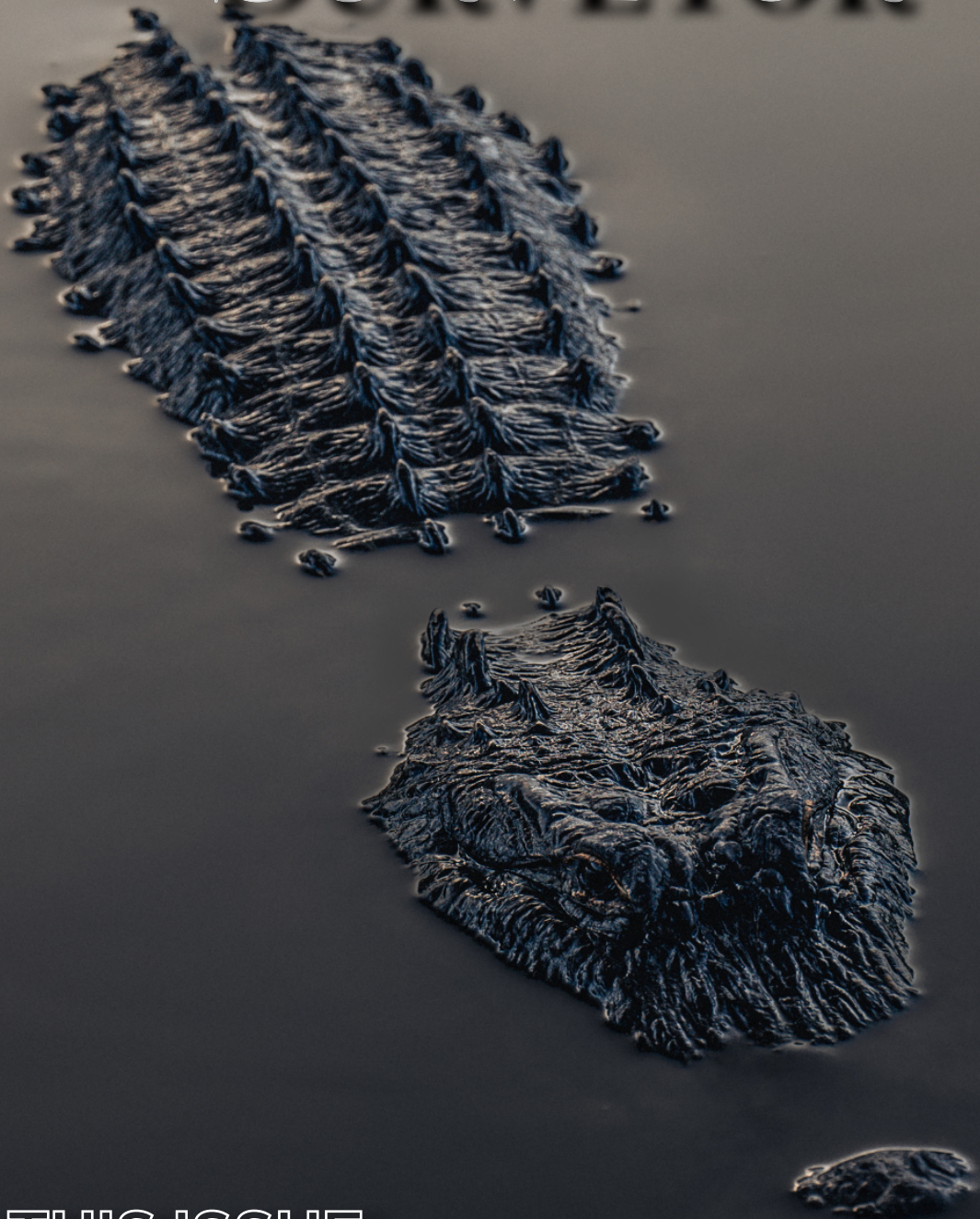


THE FLORIDA SURVEYOR

April 2023
Volume XXXI, Issue 4



IN THIS ISSUE

Nat. Surveyors Week Proclamations

Spotlighting Florida Surveyors

YSN Student Competition





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The GTL-1200 combines the power of a robotic total station with a best-in-class laser scanner to perform digital layout and capture high-res 3D scans in a single setup. Simplify the scanning process and dramatically reduce the need for post-processing by capturing scan data on survey control. The workflow seamlessly integrates with ClearEdge3D software for advanced construction QA workflows and as-builts.

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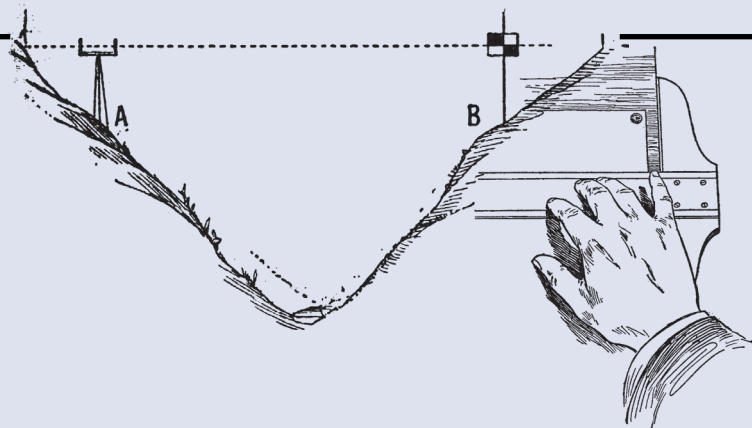
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Products for Professionals



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THE FLORIDA SURVEYOR is the official publication of the Florida Surveying and Mapping Society, also known as FSMS. It is published monthly for the purpose of communicating with the professional surveying community and related professions who are members of FSMS. Our award winning publication informs members eleven months out of the year about national, state, and district events and accomplishments, as well as articles relevant to the surveying profession. In addition, continuing educational courses are also available.

PRESIDENT'S Message

As we start the second quarter of 2023, Rebecca and I attended the Broward Tri-County Meeting. It was a great meeting with approximately 130 local surveyors in attendance. Through the raffle, they raised over \$680 for the PAC fund, Mr. Mike Bartholomew (Biscayne Engineering) gave a presentation on William J. Krome's Cape Sable expedition and Mr. Rick Pryce was recognized for the invaluable contributions he's made to the surveying profession.

FIG working week runs from May 28th through June 1st. This is a good opportunity to see what the rest of the world does in the field of surveying. Visit <https://www.fig.net/fig2023/>

FSMS annual conference will be here before we know it. Join us July 26th – 29th at Saddlebrook Resort in Wesley Chapel. Our room rates start at \$136 a night. If you're interested in being a sponsor or exhibitor, those opportunity packets are available [HERE](#). We have a great lineup of educational courses and a fun-filled schedule. Look for registration to open this month.

I am sure we are all interested in AI in Land Surveying.

This is a recent article by Matt Wayman "The Future of Land Survey" he had this to say about AI and I quote:

"AI is likely to have a significant impact on land surveying in the United States, including improved data collection and analysis, increased accuracy and precision, increased productivity, and enhanced safety. However, there are several ways in which AI will not be able to fully replace humans in this field:

- 1. Legal and regulatory issues: There may be legal and regulatory barriers to the use of AI in land surveying. For example, in the United States, land surveys must be performed by licensed professional land surveyors.*



President
Howard Ehmke
(561) 360-8883
Howard@GCYinc.com

PRESIDENT'S Message

2. *Complex and changing environments: Land surveying often takes place in complex and changing environments, such as construction sites or disaster areas. In these situations, human judgment and adaptability is necessary to accurately survey the land.*

3. *Ethical considerations: Some people may have ethical concerns about using AI to make decisions that affect land use and ownership.*

4. *Interpersonal skills: Land surveying requires strong interpersonal skills, as surveyors may need to communicate and work with a variety of people, including property owners, government officials, and other professionals. AI may not have the ability to effectively interact with people in these situations.*

5. *Creativity and problem-solving: Land surveying requires creative problem-solving and out-of-the-box thinking to find solutions to complex challenges. AI may not be able to replicate these human traits.”*

<https://www.dlhowell.com/blog/the-future-of-land-surveying/>

CST Exam at Annual Conference

Saturday, July 29th
8 am – 3:30 pm
For any questions,
contact Alex Jenkins
at [ajenkins@
southeasternsurveying.com](mailto:ajenkins@southeasternsurveying.com)



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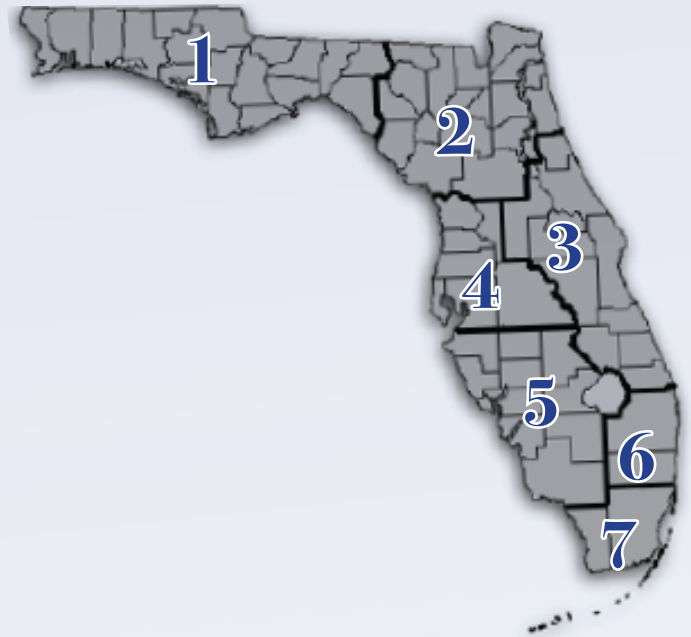
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------------------------	-------------

Spotlighting Florida Surveyors



David P. Lindley PLS 5005

David Lindley's first surveying project was near the DMZ (demilitarized zone) in Korea. He had completed the US Army Field Artillery Survey School and was now tasked with providing controls to the Artillery Battery Units. Dave's survey section was responsible for providing those controls to the Artillery in order to ensure their accuracy when engaging the enemy. His survey unit operated independently of the artillery units, as they assisted with their controls for the gun battery positions. While he was on deployment, the entire region offered itself as a base for maneuvers that allowed Dave and his surveying unit to explore the surrounding Korean countryside, which was full

of small villages, waterfalls, and tiny restaurants.

David Lindley was born on October 13th, 1963 in Richmond, Virginia, and moved to Boca Raton in 1970. He is married to his wife Kim Lindley and they have two daughters together ages 24 and 31. He also has two sisters and one brother-in-law. In 1981, he joined the Army with his friend and fellow surveyor Jeff Wagner and began surveying for the Army from 1982 until 1985. Once, while stationed at Fort Knox, Dave's unit traveled to the desert in Death Valley, California for a month's worth of training and maneuvers. It was during this time he provided controls utilizing a Position Azimuth Determining System (PADS). This 900k machine worked on inertia and could be mounted on a jeep or even a helicopter. His first project as a private surveyor was doing construction layout

for a large PUD(Planned Unit Development) in Boca Raton called Boca Pointe. Dave and Jeff have been friends since they were 14 working together at a local Publix grocery store. After the Army, Dave and Jeff both began working for Caulfield & Wheeler in 1985 and still do to this day. One of Dave's funniest memories with Jeff was a time they were both surveying a find site along the intercoastal waterway in Delray, FL. Jeff stepped on a log and a giant swarm of yellowjackets began attacking him. Dave knew his friend was allergic to them, so he rushed Jeff to the emergency room as quickly as he could. It wasn't funny at the time Dave recalls, but because everything turned out ok, they can laugh about it now. There was another time Dave and Jeff were both surveying a railroad spur track for a commerce park. They had set a couple of hundred lathes the first day and when they went back the second day to grade them, lo and behold there was a pygmy rattlesnake at each stake.

Lindley graduated from Palm Beach Junior College with an Associate's degree in surveying. He first started as an instrument operator and progressed to Party Chief for Caulfield & Wheeler until he got his professional surveyor's license in 1991. That is when he took over as lead surveyor for the surveying operations and in 2008, Dave also began running the business side as Senior Vice President and Director of Surveying. When asked what his favorite thing about surveying is, he replies, "Every day is something new whether you work in the field, office or both. You go in thinking you are going to perform a certain task and it never works out that way. I also love the challenge of figuring out boundary problems and how prior surveyors made some interesting decisions. Honestly, my favorite memories are surveying mostly undeveloped south Florida with me and a couple of guys prior to the distractions of beepers, fax machines, modems, cell phones, and the internet. Those were great days."

The largest surveying project Dave has worked on was in Port St. Lucie. The project was a PUD called "Tradition" and he was responsible for about 11,000 acres. When asked what his favorite type of survey is, he responds, "Boundary Survey because of the challenge of retracing a deed in the field. Every one is unique and many are very challenging, especially in the western part of Palm Beach and Martin county." On what he feels has changed the most during his time in the profession, Lindley responds with, "The ability to access information on the internet from deeds, plats, LABINS(Land Boundary Information System), aerials, FDOT r/w maps and the speed at which you can complete a survey utilizing GPS. We also do a lot of airborne and mobile lidar which has changed everything in the way we approach and complete projects."

The biggest hurdles Dave has encountered in the field are being self-taught

in land development, as well as platting in different municipalities, including their individual codes and regulations. Even though he believes it to be a pipe dream, one change he would like to see is for these municipalities to come up with a State standard for platting, (not in the lines of Chapter 177), and that there should be a uniform checklist. What has surprised him the most about the surveying profession, is “How many aspects of the work there are and the multiple ways of completing the work. I have been blessed to work with many fine surveyors during my career and all of them have taught me something; other ways to look at takes, or how they interpret a problem. Most notable was a surveyor named John Coates who I was privileged to work with for over 30 years and he definitely taught me the most. His mentor was Bill Keith. I always remember him having a picture of him and Bill prominently displayed in his office. Unfortunately, John passed in May of 2022, and will be forever missed as he was the finest Boundary surveyor I have ever known.”

Mr. Lindley wanted to acknowledge certain fellow surveying professionals in the field that had an influence on him: Carl Purtz, Wes Haas, Robin Petzold (and all the instructors that assisted at PBJC), Donald Todd, and John Coates. The advice he would give to young surveyors is, “Get an education while working, doesn’t have to be college, could be seminars taught by other surveyors if you do not want to go down the licensure path. I have many unlicensed surveyors that work for us and they make a great living for not having a college degree and they enjoy the outdoor aspect of the profession. When you start out, go inside the office with the party chief to understand more about what you are doing and not just sit in the truck in the parking lot waiting for the chief to come out.” ■

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FLORIDA EAST COAST RAILWAY

Courtesy of Henry Morrison Flagler Museum

In 1912 Henry Flagler arrived aboard the first train into Key West, marking the completion of the Florida East Coast (FEC) Railway's Over-Sea Railroad to Key West. With the completion of the Over-Sea Railroad the entire east coast of Florida, from Jacksonville to Key West, was linked by a single railroad system. The FEC was the product of Flagler's resources and imagination. Flagler's construction of hotels at points along the railroad and his development of the agricultural industry through the Model Land Company established tourism and agriculture as Florida's major industries, which remain so even now more than a century later. In essence, Henry Flagler invented modern Florida.



The first passenger train, called Mr. Flagler's Special, arriving at Key West on January 22, 1912.
©Flagler Museum Archives.



Amazingly, Flagler accomplished these feats after retiring from his first career and having reached an age equal to the average life expectancy for an American male of the time. Flagler had co-founded Standard Oil with partners John D. Rockefeller and Samuel Andrews, long before becoming interested in Florida. Standard Oil remained the largest and most profitable corporation in the world for more than a century.

When Flagler first visited Florida in 1878, he recognized the state's potential for growth but noticed a lack of hotel facilities. Flagler returned to Florida, and in 1885 with an eye toward developing the area around St. Augustine, he began building a grand hotel, the Hotel Ponce de Leon. Flagler realized that the key to developing Florida was a solid transportation system and consequently purchased the Jacksonville, St. Augustine & Halifax Railroad. He also noticed that a major problem facing the existing Florida railway systems was that each operated on different gauge systems, making interconnection impossible.

Historic photograph of Henry Flagler's first hotel, Hotel Ponce de Leon, in St. Augustine (now Flagler College). ©Flagler Museum Archives.





FLORIDA SURVEYING & MAPPING POLITICAL ACTION COMMITTEE

FSMS LEGISLATIVE NEWS... AND A REMINDER ABOUT PAC DUES

Greetings FSMS Members!

Following the amazing success of last year's Legislative efforts, it's once again time to prepare for the upcoming Florida Legislative Session (March 7 through May 5). Our Committees, Lobbyists and PAC are working hard to ensure strong relationships with our elected leaders.

Simply stated, without the actions, efforts and policies of the Florida Surveying and Mapping Society, our profession would have long ago been de-regulated. That's a bold statement, but it is a fact, and if you wish to continue as a regulated profession, we must continue to build our membership and re-load our PAC.

[Please consider investing in the future of your Profession through a contribution to the FSM PAC.](#) (Link to Contribution Page)

The Officers of the Florida Surveyors and Mappers Political Action Committee (FSMPAC) are Jack Breed (Chair), David Daniel (Treasurer), John Clyatt, and Don Elder.

Your FSMS Legislative Committee: Jack Breed (chair), John Clyatt, Sam Hall, Russell Hyatt, Brian Murphy, Ray Niles, Chad Thurner, Don Elder, Leo Mills, Dodie Keith, Randy Tompkins and Howard Ehmke (ex officio).



