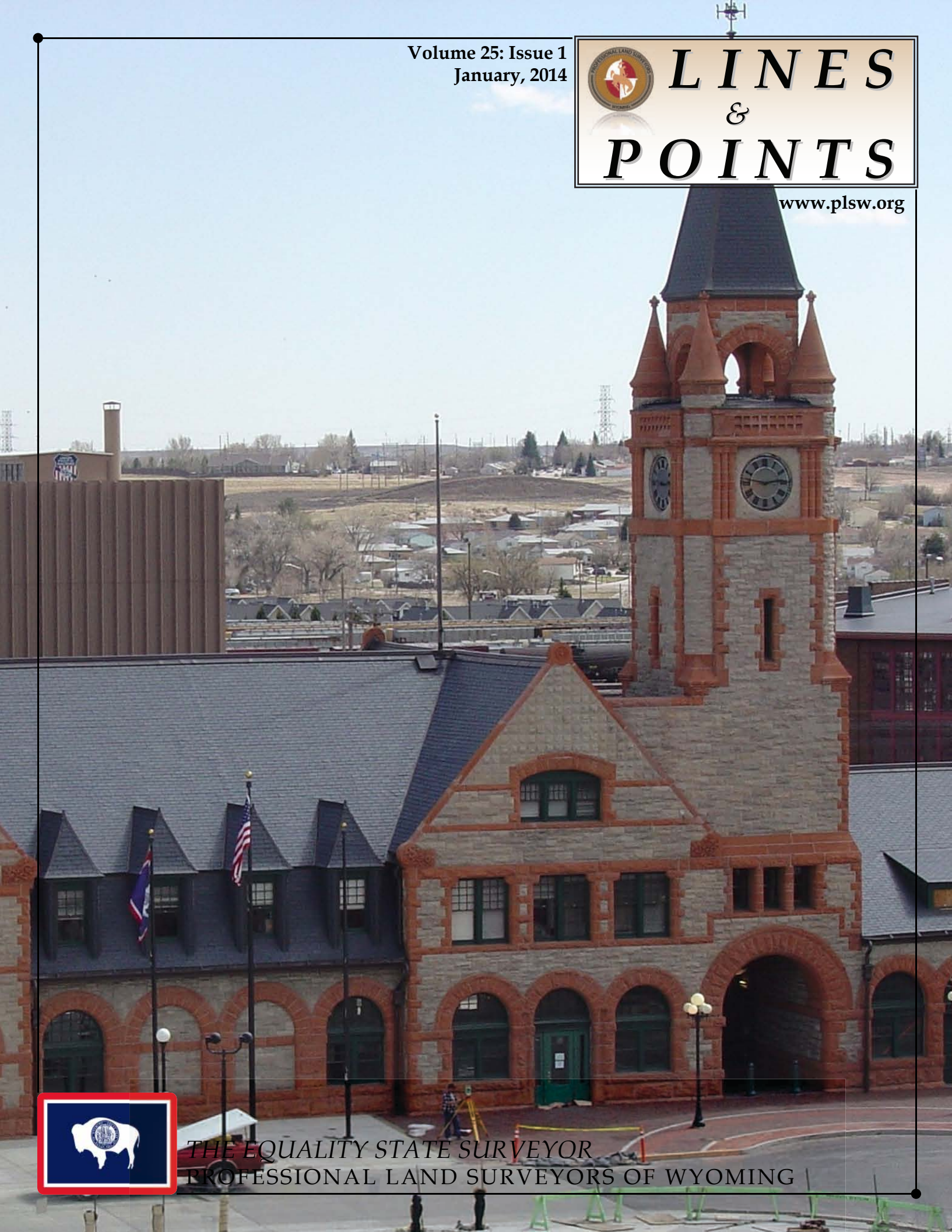


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January, 2014



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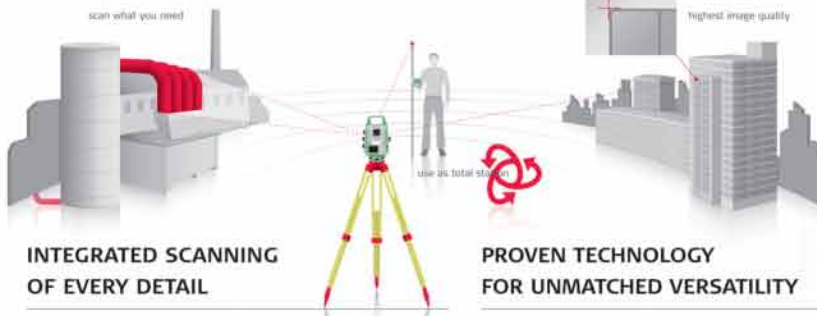
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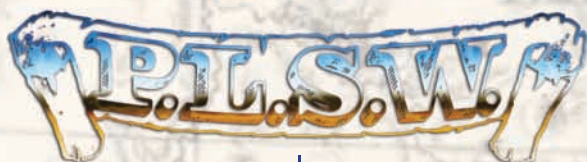
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On The Cover

CHEYENNE'S UNION
PACIFIC DEPOT
MUSEUM WITH
MODERN SURVEYING
WORK UNDERWAY
IN THE PLAZA

CONTENTS

Page 3 • PRESIDENT'S MESSAGE

Page 4 • SCHOLARSHIP OPPORTUNITIES
AND ANNOUNCEMENTS

Page 5 • 2013 FALL TECH PHOTOS

Page 6 • NSPS 100% MEMBERSHIP MAP

Page 7 • GEODETIC SURVEYING: PART IV
AGE OF ENLIGHTENMENT - PART 2
By: Herbert W. Stoughton, PhD, PELS, CP

Page 11 • CHEYENNE DEPOT MUSEUM
By: Jack Studley and Dennis Dawson

Page 19 • NSPS/PLSW MEMORANDUM OF
UNDERSTANDING

Page 21 • WARREN ALFRED GRAF
Obituary

2012 PLSW SUSTAINING MEMBERS

- John Baffert - Surv-KAP, LLC
- Troy Langston - Monsen Engineering
- Richard Monsen - Monsen Engineering
- Bryan Baker - Frontier Precision Inc.
- Chris Farnsworth - RDO Integrated Controls

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For more information please contact Pete Hutchison or Jack Studley.

PLSW (Professional Land Surveyors of Wyoming) 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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PRESIDENT'S MESSAGE



PLSW Members,

Happy Holiday season to all, I hope you each are able to spend time with family and friends and forget about your workload for a few days. It is hard to believe that this is my fourth and final message to the PLSW membership; however I am excited to pass the gavel over to our President Elect Carl Carmichael in February and look forward to his leadership to follow. It has been an honor to serve this organization the last year and I look forward to the future of PLSW and the surveying community in general.

