3D Analysis Tools and Visualization with ArcGIS

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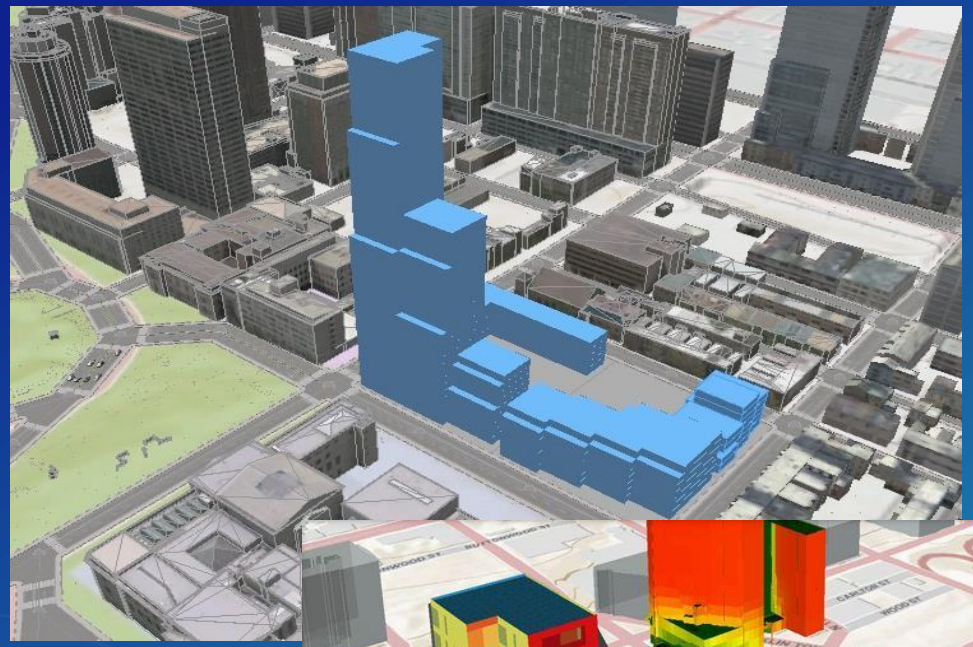
Why 3D GIS?

Because our world is 3D



Improve understanding

3D is easy for everyone to understand

Solve 3D problems

Some spatial problems can only be solved in 3D

Better communication

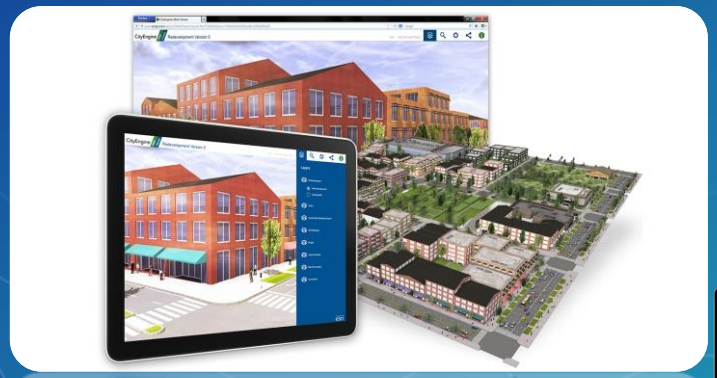
3D makes it easier to articulate ideas

What can you do with ArcGIS 3D?

Multiscale 3D Models

ArcGIS for 3D Cities

3D Geodesign

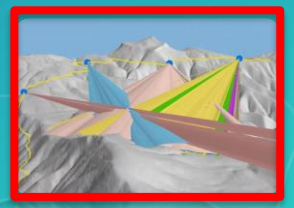


Share 3D scenes

Native lidar support

Surface modeling

Integrated 3D



3D Analysis

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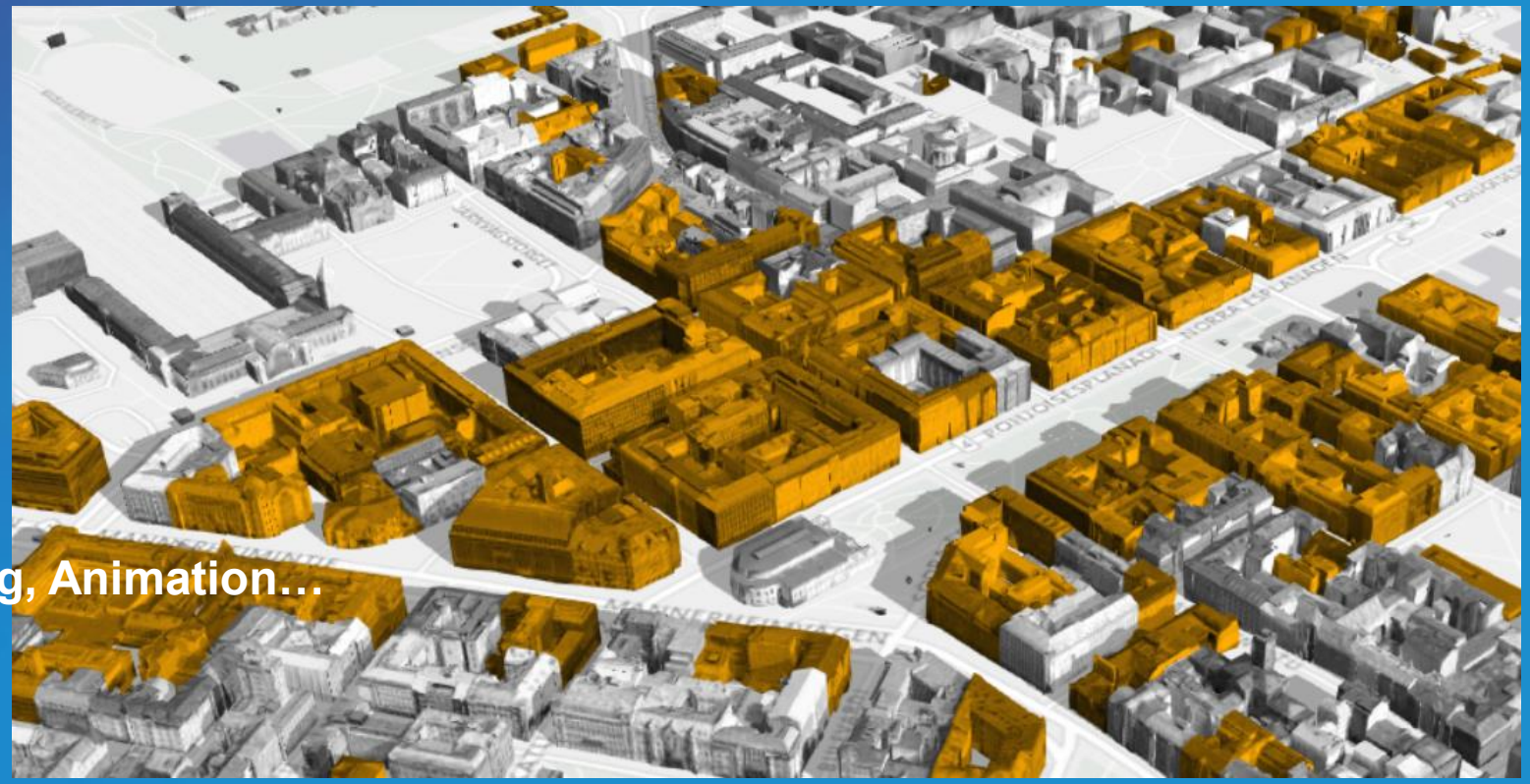
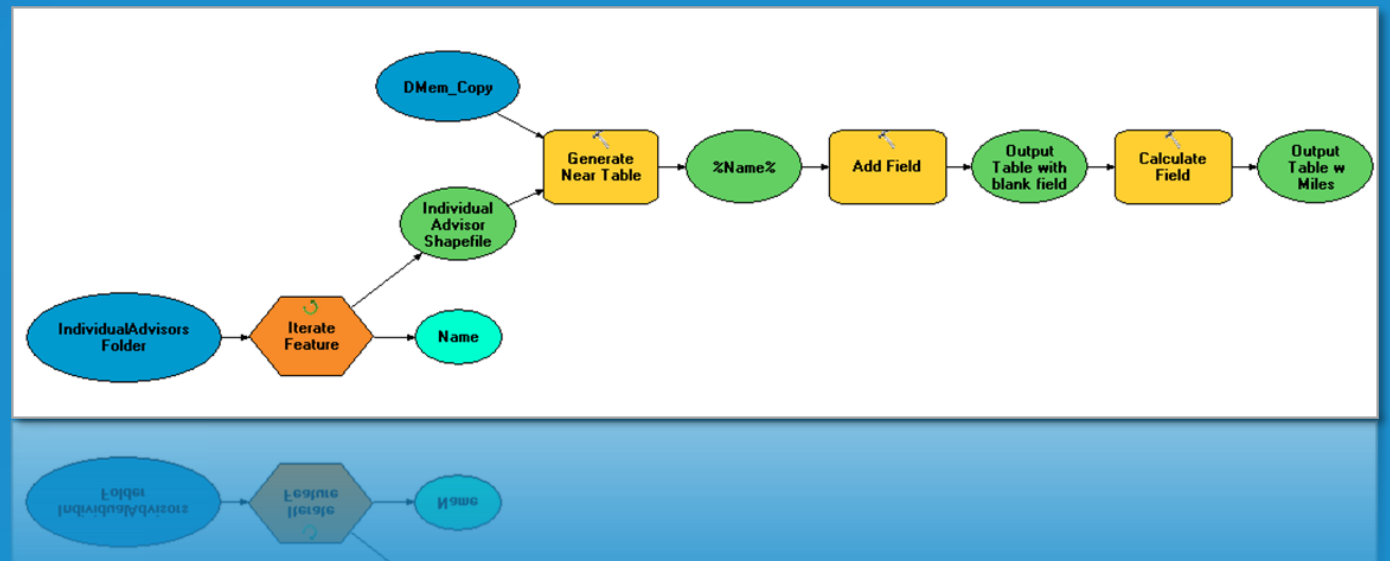
- What is 3D Analyst?
- 3D Visualization
  - ArcGlobe
  - ArcScene
  - 3D Symbology, 3D Editing, Animation…
  - Demo (ArcGlobe)
  - ArcGIS Pro
  - Demo (ArcGIS Pro)
- 3D Geoprocessing
  - Data processing
  - Surface analysis
  - Feature-oriented tools
  - Demo





What is 3D Analyst?

