



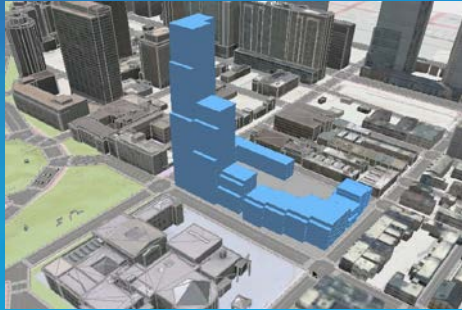
# 3D Analyst: An Introduction

Deepinder Deol

Jinwu Ma

# Why use 3D GIS?

*Because our world is 3D*



**Improve understanding**  
3D is easy for everyone to understand

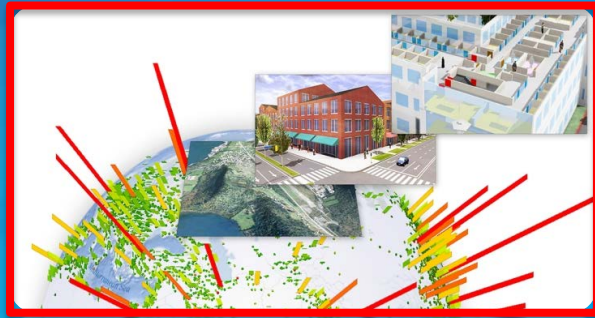


**Solve 3D problems**  
Some spatial problems can only be solved in 3D



**Better communication**  
3D makes it easier to articulate ideas

# What can you do with ArcGIS 3D?



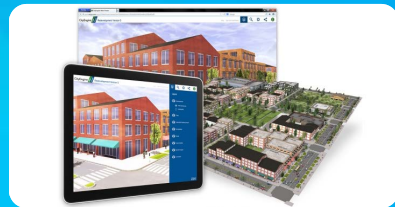
Multiscale 3D Models



3D Geodesign



ArcGIS for 3D Cities



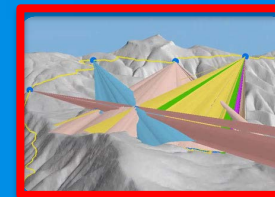
Share 3D scenes



Surface modeling



Native lidar support



3D Analysis



Integrated 3D

# Contents

- **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?

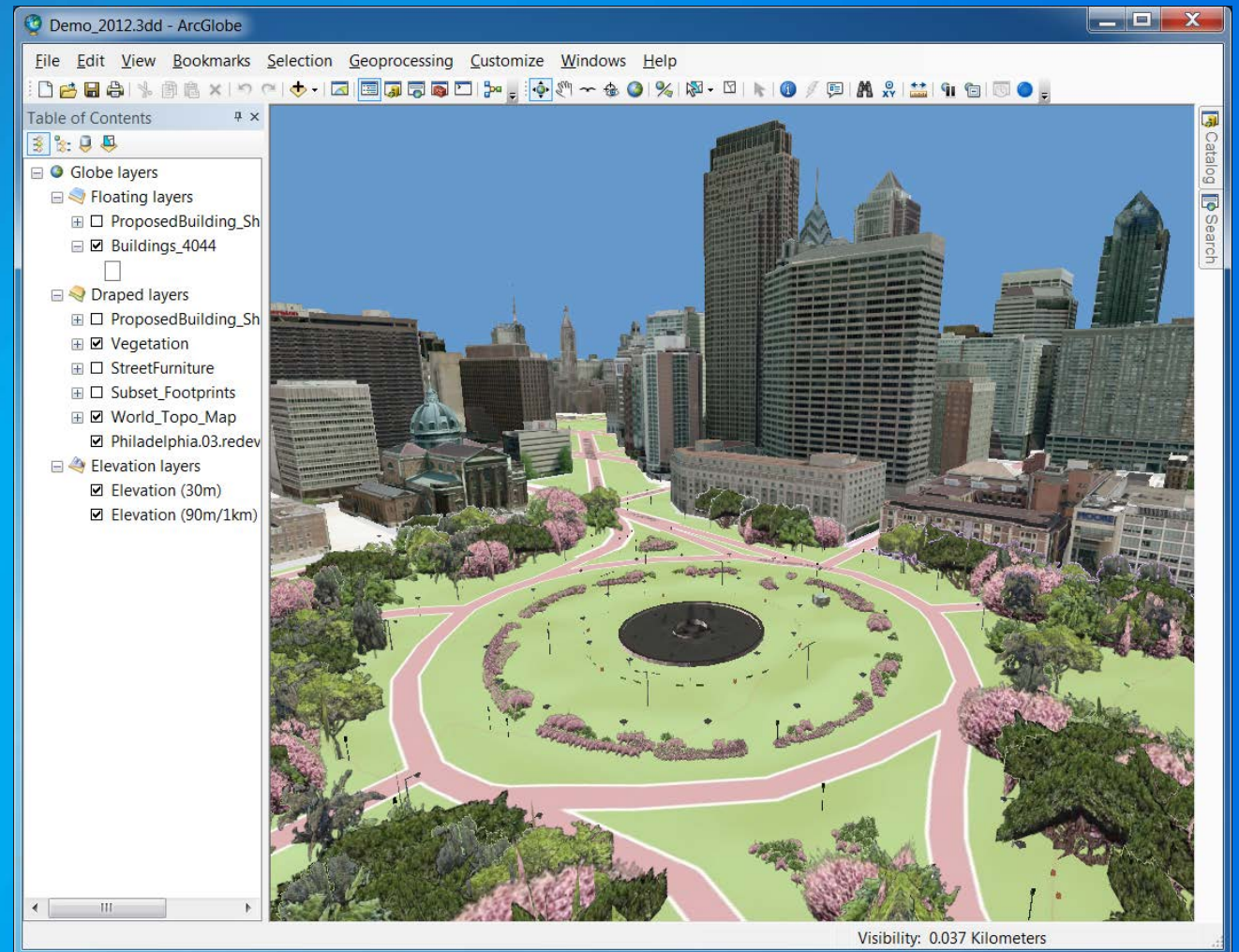
- **ArcGIS extension that provides capabilities for:**
  - **Interactive 3D Visualization of spatial data**
  - **3D Editing of feature data**
  - **3D Geoprocessing tools**
  - **Publish globe services (ArcGIS Server)**
  - **Publish globe documents (Publisher toolbar) for use in ArcReader**
  - **Export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

