Military Tools for ArcGIS in Web AppBuilder for ArcGIS (Developer Edition)

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Get Started with Military Tools for ArcGIS in Web AppBuilder for ArcGIS (Developer Edition)

Deploying the widgets

To use Military Tools for ArcGIS in Web AppBuilder for ArcGIS (Developer Edition):

1. Copy the individual widget folders found in `...\Web AppBuilder Developer Edition\Widgets` folder and paste them into the `...\WebAppBuilderForArcGIS\client\stemapp\widgets` folder where your instance of Web AppBuilder for ArcGIS (Developer Edition) is installed.

   ⚠ **Caution:** Each individual widget folder needs to be copied and pasted into the `...\stemapp\widgets` folder.

2. Start Web AppBuilder for ArcGIS (Developer Edition).
   The widgets now appear in the widgets list.

Introduction to Coordinate Conversion

It is common for analysts to work across various systems that use different coordinate systems to pinpoint places on the Earth. For example, your coordinates may be Decimal Degrees (DD) and another system might require the same location using Military Grid Reference System (MGRS). Using Coordinate Conversion, you can input coordinates using one coordinate system and output to different coordinate systems in multiple notation formats.

Caution: Coordinate Conversion requires inputs to be in the Geographic Coordinate System World Geodetic System 1984 (GCS_WGS84).

Configure the widget

Once you deploy the widget in Web AppBuilder for ArcGIS, a configuration page allows you to customize the functionality of the widget. You have the following options:

- Change the widget icon and name.
- Change the zoom scale.
- Change the default coordinate notations.

Click **OK** to finish configuration.

Add a coordinate format

Coordinate Conversion converts coordinates to multiple coordinate notations.

1. Click the **Add New Notation** button in the **Input** section of the widget.
   A tool tip callout appears, notifying you a new notation box has been added.

   A notation box appears at the top of the **Output** section.
2. Click the **Format Output** button in your newly created output box.
   The **Set Coordinate Format String** dialog opens.
3. Choose an output coordinate format from the drop-down list.
4. Click **Apply** to set the new coordinate format.

Convert a coordinate

Coordinates can be converted interactively by clicking a point on the map, or typing or pasting coordinates into the Input dialog box. The converted coordinates can then be copied and used elsewhere.

1. Type or paste coordinates into the **Input** dialog box, and press Enter. Alternatively click a location on the map.
   The **Input** dialog box collects the coordinates of the selected location and the output coordinates are automatically converted.

Click the **Copy to clipboard** button in the section of the coordinate you want to copy, or use the **Copy All** button in the **Input** section to copy all outputs for use elsewhere.

Change the display of input coordinates

The input coordinates can be changed to a number of predefined coordinate formats.

1. Click the **Format Output** button in the input section.
2. In the **Set Coordinate Format String** dialog, click the coordinate type drop-down list and select a coordinate type from the list.
3. Customize the coordinate format by adding characters, spaces, or removing components of the string.
4. Click the **Add** check box to add a +/- prefix to positive and negative numbers.
5. Click **Apply**.

Adjust or remove an output format

The display of an output format can be changed or removed.

1. Click the **Format Output** button.
2. In the **Set Coordinate Format String** dialog, click the coordinate type drop-down list and select one of the coordinate types from the list.
3. Format the coordinate string by adding characters, spaces, or removing components of the string.
4. Optionally, check the box to add a +/- prefix to positive and negative numbers.
5. Click **Apply**.

Click the **Remove Coordinate** button to remove a coordinate format.

Copy part of a coordinate

Output coordinates can be expanded to show the separate coordinate components in individual text boxes.

1. In the **Output** section, click the down arrow.
   The output format expands to show the coordinate components in separate boxes.
2. Click the **Copy** button beside a component to copy it elsewhere.

Supported notation formats

A number of formats are supported for reading and writing coordinate locations from a text string using Coordinate Conversion.

Note: The examples and explanations use the following syntax:

- | means "or". For example, + | − means you can use either the + or − character.
- [ ] denotes a choice list. For example, [+ | − | N | S] means you can use either a +, −, N, or S character.
- < > denotes a value.

Degree-based formats

- When entering invalid values for type DMS or DDM of 60 or greater, for minutes or seconds, the value is mathematically corrected (i.e. a value of 80 seconds becomes 1 minute 20 seconds).

