Military Tools for ArcGIS in ArcMap

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Get Started with Military Tools for ArcGIS in ArcMap

Military Tools for ArcGIS in ArcMap provides fundamental tools for coordinate conversion, distance and direction calculations, and visibility analysis. It contains an add-in and geoprocessing toolbox.

Installing the add-in

To install the Military Tools for ArcGIS in ArcMap Add-In:

1. Double-click the `MilitaryToolsforArcMap.esriAddin` file in the `...\ArcMap\Addins` folder.
2. Click **Install Add-In**.
   Installation Succeeded window appears.
3. Click **OK**.
4. Open ArcMap.
   The **Military Tools** toolbar will open automatically with the application.

Installing the toolbox

To install the Military Tools toolbox for ArcMap:

1. Locate the Geoprocessing folder contained in the `...\ArcMap` folder.
2. Copy this folder including its contents locally.

   Caution: The entire contents of the Geoprocessing folder must be copied locally because the toolbox contains references to scripts and other data that are stored relative to the toolbox. If you are receiving an error such as **Script associated with this tool does not exist** when running a tool, check to ensure that the `layers`, `scripts`, and `tooldata` folders are located at the same folder level as the toolbox.

3. Open ArcMap.
4. In the **Catalog** pane, click the **Connect to Folder** button.
5. In the **Connect to Folder** window, navigate to the location on disk where you copied the Geoprocessing folder.
6. Click **OK** to create a folder connection to your Geoprocessing folder.

License: In order to use Military Tools for ArcGIS Add-In, or the Military Tools toolbox, both 3D Analyst and Spatial Analyst extensions need to be licensed.

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).

Add a coordinate format

Coordinate Conversion converts coordinates between multiple coordinate formats and notation styles.

1. Click the **Coordinate Conversion** button on the **Military Tools** toolbar.
   The **Coordinate Conversion** pane appears.
2. Click the **Add** button in the **Output** section.
   The **Add New Output Coordinate** window appears.
3. Choose a coordinate format from the **Category** list.
4. Examine the selected coordinate format ion the **Formats** dialog box to verify the coordinates will be displayed correctly.
5. Type a name for the coordinate format in the **Name** text box or accept the default. Since a given coordinate format can be displayed in several different notations, you can use the name to distinguish between multiple output formats.
6. Click **OK** to add the selected coordinate format to the **Output** section.
   When you click the map using the **Map Point Tool** or paste a coordinate in the **Input** box, the equivalent coordinate values appear in each of the output coordinate value rows of the table. You can add rows for multiple formats and customize how these formats are displayed.

   Tip: Reorder the output coordinate format list by dragging the button on the far left of the row to the desired location.

Convert a coordinate

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

Note: Add desired coordinate formats to the tool dialog before converting a coordinate.

1. Enter a location:
   - Click the **Map Point Tool** on the **Coordinate Conversion** pane and select a location on the map.
   - Type or paste coordinates into the **Input** dialog and press **Enter**.

Customize a coordinate format

The default format for an output coordinate might not be exactly the way another system is designed to receive the information. You can customize the output formatting of converted coordinates, so they exactly match what another system or person needs.

1. Click the **Add** button in the **Output** section.
   The **Add New Output Coordinate** window appears.
2. Click a coordinate type from the **Category** list.
3. Click the drop down arrow to expand the **Advanced** dialog.
4. In the **Advanced** dialog, insert or delete characters or spaces to change the way the coordinate will be displayed. The Sample text in the dialog shows the changes as they are made.

   Note: For DD, DDM, and DMS, **0** represents a digit, whereas **#** represents a significant digit (not zero). For example, the default format for DD is Y0.0#####N X0.0#####E, which shows a minimum of one decimal point, but up to six if the digits are significant. If you have an input coordinate of 45.002N, 40.300W it will default to 45.002N, 40.3W in the output because there is only one significant digit. If you customize the formatting to Y0.0000##N X0.0000##E in the **Advanced** dialog the outputs would change to 45.0020N, 40.3000W.

   Note: Letters and spacing also change the display of the output coordinates. For example, the default output format for MGRS coordinates looks like this: 11SMU4217517182. However, you can add spaces, like this: 11S MU 42175 17182, or you can format it to drop the Grid Zone Designator by removing the letter Z, so the output will look like this: MU4217517182.