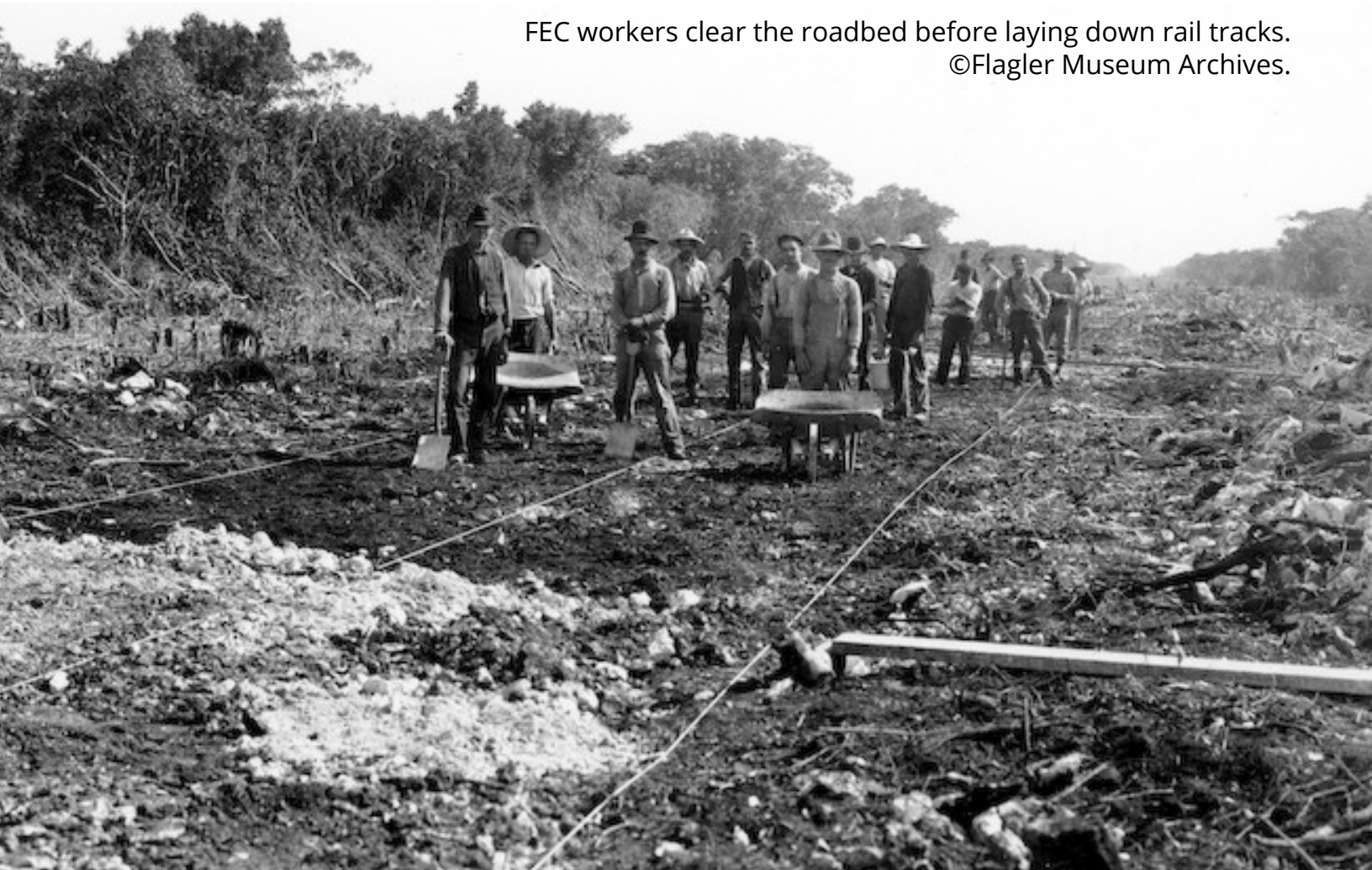
Shortly after purchasing the Jacksonville, St. Augustine & Halifax Railroad, he converted the line to standard gauge.

The Jacksonville, St. Augustine & Halifax Railroad served the northeastern portion of the state and was the first railroad in what would eventually become the Florida East Coast Railway Company. In addition to improving the railroad, Flagler built schools, a hospital and churches in St. Augustine, systematically revitalizing the largely abandoned historic city.

Flagler soon purchased three more railroads: the St. John's Railway, the St. Augustine and Palatka Railway, and the St. Johns and Halifax Railroad so that he could provide extended rail service on standard gauge tracks. With the addition of these three railroads, by spring 1889 Flagler's system offered service from Jacksonville to Daytona. Continuing to develop hotel facilities to entice northern tourists to visit Florida, Flagler bought and expanded the Hotel Ormond, located along the railroad's route north of Daytona.

Beginning in 1892, when landowners south of Daytona petitioned him to extend the railroad 80 miles south, Flagler began laying new railroad tracks; no longer

FEC workers clear the roadbed before laying down rail tracks.
©Flagler Museum Archives.



Guests in front of Flagler's 1,150-room Hotel Royal Poinciana (demolished) in Palm Beach, 1886.
©Flagler Museum Archives.



did he follow his traditional practice of purchasing existing railroads and merging them into his growing rail system. Flagler obtained a charter from the state of Florida authorizing him to build a railroad along the Indian River to Miami and as the railroad progressed southward, cities such as New Smyrna and Titusville began to develop along the tracks.

By 1894, Flagler's railroad system reached what is today known as West Palm Beach. Flagler constructed the Hotel Royal Poinciana on the eastern shore of Lake Worth in what is now known as Palm Beach. He also built The Breakers Hotel on the ocean side of Palm Beach, and Whitehall, his private 75-room, 100,000 square foot winter home. The building of the hotels, coupled with railroad access to them, established Palm Beach as a winter resort for the wealthy members of America's Gilded Age. The Hotel Royal Poinciana soon became the world's largest resort.

Probably before he even extended his railroad to Daytona, Henry Flagler was seriously considering going all the way to Key West. However, he was content

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Workers lay rail tracks for the Florida East Coast Railway.
©Flagler Museum Archives.



Florida East Coast Railway train crossing Long Key Viaduct.
©Flagler Museum Archives.



to wait for the right opportunity, which came as a result of the severe freezes of 1894 and 1895, which affected the state as far south as Palm Beach. To further convince Flagler to continue the railroad to Fort Dallas, he was offered land from private landowners, the Florida East Coast Canal and Transportation Company, and the Boston and Florida Atlantic Coast Land Company in exchange for laying track to Fort Dallas and that was enough to induce him to begin doing so immediately.

In September 1895, Flagler's system was incorporated as the Florida East Coast Railway Company and by 1896, it reached Biscayne Bay, the largest and most accessible harbor on Florida's east coast. To further develop the area surrounding the Fort Dallas railroad station, Flagler dredged a channel, built streets, instituted the first water and power systems, and financed the town's first newspaper, the Metropolis. When the town incorporated in 1896, its citizens wanted to honor the man responsible for the city's development by naming it, "Flagler." He declined the honor, persuading them to use instead the native American name for the river running through the settlement, "Miama" or "Miami."



Historic candid photograph of Henry Flagler sitting at Knights Key.
©Flagler Museum Archives.

When the United States announced in 1905 its intention to build the Panama Canal, Flagler embarked on perhaps his greatest challenge: the extension of the Florida East Coast Railway to Key West, a city of almost 20,000 inhabitants located 128 miles beyond the end of the Florida peninsula. A train depot in Key West, the United States' closest deepwater port to the Canal, could not only take advantage of Cuban and Latin America trade, but significant trade possibilities with the west via the new Canal.

The construction of the Over-Sea Railroad required many engineering innovations as well as vast amounts of labor and monetary resources. The construction, employed up to four thousand men were. During the seven years of construction, five hurricanes threatened to halt the project with three causing major damage. Despite the hardships, and the engineering challenges, the Over-Sea Railroad, the final link of the Florida East Coast Railway, was completed on January 22, 1912, just weeks after Flagler's 82nd birthday.

Linking the entire east coast of Florida with a transportation system and establishing tourism and agriculture as the basis of the state's economy, at the

time was largely an uninhabited frontier, demanded a great deal of foresight and perseverance. More than a century later, the mainstays of Florida's economy are still agriculture and tourism and Flagler's incredible legacy as the inventor of modern Florida can still clearly be seen throughout Florida.



Join our Survey Team in Florida today!

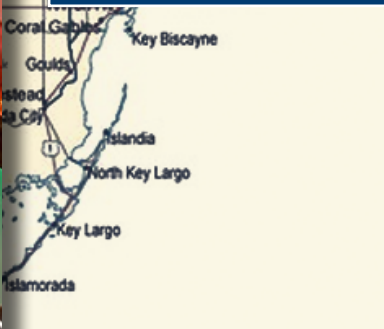
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“The Manasota Chapter has a retirement party for our surveyors who will be missed in our presence. Bob Strayer (past president & director & BBQ enthusiast), Billy Knight (BBQ enthusiast and long time surveyor of our chapter), Janice Ed Sampey, and Ed Sampey, and (past president of the Chapter) have all been in the Bradenton area for decades and we are so happy to see them leave. We are so enjoyed that they will be in retirement to the state. We wish only the best for them.”



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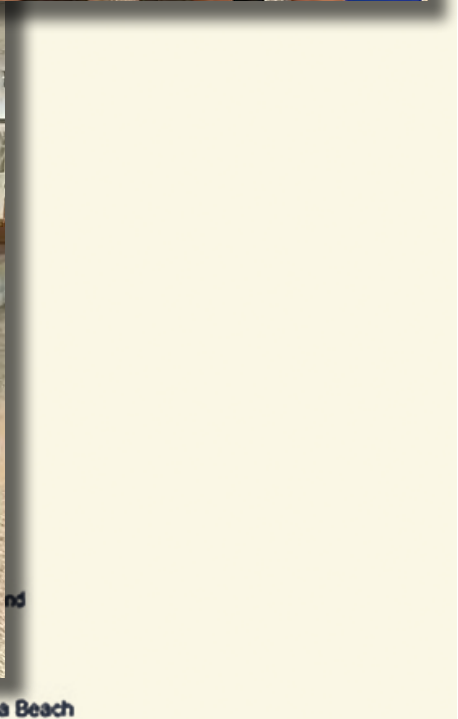
Chapter hosted
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st District 5
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 ll been surveying
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 d we are sad
 ve, but overly
 will be enjoying
 e fullest!
 e best for them!"

- Pam Hyatt



ch
dale





2023 NSPS YSN (Young Surveyors Network) Student Competition



UF Students Gabe Hancock and Kenneth Dell work with a T2 Manual Theodolite to sight the Washington National monument.



UF Students Andrea Slaven, Isabel Dupee, Kenneth Dell and Jacob Suarez work on reducing field notes to compute the coordinates of the “unknown point.”

2023 NSPS YSN (Young Surveyors Network) Student Competition



UF Geomatics Student Kenneth Dell preparing to sight the Washington National Monument.



UF Geomatics Students Gabe Hancock and Isabel Dupee working together on the 3-wire leveling field activity on the National Mall.

UF Geomatics Students Gabe Hancock and Kenneth Dell working with a 33' Gunter's Chain and Chaining Pins to measure the sides of the parcel in the Geometric Traverse problem.



UF Geomatics Students Jacob Suarez, Gabe Hancock and Isabel Dupee working with a compass to solve the Geometric Traverse problem, located on the National Mall, just south of the Washington National Monument.

2023 NSPS YSN (Young Surveyors Network) Student Competition

UF Geomatics Students, [(Back Row, Left to Right) Kenneth Dell, Jacob Suarez, Gabe Hancock, Andrea Slaven]; [(Front Row, Left to Right) Isabel Dupee, Karol Hernandez], after day 1 of the competition.

UF Geomatics Students Andrea Slaven, Jacob Suarez, Gabe Hancock, standing at the Zero Mile Stone (NGS PID: HV1847) in front of the White House during the 6-hr NGS Monument Hunt.





UF Geomatics Students, Andrea Slaven, Kenneth Dell and Isabel Dupee standing next to the NE3 Washington DC Boundary stone set by Benjamin Banneker circa 1791.



UF Geomatics Students, Andrea Slaven, Kenneth Dell, Jacob Suarez, Isabel Dupee and Gabe Hancock standing next to the NE2 Washington DC Boundary stone set by Benjamin Banneker circa 1791.

2023 NSPS YSN (Young Surveyors Network) Student Competition

UF Geomatics Students (Left to Right) Karol Hernandez, Jacob Suarez, Andrea Slaven, Isabel Dupee, Kenneth Dell, and Gabe Hancock, standing at the Lock Keepers House (NGS PID: HV1851) during the 6-hr NGS Monument Hunt.



UF Geomatics Students (From left to right) Andrea Slaven, Jacob Suarez, Isabel Dupee, Kenneth Dell, Gabe Hancock, and Karol Hernandez receiving their Award during the Awards Luncheon at the 2023 NSPS YSN Student Competition.





UF Geomatics Students (L to R) Andrea Slaven, Jacob Suarez, Justin Thomas P.S.M.(faculty), Kenneth Dell, Karol Hernandez, Isabel Dupee and Gabe Hancock during the Awards Luncheon.

2023 NSPS YSN (Young Surveyors Network) Student Competition

UF Geomatics Students with past FSMS President Lou Campanile, Jr. holding their Award during the Awards Luncheon.



