SIGNIFICANCE OF THE UNITED STATES PUBLIC LAND SURVEY

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Editorial Foreword

The speech which follows relates to an episode in American history that is intimately intertwined with Western Pennsylvania tradition and has its roots deeply imbedded in its soil.

The survey of the Mason and Dixon Line had been started in 1766 and halted by Indian hostility in southern Bedford County, in 1767. Not until 1784 was it feasible to complete the project to its intended five degrees measured from the Delaware River. A noted panel of scientists made up the survey team: Dr. James Ewing, Provost of the University of Pennsylvania; David Rittenhouse, mathematician and astronomer of the same institution; Dr. James Madison, Bishop of Virginia and President of the College of William and Mary; John Page of Virginia; John Lukens of Pennsylvania; Andrew Ellicott, surveyor of more state lines than any man of his day or since; and Thomas Hutchins.

Hutchins, it will be remembered, had been present at and rendered most valuable service at every important event at Fort Pitt. In Forbes' army he had merited favorable mention in reports, had been very useful to Engineer Captain Harry Gordon in building Fort Pitt, had assisted Gordon in the first mapping of the course of the Ohio River, had accompanied Bouquet, in 1760, to establish Fort Presqu’ Isle, had been Bouquet's engineer on his never-to-be-forgotten expedition into Ohio to quell Pontiac’s Indian allies, in 1764, had been engineer in General Green’s army in the South in the Revolution, and now enjoyed the appointment as Geographer of the United States. In most of these activities he had been based at, or operated from Pittsburgh, and lies buried in an unmarked grave in the quaint graveyard of Pittsburgh’s First Presbyterian Church.1

Address of Jerry A. O'Callaghan, Chief, Office of Legislation and Cooperative Relations, Bureau of Land Management, U. S. Department of the Interior, at the dedication of the point of beginning of the United States Public Land Survey as a national historic landmark, Friday, September 30, 1966, at East Liverpool, Ohio.—Editor

At the end of this celebrated line, established with observations of Polaris by night and sightings on the sun by day, this distinguished corps of surveyors placed a monument composed of a pyramid of native rocks with a white oak post in its center. This historic cairn in the wilderness marked the extreme southwest corner of Washington County, Pennsylvania.

By that time Virginia had ceded to the Confederated United States Government her interest in the lands northwest of the Ohio River, which made necessary a definition of the western boundary of Pennsylvania. Congress accordingly adopted the Land Ordinance of May 20, 1785, the first subdivision of public land in the United States, ordering it to be laid out in north and south columns or Ranges of Townships, six miles square divided into mile-square sections. This system was to begin on the western bank of the Ohio River at the point where a due north line projected from the corner of Pennsylvania just described crossed the said river. Here, on September 30, 1786, Geographer of the United States supervised the driving of the stake that instituted the greatest land subdivision in the entire world, and still continuing.2

We may readily see from the foregoing that all of this movement was very much Pennsylvania orientated and the interest ran deeper as the western movement of emigration flowed across Western Pennsylvania via the National Road to Brownsville or Wheeling and thence to Kentucky and southern Ohio, Indiana and Illinois. The Pennsylvania Road carried more vast throngs to Pittsburgh and thence to the same Northwest Territory settlements. Over the Susquehanna Road and other northern routes came the settlers of the Connecticut Reserve. From very many Pennsylvania families sons joined the land-hungry throng and Pennsylvania became even more closely related to the greatest emigration of world history by ties of consanguinity.

The following speech calls attention to a divergence of 1500 feet in the distance of the Seven Ranges (42 miles), commonly taken for an error, and which has called forth unfavorable criticism from the earliest times to the present, the latest appearing in the press after the delivery of this speech. All of this comment has been due to lack of understanding of the technical aspects of the project.

"Malaria, mosquitoes and harrassing Indians did not promote rapid and precise surveying over the rough hills of the Old Seven Ranges.”