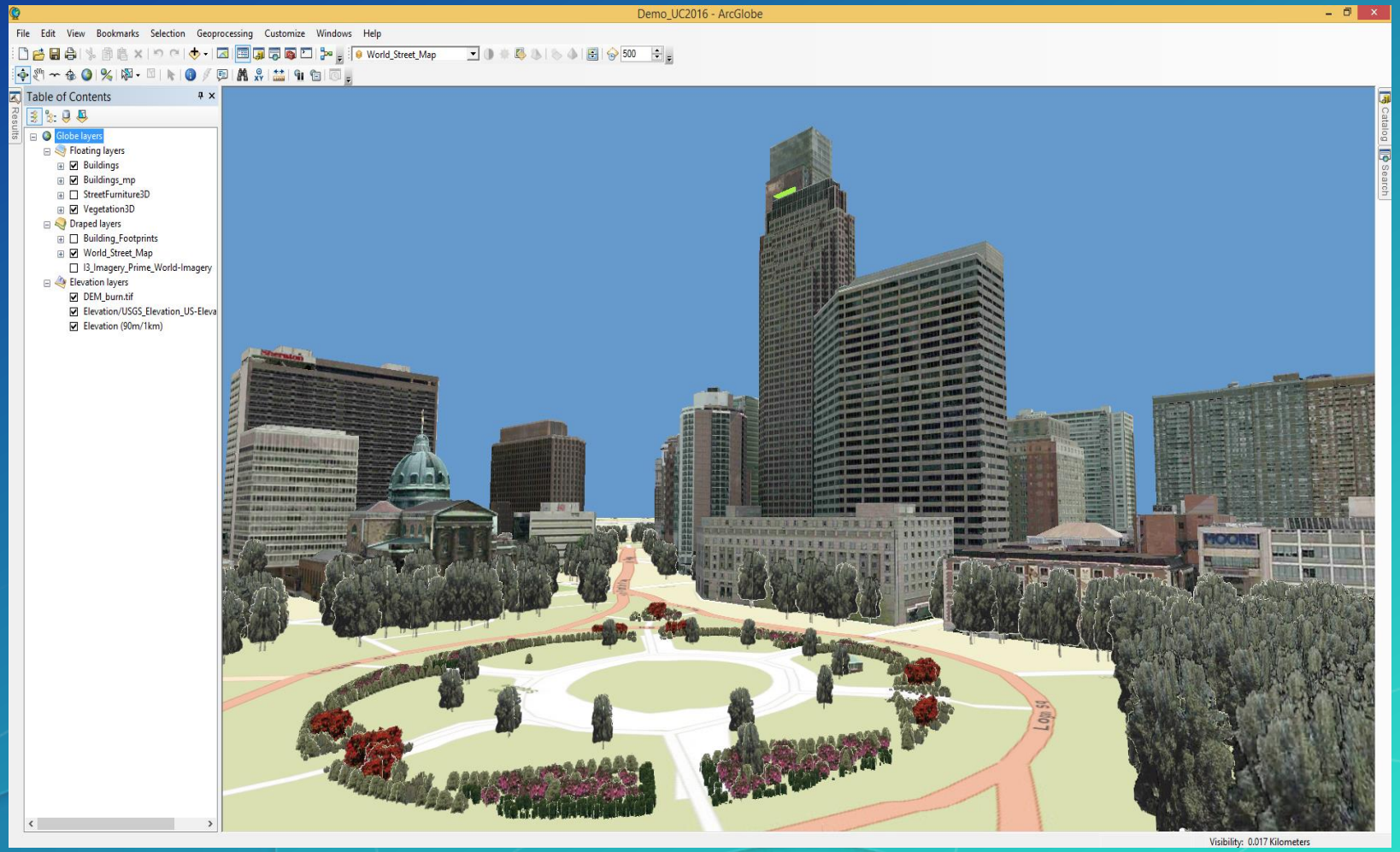
- ArcGIS extension that provides capabilities for:
  - Interactive 3D Visualization of spatial data
  - 3D Editing of feature data
  - 3D Geoprocessing tools
  - Publish globe services (ArcGIS Server)
  - Publish globe documents (Publisher toolbar) for use in ArcReader
  - Export ArcScene documents to 3D web scenes

Data Types

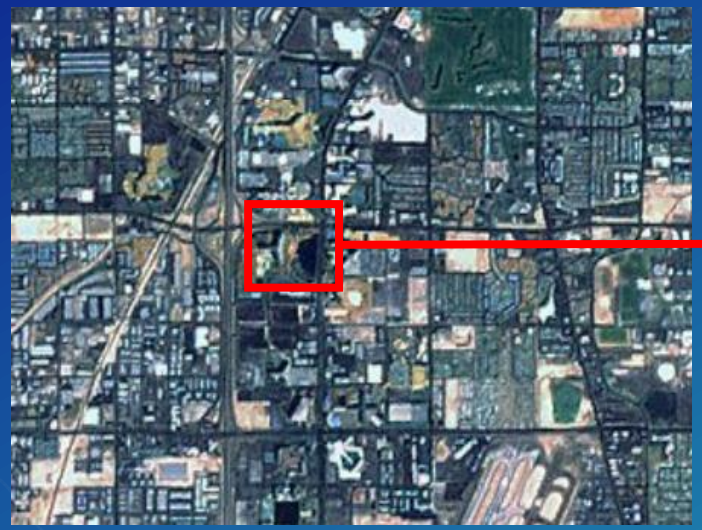
- Vector features
  - Points, lines, polygons, and multipatches
- Surface types
  - Triangular Irregular Networks (TINs)
  - Raster surfaces
  - Terrain datasets
  - LAS datasets (LASD)

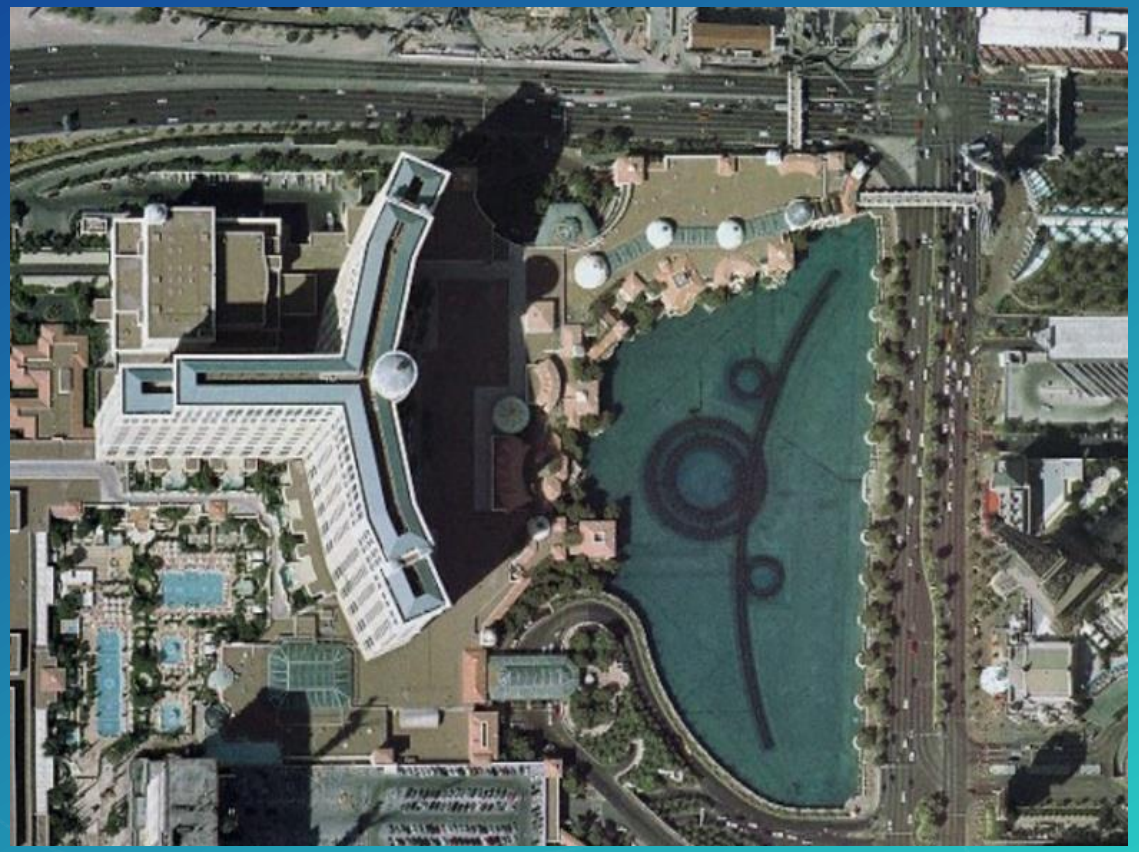
ArcGlobe

- 3D visualization application
  - Data placed on 3D globe
  - Map like & oblique views
- Integrated topography
  - One logical ‘globe surface’
  - One multi-resolution mesh
- Caching
  - Disk cache and memory cache
  - Levels-of-detail (raster data)



