.

Perhaps this will explain the color of my opinion. Following graduation I spent a year studying at the Universities of Zurich and Bonn, albeit in political science. More recently, I received the Master's degree in geodesy, photogrammetry, and cartography at the Ohio State University where, as you probably realize, surveying has been kicked around between civil engineering, geology, and physics. I am registered both as a Professional Engineer and as a Surveyor.

Regarding surveying vs engineering: I believe we should be careful not to encourage intramural hostility, but we must face the facts. Surveying and engineering are vitally different in philosophy and training and are similar only in their common use of certain tools. Surveyors and engineers have a great deal to offer each other, as also with other related fields, but let us be good friends, not contemptuous competitors—let each fill the other's cup but not drink from the same cup.

Regarding United States vs European methods of education: I agree that, technically, European education has many advantages, but, philosophically, there are some disadvantages in the European system—at least as seen through our glasses, strongly tinted by the democratic tradition. There is more to be said about the European lecture system than what I now say, but I do see merit in our textbook system. It makes knowledge available more widely, including self study. European professors tend to use the fact that their notes are unpublished to monopolize knowledge in their fields.

I agree completely that a new name for surveying is only to fool ourselves and provide humor for others aware of the situation.

In conclusion: I believe that surveying is a basic, important, and integral field. Essentially, it is a simple one in concept, philosophy, and origin. It is confused and prostituted by attempting to make anything else of it.

Surveying - Yesterday - Today - Tomorrow

By WALTER R. DIX, President, American Congress on Surveying and Mapping

There has always been a yesterday. We learn from the Old Testament and its Historical and Chronological Table — "No dates can be assigned to the events narrated in the first eleven chapters of Genesis, that is, from the Creation to Abraham." Theologians and scientists agree that the period covered in these chapters is much longer than the 2000-odd years that can be reckoned from Chapters 5 through 11 by adding the years the patriarchs were recorded as begetting their offspring.

However, the Bible is plentiful with evidence of surveying and of construction that is based upon measurement and surveying of a sort. In fact the evidence quite clearly indicates that surveying is probably the second oldest profession.

Some 3000 years B. C. the Pyramids were begun by kings of Egypt at Sakkara. Cheops built the great Pyramid at Giza, and Chephran the second largest. About 100 years later (2900 B.C.) the Sphinx was built. If it could talk, we, no doubt, would have many more facts about the history of surveying.

The earliest positive evidence of a cadastral survey map stems from Babylonia—a clay tablet (age of Sargon of Akkad, circa 2300 B.C.) upon which the map or diagram with notes had been scratched or scribed while the clay pattie was soft, then baked or dried to harden. The British Musum has clay tablets containing surveying notes dating back to 2300 or 2100 B.C.

From historical evidence—relics of instruments or diagrams of same — or scribed documents that have come down through the ages — we have knowledge that a practical application of land measuring or surveying was known to the ancient cultures of Babylonia, Egypt, and China. Chinese documentation indicates surveying practices in China early in the second millenium B. C.

A most ancient record of surveying in Egypt is the Palermo Stone, which records river gauge readings and gives accounts of the “numbering of gold and lands” as far back as 3000 B.C. An Egyptian King of the 18th Dynasty had boundary stones erected on both sides of the Nile Valley to define his possessions. In ancient times boundary stones were placed with religious rites. Removal or disturbance of these sacred monuments was subject to severe punishment.

As knowledge of mathematics and astronomy developed among the Greek, Roman, Egyptian, and Arabic scholars, so did the art and practice of surveying and the use of surveying instruments, not only for measuring land, but for laying out plans for extensive works of construction and for maps for civil and military planning. And as these knowledges improved and were spread to other parts of the ancient and mediæval world by sea navigators and land explorers, and warriors, the practices of surveying also spread and improved in what is now Europe, the Middle East, and the Far East, but, in particular, throughout the Roman Empire.

Two hundred forty years B. C. Eratosthenes deduced the earth's circumference at the equator or around a meridian to be 25,000 miles. He arrived at this by measuring the difference in shadows of verticals some 500 miles apart to be an angle of 7 degrees 12' or 1/50 of a circle. In 1800 A.D., Sir John Herschel computed the circumference to be 24,899 miles — under reasonably modern knowledge of astronomy, geodesy, and telescopes.

As civilization progressed, surveying, in pace with exploration, engineering, and commerce, also progressed. The “rope stretchers” of ancient Egypt were destined to become “chainmen” and “tapemen” of a later day. As civil, military, and naval surveys required greater accuracies, surveying instruments were invented and designed in pace with the demand and the increased knowledges in science and technology. Thus, then, as now, for one reason or another, the demand for improvement more accuracy, quicker results, and lesser costs has always been met with improved instruments, methods, or both.