The largest challenge in the past year was completing the memorandum of understanding (MOU) necessary to finalize our membership with NSPS. I am thrilled to say that process has gone full circle and we have officially executed the necessary documents making the MOU official with NSPS. I extend a huge "Thank You" to the NW Chapter for their editing and a "Special Thank You" to Cotton Jones, Rick Hudson and Kevin Jones for the countless communications back and forth and their dedication to the PLSW.

We had 131 surveyors attend the Fall Tech

Session in November; it was wonderful to see a large turnout. Once again Bill Fehringer and his committee members did an outstanding job with the preparation and speaker selection and require a huge pat on the back for continuously pulling off this difficult task each year, thank you. In addition, thanks again to Frontier Precision for sponsoring our Social Hour with beer and hors d'oeuvres, I believe we each appreciated the nice gesture. Our raffle ticket sales provided an additional \$382 to the scholarship fund and on an unfortunate note \$800 from the memorial of Warren Graf (NE Chapter member/surveyor) was also added to the scholarship fund, thanks to all that supported the scholarship fund.

During the November BOD meeting we combined the News Letter Committee with the Website Committee to create the Publications Committee. The SE Chapter suggested the merge and accepted the associated responsibilities. Periodically check the website for the latest developments moving forward, our goal is to make the PLSW Webpage a useful tool that each of us can rely on for the latest information.

Mark your calendar and pre-arrange your hotel reservations for the upcoming Annual meeting scheduled for February 6, 2014 in Laramie.

Respectfully,

Cevin C. Imus, P.L.S., President
Professional Land Surveyors of Wyoming

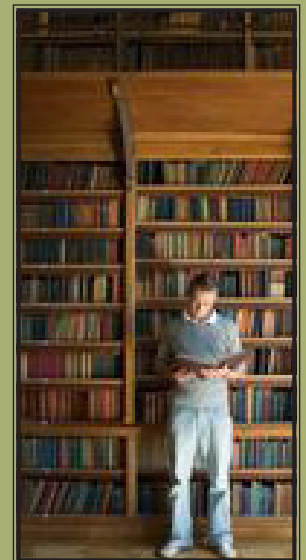
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SCHOLARSHIP OPPORTUNITIES

Each year, through the National Society of Professional Surveyors Foundation, Twenty Five Thousand dollars in scholarships funded by a variety of individuals, companies, and organizations are made available to encourage and support college education in geospatial sciences. The scholarships are awarded in four eligibility categories.

Category 1: Students enrolled in two-year degree programs in surveying technology.

*Berntsen International Scholarship in Surveying Technology (\$1000).

Category 2: Students enrolled in, or accepted to, a graduate program in geodetic surveying or geodesy.

*AAGS Graduate Fellowship Award (\$2000).

Category 3: Students enrolled in four-year degree programs in surveying (or in closely related degree programs such as geomatics or surveying engineering).

*AAGS Joseph F. Dracup Scholarship Award (\$2000).

*Berntsen International Scholarship in Surveying (\$2000).

*NSPS Scholarship (\$1000).

*Nettie Dracup Memorial Scholarship (\$2000).

*Schonstedt Scholarship in Surveying (\$1500).

*Fellows Scholarship (\$2000).

Category 4: Students enrolled in two- or four-year surveying (and closely related) degree programs, either full or part time.

*Cady McDonnell Memorial Scholarship (\$1000).

*NSPS Board of Governors Scholarship (\$1000).

*Tri-State Surveying and Photogrammetry Kris M. Kunze Memorial Scholarship (\$1000).

*Lowell H. and Dorthy Loving Undergraduate Scholarship (\$2500).

Wyoming Engineers Society; Surveyors Scholarship - a \$2000 scholarship given to a Junior pursuing completion of the academic requirements to become a Professional Land Surveyor, for use during the senior year.

Professional Land Surveyors of Wyoming Scholarship for students attending college with the intent of pursuing a career in Land Surveying. Award amounts vary. Application is available at: http://plsw.org/download/scholarship_form_rev_42012.pdf.

CONGRATULATIONS!

The members of the Professional Land Surveyors of Wyoming would like to recognize the achievement of the following new registrants and encourage you to join our society.

Clayton Rosenlund, Sheridan, WY, LS 14250
Christopher Ambourn, Spearfish, SD, LS 14271

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LINEs AND POINTs ARTICLE ROTATION SUBMISSION SCHEDULE BY CHAPTER

Responsible Chapter	First Call Date	Last Call Date	Publication Date
Southeast Chapter	THANK YOU!! (SEE "UNION PACIFIC RAILROAD DEPOT" IN THIS ISSUE)		
Laramie Valley Chapter	March 1	March 15	April 1
Upper Platte Chapter	June 1	June 15	July 1
Southwest Chapter	September 1	September 15	October 1
Northeast Chapter	December 1	December 15, 2014	January 1, 2015
Northwest Chapter	March 1	March 15	April 1

2013 PLSW FALL TECHNICAL SESSION



Geodetic Surveying: Part V *Age of Enlightenment - Part 2*

Herbert W. Stoughton, PhD, PEELS, CP

Geodetic Engineer

In the previous article, the writer addressed the survey campaigns of the Ordnance Survey (of Great Britain) and General Roy; the Great Trigonometrical Survey under Colonel Lambton and Colonel Everest; the Survey of Hanover by Gauss; and the contributions of Legendre and Bessel; and the Mason-Dixon survey. As these were taking place, other developments were occurring.

Until 1800, all significant publications on geodesy and geodetic surveying described projects, programs, and campaigns. There were no textbooks. One of the first to appear was authored by Louis Puissant (22 September 1769 - 10 January 1843). Puissant was an officer in *ingénieurs géographes*. Later he was appointed professor in *l'école centrale d'Agen* in 1796. Between October 1802 and 1804, Puissant was in charge of the geodetic triangulation of the island of Elba and Lombardy. Puissant was elected to the *l'Académie des sciences* in 1828. In 1805 he authored the first edition of *Traité de géodésie*. This book is one of the first general textbooks pertaining solely to geodesy. The work went through several editions. The last edition was 1842. The work was referenced in several technical publications of the U.S. Coast and Geodetic Survey.

The second major triangulation arc figure of the earth determination to be executed in the southern hemisphere occurred in the Cape Colony of South Africa. The initial surveys were executed by Abbé Nicolas Louise de Lacaille (15 May 1713 - 21 March 1762). de Lacaille had been employed by Jacques Cassini, and worked on remeasuring the French arc between 1739 - 1741. For his efforts to correct anomalous results published by J. Cassini in 1718, he was appointed to the *l'Académie des sciences*. In 1750, he proposed to *l'Académie* to observe the heavens in the southern hemisphere (at the time there was no astronomic observatory in the southern hemisphere). Upon arrival at Cape Town, de Lacaille built a small observatory, and observed over 10,000 southern stars. Also, he wanted to test Newton's theory of gravitation in the southern hemisphere. His triangulation

was initiated at the observatory and proceeded northward to Aurora. The arc of meridian was 137 km long. The results suggested the earth was egg-shaped rather than an ellipsoid. In 1754, de Lacaille returned to Paris. Joseph Jérôme le Francais de Lalande (11 July 1732 - 4 April 1807) wrote about de Lacaille's work and stated that the quality of his efforts rivaled its quantity, and that he made more observations and calculations than all the astronomers of his time put together. After his return to Paris, he was elected honorary member of the academies of St. Petersburg and Berlin; the *Royal Society of London*, the *Royal Society of Sweden*; the *Institute of Bologna*. In his final years, he proposed practical rules for employing the lunar method of longitude determination, and proposed the model for a nautical almanac.