5. Type a name or accept the default for the coordinate format in the **Name** box.

   Note: All format names need to be unique.

6. Click **OK**.

Change the displayed input coordinate format

The **Input** dialog and the coordinate **List** can be changed to display a number of predefined coordinate formats.

1. Click the **Edit Properties** button in the **Input** section.
   The **Edit Properties** window appears.
2. Click the **Display Coordinate** drop-down list and select the desired format.
3. Optionally, check the **Display Ambiguous Coordinates** dialog to display ambiguous coordinates.
   The **Display Ambiguous Coordinates Dialog** allows the user to choose whether their ambiguous coordinates are in **Lat/Lon** or in **Lon/Lat**.
4. Click **OK**.
5. Click the **Map Point Tool** button and move the mouse to a location on the map. The **Input** coordinate values and the coordinate **List** will be displayed using the new coordinate format.

Copying coordinates

Different workflows require analysts to copy single coordinates, multiple coordinates, or specific components of a coordinate to be used in various applications.

- Click the **Copy** button beside an output coordinate row to copy the coordinate.
- Click the **Copy All** button in the **Output** coordinate section to copy all coordinates.
- Click the **Expand** button on a coordinate row and then click the **Copy** button to copy a component of the coordinate.
- Select a coordinate in the **List** section, then right-click the coordinate and select **Copy** to copy a single coordinate from the **List**.
- Right-click a coordinate in the **List** section, then select **Copy All** to copy all of the coordinates in the **List**.

Adjust the output format

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

1. Right-click an output format and click the **Configure** option.
2. In the **Edit Output Coordinate** window, change the **Category** of output coordinates or click **Advanced** and change the formatting of the output coordinate.
3. Click **OK**.

   Note: To remove an output format, right-click it and click **Delete**.

Import Coordinates

Tabular coordinates can be imported into the Coordinate Conversion pane.

1. Click the **Import** button on the **Coordinate Conversion** pane.
2. Navigate to a .csv file containing coordinates, and click **Open**.
   The **Select Fields** dialog will appear.
3. Use the **X Field (Longitude)** drop-down to choose the field from the .csv that contains the coordinates to be imported.
4. Optionally, check the **Use two fields** check box if your coordinates are in two separate fields. Use the **X Field (Longitude)** drop down to select the X value (longitude) field and use **Y Field (Latitude)** drop down to select the Y value (latitude) field.
   The **Y Field (Latitude)** field with be grayed out, until the **Use two fields** check box is marked
5. Click **OK**. The imported coordinates will appear on the map and in the **List** section.
   After points are imported, they are placed in the list in reverse order of they were listed in the input. This means that the first row from the input is the bottom entry in the list.

Export Coordinates

Coordinates can be collected from the map and exported as a feature class, shapefile, CSV, or KML.

1. Click the **Map Point Tool** on the **Coordinate Conversion** pane.
2. Select a location on the map. Coordinates will automatically be added to the **List**.
3. Optionally, click the **Edit Properties** button to change the display input to a predefined format.
4. Click the **Export** button on the **Coordinate Conversion** pane to export the collected coordinates as a feature class, shapefile, KML, or CSV.
   To export as a feature class an existing geodatabase must be selected. To export as a shapefile, use the drop-down on the bottom of the **Select ouput** dialog to select `Shapefile`.

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

- Both <longitude/latitude> and <latitude/longitude> are supported.

  Note: If the coordinate is entered in <longitude> <latitude> order and no hemisphere abbreviation (i.e. N, S, E, W) is specified and the <longitude> value is less than 90 the value will be interpreted as <latitude> <longitude>.

- 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 formats:

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

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

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

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

<table>
<tr><td>degrees</td><td>0 to 90 (latitude)
0 to +180 and 0 to -180 (longitude)</td></tr>
<tr><td>decimal</td><td>[. | , | :]
Note: the Operating System Region decimal symbol must be changed to match. When using , or : as decimal symbol, these symbols can't be used as the <coord-pair-separator>.</td></tr>
<tr><td>fraction of degree</td><td>0 to 99</td></tr>
<tr><td>degree-mark</td><td>Degree Sign ° (U+00B0)
Ring Above ˚ (U+02DA)
Masculine Ordinal Indicator º (U+00BA)
Circumflex Accent(Caret) ^ (U+005E)
Tilde ~ (U007e)
Asterisk * (U+002A)</td></tr>
</table>

Note: Degree mark can be omitted.