The Romans had a skilled body of agrimensores—the land measurers or surveyors — which had been organized and fostered by Emperor Caesar to construct a complete map of the Empire, a 30-year project that was carried to completion under Emperor Augustus by his son-in-law Vispanius Agrippa. The huge map, the prototype of all present day strategical maps, was constructed on a wall of a building built specially for the purpose.

The building of fortress cities, the besieging and taking of them by war and conquest, the building of empires, with the roads and highways and the sea lanes opened to commerce and exchanges of goods and travellers, led to the eventual establishment of world commerce, culture centers, and constant expansion to new frontiers. The knowledges and practices of established cultures also spread to the new frontiers, from the old seats of learning to new seats of teaching, and from the old worlds to the new worlds.

Colonial America very early had, first, Harvard College in Massachusetts, and second, the College of William and Mary in Virginia. The College of William and

Mary was authorized as a faculty to license surveyors. George Washington, who has made surveying and other history, studied and was licensed a surveyor there—the first licensed surveyor in the Virginias.

First in many things, including Presidency of the United States, George Washington when General of the Continental Armies, with an educated and experienced respect for surveying and engineering, was the first to recognize the importance of modern methods and modern instruments when he commissioned French military engineers and surveyors in his support, in knowledge of their advanced methods and instruments.

Benjamin Franklin too had respect for good surveying. He induced Thomas Hutchins, an American born British Colonial officer, in Britain at the onset of the Revolution, who deserted and fled to France, where Franklin arranged his return to America, to accept a commission as Surveyor in the Southern Continental Army.

In our own country—as in the pattern of the Greeks, Romans, Egyptians, and in Europe and elsewhere—surveying developed in pace with education, and with military and civil demands, as it does yet today.

The sketchy reconnaissance surveys of the wilderness frontiers were followed by better surveys as expansion of civilization demanded. Closely accurate surveys were not yet required to build the early roads which followed the natural paths of the trails they replaced, but the measurement of land and location of boundaries did require more exactness relative to the importance involved, and experts like the British astronomers Charles Mason and Jeremiah Dixon, and Americans such as David Rittenhouse, Andrew Elliott, and Thomas Hutchins were soon employed on important boundary-line surveys. Hutchins was to become Geographer responsible for establishment of the now famous Geographers Line that was to be the beginning of the American Rectangular Survey system of the public domain.

Ever westward, trails were followed by wagon roads and later by post and stagecoach roads. Later came the steam engine and trains on steel rails. Port cities grew and prospered. Civilization pushed ever further the frontiers of new world freedom. Roads, railroads, and canals were being built. The demand for surveying increased with the demand for engineering, and with improved engineering came the demand for improved surveying.

Simple surveys sufficed for the roads of yesterday which followed natural paths. The more complex geometry of surveying came later with railroadng, or even before with the building of canals.

It was learned long ago that school-room and drafting-room functional geometry tables, while quite adaptable in flat open lands, could not be so easily adapted to cities congested with buildings or to surveying in the mountains where the drawing-plan construction points vanished often into solid rock within the mountain mass or out into mid-air space over a precipice. The route surveyor under such conditions was necessarily required to survey from where he stood on meagre foothold and upon the thorough understanding of applied mathematics, geometry, and trigonometry he had to have and still needs, even with more modern and applicable functional tables.

Yesterday, surveys for road construction in the flatland areas, where tangential straight-aways and angular intersections prevailed, did not place heavy strain on one's knowledge of curves and geometry.

As frontiersmen trekked west, so also to the Midwest came the French explorers and missionaries, by boat and canoe on the great rivers from the lake countries to the northeast, Joliet, Father (or Pere) Marquette, Tonti, LaSalle. These 17th cen-

tury explorers made maps and charts, and were surveyors in a way. Then there were men like George Rodgers Clark and Meriwether Lewis and they made surveys.

This territory was ceded by the British to the United States to become Northwest Territory and from it in 1818 sprung a State — your State of Illinois, which was to give to the United States a President who, when a young man, was a surveyor. Abraham Lincoln was a land surveyor when a young man about 24 years of age. On page 59 of the Lincoln Reader, which was edited by Paul M. Angle and published by the Rutgers University Press in 1947, there is a reference which explains how Lincoln came to be a surveyor.

“In the latter part of 1833, he secured employment as a deputy to John Calhoun, the county surveyor. Calhoun was one of the most prominent Jacksonian politicians in the county and Herndon says that Lincoln probably got the job through the recommendation of some Democrat. Knowing Calhoun's political affiliation, Lincoln hesitated to accept the job at first, but upon being assured that it would entail no political commitment, he did so.