2023 SUSTAINING

3002 Surveying
352-538-1320

A

A. D. Platt & Associates, Inc.
850-329-5551

Agnoli, Barber & Brundage, Inc.
239-597-3111

AIM Engineering & Surveying
239-332-4569

Allen & Company, Inc.
407-654-5355

Allen Engineering
321-783-7443

American Surveying, Inc.
813-234-0103

Amerritt, Inc.
813-221-5200

Arc Surveying & Mapping, Inc.
904-384-8377

Ardurra, Inc.
239-292-7773

Associated Land Surveying & Mapping, Inc.
407-869-5002

Atwell, LLC
866-850-4200

Avirom & Associates, Inc.
561-392-2594

Axis Geospatial, LLC
410-822-1441

B

Banks Engineering
239-939-5490

Barnes, Ferland and Associates, Inc.
407-896-8608

Barraco & Associates, Inc.
239-461-3170

Bartram Trail Surveying, Inc.
904-284-2224

Bello & Bello Land Surveying Corporation
305-251-9606

Benchmark Surveying & Land Planning, Inc.
850-994-4882

Bennett-Panfil, Inc.
941-497-1290

Berntsen International
608-443-2772

Betsy Lindsay, Inc.
772-286-5753

Biscayne Engineering Company, Inc.
305-324-7671

Boatwright Land Surveyors, Inc.
904-241-8550

Bock & Clark Corporation(NV5)
330-665-4821

Bowman Consulting Group
703-454-1000

Bradshaw-Niles & Associates, Inc.
904-829-2591

Brown & Phillips, Inc.
561-615-3988

BSE Consultants, Inc.
321-725-3674

Buchanan & Harper, Inc.
850-763-7427

C

Calvin, Giordano & Associates, Inc.
954-921-7781

Carlson Environmental Consultants, PC
704-283-9765

Carnahan, Proctor & Cross, Inc.
407-960-5980

Carter Associates, Inc.
772-562-4191

FIRMS DIRECTORY

**Caulfield
& Wheeler**
561-392-1991

**Chastain-Skillman,
Inc.**
863-646-1402

**CHW Professional
Consultants
(Causseaux, Hewett
& Walpole, Inc.)**
352-331-1976

**CivilSurv Design
Group, Inc.**
863-646-4771

**Clements
Surveying, Inc.**
941-729-6690

**Clymer Farner
Barley Surveying,
Inc.**
352-748-3126

**Coastal
Engineering
Associates, Inc.**
352-796-9423

**Colliers
Engineering
& Design**
732-383-1950

**Collins Survey
Consulting, LLC.**
863-606-2155

**Cousins Surveyors
& Associates, Inc.**
954-689-7766

**CPH
Consulting, LLC**
407-322-6841

**Craven-Thompson
& Associates, Inc.**
954-739-6400

**Culpepper &
Terpening, Inc.**
772-464-3537

**Cumbey & Fair,
Inc.**
727-797-8982

**DeGrove
Surveyors, Inc.**
904-722-0400

**Dennis J. Leavy
& Associates**
561-753-0650

**DMK Associates,
Inc.**
941-412-1293

**Donald W.
McIntosh
Associates, Inc.**
407-644-4068

**Donoghue
Construction
Layout, LLC.**
321-248-7979

**Douglass, Leavy
& Associates, Inc.**
954-344-7994

DRMP, Inc.
833-811-3767

**DroneView
Technologies**
248-321-9417

**DSW Surveying &
Mapping, PLC.**
352-735-3796

**Duncan-Parnell,
Inc.**
800-849-7708

**Durden Surveying
and Mapping, Inc.**
904-853-6822

E

ECHO UES, Inc.
888-778-3246

**Eda
Consultants, Inc.**
352-373-3541

**Eiland &
Associates, Inc.**
904-272-1000

**Element
Engineering
Group, LLC.**
813-386-2101

**Engenuity Group,
Inc.**
561-655-1151

**Engineering
Design &
Construction, Inc.**
772-462-2455

**ER Brownell &
Associates, Inc.**
305-860-3866

**ETM Surveying
& Mapping**
904-642-8550

2023 SUSTAINING

Exacta Land Surveyors, Inc.
866-735-1916

Frontier Precision Unmanned
701-222-2030

Germaine Surveying, Inc.
863-385-6856

Hyatt Survey Services
941-748-4693

EXP Energy Services Inc.
305-213-9969

F.R.S. & Associates, Inc.
561-478-7178

GPI Geospatial, Inc.
407-851-7880

I

F

G

Gustin, Cothorn & Tucker, Inc.
850-678-5141

Ibarra Land Surveyors
305-262-0400

Ferguson Land Surveyors
727-230-9606

GCY, Inc.
772-286-8083

H

I.F. Rooks & Associates, LLC.
813-752-2113

First Choice Surveying, Inc.
407-951-3425

GeoData Consultants, Inc
407-732-6965

Haley Ward, Inc.
207-989-4824

J

Florida Design Consultants, Inc.
727-849-7588

Geoline Surveying
386-418-0500

Hanson Professional Services, Inc.
217-788-2450

John Mella & Associates, Inc.
813-232-9441

Florida Engineering & Surveying, LLC.
941-485-3100

Geomatics Corporation
904-824-3086

Hanson, Walter & Associates, Inc.
407-847-9433

Johnston's Surveying, Inc.
407-847-2179

FLT Geosystems
954-763-5300

Geo Networking, Inc.
407-549-5075

H.L. Bennett & Associates, Inc.
863-675-8882

K

Ford, Armenteros & Fernandez, Inc.
305-477-6472

GeoPoint Surveying, Inc.
813-248-8888

Hole Montes, Inc.
239-254-2000

KCI Technologies
954-776-1616

Fortin, Leavey, Skiles, Inc.
305-653-4493

George F. Young
727-822-4317

HUB International
850-386-1111

Keith and Associates, Inc.
954-788-3400

Geosurv, LLC
877-407-3734

FIRMS DIRECTORY

**Kendrick Land
Surveying, LLC**
863-533-4874

**Leo Mills
& Associates**
941-722-2460

**Mock Roos &
Associates, Inc.**
561-683-3113

O

L

**Long
Surveying, Inc.**
407-330-9717

**Moore Bass
Consulting, Inc.**
850-222-5678

**On The Mark
Surveying, LLC.**
321-626-6376

**L&S
Diversified, LLC.**
407-681-3836

M

**Morris-Depew
Associates, Inc.**
239-337-3993

P

**Land Precision
Corporation**
727-796-2737

**Manuel G. Vera
& Associates, Inc.**
305-221-6210

**Murphy's
Land Surveying**
727-347-8740

**PEC Surveying
& Mapping**
407-542-4967

**Landmark
Engineering
& Surveying
Corporation**
813-621-7841

**Massey-Richards
Surveying &
Mapping, LLC.**
305-853-0066

N

**Navigation
Electronics, Inc.**
337-237-1413

**Pennoni
Associates, Inc.**
863-594-2007

**Langan
Engineering and
Environmental
Services, Inc.**
973-560-4900

**Masteller, Moler
& Taylor, Inc.**
772-564-8050

**Northwest
Surveying, Inc.**
813-889-9236

**Perret and
Associates, Inc**
904-805-0030

**Leading Edge
Land Services, Inc.**
407-351-6730

**McKim &
Creed, Inc.**
919-233-8091

**NV5 - Technical
Engineering
& Consulting
Solutions**
954-495-2112

**Pickett &
Associates, Inc.**
863-533-9095

**Leiter Perez &
Associates, Inc.**
305-652-5133

**McLaughlin
Engineering, Co.**
954-763-7611

**Platinum
Surveying &
Mapping, LLC.**
863-904-4699

Lengemann Corp.
800-342-9238

**Metron Surveying
and Mapping, LLC.**
239-275-8575

**Point Break
Surveying**
941-378-4797

2023 SUSTAINING

**Polaris
Associates, Inc.**
727-461-6113

**Porter
Geographical
Positioning &
Surveying, Inc.**
863-853-1496

**Pulice Land
Surveyors, Inc.**
954-572-1777

Q

**Q Grady Minor
& Associates, PA**
239-947-1144

R

**Reece & White Land
Surveying, Inc.**
305-872-1348

**Rhodes & Rhodes
Land Surveying, Inc.**
239-405-8166

**Richard P. Clarson
& Associates, Inc.**
904-396-2623

**R.J. Rhodes
Engineering, Inc.**
941-924-1600

**R.M. Barrineau
& Associates, Inc.**
352-622-3133

**Robayna and
Associates, Inc.**
305-823-9316

S

**SAM Surveying
& Mapping, LLC.**
850-385-1179

**SCR & Associates
NWFL Inc.**
850-527-1910

**Sergio Redondo
& Associates, Inc.**
305-378-4443

**Settimio
Consulting
Services, Inc.**
850-341-0507

**SGC
Engineering, LLC.**
407-637-2588

**Shah Drotos &
Associates, PA**
954-943-9433

Sherco, Inc.
863-453-4113

**Sliger &
Associates, Inc.**
386-761-5385

**Southeastern
Surveying &
Mapping Corp.**
407-292-8580

**Stephen H. Gibbs
Land Surveyors, Inc.**
954-923-7666

Stoner Inc.
954-585-0997

**Surveying &
Mapping Inc.**
239-340-2409

**SurvTech
Solutions, Inc.**
813-621-4929

T

T2 UES Inc.
407-587-0603

**Tectonic
Engineering
and Surveying
Consultants**
845-534-5959

**Thurman
Roddenberry
& Associates**
850-962-2538

**TranSystems
Corporation
Consultants**
727-822-4151

U

**UF/IFAS School of
Forest, Fisheries,
and Geomatics
Sciences**
352-846-0850

Upham, Inc.
386-672-9515

W

**Wade Surveying,
Inc.**
352-753-6511

FIRMS DIRECTORY

**Wallace
Surveying Corp.**
561-640-4551

**Wantman
Group, Inc.(WGI)**
561-687-2220

**WBQ Design &
Engineering, Inc.**
407-839-4300

**Whidden
Surveying**
561-790-5515

**Winnigham &
Fradley, Inc.**
954-771-7440

Woolpert, Inc.
803-214-5928

Z

**ZNS
Engineering, LLC.**
941-748-8080

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Proclamations from National Surveyors Week March 19–25, 2023

Proclamation

WHEREAS, surveyors and mappers are counted among the founding leaders of our country and were instrumental in the formation of the layout of property boundaries in the United States which have provided our citizens the opportunity for property ownership; and

WHEREAS, George Washington, Thomas Jefferson and other former Presidents of the United States, served their fellow colonists as surveyors; and

WHEREAS, the citizens of Florida recognize the valuable contributions of the surveying and mapping profession to history, development, and quality of life in Florida and the United States of America and make important decisions based on the knowledge and expertise of licensed surveyors and mappers; and

WHEREAS, the surveying and mapping profession requires specific education prerequisites, training, the knowledge of mathematics, the related physical and applied sciences, and requirements of law for evidence; and

WHEREAS, surveyors and mappers are uniquely qualified and licensed to determine and describe land and water boundaries for the management of natural resources and protection of private and public property rights; and

WHEREAS, the continual advancements in instrumentation have required the surveyor and mapper not only to be able to understand and implement the methods of the past, but also to learn and employ modern technology in finding solutions to meet the challenges of the future.

NOW, THEREFORE, in conjunction with National Surveyors Week, I, Wilton Simpson, Commissioner of Agriculture for the State of Florida, recognize the week of March 19-25, 2023, as

FLORIDA SURVEYORS & MAPPERS WEEK

and commend the many contributions and the ongoing dedication of surveyors and mappers to the citizens of Florida and the United States.



IN WITNESS WHEREOF, I have hereunto set my hand and caused the Great Seal of the State of Florida to be affixed at Tallahassee, the Capitol, this 20th day of March, in the year two thousand twenty-three.

WILTON SIMPSON
COMMISSIONER OF AGRICULTURE

BPSM Executive Director Liz Compton (left) presents this year's Florida Surveyors & Mappers Week Proclamation to Executive Director of FSMS, Rebecca Porter.



Broward County

Proclamation

REQUESTED BY
MAYOR LAMAR P. FISHER
BROWARD COUNTY

WHEREAS, the honorable professions of surveying and mapping are integral to the history of civilization, charting boundaries and setting the basis for both the development of cartography and geography that would, in turn, make possible the exploration of the world, and the territorial governance of the modern nation-state; and

WHEREAS, the profession of surveyor was first recognized under the Roman Empire, and throughout history surveyors were at the forefront of scientific innovations in geometry and trigonometry, as today they are at the cutting edge of new satellite and laser technologies; and

WHEREAS, surveyors were instrumental in the settlement of the United States, and surveyors are counted among the founding leaders of our great nation; including Thomas Jefferson, who inherited the profession from his father Peter, author of one of the earliest maps of colonial Virginia during the time, precisely, that a young George Washington was Virginia's Surveyor General; and including also Abraham Lincoln, in private service in Illinois during the 1830s; and

WHEREAS, surveyors were also instrumental in the establishment of the Florida Territory, mapping portions of southern Florida including the area now known as Broward County in 1823; and

WHEREAS, several well-known and respected surveyors in our area were pertinent to the early exploration, development, building, and platting of lands, roads, bridges, and institutions in Broward County. Surveyors such as James W. & Robert McLaughlin, Eugene Stoner, Maurice E. Berry, Harry Schwebke, James Shiskin, William (Bill) Keith, and Robert P. Legg, have all left their marks and built upon those that came before them; and

WHEREAS, the Surveyors they trained and inspired, and those that are now graduating with Surveying degrees will continue in their footsteps and expand with the technology of today to survey, map, and build upon the backbone of this county; and

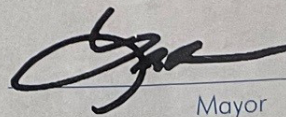
WHEREAS, the citizens of Broward County make important and daily decisions based on the knowledge and expertise of licensed surveyors and mappers, and therefore wish to honor the valuable contributions of the surveying and mapping profession to the history, development, and quality of life in Broward County, Florida, the United States of America, and the world;
NOW, THEREFORE,

BE IT PROCLAIMED BY THE BOARD OF COUNTY COMMISSIONERS OF BROWARD COUNTY, FLORIDA:

That in conjunction with National Surveyors Week, the Board hereby designates, **March 19 – 25, 2023**, as "**FLORIDA SURVEYORS & MAPPERS WEEK**" and recognize the many contributions and the ongoing dedication of surveyors and mappers to the prosperity of Broward County, Florida.

March 9, 2023
Date




Mayor

Town of Davie



Proclamation

WHEREAS, surveyors and mappers are counted among the founding leaders of our country and were instrumental in the formation of the layout of property boundaries in the United States which have provided our citizens the enjoyment of property ownership; and

WHEREAS, the citizens of Florida recognize the valuable contributions of the surveying and mapping profession to history, development, and quality of life in Florida and the United States of America, and make important decisions based on the knowledge and expertise of licensed surveyors and mappers; and

WHEREAS, the surveying and mapping profession requires special education, training, knowledge of mathematics, the related physical and applied sciences, and requirements of the law for evidence; and

WHEREAS, surveyors and mappers are uniquely qualified and licensed to determine and describe land and water boundaries for the management of natural resources and protection of private and public property rights; and

WHEREAS, the continual advancements in instrumentation have required the surveyor and mapper not only to be able to understand and implement the methods of the past but also to learn and employ modern technology in finding solutions to meet the challenges of the future; and

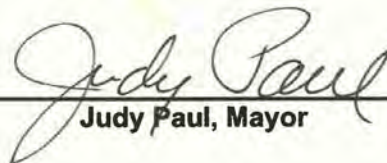
WHEREAS, Global Surveyors Day March 21, 2023, was created in 2018 through a collaboration among worldwide surveying organizations to recognize the role of Surveyors.

NOW, THEREFORE BE IT PROCLAIMED that the Mayor and the Town Council of the Town of Davie do hereby proclaim March 19-25, 2023 as:

NATIONAL SURVEYORS WEEK

IN WITNESS WHEREOF, I have hereunto set my hand this 15th day of March, 2023.





Judy Paul, Mayor

City of Deerfield Beach



Proclamation

WHEREAS, surveyors and mappers are counted among the founding leaders of our country and are instrumental in the formation of the layout of property boundaries in the United States, which have provided our citizens with the opportunity for property ownership; and

WHEREAS, the City of Deerfield Beach recognizes the valuable contributions of the surveying and mapping profession to history, development, and quality of life in our City as they make important decisions based on the knowledge and expertise of licensed surveyors and mappers; and

WHEREAS, the surveying and mapping profession requires specific educational prerequisites, training, knowledge of mathematics, the related physical and applied sciences, and requirements of the law for evidence; and

WHEREAS, surveyors and mappers are uniquely qualified and licensed to determine and describe land and water boundaries for the management of natural resources and protection of private and public property rights; and

WHEREAS, continued advancements in instrumentation have required the surveyor and mapper not only to be able to understand and implement the methods of the past, but also to learn and employ modern technology in finding solutions to meet the challenges of the future.

NOW, THEREFORE, I, BILL GANZ, Mayor of the City of Deerfield Beach, Florida, in recognition thereof, do hereby proclaim March 20, 2023 - March 26, 2023, as:


“Florida Surveyors and Mappers Week”



IN WITNESS WHEREOF, I hereunto set my hand and caused the seal of the City of Deerfield Beach to be affixed at Deerfield Beach, Florida, this 7th day of March 2023, A.D.



Bill Ganz, Mayor



Heather Montemayor, City Clerk

City of Dunedin



March 23, 2023
City Commission Regular Meeting

1.c. Florida Surveyors and Mappers Week, March 19-25, 2023



City of Dunedin, Florida
Office of the Mayor

Proclamation

in recognition of
Florida Surveyors and Mappers Week
March 19-25, 2023

Whereas, surveyors and mappers are counted among the founding leaders of our country and are instrumental in the formation, retracement, and layout of land boundaries in the United States, thus allowing citizens the peaceable ownership of real property; and

Whereas, George Washington, Thomas Jefferson, George Mason, and other forefathers of the United States served their fellow colonists as surveyors; and

Whereas, the citizens of this City recognize the valuable contributions of the surveying and mapping profession to the history, development, and quality of life in Dunedin, Florida, and the United States of America and continually rely on the knowledge and expertise of licensed surveyors and mappers to make important decisions to improve their day-to-day life; and

Whereas, the surveying and mapping profession requires advanced education, specialized training, the knowledge of mathematics, the related physical and applied sciences, and the application of common law principles to the hierarchy of conflicting evidence; and

Whereas, surveyors and mappers are uniquely qualified and licensed to measure, determine, and describe land boundaries for the management of natural resources and protection of private and public property rights; and

Whereas, the continued advancements in instrumentation have required the surveyor and mapper not only to understand and implement the methods of the past, but also to learn and employ modern technology in finding solutions to meet the challenges of the future.

Now, therefore, I, Julie Ward Bujalski, by virtue of the authority vested in me as Mayor of the City of Dunedin, Florida and on behalf of the entire City Commission, do hereby proclaim March 19-25, 2023, as Florida Surveyors and Mappers Week in the City of Dunedin, Florida.

Attest

Rebecca C. Smith
City Clerk



In witness whereof, I have hereunto set my hand and caused the seal of the City of Dunedin to be affixed at Dunedin this date

March 23, 2023

Julie Ward Bujalski
Mayor

City of Fort Lauderdale

Office of the Mayor
City of Fort Lauderdale

Proclamation

In Recognition of
Florida Surveyors and Mappers Week
March 19-25, 2023

- WHEREAS,** surveying and mapping professionals have contributed to our nation's history, development, and quality of life. These experts were instrumental in forming and establishing boundaries in the United States. Without them, enjoying the American dream of property ownership would be more challenging; and
- WHEREAS,** our founding fathers served as surveyors, adding to the historical mapping of America as it expanded. This includes former United States presidents George Washington, Thomas Jefferson, Abraham Lincoln, and Theodore Roosevelt; and
- WHEREAS,** this esteemed profession requires special education and training, knowledge of mathematics and related physical and applied sciences, and an understanding of the law; and
- WHEREAS,** continual advancements require surveyors and mappers to understand and implement the methods of the past while adapting to meet current needs. They are also expected to implement modern technology to solve future challenges; and
- WHEREAS,** surveyors and mappers are uniquely qualified and licensed to determine and describe land and water boundaries for managing natural resources. Their expertise assists in making important decisions and they help to protect private and public property rights; and
- WHEREAS,** the City of Fort Lauderdale celebrates and appreciates the contributions of surveying and mapping professionals in the local area.

NOW, THEREFORE, WE, as City Commissioners of the City of Fort Lauderdale, Florida, do hereby proclaim **March 19-25, 2023, as:**

FLORIDA SURVEYORS AND MAPPERS WEEK

in the City of Fort Lauderdale and recognize the ongoing dedication of surveyors and mappers to our community and throughout the United States.

DATED this, the 8th day of March 2023.



