### Why are We Here?

2022 SPCS Policy Changes





### Surveying & Mapping Council (FSMS)

### Surveying & Mapping Council

### FLORIDA GEOSPATIAL USERS GROUP

### A Practice Section of the Florida Surveying and Mapping Society



### The National Geodetic Survey 10 year plan Mission, Vision and Strategy 2013 – 2023

http://www.ngs.noaa.gov/web/news/Ten\_Year\_Plan\_2013-2023.pdf http://www.ngs.noaa.gov/2010Summit/Improving\_the\_NSRS.pdf



- Official NGS policy as of Jan 31, 2013
  - Updates 2008 plan
  - Modernized and improve NSRS
  - Attention to accuracy
  - Attention to time-changes
  - Improved products and services
  - Fully vetted by AAGS/NSPS
- 2022 Targets:
  - Replace NAD 83 and NAVD 88
  - Cm-accuracy access to all coordinates

### The National Geodetic Survey 10 Year Plan Mission, Vision and Strategy 2013 – 2023



### Thank You to NGS

Special thanks to Michael Dennis (NGS) for on the information provided to us.

### Change from NAD 83 to ITRF/IGS in 2022



Identically shaped ellipsoids (GRS-80) a = 6,378,137.000 meters (semi-major axis) 1/f = 298.25722210088 (flattening) Predicted Positional Changes in 2022 Computed with <u>xGEOID16B</u>



Predicted Positional Changes in 2022 near Miami, FL Computed for MIAMI (AC2170) HORIZONTAL = 0.67 m (2.2 ft.) ELLIPSOID HEIGHT = - 1.62 m (- 5.3 ft.) ORTHOMETRIC HEIGHT = + 0.06 m (+ 0.2 ft.) Computed with <u>xGEOID16B</u>

Predicted Positional Changes in 2022 near Key West, FL Computed for BAYOU (AA0028) HORIZONTAL = 0.66 m (2.2 ft) ELLIPSOID HEIGHT = - 1.63 m (- 5.3 ft) ORTHOMETRIC HEIGHT = + 0.20 m (+ 0.7 ft) Computed with <u>xGEOID16B</u> Predicted Positional Changes in 2022 near Tampa, FL Computed for Q 18 (AG6038) HORIZONTAL = 0.75 m (2.5 ft.) ELLIPSOID HEIGHT = - 1.54 m (- 5.0 ft.) ORTHOMETRIC HEIGHT = + 0.04 m (+ 0.1 ft.) Computed with <u>xGEOID16B</u>

Predicted Positional Changes in 2022 near Orlando, FL Computed for C 188 (AK0453) HORIZONTAL = 0.75 m (2.2 ft.) ELLIPSOID HEIGHT = - 1.54 m (- 5.1 ft.) ORTHOMETRIC HEIGHT = + 0.01 m (0.0 ft.) Computed with <u>xGEOID16B</u> Predicted Positional Changes in 2022 near Jacksonville, FL Computed for 872 0226 E (DI9223) HORIZONTAL = 0.80 m (2.6 ft.) ELLIPSOID HEIGHT = - 1.49 m (- 4.9 ft.) ORTHOMETRIC HEIGHT = - 0.12 m (- 0.4 ft.) Computed with <u>xGEOID16B</u>

Predicted Positional Changes in 2022 near Pensacola, FL Computed for 872 9840 M TIDAL (BG4867) HORIZONTAL = 0.87 m (2.9 ft.) ELLIPSOID HEIGHT = - 1.42 m (- 4.7 ft.) ORTHOMETRIC HEIGHT = - 0.22 m (- 0.7 ft.) Computed with <u>xGEOID16B</u>

# A New State Plane Coordinate System in 2022

State Plane Coordinate System of 2022 (SPCS202)

Referenced to new 2022 Terrestrial Reference Frames (TRFs)



# Where are We with the SPCS2022 Zone Changes Today?

SPCS2022 policy and procedures are out for comment now.

Public comment period ends August 31, 2018.

By official release of SPCS2022 should be sometime in 2022.





# What is Our Goal?

To provide input on the design of the new State Plane Coordinate System of 2022 (SPCS202) for Florida.