Decimal Degrees (DD)

Input format

<latitude> <coord-pair-separator> <longitude>

latitude	[+ | − | N | S]<DD.dd> [N | S]	Case is ignored
longitude	[+ | − | E | W]<DDD.dd> [E | W]	Case is ignored
coord-pair-separator	[space | / | \ || |,]	Can be more than one separator, for example, comma space, space space

Latitude <DD.dd> and longitude <DDD.dd> values can be formatted as:

- <degrees> <decimal> <fraction of degree> [<degree-mark>]

degrees	0 to 90 (latitude) 0 to +180 and 0 to -180 (longitude)
decimal	[. | ,]
fraction of degree	0 to 99
degree-mark	Degree Sign ° (U+00B0) Ring Above ˚ (U+02DA) Circumflex Accent(Caret) ^ (U+005E) Masculine Ordinal Indicator º (U+00BA) Tilde ~ (U007e) Asterisk * (U+002A)

Note: Degree mark can be omitted.

Degrees Decimal Minutes (DDM)

Note: You cannot have multiple +/-signs within the DD MM SS.sss format.

Input format

<latitude> <coord-pair-separator> <longitude>

latitude	[+ | − | N | S]<DD MM.mmm> [N | S]	Case is ignored
longitude	[+ | − | E | W]<DDD MM.mmm> [E | W]	Case is ignored
coord-pair-separator	[space | / | \ || |,]	Can be more than one separator, for example, comma space, space space

Latitude <DD MM.mmm> and longitude <DDD MM.mmm> values can be formatted as:

- <degrees> [<degree-mark>] [<separator>] <minutes> <decimal> <fraction of minute> [<minute-mark>]

degrees	0 to 90 (latitude) 0 to +180 and 0 to -180 (longitude)

degree-mark	Degree Sign ° (U+00B0) Ring Above ˚ (U+02DA) Circumflex Accent(Caret) ^ (U+005E) Masculine Ordinal Indicator º (U+00BA) Tilde ~ (U007e) Asterisk * (U+002A)
separator	[space | underscore]
minutes	0 to 59
decimal	[. | ,]
fraction of minute	digits
minute-mark	Minute Sign ' (U+2032) Apostrophe ' (U+0027)

Note: Degree and minute marks can be omitted.

Degrees Minutes Seconds (DMS)

Note: You cannot have multiple +/-signs within the DD MM SS.sss format.

Input format

<latitude> <coord-pair-separator> <longitude>

latitude	[+ | − | N | S]<DD MM SS.sss> [N | S]	Case is ignored
longitude	[+ | − | E | W]<DDD MM SS.sss> [E | W]	Case is ignored
coord-pair-separator	[space | / | \ || |,]	Can be more than one separator, for example, comma space, space space

Latitude <DD MM SS.sss> and longitude <DDD MM SS.sss> values can be formatted as:

- <degrees> [<degree-mark>] [<separator>] <minutes> [<minute-mark>] [<separator>] <seconds> <decimal> <fraction of second> <second-mark>

degrees	0 to 90 (latitude) 0 to +180 and 0 to -180 (longitude)
degrees-mark	Degree Sign ° (U+00B0) Ring Above ˚ (U+02DA) Circumflex Accent(Caret) ^ (U+005E) Masculine Ordinal Indicator º (U+00BA) Tilde ~ (U007e) Asterisk * (U+002A)
separator	[space | underscore]
minutes	0 to 59
minute-mark	Minute Sign ′ (U+2032) Apostrophe ' (U+0027)
seconds	0 to 59
decimal	[. | ,]
fraction of second	digits
second-mark	Quotation Mark " (U+0022) Diaeresis ¨ (U+00A8) Double Acute Accent ˝ (U+02DD)

Note: Degree, minute, and second marks can be omitted.

Military Grid Reference System (MGRS)

Given the MGRS coordinate, ZZBGGEEEEENNNNN, the various coordinate components are:

- ZZ: UTM Zone
- B: Latitude Band
- GG: Letters representing a 100K grid square (Universal Polar Stereographic area for polar regions)

- EEEEE: X Coordinate (Easting)
- NNNNN: Y Coordinate (Northing)

Note: Together, the first three letters, ZZB, are sometimes called the Grid Zone Designator.