“Surveying in those days, when the country was rapidly filling with settlers and the division lines of farms were being run for the first time, when speculators were buying large tracts and laying off towns, and when miles of wagon road were being opened, was an important and responsible job. Lincoln knew nothing about it; but borrowing books from Calhoun and enlisting the help of Mentor Graham, he went to work. Using Robert Gibson's “Theory and Practice of Surveying” and Flint's “Treatise on Geometry,” “Trigonometry and Rectangular Surveying” as texts, he studied day and night. Often he and Graham were up until midnight, interrupting their calculations only when Mrs. Graham ordered them out for a fresh supply of wood for the fire. But he mastered the books, obtained a fifty-dollar horse on credit, procured a compass and chain, and by the end of the year was ready to start work.”

Surveyors of Illinois have gathered together on several occasions in the past one hundred years to discuss problems of mutual interest. One of the most historic of these gatherings was the meeting, held in Springfield in 1857, where the land surveyors of Illinois engaged Abraham Lincoln, who was then a young attorney, to render a decision on how the section was to be legally divided into quarters.

That was all yesterday. There have been lots of yesterdays—some ancient, some very long ago, some not so long ago—as we approach today. There was a yesterday when the telegraph was the world's fastest communication system, and aerial observation, if any, was done from balloons. Much has changed since then. And much has changed in surveying since then. The automobile and the airplane have had their influence on surveying.

Today—due to modernization of our highways—even in the flatlands, the complex curve has been introduced into surveys that affect property-lines. No longer is a knowledge of simple straight-line surveying sufficient for a land surveyor of professional status. Abraham Lincoln, today, could not fully qualify as a professional surveyor by the brief assimilation of Abel Flint's treatise on “Measuring, laying out, and dividing land.”

The fully qualified professional land surveyor of today, needs to be able to trace or retrace the curvilinear boundaries of transitional high-speed highway cut-offs and the complex cloverleaf interchanges that exist today even in the midst of flat farmland and heretofore straight-line rectangular-system areas.

We must admire those of us, and those before us, who have lifted themselves to professional status, by self study and experience over long years of application, without the tremendous lift and benefit of formal education—or with it. Nevertheless, the time has come when all of us must realize that as reading for medicine,

the law, or the ministry, has given way to formal education, in the latter days of yesterday, in meeting demands of time and modernization, so must the demands of tomorrow's surveying be met with a broad base of formal education for today's beginner.

The demand requirement for higher education has overtaken us. The professional surveyor of tomorrow must be ready—ready in the shortest possible number of years to perform fully and professionally—to be able to compete.

Today we stand on the frontier of space — in an electronic and push button age of speeds and distances beyond yesterday's comprehension — an age demanding more precise and faster answers to more complex and bigger problems than ever before. To meet demands of this missile and space age, even our continental geodetic datums must be expanded to worldwide datums. Continental datums must be strengthened and improved — and must be surveyed more precisely — to achieve the preciseness required for, and in time for, tomorrow's higher accuracy demands.

We have entered a new age of super-accuracy in earth measurements. In a general refinement of the geodetic network a ten-year program is underway by the C&GS to increase the density of surface gravity measurement, with corresponding network of astro-geodetic stations. It is proposed to extend a network of about fifteen super-grade traverse surveys crossing the 48 States in N-S and EW directions. Ultimately there will be a general upgrading of the precision of the entire geodetic network in the United States.

Satellite Triangulation will expand continental triangulation to world triangulation by simultaneous observation of high altitude satellites from three or more points on the earth's surface. Highly precise and co-ordinated theodolite-camera systems, that triangulate by photographing the satellite against a background of stars, allow computations free from the effects of gravity differential and will make possible the extension of continental networks to effect world networks of precision not heretofore possible.

All of these improvements in precision and the speed of machine computations will eventually result in refinements and increased use of coordinate systems in surveying and in recording. The property record of the future is likely to be a punched-type data-storage system of some sort streamlined to numbers in elimination of written word descriptions, the simplest form of which would be coordinates.

Aerial surveys by photogrammetric methods have just about replaced the planetable method for topographic mapping, except for an occasional small area operation. Aerial surveys by magnetic and radio methods are used for exploratory surveys. Magnetic, radio, and sound waves are used for geophysical surveys. Light waves and radio waves have entered into the distance measuring field as most of you know, and such devices as the Tellurometer, Geodimeter, Electrotape, and similar instruments already are replacing tape and chain methods of measuring distance on some survey operations. Already combinations of aerial photogrammetry with electronic recording devices and electronic plotting devices are producing and plotting terrain or profile data at speeds never before thought possible.

