Volume 29: Issue 2
April, 2018

LINES & POINTS

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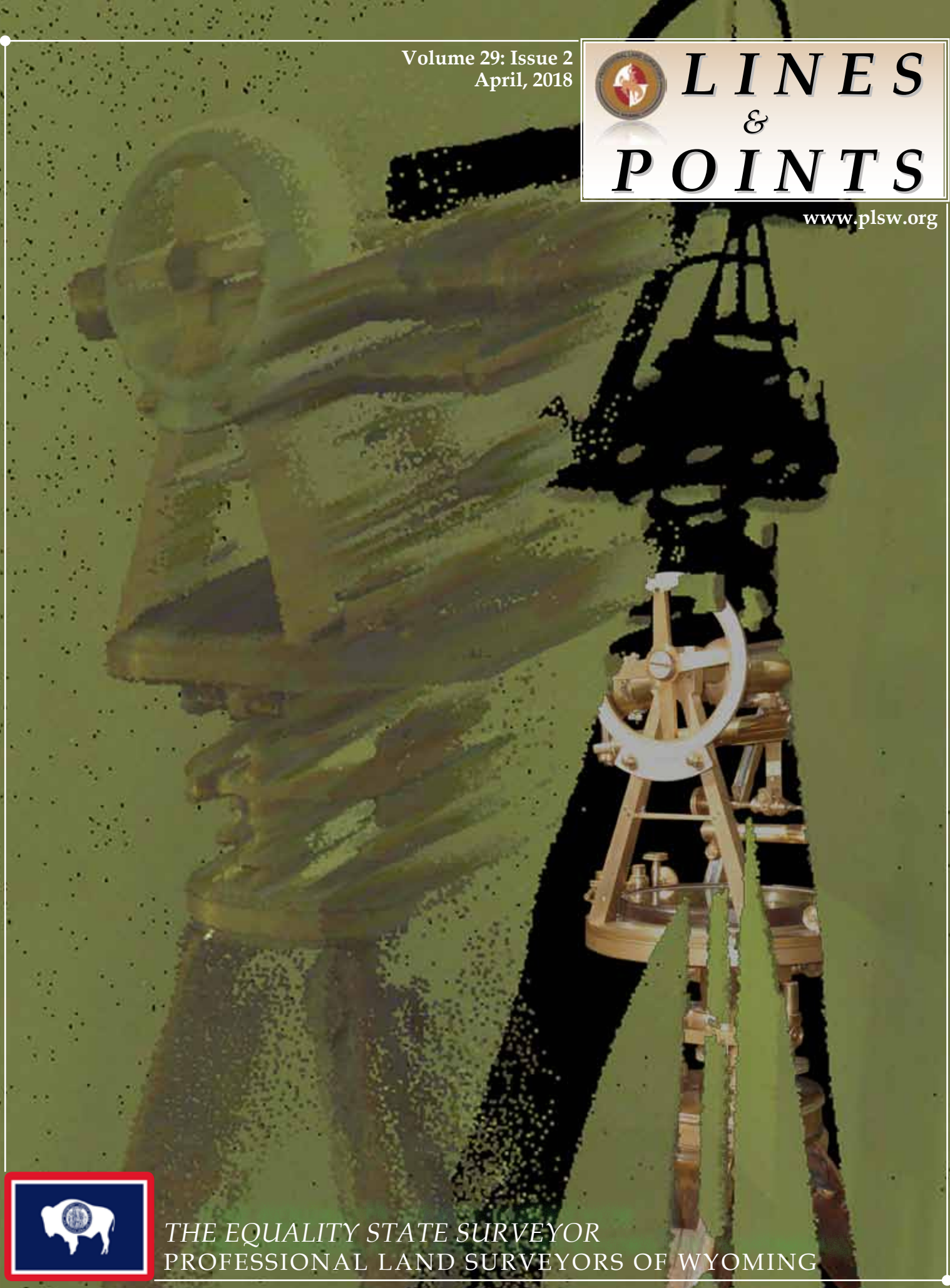
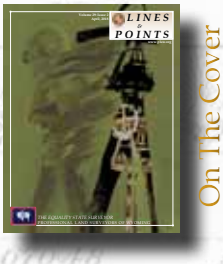


THE EQUALITY STATE SURVEYOR

PROFESSIONAL LAND SURVEYORS OF WYOMING

Publications Committee



On The Cover

"Scanning the Past"
Original Art Work Composite of C-10 Terrestrial Scanner Point Cloud Data and Digital Photography
by Mike Flaim

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2018 PLSW SUSTAINING MEMBERS

- Jenn Heinrich - Frontier Precision Inc.
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- Chris Farnsworth - RDO Integrated Controls
- Kelly Goff - Underground Consulting Solutions
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PLSW (Professional Land Surveyors of Wyoming; PO Box 8, Cheyenne, WY 82003) is a statewide organization of Land Surveyors registered to practice in the Equality State of Wyoming. PLSW is dedicated to improving the technical, legal, and business aspects of surveying in the State of Wyoming. PLSW is affiliated with the National Society of Professional Surveyors (NSPS) and the Western Federation of Professional Land Surveyors (WestFed).

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For more information please contact Jack Studley.

PRESIDENT'S MESSAGE

With the ever expanding forms of media outlets there seems to be a TV show, movie, or web-series depicting a plethora of occupations and professions; but where are the surveyors? STEM education and occupational literature is full of the glamorization of engineers, analysts, computer programmers, and any other occupation that uses science; but where are the surveyors? Technological advancements are now commonplace in news outlets from print to television to websites and blogs where they showcase numerous applications for technology; but where are the surveyors? My answer is that we are out working hard, behind our desks, in the fields, meeting with clients, traveling between job sites, all while trying to meet deadlines and keep up with Wyoming's construction season.

This is nothing new; anyone who has been in the profession understands this. Unless you meet someone who has a family member that is or has been a surveyor, you will likely spend quite a bit of time describing what a land surveyor does. Have you ever met someone who doesn't know what a lawyer does; they don't have this problem. If surveyors as professionals, business owners, and employees do not take action to educate and market to the public, who will? There is never going to be a television show that does for surveying what CSI did for forensic pathologists; this is a burden of our profession.

I would like to make a challenge to the surveyors in the State of Wyoming. I challenge each and every one of you to take the extra steps to go beyond outreach and move into engagement. By engagement I mean taking the initiative to have a conversation about what it is you are doing on the job site, what the piece of equipment is that you are using, what you are surveying and why you are needed, or simply explain to someone what it is about the profession that you enjoy. Find something that resonates with them, whether they are a child walking by or a client requesting a property survey.

I don't expect things to change overnight, but I do feel that if surveyors take the time to engage people we can slowly educate the public about what we do. The University of Wyoming together with the Board of Registration has started the ball rolling with statewide outreach into schools during National Surveyors Week. This is a great start and surveyors around the state have responded overwhelmingly. We have always been the best marketers for our profession. We understand that once you get hands on with people they are more likely to become interested in the profession. I get excited when meeting new people who, once learning that I am a surveyor, reminisce about summers spent working on a field crew or the years they working as a crew chief. These are the connections we need to make with all walks of life. Then maybe one day our profession will be well known and we will see new licensures start to increase in numbers and a new generation of land surveyors following the footsteps of those before them.

So where are the land surveyors? We are everywhere; we just need to let everyone know.

Geno Ferrero, PLS

President, Professional Land Surveyors of Wyoming

ANNOUNCEMENTS

CONGRATULATIONS!

The members of the Professional Land Surveyors of Wyoming would like to recognize the achievement of the following new Wyoming registrants:

David Gustafson	Alpine, WY	PLS 16420
Aaron Hummert	Mandan, SD	PLS 16357

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Obviously questions will still exist so e-mail them to ray.hintz@maine.edu

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Please tell everyone about this exciting opportunity.

