



# imagiNEWS

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## *What changing from SPCS27 to SPCS83 really means...*

By Brooks E. Kelley, 3Di, LLC.

At present, geographic data producers throughout the state are in the process of converting base data from the 1927 State Plane Coordinate Systems (commonly referred to as SPCS27) to the 1983 version (commonly referred to as SPCS83). This article seeks to address general misunderstandings of what this conversion implies.



Think of the SPCS as a three-layer cake with the following layers: datum, projection, and coordinate system. The order here is important because the coordinate system is based upon the projection, which is in turn based upon the datum. Let's examine each of these layers, from the bottom up.

Datum: A datum is - in general terms - a model of the Earth's surface at a particular area of interest; think of it as mean sea level. This model is based upon a slightly less than spherical model of the Earth's shape called an ellipsoid that is further adjusted to account for regional variations in such a shape to form a geoid. For the Michigan SPCS there are three North American Datums (NAD) of note: "Old" NAD27 (pre 1964), "New" NAD27 (post 1964), and NAD83. While there are numerous technical differences between these datums, the most profound are their reliance upon different ellipsoids and geoid-level points of origin. Old NAD27 is based upon the Clarke 1866 ellipsoid; New NAD27 is based upon a slightly modified version of this same ellipsoid called "the Michigan Spheroid." The geoid origin point for both is the survey station at Meades Ranch Kansas. NAD83, on the other hand, is based upon the satellite-derived Geodetic Reference System of 1980 ellipsoid (commonly referred to as GRS 80) without a geoid-level correction.

The process of switching from one datum to another is referred to as a datum shift. During a datum shift locations are recalculated or translated from one ellipsoid/geoid model to another. Think of marking a point on an inflatable balloon with a felt tip pen and then squeezing the balloon between the palms for your hands to slightly alter the shape. Here the balloon represents the ellipsoid/geoid model of the Earth and the point a location on its surface. As you squeeze the balloon, the point's location doesn't change but the model upon which that point is based does - it's now a different shape.

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## MAIN STORY *continued from page 1*

**Projection:** In layman's term a projection is a means by which the semi-spherical Earth (remember the ellipsoid/geoid model) can be represented on flat media, such as paper or computer screens. More precisely it is a set of mathematic formulae for converting semi-spherical geometry to planer geometry. To help visualize this conversion from semi-spherical geometry to planer geometry, imagine wrapping a sheet of paper around a small globe to form a tube. Hold the paper with your thumb and index finger at both poles so the orientation of the paper tube is at a right angle to the location of Michigan; i.e., the paper should be in contact with the globe along a north-south (longitude) line from pole to pole through Michigan and around the other side. Now imagine illuminating this globe with a small light bulb placed inside so the image of Michigan is projected from the globe's surface onto the paper. Such an exercise represents the transverse cylindrical basis of the older SPCS27's Traverse Mercator projection.

Switching from one projection to another is called reprojecting. Using the small globe and paper example, imagine forming a second sheet of paper into a cone and then placing that cone over the globe so that the tip of the cone is above the North Pole and the sides of the cone touch the globe along an east-wide (latitude) line roughly across the middle of Michigan and around the rest of the globe. Now turn the light inside the globe on and look at the projected image of Michigan. Such an exercise illustrates the process of reprojecting a map from a transverse cylindrical

projection symbolic of older SPCS27 to a regular conic projection symbolic of the newer SPCS27 and SPCS83.

**Coordinate System:** A coordinate system is a means of referencing locations based upon a set of values. The most common coordinate system is the Cartesian coordinate system, named for the French mathematician and philosopher René Descartes, in which any point can be located through the use of coordinate (X, Y) pairs; remember playing the game Battleship? This system works because a rectilinear system of lines - called a graticule on maps - is superimposed on the measured area to establish a coordinate grid. In the case of the SPCS the graticule is defined in terms of commonly understood measurement units such as feet or meters.

The process of changing from one coordinate system to another is referred to as a transformation. A transformation can be based upon 1) movement of the origin point, 2) realignment of the axes 3) reorientation of the axes, or 4) substitution of the measurement unit; e.g., switching from feet to meters. To help visualize this process, imagine placing a pin through a sheet of graph paper and into your desk and then moving the paper around the pin. Note that the pin has not changed position but, depending upon where you start measuring from, the coordinates defining that point most likely have.