Today's accelerated highway programs, urban sprawl, and the overlapping sprawl or megalopolitan congestion—where the suburban areas of nearby cities encroach upon and grow into each other to become contiguous densities—separately and together have created high real estate values, which, like oil or mineral lands, require equitable surveys in the property-line and property-right interests. Surveys of high standard are also in order for city and metropolitan planning. Such surveys are recommended, and, as approved, funds are allowed for such sur-

veys, in accord with policy of the Urban Planning and Urban Renewal Administrations of the Federal Housing and Home Finance Agency.

To meet the challenge of tomorrow the surveying profession must insist upon education for tomorrow's surveyor. The surveying profession must support this education in universities, and must encourage its local sons to become professionally educated in surveying and make it their career. If we all insist that surveying is taught with adequate courses with adequate recognition, and that State Boards of licensure for land surveying require adequate educational background, then the professed surveyor of tomorrow will be proud to be a land surveyor. If we fail in this, there will be no surveying profession tomorrow.

I think President Kennedy summed it up nicely in his message to ACSIM at our Convention last year.

Yesterday — since the beginnings of our nation, those of your professional calling have contributed in full measure to its opening, growth, and development.

Today — Today, our horizons have extended beyond the limits of the imagination of our forbears. They who founded our nation included in their numbers men whose professional efforts were devoted, as are yours, to the description in evermore precise terms of the world about us.

Tomorrow — I know that you, with the inspiration which has characterized the work of your profession, are more than equal to the challenge of the future. Among the great contributions on which all of us count is your continued and valued support of the educational development of those who will follow you, your efforts in their behalf will help to assure a furtherance of achievements thus far realized . . . Congratulations. . . , JOHN F. KENNEDY

On education let me say that, besides the WHAT-WHY-HOW curriculums for the professional surveyor of tomorrow, we shall also need specific Know How courses for the surveymen—the technicians—who support the professional on the field party and in the office.

In closing, let me touch on the qualifications for a professional Land Surveyor—the professional responsible for property-line bounds. On one hand he needs a firm basis of technological education and experience to perform the physical or technical survey. On the other hand he needs a firm basis of education in philosophy of the legal-line, together with knowledge of land law in general and of local laws, local customs, and judicial customs in particular, in order to perform professionally the property-line or title survey.

A lawyer without knowledge of survey technology would not qualify as a professional land surveyor. Neither would an engineer fully equipped with the technology of the physical survey, unless he further qualified with the philosophy and experience concerned with the legal property bound.

For truly professional qualification, in the general sense of Land Surveyor licensure, both qualifying elements must be met.

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Expanded Survey School Awards 32 Certificates

By GEORGE HERMAN in Halifax Herald

LAWRENCETOWN — The Nova Scotia Land Survey Institute, the only school in Canada exclusively devoted to land surveying, held its annual closing exercises in the Lawrencetown Consolidated School, when the Hon. E. D. Haliburton, Nova Scotia's minister of agriculture and lands and forests presented 32 certificates to students.

The students, presented by the Survey Principal, Major James A. H. Church, included 13 from the Survey Class of 1963, 13 from the Survey Class of '64, five in Photogrammetric and one in Cartographic-Drafting. The last two named subjects were taught this year for the first time. Two prizes awarded included the March Prize for the best kept field book, won by F. W. Miller, Elmsdale, and the Association of Provincial Land Surveyors' Prize won by Hugh James Sullivan, Heather-ton, Guysborough County.

The March Prize is donated annually by J. E. R. March, Director of Surveys, Department of Lands and Forests, Halifax, while the Land Surveyors' Prize is annually awarded to the first year student making the most progress. The presentation was made by J. R. Chisholm, Association President.

The certificate winners included:

Land Survey Class of 1963

Arthur Briggs, Donkin; Gerald Conrad, Bridgewater; Ronald Dearman, Dartmouth; Richard Dunbar, Antigonish; Harry Edwards, Bridgewater; Donald Elmore, Middleton; Everett Hall, Granville Ferry; Douglas Joudrey, Chester Basin; William Mason, Armdale; Duncan MacGregor, Halifax; Sheldon Patriquin, Londonderry; Alfred Wallace, Milford Station; Harold Weir, Round Hill.

Land Survey Class of 1964

William Atkinson, West Brook; John Bishop, Seabright; Lloyd Bonang, West Lawrencetown; Thomas Foster, Fairview; Joseph Hannifen, Erinville; Emerson Howard, St. Michael, Barbados; Edward MacDonald, Halifax; Wayne Miller, Elmsdale; Walter Murphy, Digby; Burnley Nickerson, Centreville; Donald Purcell, Beaverbank; Hugh Sullivan, Heather-ton; Charles Topple, Yarmouth.

Photogrammetric Class 1963

William Fenwick, River Hebert; MacAllister Rafuse, New Ross; John Ryan, Middleton; Gerald Sloat, Lawrencetown; Leonard Telfer, Bridgewater.