Degrees Decimal Minutes (DDM)

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

Input formats:

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

<table>
<tr><td>latitude</td><td>[+ | − | N | S]<DD MM.mmm>[+ | − | N | S]</td><td>Case is ignored</td></tr>
</table>

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

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>]

<table>
<tr><td>degrees</td><td>0 to 90 (latitude)
0 to +180 and 0 to -180 (longitude)</td></tr>
<tr><td>degree-mark</td><td>Degree Sign ° (U+00B0)
Ring Above ˚ (U+02DA)
Masculine Ordinal Indicator º (U+00BA)
Circumflex Accent(Caret) ^ (U+005E)
Tilde ~ (U007e)
Asterisk * (U+002A)</td></tr>
<tr><td>separator</td><td>[space | underscore | hyphen]</td></tr>
<tr><td>minutes</td><td>0 to 59</td></tr>
<tr><td>decimal</td><td>[. | , | :]
Note: the Operating System Region decimal symbol must be changed to match. When using , or : as decimal symbol, these symbols can't be used as the <coord-pair-separator>.</td></tr>
<tr><td>fraction of minute</td><td>digits</td></tr>
<tr><td>minute-mark</td><td>Minute Sign ' (U+2032)
Apostrophe ' (U+0027)</td></tr>
</table>

Note: Degree mark can be omitted.

Degrees Minutes Seconds (DMS)

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

Input formats:

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

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

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>

<table>
<tr><td>degrees</td><td>0 to 90 (latitude)
0 to +180 and 0 to -180 (longitude)</td></tr>
<tr><td>degrees-mark</td><td>Degree Sign ° (U+00B0)
Ring Above ˚ (U+02DA)
Masculine Ordinal Indicator º (U+00BA)
Circumflex Accent(Caret) ^ (U+005E)
Tilde ~ (U007e)
Asterisk * (U+002A)</td></tr>
<tr><td>separator</td><td>[space | underscore | hyphen]</td></tr>
<tr><td>minutes</td><td>0 to 59</td></tr>
<tr><td>minute-mark</td><td>Minute Sign ′ (U+2032)
Apostrophe ' (U+0027)</td></tr>
<tr><td>seconds</td><td>0 to 59</td></tr>
</table>

decimal	[. | , | :] Note: the Operating System Region decimal symbol must be changed to match. When using , or : as decimal symbol, these symbols can't be used as the <coord-pair-separator>.
fraction of second	digits
second-mark	Quotation Mark " (U+0022)

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

Spaces are allowed on input to Coordinate Conversion between the Grid Zone Designator (ZZB), 100K grid square (GG), Easting (EEEEE), and (Northing). The number of digits used for eastings and northings must match. For example, all of the following inputs are equivalent:

- `11SWC8081751205`
- `11S WC8081751205`
- `11S WC 8081751205`
- `11S WC 80817 51205`

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.

Note: 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.

Note: 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.

Introduction to Distance and Direction

Analysts need to understand and visualize basic information about places and objects of interest, for instance, the distance between two geographic locations or the range of a weapon system. Using Distance and Direction you can draw geodetic lines, circles, ellipses, and range rings to visualize relevant information. You can use created graphics for further analysis and planning by saving the graphics to feature classes, shapefiles, and KMZ (compressed Keyhole Markup Language) files.

Change the display of input coordinates

Use the Edit Properties button to change the display of input coordinates.

1. Click the **Edit Properties** button.
   The **Edit Properties** window appears.
2. Click the **Display Coordinate** drop-down list and select a display coordinates format.
3. Click **OK**.
4. Use the **Map Point Tool** to select a location on the map.
   The input box will display the selected coordinate format.

Create lines interactively

Click on the map to create geodetic, great elliptic, or loxodrome lines.