MGRS Coordinates may be rounded to reflect lesser precision. For example:

- `11SWC8081751205` is at one-meter refinement.
- `11SWC80815120` is at 10-meter refinement.
- `11SWC808512` is at 100-meter refinement.
- `11SWC8051` is at 1,000-meter refinement.
- `11SWC85` is at 10,000-meter refinement.
- `11SWC` is at 100,000-meter refinement.

Coordinate Conversion only supports MGRS in New Style lettering scheme based on WGS 1984.

Caution: Coordinate Conversion does not support MGRS in the polar regions (i.e. North of 84 degrees North and South of 80 degrees south).

United States National Grid (USNG)

The USNG coordinate notation format is a simplified version of MGRS based on the United States National Grid. The components, space formatting, and precision follows the conventions of MGRS, which is explained above for reference.

Caution: Coordinate Conversion does not support MGRS in the polar regions (i.e. North of 84 degrees North and South of 80 degrees south).

Universal Transverse Mercator (UTM)

The Universal Transverse Mercator system is a specialized application of the transverse Mercator projection. The globe is divided into 60 north and south zones, each spanning 6° of longitude. Each zone has its own central meridian. Zones 1N and 1S start at 180° W. The limits of each zone are 84° N and 80° S, with the division between north and south zones occurring at the equator.

Given the UTM coordinate, ZZB EEEEEE NNNNNNN, the various components are:

- ZZ: UTM Zone
- B: Latitude Band (Coordinate Conversion uses a latitude band and not N or S to represent a North or South UTM zone)
- GG: Letters representing a 100K grid square (Universal Polar Stereographic area for polar regions)
- EEEEEE: X Coordinate (Easting)
- NNNNNNN: Y Coordinate (Northing)

To input a UTM coordinate to Coordinate Conversion, spaces must be embedded between the UTM Zone/Latitude Band (ZZB), the Easting (EEEEEE), and Northing (NNNNNNN) components, and must be listed in this order: ZZB EEEEEE NNNNNNN, for example, 11S 369420 3763875.

Caution: Coordinate Conversion does not support UTM in the polar regions (i.e. North of 84 degrees North and South of 80 degrees south).

Global Area Reference System (GARS)

Gars is based on longitude and latitude and divides the world into 30 minute by 30 minute cells. The first three digits represent a 30 minute wide longitude band. The forth and fifth letters represent a 30 minute tall latitude band. Each 30 by 30 minute cell can be divided into four 15 by 15 minute cells. Converting from GARS, the lower left of the represented square is used to calculate degree-based coordinates.

`[ . | , ]`

Introduction to the Distance and Direction widget

Analysts need to understand and visualize basic information about places and objects of interest. Analysts may be tasked with answering questions such as How far apart are two geographic locations? or Can I visualize the range of a weapon system? Using the Distance and Direction widget, you can draw lines, circles, ellipses, and range rings to visualize important information.

Configure the distance and direction widget

Once you deploy the Distance and Direction widget, configure the widget in Web AppBuilder for ArcGIS (Developer Edition) and configure the application to view map labels.

1. Configure the widget.
    - Change the widget icon and name.
    - Check or uncheck check boxes to control which tabs will be available on the widget.
    - Change the color and width of Lines, Circles, Ellipses, and Rings.
    - Change the color and size of graphic labels.
2. Click **OK** when you are finished.
3. To enable labels, navigate to the `config.json` file of the app that contains your widget. This file is located under `WebAppbuilderForArcGIS/server/apps` , the apps are named numerically by default.
4. Open the file in a text editor.
5. In the text editor, search for `"mapOptions":`. Add the following statement `"showLabels": true,` within the `mapOptions` brackets. Adding this statement will turn on the visibility of the map labels within the application.
6. Save `config.json` and refresh the application to view map labels.

Change the input coordinate format

1. Click the **Gear** button to set the coordinate format string.
   The **Set Coordinate Format String** dialog appears.
2. Click the drop-down list and select a display coordinates format. The default format is **Decimal Degrees**.
3. Format the coordinate string by adding characters, spaces, or removing components of the string.
4. Optionally, check the box to add a +/- prefix to positive and negative numbers.
5. Click **Apply**.

Create lines interactively

Interactively create geodesic lines on the map.

1. Click the **Lines** tab.
2. Check the **Create Line Interactively** check box.
3. Click the **Draw Line** tool.
4. Click a location on the map to designate the line starting point.
5. Click a second point on the map to designate the line ending point.
   A graphic line is displayed along with the line's distance and direction.
6. Click the **Clear Graphics** button to remove the graphics from the map.