Cartographic — Drafting Class 1963

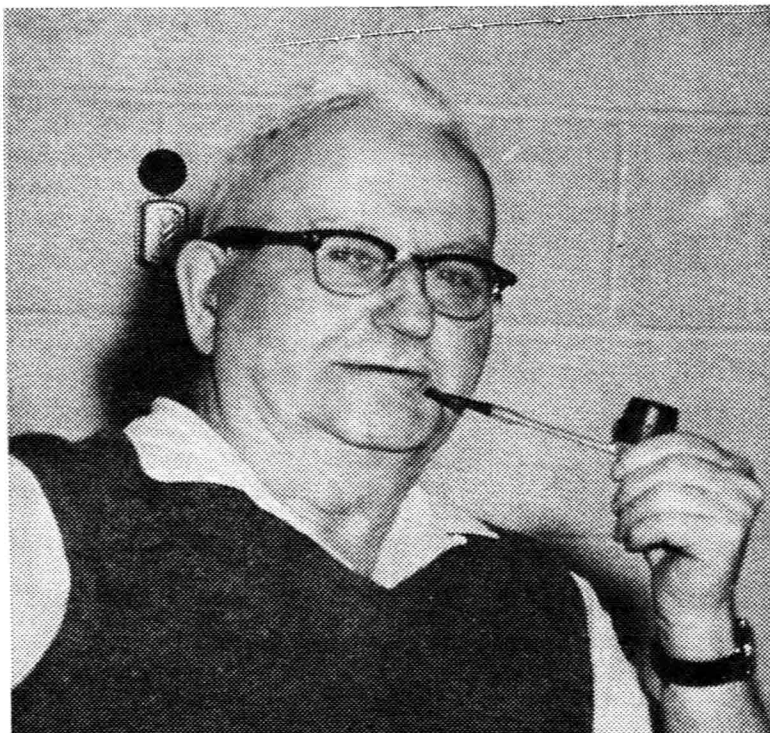
John Gasparac, Halifax.

Platform guests, in addition to Mr. Haliburton, the principal and prize donors, included: E. A. Green, Supervisor of Vocational Schools; R. E. Dickie, Chairman Advisory Committee; V. P. Harrison, Department of Lands and Forests; John Russell, Digby; Walter E. Servant, Halifax; George Bates, president Halifax Branch Institute of Surveying.

The Nova Scotia Land Survey Institute, it was pointed out, stands in a very favorable position inasmuch as its graduates are almost certain to get professional employment immediately upon completion of the course.

With low tuition fees, only \$100 a year for Nova Scotians, and the demand for qualified surveyors being greater by far than the supply, the future of the school was envisioned as very bright. The need for additional space that could be pro-

vided by the addition of a third floor to the present building was advocated by Major Church.



Major James A. H. Church, D.S.O., M.C., retiring principal of the Nova Scotia Land Survey Institute was honored at the closing exercises of the Institute held in Lawrencetown Consolidated School and at a complimentary dinner tendered at the Cornwallis Inn, Kentville. (Goldston Photo)

The Major retires this year following twenty years of service as Chief Instructor during which he has seen the school firmly established in a well-equipped building and with a capable staff following several years of uncertainty which included a number of location changes.

Tributes were paid to Major Church by Mr. Haliburton who expressed pleasure with the advances made by the setting up, during the past year, of two new departments, photogrammetry — headed by Captain C. Hogg, Canadian Army topographical survey and photogrammetrist, and cartographic-drafting under the direction of J. F. Wightman, B.Sc., B. Ed., of Digby.

The demand for qualified technicians in these two new branches of Institute work comes continuously from government departments, map making and other privately operated industries. The federal Department of Mines and Technical Surveys each year requires twenty or more trained technicians and the Nova Scotia Land Survey Institute is the only technical school in Canada giving this scientific type of training.

“Cartographic — Drafting,” stated Mr. Wightman, “should appeal to women students as well as to men. The opportunities for employment on completion of the course are far brighter in regards to salary and permanency than in office work.”

The equipment at the institute is equal to that found in the drafting rooms of

the best companies in the industry. Under the new method of negative plastic scribing, as taught at the school, maps are produced at a very fast rate and with the highest degree of accuracy.

Photogrammetry, the other new course of instruction, described as "the science of making surveys from photographs," is closely linked with cartographic-drafting.

The object of this course is to train technicians in the basics of their trade and to apply this knowledge to current compilation methods and photogrammetric plotter operations. The course, of somewhat more than one thousand hours, is presently on a one year basis. Candidates for the course are required to have junior matriculation and must pass an eye test.

The students, explained Captain Hogg, have the use of most approved equipment. There are three multiplex units and one WILD B-8 which has just arrived from Switzerland and is the only instrument of its kind in Canada.