When Colonel George Everest visited the Cape in 1820, he reviewed the geodetic work de Lacaille executed in the 1750's. Because of his experience in India and the presence of high mountains at the Cape of Good Hope, Everest suggested that the mountains had effected the deflection of the plumb line causing erroneous survey data. Everest executed no observations.

The second important figure at the Cape Colony was Sir Thomas Maclear (17 March 1794 - 14 July 1879). Maclear was born in Newtonstewart, County Tyrone, Ireland. He was accepted in the *Royal College of Surgeons* of England in 1815. At an early age Maclear had a keen interest in astronomy and was a member of the *Royal Astronomical Society*. When the post of Her Majesty's Astronomer at the Cape of Good Hope became vacant in 1833, Maclear was appointed. In 1834, Maclear arrived in the Cape Colony with his wife and five daughters. He worked with John Herschel (7 March 1792 - 11 May 1871) for four years at the *Cape Observatory*. Maclear initiated geodetic surveys starting with verification of de Lacaille's work. The rework verified the outstanding geodetic capabilities of de Lacaille. Unfortunately, the local attraction, which was not well understood in 1750, was the problem with the computed results. When Maclear started his work, there was no length standard at the Cape

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Colony. At the recommendation of the Astronomer Royal George Biddel Airy (27 July 1801 - 2 January 1892), two 10-foot iron bars were made which were similar to the bar made for Colonel Colby. These were shipped to Maclear and were known as "Bar A" and "Bar B". Bar B was used to compare with the Colby compensation apparatus for the 13 kilometer Zwaarland Baseline. After this project, Bar B and Colby's apparatus were returned to England. Bar A is officially known as the "Cape Standard Bar A" and is preserved at the museum of the Chief Directorate: Surveys and Mapping, Mowbray. The arc of triangulation completed by Thomas Maclear between 1841 and 1848 was $4^{\circ} 37'$ in length. No further work was executed under Maclear's tenure at the Cape Colony.

David Gill (12 June 1843 - 24 January 1914) would be the next major player in what would become the 30th Meridian Arc. Gill was born in Aberdeen, Scotland, and received two years of college education at *Aberdeen University*. For some time Gill spent time equipping Lord Lindsay's private observatory at Dun Echt, Aberdeenshire. In 1874, he joined the expedition to the island of Mauritius to observe the transit of Venus. In 1877, he went to Ascension Island to observe a near approach of Mars and calculate its distance from the earth.

In 1879, Gill was appointed Her Majesty's Astronomer of the *Royal Observatory at the Cape of Good Hope*. Soon after his arrival Gill proposed to extend the triangulation from the Cape to Egypt. He proposed to make a tie to Struve's arc of triangulation from Fugenaes (northerly terminus) [$70^{\circ} 40' \text{ N}$, $23^{\circ} 37' \text{ E}$] to Staro-Nebrassowka (southerly terminus) [$45^{\circ} 20' \text{ N}$, $28^{\circ} 56' \text{ E}$]. If Gill's proposal was completed, it would cover approximately 105° of latitude.

In 1883, the Geodetic Survey of South Africa commenced the survey of the 30th meridian. In 1892, the triangulation in the Cape Colony and Natal was completed, including incorporating the earlier work of Maclear. Dill enlisted the assistance of Cecil Rhodes (5 July 1853 - 26 March 1902) to extend the arc north into southern Rhodesia almost to the Zambezi River. Between 1902 and 1906, the geodetic work was carried through the Orange River Colony and Transvaal. Five baselines were established. Each of these baselines

had a 146.3 meter standard line for comparing the tapes. The tapes were the invar Jäderin wires. In 1906 and 1907, Captain Gordon completed 2° of triangulation to connect Southern Rhodesia and Transvaal triangulation networks. When Sir David Gill retired (1907), the Geodetic Survey of South Africa triangulation was completed from the Cape Colony to the southern shores of Lake Tanganyika.

The next campaign was directed by Major Martin Hotine (17 June 1898 - 12 November 1968), and was initiated in 1931. The campaign started at triangulation stations in Northern Rhodesia and continued the triangulation through Tanganyika up to Urundi. Later, the Tanganyika Survey Department completed a 400 km arc of triangulation across Urundi and Ruanda to complete the arc from the Cape Colony to the equator.

The northern portion of Gill's dream - the arc of triangulation from Cairo to the equator was not initiated until 1907. The network proceeded southward along the Nile Valley to Wadi Halfa. By 1930, the network for the 30th meridian extended from Cairo to the southerly boundary of Egypt and contained six baselines. It was not until 1935 that work started in the Sudan and continued along the Nile Valley from Wadi Halfa to Debba. Three baselines were measured (Amentego Baseline; Quleit Baseline; and the Abu Qarn Baseline). The Abu Qarn Baseline was the southern point of the northern network of the 30th meridian. This left only a 1,000 km gap between the Abu Qarn Baseline and the Semliki Baseline in Uganda, which was the northerly extent of the 30th meridian from the Cape. Between 1952 and 1954 the U.S. Army Map Service observed three baselines and observed the triangulation for the 1,000 km gap. On 27 January 1954, the last observations were completed. This fulfilled Sir David Gill's dream of a single meridional triangulation network extend the length of Africa. This network (1883 - 1954) contained a total of twenty-three baselines.

The Cape Town to Cairo 30th meridian was only the southerly portion of a continuous meridional triangulation network from the Arctic Circle ($66^{\circ} 33' \text{ North latitude}$) to Cape Town meridional network envisaged by Dr. Gill. The northerly portion of the network had been completed before Dr. Gill initiated the southern arc in 1883. The

northern portion was from Hammerfes (Northern Norway) to the Baltic Sea. The observations were carried out between 1816 and 1855. The project was initiated by Friedrich Georg Wilhelm von Struve (15 April 1793 - 23 November 1864) (Russian name: Vasily Yakovlevich Struve). His father moved the family to Russia in order to avoid French military service. In 1808, Struve initiated studies in philosophy at the *Imperial University of Dorpat*, but soon became interested in astronomy. From 1813 to 1820, he taught at the university and worked at the *Dorpat Observatory*. In 1820, he was appointed full professor and director of the observatory. In 1839, Struve became director of the newly established *Pulkovo Observatory* near St. Petersburg.