Thanks,
Ray Hintz
SVT program coordinator, Univ. of Maine

(Find the link at www.plsw.org)

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LINES AND POINTS ARTICLE ROTATION SUBMISSION SCHEDULE BY CHAPTER

Responsible Chapter	First Call Date	Last Call Date	Publication Date
South Central Chapter	THANK YOU!!	(SEE "POINT OF TANGENCY" IN THIS ISSUE)	
Southeast Chapter	June 1	June 15	July 1, 2018
Laramie Valley Chapter	September 1	September 15	October 1, 2018
Upper Platte Chapter	December 1	December 15, 2018	January 1, 2019

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U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

CADASTRAL SURVEY

BLM NEWS

This letter is to inform you of the official cadastral surveys that were approved in Wyoming in 2017 and have been published to BLM Wyoming's Cadastral Survey website. Copies of the surveys can be viewed and/or printed from this website: ***http://www.wy.blm.gov/cadastral/plats17.htm***

Township and Range	Type of Survey	Meridian	Accepted
T. 41 N., R. 117 W.	Dep. Res.	6 P.M.	01/13/2017
T. 23 N., R. 103 W.	Dep. Res. & Survey	6 P.M.	03/21/2017
T. 23 N., R. 103 W.	Dep. Res. & Survey	6 P.M.	03/21/2017
T. 23 N., R. 117 W.	Dep. Res. & Survey	6 P.M.	03/21/2017
T. 23 N., R. 118 W.	Dep. Res. & Survey	6 P.M.	03/21/2017
T. 24 N., R. 118 W.	Dep. Res. & Survey	6 P.M.	03/21/2017
T. 23 N., R. 103 W.	Remonumentation	6 P.M.	03/21/2017
T. 22 N., R. 92 W.	Dep. Res.	6 P.M.	06/27/2017
T. 48 N., R. 88 W.	Dep. Res.	6 P.M.	06/27/2017
T. 32 N., R. 69 W.	Dep. Res.	6 P.M.	06/27/2017
T. 21 N., R. 87 W.	Supplemental Plat	6 P.M.	07/18/2017
T. 26 N., R. 119 W.	Dep. Res. & Survey	6 P.M.	07/20/2017
T. 52 N., R. 94 W.	Dep. Res. & Survey	6 P.M.	07/20/2017
T. 12 N., R. 111 W.	Dep. Res. & Survey	6 P.M.	10/02/2017
T. 56 N., R. 97 W.	Dep. Res. & Survey	6 P.M.	10/02/2017
T. 50 N., R. 103 W.	Dep. Res.	6 P.M.	10/02/2017
T. 55 N., R. 100 W.	Dep. Res. & Survey	6 P.M.	10/02/2017
T. 42 N., R. 84 W.	Dep. Res. & Survey	6 P.M.	10/02/2017
T. 57 N., R. 73 W.	Dep. Res. & Survey	6 P.M.	10/02/2017
T. 51 N., R. 69 W.	Dep. Res. & Survey	6 P.M.	10/02/2017

Geodetic Surveying: Part XIV

Alexander Dallas Bache and the Coast Survey: Part 3

Herbert W. Stoughton, PhD, PELS, CP

From 1850 through 1860, the appropriations, the number of deployed field parties engaged in triangulation, topography, and tidal observations doubled in the 1840's. At the same time the hydrographic and astronomic parties increased by thirty percent. With the marked increase in the production of triangulation and topography, the number of completed hydrography projects rose from fifteen per annum to forty-eight. This was accomplished with only an increase of hydrographic crews from seven per year to ten per year.

When an area was chosen to be charted, a stringent sequence of operations took place. Initial reconnaissance selected sites for primary triangulation and base lines. Following the initial reconnaissance, primary triangulation and base line observations were executed with astronomic (azimuth, latitude, and longitude) and magnetic observations were executed. Usually, secondary and lower-order triangulation and base lines would be established and observed to support topographic and hydrographic operations. In some instances, the secondary and lower-order triangulation and base lines would precede the primary work in order to expedite topographic and hydrographic surveys.

For triangulation reconnaissance, the criteria were: (1). Stations were accessible; (2). satisfied the geometrical criteria of a strong triangulation network; and (3). had direct or cleared lines of sight to neighboring stations. For the spacing of base lines the important elements were based on: (1). the distance through the triangulation network from the previous base line; (2). a level area of long extent; (3). grading and clearing the line; and (4). the geometry to connect to the triangulation (called base network).

One of the early and remarkable efforts was executed by Assistant Ferdinand H. Gerdes. In 1851 and 1852, Gerdes completed reconnaissance of over 1,000 miles of coast line from Cape Florida to the Delta of the Mississippi River, approximately 600 air line miles. Gerdes had joined the Coast Survey under Hassler in 1836. During the American Civil War, Gerdes would be cited for his invaluable contribution supporting the Union forces campaigns on the Atlantic coast and along the Mississippi River.

A second important Coast Survey Assistant performing reconnaissance was Brevet Major Henry Price. Major Price served two separate details/assignments at the Coast Survey (1844 - 1846 and 1850 - 1855). He was assigned from Cape Fear, North Carolina, to the North Santee River, South Carolina project. Bache wrote an effusive commendation for Major Price who strongly endorsed the selection for a verification base line on the Epping Plains in northeastern Maine. Bache was very reserved in giving accolades. Only a small percentage of the civilian and military aids received such praise.

In 1855 or 1856, it became apparent that a variation in the program was identified. The triangulation, topographic, and hydrographic operations along the Atlantic coast had reached the Georgia - Florida boundary and the Cape Florida - Mississippi Delta were complete or nearing completion. The previous Coast Survey appropriations permitted triangulation along the coast to support topographic mapping and hydrographic charting. This literally meant that the connection of these two projects could be completed by continuing southward along Florida's east coast and then proceed northward along Florida's Gulf of Mexico coast. Having been through a series of Congressional confrontations since 1844, Bache carefully disbursed his allocated funds. Bache recognized the opportunity, due to geography, that the economical and expeditious means of connecting the triangulation of the Atlantic coast to the triangulation along the Gulf of Mexico coast was across northern Florida. Therefore, in the budget request for 1856 - 1857, Bache request authorization to execute a triangulation network across a land mass not directly supporting hydrographic charting. The project was authorized ($ 15,000). Bache estimated it would cost only twenty-five percent as much to tie the two coasts together as opposed to "going around". The project was named "air - line", and the project was the first primary intent to extend primary (first-order) triangulation into the nation's interior. Two years later, the Committee of Twenty (mentioned earlier: Lines and Points, Jan. 2018, page 23) recommended a similar project to complete a triangulation network from the Northeast through the Appalachian Mountains to the triangulation along the Gulf Coast. This

project would not be attempted and completed for several decades. When it was finally instituted/ completed the project was known as The Eastern Oblique Arc of the United States and Osculating Spheroid (1902). These two events set the stage for further discussions and requests to extend the triangulation nets throughout the interior in an attempt to join the nation together. Captain James H. Simpson, Topographic Engineer, executed the reconnaissance in twenty-one days, covering a distance of 429 miles.

In the summer of 1879, Charles O. Boutelle proceeded to the St. Croix River and Passamaquoddy Bay on the Canada - United States boundary to complete the reconnaissance for triangulation. This reconnaissance marked completion of the Coast Survey's first complete inspection of the coast line of the United States from Canada to Mexico (in a span of fifty years). Also, the Coast Survey completed the reconnaissance of the entire Pacific coast. The surveys and charting of the west coast would not be completed during Bache's tenure at the Coast Survey.

Triangulation along the Atlantic coast and the Gulf of Mexico presented logistical problems. The major factors were the terrain, vegetation, and primitive transportation which hampered timely completion of the program. The triangulation net in New England challenged the field assistants to construct 40 to 60 foot high signals for inter visibility. The Epping Plains base line (later called the Epping base line) offered unique challenges. There was over 140 feet of vertical relief. This was the sixth base line measured with the Bache-Würdemann apparatus. The final length was 8,715.9422 m. (28,595.554 ft.; 5.4158 miles). The estimated uncertainty was ± 0.0158 m (1:551,650 or 1.81 ppm). Inspection of the base line expansion network to connect to the primary triangulation was an intricate network of triangles required to connect to the overlapping quadrilateral whose perimeter dimensions were 25, 26, 29, and 36 kilometers. The network included nine stations. Figure 1 illustrates the scheme. Assistant Charles O. Boutelle was assigned to observe the network. He had to build 40 foot scaffolds for the base termini. These scaffolds were 18 feet wide at the base and 9 feet at the top. In mid-October, Boutelle attempted to execute the angle observations. He reported that the winds were at gale force. Therefore, he draped canvas around the windward side of the scaffolding. On the evening/ morning 15/16 October, Boutelle reported that the wind screen effectively protected the tripod. The innovation would be employed with successful results for several years.