Major Church, in commenting on the range of subjects now taught at the Institute and the facilities available, expressed hope that more young people would take the opportunity to become trained survey technicians and thus assure themselves of well - paid employment in a truly worthwhile field of Canadian development.

Ye Olde Chaynes

The Canadian Surveyor Supplement Vol. XVII No. 2 June 1963

The first of two articles taken from a report of the Department of the Interior published in 1913, appeared in the last supplement entitled "Standards of Length". In it, the then Surveyor General, Dr. E. Deville, discussed the uncertainty of measurement up to that time and the remedies proposed, concluding with a description of the Lufkin steel tape which became the subsidiary standard. The second article, from the same report, appears below.

Errors in Dominion Land Surveys

Nearly nine-tenths of the existing surveys have been executed under my direction. When I took charge, the subdivision surveys had barely crossed the western limit of Manitoba; they now spread from Ontario to the Pacific Ocean and to township 110 in the north.

Under the provisions of the first Dominion Lands Act, a quarter section was held to contain 160 acres, whatever might be the actual contents. It followed that a section side was held to be one mile in length and was so returned by the surveyors. Four directions, no more, were admitted for section or township lines and entered by surveyors in their field notes, namely, north, south, east and west. Although the law has been changed on my recommendation and surveyors now return in their field notes what they actually find, the principle of the old law was sound. It makes absolutely no difference to a farmer whether his quarter section contains 159 or 161 acres; by calling the area 160 acres and the section side one mile, a great simplification was introduced in all land transactions. Evidently, the Surveyor General, Col. Dennis, when drafting the first Dominion Land Act, expected that the discrepancies of the survey could be kept within narrow limits and that is where the principle failed. As time went on, we heard of discrepancies sometimes exceeding a quarter of a mile, where, according to the surveyor's field notes, everything was perfectly regular. These errors appear to spread all over Manitoba. In extending the surveys west of Manitoba, discrepancies of a like nature, although on a smaller scale, were met with; they were located and corrected by astronomical observation. Measuring on the earth by means of the stars is a roundabout way of finding distances and a not very accurate one, but it was the best we could do. We thus managed to keep errors within bounds outside of Manitoba. On reaching Peace River, we were a quarter of a mile out, but Peace River is a long way off; the error was corrected

later. So far as we are able to judge, and with the exception of lower Peace River, which has not been checked, few if any township lines outside of Manitoba are more than 200 feet out of position.

For a long time, the condition of affairs in Manitoba was utterly incomprehensible; errors would crop up in the most unexpected places. In starting from a township corner and steering for the next one, we were never sure we would hit it or anywhere near it. The field notes of the old surveys, in which the entries were often purely conventional, afforded very little assistance. The trouble was attributed to the carelessness and incompetence of early surveyors, but even if it had been understood it was too late for making corrections, because the lands had been taken up and their boundaries could not be changed. The climax happened when the principal meridian was produced northerly across Lake Winnipeg for the purpose of surveying lands along the Hudson Bay railway; it was found by astronomical observations that township 35 was one-third of a mile too far north. A connected system of surveys could not be carried out with errors of this magnitude in the short space of 35 townships and so it was decided to find out what the trouble was by going over the old lines right from the beginning. This was done last year by Mr. A. G. Stuart, who retraced the principal meridian from the international boundary to township 28. Then came the astonishing discovery that the errors were mostly due to the use of incorrect measures. The old surveyors were not to blame, but their chains were wrong and this was because the means of verification furnished to them were inadequate. The evidence is incontrovertible. Milner Hart, for instance, in laying our fifteen townships in 1871 made all his miles within a few links of the same length, which is proof of careful chaining, but every mile is 13 feet too long, which shows that his chain was two inches too long. It may be asked how it could possibly be so much in error. If Milner Hart verified his chain by stretching it on the prairie and measuring it with the wooden yard, furnished to him as a standard, the error on each yard length was less than one-tenth of an inch and is perhaps not more than was to be expected under the circumstances and with such rudimentary means of verification. If the measurements had been continued with that same chain up to Peace River or the Pacific Ocean, the township lines would have been nearly three miles out of position. If all the chains had been equally wrong, there would have been no difficulty; the townships and sections would have been square and all of equal size, without gap or overlap anywhere. But the chains were of various lengths; there were even some that were correct. The conditions can now be easily understood. Between the lines run westerly from the principal meridian and those run easterly from the second meridian upon which lengths are about correct, there is a gap which varies all the way from a few chains to 26 chains. This is not all; the base line running east and west are affected by the same causes as the meridians and produce another set of discrepancies. The result of the whole is inextricable confusion.

It is unfortunate that surveyors were not at the outset provided with adequate means of verifying their chains. If lengths had been correctly measured the land survey of the Dominion would have been the most perfect and remarkable in the world.