ArcGlobe: Levels-of-detail



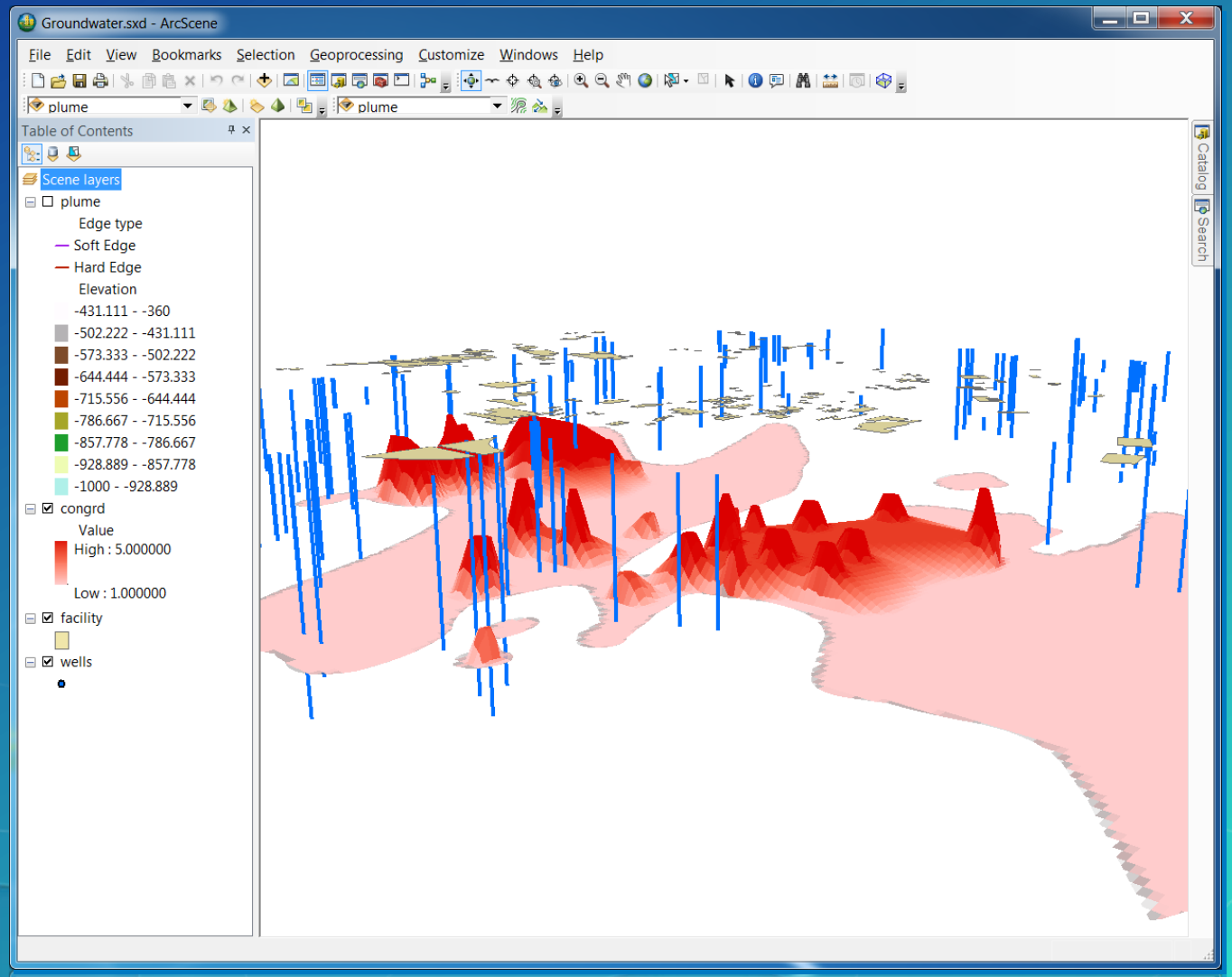


Far
(less detail)

Near
(more detail)

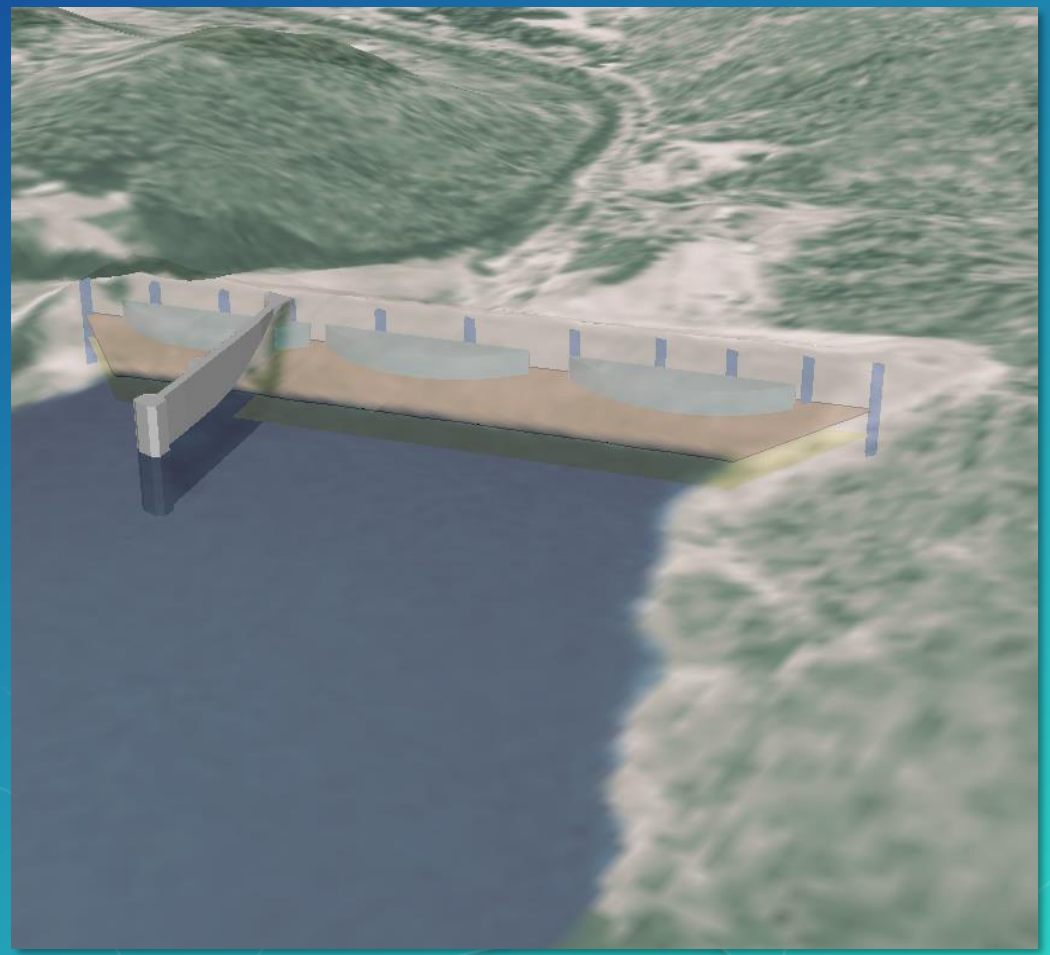
ArcScene

- 3D visualization application
- Memory based application
- Better for smaller study areas
- Export to 3D web scene (.3ws)



3D Effects Toolbar

- Real-time feedback for
  - Transparency
  - Front/backface culling
  - Lighting
  - Depth priority (ArcScene only)
  - Swipe tool (ArcGlobe only)
  - Flicker tool (ArcGlobe only)