1. Click the **Lines** tab.
2. Click the drop-down list to choose a line type. Line types include: **Geodesic**, **Great Elliptic**, and **Loxodrome**.
3. Use the **Distance/Length** drop-down menu to change the unit of measure.
4. Use the **Angle** drop-down menu to change the unit of measure.
5. Click the **Map Point Tool**.
6. Click a location on the map to designate the line starting point.
7. Click a second point on the map to designate the line ending point.
   A graphic line is created with the line's distance and direction.
8. Click the **Save As** button to export the line graphics to a file geodatabase, shapefile, or KML (compressed Keyhole Markup Language).
9. Optionally, click **Clear Graphics** to remove the graphics from the map.

Create lines from distance and bearing

Create lines using distance and bearing.

1. Click the **Lines** tab.
2. Click the drop-down list to choose a line type. Line types include: **Geodesic**, **Great Elliptic**, and **Loxodrome**.
3. Click the **From** drop-down list and select **Distance and Bearing**.
4. Type or paste a coordinate in the **Starting Point** dialog or use the **Map Point Tool** to set a start point.
5. Select the desired unit of measure from the **Distance/Length** drop-down and enter a value.
6. Select the desired unit of measure from the **Angle** drop-down and enter a value.
7. Press the **Enter** key.
8. Click the **Save As** button to export the line graphics to a file geodatabase, shapefile, or KMZ (compressed Keyhole Markup Language).

   Note: Clicking the **Clear Graphics** button removes all the graphics from the map created with this tab.

Create lines from known coordinates

Use known coordinates to create geodesic, great elliptic, or loxodrome lines.

1. Click the **Lines** tab.
2. Click the drop-down list to choose a line type. Line types include: **Geodesic**, **Great Elliptic**, and **Loxodrome**.
3. Type or paste coordinates in the **Starting Point** dialog.
4. Type or paste a coordinates in the **Ending Point** dialog.
5. Press the **Enter** key.

Create circles interactively

Interactively create circles by clicking on the map.

1. Click the **Circles** tab.
2. Click the **From** drop-down menu to choose a drawing method. Choose between **Radius** or **Diameter**.
3. Select a unit of measure from the drop-down menu for **Radius/Diameter**
4. Click the **Map Point Tool** and select a center point.
5. Use the cursor to select the size of the circle and click to draw the circle.
   A graphic circle is displayed along with the circle's radius or diameter.
6. Click the **Save As** button to export the circle graphics to a file geodatabase, shapefile, or KMZ (compressed Keyhole Markhole Language).

   Note: Clicking the **Clear Graphics** button removes all the graphics from the map created with this tab.

Create circles from known coordinates

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

1. Click the **Circle** tab.
2. Click the **From** drop-down menu and choose **Radius** or **Diameter**.
3. Type or paste coordinates in the **Center Point** dialog.
4. Type or paste a distance in the **Radius / Diameter** dialog.
5. Press the **Enter** key.

Create circles using speed and time

Create circles to identify potential locations for moving objects using a center point and time.

1. Click the **Circle** tab.
2. Click the **From** drop-down menu and choose radius or diameter.
3. Type or paste a coordinate in the **Center Point** section or use the **Map Point Tool** and click a location on the map
4. Click the **Distance Calculator** drop-down arrow.
5. Use the **Time** drop-down to select a unit of measure.
6. Type a rate of time in the **Time** section.
7. Use the **Rate** drop-down to select a unit of measure.
8. Type a rate of travel value in the **Rate** section.
9. Press the **Enter** key.

Create ellipses interactively

Interactively create ellipses.

1. Click the **Ellipse** tab.
2. Click the **Ellipse Type** drop-down and select between **Semi** or **Full**.
3. Set the unit of measure in the **Axis** section.
4. Set the unit of measure in the **Orientation** section.
5. Click the **Map Point** tool and select a center point on the map
6. Use the cursor on the map to designate the ellipses major axis and click to accept.
7. Use the cursor on the map to designate the ellipses minor axis and click to accept.
8. Click the **Save As** button to export the ellipse graphics to a file geodatabase, shapefile, or KMZ (compressed Keyhole Markup Language).