Example: At present Grand Traverse County maintains its GIS data using the newer Lambert Conformal Conic-based

	"New" SPCS27	SPCS83
<b>COORDINATE SYSTEM</b>		
<b>Zone:</b>	Central	Central
<b>Origin:</b>	-84° 20' 00", 43° 19' 00"	-84° 22' 00", 43° 19' 00"
<b>False Easting:</b>	609 601.219 20 m	6 000 000 m
<b>False Northing:</b>	0 m	0 m
<b>Units</b>	US survey feet	International feet or meters
<b>Projection</b>	Lambert Conformal Conic	Lambert Conformal Conic
<b>Datum</b>	NAD27	NAD83
<b>Ellipsoid</b>	Clarke 1866 (MI Spheroid)	GRS 80
<b>Origin Point</b>	Meades Ranch Kansas	NA



## A Message from the Director

### SO YOU NOTICED! WE'VE CHANGED.

SPCS27. Over the next several months the County will be converting to SPCS83. Properties of each system are presented in the table below.

Again, working our way up from the datum, note that the new SPCS27 and SPCS83 rely upon two different datums, NAD27 and NAD83, respectively. These are based upon two different ellipsoids and geoid-level origin points. Note that the projections are the same - Lambert Conformal Conic. Finally, note the coordinate systems are radically different.

While the SPCS27 and SPCS83 have different origins and false easting values, it is their reliance on different measurement units that perhaps marks their greatest difference. The SPCS27's coordinate system relies upon US survey feet whereas Michigan's SPCS83's coordinate system relies upon meters or so-called international feet (the international foot being simply a meter to foot conversion factor in which 1 ft equals 30.48 cm or 0.3048 m, precisely). While the US survey foot and international foot only differ by a small amount (two parts per million), this difference is enough to cause significant positional errors if the US survey foot is inappropriately used with the SPCS83. The point here is when converting from SPCS27 to SPCS83 use meters or international feet not US survey feet.

In conclusion, while those in the GIS industry will casually refer to the process of converting data from one of Michigan's two flavors of SPCS27 to SPCS83 as a "datum shift", "reprojection" or possibly "transformation," in truth it depends upon which SPCS27 you're coming from. If, like Grand Traverse County, your data is currently stored in the newer Lambert Conformal Conic-based SPCS27 you'll be performing a datum shift and transformation on your data when converting from SPCS27 to SPCS83. If however your data is currently stored in the older Traverse Mercator-based SPCS27, you'll be performing a datum shift, reprojection and transformation on your data when converting from SPCS27 to SPCS83.

#### REFERENCES

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Snyder, John. *Map Projections - A Working Manual* Washington: US GPO, (1987).

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Yes, we have changed! We are moving from a news magazine format to a newsletter format. Starting in July the *imagiNews* will be a monthly publication.

So why the change? We believe that we had a very handsome news magazine that contained pertinent information to our members. The problem is that most of you and myself included do not have the time, an hour or more, to read the publication and digest the information. So, what often happens — you want to read the magazine and you put it aside until that hour magically appears in your schedule. Unfortunately, the next issue arrives and that magic hour has not appeared. As hopeful beings, we stash the second issue on top of the first hoping that two hours will magically appear.

Am I describing you? I know I'm describing myself. I get several news magazines and I have been known to throw all 12 issues out without cracking a cover at the end of the year. I also know there are several newsletters I read cover to cover. They are the size of this issue with shorter articles. They are publications I can review in five minutes and read cover to cover in 15–20. Current market research tells us that with our hectic lives this is the only type of publication that most of us read. As one of our colleges recently stated, "If I can take it to the restroom and completely read it there — it is a publication that gets read."

We will soon be coming to you monthly with the hope that you read the *imagiNews* cover to cover and find the information pertinent, timely, and useful. Let us know what you think.