3D Symbology

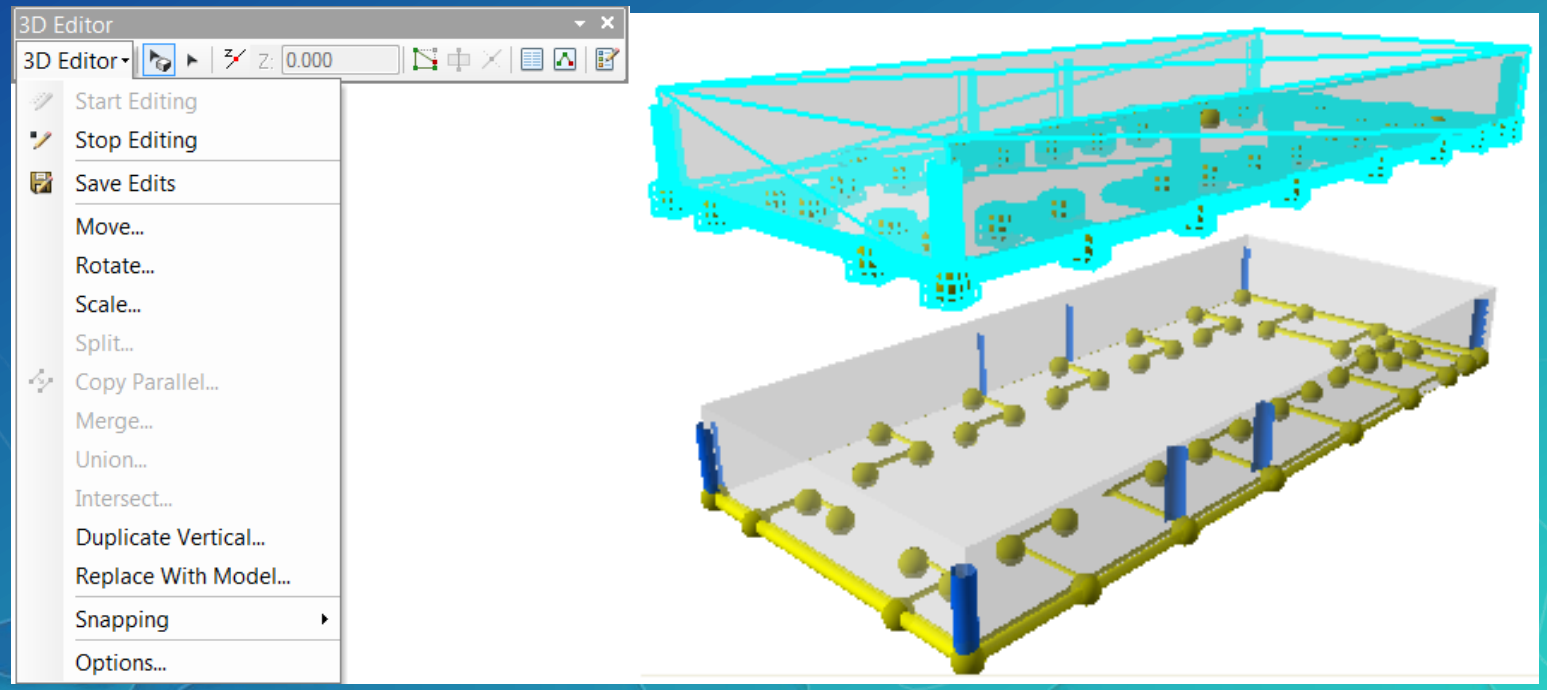
- Applied to feature data
- Add realism to your documents
- Match to symbols in style

3D Styles

- Points
  - 3D Geometric primitives: Spheres, Cones, etc.
  - 3D Models: Street furniture, Houses, etc.
  - 3D Character Markers
  - Import 3D models –
    - OpenFlight (*.flt), 3DS Max (*.3ds), Virtual Reality Markup Language (*.vrml), and SketchUp (*.skp), Collada (*.dae) models
- Lines
  - 3D Texture Line Symbols: Pavement, Concrete, etc.
  - 3D Geometric primitives (ArcScene): Tube, Strip, Wall etc.
- Polygons
  - 3D Texture Fill Symbols: grass texture...

3D Editing

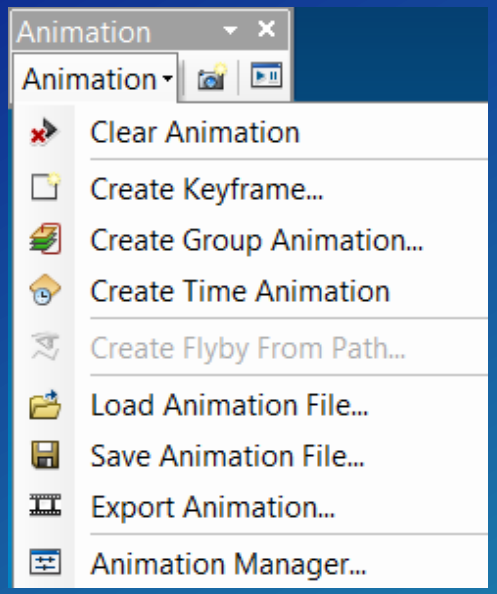
- Feature editing in ArcGlobe and ArcScene
- Template based editing
- Support for snapping

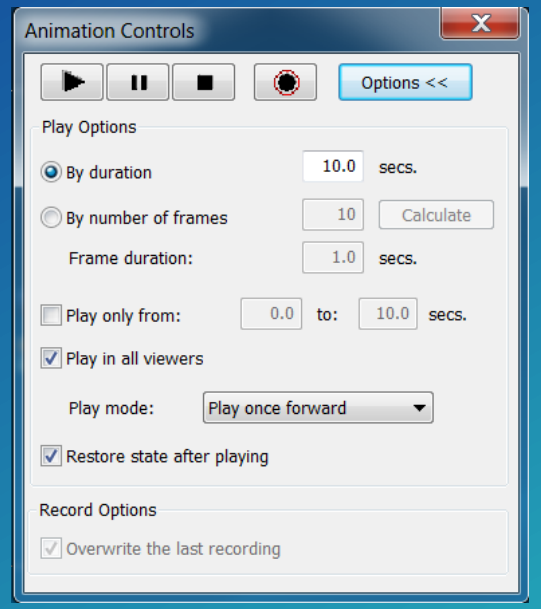


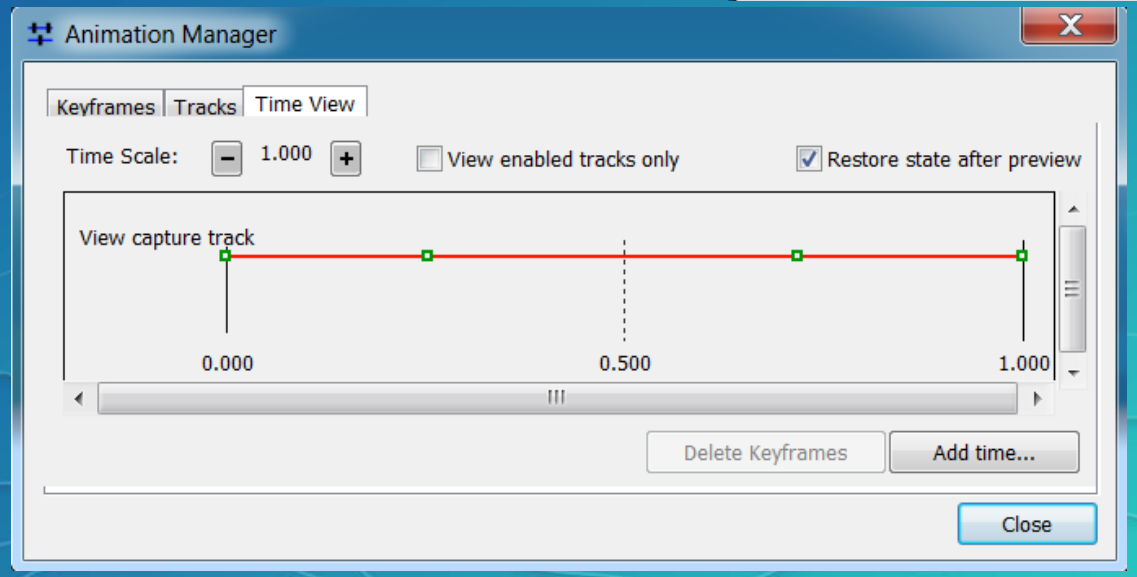
3D Graphics and KML support

- 3D Graphics Toolbar
  - Digitize points, lines, polygons and text graphics
  - Apply 3D Symbology to the graphic elements
- Keyhole MarkUp Language (ArcGlobe only)
  - Add KML data using the KML toolbar in ArcGlobe

Animation Tools







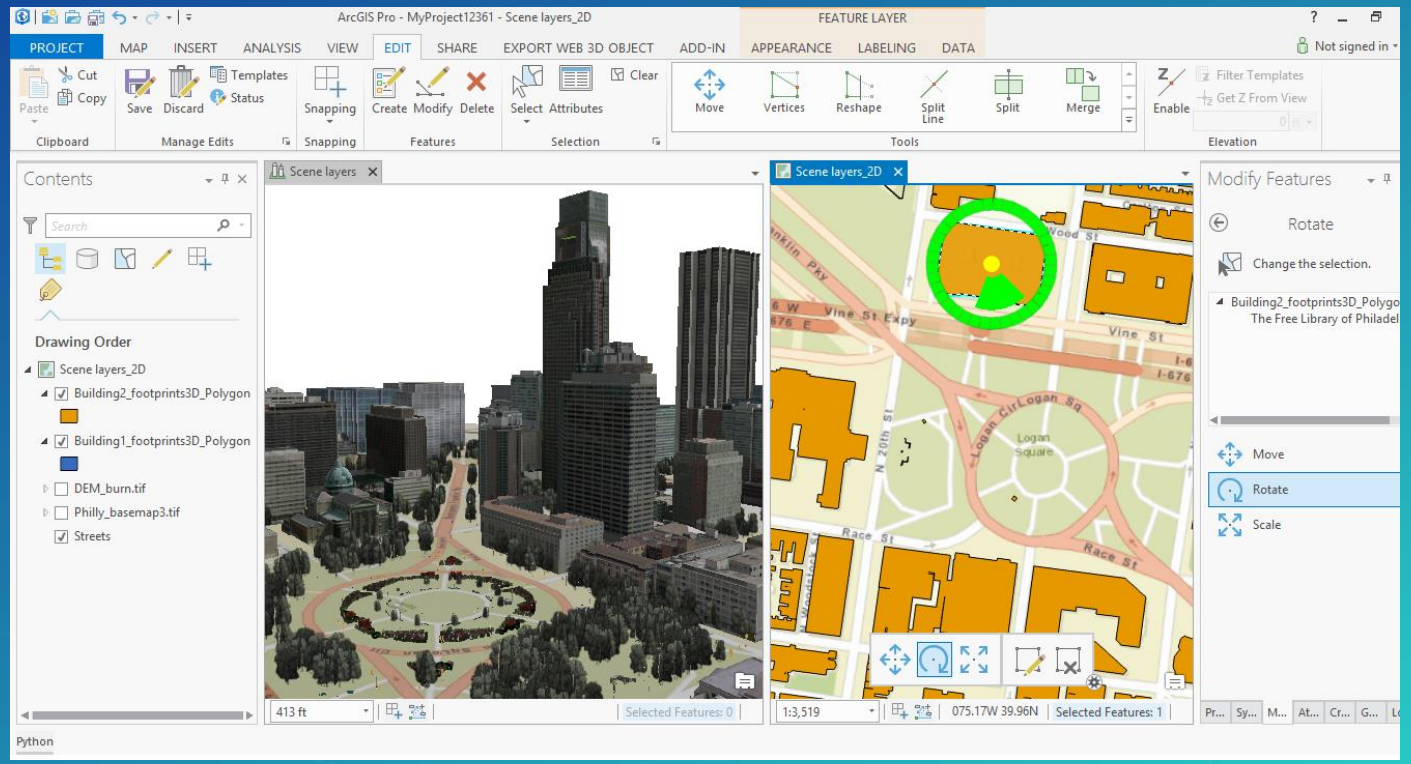
Customization framework

- Customization environments
  - C#, VB.NET, Java, etc.
- GlobeControl and SceneControl
  - Used in custom applications
  - Can easily view existing documents