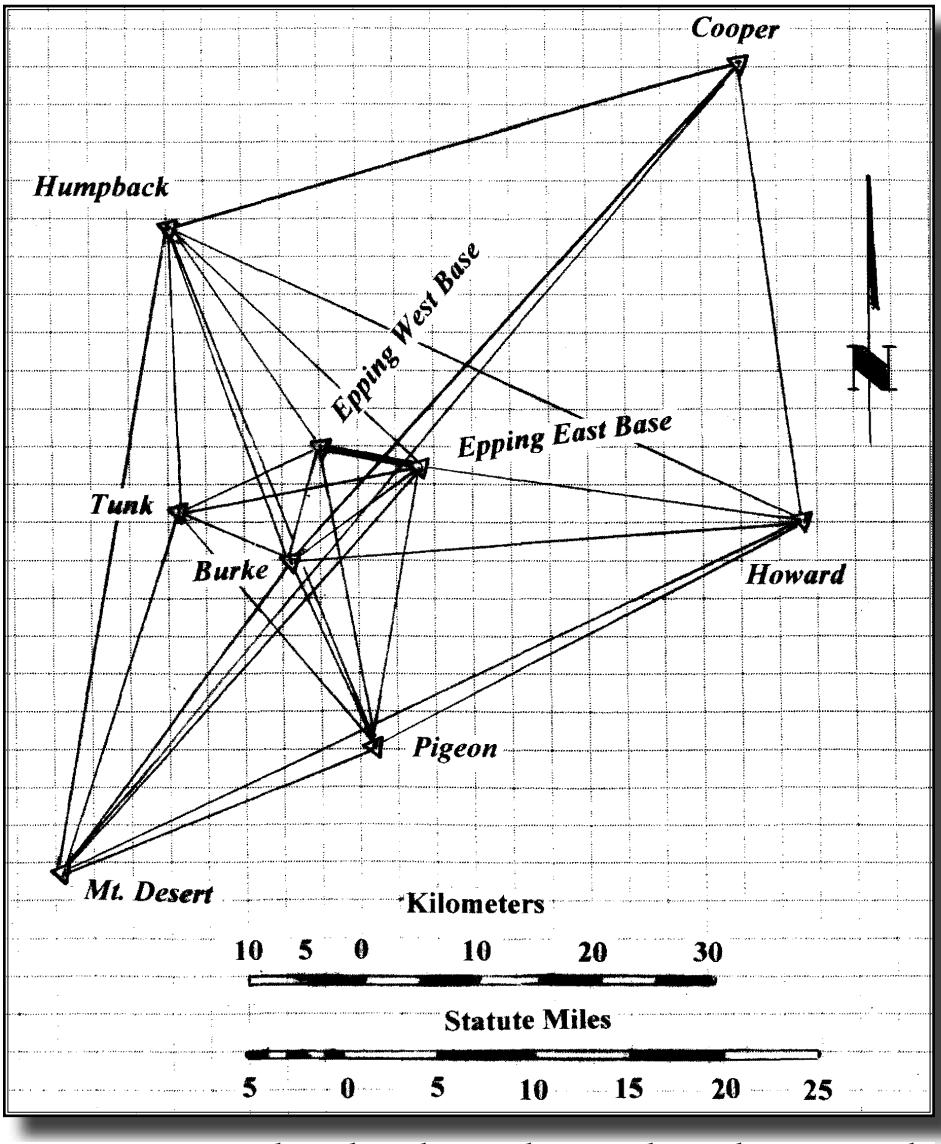


Figure 1. Epping Plains base line and triangulation base network.

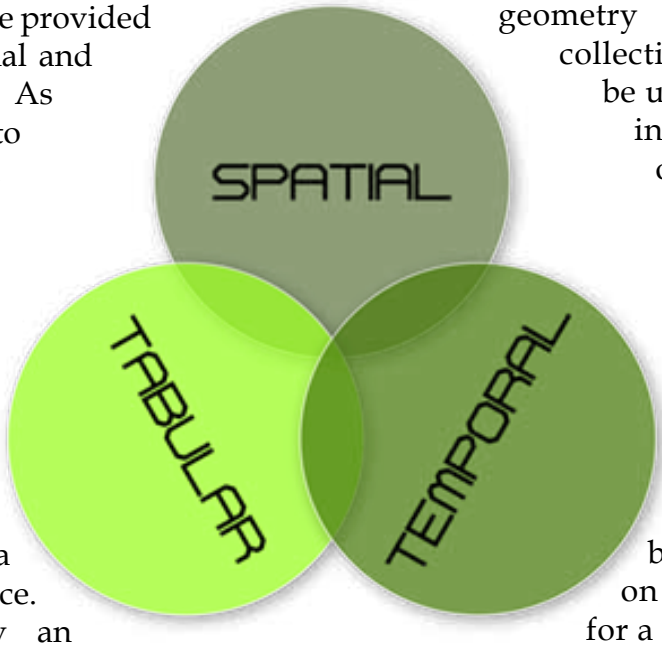
When the length of the Epping base line was computed from the Fire Island base line and the Massachusetts base line, the discrepancy was about 0.008 meter, or greater than 1 ppm.

(Continued on Page 23)

Point of Tangency: A Case for GIS in Land Surveying

by Steven Cowley

In 2006, I began my life as a Geographic Information Systems professional. In some ways I learned more in the first thirty days of applying GIS theory than I did in the previous four years of studying it. Over the years, I've had the opportunity to work on a wide array of projects that have connected disciplines that I never thought were compatible with one another. Through these experiences I've been challenged to find new and innovative ways to develop and utilize my skills. Without pandering too much to my audience, of projects that I've worked on during my professional career, those related to land surveying and geodesy have provided the most challenge, personal and professional satisfaction. As I've had the opportunity to collaborate heavily with land survey professionals, I've noted that the spatial abstraction process that's utilized by a land surveyor when approaching a project is essentially the same as that applied by a GIS professional. Both professionals need a healthy understanding space. Both professionals apply an appropriate data collection method. Both professionals store their data in a logical and organized manner. Both professionals analyze their data to ensure accuracy and precision. Both professionals produce spatial data products and lastly both professionals must be able to distribute these spatial data products to others. Taken in total these observations tie well to the actual definition of a GIS:



"A GIS is a computer-based system to aid in the collection, maintenance, storage, analysis, output, and distribution of spatial data and information." (Bolstad, 2008)

By distilling this definition further, we can develop a better understanding of the similarities of how land survey and GIS professionals abstract space and how these abstractions can be used to further develop skills and dialog between these two professions.

Collection

Spatial data collection combines many different approaches. The utilization of GNSS equipment and conventional instruments to observe physical objects is a primary means of spatial data collection. The land surveyor and the GIS professional use physical observations to produce the basic point, line and area geometry data. Secondary data collection approaches that can be utilized in both disciplines include the compilation of tabular data and databases from various organizations. Tabular data are utilized by GIS professional to produce geometries or to build attribute values for collected or existing features. In general, the data collection process in both disciplines is focused on the aggregation of data for a subject of interest.

Maintenance

Once spatial data has been collected, it must be maintained in order for the accuracy of the data to remain current. In most land survey applications, data are collected once and not typically visited again. This contrasts with GIS professionals who typically collected data and continually maintain it to support some type of research or institutional mandate. GIS professionals view the accuracy of spatial data as being divided into three categories; spatial, tabular and temporal. Spatial accuracy is related to the geometric characteristics of a set of features. This also includes the level of precision used to capture the geometric characteristics.

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This area of concern is present in both GIS and land survey applications. In order to maintain high spatial accuracy/high precision data sets, such as cadastral features, it is necessary for GIS professionals to understand horizontal datums, projections, coordinate systems, scale factors and convergence angles to properly utilize subdivision plats and other records of survey to produce GIS features. Tabular accuracy refers to feature attributes. Attributes detail the characteristics of a feature or set of features. GIS professionals place a great deal of emphasis on tabular accuracy. Databases contain many records and require tight controls on data entry to maintain a high degree of confidence in the record contents. This is an area that land survey professionals could benefit greatly from when collecting and organizing data. Temporal accuracy refers to the currentness of the data and can affect both spatial and tabular accuracy. Land survey professionals consider temporal accuracy when comparing two plats or when reviewing GLO notes from two different time periods. GIS professionals consider temporal accuracy when reviewing both geometry and attributes.