2 C. E. Sherman, Ohio Land Subdivisions (Columbus, 1925), 38-40; Journals of Continental Congress (Washington), XXVIII, 376-377.
Ranges, covered as they were with dense woods. . . . On account of these difficulties Congress, May 12, 1786, waived the requirement in the original ordinance specifying that all lines should be run by true meridian, and permitted the use of magnetic bearings." 3 One of the finest authorities on the subject, Colonel Charles Whittlesey, wrote, "The work of these brave men should not be closely criticised, even where there are some irregularities." 4

With the object in mind of establishing truth in the matter, we interviewed the head of the Magnetics Section of one of the nation's greatest research institutions, highly specialized in mapping and interpreting magnetic phenomena. 5 After considering the above presented evidence, this modern scientist gave it as his opinion that, under the stated conditions, it is doubtful whether the result could be bettered using today's improved and precise instruments. Thereupon he caused to be compiled a table of increments to be added at stations of one mile on an absolutely straight surveyed line of forty-two miles to plot the locus of points on the parallel of 40° 30' north latitude (the latitude of East Liverpool, Ohio). By interpolation it is established that the variance between the straight line from the true parallel would be 987.2 feet. Thus only a discrepancy of 512.8 feet remains to be reconciled. The magnetics expert pointed out that the isogonic lines (lines of equal magnetic declination) are irregular and waver greatly, especially in this very section of Ohio. If the needle were in error 1°, the distance at the end of 42 miles would be .73332 mile or 3771.929 feet. Thus, with only 512.8 feet to account for, it can be calculated that the error in the needle bearing would be only 8'1", which could easily have been caused by a mere waver in the isogonic line of magnetic declination.

Thus, although the execution took place upon the soil of our near neighbor, Ohio, Pennsylvania contributed to every phase of the fulfillment of this progression of epoch-making events. Mr. O'Callaghan's speech is undoubtedly one of the most significant contributions to the history of that era of American expansion.

Edward G. Williams

The speech follows:

3 C. E. Sherman, Ohio Land Subdivisions, 42, 174, 178.
4 Charles Whittlesey, Western Reserve Historical Society Publications, II, Tract No. 61, p. 283.
5 The Gulf Research Center at Harmarville, Pa., has been the oracle of information on subjects relating to magnetics, geodetics and mapping methods. The aid and advice rendered by Mr. James Affleck, Chief of the Division of Magnetics, is gratefully acknowledged.
The American people have suddenly found systems.

We have weapons systems, missiles systems, information systems, communications systems, systems managers, systems analyses and systems analysts.

Today, we are standing here at the point of origin on the 181st anniversary of one of the most down-to-earth extensive communications systems ever devised.

From this point, on September 30, 1785, the Geographer of the United States, Thomas Hutchins, began surveying the public lands of the United States.

One hundred eighty-one years and a billion acres later, cadastral engineers of the Bureau of Land Management are still busy at this same task. The equipment is more precise, but the system and tradition are largely the ones first tried out here in the Seven Ranges of Ohio, and completely perfected in the Ohio Valley.

Clark Gumm, Chief of our Branch of Cadastral Surveying, and possibly the closest approximation we now have to the Geographer of the United States, came to East Liverpool a few months ago with some other surveyors, “to recover,” in the language of the land surveyors, the Point of Beginning of the Public Land Surveys.

It is the ability of Mr. Gumm and other surveyors to communicate back to their predecessors by way of field notes and plats which has led me to describe the United States Public Land Survey as a down-to-earth communication system. Hutchins and his men so organized and recorded their work that anyone trained in the system can duplicate that work. Because of this United States Public Land Survey, over one billion acres stretching from this point westward to the Pacific and northward to the Arctic have been systematically located, described and recorded.

One of my responsibilities in the Bureau of Land Management is to oversee the export, so to speak, of land management techniques to the developing nations. One does not work very long in this field until he discovers the real accomplishments of the United States Public Land Survey.

I recall particularly talking to three Turkish officials. They were very keen and alert men. They had spent something like a year at MIT studying regional planning. They were visiting the Department of the Interior to see how we did our planning.

They had great difficulty in grasping the fact that the United States has been surveyed, the topographic mapping well advanced and the geodetic triangulations set. I was, of course, taking all this for
granted in describing the planning processes in the Department of the Interior. For these Turkish officials, who could not think of planning the smallest project without a first step providing a surveying and mapping program, it was incomprehensible that this preliminary work had been done so long ago that we take it for granted. They kept calling on me to discuss this as part of planning.

As technical and mechanical as the public land survey may be, it was, itself, the product of an emerging democratic process. To the extent that it assisted in the settlement of this continent and now promotes the intensive management of a natural resource complex which the American people have retained for themselves, the United States Public Land Survey has made and continues to make a distinct contribution to the democratic way of life.