Demo - ArcGlobe

ArcGIS Pro

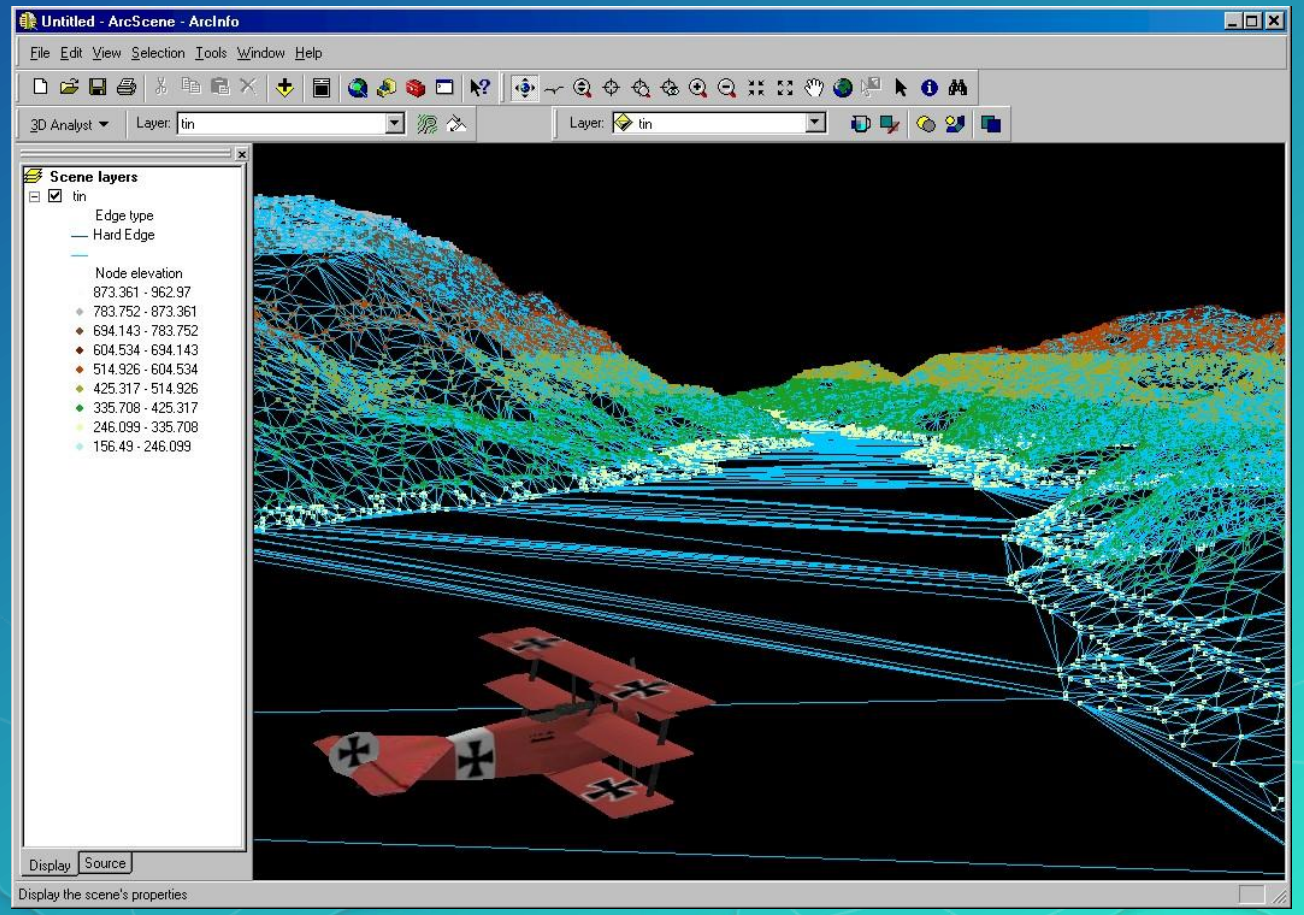
- 64-bit desktop application
- Multithreaded processing
- New graphics engine
- Modern user interface
- Visualize, design, edit (2D/3D)
- Geoprocessing tools
- Share
- Customize
  - SDK for Microsoft .NET
  - ArcPy



Demo – ArcGIS Pro

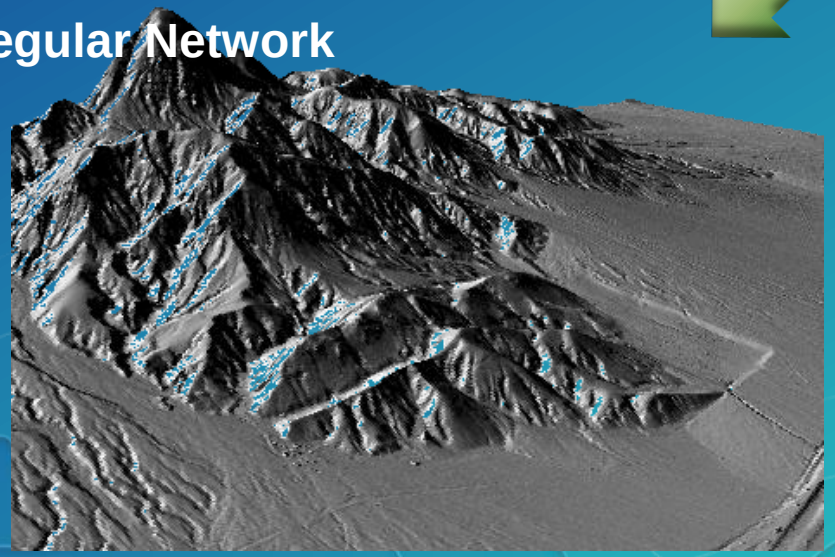
Why 3D Analyst?

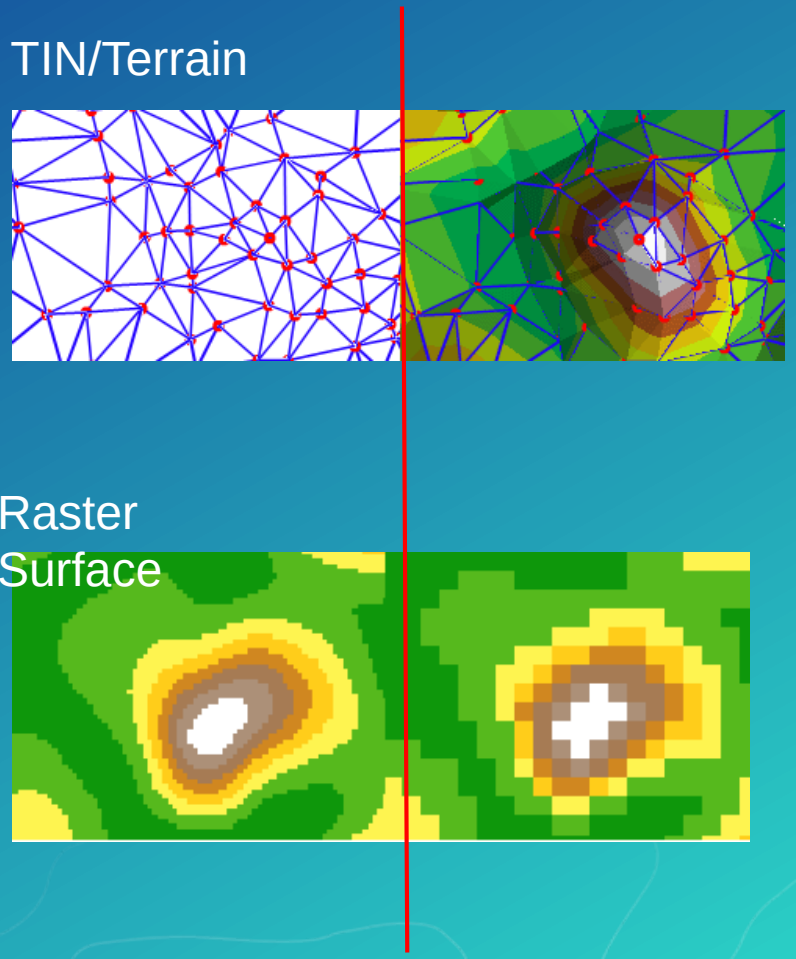
- Visualize Data, 2D and 3D
- Surface Creation & Analysis
- 3D Operators and Visibility Tools
- Conversions



What Is a Surface?