Struve's attainments in astronomy and geodesy earned him the Gold Medal of the *Royal Astronomical Society* (England); and fellow of the *Royal Society of London* and the *Royal Swedish Academy of Sciences*. In astronomy, Struve made micrometric measurements of 2,714 double stars (1824 - 1837), the constant of aberration (1843); and the parallax of the star 61 *Cygni*. Freidrich Struve was the son of the German mathematician

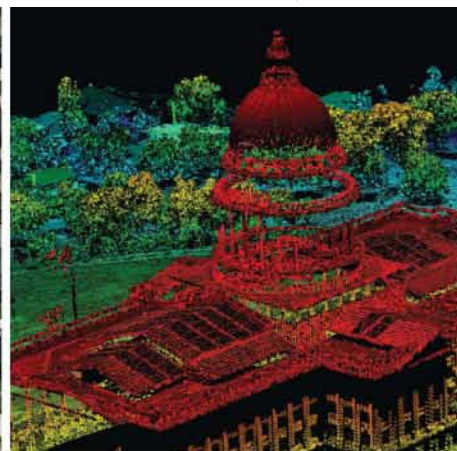
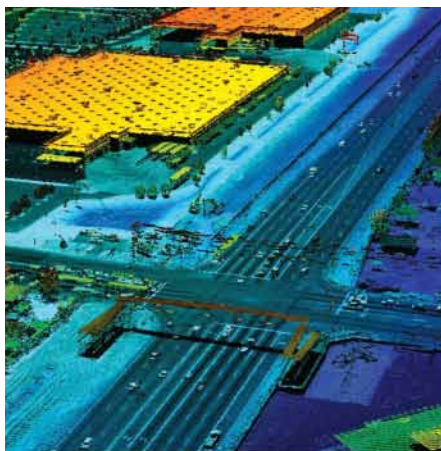
Jacob Struve (21 November 1755 - 2 April 1841); father of the astronomer and second director of the *Pulkovo Observatory* Otto Wilhelm von Struve (7 May 1819 - 14 April 1905); grandfather of the astronomer Karl Herman Struve (1854 - 1920); great grandfather of the astronomers George Herman Struve (1886 - 1933) and Otto Struve (1897 - 1963); and great-great grandfather of the astronomer Wilfred Struve (1914 - 1992).

In 1812, Freidrich Struve was charged to execute a trigonometrical survey of Livonia. In 1820, Struve assisted Gauss in a baseline measurement near Braack. From these experiences, Struve was able to gain support for an arc of triangulation between Gögland (an island in the Gulf of Finland) and Jacobstadt (1821 - 1831). At approximately the same time (1816 - 1828) General Carl F. de Tenner (22 June 1783 - 28 December 1859) was executing similar work in Lithuania.

Historians have reported division of Struve's Arc into in four phases totaling seven sections (See The Stuve Arc of Triangukation Table).

Another leader of the project was Nils Haqvin Selander (20 March 1804 - 18 June 1870). When

[\(Continued on Page 18\)](#)



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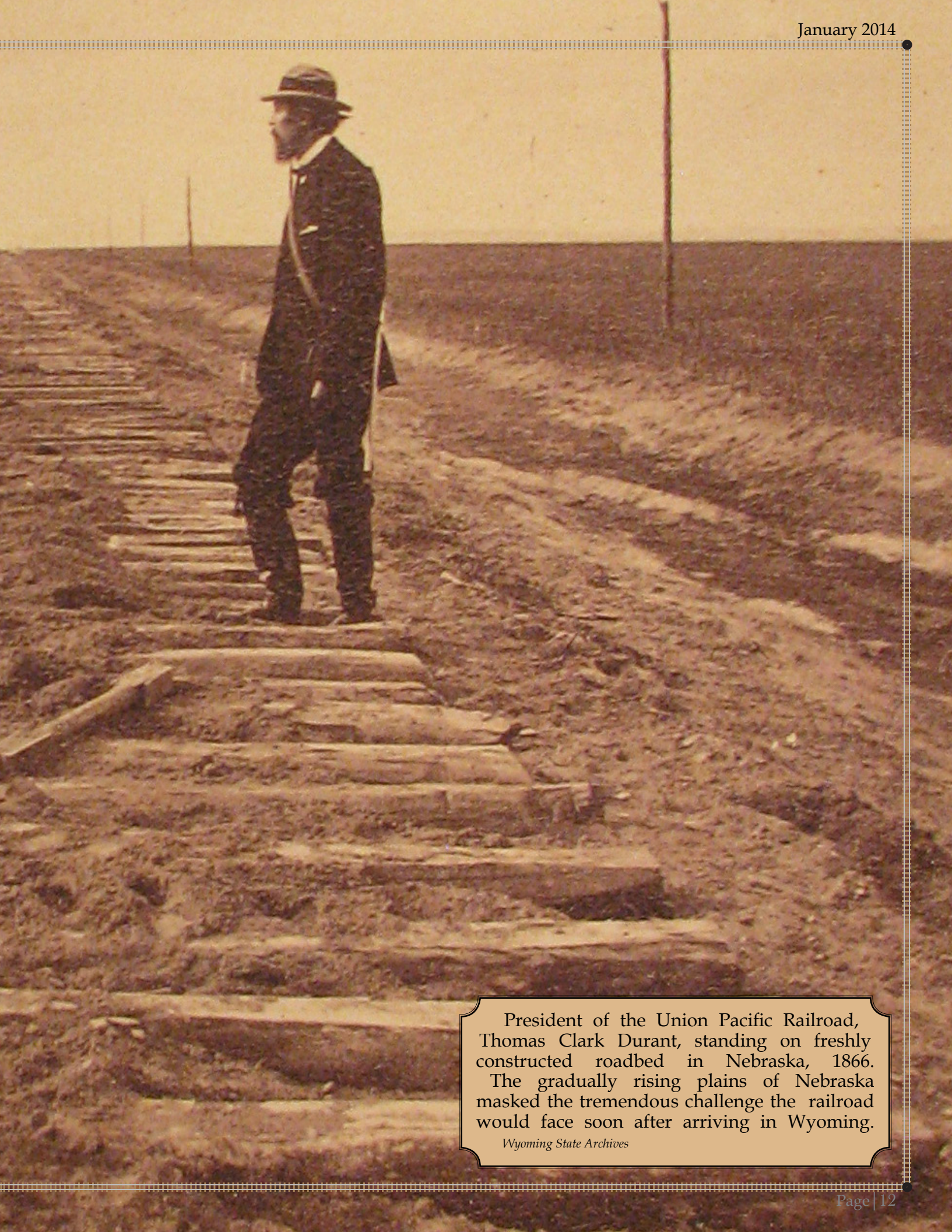


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Cheyenne Depot Museum

THE SOUTHEAST CHAPTER OF THE PROFESSIONAL LAND SURVEYORS OF WYOMING HAS BEEN WORKING WITH THE CHEYENNE DEPOT MUSEUM IN SETTING UP A DISPLAY DEMONSTRATING THE CLOSE TIES BETWEEN BUILDING THE ORIGINAL TRANSCONTINENTAL RAILROAD (UNION PACIFIC RAILROAD) AND THE LAND SURVEYING PROFESSION. THIS DISPLAY PROVIDES SAMPLES OF ANTIQUE EQUIPMENT AND BOOKS USED IN THE BUILDING OF THE RAILROAD; AND A HISTORY DISPLAY PROVIDED BY THE WYOMING BUREAU OF LAND MANAGEMENT OF THE COINCIDENTAL DEVELOPMENT OF THE PUBLIC LAND SURVEY SYSTEM ALONG WITH THE RAILROAD CONSTRUCTION.