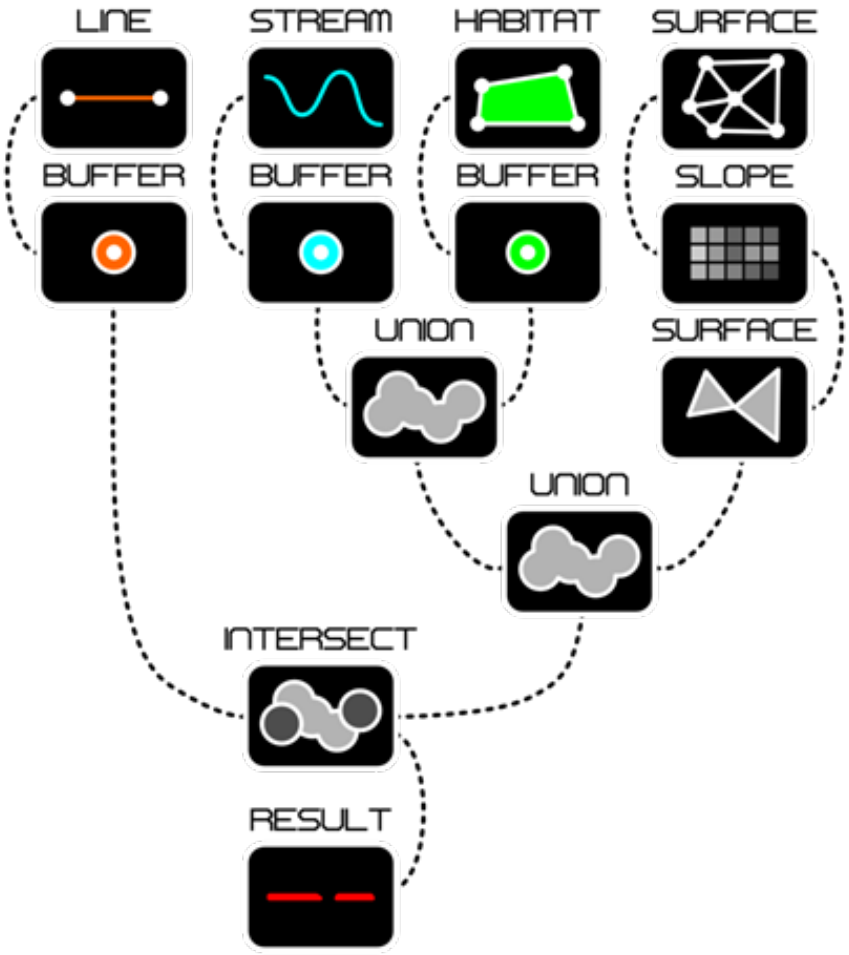

Figure 1: Analysis of Proposed Pipeline Location

Storage

GIS professionals store spatial data in formats such as a relational database. Relational databases utilize a schema to define the logical structure of its data. One can use a simple filing cabinet as a metaphor for a schema. The cabinet is the spatial data file. The drawers within the cabinet are the feature datasets, which are groupings of like features such as utilities. The hanging files within a drawer are the feature classes within the feature datasets. These would include water lines, sewer manholes or storm detention facilities. The papers within the hanging files represent the records within each feature class. Most land survey applications do not require such extensive data structures, but both GIS and land survey professionals must organize and store data in a manner that is logical, efficient, consistent and appropriate for the scale of the data at hand.

Analysis

Analysis is the major differentiator when it comes to the spatial abstractions of a GIS and land survey professional. Land survey analysis is typically more limited in the types and sources of data being analyzed, as well as the geographic extent. The goals of analysis performed by a land surveyor and GIS professional also differ. Although the scope and goals of analysis differ, the intent to produce actionable information is the same. The following is a simple example of an analysis performed by a GIS professional on a proposed pipeline route. The goal of this analysis would be to determine its best location, given design, construction and regulatory requirements.

The accompany *Figure 1* is a graphical depiction of the analysis model. In this example, the proposed centerline, stream centerlines, habitat polygons and surface data are used as inputs. The proposed centerline has a buffer polygon generated to depict the proposed right-of-way. Stream centerlines have buffer polygons generated to depict the desired setbacks from flowing water. Habitat areas have buffer polygons generated to depict the regulated distances from protected lands. The existing ground surface is processed to determine where grades are greater than regulated percent. The stream, habitat and surface buffer polygons are unioned or combined into a new dataset that depicts the areas excluded from consideration. The exclusion polygon and the right-of-way polygon are intersected to determine where they overlap. In this example, if no overlap is observed the proposed centerline may proceed. If an intersection is observed, alterations to the centerline can be made and the model can be quickly run to produce additional results. The presence of models in GIS analysis is significant in that it allows for the inputs and parameters to be modified in an iterative manner to produce different results.

Output

The result of most land survey projects is a legal plat or narrative instrument that is meant to communicate the geometric, legal and physical characteristics of a parcel of land. These documents are complex and require a knowledgeable professional to ensure that they meet the legal and ethical standards of the regulating agencies and state statutes. Although data are generated to produce the final hard copy document, these data are somewhat ephemeral and tend to only be distributed to regulating agencies or to clients. To most, the output of a GIS is some form of cartographic representation. Although a GIS can produce maps and other visuals, this is just one of many types of output. A GIS can be generated from a large variety of data types and subsequently it can be output in a wide variety of data types. The outputs from a GIS and land survey professional may differ, but the basic principle is still the communication of information about space.

Distribution

Data distribution by GIS professionals has experienced significant changes in recent years. Historically, a GIS would be distributed as a file or collection of files. As internet connectivity has improved, the distribution of GIS data and resources has shifted from file distribution to web service applications and clearinghouses. At present, nearly every county in the state of Wyoming has a web mapping application that provides users with access to base information such as cadastral records, transportation routes and utilities. While some of these applications show more maturity and aesthetic sophistication, the overall intent is the same; provide data. Aside from federal agencies such as the department of the interior, most land survey professionals to not concern themselves with distributing data en masse. If it were to be necessary for a land survey professional to deliver data on a large geographic extent, the utilization of a GIS platform would be ideal to leverage an already existing mechanism to quickly and efficiently provide greater access to spatial data resources. Data distribution is a more significant factor in the spatial abstraction process for GIS professionals, but these same distribution methods could easily be utilized by land survey professionals.

Summary

Although a number of subtle differences can be noted in the spatial abstraction process of GIS and land survey professionals, one can easily see that many of the core components of this process are strikingly similar. These similarities, I believe, provide points of tangency by which GIS and land survey professionals can foster cross-communication, cross-training and professional development opportunities to enhance their interactions and to further enrich each profession.

SIDESHOTS

Tieing in Somethiing Extra Along My Traverse

by: Thomas A. Johnson, PLS, CFedS

What is it that they say about the surveying profession? That a surveyor must have one foot in the past, his or her head in the present and his or her eyes to the future. Maybe this quote, attributed to John Smith was for everyone, not just surveyors. The tendency to relate so many proverbs to the Land surveying profession I recall once, at a family picnic, when my brother (in sales) said to my sister (also in sales) that they were in the oldest profession. This caused my brother-in-law (a land surveyor) to interject- "wait a minute, Surveying is the oldest profession!". I don't think there are many surveyors who would not agree that history has a big impact on the vocation of land surveying.

Over the course of the last year I have pondered the contributions of some surveyors who came before me. In the day to day work of land surveying we often build, or rebuild upon the work of surveyors who walked the ground before us. Many times we are using data recorded or monuments set by surveyors we know quite well.

Elmer Newton Johnston (1908-1992)

Some are our colleagues, and had careers that overlapped ours but are now retired, and some are long gone and unheralded until we find a corner monument, or survey record that reminds us that others "walked the walk".

The following account of the lives of Elmer Johnston, Edward Crabb, Goyne Drummond, and Guy Higby are pieced together from surveying records, historic newspapers and genealogy research.

I ran across some brass caps inscribed "E.N. Johnston" on a project in 2016. They were also dated "1976". This was the first I had heard of Mr. Johnston and like many surveyors, I am sure, I began wondering what brought surveyor Johnston to my neck of the woods in 1976. He could not be considered a prolific surveyor in this area so, just out of historical interest, I set out to find out more.

Elmer was born in 1908. To a genealogy researcher this means he has possible presence in four publicly available federal census' 1910, 1920, 1930 and 1940.[1] Because of varying questions, deemed important for the time period, the data collected from each citizen in the U.S. census changes a little every decade. Therefore, each census tabulation gives not only a snapshot of the family at the date of the census, but also various gems of information that help to piece together a family story. In the early 1900's it appears that Elmer's parents both lived along the Mississippi River and Elmer was reportedly born in Gregory Landing, Clark County, Missouri. Clay Township, Clark Co., Missouri was their home in the early part of 1910. However by late September of that year, Elmer's parents had relocated to Wyoming. The Big Horn County Rustler of December 20, 1918, reports on the death of Elmer's mother to pneumonia. Her death was during the influenza outbreak of 1918.[2] Because of that event, the 1920 census reports an 11-year-old Elmer living with his widower father and the rest of the family near Manderson, Big Horn County, Wyoming. He was the fourth child and the second son in a family with two sons and five daughters. Two of Elmer's paternal uncles also resided in the Big Horn Basin, at least one coming before Elmer's family moved there.

One can only assume some details of Elmer's early life in Wyoming. He most likely worked on the family farm until he reached an age at which he left home to follow his own path. Big Horn Basin newspapers mention him from time to time in the social pages, and in 1917, at age 9 he is listed among the names of the Big Horn Junior Home Guards.[3] He made his way to Casper at age 20, in 1928, and worked for a time at The Texas Company, now known as Texaco.