   Note: Clicking **Clear Graphics** will remove all the graphics from the map that were created with this tab.

Create ellipses from known coordinates

Use known coordinates to create ellipses.

1. Click the **Ellipse** tab.
2. Click the **Ellipse Type** drop-down and choose between **Semi** or **Full**.
3. Set the unit of measure in the **Units** drop-down menu in the **Axis** section.
4. Set the unit of measure in the **Units** drop-down menu in the **Orientation** section.
5. Type or paste coordinates in the **Center Point** dialog.
6. Type or paste a value in the **Major** dialog in the **Axis** section.
7. Type or paste a value in the **Minor** dialog in the **Axis** section.
8. Type or paste a value in the **Angle** dialog of the **Orientation** section.
9. Press the **Enter** key.

Create range rings interactively

Interactively create range rings.

1. Click the **Rings** tab.
2. Check the **Interactive** box.
3. Optionally, type a value in the **Number of Radials** section.
4. Click the **Map Point Tool**.
5. Click on the map to designate the center point.
6. Move the cursor to select the diameter of the next ring and click to create it. Add rings as necessary and double-click to finish.
7. Click the **Save As** button to export the range ring graphics to a file geodatabase, shapefile, or KMZ (compressed Keyhole Markup Language).
8. Optionally, click **Clear Graphics** to remove the graphics from the map.

Create range rings using a set ring number and distance

Create range rings with a set number of rings at a specified distance.

1. Click the **Rings** tab.

   Note: Ensure the **Interactive** box is unchecked.

2. Type a value in the **Number of Rings** section.
3. Type a value in the **Distance Between Rings** section.
4. Use the drop-down menu to set the unit of measure.
5. Type the desired **Number of Radials**.
6. Click the **Map Point Tool**.
7. Click a location on the map to designate the center point.
8. Press the **Enter** key.

Introduction to Visibility

Visibility takes into consideration what can be seen by an observer from a given location. Analysts use key terrain, observation posts, and other locations to assess capabilities (what can be seen) and vulnerabilities (what cannot be seen). The Visibility tools use elevation data paired with observer information to produce linear line of sight (LLOS) and radial line of sight (RLOS) information.

Creating linear lines of sight

You can create linear lines of sight (LLOS) by specifying observer and target locations. You can use one or multiple observers and one or multiple targets to analyze lines of sight.

1. Click the **LLOS** tab.
2. Add an elevation surface to the map.

   Note: The surface data may be a raster, image service, or mosaic dataset.

   Caution: The input surface data must be in a projected coordinate system, and the data frame must have the same spatial reference as the input surface data. If you do not check for this, invalid results may be returned.
3. Click the **Input Surface** drop-down to choose an elevation surface from the **Table of Contents**.
4. Type, or paste in coordinates to designate one or more observer locations or use the **Observer Map Point Tool** and click on the map.
   Observer points are marked with blue circles.
5. Type, or paste in coordinates to designate one or more target locations or use the **Target Map Point Tool** and click on the map.
   Target points are marked with red squares.
6. In the **Offsets** section, input **Observer** and **Target** heights and specify the unit of measure.
7. Click **OK**.
   If the target is visible from an observer it will be colored green. If the target is not visible from an observer it will be colored red. Sections of the line between the observer and target that are visible will be green. Sections of the line that are not visible will be red. Visible targets will have a numeric label showing how many observers can see them.

   Note:
   - You can refine the analysis by changing offset heights or adding observers or targets.
   - **Clear Graphics** removes previous results.
   - **Cancel** removes the observer and target coordinates.

Creating radial lines of sight

Radial Line of Sight (RLOS) shows terrain visibility from a location using given observer information.

Caution: The use of a global or large area extent image service will result in excessive processing time. It is recommended to use a local dataset or a small area extent image service.

1. Click the **RLOS** tab.
2. Add an elevation surface to the map.

   Note: The surface data may be a raster, image service, or mosaic dataset.

   Caution: The input surface data must be in a projected coordinate system, and the data frame must have the same spatial reference as the input surface data.