President of the Union Pacific Railroad, Thomas Clark Durant, standing on freshly constructed roadbed in Nebraska, 1866. The gradually rising plains of Nebraska masked the tremendous challenge the railroad would face soon after arriving in Wyoming.

Wyoming State Archives

Union Pacific Railroad Depot



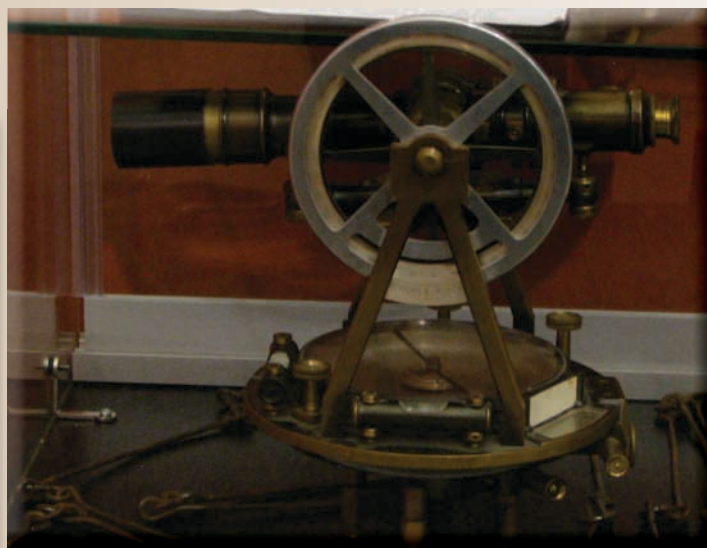
Special Thanks and recognition is due to Reid Miller of BLM's Casper Trail Center who worked way above and beyond the call of duty to prepare and hang the BLM display that now hangs at the museum. Thanks so much for your help Reid! Pictures of the BLM display along with other pictures are shown following:



Following is a brief history of the Union Pacific Depot in Cheyenne provided by Linsey Taylor, Event Coordinator of the Cheyenne Depot Museum:

General History: Built in 1886-1887, the Union Pacific Depot in Cheyenne, Wyoming, is a nationally prominent landmark that derives its significance from two principal areas: transportation and architecture. The Depot is the last of the grand 19th century depots remaining on the transcontinental railroad. It is one of the best articulated examples of the Richardsonian Romanesque style in the West, and was designed by one of America's most distinguished architects at a pivotal point in his practice. It formed a strategic point along the Union Pacific Railroad, America's first transcontinental rail line, and was easily the Union Pacific's most grandiose facility west of its starting point at Council Bluffs.

The depot is located naturally enough alongside the still active tracks of the Union Pacific, America's first transcontinental railroad, in the heart of Cheyenne's central business district. No longer used as a passenger facility, it sits at the northern edge of a large complex of railroad-owned structures, on the northern side of the railroad's mainline tracks. The Union Pacific Depot forms the visual cornerstone for downtown Cheyenne. Located on the site of its predecessor, a wood frame building constructed in 1867, the Depot is one of the downtown's two most significant landmarks. The political and financial clout of the Union Pacific in Wyoming is symbolized by the Depot's prominent placement at one end of a power corridor, opposite the Wyoming State Capitol, Cheyenne's other major landmark.¹



¹The Union Pacific Depot actually predates the capitol building, which has been listed as a National Historic Landmark. Its location had been determined as early as 1867 by the positioning of the first station building here. The territorial capitol (which became the state capitol with statehood in 1890), symbolically faces the depot ten blocks north on Capitol Avenue. The location of this latter building was not determined until April 1886, after construction had already commenced on the new Depot structure. "The Capitol Site," Cheyenne Sun, 10 April 1886.



Posed shot of a surveying party, circa 1880.



Designed in 1885-1886 by the Boston-based architectural firm of Van Brunt & Howe, the Cheyenne Depot was built in 1886-1887. The building features massive stone exterior bearing walls and foundations, with traditional wood- and iron-frame internal structure. It is massed with an immense three-story (with basement) center block, which is dominated by a central clock tower and flanked by single-story wings on the east and west ends. The building presents two facades – the south toward the tracks and the north toward the city – that differ only slightly. These were originally asymmetrically configured with the center section and the west wing, but construction of the east wing in 1922 has balanced the building into a more symmetrical appearance. The center section measures 122 feet long, the original west wing is 98 feet, and the later east wing is 130 feet, for an overall length of 350 feet. The building is 53 feet wide, with slight projections for the cross-gabled sections and a deeper, slant-walled projection for the dispatcher's bay on the south side.

During the 1860s, the Union Pacific built westward from Council Bluffs, Iowa, while the Central Pacific built eastward from Sacramento, California. The two lines met at Promontory, Utah, in May 1869, in an event that has been likened by historians to the signing of the Declaration of Independence in terms of its national significance. The Union Pacific Board of Directors had intended from the start to locate the railroad's principal depot in the Rocky Mountains in Cheyenne, approximately halfway between the route's two termini at Council Bluffs and Ogden. The directors promised that Cheyenne's depot would be the finest on the line, but they made do with a temporary frame building here until construction began on this structure in 1886. Completed the following year, the massive three-story stone depot building was an architectural masterpiece. Other large-scale depots were later built along the transcontinental railroad – at



Omaha, Ogden, Reno and Sacramento – but all have subsequently been destroyed by fire or demolition. The Cheyenne Depot is the last one standing.