The land survey was authorized by the Land Ordinance of 1785, one of the lasting achievements of the Confederation Congress. Since the days when ancient Babylonians recorded their land titles on deeds of clay tablets, land has always been described by metes and bounds, however irregularly shaped. Survey followed occupation.

The Confederation Congress set out on a novel policy of surveying into rectilinear grids prior to occupation. The genesis of the American rectilinear public land survey was carried in a committee report drafted very literally by Thomas Jefferson. It was written in his own hand. The report recommended parceling the western, that is, the public lands in squares by declaring "It [public land] shall be divided into Hundreds of ten geographical miles square ... by lines to be run and marked due north and south, and others crossing these at right angles ..."

I do not think it necessary to detail the legislative progress of this enactment. Its final provisions were the result of the normal play of force and personality on issues. When the ordinance emerged it provided for townships six miles square.

The move to a six-mile township was probably based on the New England township which usually contained 36 square miles not necessarily a perfect rectangle. The good Yankees had seemingly arrived at this dimension by ascertaining that the distance beyond three miles was an undue inconvenience to place upon citizens to walk to church, school and the seat of their local government. A distance less than three miles would not constitute a sufficient area and population to justify local government. The New Englanders were accustomed by their English background to thinking not in multiples of ten but multiples of dozen and half-dozen.
The ordinance itself required the survey to begin "... on the River Ohio at a point that should be found to be due north from the western terminus of a line which has been run as the southern boundary of the State of Pennsylvania."

The boundary commissioners representing the States of Virginia and Pennsylvania, including Andrew Ellicott who later surveyed the boundaries of the District of Columbia, and David Rittenhouse, Pennsylvania mathematician and astronomer, established this point on August 20, 1785. They arrived on the south bank of the Ohio River near the mouth of Mill Creek.

This has been recorded in the words of Andrew Porter, Rittenhouse’s fellow commissioner from Pennsylvania:

This morning continued the Vista over the hill on the south side of the River and set a stake on it by the signals, about two miles in front of the Instrument, brought the Instrument forward and fixed it on a high post, opened the Vista down to the River, and set a stake on the flat, the north side of the River.

A little over a month later, Thomas Hutchins, Geographer of the United States, arrived to begin. Hutchins was a military engineer and topographer. While serving in the British Army he had laid out plans for Fort Pitt. His extensive topographical writings had brought him membership in the American Philosophical Association in 1772. He sat out the American Revolution in Great Britain where he refused to bear arms against the Colonies. His attempts to sell his commission were rebuffed. He was charged with high treason, but having resigned his commission “in a private manner” he left England for France. He presented himself to Franklin. On the recommendation of that august scientist and statesman, he was appointed Geographer of the Southern Army, a title ultimately changed to Geographer of the United States. As such, he was placed in charge of the new survey and directed personally to run the east and west line, that is, the Geographer’s Line.

Hutchins’ deputy surveyor, William Morris of New York, began from this point on September 30, 1785. After four miles which would have placed him near just west of present day Lisbon Street, he suspended his survey on account of “the uncertain state of the Indians.” In the next year Absalom Martin, starting from the Point of Beginning, made the final survey as approved.

In reading the notes, we find in the first miles, for example, such judgments as:

In the first mile: “Rich bottom land chiefly with white and black walnut.”
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In the second mile: "The Soil . . . is generally of a good quality for wheat. Some of it is suitable for the cultivation of Tobacco, Hemp, Indian Corn, to great perfection."

If the surveyors saw the yellow clays which were to make East Liverpool a pottery center, they did not record them.

Three years after the start in 1785, Hutchins presented his general plan, along with the notes and plats, to Congress. As a member of the Executive Branch of the Government, I regret to report that the Congress was disappointed. The field work took three times as long and cost three times as much as originally planned.

There are probably cynics who would observe that things have not changed much. Bureaucrats might wonder what was wrong with the planning, programming, budgeting system. Getting land surveyed and sold to produce revenue was the priority in Congress. Hutchins was bothered by the prospect of Indian attack and seemed insistent on getting a general plan of survey outlined before submitting this report.