Dean J. Trantalis
Mayor Dean J. Trantalis



"Fort Lauderdale: The City You Never Want To Leave"

City of Hollywood

Proclamation

City of Hollywood, Florida

in recognition of

FLORIDA SURVEYORS AND MAPPERS WEEK

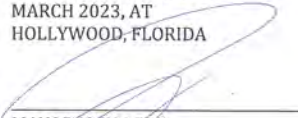
MARCH 19-25, 2023

- WHEREAS,** SURVEYORS AND MAPPERS ARE COUNTED AMONG THE FOUNDING LEADERS OF OUR COUNTRY AND WERE INSTRUMENTAL IN THE FORMATION OF THE LAYOUT OF PROPERTY BOUNDARIES IN THE UNITED STATES, WHICH HAVE PROVIDED OUR CITIZENS THE OPPORTUNITY FOR PROPERTY OWNERSHIP; AND
- WHEREAS,** GEORGE WASHINGTON, THOMAS JEFFERSON, AND OTHER FORMER PRESIDENTS OF THE UNITED STATES, SERVED THEIR FELLOW COLONISTS AS SURVEYORS; AND
- WHEREAS,** THE CITIZENS OF FLORIDA RECOGNIZE THE VALUABLE CONTRIBUTIONS OF THE SURVEYING AND MAPPING PROFESSION TO HISTORY, DEVELOPMENT, AND QUALITY OF LIFE IN FLORIDA, AND THE UNITED STATES OF AMERICA AND MAKE IMPORTANT DECISIONS BASED ON THE KNOWLEDGE AND EXPERTISE OF LICENSED SURVEYORS AND MAPPERS; AND
- WHEREAS,** THE SURVEYING AND MAPPING PROFESSION REQUIRES SPECIFIC EDUCATION PREREQUISITES, TRAINING, THE KNOWLEDGE OF MATHEMATICS, THE RELATED PHYSICAL AND APPLIED SCIENCES, AND REQUIREMENTS OF LAW FOR EVIDENCE; AND
- WHEREAS,** SURVEYORS AND MAPPERS ARE UNIQUELY QUALIFIED AND LICENSED TO DETERMINE AND DESCRIBE LAND AND WATER BOUNDARIES FOR THE MANAGEMENT OF NATURAL RESOURCES AND PROTECTIONS OF PRIVATE AND PUBLIC PROPERTY RIGHTS; AND
- WHEREAS,** THE CONTINUED ADVANCEMENTS IN INSTRUMENTATION HAVE REQUIRED THE SURVEYOR AND MAPPER NOT ONLY TO BE ABLE TO UNDERSTAND AND IMPLEMENT THE METHODS OF THE PAST, BUT ALSO TO LEARN AND EMPLOY MODERN TECHNOLOGY IN FINDING SOLUTIONS TO MEET THE CHALLENGES OF THE FUTURE; NOW
- THEREFORE,** JOSH LEVY, MAYOR OF THE CITY OF HOLLYWOOD, FLORIDA, AND THE HOLLYWOOD CITY COMMISSION HEREBY PROCLAIM MARCH 19-25, 2023 AS:

FLORIDA SURVEYORS AND MAPPERS WEEK

SIGNED THIS 15TH DAY OF
MARCH 2023, AT
HOLLYWOOD, FLORIDA




MAYOR JOSH LEVY
VICE MAYOR ADAM GRUBER
COMMISSIONER CARYL S. SHUHAM
COMMISSIONER LINDA HILL ANDERSON
COMMISSIONER TRACI L. CALLARI
COMMISSIONER KEVIN D. BIEDERMAN
COMMISSIONER IDELMA QUINTANA

Indian River County



Proclamation

RECOGNIZING THE WEEK OF MARCH 19-25, 2023, AS NATIONAL SURVEYORS WEEK

Whereas, land surveyors are counted among the founding leaders of our country and were instrumental in the layout of property boundaries in the United States, providing our citizens the opportunity to enjoy the American Dream of property ownership; and

Whereas, United States Presidents Washington, Jefferson, Adams, and Lincoln all served as surveyors, contributing to the historical mapping of America in its early years; and

Whereas, the surveying profession requires special education, training, knowledge of mathematics and related physical and applied sciences, and requirements of law for evidence; and

Whereas, surveyors are uniquely qualified and licensed to determine and describe land and water boundaries for the management of natural resources and protection of private and public property rights; and

Whereas, continual advancements in instrumentation have required surveyors to not only understand and implement the methods of the past, but also to learn and employ modern technology as changes occur through the years; and

Whereas, the citizens of Indian River County recognize the valuable contributions of the surveying profession to land development and quality of life throughout our county, and make important decisions based on the knowledge and expertise of licensed surveyors and mappers.

Now, Therefore, be it Proclaimed by the Board of County Commissioners of Indian River County, Florida, that the week of March 19-25, 2023, is recognized as "National Surveyors Week" in Indian River County, and the Board encourages all citizens to applaud the many contributions and ongoing dedication of surveyors to our community and the United States.


Adopted this 7th day of March, 2023.


BOARD OF COUNTY COMMISSIONERS
INDIAN RIVER COUNTY, FLORIDA


Joseph H. Earman, Chairman


Susan Adams, Vice Chairman


Joseph E. Flescher


Deryl Loar


Laura Moss



Lake County

PROCLAMATION 2023 - 24

WHEREAS, surveyors and mappers are counted among the founding leaders of our country and were instrumental in the formation of the layout of property boundaries in the United States which have provided our citizens the enjoyment of property ownership; and

WHEREAS, George Washington, Thomas Jefferson, and other former Presidents of the United States, served their fellow colonists as surveyors; and

WHEREAS, the citizens of Florida recognize the valuable contributions of the surveying and mapping profession to history, development, and quality of life in Florida and the United States of America and make important decisions based on the knowledge and expertise of licensed surveyors and mappers; and

WHEREAS, the surveying and mapping profession requires special education, training, the knowledge of mathematics, the related physical and applied sciences, and requirements of law for evidence; and

WHEREAS, surveyors and mappers are uniquely qualified and licensed to determine and describe land and water boundaries for the management of natural resources and protection of private and public property rights; and

WHEREAS, the continual advancements in instrumentation have required the surveyor and mapper not only to be able to understand and implement the methods of the past, but also to learn and employ modern technology in finding solutions to meet the challenges of the future.

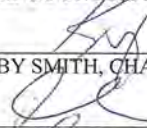
NOW, THEREFORE, in conjunction with National Surveyors Week, the Board of County Commissioners of Lake County, Florida, proclaims that:

1. The week of March 19-25, 2023, shall be proclaimed as "FLORIDA SURVEYORS AND MAPPERS WEEK."
2. The Board of County Commissioners recognizes the many contributions and the ongoing dedication of surveyors and mappers to the citizens of Florida and the United States.
3. A copy of this Proclamation shall be spread upon the minutes of this meeting.
4. This Proclamation shall become effective upon adoption.

DONE AND PROCLAIMED this 14TH day of March 2023 in regular session of the Board of County Commissioners of Lake County, Florida.

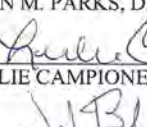


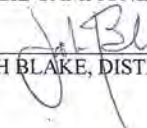
BOARD OF COUNTY COMMISSIONERS LAKE COUNTY, FLORIDA


KIRBY SMITH, CHAIRMAN



DOUGLAS B. SHIELDS, VICE-CHAIR


SEAN M. PARKS, DISTRICT 2



LESLIE CAMPIONE, DISTRICT 4


JOSH BLAKE, DISTRICT 5

ATTEST:


GARY J. COONEY, CLERK TO THE
BOARD OF COUNTY COMMISSIONERS
LAKE COUNTY, FLORIDA

APPROVED AS TO FORM AND LEGAL
SUFFICIENCY:


MELANIE MARSH
COUNTY ATTORNEY

Manatee County



Proclamation

Board of County Commissioners
Manatee County, Florida

WHEREAS, Surveyors and Mappers are counted among the founding leaders of our country and were instrumental in the formation of property boundaries, which support the enjoyment of property ownership; and

WHEREAS, we recognize the valuable contributions of the Surveying and Mapping Profession to history, development, and quality of life, in Florida and nationwide, and make important decisions based on the knowledge and expertise of Licensed Surveyors and Mappers; and

WHEREAS, the Surveying and Mapping profession requires special education, training, the knowledge of mathematics, the related physical and applied sciences, and requirements of law for evidence; and

WHEREAS, Surveyors and Mappers are uniquely qualified and licensed to determine and describe land and water boundaries for the management of natural resources and protection of private and public property rights; and

WHEREAS, the continual advancements in instrumentation have required the Surveyor and Mapper not only to be able to understand and implement the methods of the past, but also to learn and employ modern technology in finding solutions to meet the challenges of the future.

NOW, THEREFORE, BE IT PROCLAIMED by the Board of County Commissioners of Manatee County, Florida, that March 19 – March 25, 2023, shall be known, designated, and set aside as

NATIONAL SURVEYORS & MAPPERS WEEK

in Manatee County, Florida.

ADOPTED with a quorum present and voting this 28th day of February 2023.



BOARD OF COUNTY COMMISSIONERS
MANATEE COUNTY, FLORIDA

A blue ink signature of Kevin Van Ostenbridge.

Kevin Van Ostenbridge, Chairperson

ATTEST: Angelina Coloneso
Clerk of the Circuit Court

A blue ink signature of Angelina Coloneso.

Martin County



Before the Board of County Commissioners Martin County, Florida A Proclamation

Declaring Surveyors and Mappers Week in Martin County

- Whereas,** surveyors and mappers are counted among the founding leaders of our country and were instrumental in the formation of the layout of property boundaries in the United States that provide our citizens the enjoyment of property ownership; and
- Whereas,** the citizens of Florida recognize the valuable contributions of the surveying and mapping profession to the history, development and quality of life in Florida and the United States of America and make important decisions based on the knowledge and expertise of licensed surveyors and mappers; and
- Whereas,** the surveying and mapping profession requires specific education, special training, intimate knowledge of mathematics, related physical and applied sciences and a heavy understanding of the requirements of law for evidence; and
- Whereas,** surveyors and mappers are uniquely qualified and licensed to determine and describe land and water boundaries for the management of natural resources and the protection of private and public property rights; and
- Whereas,** the continual advancements in science and instrumentation have required the surveyor and mapper not only to be able to understand and implement the methods of the past, but also to learn and employ modern technology in finding solutions to meet the challenges of the future.

Now, therefore, be it proclaimed by the Martin County Board of County Commissioners that the week of March 19-25, 2023 shall be known as Surveyors and Mappers Week in Martin County, acknowledging the men and women of this profession for their diligence in meeting the continuing needs of our communities.

Presented this Twenty-First Day of March 2023

ATTEST:


CAROLYN TIMMANN, CLERK OF THE
CIRCUIT COURT AND COMPTROLLER



BOARD OF COUNTY COMMISSIONERS


EDWARD V. CIAMPI, CHAIRMAN


HAROLD E. JENKINS, VICE CHAIRMAN


DOUG SMITH, COMMISSIONER


STACEY HETHERINGTON, COMMISSIONER


SARAH HEARD, COMMISSIONER

Orange County



Office of the
Orange County Mayor

Proclamation

WHEREAS, surveyors and mappers are counted among the founding leaders of our country and were instrumental in the formation of the layout of property boundaries in the United States which have provided our residents the enjoyment of property ownership; and

WHEREAS, George Washington, Thomas Jefferson, and other former Presidents of the United States served their fellow colonists as surveyors; and

WHEREAS, the residents of Orange County recognize the valuable contributions of the surveying and mapping profession to history, development, and quality of life in Florida and the United States of America and make important decisions based on the knowledge and expertise of licensed surveyors and mappers; and

WHEREAS, the surveying and mapping profession requires special education and training, including the knowledge of mathematics, related physical and applied sciences, and requirements of law for evidence; and

WHEREAS, surveyors and mappers are uniquely qualified and licensed to determine and describe land and water boundaries for the management of natural resources and protection of private and public property rights; and

WHEREAS, the continual advancements in instrumentation have required the surveyor and mapper not only to be able to understand and implement the methods of the past but also to learn and employ modern technological solutions to meet the challenges of the future.

NOW, THEREFORE, I, Jerry L. Demings, Orange County Mayor, do hereby proclaim March 19 through 25, 2023, as

FLORIDA SURVEYORS AND MAPPERS WEEK

in Orange County, Florida, and recognize the many contributions and ongoing dedication of surveyors and mappers to residents of Orange County and those around the nation.

DONE AND ORDERED this 15th day of March, 2023,

JERRY L. DEMINGS, ORANGE COUNTY MAYOR



City of Orlando

Proclamation

CITY OF ORLANDO - OFFICE OF THE MAYOR

- WHEREAS,** surveyors and mappers were among the founding leaders of our country and were instrumental in the formation of the layout of property boundaries in the United States; and
- WHEREAS,** George Washington, Thomas Jefferson and other former Presidents of the United States served their fellow colonists as surveyors; and
- WHEREAS,** the surveying and mapping profession requires special education, training, knowledge of mathematics and physical and applied sciences and requirements of law for evidence; and
- WHEREAS,** surveyors and mappers are uniquely qualified and licensed to determine and describe land and water boundaries for the management of natural resources and protection of private and public property rights; and
- WHEREAS,** the continual advancements in instrumentation have required the surveyor and mapper not only to be able to understand and implement the methods of the past, but also to learn and employ modern technology in finding solutions to meet the challenges of the future; and
- WHEREAS,** the City of Orlando celebrates the valuable contributions of surveyors and mappers to our community and appreciates their professionalism and commitment, recognizing that important decisions are made based on the knowledge and expertise of licensed surveyors and mappers;

NOW, THEREFORE, I, Buddy Dyer, Mayor of the City of Orlando; do hereby proclaim March 19-25, 2023, as

“National Surveyors and Mappers Week and Florida Surveyors and Mappers Week”

in the City of Orlando.

IN WITNESS WHEREOF, I hereunto have set my hand and caused the Seal of the City of Orlando to be affixed this 19th day of March, 2023.



Buddy Dyer
MAYOR

**Duncan
Parnell**

YOUR FIELD-TO-FINISH SURVEY PARTNER

As surveying technologies continue to advance, a trusted and knowledgeable partner can help you stay ahead of the game. For over 75 years, Duncan-Parnell has provided leading-edge products and services to help surveyors succeed.




- Robotic Total Stations • Trimble GNSS Instruments
- UAS/Drone Solutions • Monitoring Solutions
- Software for Survey and Mapping
- Survey Supplies • Instrument Repair & Maintenance
- Technical Training



Orlando, FL 407-601-5816
duncan-parnell.com

Osceola County

OSCEOLA COUNTY



P Proclamation

WHEREAS, surveyors and mappers are counted among the founding leaders of our country and were instrumental in the formation of the layout of property boundaries in the United States, which have provided citizens the enjoyment of property ownership; and

WHEREAS, George Washington, Thomas Jefferson and other former Presidents of the United States served their fellow colonists as surveyors; and

WHEREAS, the citizens of Florida recognize the valuable contributions of the surveying and mapping profession to the history, development and quality of life in Florida and the United States and make important decisions based on the knowledge and expertise of licensed surveyors and mappers; and

WHEREAS, the surveying and mapping profession requires special education, training, the knowledge of mathematics, as well as the related physical and applied sciences and requirements of law for evidence; and

WHEREAS, surveyors and mappers are uniquely qualified and licensed to determine and describe land and water boundaries for the management of natural resources and protection of private and public property rights; and


WHEREAS, the continual advancements in instrumentation have required the surveyor and mapper not only to be able to understand and implement the methods of the past but also to learn and employ modern technology in finding solutions to meet the challenges of the future.


NOW, THEREFORE, BE IT PROCLAIMED that the Osceola County Board of County Commissioners does hereby proclaim the March 19-25, 2023 to be known as

NATIONAL SURVEYORS WEEK

DONE AND ADOPTED by the Osceola Board of County Commissioners at their regular Board meeting on the 20th day of March 2023.

BOARD OF COUNTY COMMISSIONERS OF OSCEOLA COUNTY, FLORIDA


Viviana Jankar, Chairwoman


Peggy Choudhry, Commissioner


Cheryl L. Grieb, Vice Chairwoman


Brandon Arrington, Commissioner


Ricky Booth, Commissioner

Commonwealth of Pennsylvania

Commonwealth of Pennsylvania



Governor's Office

PROCLAMATION

LAND SURVEYORS WEEK
March 19-25, 2023

WHEREAS, land surveyors throughout history have played a crucial role in the mapping and design of the uncharted territories of our great nation; and

WHEREAS, the specialized training and specific skills of land surveyors remain essential as we continue to rely upon precise measurements for developing our communities, our Commonwealth, and our nation; and

WHEREAS, technological and societal advancements, such as the expanded use of computers and satellites to determine precise geographical boundaries in the proper construction of new roads and buildings, reflect the increasing complexity of surveyors' skills, and the integral role that these dedicated professionals continue to play in the development of the United States; and

WHEREAS, land surveyors provide an exceptional service through their work to develop and improve transportation routes, buildings, water systems, housing projects, and much more.

THEREFORE, I, Josh Shapiro, Governor of the Commonwealth of Pennsylvania, do hereby proclaim March 19-25, 2023 to be LAND SURVEYORS WEEK in recognition of the invaluable services that surveyors provide and encourage all citizens to join me in recognizing these highly skilled and dedicated professionals.

GIVEN under my hand and the Seal of the Governor, at the City of Harrisburg, this twenty-second day of February two thousand twenty-three, the year of the Commonwealth the two hundred forty-seventh.

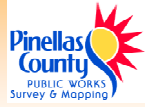
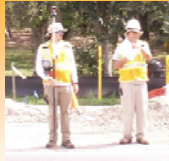
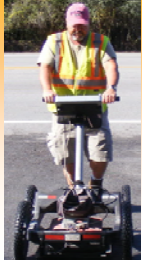


A handwritten signature in black ink, appearing to read "Josh Shapiro".

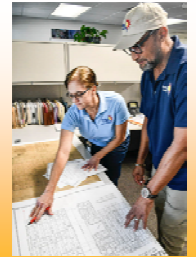
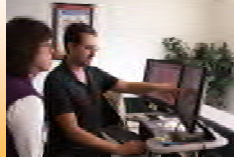
JOSH SHAPIRO
Governor

Pinellas County

MARCH 19th - 25th, 2023



2023 NATIONAL SURVEYORS WEEK



PROCLAMATION PINELLAS COUNTY BOARD OF COUNTY COMMISSIONERS

FLORIDA SURVEYORS & MAPPERS WEEK

- WHEREAS,** surveyors and mappers are counted among the founding leaders of our country and were instrumental in the formation of the layout of property boundaries in the United States which have provided our citizens the enjoyment of property ownership; and
- WHEREAS,** George Washington, Thomas Jefferson, and other former Presidents of the United States, served their fellow colonists as surveyors; and
- WHEREAS,** the citizens of Pinellas County recognize the valuable contributions of the surveying and mapping profession to history, development, and quality of life in Florida and the United States of America and make important decisions based on the knowledge and expertise of licensed surveyors and mappers; and
- WHEREAS,** The Florida Surveying and Mapping Society's Tampa Bay Chapter has at least ninety active Florida licensed Professional Surveyors and Mappers and twenty-seven Florida licensed Surveying and Mapping Businesses are located in Pinellas County; and
- WHEREAS,** the surveying and mapping profession requires special education, training, the knowledge of mathematics, the related physical and applied sciences, and requirements of law for evidence; and
- WHEREAS,** surveyors and mappers are uniquely qualified and licensed to determine and describe land and water boundaries for the management of natural resources and protection of private and public property rights; and
- WHEREAS,** the continued advancements in instrumentation have required the surveyor and mapper not only to be able to understand and implement the methods of the past, but also to learn and employ modern technology in finding solutions to meet the challenges of the future.