Create lines from coordinates

Use known coordinates to create geodesic lines.

1. Click the **Line** tab.
2. Type or paste coordinates in the **Start Point** dialog. Press the **Enter** key. Alternately, use the **Draw Line** tool to select a start point on the map.
3. Type or paste a coordinates in the **End Point** dialog. Press the **Enter** key. Alternately, use the **Add Point** tool to select an end point on the map.
4. Click the **OK** button.

Create lines from distance and bearing

Create lines from a given distance and bearing.

1. Click the **Line** tab.
2. On the **From** drop-down list select **Distance and Bearing**.
3. Set a start point.
    - Type or paste a coordinate in the **Start Point** dialog and press Enter.
    - Or, use the **Add Point** tool, to set a start point.
4. Enter a **Length** value and set the units in the drop-down menu.
5. Enter an **Angle** value and set the units in the drop down menu.
6. Click **OK**.
7. Optionally, click **Clear Graphics** to remove the graphics from the map.

Create circles interactively

Interactively create circles by clicking on the map.

1. Click the **Circle** tab.
2. Click the **Create Circle From** drop-down menu to choose a drawing method. Choose **radius** or **diameter**.
3. Check the **Create Circle Interactively** check box.
4. Click the **Radius/Diameter** drop-down menu to set the distance units.
5. Click the **Draw Circle** tool.
6. Click a point on the map to designate the circle's center.
7. Click a second point on the map to designate the circle's radius or diameter.
   A graphic circle is displayed along with the circle's radius or diameter.
8. Optionally click **Clear Graphics** to remove the graphics from the map.

Create circles from known coordinates

Use known coordinates to create circles using radius or diameter lengths.

1. Click the **Circle** tab.
2. Click the **Create Circle From** drop-down menu and choose radius or diameter.
3. Type or paste coordinates in the **Center Point** dialog. Press the **Enter** key. Alternately use the **Draw Circle** tool to select a center point.
4. Type or paste a distance in the **Radius / Diameter** box.
5. Select desired units from the drop-down.
6. Click **OK**.

Create circles using speed and time

Create a circle to identify potential locations for moving objects using a center point, time, and rate.

1. Click the **Circle** tab.
2. Click the **Create Circle From** drop-down menu and choose **radius** or **diameter**.
3. Set a center point in one of the following ways:
   - Type or paste a coordinate in the **Center Point** dialog box. Press the Enter key.
   - Use the **Draw Circle** tool.
4. Expand the**Distance Calculator** dialog box to enter the other options.
5. Enter a **Time** value and set the units in the drop-down menu.
6. Enter a **Rate** value and set the units in the drop-down menu.
7. Click **OK**.

Create ellipses interactively

Interactively create ellipses by clicking on the map.

⚠ **Caution:** Graphics generated using the ellipse tool are not geodetic.

1. Click the **Ellipse** tab.
2. Click the **Ellipse Type** drop-down. Choose between semi or full.
3. Check the **Create Ellipse Interactively** check box.
4. Click the **Unit** drop-down menu in the **Axis** section, to change the axis units.
5. Click the **Draw Ellipse** tool.
6. Click a point on the map to designate the ellipse center.
7. Drag the mouse and click on the map to designate the ellipse major axis length and orientation.
8. Drag and click on the map to designate the ellipse minor axis length.
9. Optionally, click **Clear Graphics** to remove the graphics from the map.

Create ellipses from known coordinates

You can use known coordinates to create ellipses.

Note: Ellipses are not geodetic.

1. Click the **Ellipse** tab.
2. Click the **Ellipse Type** drop-down . Choose semi or full.
3. Type or paste coordinates in the **Center Point** text box. Press the Enter key. Alternatively use the **Draw Ellipse** tool to designate an ellipse center point.
4. Enter values for the **Major** and **Minor** axes in the **Axis** section and select a value from the **Units** drop-down.
5. Enter an **Orientation Angle** value and set the units in the drop-down.
6. Click **OK**.

Create range rings interactively

Interactively create range rings by clicking on the map.