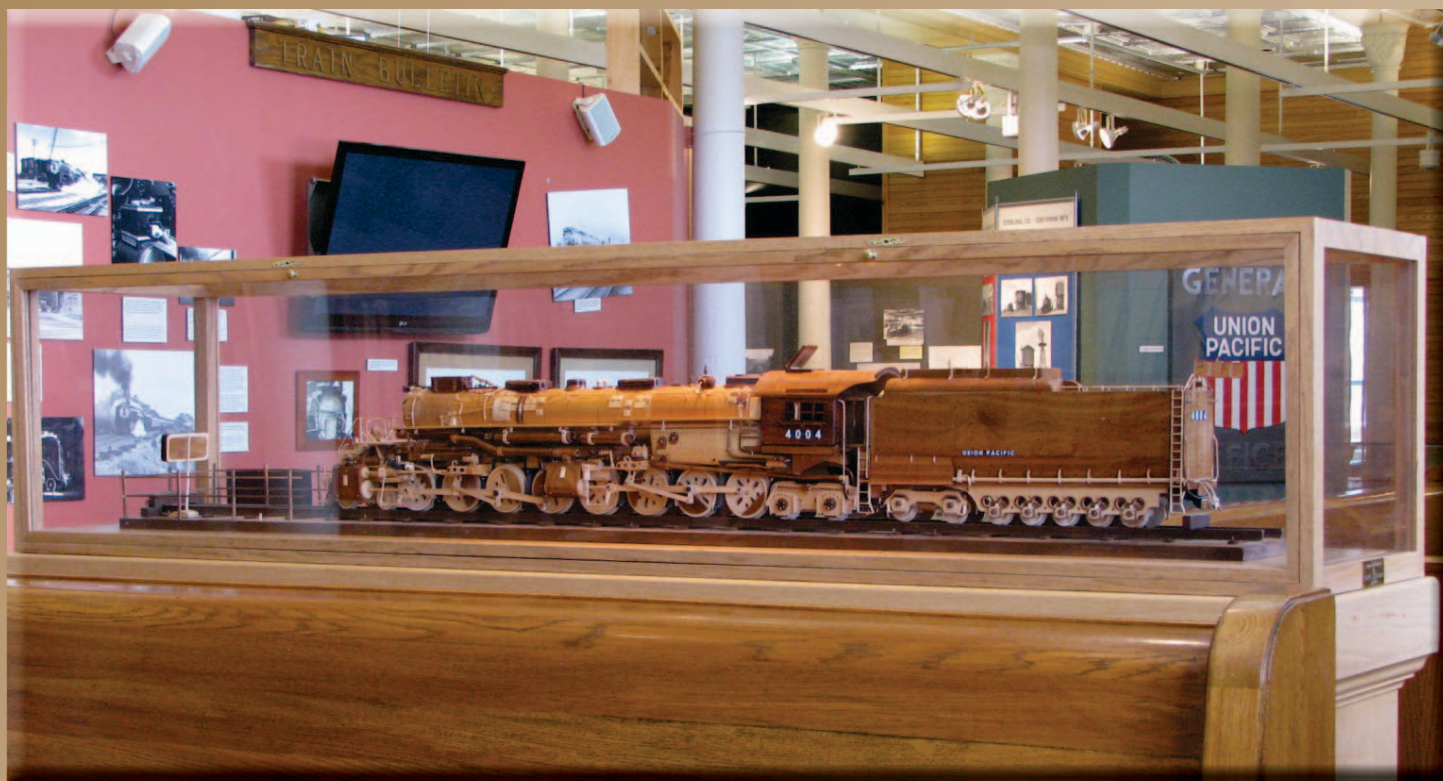
As an integral part of the nation's first transcontinental railroad, the Union Pacific has played a central role in the development of rail transportation in America. The transcontinental road marked the first large-scale, federally sanctioned construction in the aftermath of the Civil War. More importantly, it represented a watershed in American history: the opening of the West to mechanized travel. In this, the railroad's economic impact upon the region – and upon the nation as a whole – can hardly be overstated. The transcontinental railroad literally stitched the country together, making possible the development of the West. Its politically charged conception, frenzied



construction, ceremonious opening, and even the scandals and bankruptcy attendant to its operation, captured the imagination of the American public. No other railroad has received as much attention in the national press as the transcontinental line. And 140 years after its charter, the Union Pacific is still one of America's most economically important railroads. The Cheyenne Depot, in its placement at a strategic point along the railroad's length, has functioned as a crown jewel in the Union Pacific's extensive system.

Nearly a thousand men strong, the Casement Army reached Cheyenne on November 13, 1867. "A vast assemblage of citizens and railroad men convened to celebrate the occasion of the advent of the U.P.R.R.," the Cheyenne Leader cheered. "The large transparency near the speakers' stand bore the motto: 'The Magic City greets the continental railway.'" What the railroad crew found here was a fully developed town with a population of some 4,000 people, two daily newspapers, over 200 businesses and a functioning town government. The town had been surveyed within a week of Dodge's visit in July and lots sold by the Union Pacific's land company. The initial residences and businesses were housed in tents, shanties, adobes and prefabricated buildings that had been erected, dismantled and re-erected





at different locations as the railroad moved westward. Cheyenne typified the end-of-tracks towns that followed the railroad's progress. City lots that had initially sold for \$150 had burgeoned to as much as \$2000 in the speculative boom.

At the end of the line and the eventual Rocky Mountain headquarters for the UP, Cheyenne received an extensive Union Pacific stone roundhouse and several maintenance shops. The UP Steam Shop is still active as part of Cheyenne's

main yard. The steam locomotives are stored and maintained here, including the Challenger and the No. 844.

IN CONCLUSION: The Southeast Chapter of the Professional Land Surveyors of Wyoming would encourage each of you to visit the Cheyenne Depot Museum and the display of railroad history, surveying history, and model train construction display available for you and your family's education and enjoyment



Wyoming State Archives, Dept. of State Parks and Cultural Resources - Cheyenne Depot ca. 1870.

(Continued from Page 10)

The Struve Arc of Triangulation				
Tears	Leader	Latitude	Arc Section	Baselines
1816 - 1828	Tenner	56° 30' N 52° 03' N	Jacobstadt, Lithuania Belin	Ponedel Baseline Ossownitza Baseline
1816 - 1831	Struve	60° 05' N 56° 30' N	Gögländ, Baltic Jacobstadt	Simonis Baseline
1830 - 1851	Struve	65° 50' N 60° 05' N	Torneå, Finland Gögländ	Uleaborg Baseline Elimä Baseline
1835 - 1840	Tenner	52° 03' N 48° 45' N	Belin, Podolia & Volynia Dnestre River	Staro-Konstantinow
1844 - 1852	Tenner	48° 45' N 45° 20' N	Dnestre River Bessarabia Staro-Nekrassowka Ismail	Romankautzi Baseline Taschbunar Baseline
1845 - 1850	Hansteen	70° 40' N 68° 54' N	Fuglenaes Hammerfest, Norway Kautokeino, Sweden	Alta Baseline
1845 - 1852	Selander	68° 54' N 65° 50' N	Kautokeino Tomea	Over-Torneå Baseline

Struve visited Sweden in 1844, he contacted the *Swedish Academy of Sciences*. Selander was an astronomer and geodesist who became director of the *Royal Swedish Observatory*. From 1850 to 1869 he was professor of geodesy at the Topographic Corps, and was responsible for topographic mapping and the geodetic systems of Sweden. Struve and Selander decided not to utilize the existing Svanberg Arc, but planned the arc as a separate Swedish project from Torneå to Kautokeino, where it would connect to the work in Norway. The arc extended 3° 03" between Torneå and Bäljatz-vaara in Norwegian Finnmark. The arc contained one baseline and 21 main triangles.