(Crest)

No.
1569

Board of Examiners
for Dominion Land Surveyors
Ottawa, 5th Nov. 1884

Sir —

It is contemplated, compiling, for publication
a complete list of Dominion Land Surveyors, and

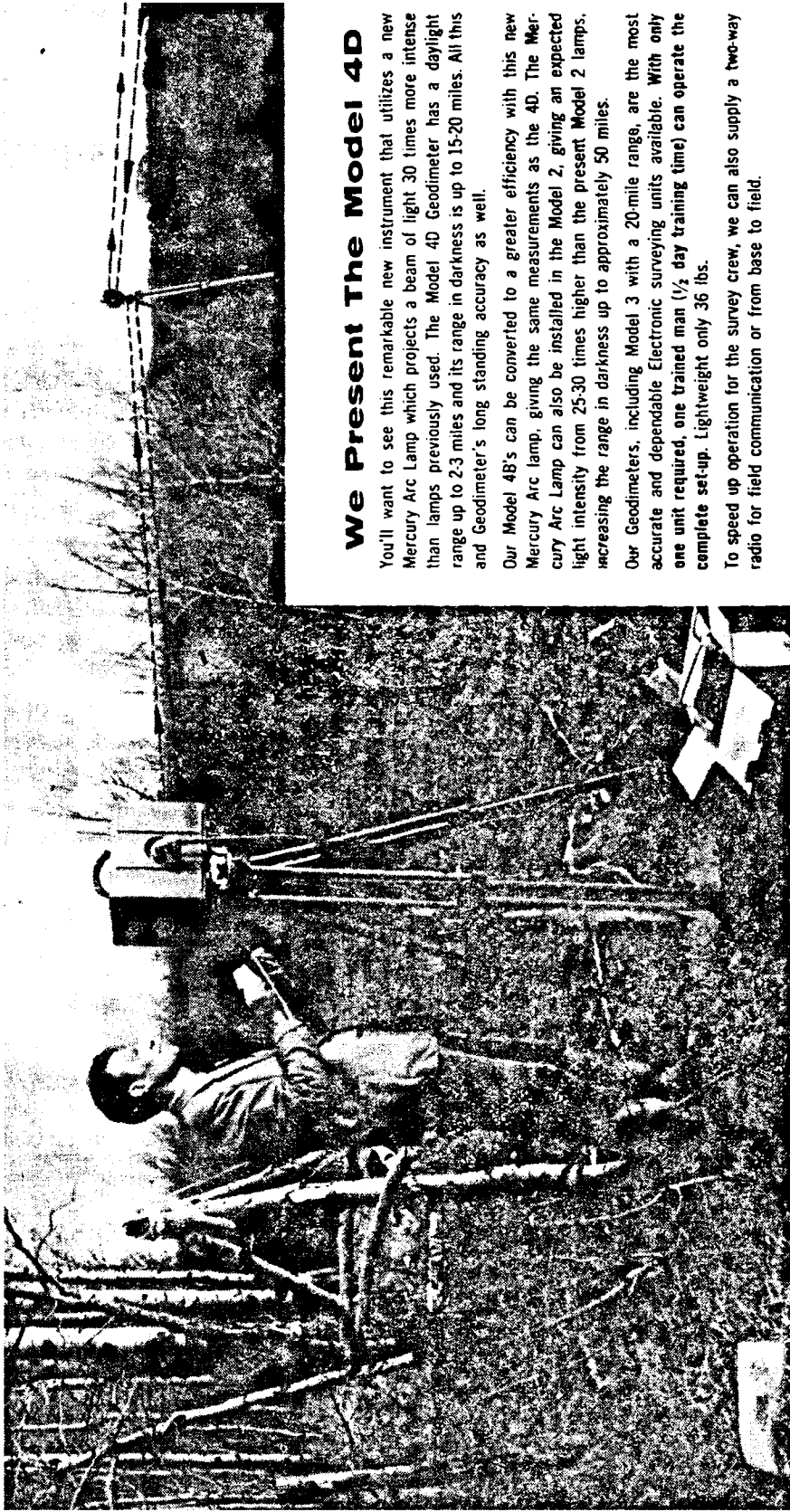
as, according to the Statute, all Land Surveyors of the Provinces of the Dominion, licensed or appointed previous to the 14th April 1872, are Dominion Land Surveyors. I have the honor to request that you furnish me with a list of all the Land Surveyors licensed, commissioned or appointed by the Province of Nova Scotia, prior to the said 14th day of April 1872.

I have the honor to be,
 Sir,
 Your obedient Servant
 R. Lang
 Secretary to Board of
 Examiners for D. L. S.

The Hon
 The Commissioner
 of Works Mines of
 Nova Scotia
 Halifax, N. S.