The snapshot of Elmer's life which one would hope to find for 1930, was not discovered in my research for this article. I cannot find Elmer in the 1930 census. He attended the University of Wyoming in 1934, and was living in Laramie in 1939 and working in an assistant supervisory position (field man for the SE district of Wyoming) with the U.S. Department of Agriculture. It appears that he worked later in Torrington in a like capacity until his military service began in July 1943. Elmer married in 1941, and started his family while in Torrington. His wife Christine, and young daughter Carol were left behind at the time of his Army service in the South Pacific during WWII in Guam and New Guinea. Elmer was with the Corps of Engineers and was a water supply Foreman. He and his 9 men procured, tested, purified and delivered water for the troops. If Elmer's experience during his enlistment is similar to other young men in the service, he was likely overseas from 1943 until the end of the war in 1945

The records of the Wyoming State Board for Professional Engineers and Professional Land Surveyors indicate that Elmer Johnston became LS 144 in January of 1948. In the military he took a 15-month course in surveying and mapping. Undoubtedly this was an event that steered him toward a career in surveying.[4]

Elmer returned to Wyoming in 1946. The family moved to Casper in 1947. He remained working for the U.S department of Agriculture as late as 1953. Perhaps he used his surveying license to moonlight as a surveyor. In 1954, his profession has changed to surveyor and he is advertising his services, working out of his home. Elmer's firm can be found in the Casper telephone directories alongside the well-known firm of Worthington-Lenhart. Elmer worked from Casper under his own employ during the late 50's, 60's and at least into the late 1970's. Elmer and his wife Christine raised two daughters and one son, two of which, as well as a son-in-law, worked with Elmer some in his business. I had the good fortune to be able to correspond with one of Elmer's daughters, Barbara, who recalls his office collection of rocks, petrified wood and rattlesnake rattles. In additions to pictures and information from Barbara, I also received a picture from son-in-law George.

Elmer and Christine lived the rest of their lives in Casper.

The monuments I found of Elmer's were brass caps and are holding up well to this day, which I am sure he would be happy to hear.

Elmer on the job in later years.

1954 photo with: (L to R) Elmer's father-in-law John, Christine and Elmer, and young son Roy

Edward L. Crabb (1863-1949)

The name Edward Crabb shows up when researching early surveys for the town of Shoshoni, and Fremont County, Wyoming. Edward may just have one of the more interesting backgrounds of the surveyors I have chosen to research.

Edward Crabb was born in 1863 in Matanzas, Cuba.[5] Ed described his heritage as English, Spanish and French Basque. Edward was the fifth of nine children. The census records for Edward list his immigration year as 1872. Though his naturalization record shows he became a U.S. citizen in New York, New York, in 1865. In the 1875 New York state census the family was living in a brick home in Brooklyn. A household which included two servants. Ed's father, George, and uncle Edward were at least second-generation sugar plantation owners and partners in a sugar company in New York.[6]

The publicly available U.S. census forms for each 10 year count from 1880-1940, included the line item for race.[7] Edward, and his sisters living with him in later years, is/are listed as mulatto, white and negro in the various records found. It is not clear whether these classifications are from Edwards answer to the question of race, or observations by the census taker. The evidence is that Edwards mother was of Creole/African descent.[8]

Edward was educated in New York. School records indicate he was enrolled in the "scientific program" at Brooklyn Collegiate and Polytechnic Institute, an engineering college now part of

NYU. He spent the years 1879-1882 in school there. A brief review of the college's 1882 catalog indicates the mathematics courses that one might expect: Algebra, Trigonometry, Geometry, and Calculus, but also surveying with compass and transit, astronomy, and stone cutting. Edward's program was to contain "over two hundred out-door or field exercises in Engineering". The 1880 census has Edward living with a couple, the husband being the superintendent at a sugar refinery. It might just be that Edward's folks had made an arrangement for Edward to stay with a man he did business with so Edward could attend college. Clearly Edward was a very well educated individual.

An account of Edward's early years in Wyoming, from the *Shoshoni Enterprise* [9] makes it clear that Edward moved to central Wyoming soon after he left college. He was in the Dubois, Wyoming, area in 1888 working as a "market hunter". He was then employed in 1890 working on survey crews on government contract surveys in the Wind River basin. He worked about 10 years for different sheep "outfits" from Casper to Lost Cabin, and homesteaded a quarter section near present day Lysite from ca. 1900-1906. The story indicates he sold his homestead and moved to Shoshoni when the "reservation opened" in 1906. The 1910 U.S. census indicates Edward's profession as surveyor and engineer. Clearly Edward was carving his proper niche, finally, at the age of 46.

The earliest subdivisions in Shoshoni have no indication of who was the surveyor. We know that Edward was around the area in 1905 when the Original plat of Shoshoni was filed, and also in the succeeding years when the next two plats were developed. The Shoshoni Townsite Company caused the plats to be made, and could very well have hired Edward to do the surveys. The minutes of the Fremont County commission during the 1910's-1930's contain numerous references to Ed Crabb doing county road surveys.

In 1907, Wyoming led the nation with the first engineering licensing laws. Edward was examined June 20, 1907, and became licensed as a grade 2 registrant (described as a Topographic Engineer) with registration no. 55. Wyoming's online roster shows Edward with LS no. 3, and a registration date of June 1925. I am told that this reflects a change in the system in those early years.[10]

A 1911 newspaper, the *Natrona County Tribune*, makes mention of Edward as a civil engineer. In December of that year he was appointed as superintendent of a newly formed water district under the Wyoming State Engineers Office Board of Control.

By 1920, Edward had two sisters and a niece living with him. During this time period Edward appears to be involved with developing the water system for Shoshoni, served on the town council, and is active in organizations such as the Shoshoni Rifle Club, serving that group as secretary. He was known as a champion shooter among other members of a traveling rifle club based in Thermopolis. By the late 1920's, he is known as one of the real "old-timer's" and his knowledge of the area history was well respected.

Edward lived the remainder of his life in Shoshoni and was clearly one of its most respected citizens. He was still self-employed through the 30's and 40's as a surveyor. He had his sisters with him until sister Anita died in 1948, and Pauline survived him and died in 1956.[11] There is no evidence that I have uncovered that Edward had any children of his own.

Edward died on December 18, 1949, two days before his 86th birthday and his eternal remains rest in the Lakeview Cemetery in Shoshoni, alongside his sister Pauline. He was a Fremont County pioneer who made his mark on the community he chose as his home and who is now memorialized with a humble headstone without even his birth and death dates inscribed.

Crabb memorial at Shoshoni Cemetery

Goyne Drummond (1858-1937)

Ohio born Goyne Drummond is a figure well known to surveyors and historians in Fremont County. He is credited with platting the Original town of Riverton, and was an early resident. In fact he moved to Riverton almost immediately once the townsite was opened. He lived and based his surveying career out of the Riverton area from 1906-1921. He was a known figure in the State of Wyoming before and after his years in Riverton. He appears to have been in private practice as a private surveyor, mineral surveyor, and civil engineer given his ads in the Riverton newspapers. He held posts, not only as a surveyor with the "U.S. geological survey", but also as a postal clerk for the UP (ca. 1888), City Engineer for the town of Riverton (ca. 1916), and District engineer for the Wyoming roads department (after 1921).

Goyne Drummond started out as so many others did in his era, he was a farm kid, and part of a large family. Goyne's early life was spent on the family farm in Clark county, Ohio. It appears that Goyne's father Samuel farmed land that his own father had settled. Clearly the Drummonds were a pioneer family in Ohio. Goyne's mother was widowed when Goyne was only 10, and as late as 1880, Goyne was farming. One would assume that he continued that until his mother's death in 1882. Goyne was the fourth child of the marriage of his father Samuel and mother Mary, however both had been married before and between them had a total of 20 children. It is very likely that Goyne was not in line to inherit the family farm with his mother's passing, as he was not the oldest son on the place in 1882. Goyne lived in an age in which some of his half-brothers were killed in the Rebellion (Civil War), but he had one older brother from Mary and Samuel on the farm before his mother's death.

In 1886, Goyne headed to Denver and reportedly made his home there for a time. It appears that he had a sister who settled in the Denver area and Goyne maintained a connection to Denver at least through 1900. However, as early as 1888, he was mentioned regularly in the news media in Cheyenne. During these years it does not appear that Goyne was employed in the surveying or engineering field. He apparently was appointed as a postal clerk to the Union Pacific railroad in 1888, and may have been splitting his time between Cheyenne and Wheatland. In the early 1890's, it seems Goyne was living in Cheyenne, and even served in the military there. It may be that Goyne received his surveying training while in the military, and perhaps the first evidence of his career in surveying and engineering is while he worked on surveys for the Wyoming-Utah (Northwestern) railroad. Specifically, he is said to have worked from Casper to South Pass and west. He was to be found surveying for that railroad route in Uintah County in the Willow Creek Gap in 1893.