Another leader listed above was Christopher Hansteen (26 September 1784 - 15 April 1873). Hansteen was professor at *Christina* and director of the *Christina Observatory* and *Royal Norwegian Geographic Department*. As president of the *Geodetic Institute* he played a leading role in the survey of Norway. Hansteen directed the arc of 1° 46' between Atjik and Fuglenaes on the isle of Kval-oe in the Arctic Ocean (68° 54' N to 70° 40' N). The arc contained one baseline and twelve main triangles.

General Carl F. Tenner (Karl Ivanovitsch de Tenner, Russian) started his military career

during the Napoleonic Wars. He rose to General of Infantry of the Russian Imperial Staff. In 1816, he was appointed head of the extensive Russian triangulation in the western provinces of the Empire. For most of the remainder of his working life he directed triangulation campaigns. Voluntarily (without funding), he started measurement of a meridional arc in 1817 south of Livonia. He was in charge of the arc between the Danube and the Dura. The arc extended 11° 10', and contained five baselines and 125 main triangles.

Struve employed a universal theodolite made by Reichenbach of Munich [13 inch diameter horizontal circle, 11 inch vertical circle, four arc second vernier]. Tenner used seven different instruments [a Baumann, 13 inch diameter horizontal circle, four arc second vernier, and a Troughton, 14.3 inch diameter horizontal circle, ten arc second vernier].

The complete arc had ten baselines and 258 principal or main triangles. The accuracy between a pair of baselines ranged from 1:26,104 to 1:395,991. The difference in latitude for the entire arc (now called the *Struve Arc*) is 25° 20' 08.3", and its linear length was 2,821.8 ± km (about 1,753 miles).

(Continued on Page 21)

MEMORANDUM OF UNDERSTANDING (MOU)
BETWEEN THE
NATIONAL SOCIETY OF PROFESSIONAL
SURVEYORS, INC. (NSPS)
AND THE
PROFESSIONAL LAND SURVEYORS OF
WYOMING (PLSW)

ARTICLE I
PURPOSE

The purpose of the NSPS 100% State Affiliate Membership Program is to create an environment that will not only maintain but enhance our national influence by joining our memberships into a single unified organization that represents, as near as possible, 100% of the surveying profession.

A unified national organization would better serve the interests, objectives, and communication needs of its members in helping to enhance the public image of the surveying profession. This stronger organization would also give its members a more powerful national voice in promoting and protecting our profession. This unity of purpose will also help to advance the sciences and the disciplines within the profession of surveying and mapping, encourage cooperation between the public and the private sectors, create an active public relations program and advance the protection of public welfare relative to surveying and mapping issues.

ARTICLE II
BACKGROUND

The NSPS Board of Governors and Board of Directors feel that the continued success and growth of our society and our profession requires a stronger relationship between the national and state societies. To that end, we desire to create a joint membership program that will attract state societies to join with NSPS to work together to enhance our profession while enjoying the benefits of membership.

Benefits of a unified national organization for NSPS would include:

STRONGER INFLUENCE in dealing with federal and state legislators, agencies, and administrators.

GREATER RECOGNITION when operating among other national and international professional organizations.

INCREASED EFFICIENCY in building on past, present, and future initiatives to strengthen the surveying profession.

Thus at the May 5, 2012 NSPS Annual meeting, a motion from members of the NSPS Board of Governors, to create and implement a 100% Affiliate Membership Program was presented and approved by both the NSPS Board of Governors and Board of Directors.

ARTICLE III
OBLIGATIONS AND RESPONSIBILITIES
OF THE PROFESSIONAL LAND SURVEYORS OF
WYOMING (PLSW)

Furnish the NSPS, Inc. Secretary/Treasurer, at least sixty (60) days prior to the start of the State's membership year, a preliminary list of the names, or the number of its regular/licensed members whose legal residence is Wyoming, along with a list of PLSW members who are not Wyoming residents as of the signing date of this document.

Within one hundred and twenty (120) days from the start of the State Affiliate's membership year, the Affiliate shall provide NSPS a list of all regular/licensed members paid to date and the balance due for their NSPS membership fees (\$40/member).

PLSW, after the first one hundred and twenty (120) days of the membership year, shall forward NSPS on a monthly basis the names and membership dues for all newly paid to date regular/licensed members.

PLSW will provide a representative(s) to serve on the NSPS Board of Governors and Board of Directors.

PLSW will pay all of the expenses associated with the attendance of their Representative (s) to the NSPS Board of Governors and Board of Directors meetings.

PLSW will publish the MOU once each year in a State Association/Society publication.

PLSW will furnish NSPS, Inc. with the names and addresses of their officers directors, and NSPS Governor/Director after each election.

PLSW will affirm the affiliation with NSPS, Inc. through the display of the NSPS, Inc. logo or other statements of affiliation on the State's stationery, website and publications.

ARTICLE IV
ROLES AND RESPONSIBILITY OF NSPS

To provide leadership for the surveying and mapping community on a national level.

To provide a voice for the surveying and mapping community on a national level.

To provide a National Government Affairs Program and leadership on State and Regional Government Affairs issues.

To provide coordination and promotion of surveying and mapping curriculums on a national level.

To provide a liaison with other national and international geomatics and geospatial organizations.

Provide for the distribution of significant information of new technology and innovations that support the furtherance of surveying and mapping science.

Provide assistance to the affiliate in obtaining speakers and programs for conferences and workshops.

Coordinate licensing concerns of a national interest with the affiliates and provide review of the NCEES Model Law.

Promote the affiliates activities and programs through the NSPS Website and publications.

ARTICLE V ISSUES OF MUTUAL UNDERSTANDING

The two parties are two distinct and separate entities, that share a mutual interest in furthering the surveying and mapping professions.

NSPS will act as the clearinghouse and spokesperson for the Affiliates on national issues.

PLSW may opt out for all of their members having their personal information shared by NSPS with third parties by submitting a letter to the NSPS Secretary/Treasurer at the beginning of every membership year.

PLSW has the right and is expected to send a representative to all meetings of the Board of Directors.

PLSW is expected to participate in the annual NSPS Lobby Day and schedule meetings with their Congressional Delegation when attending.

ARTICLE VI COMPENSATION DETAILS

PLSW will remit to NSPS an annual fee of \$40.00 for each dues-paying, resident Member, defined as a person duly licensed in the state of Wyoming to engage in the practice of land surveying. Non-resident Members, Honorary Members, Life Members, and Affiliates, including Associate and Special members, may voluntarily participate by adding said \$40 annual fee to their payment of PLSW dues. Affiliates, specifically Student members, may voluntarily participate by adding a \$10 annual fee to their payment of PLSW dues.

