

Digitizing - Creating New GIS Data – The Details

Overview

1. Creating Feature Classes
2. Creating Shapefiles
3. The Coordinate System / Spatial Reference
4. The Coordinate System / Spatial Reference in Massachusetts
5. The Coordinate System / Spatial Reference for ArcGIS Online
6. Adding Attribute Fields = Making Spatial Data Meaningful!

Digitizing is easy, but can be quite tedious and time-consuming.

Great Tutorial: Esri Press GIS Tutorial 1: Basic Workbook, Chapter 6
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In essence you create new feature classes and add attribute data to your feature classes to create meaningful and intelligent geospatial data.

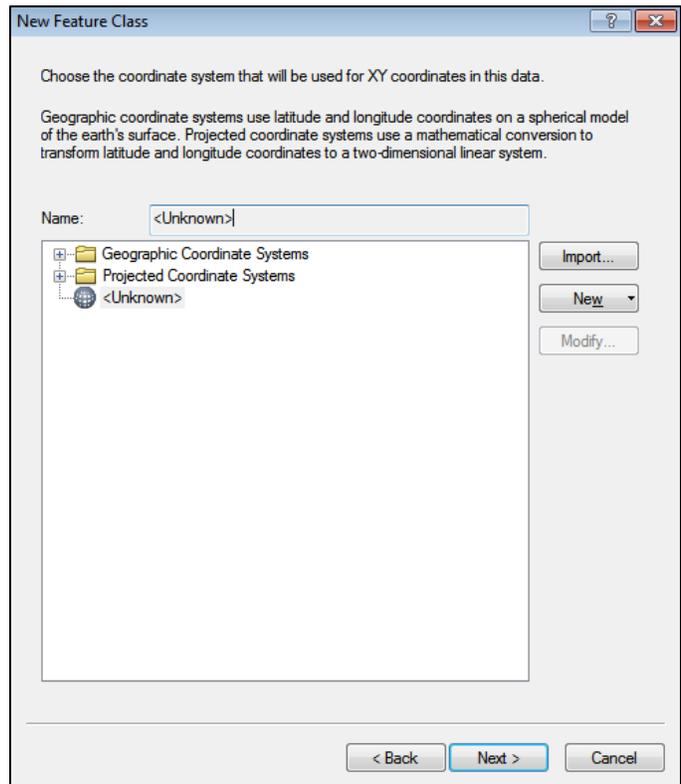
	Task	Challenge
Step 1	Create a new (empty) feature class or shapefile	Define the correct coordinate system
Step 2	Add the new (empty) feature class or shapefile to ArcMap	None!
Step 3	Add needed attribute fields to the attribute table	Define the correct field types
Step 4	Digitize the spatial features	Learn the ArcGIS editing tools
Step 5	Enter the attribute information	None!

1) Creating Feature Classes

Creating new (= empty) feature classes is easy and it is worthwhile to review the procedure and to explain a few of the details.

Obviously you need a file geodatabase to provide a 'home' for your feature class!

1. Start ArcMap, open the ArcCatalog window, and create a folder connection to your USB flash drive.
2. Create a filegeodatabase on your USB flash drive.
3. In ArcCatalog browse to your file geodatabase.
4. Right-click on the file geodatabase, select New, Feature Class.
5. Enter a meaningful, simple name (no caps, no blank spaces), select the appropriate feature type, and click on Next.
6. Now you need to define the coordinate system for your feature class so ArcMap knows where to display it on your map. You can choose, Import..., or create a New coordinate system. More details in Sections 3, 4, 5.
7. Click Next a few times and Finish and see your new feature class appear inside your file geodatabase.



This feature class is still empty = does not contain any spatial or attribute information!

Analogy: you created a new empty MS Word document – now you need to type!

Here: add the feature class to the map, digitize the spatial features and enter the attribute data.

2) Creating Shapefiles

Creating new (= empty) shapefiles is easy!

1. Start ArcCatalog and create a folder connection to the folder where you want to create the new shapefile.
2. In ArcCatalog, right-click on the folder where you want to create the new shapefile and select New – Shapefile.

Steps 1 and 2 are critical to make sure you create the new shapfile where you want to...and not in some random place on the computer.