Somehow, like many of us, Goyne was able to find a spouse and was married in 1894. Exactly how he managed to court an Ohio girl from near his boyhood home has not been determined, but they were wed in June, 1894, in Ohio and Mrs. Clara (Harb) Drummond joined him to reside in Wheatland after that.

Goyne continued to travel around the west working on surveys of various sorts. He worked with Edward Stahle on the Shoshone reservation as early as 1898. He worked in the Kalispell, Montana, area in 1901, out of Needles, California, on the Colorado River project in 1902, then directly on to the Milk River project in Montana soon after that. He returned to the southwest, to Yuma, Arizona, in 1904, and then back to the Shoshone reservation.

Obviously, his familiarity with Fremont County and the reservation had a lot to do with his involvement in surveying the townsite of "Riverton". Goyne was involved with a Mr. Gill and his Shoshoni based contingent, but there was a competing group of persons from Lander with their own layout and the name "Central City" in mind. The news media based in Lander and Shoshoni in 1906 kept busy sniping back and forth between these opposing forces making plans for the opening of the townsite, following the ceding of lands from the reservation (McLaughlin Act, March 3, 1905). Ultimately Goyne's plat and the name Riverton was what stuck. The early street names on that plat included the names Gill, Adams, and Drummond. At some point in history most of the avenues were renamed after U.S. presidents. Adams continues to be in use, and one would assume since it is among the current street names such as Washington, Lincoln, Jefferson, etc. that it was president Adams who was honored with this street. I prefer to believe that the name continues to honor surveyor William S. Adams, GLO contract surveyor, another early Riverton resident, and hunting buddy of Goyne.

The earliest record of Goyne having been licensed in Wyoming is records of the Wyoming SBPEPLS stating that Goyne was examined on September 11, 1907 and was licensed as a Grade 2 registrant with

License No. 84. A grade 2 registration is described as a topographic engineer.[12] Wyoming's online roster shows Goyne with LS 66, and a registration date of January 27, 1933.

Goyne resided in Riverton until 1921. He continued to work on projects away from home, including Idaho in 1909. He served as city engineer for Riverton in the 1910's. He is said to have laid out the Masonic Temple building in Riverton, which was built in 1917-1918. By 1920, he appears to be working on highways in the Lusk area, and in the spring of 1921, he was offered a position as district engineer for the Wyoming roads department. Goyne and his wife relocated to Rock Springs where he managed highway projects from there, including the Pinedale-Eden highway, and certainly others.

There were some dark days for Goyne. He found himself on the wrong side of a widely reported switching he administered to a young orphan girl who was being fostered at the Drummond home in 1909, for which he paid a fine of $5, but certainly he suffered from community disapproval more damaging than the fine. In 1915, his wife Clara died after suffering for a number of years of illness. When World War I broke out, Goyne's son Harb served in the military, which surely caused Goyne some concern, but Harb apparently came through that conflict okay.

Goyne did get remarried to Kentucky native Emma Buntin, widowed in 1910 and 13 years younger than Goyne. She had a young son David H. Wagner. It appears that they were wed sometime around 1917. It was reported that year that he had a large new home under construction. That house still stands today at Adams and South Second Street in Riverton. Perhaps Emma prompted the building of the new home.

Beyond 1921, Goyne does not make many appearances in the available news media. The records show that in 1930 he was at the home of his oldest daughter in Kansas City, Kansas. The could have been just a visit, found that at the date the census taker came. He was definitely living in Ann Arbor, Michigan, by 1934. It was in Ann Arbor that Goyne died at age 78, in April 1937.

Goyne had fathered three children. Besides Harb, he had daughters Louise and Kathleen. All his children were in their mid-teenage years at the time of their mother's death, so Goyne was to finish their upbringing. They went on to have their own families in Kansas, Missouri, and California respectively. And young David Wagner, raised

by Goyne and Emma, having never known his biological father, apparently became a career military man. He shows up in the 1940 census as living in Scofield Barracks in Hawaii, prior to the Pearl Harbor attack. He is buried in Arlington National Cemetery with the rank of Major. His death took place in 1942, at age 32, during World War II. While he used the name Wagner in most public sources, the name on his grave, perhaps out of respect for the man who raised him, is David Hickman Drummond.

Guy Higby

Guy Higby belonged to that group of professionals who routinely advertised their services in the Fremont county newspapers in the early 1900's. In this day and age, you seldom see engineers and surveyors advertising, but Guy has his ads right there alongside the attorneys, physicians, and blacksmiths of the day.

Guy William Higby was born in January, 1869, in Waterloo, Iowa. He was the third child of 4, the second boy, to parents who had been born in Ohio themselves and apparently lived in Illinois for the births of their two older children. Guy's parents, Enoch and Hannah, spent a short few years in Iowa, long enough for Guy to have a second sister born, and then moved to Nebraska. Guy is another of my subjects who lost a parent at a young age, as his father died in December, 1872, when Guy was only 3 years old. While Enoch had been a farmer, it appears that Hannah probably worked as a housekeeper and her oldest son, Osceola, worked as a laborer to help support the family. Enoch had served in the Civil War out of Illinois and Hannah may have received a soldier's pension.[13]

Some of that time period after Guy reached adulthood and before Guy's marriage might very well have been a period of schooling and or training for Guy. Surely it was for most young men at the time. Though there is little apparent evidence of Guy's training in the field of Engineering, it is mentioned in the records that he had a "correspondence course".[14] When he later ran for city office in Lander it was mentioned that he had been part of the Northwestern Railroad engineering corps.[15]

Guy was married in 1891, and over the next seven years he built his own family of two daughters and a son. Guy lived in Nebraska at least through early 1900 and was reported to be working as a store keeper in the 1900 census.

MAP of the Townsite of MONETA

Scale 1 inch = 100 feet

Surveyor's Certificate
For the Townsite of Moneta Fremont County, Wyoming

State of Wyoming } ss.
County of Fremont }

I hereby certify that on the 29, 30 and 31st days of October and 1, 2, 3, 4, 5, 6 and 7th days of November, A.D. 1919, I surveyed the Townsite of Moneta, Fremont County, Wyoming, being the Southwest quarter of Section 23, Township 37 North, Range 91 West of the sixth P.M., all of the above named tract excepting the Right of Way of the Wyoming and Northwestern Railway, as shown on this plat, and more particularly described as follows, to-wit:

Beginning at the Northwest corner of the tract for corner No. 1, whence; the North one quarter corner of Section 23, Township 37 North, Range 91 West of the sixth P.M., bears North 1320 feet. Thence East 1324 feet to corner No. 2, Thence South 2646 feet to corner No. 3. Thence West 1324 feet to corner No. 4. Thence North 2646 feet to corner No. 1 the place of beginning. Each lot and block bears it's own number.

Witness my hand this 14th day of November, 1919.

Guy W. Haigler U.S.M.S.

STATE OF WYOMING } S.S.
COUNTY OF FREMONT }

I, John Goodman, have this 14th day of November, A.D. 1919 set aside and platted the Townsite of Moneta, in the County of Fremont, and the State of Wyoming, the following described tract of land, being the Southwest quarter of the Northeast quarter, and the Northwest quarter of the Southeast quarter of Section 23, Township 37 North, Range 91 West of the sixth P.M., all of the above named tract excepting the Right of Way of the Wyoming and Northwestern Railway, as shown on this plat, and more particularly described as follows, to-wit:

Beginning at the Northwest corner of the tract for Corner No. 1, whence; the North one quarter corner of section 23, Township 37 North, Range 91 West of the sixth P.M. bears North 1320 feet; thence East 1324 feet to corner No. 2, thence South 2646 feet to corner No. 3, thence West 1324 feet to corner No. 4, thence North 2646 feet to corner No. 1, the place of beginning, to be known as the Townsite of Moneta; that the platting of the above is with the free consent and in accordance with the desire of the undersigned owner and proprietor, and the streets and alleys shown hereon are hereby dedicated to the public use.

Signed, sealed and delivered in the presence of John Goodman

Grant Kisor as a witness.

I P. J. Coolidge, a Notary Public in and for said County, in the State aforesaid, do hereby certify that John Goodman, to me known to be the same person whose name is subscribed to the foregoing instrument, appeared before me this day in person and acknowledged that he signed, sealed and delivered said instrument as his free and voluntary act, for the uses and purposes therein set forth.