## CENTRAL DISPATCH

- Provide digital updates for Computer Aided Dispatch
- Road Indexes
- Public Safety jurisdictional maps

*\*GIS Coordinator provides hardware purchasing, support, maintenance*

## TOWNSHIP/VILLAGE/CITY SERVICES

- Parcel maps w/ aerial photography
- Zoning, landuse maps
- Utility (sewer,water, storm sewer) mapping-City of Hastings, Village of Middleville
- Address point and range mapping for township clerks
- Fire and Ambulance service areas
- School District maps

## STATE AND FEDERAL SERVICES

- Michigan Information Center, road and boundary updates
- Census Bureau, address verification
- National Resource Conservation Service, Gypsy Moth Spray Block Maps
- State Police, accident maps, road indexes, aerial photography

### 2. Describe any new projects or activities

In mid 1999, we started an ambitious project to GPS all monumented section corners. We plan to expand our GPS program this year collecting road centerlines as well. Production of an in-house plat book is in the works along with making section maps available via the web.

### 3. What would you do differently if you had to start over?

I'm not sure, we started in 1991, and there weren't as many options as there are today. Early on we had some quality problems with our photography and should have performed better quality control.

### 4. If you had the GIS guru standing in front of you, what questions or problem would you have him/her solve?

We could use a silver bullet for low-cost, transformation of our current layers to our new GPS Data.

### 5. What valuable piece of information have you learned that you would like to share with the GIS community?

Successful GIS Projects are driven by solid financial backing and dedicated staff. There seem to be very few examples of successful part-time GIS work funded by grants at the county level.

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# State & Federal News

## KEEP THOSE CARDS COMING IN!

IMAGIN is assisting the Michigan Information Center (MIC) in creating an Internet Website for Michigan. The website (clearinghouse) will contain an inventory of digital geographic information systems (GIS) resources from various organizations/agencies within Michigan. In order to build the site, it is necessary to survey organizations/agencies to obtain information about their resources.

In mid-January, IMAGIN mailed thousands of post cards throughout the state to every city, village, township, county, region, and all of IMAGIN membership requesting the identification of the person most knowledgeable in each organization to respond to the survey. This individual should be able to answer questions, which varies from policy (such as funding level, budgets etc) to technical

information (metadata, created themes, etc). Once we receive the name of the appropriate person, we will mail a correspondence giving the on-line survey address or providing instructions for ordering a hard copy of the survey.

Please make sure that you and/or your organization has responded to the post card. We have the opportunity to build a fantastic resource for all of us to use and reference. However, we need to make sure everyone participates. The survey should take an hour or less for most organizations/agencies to complete. It has the potential to save hundreds of hours if you find out there is information available to you that someone else has already created.

## MAKE SURE YOU KEEP THOSE CARDS COMING IN!

# Announcing Statewide Award Program

The Quality Committee of IMAGIN is announcing the first annual IMAGIN Awards Program. In order to recognize excellence in the field of GIS and Spatial Technology, IMAGIN will present the awards at the May Forum. Awards will be presented in the following three categories:

### 1. GIS Education and Outreach Award

This award is open to individuals and organizations that established an original GIS program or activity that promotes public GIS education. This could include seminars, trainings and GIS Day activities.

### 2. GIS For Everyone Award

This award is open to individuals and organizations

that promote the propagation of GIS by exhibiting any of the following characteristics in their programs: Data Sharing, Enterprise, Multi-participant, and Internet use.


### 3. Outstanding Individual Achievement in GIS Award

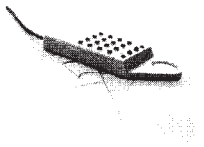
This award is open to individuals who advanced the field of GIS through their contributions while representing and promoting the ideals of IMAGIN.

The nomination process will be open to self-nomination and third-party nomination. Applications will be available at [www.imagin.org](http://www.imagin.org) on February 14th.

*Sharon Bramble, Board Liaison*

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IMAGIN is a nonprofit 501(c)3 organization comprised of individuals and organizations interested in the use and application of geographic information system (GIS) technology in Michigan. Our members are committed to improving the quality and availability of digital data necessary to make good use of GIS. We believe that cooperation and open communication are necessary to achieve these objectives.

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