The Create New Shapefile dialog box:

Name

Enter a meaningful name for your new shapefile. Do NOT use blank spaces, weird characters, and capital letters. Keep it all lowercase.

Feature Type

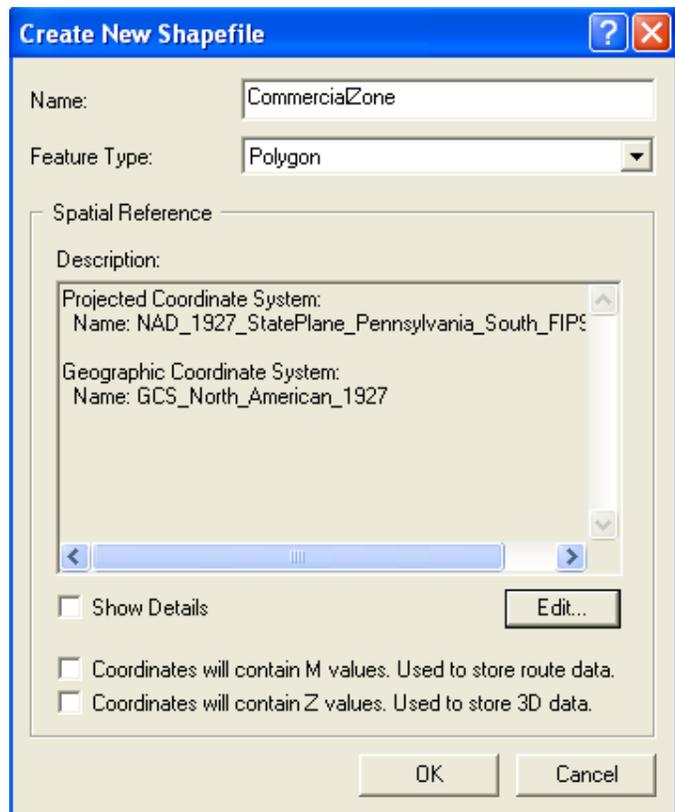
Select the appropriate feature type for your new feature (point, polyline, or polygon).

Spatial Reference

A shapefile has to have a spatial reference – otherwise ArcMap does not know where to display the shapefile on the map.

See Sections 3, 4, 5 below.

That's all that there is to creating a new (= empty) shapefile. But, that's all that is right now: an empty container for geospatial data. Now:



- Create your spatial data (= digitizing).
- Enter your attribute data to add meaning to your spatial data.

The screenshot shows the ArcCatalog interface with the 'Create New Shapefile' dialog box open. The dialog box has the following fields and options:

- Name:** CommercialZone
- Feature Type:** Polygon
- Spatial Reference:**
 - Description:
 - Projected Coordinate System:
 - Name: NAD_1927_StatePlane_Pennsylvania_South_FIPS
 - Geographic Coordinate System:
 - Name: GCS_North_American_1927
- Show Details
- Coordinates will contain M values. Used to store route data.
- Coordinates will contain Z values. Used to store 3D data.

Callouts provide additional instructions:

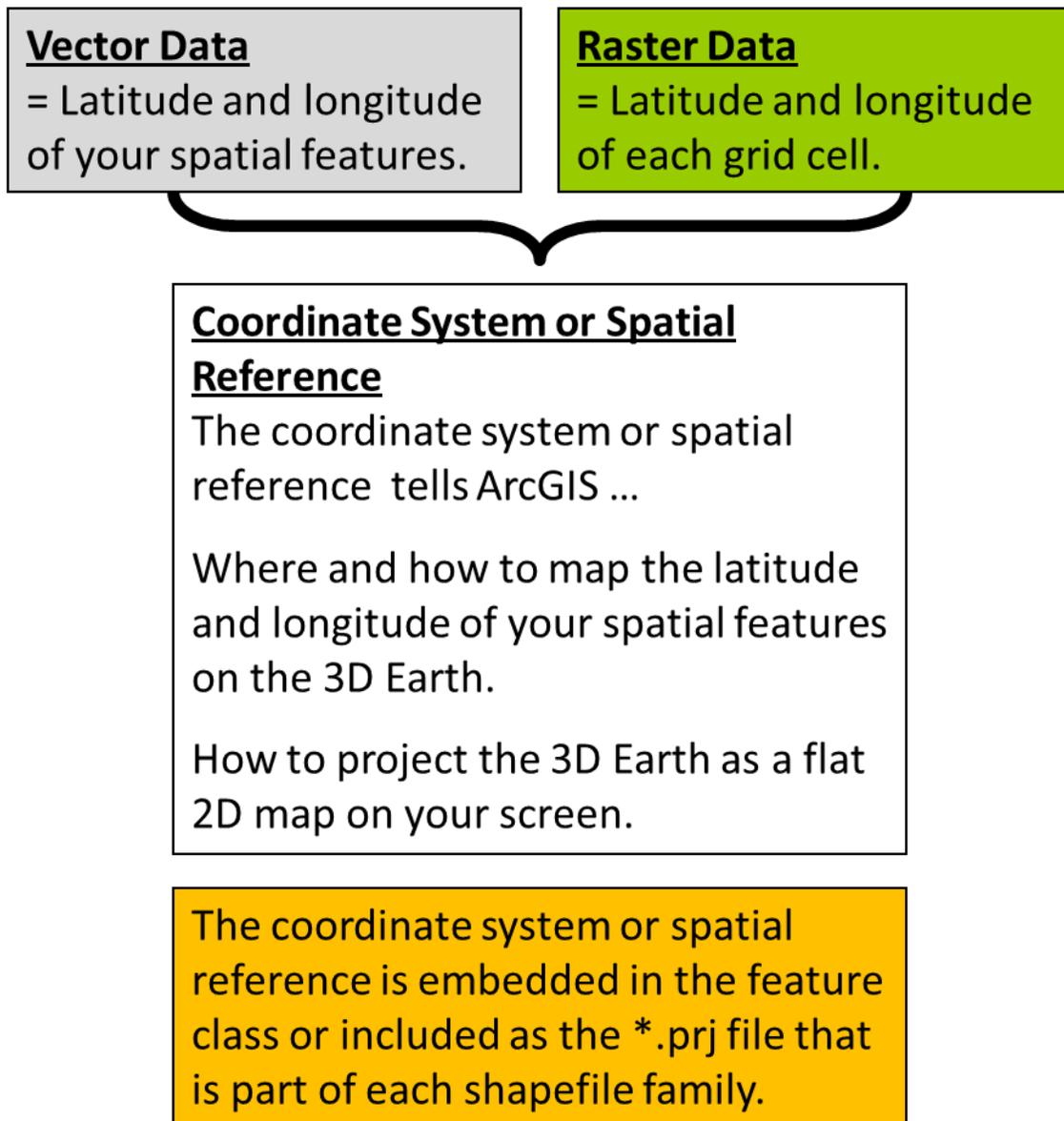
- Simple, Meaningful Name**: No blanks, weird characters, or caps. (Points to the Name field)
- Feature Type**: Point, polyline, or polygon. (Points to the Feature Type dropdown)
- Spatial Reference**: Click Edit..., then Select... or Import... (Points to the Edit... button)

3) The Coordinate System / Spatial Reference

The Spatial Reference or Coordinate System tells ArcGIS two things:

1. Where on Earth to map a geospatial data set.
2. How to convert the 3D shape of the Earth into the 2D shape displayed on your computer screen.

ArcGIS needs to know both things to accurately place a feature class or a shapefile onto your map. See http://nationalatlas.gov/articles/mapping/a_projections.html