Given under my hand and Notarial seal this 14th day of November A.D. 1919

My commission expires April 29th 1922

P. J. Coolidge
Notary Public.

NOTARY PUBLIC FREMONT COUNTY WYO. P. J. COOLIDGE

Filed for record at ... o'clock ... M. Nov 15 1919 and recorded in Book ... of Deeds, page ... Fremont County, Wyoming.

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Before appearing in Wyoming, Guy had also lived in or near Deadwood and Whitewood, South Dakota.[16] As early as April 1905, Guy is in Lander, Wyoming, advertising his services as a U.S. Deputy Mineral surveyor as well as civil, mining, and irrigation engineering. Later this same year he appears to have teamed up with a John Linn, forming the apparent short-lived firm of "Higby and Linn". Reports are that he spent some of 1905 working in the Rattlesnake Mountains of central Wyoming "running lines" for sheep men.

In 1906, Guy was a part of the "Lander Locating Company", advertising that they can locate settlers on good ranches being surveyed, and onto which water is being routed for irrigation. Guy was also active surveying claims in the Willow Creek mining district.

The earlier records of the Wyoming SBPEPLS indicate that Guy was examined on December 31, 1907, and became licensed as No. 104, as a grade 3 registrant or Hydraulic and Hydrographic Engineer. As with others I have researched, Mr. Higby also has Wyoming registration numbers from later dates: LS 10, dated June 2, 1925, and PELS 224, dated January 11, 1936.[17]

In the years following 1907, he is mentioned for his mine surveys in the Copper Mountain area,[18] oil industry surveys near Powder River, underground work at an asbestos mine south of Lander, and weeks of surveying in the Dubois country with his son Hollis helping him. Notably, he was reported in 1914 to have been surveying what was then called the Northwestern Tie Camp, 20 miles northwest of Dubois. Also, of interest is his work laying out the townsite of Moneta in 1919.

Guy and his family were active in the community as well. While his wife was often noted for involvement with local festivities, Guy endeavored to represent the Lander citizenry in local and state government efforts. In 1908, Guy ran for Lander City Council. He lost that race but was appointed City Engineer in 1909 by the councilmen who did win. In 1912, Guy served as a delegate to the Nation Irrigation Congress which was held that year in Salt Lake City, Utah. Guy was a charter member of the Kiwanis Club when it was established in Lander in 1921. In the 1930's, Guy served as County Surveyor and as a Water Commissioner.

Guy was seldom in the news in a personal capacity. He was mentioned in a 1913 article which described how he had a horse drown in Twin Creek, near Lander. The creek was in flood stage that spring and a bad spot on the Twin Creek Bridge caught a wheel on his buggy and the carriage and horses went off the bridge. He and a companion managed to release the horses from harness but one did not make it out of the flooding watercourse.

Information on Guy in later years is more difficult to find. He continued to work as a civil and irrigation engineer through the 1930's and into the 1940's. I have no information on Guys later years. His son, Hollis worked various jobs as a young man, including in the oil field and as a telephone operator manager. He ultimately became a civil engineer[19] and later lived in California. Guys middle child Emily married Wyoming politician Lester C. Hunt.[20] After the death of her husband, she lived in Spokane, Washington. Guy's oldest daughter married in Los Angeles, California, in 1920, and made her home there.

Guy Higby lived many years in Lander, Wyoming, and died there in April 1953. He was certainly a pioneer in our profession and another notable figure.

This summary of the lives of these four individuals was begun with a thought that maybe I could uncover just a little bit of information about someone whose work I was walking in the footsteps of. It was spurred on by the ready availability of some early Wyoming newspapers, some skill in research in genealogy, and by some random connections with a few descendants. Each community, has in its history, persons such as these who simply did the work needed and passed on. There is often little "original evidence" to point to individuals of their era, maybe a few recorded plats or occasionally an unrecorded survey map shared by a client. The fact is that most older survey work found on the ground does not bear the "brand" so to speak of the surveyor who was responsible for it. The monuments were iron pins, rebar, pipes, and axles. Some piece of iron maybe the surveyor had on hand, or found, and thought: "look at this! This would make a good corner point!" We will find it, and we will judge it for its worth, from record deeds and maps. While I can't say I have ever found corners set by some of these fellows, I recognize that they were professionals of their day, trusted in their work and I deem them to be found, verified, proven, called for, original surveyors.

[1] Census records newer than 1940 are not made public until 72 years has passed since their date.

[2] Personal correspondence with Barbara Johnston, her granddaughter.

[3] The Home Guards were a precursor to the U.S. National Guard.

[4] Personal correspondence with daughter Barbara.

[5] Personal Correspondence with his great nephew, Jeff Morrison.

[6] Public records and correspondence with Jeff Morrison. The Wilson-Crabb Sugar Co.

[7] 1890 U.S. Census records are nearly all lost as a result of a fire.

[8] Confirmed by family research (DNA testing) by Jeff Morrison.

[9] January 6, 1928.

[10] Personal communication with the Wyoming State Board of Professional Engineers and Professional Surveyors.

[11] Information from Jeff Morrison, no death dates appear on Ed or Pauline's headstones.

[12] Personal correspondence with the Wyoming SBPEPLS (State Board of Professional Engineers and Professional Land Surveyors).

[13] From an 1890 Civil War pension application.

[14] Person communication with Wyoming State Board of Surveyors and Engineers.

[15] Wyoming State Journal May 1908.

[16] Wind River Mountaineer, Feb. 1907.

[17] Wyoming online roster.

[18] Williams-Luman copper mine, Depass, Wy.

[19] Wyoming PELS 137, registered in March 1933.

[20] Who served as Secretary of State, Governor and later as Wyoming Senator in Washington DC, credited with the idea of the bucking horse on our state plates ca. 1936.

Editor's Note: Elmer N. Johnston attended the special meeting called at the January, 1977, WES Annual Meeting. He also attended the PLSW formation meeting of April 21, 1980. Elmer N. Johnston was installed (along with Elmer Lenhart, Paul N. Scherdel, Robert Jack Smith, and William H. Smith) as the first PLSW Honorary Members.

(Continued from Page 8)

Captain T. J. Cram, Topographic Engineer, conducted a study to determine the elevation of the stations. In 1852 and 1853, he conducted trigonometric leveling and differential leveling tests, as well as barometric hypsometry and variation of the temperature of boiling water. Cram discussed the problems of refraction and other problems in his report. The surveys were not without danger and hazards. In Virginia and North Carolina, extreme cold occasionally inhibited progress. At other times, mud, mosquitoes, flies, swamps, marshes, timber, and heavy brush were factors for delaying progress. In one instance, ice accumulated to ten feet along the beach of Cape Henry. J.J. Scipio Hassler reported that "Nearly all the wild fowl in the vicinity, many of the fishes, and some of the cattle were frozen to death." In 1858, he fell and broke his arm. The results of his injury probably contributed to his death on 23 June 1858.

In the period just before the American Civil War, the Coast Survey worked with the General Land Office in the Florida Keys. The Keys were part of the Public Domain, and required cadastral survey monumentation. The classical GLO procedure is to systematically run all the section lines (north - south and east - west) and set section corners and one-quarter section corners where appropriate. The protraction of townships across the mapped islands identified the location of section corners or one-quarter section corners lying on dry land. The Coast Survey computed the geodetic location of these corners and the geodetic azimuth and distance to the nearest triangulation station. The geodetic surveys in the Florida Keys was one of the limited instances in the history of the GLO/BLM which permitted use of triangulation to execute original cadastral surveys. In the 1850's, the Coast Survey assistants were confronted with the Siminole Indians. The Indians had never signed a peace treaty with the United States. The Coast Survey operations between Cape Florida and Cape Sable, were in Seminole territory. Although no Coast Survey personnel were attacked, the heightened hostilities caused delays.

The Louisiana coast was not the territory of warring Native Americans, but nature produced impediments equally as dangerous. As mentioned earlier, Assistant Ferdinand H. Gerdes executed reconnaissance from Cape Florida and the Mississippi Delta. In 1857 - 1858, the Mississippi River reached its highest stage in two decades. The neighboring marshes were inundated from December through May. Gerdes noted that the soil had become too unstable for tripods and scaffolds. At many of the survey stations where the tripods and scaffolding were constructed the previous season were now covered with several feet of water. At sites where suitable soil stability was noted, the feet of the tripods and scaffolds were buried deeper than normal. The signals at intersection stations were inserted into screw piles and braced by wire cables. These signals were destroyed in a violent storm on 23 December 1857. After rebuilding these stations, a second violent storm on 15 January 1858 destroyed stations. Also, the schooner Gerdes (named for Ferdinand H. Gerdes by Bache) was blown ashore with minimal damage and only the loss of an anchor and cable. Other Coast Survey assistants noted that the Louisiana coast line changed rapidly after every storm.