All costs incurred by PLSW that are associated with collecting and disbursing the annual fee to NSPS shall be borne solely by the PLSW.

ARTICLE VII MISCELLANEOUS DETAILS

PLSW will supply NSPS an additional listing of those members and affiliates who are voluntarily participating.

PLSW student members can qualify to be included in this program at the current NSPS student membership fee of membership fee of \$10 (ten dollars) starting with the 2014 membership year.

All newly licensed Land Surveyors with a Wyoming residence will be offered a membership at no cost in PLSW and NSPS for one full year. These newly licensed members will be included in the yearly PLSW membership tally.

ARTICLE VIII TERMS OF THE AGREEMENT

This MOU Agreement will become effective upon the first day after the signing of this Agreement by the authorized officers of both parties.

This MOU Agreement shall remain in force until such time as either party ceases to exist as a legal entity within the state of their listed headquarters.

The agreement may be terminated by either party upon a two-thirds vote by their governing Board and the delivery of a written notice of termination to the other party's listed headquarters with in no less than ninety days prior to the commencement of a new membership year.

Upon receipt of a termination notice from either party, both parties will have a maximum of sixty days in which to complete all financial and legal obligations existing between them.

Should a dispute arise between the parties as to the terms of this agreement, and an amicable settlement cannot be reached by the two parties, both parties agree to submit the dispute to a dispute resolution procedure to be held within the state of the aggrieved party.

ARTICLE IX EFFECTIVE DATE AND SIGNATURES

NOW BE IT RESOLVED that the National Society of Professional Surveyors, Inc., (NSPS, Inc.) and the Professional Land Surveyors of Wyoming (PLSW) have joined together with mutual understanding as to their obligations and responsibilities, that each party will adhere to the MOU Agreement to the best of their ability and herewith sign this MOU Agreement in good faith.

SIGNED FOR THE
NATIONAL SOCIETY OF PROFESSIONAL
SURVEYORS
ON

This 12th day of NOVEMBER 2013.


Attest: Secretary

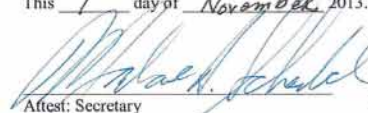
John Fenn


President

Lamar Evers

SIGNED FOR THE
PROFESSIONAL LAND SURVEYORS OF WYOMING
ON

This 7 day of November 2013.


Attest: Secretary

Marlowe Scherbel


President

Cevin C. Imus

Warren Alfred Graf

August 8, 1940 - October 19, 2013

Resided in Gillette, WY



Warren Graf, age 73, of Gillette, Wyoming died Saturday October 19, 2013 at the Close to Home Hospice House in Gillette.

Warren Alfred Graf was born August 8th, 1940 in St Louis, Mo to Alfred & Esther (Bremer) Graf. At the age of 12, his family moved to Delafield, Wisconsin. During high school, he was proud to have worked two summers for Timbertrail, a summer camp for crippled children.

In 1958, he graduated from Oconomowoc High School. He went to work for AlbersEnco Station until being drafted in 1963. He served in the U S Army from 1963 to 1965. He served in the 69th Engineering Company stationed in Frankfurt, Germany for 18 months, where he learned his land surveying profession.

After discharge, he worked for the Wisconsin Highway Department in Waukesha, Wi. He later went to work for Mark Hurd Aerial Surveys in Minneapolis, Mn, doing extensive work in Honduras and Puerto Rico.

On January 20, 1973, he married Carol Neugebauer at St Jolm's Lutheran Church, Dimock, South Dakota.

In 1974, they moved to Gillette, WY, to survey the railroad loops running from Black Thunder Mine to Douglas, WY. He continued surveying for survey companies out of Gillette & Buffalo until his retirement in 2002. He became licensed in Wyoming in 1977 and South Dakota in 1987. He was a member of NE Wyoming Chapter of PLSW.

Warren and Carol were blessed with one son, Justin, in 1979. Some of his fondest memories was teaching his son how to hunt and fish, and also shooting an elk with his four-year old son by his side in the Big Horns. In 2010 Justin married Missy McNeil. Warren was very proud of his son and daughter-in-law, and in the past two years was especially proud to be called Grandpa by his two grandchildren, River and Sky.

He enjoyed hunting, fishing, golf, bowling and watching sports on T. V., and visits from the grandkids. He was a lifetime 'Cheese Head', supporting the Green Bay Packers all of his life. One of his favorite memories was meeting Bart Starr, famous Packer quarterback, at a Fire Dept. fundraiser in Delafield when he was a member of the Delafield Fire Department serving as captain of the Rescue Squad and Squad Lieutenant.

A memorial has been established to benefit the Campbell County Senior Center Foundation, PLSW Scholarship Fund or the designation of your choice. Memorials and Condolences may be sent in care of Walker Funeral Home 410 Medical Arts Court Gillette, WY 82716.

(Continued from Page 18)

The Struve arc passed through ten countries [Belarus, Estonia, Finland, Lithuania, Latvia, Moldova, Norway, Russia, Sweden, and Ukraine]. Struve completed only two volumes of his final report before his death. The titles are: *Arc du méridien de 20° 20' entre le Danube et la Mer Glaciale mesure depuis 1816 jusgu'en 1855: Volume I, (1857): Operations geodesiques entre le Danube et le Golfe de Finlande (334 p.); Volume II, (1860): Operations geodesiques entre le Golfe de Finlande et la Mer Glaciale (483 p.); St. Petersburg: Academie Imperiale des Sciences.*

The completion of Struve's Arc (also called Struve's Great Arc) and the Cape town - Cairo arc demonstrated the diplomatic art of scientific cooperation between nations who might have serious political diplomatic disagreements. Struve's work predated Dr. Gill's work. Struve's Arc, although the final results had not been completely published, were known by Dr. Gill.

Although Struve's arc ranged from 23° 38' 48" E longitude to 28° 55' 40" E longitude, Gill reasoned that the longitude nearly approximated the projected longitude of the Cape Town - Cairo arc (30°). Of the two arcs could be connected, it would be the longest single meridional arc available for determining the size and shape of the earth. The mission would be completed in the 1950's with a new technology known as trilateration. That story is another chapter in geodetic surveying.

To find the previous installments of "Geodetic Surveying" by Herbert W. Stoughton look back to the following issues of Lines and Points:

Part I, The Underlying Principles
(Vol. 23.4, October 2012)

Part II, The Origins of Control Surveying
(Vol. 24.2, April, 2013)

Part III, Growing Pains
(Vol. 24.3, July, 2013)

Part IV, Age of Enlightenment - Part 1
(Vol. 24.4, October, 2013)

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