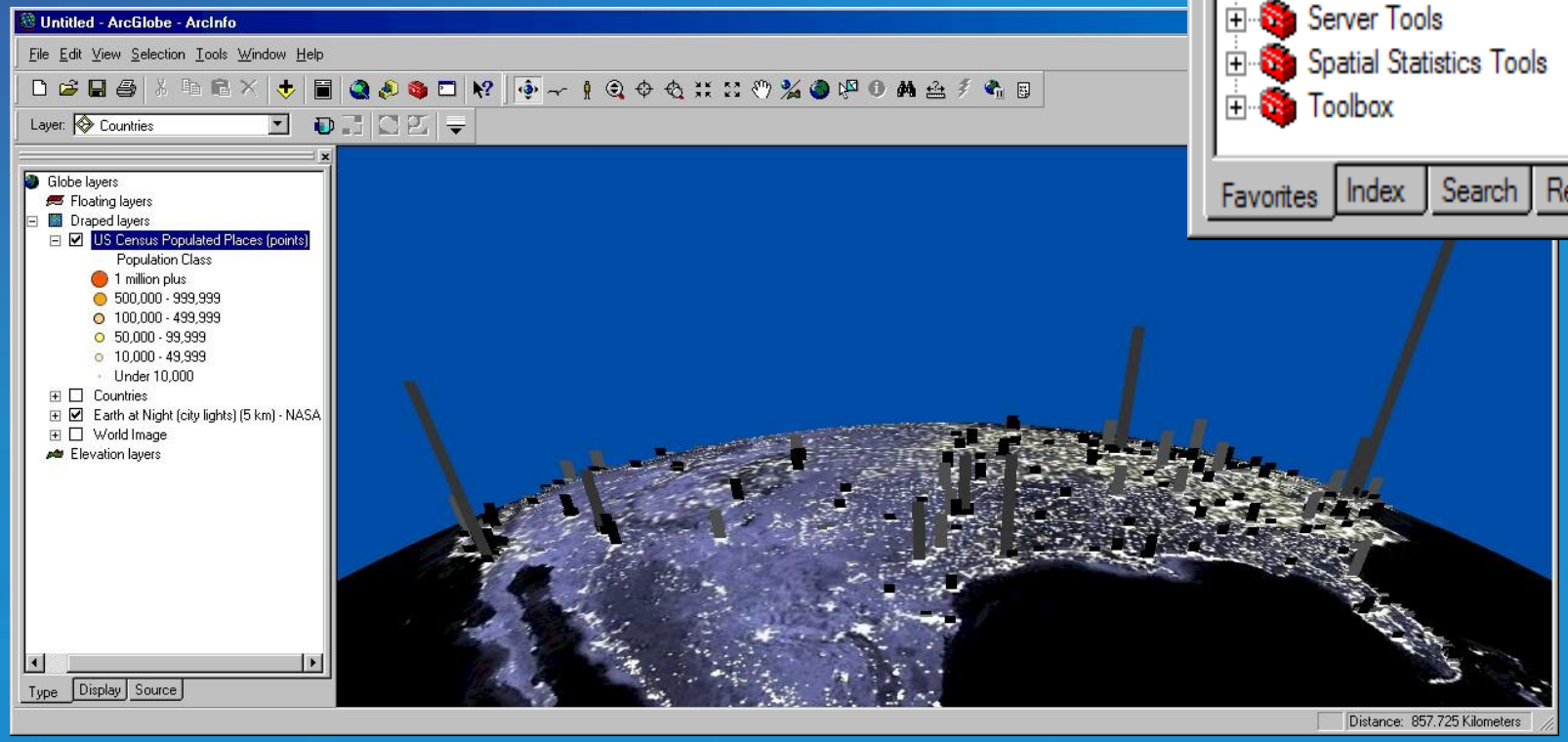
- Functional Surface
  - f(X) = aX + b
  - Z = a + bX + cY
- Raster Surface
- TIN Surface
  - Triangulated Irregular Network
- Terrain
- Las Dataset

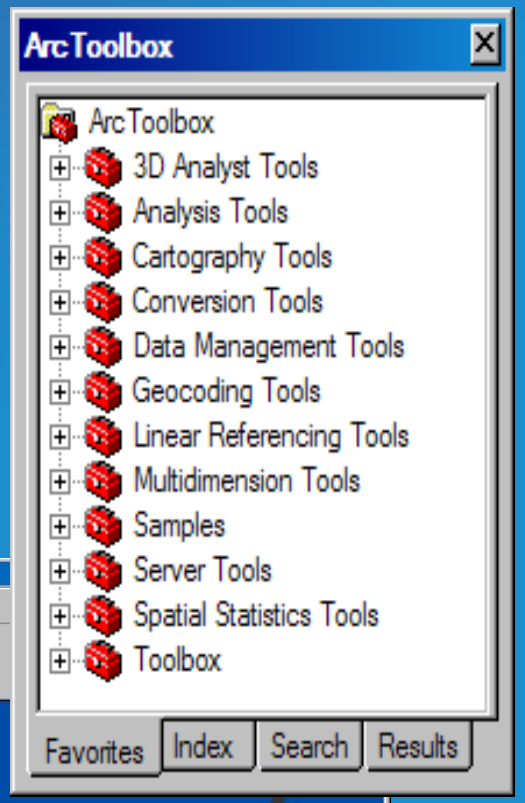


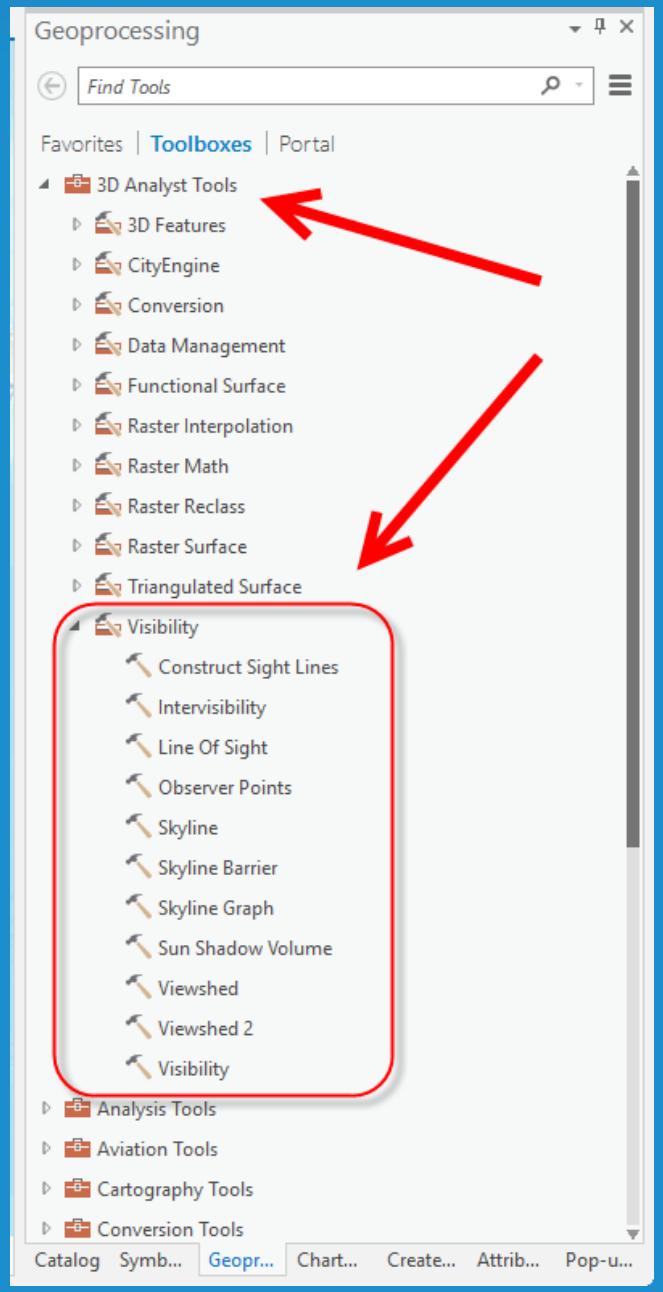


Why GeoProcessing?