1. Click the **Rings** tab.
2. Check the **Create Rings Interactively** check box.
3. Use the **Distance Between Rings** drop-down to set the units.
4. Type a value in the **Number of Radials** box.
5. Click the **Add Point** tool.
6. Click on the map to designate a center point.
7. Drag the mouse and click on the map to designate the first ring.
8. Replicate step seven to add additional rings.
9. Double-click the map to complete the range rings.
10. Optionally, click **Clear Graphics** to remove the graphics from the map.

Create range rings using a set ring number and known distance.

Create range rings using a set ring number and distance in the distance and direction add-in.

1. Click the **Rings** tab.
2. Type or paste coordinates into the **Center Point** input box and press the **Enter** key. Alternately click the **Add Point** tool and click on the map to designate a center point.
3. Ensure the **Create Rings Interactively** check box is unchecked.
4. Type a value in the **Number of Rings** input box.
5. Type a value in the **Distance Between Rings** input box.
6. Use the drop-down to set the units.
7. Type a value in the **Number of Radials** input box.
8. Click **OK**.

Introduction to Visibility

Visualizing the terrain and understanding its impact is a crucial aspect of tactical operations. Analysts can determine visibility from key terrain, observations posts, and other locations to assess mission vulnerabilities and determine how to use the terrain to their advantage. The Visibility widget uses elevation data to create radial line of sight information needed for making operational decisions. The Visibility widget determines what is visible from an observer location based on a given distance, an observer height, and a field of view.

Note: The widget relies on a viewshed geoprocessing service.

Set up the visibility geoprocessing service

The visibility widget requires a viewshed geoprocessing service in order to function. The viewshed geoprocessing service uses elevation data to calculate radial line of sight. Elevation data can be a single raster or mosaic dataset in a projected coordinate system.

1. Open the **Viewshed.py** script located in `...\Web AppBuilder Developer Edition\GeoProcessing\Viewshed` folder.
2. Replace the sample elevation path (line 19) , `elevation = r"d:\Workspace\data\n36prj.tif"`, with your source elevation data path.
3. Save and close the **Viewshed.py** script.
4. Open a new ArcMap document

   Note: Spatial Analyst extension must be enabled.
5. Under Geoprocessing Options enable "Overwrite the outputs of geoprocessing operations".
6. Add your elevation data to the map using the **Add Data** button.
7. Open the **Viewshed** tool in the Viewshed toolbox in the `...\GeoProcessing\viewshed` folder.
8. Choose **Input_Observer** and place a point on the map.
9. Click **OK** to run the tool.
10. Open the **Results** window.
11. Right-click the instance of the Viewshed tool and click **Share As** > **Geoprocessing Service**.
12. Click **Publish a service** and click **Next** .
    If you've already established an ArcGIS Server connection, skip to step 16.
13. Click on the **Add ArcGIS Server** button.
14. In the **Add ArcGIS Server** dialog, select the **Publish GIS services** button and click **Next** .
15. In the dialog, enter the url of the server and click **Finish**.
16. In the dialog, name the service the service. Click **Next**.
17. Select a folder for the service and click **Continue**.
18. In the service editor, set **Execution Mode** to **Synchronous** and **Message Level** to **Warning**.
19. Click **Publish**.

    Note: The source elevation data referenced in the viewshed script is published to the server.

    You have now published the geoprocessing service.
20. Run the geoprocessing service in ArcMap to verify that the service published correctly.

Configure the Visibility Widget

Once you deploy the Visibility widget, configure the widget in Web AppBuilder for ArcGIS (Developer Edition).

1. Enter a url for the visibility geoprocessing service, which was published from the included Viewshed script tool, including the task name.

   Note: An example may look like `https://[ArcGIS Server REST folder]/services/[optional folder name]/GPServer/Viewshed`.

2. Optionally, change the widget icon and name.
3. Click **OK**.

Create radial line of sight

The Visibility widget can be used to create a radial line of sight.

1. Set the observer point by clicking the **Add Observer** button and selecting a location on the map.
2. Enter a value (in degrees) in the **Field of View** dialog.
3. Optionally, check the box to use mils instead of degrees for your bearing angle.
4. Adjust the **Field of View** bearing by dragging the visible area to your desired bearing angle.
5. Enter a value for the **Observer Height**.
6. Set the **Observer Height** units of measurement.
7. Enter a value for the **Min Observable Distance**.
8. Set the **Min Observable Distance** units of measurement.
9. Enter a value for the **Max Observable Distance**.
10. Click **Create**.
11. Optionally, click the **Clear** button to clear the results.