   Caution: The use of a global or large area extent image service will result in excessive processing time. It is recommended to use a local dataset or a small area extent image service.
3. Click the **Input Surface** drop-down to choose an elevation surface from the **Table of Contents**.
4. Type or paste coordinates to designate one or more observer locations, or use the **Observer Map Point Tool** and click on the map.
   Observer points are marked with blue circles.
5. Check the **Symbolize Non-Visible Data in Output** box to symbolize non-visible areas in red; otherwise the output will only show areas that are visible in green.
6. You can change the following settings by clicking on **Observer Options** or accept the defaults:
   - Type an offset height in the **Observer** section.
   - Type an offset height in the **Surface** section.
   - Click the drop-down list to specify the offset units.
   - Type a minimum and maximum linear **Distance** for the analysis.

     Note: The units for linear distance are the same units specified for the offset.
   - Type limits to the observer's **Horizontal** field of view.
   - Type limits to the observer's **Vertical** field of view.
   - In the **Field of View** section, click the drop-down list to specify the angular units for the field of view.
7. Click **OK** to calculate visibility around the observers.
   A new polygon layer is added to the map each time you run the analysis. Areas visible from an observer are shown in green. If an area is visible from more than one observer, it will be shown with a unique value indicating how many of the observers can see it.

Note:
- You can refine your analysis by changing the observer offsets heights or fields of view.
- **Cancel** removes the observer coordinates from the tool.

Introduction to Military Tools toolbox

The Military Tools toolbox provides a collection of geoprocessing tools that enable the automation of analytical processes and workflows for determining location, distance, range, and visibility.

The Conversion toolset supports the conversion of coordinate values between multiple coordinate formats. The Conversion toolset also allows the creation of points, polylines, polygons, lines of bearing, 2-point lines, and ellipses from tabular coordinate values. The Distance and Direction toolset supports the creation of range rings using different input methods. These tools work in projected and geographic coordinate systems and support planar and geodetic outputs. The Visibility toolset supports linear and radial visibility analysis on raster surfaces, as well as the identification of highest and lowest locations.

Toolset	Description
Conversion	Provides tools to create features from coordinates in tabular form.
Distance and Direction	Provides tools to create range rings from an interval or a minimum and maximum distance.
Visibility	Provides tools to better understand how the terrain affects relationships between observer and target positions.

An overview of the Conversion toolset

The Conversion toolset contains tools to create features from coordinates in tabular form, such as polygons, lines of bearing, ellipses, and points.

Tool	Description
Convert Coordinates	Converts source coordinates in a table to different coordinate formats.
Table to 2-Point Line	Creates a line feature from a start point and an endpoint.
Table to Ellipse	Creates ellipse features from tabular coordinates and input data values.
Table to Line of Bearing	Creates lines of bearing features from tabular coordinates.
Table to Point	Creates point features from tabular coordinates.
Table to Polygon	Creates polygon features from tabular coordinates.
Table to Polyline	Creates polyline features from tabular coordinates.

An overview of the Distance and Direction toolset

This toolset allows analysts to create range rings from an interval or a minimum and maximum distance.

Tool	Description
Range Rings (from Interval)	Create a concentric circle from a center, with a number of rings, and the distance between rings.
Range Rings from Minimum Maximum	Create two range rings from a center with a minimum and maximum range.
Range Rings from Minimum Maximum Table	Create two range rings from a center with a minimum and maximum range from a table.

An overview of the Visibility toolset

This toolset allows analysts to better understand how the terrain affects relationships between observer and target positions.

Tool	Description
Add LLOS	Adds `height` field to observer and target point features before they are used in Linear Line of Sight.
Add RLOS Observer Fields	Adds the required visibility modifier fields to a point feature class for use in Radial Line of Sight.
Find Local Peaks	The number of peaks to find within the Area of Interest. The number of peaks returned may be less than the input value depending on the number of peaks in the area. You must enter a whole number.
Highest Points	Finds the maximum elevation value of a surface within a defined area.
Linear Line of Sight	Creates a line drawn between two points, an origin and a target, that is compared to a surface to show whether the target is visible from the origin and, if it is not visible, where the view is obstructed.
Lowest Points	Finds the minimum elevation value(s) of a surface within a defined area.
Radial Line of Sight	Creates a viewshed by finding the locations visible from one or more specified observer locations.