List of Surveyors in Nova Scotia appointed previous to 14th, April 1872.

WILLIAM A. HENDRY	Halifax
JAMES H. AUSTIN	Halifax
HUGH McDONALD	Antigonish
HUGH R. McKENZIE	Cape Breton
ROBERT L. BYERS	Colchester
WILLIAM FAULKNER	Colchester
ANSELM M. COMEAU	Digby
WILLIAM HARTSHORN	Guysboro
CHARLES TAYLOR	Guysboro
D. W. CROCKETT	Guysboro
E. H. KEATING	Halifax
JAMES LAIRD	Kings
JAMES HOLMES	Pictou
FRANCIS W. McKENZIE	Pictou
SAMUEL SMITH	Queens
JOHN H. HARLOW	Queens
NATHAN R. FREEMAN	Queens
JOHN J. ROBERTSON	Richmond
P. LENT HATFIELD	Yarmouth
WELWOOD McNAB	Cumberland
DAVID McKEEN	Cape Breton
JOHN P. LAWSON	Lunenburg
ALEXANDER CAMPBELL	Annapolis
JOHN HENRY BALCOM	Halifax
EDWARD H. SOLOMON	Lunenburg
W. A. CALNEK	Annapolis



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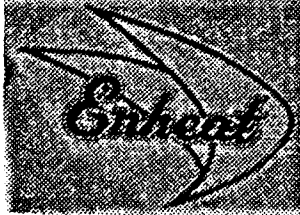
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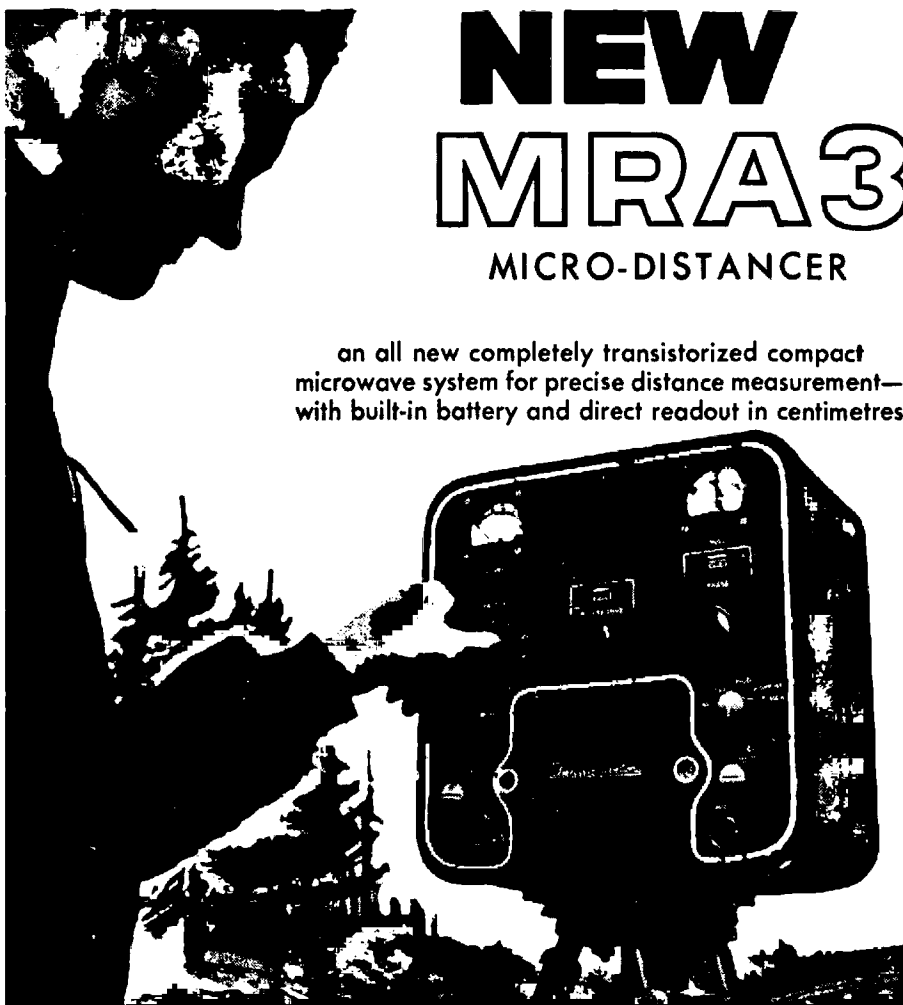
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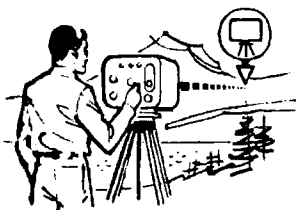
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