- Prepare data for visualization and analysis
- Performing surface & visibility analysis
- Batch/non-interative data processing

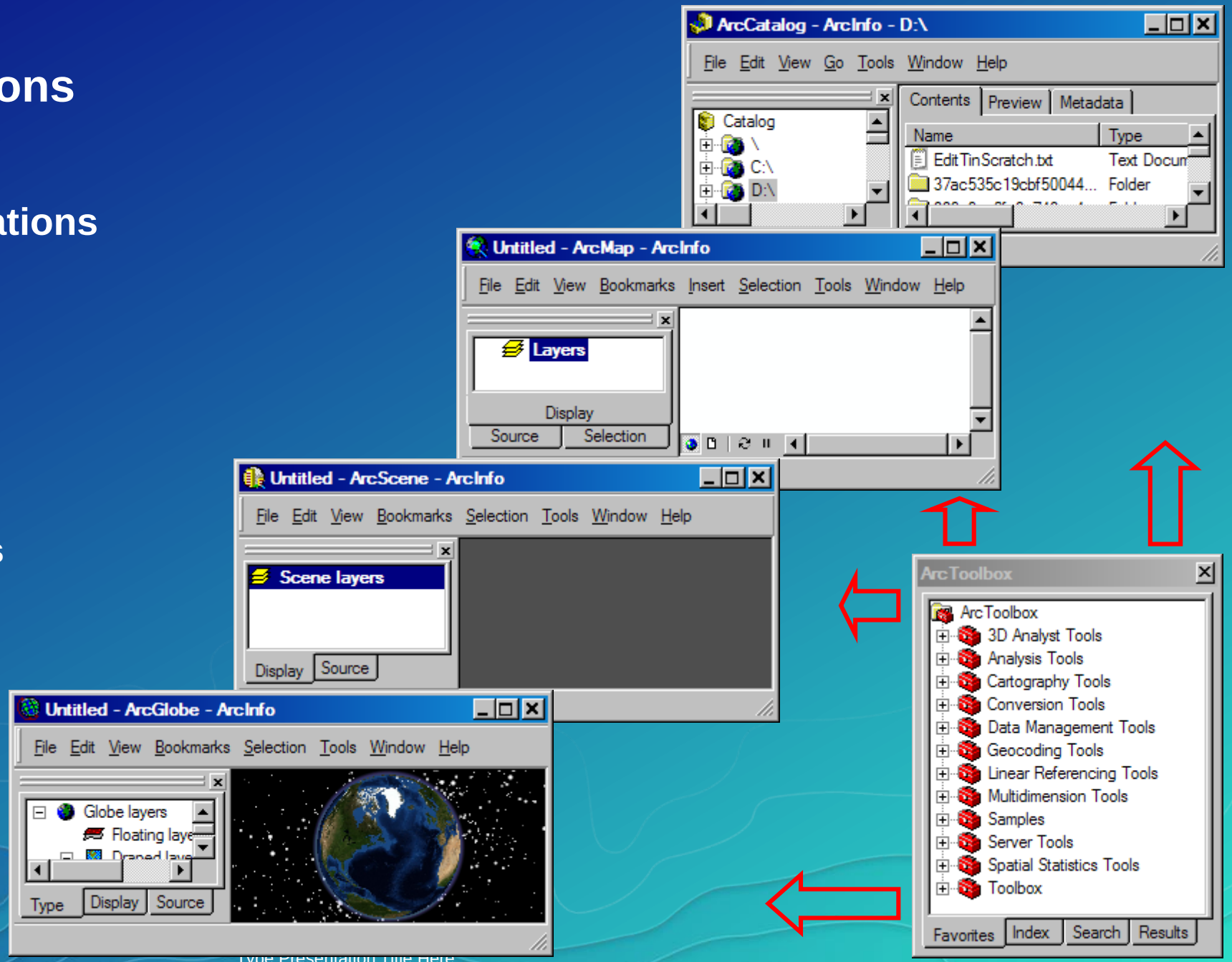






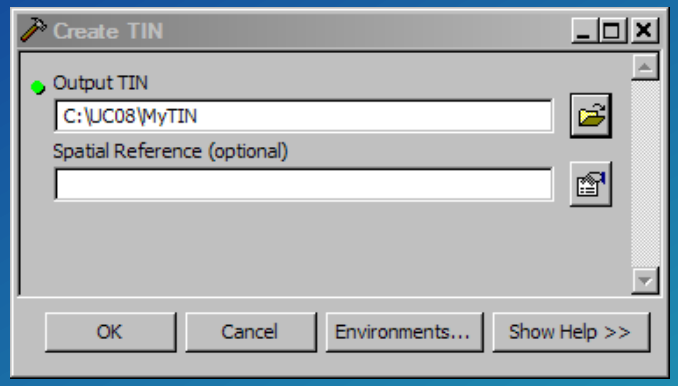
Host Applications

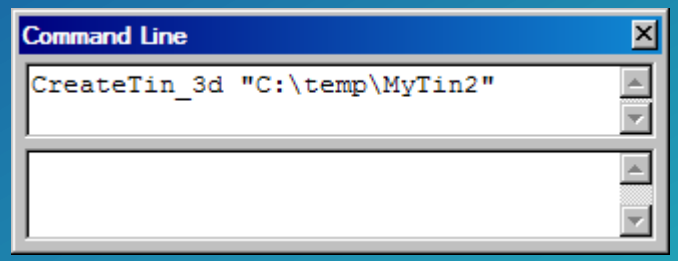
- Desktop applications
  - ArcCatalog
  - ArcMap
  - ArcScene
  - ArcGlobe
- ArcGIS Server
  - As GP services
- ArcGIS Pro
  - All in one!

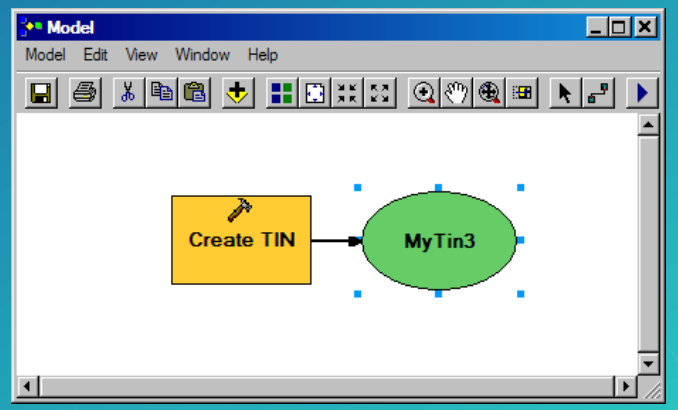


Different Ways to Run GP Tools

- How are they used?
  - Graphical user interface
  - Command line mode
  - Model Builder
  - Scripting





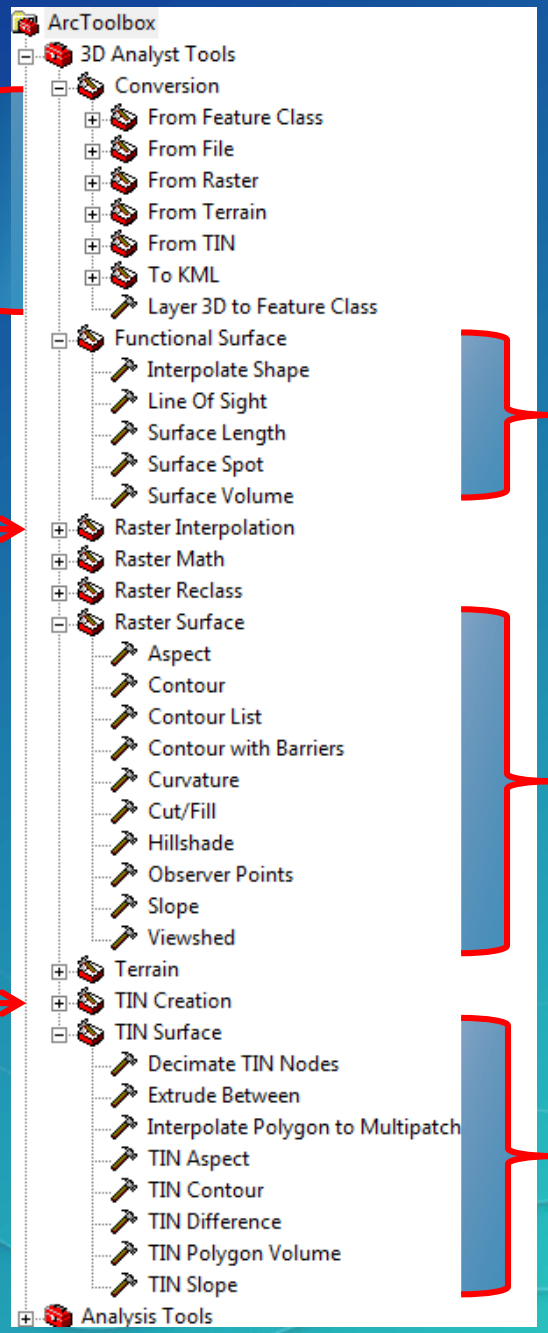


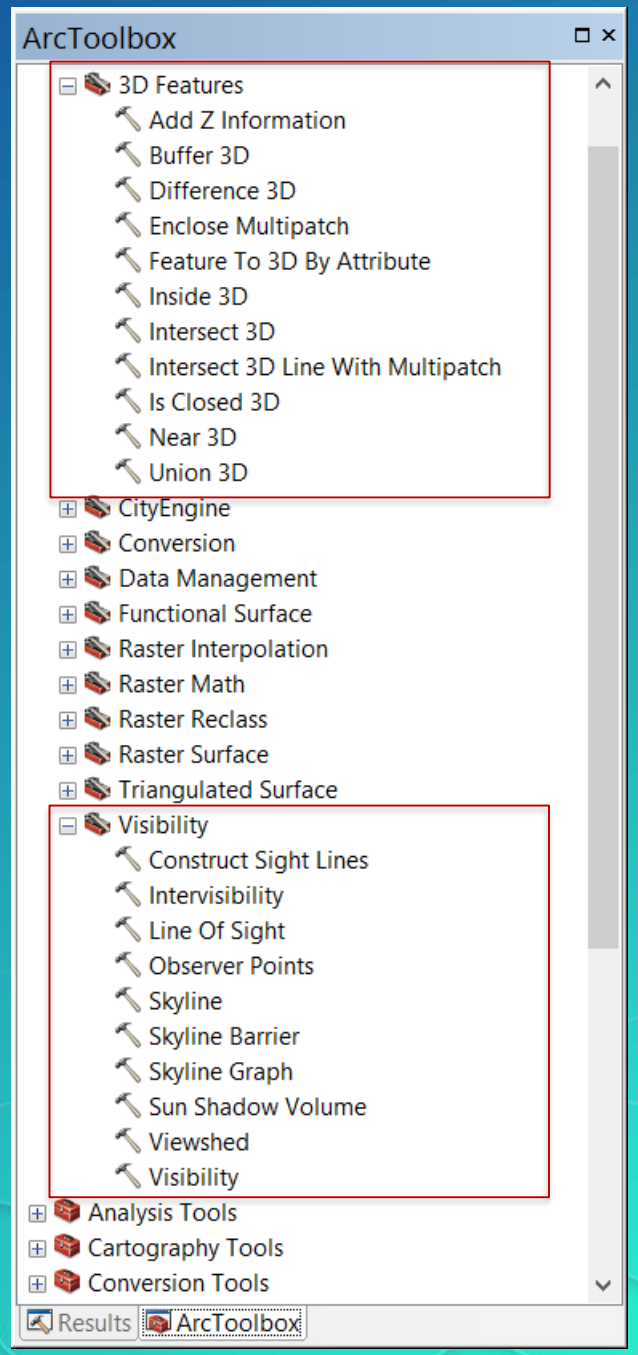
Python:

```
import arcgisscripting
gp = arcgisscripting.create()
gp.CheckOutExtension ("3D")
gp.workspace = "C:/UC09"
gp.toolbox = "3D"
gp.createtin_3d ("MyTin4")
```