NOW, THEREFORE, BE IT PROCLAIMED by the Pinellas County Board of County Commissioners that the week of March 19-25, 2023, be recognized as

FLORIDA SURVEYORS & MAPPERS WEEK

 JANET C. LONG, Chair	 KATHLEEN PETERS, Vice Chair
 DAVE EGGERS, Commissioner	 RENÉ FLOWERS, Commissioner
 CHRIS LATVALA, Commissioner	 CHARLIE JUSTICE, Commissioner
	 BRIAN SCOTT, Commissioner



City of Pompano Beach

Proclamation



WHEREAS: throughout history, Surveyors have remained the pioneers of discovery, shaping our world to its current existence by exploring the unknown on earth and in space; and

WHEREAS: the world depends daily on the work of surveyors. Many everyday occurrences depend on information provided by surveyors such as fighting fires, emergency response by ambulances and police, and postal carriers delivering mail. A surveyor will be there first to provide critical information used to ensure that these essential tasks are possible; and

WHEREAS: Surveyors and mappers are uniquely qualified and licensed to determine and describe land and water boundaries for the management of natural resources and protection of private and public property rights; and

WHEREAS: dedicated to recognizing and promoting the importance of surveyors and the surveying profession throughout the world, Global Surveyors Day was first proposed to the International Federation of Surveyors in 2010 and is celebrated each year on March 21st. The date was chosen to ensure that it will always occur during the U.S National Surveyors Week; and

WHEREAS: the citizens of Pompano Beach recognize the valuable contributions of the surveying and mapping profession to history, development and quality of life.

NOW, THEREFORE, BE IT RESOLVED that I, Mayor Rex Hardin, along with my colleagues on the City Commission and the residents of the City of Pompano Beach do hereby proclaim March 21st, 2023 as

Global Surveyors Day

in the City of Pompano Beach, Florida

and recognize the many contributions and the ongoing dedication of surveyors to the citizens of Pompano Beach, Florida and the world.

DONE this 21st day of March, 2023.



Rex Hardin
MAYOR

City of Sanford



CITY OF
SANFORD
FLORIDA

PROCLAMATION

WHEREAS, surveyors and mappers are counted among the founding leaders of our country and were instrumental in the formation of the layout of property boundaries in the United States which have provided our citizens the enjoyment of property ownership; and

WHEREAS, George Washington, Thomas Jefferson and other former Presidents of the United States, served their fellow colonists as surveyors; and

WHEREAS, the citizens of Florida recognize the valuable contributions of the surveying and mapping profession to history, development and quality of life in Florida and the United States of America and make important decisions based on knowledge and expertise of licensed surveyors and mappers; and

WHEREAS, the surveying and mapping profession requires special education, training, the knowledge of mathematics, the related physical and applied sciences, and requirements of law for evidence; and

WHEREAS, surveyors and mappers are uniquely qualified and licensed to determine and describe land and water boundaries for the management of natural resources and protection of private and public property rights; and

WHEREAS, the continual advancements in instrumentation have required the surveyor and mapper not only be able to understand and implement the methods of the past, but also to learn and employ modern technology in finding solutions to meet the challenges of the future.

NOW, THEREFORE, I, ART WOODRUFF, by virtue of the authority vested in me as Mayor of the City of Sanford, Florida, do hereby officially proclaim, the week of March 20-26, 2022, as

“FLORIDA SURVEYORS AND MAPPERS WEEK”

and recognize the many contributions and the ongoing dedication of surveyors and mappers to the citizens of Florida and the United States



IN WITNESS WHEREOF, I have hereunto set my hand and caused the Seal of the City of Sanford, Florida to be affixed this 14th of March in the year of our Lord two thousand and twenty two.



ART WOODRUFF, MAYOR



FSMS will be an Exhibitor at the FIG Conference in May and we're looking for any interesting surveying photos to showcase at our booth. This is a chance to tell a story to the world of what surveying in Florida has looked like throughout the years. If interested, please send your photos to communications@fsms.org.



Seminole County

**PROCLAMATION
OF THE
SEMINOLE COUNTY BOARD OF COUNTY COMMISSIONERS
PROCLAIMING THE WEEK OF MARCH 19-25 AS
FLORIDA SURVEYORS AND MAPPERS WEEK 2023
IN SEMINOLE COUNTY, FLORIDA**

WHEREAS, surveyors and mappers are counted among the founding leaders of our country and were instrumental in the formation of the layout of property boundaries in the United States, which have provided citizens the enjoyment of property ownership; and

WHEREAS, George Washington, Thomas Jefferson and other former Presidents of the United States served their fellow colonists as surveyors; and

WHEREAS, the citizens of Florida recognize the valuable contributions of the surveying and mapping profession to the history, development and quality of life in Florida and the United States of America and make important decisions based on the knowledge and expertise of licensed surveyors and mappers; and

WHEREAS, the surveying and mapping profession requires special education, training, the knowledge of mathematics, the related physical and applied sciences, and requirements of law for evidence; and

WHEREAS, surveyors and mappers are uniquely qualified and licensed to determine and describe land and water boundaries for the management of natural resources and protection of private and public property rights; and

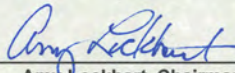
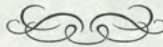
WHEREAS, the continued advancements in instrumentation have required the surveyor and mapper not only to be able to understand and implement the methods of the past, but also to learn and employ modern technology in finding solutions to meet the challenges of the future.

NOW, THEREFORE, be it proclaimed that the Seminole County Board of County Commissioners does hereby proclaim the week of March 19-25, 2023 as

FLORIDA SURVEYORS AND MAPPERS WEEK

BE IT FURTHER PROCLAIMED by the Board of County Commissioners of Seminole County, Florida, that this Proclamation be spread upon the Official Minutes by the Clerk of the Circuit Court in and for the County of Seminole.

ADOPTED this 28th day of March 2023.



**Amy Lockhart, Chairman
Seminole County, Board of County Commissioners**

City of Venice



Office of the Mayor



Proclamation

Whereas, surveying has been an essential element in the development of the human environment since the dawn of recorded history and is instrumental in the definition of legal boundaries for land ownership as well as the planning and execution of nearly every form of construction with its most familiar uses in the field of transportation, land development, communications, energy delivery and mapping; and

Whereas, surveyors and mappers are counted among the founding leaders of our country including George Washington, Thomas Jefferson, Abraham Lincoln, among many others and were instrumental in the formation of the layout of property boundaries in the United States which have provided our citizens the enjoyment of property ownership; and

Whereas, the surveying and mapping profession requires special education and training including the knowledge of mathematics, trigonometry and geometry as well as the related physical and applied sciences tempered by the requirements of law for evidence and possession; and

Whereas, surveyors and mappers are uniquely qualified and licensed to determine and describe land and water boundaries for the management of natural resources and protection of private and public property rights.

Now therefore, I, Nick Pachota, Mayor of the City of Venice on behalf of the Venice City Council do hereby proclaim the week of March 20-26, 2023 as

National Surveyors Week

in the City of Venice and invite all Citizens of this City to join surveyors and mappers in using their own talents for the good of the community as well as recognizing and appreciating the talent of others.



In Witness Whereof, I have hereunto set my hand and caused the Seal of the City of Venice to be affixed this 21st day of March, 2023.

Nick Pachota, Mayor

Exhibitor Opportunities



68th Annual Conference

at

Saddlebrook Resort

in

Wesley Chapel, FL

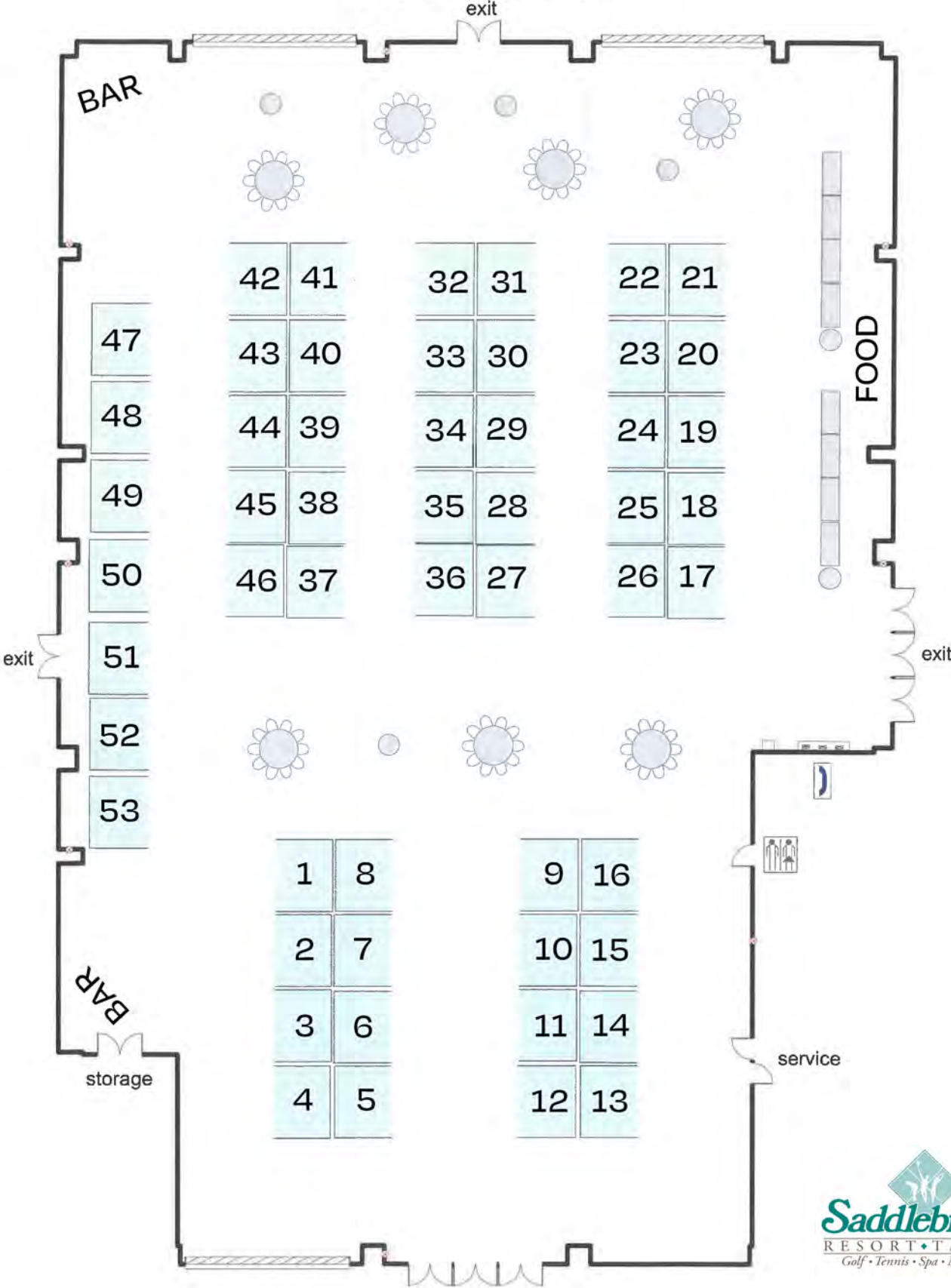
on

July 26th – July 29th



Florida Surveying & Mapping Society Exhibit Hall Layout ♦ July 27-28, 2023

Grand Pavilion





EXHIBITOR OPPORTUNITIES



**Only 1 Platinum Exhibitor allowed. All other levels can have multiple exhibitors.*

PLATINUM EXHIBITOR*

\$4,700

- Company Name and Logo on a Banner
- Company Bio and Logo in the Conference Program Book
- 1 month free full-page ad in [The Florida Surveyor](#)
- Sustaining Firms will receive an additional month free ad in [The Florida Surveyor](#)
- Recognition in Conference Edition of [The Florida Surveyor](#)
- Recognition on [FSMS.org](#) Header Banner for 2 months
- Logo with Hyperlink to Website displayed on [FSMS.org](#)
- Complimentary full page ad in Conference Program Book
- 2 night complimentary hotel stay
- Two Packet 1 Registrations (Each Registration includes 1 BBQ Ticket, 1 Exhibitor Luncheon Ticket, 1 Recognition Banquet Ticket, & 6 Saturday Seminar CECs)
- 2 Floor Clings with Logo displayed in Exhibit Hall
- 2 Booths
- Opportunity to Speak at Welcome BBQ

GOLD EXHIBITOR

\$3,500

- Company Bio and Logo in the Conference Program Book
- 1 month free half-page ad in [The Florida Surveyor](#)
- Sustaining Firms will receive an additional month free ad in [The Florida Surveyor](#)
- Recognition in Conference Edition of [The Florida Surveyor](#)
- Logo with Hyperlink to Website displayed on [FSMS.org](#)
- 1 night complimentary hotel stay
- One Packet 1 Registration (Each Registration includes 1 BBQ Ticket, 1 Exhibitor Luncheon Ticket, 1 Recognition Banquet Ticket, & 6 Saturday Seminar CECs)
- 1 Floor Cling with Logo displayed in Exhibit Hall
- Opportunity to Speak at Welcome BBQ



EXHIBITOR OPPORTUNITIES



SILVER EXHIBITOR

\$2,000

- Company Bio and Logo in the Conference Program Book
- 1 month free half-page ad in [The Florida Surveyor](#)
- Sustaining Firms will receive an additional month free ad in [The Florida Surveyor](#)
- Recognition in Conference Edition of The Florida Surveyor
- Logo with Hyperlink to Website displayed on [FSMS.org](#)
- 2 Welcome BBQ tickets

CONFERENCE EXHIBITOR

\$1,500

- Company Bio and Logo in the Conference Program Book
- 1 month free half-page ad in [The Florida Surveyor](#)
- Sustaining Firms will receive an additional month free ad in [The Florida Surveyor](#)
- Recognition in Conference Edition of The Florida Surveyor
- Logo with Hyperlink to Website displayed on [FSMS.org](#)

ALL EXHIBITORS WILL RECEIVE:

8' x 10' draped booth with 10' backdrop and 36" side rails

7" x 44" Sign provided by [Request Only!](#)

6' draped table, 2 chairs and waste basket

4 name tags for booth personnel per booth

2 lunch tickets per booth for Friday

Attendee List

— Additional Booths can be purchased for \$850 per Booth —



68th Annual Conference

Program Book Advertising



1 full page 5.5" (width) x 8.5" (height)	\$200.00
7.5% sales tax	\$ 15.00
TOTAL	\$215.00

1/2 page 5.5" (width) x 4.25" (height)	\$125.00
7.5% sales tax	\$ 9.38
TOTAL	\$134.38

Sponsor/Advertiser

Contact Name

Address

City State Zip

Phone Email

Ads must be in .pdf, .jpg, or .png format

We agree to the terms & conditions in the rate schedule.

Print Name Signature

MAIL CHECK AND FORM TO:

Florida Surveying & Mapping Society
P.O. Box 850001-243, Orlando, FL 32885-0243

Email: Education@FSMS.org

Payment Information:

Check Enclosed _____ AE/Discover/Mastercard/Visa _____

Card Number _____ Card Expiration Date _____

CCV/Card Identification # _____ Billing Zip Code _____

Signature _____



68th Annual Conference Showcase Flyer Inserts



Create a Unique Touchpoint with Your Showcase Flyer Insert!

An additional way to showcase your company at our Annual Conference is via our Attendee Registration Packets. Prepare your company's flyer and ship (200 inserts) to the Administrative Office for arrival by June 15th.

Cost - **\$100**

Or, FSMS can print your flyers on letter size copy paper (8.5" x 11") with B & W print

Cost - **\$200**



MAIL CHECK AND FORM TO:

Florida Surveying & Mapping Society
P.O. Box 850001-243, Orlando, FL 32885-0243

Email: Education@FSMS.org

We agree to the terms & conditions in the rate schedule.

Company _____

Contact Name _____

Signature _____

Address _____

City _____

State _____

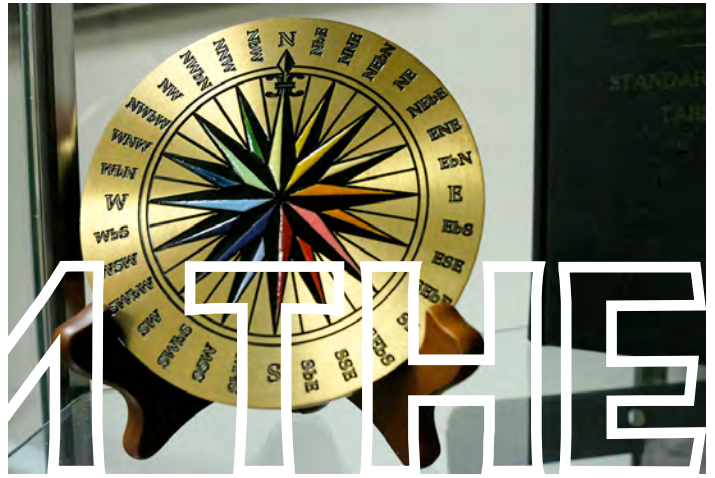
Zip _____

Method of Payment: Check _____ Credit Card(AE/Discover/MasterCard/Visa) _____

Card # _____ Exp. Date _____

CCV/Card Identification # _____ Billing Zip Code _____

Email _____



FROM THE ARCHIVES



Instruments and Methods for Surveying and Mapping

ACSM, National Report to FIG, Commission V.
Thirteenth International Congress of Surveyors
Wiesbaden, Germany, September 1-10, 1971

By DR. ERICH H. RUTSCHEIDT

CHIEF, GEOSCIENCES DIVISION, DEPARTMENT OF GEODESY AND GEOPHYSICS,

U.S. ARMY TOPOGRAPHIC COMMAND

SECRETARY, COMMISSION V

and

CHARLES H. ANDREGG

TECHNICAL DIRECTOR, MAPPING, CHARTING AND GEODESY

U.S. DEPARTMENT OF DEFENSE

ALTERNATE U.S. MEMBER, COMMISSION V

American Congress on Surveying and Mapping

(Originally published June 1971 in Surveying and Mapping)

THIS REPORT summarizes the applications in the United States of the developments and innovations in instruments and methods since the last meeting of the FIG in September 1968. The past three years have seen refinement in accuracies and operating characteristics of classical instruments, operational application of new equipment and methods made, and additional applied research initiated in the fields of new equipment, methods, and their combinations.

Increased sophistication of electronics application remains the major factor in the design and improvement of instruments and techniques for all

phases of surveying and mapping, particularly in the arts of mensuration, analysis, reduction and adjustment.