# Procedures for SPCS2022 Input

#### **Procedures 1**

- NGS contact information
- **CONSENSUS** stakeholder input is **REQUIRED**
- Stakeholders should first agree, then collectively provide input

#### **Procedures 2**

- Stakeholder requests for designs by NGS
- Stakeholder proposals of designs by contributing partners

#### **Procedures 3**

Submittal of **approved** designs by contributing partners

#### **Procedures 4**

- NGS role and responsibilities for SPCS2022 reviews
- Limitations for zones designed by NGS

# Procedures for SPCS2022 Input

If no input is received from a state, or if input is not unanimous, DEFAULT design will be used for state zones

# Deadlines for SPCS2022 Input

NGS.Feedback@noaa.gov by August 31, 2018

#### Federal Register Notice (FRN)

Announcement and public comments On draft SPCS2022 policy & procedures On "special purpose" zones

NGS.SPCS@noaa.gov by December 31, 2019 for *requests* and *proposals* 

by **December 31, 2020** for *submittal* of *approved* designs

Submit after policy and procedures finalized (after August 31, 2018)

#### Procedures 1

**Consensus** input per SPCS2022 procedures *Requests* for designs done by NGS *Proposals* for designs by contributing partners

Submittal of **approved** designs Proposal must first be approved by NGS Designs must be complete for NGS to review

After deadlines, requests will be for *changes* to SPCS2022

# Definitions in Policy & Procedures

<u>Stakeholders</u>. State organizations that can give input on SPCS2022: DOTs, GIS offices, surveying & engineering societies, professional geospatial organizations, and universities that perform geospatial education or research.

<u>Contributing partners</u>. Organizations or individuals that design SPCS2022 zones for stakeholders and in cooperation with NGS.

<u>Zone</u>. The region where a projected coordinate system is used.

<u>Linear distortion</u>. Amount a map projection distance differs from "true" horizontal distance at the ground surface.

<u>Conformal map projection</u>. Linear distortion is unique (same in every direction) at a point.

<u>Projection axis</u>. The line along which linear distortion is minimum and constant with respect to the reference ellipsoid.

# Stake Holders

FSMS Geospatial Users Group SWFWMD FBPSM FACM OCFL Surveyors in Government

FES FDOT NGS/NOAA FDEP Emergency Management CFGW



# **Existing SPC Zones**

East Zone West Zone North Zone Transverse Mercator Transverse Mercator Lambert Conformal Conic







# Some Factors to Look At

- From NGS:
- Linear distortion at topographic surface
- One-parallel Lambert Conformal Conic projections
- Default SPCS2022 zone designs
- Statewide and "layered" zones
- Linear distortion design criteria
  - Maximum and minimum zone size and distortion
  - Low distortion projections (LDPs)

NOAA's National Geodetic Survey Positioning America for the Future

geodesy.noaa.gov

### Linear distortion magnitudes

#### Procedures §5.c.ii

	Corresponding zone dimension and height limits			
(ppm = parts per million)	Zone width perpendicular to projection axis (no variation in topo height)	Topographic height range (independent of zone width)		
±5 ppm (1:200,000)	57 km (35 miles)	64 m (209 ft)		
±10 ppm (1:100,000)	81 km (50 miles)	127 m (418 ft)		
±20 ppm (1:50,000)	114 km (71 miles)	255 m (836 ft)		
±50 ppm (1:20,000)	180 km (112 miles)	637 m (2,090 ft)		
±100 ppm (1:10,000)	255 km (158 miles)	1,274 m (4,180 ft)		
±400 ppm (1:2,500)	508 km (316 miles)	5,097 m (16,722 ft)		



### Linear distortion magnitudes

Parts per million	Centimeters per kilometer	Feet per mile	Dimensionless ratio
20 ppm	2 cm/km	0.1 ft/mile	1:50,000
50 ppm	5 cm/km	0.3 ft/mile	1:20,000
100 ppm	10 cm/km	0.5 ft/mile	1:10,000
400 ppm	40 cm/km	2.1 ft/mile	1:2,500





### **Smaller Low Distortion Zones**



29

### Florida Department of Transportation Statewide Districts





### Water Management Districts



# Some Factors to Look At

### **Future Population**

# Current & 2060 Projection



### **Proposed SPC Zones Options**









# Other SPC Options

### Combined East and West Zones Using Oblique Mercator





#### Preliminary SPCS2022 default design: Florida East and West zones (combined) **Oblique Mercator projection** Origin latitude: 27° 48' N Origin longitude: 81° 33' W Skew axis scale: 0.999 91 (exact) Skew azimuth: -15° Areas within ±50 ppm distortion (±0.26 ft per mile): 38% of entire zone 45% of all cities and towns 67% of population Distortion values (ppm) For entire For cities: Min, Max = -97, +96zone: Min = -99Range = 511Max = +97Median = -36Range = 196Mean = -12(weighted by population) Mean = -50Linear distortion at topographic surface (parts per million) <-120 to -60 to +60 to -40 to -120 to +80 to -100 ±20 to +100 to +40 to -80 >+100