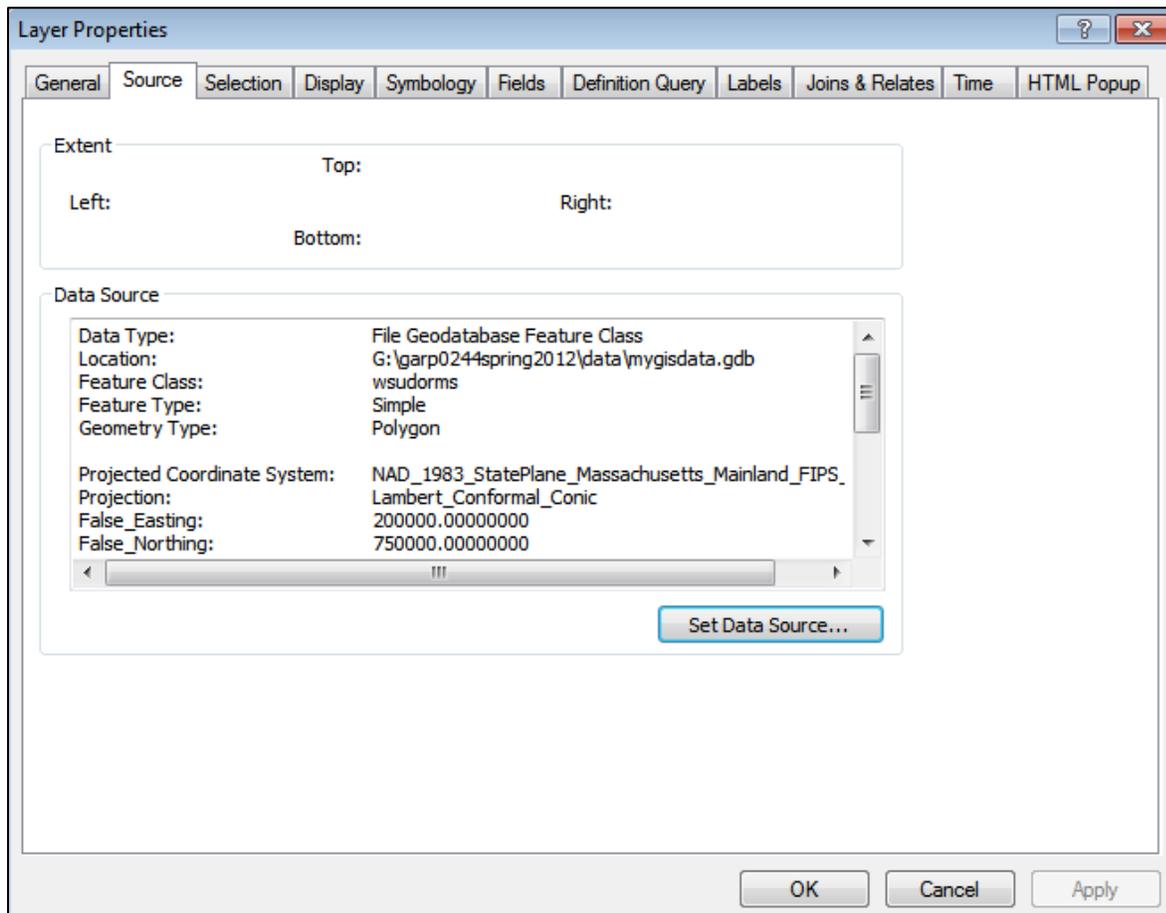
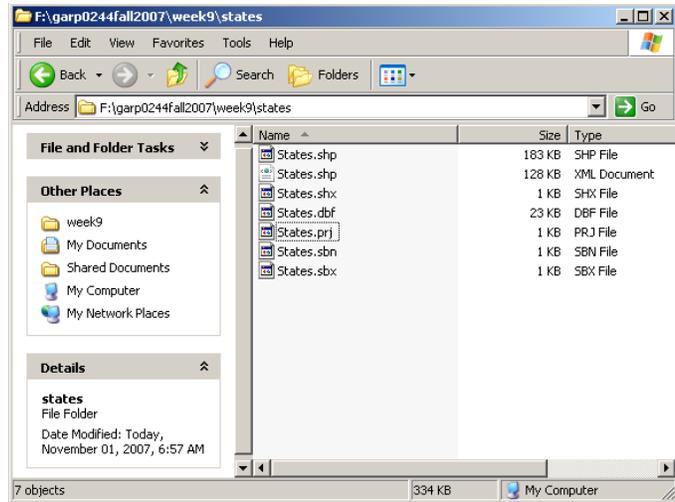


The coordinate system or spatial reference is a small file that is/should be part of each shapefile (*.prj).

In the example on the right you see a shapefile called States and States.prj is the projection file for this shapefile.

If this file is missing...ArcMap will try to perform an “on-the-fly projection”...which may/may not work.

➔ When creating a new shapefile (i.e. when you digitize) you need to define the projection or spatial reference yourself.