GEODETIC SURVEYS

The past three year period has seen most activities dealing with the provision and development of geodetic equipment and methods directed at improvements to increase accuracies and time rates of data acquisition and reduction, with a particular emphasis on satellite geodesy and precise baseline and traverse measurements. A number of developments have become operational with some results meeting

or exceeding original expectations. Satellite geodesy has grown into an accepted geodetic tool throughout the world.

Electronic Optical Distance Measuring Equipment

The increase in the use of Electronic Distance Measuring (EDM) equipment in the United States is demonstrated by its wide application in all survey mensuration, from cadastral work to the measurement of geodetically precise baselines. Among its many interesting new uses is the measuring of displacements in large structures such as dams and measuring the movements of the earth's crust in fault zones.

The most significant developments in EDM equipment in the last three years have been in instruments using laser and infra-red beams as the carrier waves for measurement information. Laser instruments have been developed for measuring long distances (up to 90 kms night and 50 kms day) as well as short distances (up to 6 kms night and day). Infra-red instruments are available for measuring short distances (up to 3 kms night and day). The trend in the development of both types of equipment has been toward automation of the measurement system, providing direct digital

readouts. Some of the short-range equipments use oscillators that require little or no warm-up time, reducing total measurement time, including instrument set-up time, to five minutes or less.

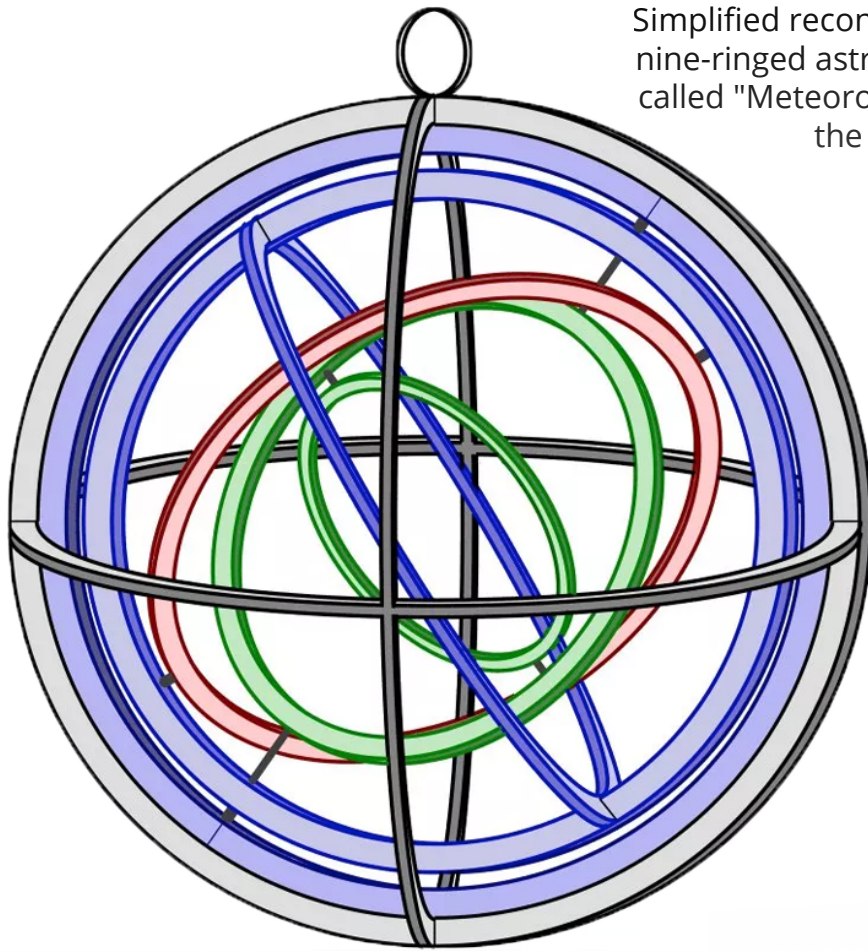
Improvements in EDM equipment using the microwave principle have also been made. Tellurometer has developed the MRS 4 using 35 GHz as the carrier frequency.

During the past few years advances in solid state electronics, optical modulation and detection techniques and laser increased the potential for a new generation of distance-measuring instruments operating at optical wavelengths. Characteristics of the geodetic instruments which have been developed are ease of operation, increased day and night time range, and an absolute accuracy of one millimeter plus or minus the error due to refraction and uncertainty in the value for the velocity of light in vacuum. This implies that at distances beyond a few hundred meters the instruments might be expected to give answers comparable to those obtained with Invar tapes. In addition, there is some promise of techniques for measuring the refractive index of the air over the entire line of sight, thus increasing the accuracy of measurements at longer distances.

Over the past eighteen months, evaluation has been in progress on one of the first of this new generation

This report was published from materials furnished by the National Ocean Survey, the U.S. Geological Survey, and the Department of Defense. It has been consolidated and organized by Dr. Erich H. Rutscheidt, Chief Geosciences Division, Department of Geodesy and Geophysics, U.S. Army Topographic Command.

Simplified reconstruction of Ptolemy's nine-ringed astronomical instrument called "Meteoroscope," as described in the hidden manuscript.



DID YOU KNOW?

Ptolemy's Meteoroscope was a device known to calculate heights and distances, often in relation to celestial bodies. It has been referenced in several ancient texts, including Ptolemy's *Geography*.

However, details of its structure and operation were lacking, until now. Researchers have now unveiled a hidden manuscript on a reused parchment believed to have been written by Greek astronomer, geographer, and mathematician Claudius Ptolemy.

(NEWSWEEK, MARCH 28, 2023)

Source

of instruments, the “Geodolite,” built by Spectra-Physics Corporation of Mountain View, California. The instrument projects the beam from a collimated He-Ne laser to a corner cube retro-reflector target and measures the distance to the target by comparing the phase of the modulated outgoing beam with that of the returning beam. The shortest modulation wavelength has been made exactly 3.0479947 meters (10 feet), in dry air at 760 mm of Hg and 20° Centigrade, by selecting a modulation frequency of 49.163707 megahertz. The output of the instrument is a voltage proportional to the distance measured, one volt per 0.3479947 meters (one foot) over the modulation wavelength. Distances may be read to about 0.3 millimeters or one millivolt necessitating a good voltmeter as an accessory piece of equipment. To resolve ambiguities a total of five wavelengths, each differing from the previous one by a factor of ten, are switch selectable giving a longest ambiguity interval of over 30 kilometers.

An example of a long distance measured with electro-optical techniques is a 400-mile traverse connection, being executed by the U.S. Army Topographic Command. A positional relationship between terminal points of at least 1 part in 10^6 was required.

The distance-measuring equipment selected consisted of 1) a Model 4L Geodimeter which was modified

with a stronger laser unit to obtain a transmitted light output of about 2 milliwatts, 2) a Model 8 Geodimeter which normally has a transmitted light output of about 2.5 milliwatts, and 3) a Geodolite which was modified to permit the installation of a 25 milliwatt laser which gave a transmitted light output of about 10 milliwatts. The modification of the Model 4L Geodimeter and the Geodolite to increase its power output was considered essential if the project was to be successful because there was an immediate requirement to directly measure individual distances of 50, 71 and 83 kilometers. The modifications mentioned above proved to be operationally successful. An unexpected result was the capacity of the Model 8 Geodimeter with its 2.5 milliwatt transmitted power to measure all three of these distances.

In addition to the capacity of these instruments to measure the long lines, there was a requirement for obtaining a comparison of distances as determined by different instruments which would produce ratios of comparisons exceeding 1 part in 10^6 . Of these rather limited number of long-distance determinations, the ratio of comparison exceeded the accuracies required. The excellent comparisons are a result of the quality of the instruments and the attention given to obtaining ambient temperatures throughout the entire length of each line. This is, and continues to be, accomplished by using a thermistor

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equipped aircraft which flies the line during measurement.

Based on the results obtained to date and continued improvement in the power of the light source, it appears that lines of 100 kilometers in length will soon be measured.

A concept for the development of an ultra-precise geodetic baseline has been proposed. The method is that of optical interferometry using the long coherent length and precise wavelength characteristics of the stabilized single frequency gas laser. As proposed, the baseline might also serve as a calibration range for distance-measuring equipment and for a very accurate determination of the velocity of light. Essentially, the concept describes a method of measuring a short geodetic baseline with an absolute accuracy approaching 1 in 10^8 . A preliminary evaluation has been made with an available advanced optical distance-measuring instrument which uses the phase comparison technique. The instrument was tested for resolution, distortion over a complete modulation wavelength, offset or zero error, precision, and accuracy at distances up to 1.6 kilometers. Results of these tests indicate an error in distance measurements which can be assigned to the instrument of about 1 millimeter.

Small Movement Measurement

Techniques for measuring small

movements in large structures make use of advanced-type measuring instruments, as well as modified measuring techniques. Knowledge of the refractive index of the air is not required. Typically, for measurements of the greatest precision, triangulation has been the preferred method. In recent times, however, it has been recognized that atmospheric vagaries limit the accuracy of triangulation. Distance-measurement methods have similar problems. The degree to which the refractive index can be ascertained along the entire measuring path limits accuracy, so that little or no advantage over triangulation may be expected. Since absolute accuracy in many cases is not required, these methods are still used, in the case of a dam or other large engineering structures.

Frequently it is only necessary to measure displacements of the structure relative to some nearby point which is assumed to be stationary. In this case the atmosphere might be expected to influence measurements made along similar paths in much the same way. Thus, although the measured distances might be in error in an absolute sense, the differences between them can be accurately determined.

This technique was applied along a 2500- meter section of an earth dam near Sardis, Mississippi. To minimize the effects of unsuspected variations in the refractive index, all paths along which distances were measured

were above similar topography, and measurements were made rapidly to avoid large changes in refractive index which might be expected to occur in a nonlinear fashion as a function of time.

Microwave Angle Measurement

Recent experiments with microwave detectors indicate that horizontal directions may be determined with an absolute accuracy of 5 arc seconds. The practicability factors for treatment of atmospheric effects and for dimensional configuration seem to favor the higher microwave frequencies, specifically 85–94 GHz, although some work has been done at 9.4, 18.8, and 35 GHz. The most promising feature of these experiments is the capability to make angular measurement day or night, in clear weather or under conditions of fog, smoke, haze and precipitation at ranges up to 50 kms. The remaining development is expected to bridge the gap between the early experiments and a practical field surveying instrument. However, further investigations are required in order to determine the optimum frequency for a practical field surveying instrument for geodetic purposes. The prospects for a very short-range lightweight and less accurate instrument for military survey purposes are promising.

Encoder Theodolite

The recently accelerated development of shaft-angle encoders and resolvers for automated digital systems has

enabled their economical application to surveying instruments. The choice of types available now include both optical and electronic, and the techniques include both absolute and incremental. The resolution of the most recent developments has been carried to less than 1 arc second and the readout or display can be in the form of an instrument panel meter, magnetic tape, punched paper tape or filmed record. When applied to a directional theodolite, these devices provide digital data that can go directly from field measuring operations to a data processing center. One such theodolite is already being used in quantity in Europe and several others are under development in both Europe and the United States. The U.S. Army Engineer Topographic Laboratories are currently retrofitting a theodolite with both vertical and horizontal encoders for military survey application. The output is designed to be a visual display with a 0.1 mil resolution.

Initial Surveying Equipment

Inertial principles and components are currently being applied by the U.S. Army Topographic Command to surveying. The Position and Azimuth Determining System (PADS), an all-inertial system aided by a laser velocimeter, will be jeep-mounted and capable of providing position, elevation and azimuth to an accuracy suitable for military or reconnaissance surveys. Modified field operational techniques may provide accuracies suitable for engineer use. The fabrication of an

experimental model is scheduled to begin early in FY 71.

The desirability of gyroscopic azimuth instruments for surveying has been established over the past few years. To date, however, the gyro-instruments designed for surveying generally have either lacked easy portability or required experienced operators to achieve satisfactory results.

The lightweight gyro-azimuth surveying instrument under development is designed to provide an accurate, easy-to-operate, and highly portable instrument that can achieve good performance reliability in the field environment. It utilizes the well-known band suspended, pendulous design to achieve maximum decoupling of the gyroscopic element from undesirable forces due to vibration and tripod setting. A gyro-tracking servo-loop is used to avoid twisting of the suspension band. Finally the oscillation about north—typical of band-suspended, pendulous-type instruments—is avoided by an electrical damping technique which causes the gyroscope to settle in the meridian. The use of damping affords a minimum observing time and avoids mathematical computations in obtaining the final azimuth. The instrument can achieve an accuracy of better than 0.3 mil (1 minute of arc) at mid-latitudes in a settling time of 20 minutes. The weight design goal is 40 pounds.

Observing and calibrating techniques used by the Lear-Siegler Co. in the above lightweight gyro-surveying-instrument together, with sacrifices in both observing time and weight may make it possible to achieve an instrument suitable for some geodetic usage.

Combined Function Instruments

For several years the concept of measuring gravity in an airborne vehicle has been pursued by the geodetic community. Several tests have been made with gravity meters installed in fixed-wing aircraft. An initial test employing a helicopter as a vehicle was performed in the spring of 1965. Since that period several more tests have been completed by the U.S. Army Topographic Command (TOPOCOM) the Air Force Cambridge Research Laboratories and the USAF 1st Geodetic Survey Squadron. Because of problems that developed with data reduction, the system has not been certified as operational.

The Helicopter Gravity Measuring System (HGMS) is an integrated equipment configuration consisting of several components or sub-systems; LaCoste and Romberg stable platform gravity meter, Rosemont pressure port calibrator, 35 mm strip camera, HIRAN navigational system, Spectro-Physics laser altimeter, Lancer digital data logger, and the necessary interface and analog recording monitors. Determination of the x,y,z coordinates, as related to local geodetic control,

is measured by these sub-systems; HIRAN for latitude and longitude, pressure port calibrator for establishing a barometric surface for elevation reference, and the laser altimeter for flight path elevation control.

An accurate navigation system is of prime importance since the point-to-point results are used to establish course as well as speed of the aircraft. Excessive errors in either component result in a substantial correction to the recorded gravity values. Several systems have been used in test programs: on-board radar, LORAC, Raydist, SHORAN, HIRAN, on-board Doppler, and Cubic Autotape. Only two systems—HIRAN and Autotape—have been found suitable for both over-land and over-water flight control. The most recent tests were performed with HIRAN resulting in acceptable accuracies of 50 feet CEP, $0^{\circ}.3$ to $0^{\circ}.5$ course accuracy, and 0.3 knots to 0.5 knots speed accuracy. The Cubic Autotape, in tests performed separate from the HGMS operation, gave excellent results (± 2 meters repeatability in TOPOCOM tests).

Determination of an airborne reference for elevation control has been a difficult task. The sensitivity of the Rosemont pressure port calibrator has provided an accurate tool for establishing a reference in the sky. After flight altitude is reached the calibrator sensor traps a sampling of air and records any deviations from this reference sample (plane). The

barometric surface is not an ideal reference since its stability is affected by general and local atmospheric conditions.

The laser altimeter (with an accuracy of 1:10,000) has a two-fold purpose as used in conjunction with the calibrator. By flying on the surface plane over ground reference elevation sources, viz., rivers, lakes, roads, etc., the altitude of the barometric plane is fixed along the flight path. Since the laser altimeter records continuously, a profile of the terrain is recorded along the flight path. As known ground elevation sources are flown over, an update of the barometric surface allows necessary corrective factors to be made to the flight profile, and accurate elevations of points along the ground can be determined. During these recordings the 35 mm camera takes a continuous photograph of the flight path. Recordings of all systems are synchronized to fiducial marks on the photography for the purpose of relating the ground features to the graphical altimeter record.

The most sophisticated airborne cartographic and geodetic data acquisition system in existence is designated the AN/USQ-28 system and is operated by the U.S. Air Force's Aerospace Cartographic and Geodetic Service (ACGS) of the Military Airlift Command (MAC). It is housed aboard a four-engine jet aircraft and consists of three electronically interfaced systems: the photomapping system, the Terrain

Profile Recorder (TPR) System, and the distance-measuring system (SHIRAN).

The photomapping system features two KC-6A cameras in vertically-stabilized mounts controlled by HYPERNAS II Inertial Reference Unit (IRU). The KC-6A is the most advanced U.S. mapping camera (6-inch focal length, 9 x 9-inch format). Some of its outstanding features are the Geocon IV color-corrected lens with 93-degree diagonal field and 38 lines/mm resolution (AWAR), RAPIDYNE shutter, automatic exposure control, image motion compensation, and a 25-point platen reseau grid. In addition, the camera provides a fine verticality registration block and a digital data registration block which appear in the margin of each exposed frame. Besides providing vertical control for the mapping cameras, the IRU is an integral part of an inertial navigation system used for precise flight-line navigation.

The TPR is a precise, narrow-beam recording radar altimeter which provides a capability of establishing terrain elevations along the ground track of the aircraft. Its relative accuracy between nearby points along the same flight line is ± 10 feet at onesigma level. SHIRAN is a precise long-range, electronic, distance-measuring equipment (DME) capable of simultaneous measurement to four ground transponders over ranges in excess of 200 NM. One application of the SHIRAN DME is the extension of geodetic control by trilateration,

in which case the system is capable of measuring the geodetic distance between two ground stations up to 400 NM apart with a demonstrated one-sigma accuracy of ± 0.0023 NM or ± 14 feet (single mission) independent of line length. Another application of the SHIRAN DME is the Horizontally-Controlled Photograph (HCP), in which case the system is used to determine the geodetic position of nadir points of aerial mapping photographs with accuracy of the order of ± 15 feet standard error of position when three or four ground stations are used for control.

The voluminous digital data acquired during an USQ-28 mission are recorded on magnetic tape for processing by a ground computer facility (SDS 920/910 computers). The USQ-28 system is complemented by the WS-.430C photo processing and data processing complex housed in self-contained, air-liftable trailers which can be deployed to the project operating location.