35

200

250

50

100

150







# Proposed SPC Zones

East Zone Oblique MercatorWest Zone Oblique MercatorNorth Zone Lambert Conformal Conic

### Linear distortion magnitudes

geodesy.noaa.gov

#### Procedures §5.c.ii

NOAA's National Geodetic Survey Positioning America for the Future

	Corresponding zone dimension and height limits			
Linear distortion (ppm = parts per million)	Zone width perpendicular to projection axis (no variation in topo height)	Topographic height range (independent of zone width)		
±5 ppm (1:200,000)	57 km (35 miles)	64 m (209 ft)		
±10 ppm (1:100,000)	81 km (50 miles)	127 m (418 ft)		
±20 ppm (1:50,000)	114 km (71 miles)	255 m (836 ft)		
±50 ppm (1:20,000)	180 km (112 miles)	637 m (2,090 ft)		
±100 ppm (1:10,000)	255 km (158 miles)	1,274 m (4,180 ft)		
±400 ppm (1:2,500)	508 km (316 miles)	5,097 m (16,722 ft)		



# Proposed SPC Zones

**Oblique Mercator** East Zone West Zone Oblique Mercator North Zone Lambert Conformal Conic

### Linear distortion magnitudes

#### Procedures § 5.c.ii

NOAA's National Geodetic Survey Positioning America for the Future

	Corresponding zone dimension and height limits			
Linear distortion (ppm = parts per million)	Zone width perpendicular to projection axis (no variation in topo height)	Topographic height range (independent of zone width)		
±5 ppm (1:200,000)	57 km (35 miles)	64 m (209 ft)		
±10 ppm (1:100,000)	81 km (50 miles)	127 m (418 ft)		
±20 ppm (1:50,000)	114 km (71 miles)	255 m (836 ft)		
±50 ppm (1:20,000)	180 km (112 miles)	637 m (2,090 ft)		
±100 ppm (1:10,000)	255 km (158 miles)	1,274 m (4,180 ft)		
±400 ppm (1:2,500)	508 km (316 miles)	5,097 m (16,722 ft)		

### **OPTION B**

#### Legend

geodesy.noaa.gov

FL\_POP\_2022\_NAD83

#### PROJECTIONS

- ---- FLN\_2022 (199 K) LAMBERT CONFORMAL CONIC
- FLE 2022 (139 K) OBLIQUE MERCATOR
- ---- FLW 2022 (175 K) OBLIQUE MERCATOR

#### FL\_COUNTY\_SPCS\_2022

- FL\_SPN\_2022
- FL\_SPE\_2022
- FL\_SPW\_2022



### Proposed SPC Zones

East Zone West Zone North Zone Oblique Mercator Oblique Mercator Lambert Conformal Conic









Preliminary SPCS2022 default design: Florida East and West zones (combined) **Oblique Mercator projection** Origin latitude: 27° 48' N Origin longitude: 81° 33' W Skew axis scale: 0.999 91 (exact) Skew azimuth: -15° Areas within ±50 ppm distortion (±0.26 ft per mile): 38% of entire zone 45% of all cities and towns 67% of population **Distortion values (ppm)** For entire For cities: Min, Max = -97, +96zone: Min = -99 Range = 511Median = -36 Max = +97 Mean = -12Range = 196 Mean = -50(weighted by population) Linear distortion at topographic













	Preliminary proposed SPCS2022		Existing SPCS 83			
Projection type	LCC	OM	OM	LCC	TM	TM
Areas within ±50 ppm	West	Central	East	North	West	East
Entire zone	99.7%	99.9%	100.0%	91.1%	53.6%	68.7%
All cities and towns	100.0%	98.8%	100.0%	92.9%	58.1%	80.4%
Population	100.0%	99.1%	100.0%	97.4%	72.8%	91.2%
Distortion for entire zone (ppm)	West	Central	East	North	West	East
Minimum	-25	-52	-22	-57	-71	-58
Maximum	60	60	42	68	103	71
Range	85	112	64	125	174	129
Mean	19	18	-7	-26	-39	-28
Distortion for cities (ppm)	West	Central	East	North	West	East
Minimum	-23	-45	-20	-56	-64	-58
Maximum	49	52	37	59	70	62
Range	72	96	58	115	134	119
Median	-8	-26	-7	-34	-45	-14
Mean (weighted by population)	-13	-9	-4	-34	-29	1