The situation for a feature class is identical – except a feature class has its coordinate system / spatial reference embedded, rather than contained in a separate file.

Regardless, you can always confirm the coordinate system / spatial reference of a map layer in ArcGIS by looking at the Source Tab in the Layer Properties.

4) The Coordinate System / Spatial Reference in MA

From the MassGIS website at:

<http://www.mass.gov/anf/research-and-tech/it-serv-and-support/application-serv/office-of-geographic-information-massgis/datalayers/overview.html>

- The datum for the MassGIS database is North American Datum 1983 (NAD83). The data are registered to the Massachusetts State Plane Coordinate System, Mainland Zone (Fipszone 2001). Units are meters.

Defining the correct coordinate system for a new feature class or shapefile can be difficult, but there is a simple trick if you are working in Massachusetts:

When creating a new feature class or shapefile in Massachusetts using baselayer data from MassGIS, simply **import** the coordinate system from an existing MassGIS data layer.

This makes sense as it is usually the best to use the same coordinate system / spatial reference as your baselayer data.

4.1) Importing a Coordinate System for a Feature Class

1. Start ArcMap with a new blank map.
2. Create a new feature class, define its name and its type, and click on Next.

This opens the dialog box for choosing the coordinate system. The default coordinate system (WGS 1984 Web Mercator (auxiliary sphere)) for ArcGIS Online is selected (see Section 7).

3. Click on the Earth button with the downward-pointing black triangle and select Import...
4. Browse to your \data folder, select a data layer you previously downloaded from MassGIS, and click Add.

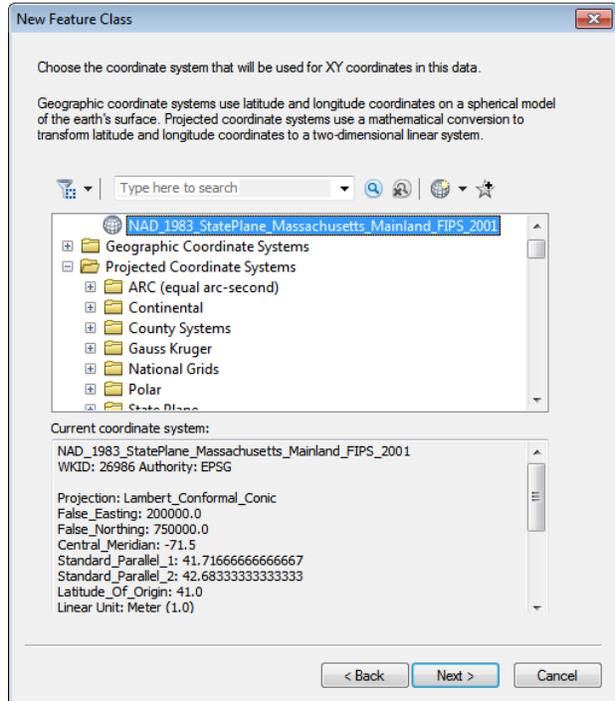
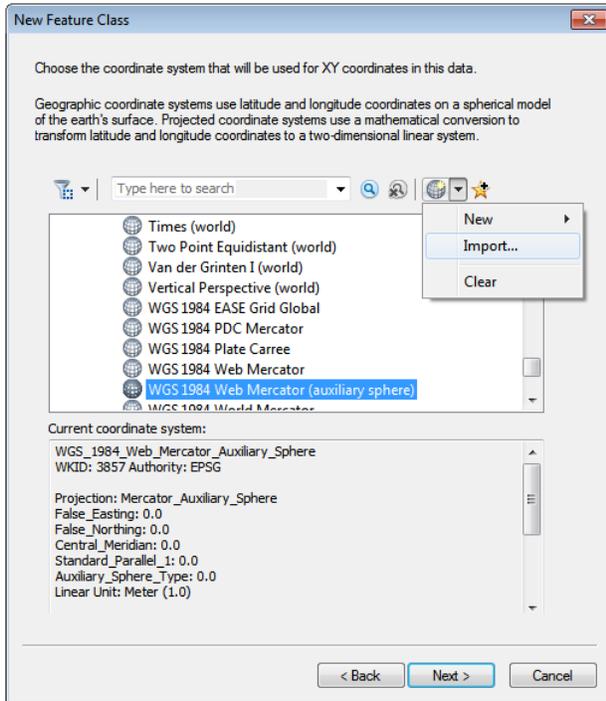
The MassGIS coordinate system is now selected and displayed in the coordinate system dialog box.