Stephen Harris noted frequent problems of maintaining and retaining survey markers. Harris submitted four suggestions/ precautions to protect triangulation marks. These proposals were adopted and became standard procedures thereafter.

Another innovation initiated in the Louisiana triangulation was that the angles observed at the Cat Island station between Ship Island Light and Chandler Light were made at night employing dioptric lights. The effort was positive. This was the first effort in the U.S. to observe triangulation employing lights at night. The procedure would become standard for triangulation observations in the twentieth century.

The work along the Texas coast was also trying. Assistant James Williams wrote, ". . . the stormy weather, the short twilight light, and intense heat of cloudless summer; the frequent, almost constant high winds; the hazy, misty air, . . . all battle against progress; . . .".

While base lines and triangulation (both primary and secondary) were geodetic matters, plane table mapping was an integral partner in the chart making process. Between 1850 and 1860, an estimated 7,295 square miles were mapped which

encompassed more than 25,000 miles of shore lines and tidal rivers and creeks. An average of 17 topographic parties were deployed each year. The field sheets were usually plotted at 1:10,000 or 1:20,000 scale. The acknowledged dean of the cadre of topographers associated with the Coast Survey was Henry Laurens Whiting, who worked for the Coast Survey from 1838 to 1897. Other excellent topographers included Alexander Wadsworth Longfellow; Charles M. Bache; Richard M. Bache; Isaac Hall Adams; John Seib; J.B. Gluck; Augustus F. Rodgers; Cleveland Rockwell; James Lawson; Clarence Fendall; J.G. Oltmanns; J.W. Dean; F.W. Dorr; and Samuel A. Wainwright.

The hydrographic surveys continued throughout the 1850's. Between 1850 and 1861, ten hydrographic survey parties were in the field and conducted 520 hydrographic surveys. The average survey encompassed 56 square miles, having 8,000 soundings, primarily obtained by a leadsman (a person who operated a lead line). To obtain the estimated 8,000 soundings meant that the survey vessels steamed, sailed, or rowed approximately 217 miles per survey. Harbor and harbor approach surveys required a high density of sounding covering the area. For one project, the boats ran 598 miles, encompassing approximately 100 square miles, 68,500 soundings, 90 bottom samples, and 9,850 angles to position the sounding vessels. Offshore surveys required about 16 soundings per mile with a position fix at approximately every 0.20 mile.

California was ceded to the United States in the Treaty of Guadalupe - Hidalgo (2 February 1848). By the summer of 1848, Congress had stated a desire to extend the Coast Survey's work along the Pacific coast. Assistant James S. Williams and Sub-Assistant Joseph S. Ruth were selected to be the initial resident Coast Survey personnel. Lt. Commanding William Pope Mc Arthur would head the hydrographic survey operations. The original plan was to initiate the work at the Columbia River, and move southward to Monterey. The discovery of gold at Sutter's mill altered the plans. Williams, Ruth, and Brevet Major Richard P. Hammond, U.S. Army, made arrangements to travel to California via the Isthmus of Panama. Lt. Commanding William Bartlett, aboard the Coast Survey Schooner Ewing departed New York in January 1849. Lt. Mc Arthur, who would assume command of the Ewing once it reached California, departed the East Coast on 17 March 1849. The Ewing arrived off the Golden Gate on 1 August 1849 (about 170 sea days). In the next 140 years, only one Coast Survey, Coast and Geodetic Survey, or NOAA vessel would make the trip around Cape Horn.

When Lt. Mc Arthur arrived at Chagres (Panama), he found an over crowded, lawless town. Because Mc Arthur was an officer, the local residents made him head of the vigilante committee. He proceeded to restore order within two days. Life in the Coast Survey had its excitement!

One of the darkest moments in the Coast Survey's history occurred on 13 September 1849. Midshipman William Gibson commanded a boat returning guests to shore after dining on the Ewing. On the return trip from the shore, five members of the boat crew mutinied. After a brief struggle, Gibson was thrown overboard to drown, but was rescued by a passing British vessel. On 23 October 1849, two of the mutineers were executed on the Ewing and the U.S. Frigate Savannah. Needless to say, the chaotic conditions fueled by the gold rush seriously impeded geodetic and charting activities on the west coast.

Enter George B. Davidson (9 May 1825 - 2 December 1911). Davidson was born in Nottingham, England. In 1832, the Davidson family moved to Philadelphia, where he was eventually enrolled in Central High School, where Alexander Bache was a member of the faculty. Bache appointed Davidson a student assistant to operate the school's astronomic and magnetic observatory. Davis graduated from Central High School on 15 July 1845 as valedictorian (age 20 years). When Davidson delivered his address, "The Progress of Science", he was on leave from an assignment with the U.S. Coast Survey along the coast of Maine. Before going to Maine, Davidson worked at the Washington office as assistant to Director Bache. Apparently, the city was boring to him, as one biographer stated that Davidson referred to the city as "Washington D(reary) C(ity)".

In the early years, Davidson served as an astronomical observer under Bache (summers in New England) and the entire spectrum of geodesy (reconnaissance, triangulation, astronomic observations, magnetism, and data reduction

and adjustment) required for chart and map production. Two of his tutors during this era were Capt. Thomas Jefferson Lee, U.S. Army, and Assistant Robert H. Fauntleroy.

With the failure of the early efforts in California, mentioned earlier, Superintendent Bache appointed Davidson to direct a west coast field party. Davidson, John Rockwell, and James S. Lawson traveled on the ship Philadelphia to Charges, Panama. The party arrived in San Francisco on 19 June 1850.

Davidson's initial project was to make astronomical observations at Point Conception, marking the entrance to the Santa Barbara Channel. The work continued until October and "moved" Point Conception eastward about nine miles than had been previously located. When Superintendent Bache read the report of the completed project, he published a detailed plan to execute work along the Pacific coast.

Although Coast Survey personnel had been in California since 1849, 1851 would be the real beginning of Coast Survey operations. A.M. Harrison arrived and headed the topographic team. Richard D. Cutts, assisted by Augustus F. Rodgers, executed triangulation and topographic mapping around San Francisco Bay and San Diego - Mexican border. Rodgers would have a fifty year career on the west coast. R.D. Cutts was a senior Coast Survey surveyor who worked with the Army and Navy Commission responsible for selecting sites for forts and bases, as well as surveying locations for lighthouses. The initial hydrographic work suffered a series of mishaps in 1850 and 1851. Lt. William P. Mc Arthur died in December 1850. In late December 1850, a storm produced major damage to the ship Ewing, and the steamer Jefferson was lost at sea in May or June 1851, near East Patagonia. Immediately after the latter incident, Lt. James Alden, Navy, arrived and took charge of the repaired Ewing. Later, he assumed command of the steamer Quickstep to perform reconnaissance of the California coast south of San Francisco. Later, the fleet was increased when the side-wheel steamer Goldhunter was acquired and renamed the Active.

By the end of 1852, Davidson had nearly completed the work of observing astronomic positions of the major headlands and ports along the west coast. Through the 1850's, additional Coast Survey personnel arrived at the west coast. Davidson measured his first base line (near San Pedro), and was deeply involved in triangulation. In 1859, Davidson instituted a triangulation campaign connecting Point Reyes to Ballenas Bay to the south and the work executed by Assistant Fairfield. For three years Assistant George Fairfield had attempted to complete this project, and was foiled by terrain conditions. Davidson completed the project in seven months!

The geodetic surveying, topographic mapping, nautical and navigational charting, tidal studies, and current studies along the Pacific coast did not lag behind the East coast and Gulf coast efforts. Although a round trip communication between Washington and the Pacific coast could take more than two months, Bache was able to monitor the efforts of the remote personnel.

In November 1854, Davidson visited the east coast for a vacation. Upon his return to California, Davidson commenced collecting information from the reports of other Coast Survey assistants, and his personal observations. These were compiled into a "Directory for the Pacific Coast of the United States", which was published as Appendix No 44 of Report of the Superintendent . . . 1858 (1859). The Appendix was also separately published as a monograph. There was a precursor publication in the Report of the Superintendent . . . 1855 (Appendix No. 26).

The publication of the "Directory" marked the end of the era of the frontier on the west coast. Davidson's effort served as a model for the Coast Pilots of the Pacific Coast for the next five decades. The work provided a glimpse of the U.S. west coast while it transitioned from a pristine wilderness.

1859 - 1860 marked the closing of the golden era of the Coast Survey. During the 1850's, the Coast Survey appropriations were between 0.5 and 1 percent of the total U.S. Congressional appropriations. In less than two years, the country would be engulfed in a civil war. Many of the Coast Survey assistants would apply their professional skills and knowledge supporting military and naval operations. Unfortunately, these assistants would serve on both sides of the conflict.

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