Categorization of 3D GP Tools

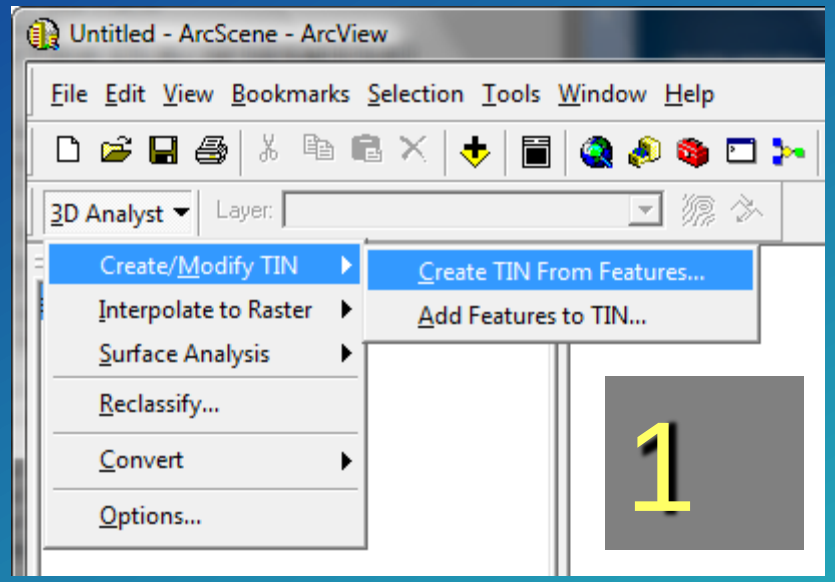
- How are they organized?
  - Toolbox
    - Toolset
      - Subset…
- 3D Analyst Tools Toolbox
  1. Data conversion/preparation
     - Text/binary files, Feature classes, Rasters, TIN-based data
  2. Surface creation
     - Raster interpolation, TIN/Terrain/LASD creation
  3. Surface analysis
     - Aspect/slope, Contour, Feature interpolation
  4. 3D operator & visibility
     - Intersect3D, Skyline, Intervisibility, and Sun Shadow analysis

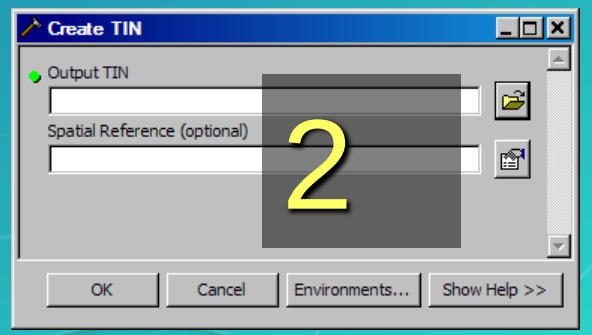




Task Levels

- **Level of GP tasks (from high to low)**
  - **UI/Model**
  - **Command line/scripting**
  - **ArcObjects**
- **Example: Creating a TIN Surface**
  1. **Using the 3D Analyst Toolbar, done by end users**
  2. **Using GP tools, done by power end users**
  3. **Using ArcObjects, done by customization developers**






```
Dim pDoc As IMxDocument: Set pDoc = ThisDocument
Dim pEnv As Ienvelope: Set pEnv = pDoc.ActivatedView.FullExtent
Dim pTinEdit As ITinEdit: Set pTinEdit = New Tin
pTinEdit.InitNew pEnv: pTinEdit.SaveAs "C:\temp\myTin"
pTinEdit.AddFromFeatureClass … …
```

3

Python:

```
>>> import arcpy
>>> arcpy.ddd.Import3DFiles("D:/data/boeing747.3ds", "D:/data/mydata.gdb/boeing747")
```

Demos

- Surface analysis primer
  - Common tasks
  - Surface types
- User interface
  - 3D Analyst Toolbar
  - 3D GP Toolbox
- Sample tools
  1. CreateTIN and EditTIN – TIN surface creation
  2. LineOfSight – linear visibility analysis
  3. Viewshed – areal visibility analysis on raster
  4. Interactive Profile – cross sections
  5. Skyline suite of tools

3D Analyst Geo-Processing Summary

- Prepare data for 3D visualization and surface analysis
  - Creating Surface
  - Surface Analysis
  - Conversion
  - 3D Feature and Visibility
- Provide a way for processing data on the UI or on batch mode
  - Application UI as Geo-Processing Tool Dialog
  - Command Line or Python Scripting
  - Model Builder
- Sample Tool Demo

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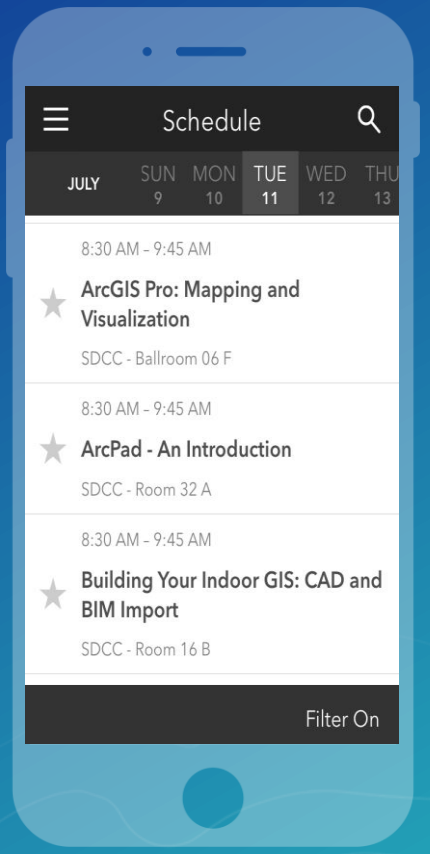
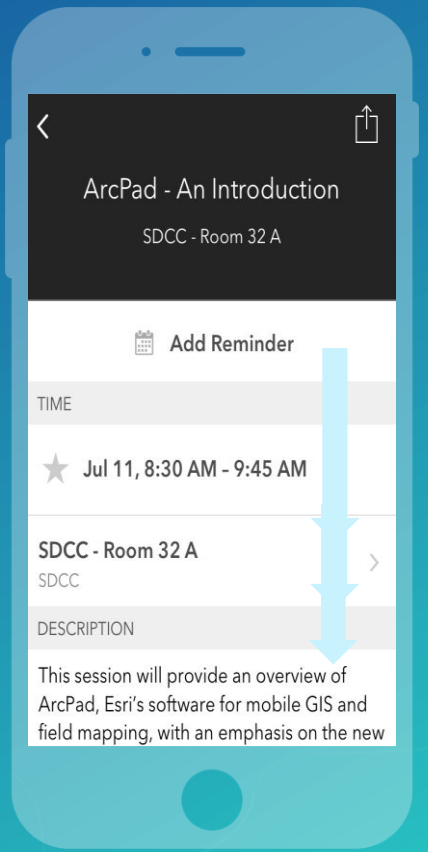
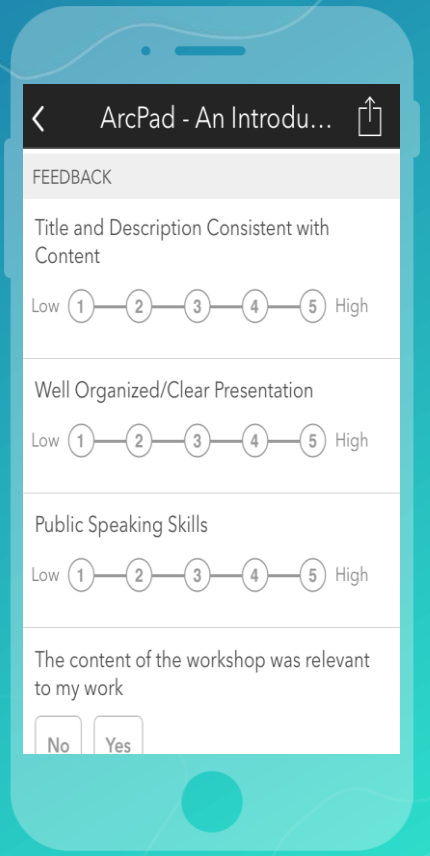


Scroll down to find the survey



Complete Answers and Select "Submit"



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