Automated Horizontal and Vertical Control Acquisitions

The establishment of horizontal and vertical control for gravity stations in inadequately mapped areas is expensive and time consuming. The U.S. Army Topographic Command, the U.S. Geological Survey and the 1st Geodetic Survey Squadron have acquired Ground Elevation Meter (GEM) Surveying Systems which are being used to establish elevations in support of gravity surveys and lower

order vertical control surveys. The GEM was built by the Sperry-Sun Well Surveying Company in Houston, Texas, and is mounted in a 1970 GMC Suburban Carryall.

The GEM establishes relative elevations which are obtained through an apparatus which measures the instantaneous angle of inclination of the surface being traversed and the instantaneous velocity of the meter along that path. The assembly consists of a four-wheel drive, four-wheel steer vehicle. A small fifth wheel that provides the velocity or distance signal through a pulse generator system is mounted on a cantilever arm suspension midway between the front and rear wheels on the left side of the vehicle. It is lowered to and raised from its operation position by use of a constant pressure air cylinder. A telescope bar, suspended between the front and rear axles provides the reference datum for the measurement. A sensitive pendulum mounted on this bar provides the angle measurement for each increment of distance traversed. In addition, the vehicle carries automatic high-speed electronic computing storage and printout computer capability with necessary power supplies for all equipment. The vehicle is fully airconditioned for dust free operation of the electronic computer.

Gravity observations are made from inside the vehicle, using a tripod which is lowered to the ground. The accuracy

of the elevations established varies with the road surface, speed of the vehicle and driving technique. The average accuracy obtained to date is ± 2.0 feet and little difficulty has been experienced obtaining the 5.0-foot tolerance. Speed and the ability to work in inclement weather are important production factors. The GEM's production rate is approximately three times that of conventional lower order spirit leveling.

Portable Towers

A portable truck-mounted tower developed by the U.S. Geological Survey (USGS) has been used successfully to speed up field surveys for establishing control for topographic mapping. Several design changes were made to improve characteristics related to the stability, erection, and mobility of the tower. The 6-inch tube used for an instrument stand was modified from a 6.5-foot length to extend the full length of the tower and be anchored to the ballast tank at the base. This modification provided the stability vitally needed for second-order control surveys. The inner and outer towers assemble in only two sections, each for a working height of 60 feet. The four sections can be telescoped and nested within one another at a length of 32 feet for transport. In the raising or lowering operation, new heavy-duty hydraulic lifters swing the tower, fully extended, through a 90° arc at a smooth uniform rate of motion.



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Portable Masts

Variable-length portable masts are being used by the USGS for survey operations where traverse lines must start or end on control stations obscured by hills or high trees. These masts, developed in two models, are extended by a hand-operated winch to heights of 56 and 74 feet above ground level. In operation, the mast lifts a rotating beacon signal light and a Geodimeter reflector above obstructions for survey operations. Guy ropes are provided to secure the extended mast and center the light over the station mark. The mast assembly weighs 115 pounds and telescopes to a length of only 21 feet, so that it may be easily transported.

Electric Signal Lights

The capability of measuring precise distances in daylight contributed to increased use of electric lights as daytime targets for the measurement of angles in geodetic transverses and triangulation. The type of signal light developed by the USGS can accommodate a wide variety of sealed-beam lamps, up to a power rating of 500 watts, including a quartz-halogen lamp that delivers 300,000-beam candlepower at a drain of 55 watts. Several lamps can be stacked vertically over the station mark and pointed in different directions. They can be turned off/on at the station by means of a push-button switch or a 24-hour, 8-day clock timer, or from a remote station by means of an audio-tone generator and

standard field ratio.

Satellite Geodesy

The satellite triangulation programs of the NOS, TOPOCOM and the U.S. Air Force are based on simultaneous observations of satellites from widely separated camera stations. The NOS/TOPOCOM program used a specially designed Wild BC-4 satellite camera (450 mm focal length) and a camera control and monitoring console containing the system's electronic and timing equipment. Only passive satellites were observed in this program. The U.S. Air Force's program used the PC-1000 Stellar Camera (1000 mm focal length) and its associated Model III Electronics System which also permits the coordinated recording of flashing strobe lights mounted on satellites.

The simultaneous observations of a satellite against the star background, recorded photographically on glass plates for precise mensuration, from camera stations on the earth's surface provide simultaneous spatial directions to the satellite. A direction from each of two camera stations define a plane through the satellite and the two camera stations. This plane, in turn, defines a chord, to include its direction, between the two camera stations. Simultaneous observations from two known and one unknown station will permit a solution for the relative position of the unknown station.

The NOS/TOPOCOM satellite field

observation program was initiated in June 1966 and completed in November 1970. High-precision baselines for scaling the worldwide network have been measured by electronic traverse in Africa, Australia, Europe and the United States. All satellite data are now being reduced by the NOS and will be completed in 1972. Results will be the basis for an accurate determination of the size and shape of the earth, and for the establishment of a global geodetic datum that approaches an accuracy of 1 part in 10^6 . The BC-4 camera system has proven its capabilities and is now being employed by NOS on the North American Densification Project.

The U.S. Air Force's PC-1000 Program was used, in co-observation with HC-4 camera observations, to densify existing networks in South America, and to connect isolated locations with primary geodetic control areas. Internal consistency of this technique is better than 1 part in 350,000 at 60.8 percent.

The TOPOCOM SECOR (Sequential Collation of Range) program has been completed. This system measured ranges from four stations, three known and one unknown to a transponder in orbit. This geodetic satellite program was designed primarily for establishing intercontinental geodetic connections determining the relative geographic positions of oceanic islands, and determining the coordinates of other points on the earth's surface for the purpose of creating a uniform world

geodetic network. In addition, it will be used to reduce the uncertainty in the constants now being used for the size and shape of the earth.

The Doppler principle of apparent change in frequency of a radio signal emitted from an artificial satellite is being used to provide accurate positional information in any part of the world. The U.S. Navy Navigation System was designed as an all-weather tool for marine use, but refinements in techniques and instruments have allowed geodesists to locate themselves on an earth-centered surface more accurately than was previously possible. The Satellite Tracking Network (TRANET) operated by the NAVAIR Systems Command provides precise ephemerides of the navigation satellite orbits which may be used by geodetic surveyors to obtain positions from Doppler observations from the satellites.

The standard AN/SRN-9(XN-5) receiver has been used by the U.S. Naval Oceanographic Office for Doppler observations to provide geodetic positions in varied environments. Raydist transmitter locations were determined on the off-lying islands of South Korea for hydrographic survey control. This equipment was also used to locate the Loran C antenna at Angissoq, Greenland and the Omega transmitter at La Moure, North Dakota. In each of these surveys the resulting positions were computed on the Mercury Datum,

Fischer Spheroid. Evaluation of cost data as would be expected indicates that surveys by satellite receiver are faster and cheaper than long-line traverses or extensive triangulation or trilateration. New receivers having refined observing characteristics and greater portability will be used to implement a complete satellite geodesy program. Experiments in translocation (simultaneous observations of the same satellite by receivers located up to two-hundred miles apart) will be continued and resulting data will be used to augment further the available technology.

The TOPOCOM's Doppler Satellite Program employs man-portable equipment to acquire data for both single-point, earthcentered positions and for relative positioning. This system tracks the U.S. Navy Navigation Satellites for which precise ephemerides are available from the Naval Weapons Laboratory (NWL). Using the known orbital data and analyzing the received Doppler frequency shift of the radio signal emitted by the satellites, highly accurate ground positions can be determined.

The International Telephone and Telegraph (ITT) 5001 Doppler Receiver tests were conducted by TOPOCOM from April to June 1970. During this test an ITT receiver was located at each of the following stations: Herndon, Virginia; Ft. Stewart, Georgia; and Ahoskie, North Carolina. A Backpack

Doppler Receiver also was located at Herndon, Virginia and participated in translocations to Ft. Stewart and Ahoskie. The receiver phase locks to the two radio frequency carriers and obtains accumulative Doppler counts at 2-minute intervals displaying partially accumulated counts every 4.6 seconds. The receiver also detects the satellite ephemeris data that are present as modulation on the carriers and processes these data before it is printed. The 5 mHz oscillator is used as a reference against which the satellite signals are compared to obtain the Doppler count. A miniaturized Doppler Receiver, called Geoceiver, is now in production and is being made available at this time. The Backpack Doppler Receiver differs from the ITT 5001 Doppler Receiver in that it provides Doppler counts every 2 minutes; is man-transportable; the Doppler counts are stored in memory and read out at the completion of the track; and the satellite ephemeris data are not printed out.

Two methods of determining positions are being tested: the Geodetic Point Positioning and the Translocation Methods. In Geodetic Point Positioning the geocentric coordinates of each station are obtained from multipass Doppler solutions using the NWL long arc ephemeris. The concept of the Translocation Method refers to the determination of the relative distance between two receivers obtained from simultaneous observations of more than one pass of a satellite. In theory

systematic errors in the ephemeris should bias the position of each station an equal amount, resulting in a cancellation of the biases when the relative station positions are computed.

Solutions were programmed for and executed on the UNIVAC 1108 Computer. Selective and additive data were processed successively to determine the convergence of the solutions. Convergence of the solutions under the conducted tests appear to be reached with 60 satellite passes and an internal consistency with 2.5 meters with a 90 percent confidence. The accuracies obtained were within 10 meters for the Geodetic Point Positioning Method and 5 meters for the Translocation Method when compared to the NOS precise traverse.

After more than a decade of satellite observations with corresponding developments in data reduction theory and techniques, our present determination include very elaborate gravitational models containing hundreds of terms, and precise worldwide positions good to ± 15 meters. Improved tracking systems and advances in techniques and equipment suggest that future achievements will include submeter accuracies in position determinations.

Stellar Orientation

Research in stellar geodesy represents one step in the development of the theory for the solution to the problem

of determining the center of earth's mass, ground station positioning, the world geocentric geodetic system and the mathematical figure of the earth. ETL by introducing a geogravity coordinate system and a new concept in defining astronomic station positioning has developed a series of formulations for determining the orientation of lines with respect to the mean equator and mean equinox for a given epoch. The station-to-satellite directions resulting from the photograph measurements are used for making the orientation of lines between unknown stations. From among lines so oriented, the astronomic azimuth and zenith distance between nonintervisible stations can be computed, and the intercontinental astronomic azimuth ties can be achieved. This theory described a method for determining the orientation of lines between unknown stations, with respect to a mean equator and equinox at some assumed epoch, in a world geodetic network.

Computer Processing

Improvements made in electronic computer facilities enhanced applications of computer processing in geodetic surveys. The trend in geodetic computations in the USGS is to write master programs to provide for the complete computations of a survey network, including preliminary computations on field observations, initial distribution of errors and finally a least-square adjustment with printout of results. Other new computer

programs provide for plotting control diagrams with an automatic plotter, computing geodetic azimuth from observations of circumpolar stars, and for printing star-finding data for astronomic observations.

PHOTOGRAMMETRY

The advances in photogrammetric instruments and methods is tied to improvements in electro-optical sensing devices and upon electronic computer technology.

Image Correlating and Measuring System

An image correlating and measuring system was developed by the USGS in cooperation with BAI Corp. to aid in data acquisition for analytical aerotriangulation. The system consists of the correlator, a card punch, and a precision comparator with associated readout and recording equipment. The correlator scans an annular area of the photographic image and develops a video signal, or signature, which uniquely defines the scanned scene. The signature is then digitized and stored on a punched card for subsequent correlation with the same scene from another photograph. The operator establishes the correlation to micrometer accuracy by means of dial readings. The comparator measures and records precise x and y machine coordinates of the selected image points. The system can also be used to derive data for registering time-variant imagery of the same scene or imagery from different sensors.

Orthophoto Instrumentation

A new instrumentation system for producing orthophotographs has been designed and fabricated by the USGS. The system includes two companion instruments, the Orthophotomat and the Autoline. The Orthophotomat is a single-projector instrument for automatic production of orthophotographs from profiles. The Autoline (automatic line follower) uses analog profiles, derived either manually or automatically, as a means of controlling the scanning motions of the Orthophotomat. Three methods with instrumentation are being developed for producing profiles: (1) An analog profiler has been built for manual scanning and recording profiles in a stereo-model formed by a double-projection plotter; (2) an automatic photographic technique for recording terrain profiles from a stereoscopic model is under development; (3) prototype instrumentation for scanning existing contour plates to generate profiles is being built.

Stereoimage Alternator System

Image Alternator (SIA) system of viewing stereomodels by means of synchronized rotating shutters has gained wide acceptance in the United States. Most USGS double-projection plotters have been equipped with SIA's. Several commercial firms in the United States have been licensed to manufacture and sell SIA units, and patents have been issued in seven foreign countries. Compatibility of the

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system with color photograph for low-cost, projection-type stereo-plotters played a considerable part in its gaining acceptance, because heretofore color photographs could be used only in the more complex instruments with a separate optical train for each eye. The latest SIA hardware development was a shutter designed to operate inside the lamphouse of an ER-55 (Balplex) projector. Another development was headband-type shutters for operators who prefer more flexibility in head position during viewing.

Aerotriangulation Methods

Most aerotriangulation for topographic mapping in the USGS is done by semi-analytical methods. The coordinates (based on an arbitrary origin) of selected photo-images are obtained from stereo-models in digital form ready for computer input. In the computer, the data are adjusted to control points which have known ground positions and have been identified on the photographs. Several methods of adjustment are programmed, and the particular program used depends upon the type of terrain, the photogrammetric control requirements, and the instrumentation available. In addition to semi-analytical techniques in use, the IBM/360 version of the Geological Survey's direct geodetic constraint method of fully analytical aerotriangulation reached operational status. The maximum size of problem that the program will now handle is 45 photographs. The number

of auxiliary storage units (magnetic tape or disk) required by the program is only two. Points targeted on the ground for positive identification serve as both horizontal and vertical control points. The Wild PUG point-transfer device is used to make pass points which are then measured on a OMI Nistri monocomparator. The analytically derived positions and elevations of pass points for model control meet all standard accuracy requirements for topographic map compilation.

Aerotriangulation

The Multiple Station Analytical Triangulation (MUSAT) program, a simultaneous adjustment technique for analytical aerotriangulation, has been developed by the U.S. Army Engineer Topographic Laboratories. A series of MUSAT programs have evolved over the past six years. The first of the MUSAT series (MUSAT I) is based on investigations and successful development of the simultaneous analytical triangulation technique begun by the Army in 1954. This work has progressed through the development of MUSAT IV, with major technique innovations implemented with each succeeding version. The MUSAT IV program is a particularly efficient general analytical triangulation program for frame photography developed and programmed in FORTRAN V for the UNIVAC 1108 Computer. This program, as in all previous versions, is designed with a production environment in mind, with particular attention given



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to the ease of data input and to the flexibility for accommodating the needs of a wide range of users. The program features a free formatting technique for ease of data input and offers a wide variety of input/output options to cover the needs of both research and production-oriented users. Preprocessing of image coordinates, including corrections for film deformation, radial and tangential lens distortion, and atmospheric refraction, is provided in several forms. Blunder and data editing features are incorporated, and diagnostic and error messages are given during each phase of the triangulation process. A rigorous least-squares adjustment with an error propagation facility is provided to handle block of virtually unlimited size. (The most recent large block solution involved the solution of 1000 photographs with the MUSAT III program. The triangulation and adjustment of this block was accomplished on the UNIVAC 1108 Computer in 57 minutes.) The mathematical model, based primarily on the collinearity condition, can be constrained by a range measurement between any two points in object space, by groups of points having equal elevation as well as by the more conventional ground and exposure station elements. Data weighting is provided, whereby input decisions estimates dictate the influence that the input parameters will have on the least-squares adjustment. The solution of the normal system of equations is accomplished using the AUTORAY

algorithm. The MUSAT programs are currently in use as a research tool by the U.S. Army Engineer Topographic Laboratories and in production applications by the U.S. Army Engineer Topographic Production Center, the National Aeronautics and Space Administration and others.

Map Revision Techniques

The USGS is experimenting with new techniques for map revision. In one experiment, film-positive composites of the old culture and drainage drawings were reduced to diapositive scale and placed in register under the diapositives of high altitude photographs in optical-train plotters. With this technique, the compiler is able to readily identify new map features and ploy them on the revision manuscripts. In another experiment, variable-scale stereoscopes were used in transferring information from aerial photographs to scribe-coated orthophotomosaics in a single scribing operation. Promising results were obtained from both experiments, and the techniques are expected to be developed for operational use.

Image Quality of Photogrammetric Systems

A project was begun under the joint sponsorship of the U.S. Geological Survey and the National Research Council, National Academy of Sciences, to evaluate the elements which affect the image quality of photographic systems for mapping.

Specially designed ground targets were constructed and laid out in a special array adjacent to the U.S. Army's Photographic Test Range at Fort Huachuca, Arizona. The targets were photographed from 6,000, 12,000, and 24,000 feet with several camera/film/filter combinations involving a Wild RC-8 camera (6-inch focal length), a Zeiss RMK 30/23 camera (12-inch focal length) and four types of Kodak aerial film. All the films were commercially processed under rigidly controlled conditions. In the laboratory the same camera/film/filter combinations used in the aerial exposures were used to photograph collimator targets, which by design and fabrication, simulated the ground targets. The laboratory films were also processed under controlled conditions. As a result of this study, analysis of modulation transfer functions (MFT's) is being considered as a basis for evaluating aerial photographic imagery.

Automation

There are photogrammetric instruments in use at the Aeronautical Chart and Information Center (ACIC) today that draw contours automatically. These same instruments can digitize the information on magnetic tape and by computer manipulation output the relief information in a variety of ways. They can also produce orthophotos which have all of the minute detail of an aerial photograph and the horizontal accuracy of a high quality map.

The computer has had an impact on the world equal to the industrial revolution. Cartography has felt this impact. The development of an airborne computer, with its large memory and fast processing capability, will make it possible for the computer to perform many operations previously done by pilots and navigators. The computer will require cartographic information in digital form. This data will require resolution of detail consonant with the decided precision of navigation.