5. Click Next several times and Finish to create your new feature class.

Here you simply imported the coordinate system of an existing MassGIS data layer into your new feature class.

Alternative Procedure

Simply add any MassGIS datalayer you previously downloaded to your map **before** creating your new feature class. In this case the MassGIS coordinate system is already pre-selected in the dialog box for choosing the coordinate system.

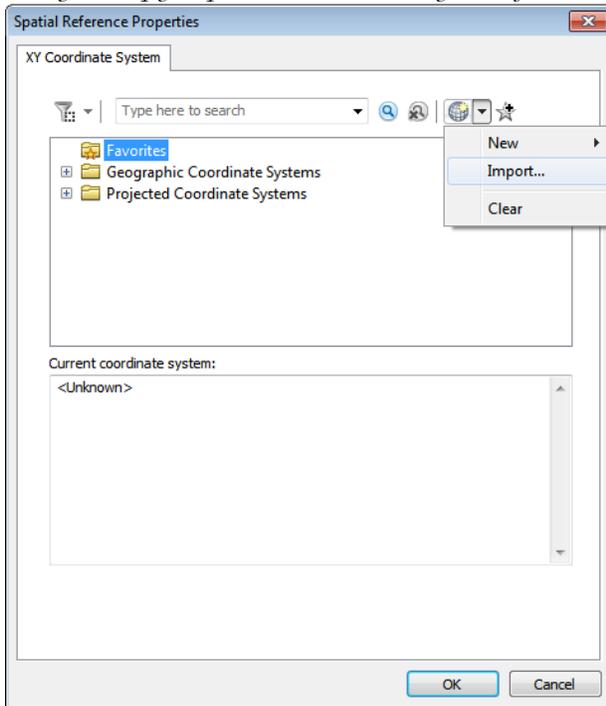


4.2) Importing a Coordinate System for a Shapefile

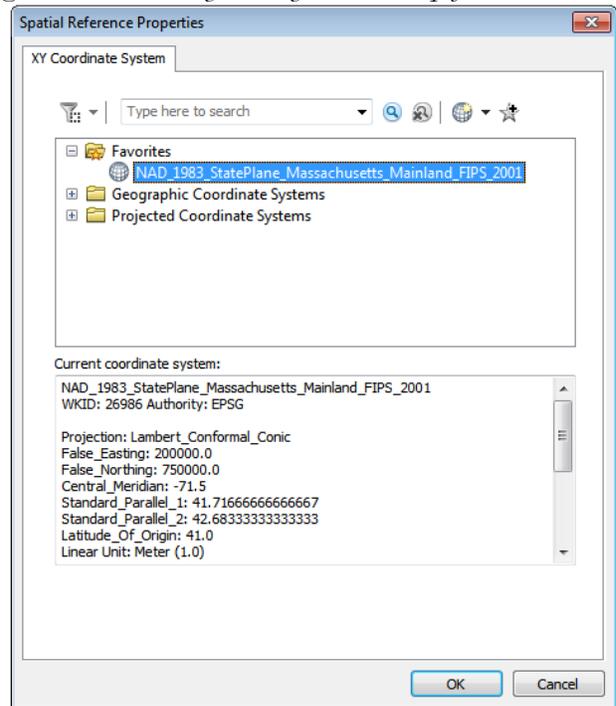
The procedure for shapefiles is almost identical.

1. Create a new shapefile and define its name and Feature type. Note that the Spatial Reference is an Unknown Coordinate System.
2. Click on Edit... and the Spatial Reference Properties dialog box opens. Click on the Earth button with the downward-pointing black triangle and select Import...
3. Browse to your \data folder, select a data layer you previously downloaded from MassGIS, and click Add.
4. Click OK several times to finish creating your shapefile.

Here you simply imported the coordinate system of an existing MassGIS data layer into your new shapefile.



'Empty' Spatial Reference



'Imported' Spatial Reference

5) The Coordinate System / Spatial Reference for ArcGIS Online

ArcGIS Online is another common baselayer source for digitizing new feature classes or shapefiles. In this case you simply import the coordinate system / spatial reference from the ArcGIS Online baselayer when you create a new feature class or shapefile.