There were numerous technical imperfections in the survey of the Seven Ranges. Hutchins, for example, misapplied the method of conforming the parallel of latitude. As a result the western terminus of the Geographer's Line left it about 1500 feet at the south of the true parallel. There was also the matter of closure at township corners. No standard method was used. Many township corners had more than one marker. Some were left open and often the surveyors failed to note the relative positions of the separation.

Part of Congress' disappointment of the land surveying progress was rooted in its financial needs. The public policy was to sell the public lands in large blocks to produce revenue to pay off the Revolutionary War debt. Under this policy, the Congress made two large grants: one to the Ohio Company and the other to John Cleves Symmes Company. The land companies undertook their own surveying generally by extending the work done on the Seven Ranges. Rufus Putman of the Ohio Company and Israel Ludlow for the Symmes Company were both to become Surveyors-General of the United States.

The improvements in practices and techniques developed in surveys of these grants imbedded the rectilinear survey into the American public policy. The Public Land Act of 1796, the first public land act under the Constitution, included the rectilinear survey almost without debate. The Public Land Act of 1796 also specified a definite order for the numbering of the thirty-six sections within the township "beginning with number one in the northeast section, proceeding west and east alternately."
Two important innovations worked out in the Ohio Valley gave us our public land survey system as it exists to the present. Jared Mansfield, Surveyor-General after 1803, was confronted with ever-increasing errors due mainly to the convergence of meridians of longitude. To correct this, Mansfield established a principal meridian approximately in the middle of Indiana, running from the Ohio River north to what is now the Indiana-Michigan border.

Later Edward Tiffin, first Commissioner of the General Land Office who became Surveyor-General in 1814, developed the last major refinement. Tiffin devised a system of guide meridians and standard parallels, the meridians at seventy-two mile intervals and the parallels at thirty mile intervals. With such an arrangement errors of convergence and other kinds would be contained within this oblong.

Three virtues were claimed for the rectilinear surveying system: (1) a simplified and readily understood system, (2) uniform land description, and (3) low cost.

A major charge against the system early and later was its failure to conform to topography. Southern leaders urged their system of indiscriminate survey, i.e., tomahawk claims. George Washington, no mean land surveyor himself, charged that "... the lands are all so versatile in nature that to the end of time they will not, by those who are acquainted therewith, be purchased in either townships or square miles."

Major John Wesley Powell, the great scientific administrator, recommended in his famous report on "The Arid Lands" a delineation of grazing holdings along topographic features.

All pros and cons weighed on the scales of experience place the pros on the heavy side.

Today, there are still 4,000,000 acres of unsurveyed public lands. These are principally within the boundaries of the national parks and national forests. It is doubtful that a system of surveying out of each and every section is necessary.

Our biggest single cadastral job today is surveying the 103 million acres to be selected by the State of Alaska. The Alaska Statehood Act itself directs the survey of the boundaries only of the individual selections. It is a fairly safe prediction that when the State itself comes to survey these interior lines it will use some form of the rectilinear system.

All the public land surveys were not carried out with the perfection envisioned by the Surveyors-General. Many of the surveyors in the field were lax, others were fraudulent. I'm speaking here of con-
tract surveyors. In California, today, for example, a large part of our cadastral surveying work is redoing the fraudulent Benson-Hyde surveys of the 1880's. Since 1910 surveys have been done by professionals working as government employees.

The United States Public Land Survey that was launched from this point 181 years ago today was one of the principal means of giving a continental dimension to democracy. Americans did not invent democracy. The Greeks did. We did not invent representative government. The English did. We have given it a continental expanse in which to prove itself.

But the surveying task is not over. The Public Land Survey is one of the little known tools in the desperate attempt to promote democratic representative government in the developing nations of the world today.

The Bureau of Land Management has had a team in Brazil this year advising on land reform. In parts of Brazil settled for 400 years there are to this day no land surveys and no effective system of land records. There is also an unsettled interior almost continental in dimension. Our team is recommending the ancient metes and bound system for the occupied areas. For the interior it is recommending a rectilinear survey on the Transverse Mercator Projection.

The recommendation is rooted in the American experience of a simplified survey of logical and systematic land description to promote both stability and initiative to the end that democratic government be properly undergirded. We do not know where such efforts will end.

We know they all began in East Liverpool, Ohio, on September 30, 1785.