An interesting development in this area is the all-weather flying capability which would be made possible by an automatic contour matching system in the airplane. Such a navigation system would have topographic data in digital form stored in the airborne computer. When a position check would be desired, the radar altimeter would begin sensing altitudes. A sequence of altitudes at specified intervals would be compared with the topographic data stored in the computer. Correlation of the sensed data and the topographic data would verify a particular position with respect to the ground. This system would work day or night, in any kind of weather.

Digital plotters are available today that plot with an accuracy that cannot be matched by the best cartographer. Complicated projections can be computed and plotted in a matter of hours. The same task would have taken months in bygone days.

The future of cartography is hard to predict. Who, 20 years ago, would have foreseen the requirement for earth orbiting charts or lunar landing charts. An article submitted by the Aeronautical Chart and Information Center (ACIC) predicts that maps of the future will be digitized and stored in memories of large central computers. When a map is required for any purpose the computer can be queried for the exact information desired and the information displayed in the most convenient way. The ship's captain, airplane pilot or automobile driver of the future may pick up a roll of magnetic tape or a magnetic disk that will contain all of the information required to navigate over a predetermined course or be piloted from a central control station to his destination. Thus, mapping may go from the memory of man to the memory of a computer.

Accuracy and Precision of Measurements

Research on the subject of centering circular measuring marks in artificially marked pass points has shown that optimum precision is obtained when the measuring mark just fits inside the pass point, irrespective of the overall size. It has been demonstrated that the precision obtainable with the human eye is at least 20 times better than that obtained with a 1-micrometer comparator. It is unlikely that factors such as size relationships between measuring mark and target background density and pattern, and laboratory brightness level make any

contribution to pointing precision in existing 1-micrometer comparators. The effect of measuring mark size and shape on the detection of y-parallax has been determined. The precision of estimation of floating mark coincidence was independent of measuring mark size for circular marks. A 50 percent increase in precision of coincidence estimation is obtainable with split circular and cross floating marks. The extent of correlation between X- and Y reading to artificial pass points has been studied, and no evidence of correlation was found. A new polar coordinate comparator has also been designed. Preliminary studies on the precision of depth setting on holograms in red light has shown that, in general, it is comparable with that obtainable in anaglyph instruments, and that there was no significant gain in pointing precision when the "speckle" was removed.

Sensing Arrays

The performance and function of the human eye can be viewed from the point of view of the dynamic theory of vision. The theory offers a basis for explaining how a comparatively gross network of retinal receptors can be used for discriminating tasks many times finer than the individual receptors. The involuntary eye movements of tremor, flick and drift, combined with complex natural interactions, appear to be largely responsible for this.

A sensing array system which

makes use of these concepts may be devised. In this electronic system, "perturbation" corresponds to the involuntary eye movements. A zero sensing error can be obtained by the introduction of an optimum perturbation signal into the system.

The sensing array system would be capable of detecting area, position, velocity, and shape of a moving object-image either in a two-dimensional or a three-dimensional form. Possible applications of the array sensing techniques to photogrammetry and metrology are numerous. Advantages of the techniques over the conventional array methods are evident. Extensions of the idea in the future are almost limitless.

Radar Mapping

A computer program for the analytical stereoplotter to accept the geometry of side-looking radar photographs has been completed by the U.S. Army Engineer Topographic Laboratories (USAETL). The analytical stereoplotter is essentially a computer controlled stereocomparator based on the original design by U. V. Helava. The computer has been programmed to transform stereomodal (or ground) coordinates into corresponding sets of photographs for stereoscopic viewing and measuring. This transformation, therefore, permits stereo-compilation of map manuscripts from stereo-pairs of side-looking radar photographs.

Lunar Control Development

Networks of photogrammetric control used in the production of topographic maps for selected Apollo Landing Sites have been developed by TOPOCOM and ACIC under contract to NASA. These networks were derived from photography obtained by Lunar Orbiters I, II, and III, which carried high- and medium-resolution cameras, with ground resolutions at 50 km altitude of 1 meter and 8 meters, respectively. This high quality lunar surface photography had stereo overlap ranging from 53 to 87 percent. TOPOCOM and ACIC have also produced control for the production of topographic maps and photomaps of several sites of scientific interest photographed by Orbiter V. An extensive test of Orbiter IV materials for possible use in the establishment of a Selenodetic Control System was conducted jointly by TOPOCOM and ACIC. About 99 percent of the surface of the moon was photographed with both high- and medium-resolution cameras by Orbiter IV. All of these control networks were developed by statistically rigorous analytical photogrammetric strip and block adjustments of the photographic data.

CARTOGRAPHY

Improvements in cartography have been directed primarily at digitization, automation, standardization, and the improvement of orthophotomapping procedures and products. The adaption of electronic computer devices plays a

large role in the development of these improvements.

Color Identification System

A color identification system for lithographic inks that is broad enough in scope to include any conceivable color and to catalog all colors into a logical and orderly arrangement has been developed by ACIC. By such cataloging, lithographic ink colors can be numbered in such a manner which actually describe in terms of color values. The system is being presented as a DOD standardization with national and international application considerations. The system is based on international values which interpret the spectral curve of any color into a set of values as seen by an international standard observer and illuminant. In this identification System, the CIE description of color is applied as the basis for color identification.

The ink formulation is based on using eight basic colors plus black and white which, by blending in specified parts, can achieve all ink colors.

Orthophotomapping

Orthophotomapping increased significantly in the USGS. Work began on more than 200 new orthophotomaps in the last fiscal year, most at 1:24,000 scale. Although a few of these maps will be experimental editions, most will be published as standard editions in lieu of conventional line maps.

High-altitude photographs were used in some instances to simplify the production of orthophotographs. Exposures were selectively made directly over the centers of 7½-minute quadrangles, so that the entire area of each quadrangle was captured on a single photograph. Quadrangle centered photography requires careful planning but it eliminates the tedious and exacting task of mosaicking, with associated problems of tonal balance and join lines. Moreover, if the quadrangle contains extensive areas of water, a single photograph presents the consistent appearance of reflection and wave patterns obtained at a single instant in time.

Aerial photographs taken from high-flying jet aircraft at altitudes up to 40,000 feet are used to aerotriangulate photographs covering large unmapped areas, to orient and control mapping photographs taken at lower altitudes, and to produce small-scale orthophotographs which are valuable for field classification of map features and in revising existing maps. These same orthophotographs which cover more than 100 sq mi, or about twice the area of a standard 7½-minute quadrangle map, are also being used in the production of low-cost orthophotomaps.

The USGS is producing a new map substitute product, the orthophotoquad. This product, an orthophotoimage base at 1:24,000 scale in 7¼-minute quadrangle format,

provides rapid coverage of unmapped or inadequately mapped areas until conventional topographic maps can be produced. In keeping with the interim nature of orthophotoquads, only a border with geographic and grid data is added, plus the usual marginal legends. No cartographic enhancement or color separation is applied.

Photographs taken on Apollo IX earth-orbital mission were used to produce a photomap of the 1:250,000 scale Phoenix, Arizona, sheet. Only two photographs from a Hasselblad camera of 88 mm focal length were needed for the 1° by 2° coverage. The photographs were scaled and rectified the planimetric drawing of the existing line map, and the imagery was superimposed reproduction on the line plates. Although the photographs had neither the original scale nor the geometric fidelity that would be used in a standard product, they produced recognizable renditions of many detailed terrain features and were nearly orthographic after rectification. A similar photomap at 1:500,000 scale was produced from several photographs taken on Apollo and Gemini missions. These were experimental projects to help develop specifications for a proposed standard product.

Cartographic Applications of Space Imagery

Space photographs are useful as working map substitutes in scientific study of areas not covered by suitable

maps. To increase the usefulness of these photographs, a computer program has been prepared for deriving photo coordinates of a reference grid (UTM) so that grid intersections or a continuous grid can be automatically plotted on the photographs. Ground coordinates of recognizable images are required for the computations.

Experiments have indicated that thematic data can be extracted from multispectral space imagery for thematic mapping. Snow, water, and IR reflective vegetation have been isolated from space photographs by optical density slicing techniques.

Storage and Retrieval of Geographic Names

A system of storing and retrieving geographic names and associated information was set up by the USGS. The immediate objective of the system is to use stored data, the computer, and the typesetter to prepare printer's copy for Decision Lists of the Board on Geographic Names. A long-range objective is to build a data file for retrieving geographic names for topographic mapping. Systematic storage of all domestic names in standard format began with storage of names for the State of Massachusetts. In the final stage, the records format will permit logical search and research of name information for cartography, geology, geography, linguistics, hydrology and history.

Color Orthophotomapping

Several experimental orthophotomaps have been produced by the U.S. Army Engineer Topographic Laboratories from color aerial photographs which depict the terrain features in their natural color. The color orthophotomosaic was reproduced using a simplified three-color lithographic technique, and supplemental information such as contours, spot elevations, grid lines, route designations and place names were overprinted in black. This exploratory development has indicated that by exercising reasonable control during the photographic processing, color separation and reproduction procedures, it is entirely feasible and practical to obtain satisfactory edge matching and color rendition over complete 1:50,000 scale quadrangles containing several models. In addition, the reaction time between receipt of aerial photography and the final product is considerably less than that required to produce standard multicolored line topographic maps. Although the utility and acceptance of this product by the military has not yet been evaluated by user testing, the products have created generally favorable comments. Of primary interest is the reduced production time and the facility with which a user can interpret or read the map.

Miniaturization

During the last ten years, ACIC has been receiving increased requirements

for charts on various miniaturized media. Production of these film chips and film strips has required pushing the state-of-the-art in equipment and films. More significant, it may require revision to specifications for current Navigation and Planning Charts to provide larger sizes for symbols and type and new color portrayal in order to make these charts more suitable for future film strip and chip production.

Digital Planimetric Compiler

This instrument was designed and fabricated by OPTO Mechanisms Incorporated under contract sponsored by the U.S. Army Engineer Topographic Laboratories. Orthophotographs which are essentially aerial photos with camera tilt and relief distortions removed are being generated rapidly on highly sophisticated electronic equipment, such as the Universal Automatic Map Compilation Equipment (UNAMACE). Using these orthophotos to derive map feature information is the function of the Digital Planimetric Compiler. The equipment consists of three basic sections: a table/digitizer, an optical projection unit, and electronics.

Stereocompilation Digitizer

This instrument can be described as a digitized Kelsh Plotter and was developed by the U.S. Army Engineer Topographic Laboratories. The equipment is used to digitize cartographic data of all types as the map is compiled. The digital data, after

computer processing, is used to drive an automatic X-Y plotter to produce symbolized color separations. In this way it should be possible to virtually eliminate the subsequent hand scribing of color separations. The digital data produced has other uses, as in computer-aided terrain analysis.

Although a Kelsh Plotter is used with the test model, the design is applicable to all types of anaglyphic plotters. The digitizing equipment is a modified version of a standard system built by the H. Dell Foster Company of San Antonio, Texas.

Auto-trol Digitizer System (ADS)

The main application of the ADS equipment has been in those cartographic processes which deal with the positioning of detail on ACIC products. Specifically, the "what" of the ADS is comprised of four Model 3950 Auto-Trol Point Digitizers connected on-line with an Automatic Data Processing card punch. This equipment, in turn, is supported (off-line) by ACIC's 7094 II computer system for card sorting, conversion of data from punched card to magnetic tape format, performing many different types of computations, storage of data, etc. The "why" of the ADS equipment is primarily to record (in automated formats) the precise locations of geodetic control points, as related to the extremities of manuscripts used in the compilation phases of 1:250,000 and smaller scale charts. The recorded data serves as a basis

for computing the relative locations of the points, and subsequently the determination of the best overall position of the cartographic detail to be shown on the manuscripts. The data is also used to determine the degree of positional accuracy achieved during the compilation processes. Similar applications of the ADS are made by ACIC in the positioning and mosaicking of lunar photography for production of charts covering areas of the moon, as well as many other functions involving recording and derivation of the relative positions of features on graphics.

Digital Charting for Future Air-Navigation Systems

Rapid improvements in airborne computers, inertial platforms, airborne radars, and altimeters are creating dramatic new requirements in aerospace charting. These avionic advances, coupled with high-speed aerodynamic vehicles, are removing aircrew members from the line or position determination-vehicle guidance loop. The mechanization of ground sensing and correlation with onboard data calls for a new approach in the format of navigation aids. We visualize the ultimate requirement for supplying many navigation materials in direct machine-usable form. These include both analog and digital high resolution matrices of terrain portrayal.

CONCLUSION

A review of the developments summarized in this report will indicate



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that the contributing agencies have directed their attention to improvements in the accuracy and rate of acquisition of mapping and related data, of the reduction and adjustment of these data, and the reproduction of maps and other obtainable and required products for distribution as input to various programs. All of the developments in the field of surveying and mapping certainly have not been covered in this report, but only those deemed to be of primary importance and received from the contributors. Surveyors and mapmakers must become more and more oriented toward and become experts in the operations and capabilities of special optical equipments and electronic computers to keep pace with and take advantage of the rapid advancements made in recent years and to be made in the future. ■

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NGS is excited to announce that we will be presenting a *full-day's worth of content* on the National Spatial Reference System (NSRS) Modernization during the [FIG Working Week 2023](#) meeting, taking place at the end of May 2023 in Orlando, Florida. For the first time in over 20 years, this annual gathering of the [International Federation of Surveyors](#) will be taking place in the United States, hosted by the [National Society of Professional Surveyors \(NSPS\)](#). [Click here to register now!](#)

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The 2023 Working Week will be an exciting week-long conference that brings the international community of surveying and geospatial professionals together for a mix of technical sessions and workshops, a trade exhibition and a variety of side events and

social functions.

On Wednesday, **May 31, 2023**, NGS Director Juliana Blackwell will give a keynote address to the full conference and NGS staff will host a series of sessions on our efforts to modernize the U.S. National Spatial Reference System. More information will be posted to the [NGS FIG 2023 webpage](#) as it becomes available.

We encourage you to attend as much of the Working Week as you can, and be sure to join us on the Wednesday after Memorial Day to talk to NGS staff about NSRS Modernization.

[Register](#)



FIG WORKING WEEK 2023

28 May - 1 June, 2023, Orlando, Florida, USA



Protecting Our World, Conquering New Frontiers



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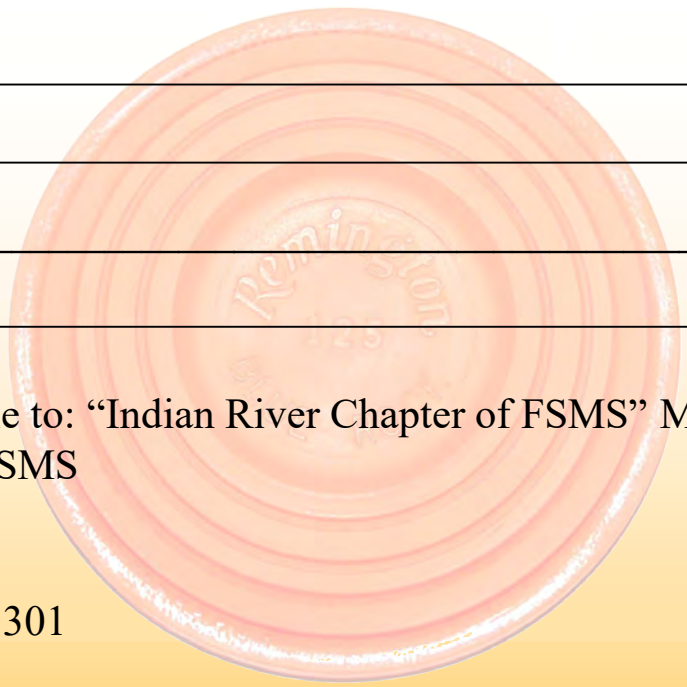
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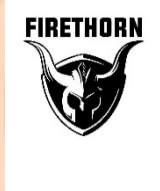
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Executive Director

Rebecca Porter

director@fsms.org



Education Director

Samantha Hobbs

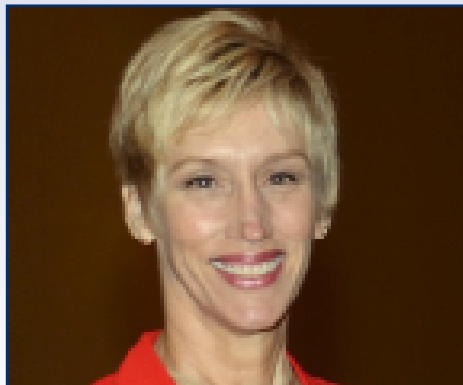
education@fsms.org



**Communications
Coordinator**

Justin Ortiz

communications@fsms.org



Regional Coordinator

Cathy Campanile

seminolecc84@gmail.com

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John P. Goggin
R.H. Jones

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Russell H. DeGrove
Perry C. McGriff
Carl E. Johnson
James A. Thigpenn, III
Harold A. Schuler, Jr.
Shields E. Clark
Maurice E. Berry II
William C. Hart
Frank R. Schilling, Jr.

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James M. King
Broward P. Davis
E.R. (Ed) Brownell
E.W. (Gene) Stoner
Lewis H. Kent
Robert S. Harris
Paul T. O'Hargan
William G. Wallace, Jr.
Robert W. Wigglesworth

1980

Ben P. Blackburn
William B. Thompson, II
John R. Gargis
Robert A. Bannerman
H. Bruce Durden
Buell H. Harper
Jan L. Skipper
Steven M. Woods
Stephen G. Vrabel
W. Lamar Evers

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Joseph S. Boggs
Robert L. Graham
Nicholas D. Miller
Loren E. Mercer
Kent Green
Robert D. Cross
Thomas L. Conner
Gordon R. Niles, Jr.
Dennis E. Blankenship
W. Lanier Mathews, II
Jack Breed

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Michael H. Maxwell
John M. Clyatt

David W. Schryver
Stephen M. Gordon
Richard G. Powell
Michael J. Whitling
Robert W. Jackson, Jr.
Pablo Ferrari
Steve Stinson

2010

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Jeremiah Slaymaker
Ken Glass
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