1. Add the imagery baselayer from ArcGIS Online to ArcMap and zoom-into Fenway Park.
2. In the Table of Contents, click on Layers, Properties..., and select the Coordinate System tab.

The coordinate system for all ArcGIS Online baselayer is WGS 1984 Web Mercator (auxiliary sphere).

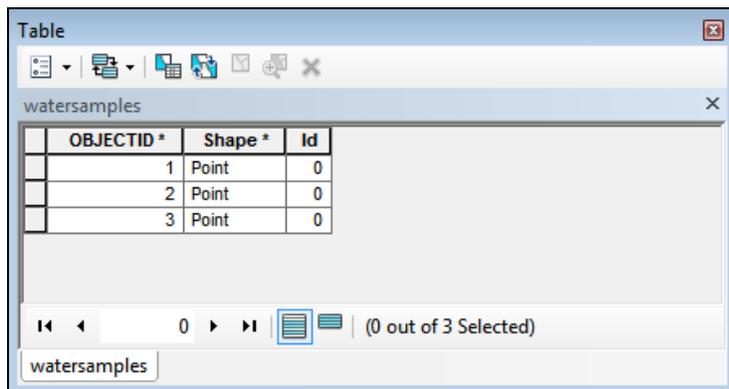
3. Click the Star button with the + sign to add this coordinate system to your favorites and click OK.
4. Create a new polygon feature class in your file geodatabase called grass_fenwaypark and click on Next.
5. Select the WGS 1984 Web Mercator (auxiliary sphere) coordinate system from your Favorites and finish creating the feature class.

Now, zoom-into Fenway Park and digitize the grass as a polygon.

6) Adding Attribute Fields = Making Spatial Data Meaningful!

Adding new fields to an attribute table is easy!

Let's assume you created a new point feature class (or shapefile) and digitized three points representing your water sample locations along the Little River in Stanley Park.



If you open the attribute table you see three rows – one for each of the three points you have digitized. Otherwise, the attribute table is empty, since you have not yet added any attribute data into the attribute table.

For that you first need to add fields to the attribute table by clicking on the Table Options (leftmost button in the tool bar) and select Add Field...

Now you need to enter the Name and the Type of the new field you are adding to the attribute table.

Name	Name of the field in the attribute table (= the column heading) Simple, no blanks, no weird characters, all lowercase
Type	<p>Short Integer Use for small, even numbers (no decimal places) Example: 1, 2, 34, 102, 887, etc.</p> <p>Long Integer Use for large, even numbers (no decimal places) Example: 997234, 12654897, etc.</p> <p>Float Use for small numbers with decimal places Example: 52.23, 187.234, 0.23, etc.</p> <p>Double As Float, but with lots of decimal places Example: 1.9875209765, 457.9999992352</p> <p>Text Use for text (i.e. letters) Example: sample location, person who took the sample, owner, etc.</p> <p>Date Use when entering a date</p>

OBJECTID *	Shape *	Id	name	code	watertemp
1	Point	0	Sample 1	1	55.869999
2	Point	0	Sample 2	2	65.980003
3	Point	0	Sample 3	3	60.522999

In the example above I added three fields to the attribute table and entered the attribute information.

name A short text field for the sample name.
Used later as a label in the map and the legend.

code A short integer field to give each sample a unique identification number.
This field is used later in the symbology to determine the color or symbol.

watertemp In this example I entered the water temperature measured at each sample site.
This field can be used to show the color of the symbols as a function of the water temperature (= choropleth map).

The Big Picture

Creating your own new original geospatial data

1. You first need an empty file for your data, for example a feature class or a shapefile.
2. Now you need to add the spatial data for your features by digitizing.
3. You add the attribute data for your features by manually typing into the attribute table.

➔ ***Now you have geospatial data!***

- The spatial data show where your data are located on the map.
- The attribute data is used to label your features, to create choropleth maps, or to perform other quantitative analysis.

The spatial data alone are boring...just some points, lines, or polygons. The attribute data alone are boring...just a spreadsheet.

➔ ***But, combine them and you have something quite interesting!***