# Data Types

- **Vector features**
  - Points, lines, polygons, multipatches
- **Surface types**
  - Triangular Irregular Networks (TINs)
  - Rasters
  - Terrain datasets
  - LAS datasets

# 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)

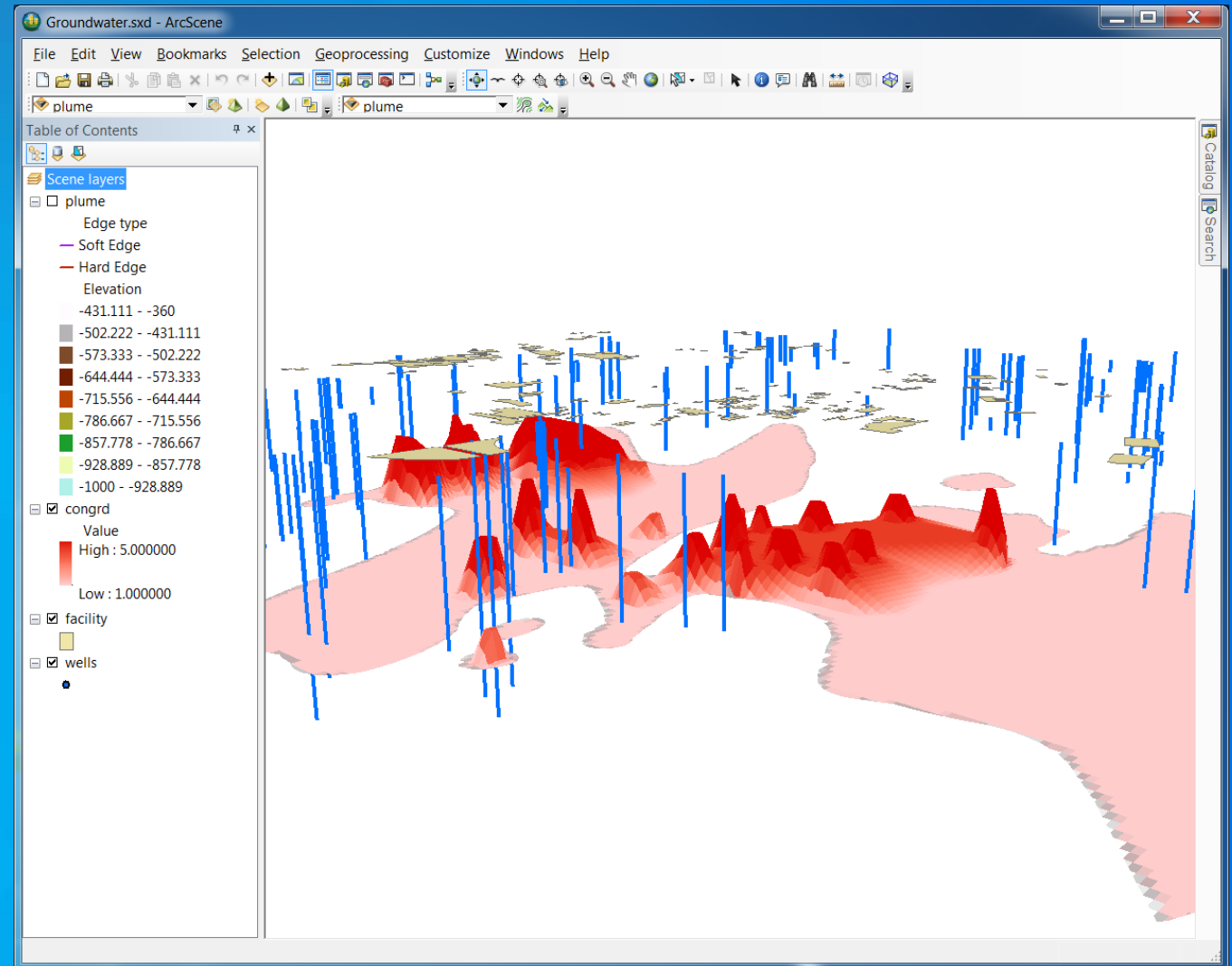


Near  
(more detail)



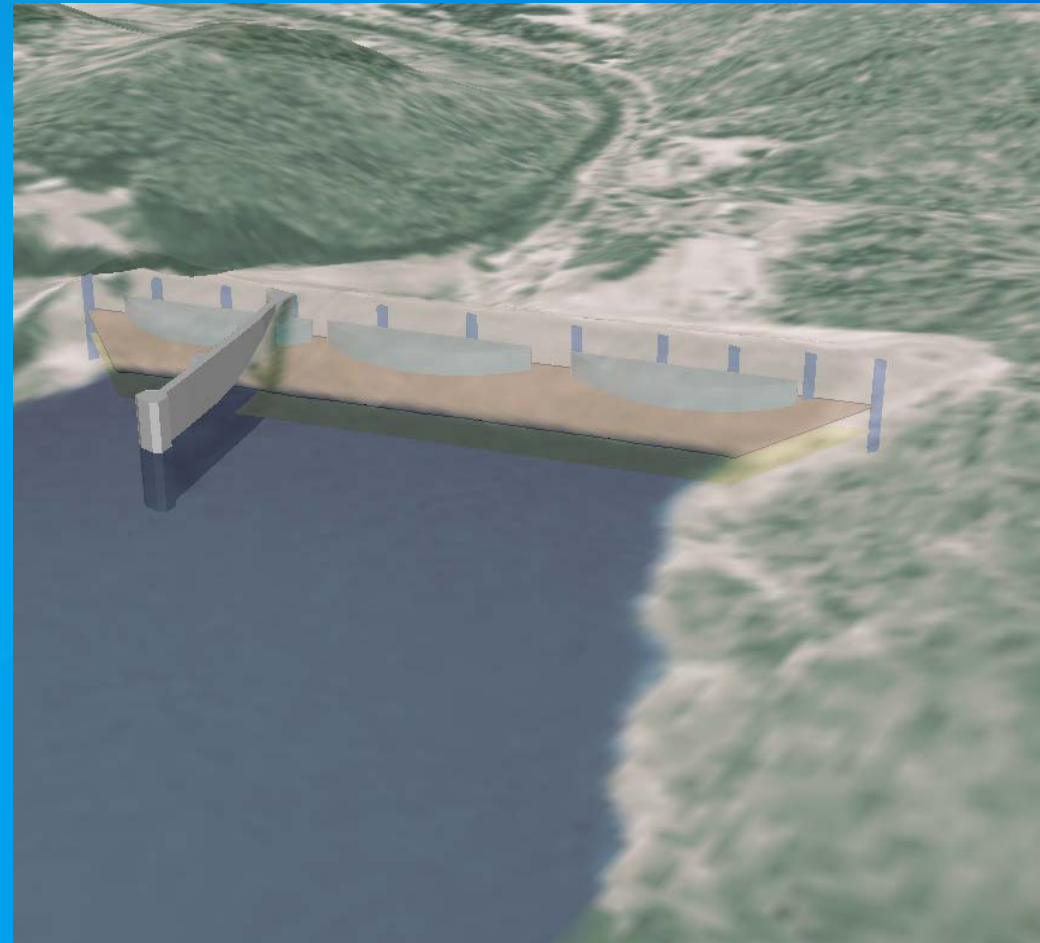
# ArcScene

- 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**

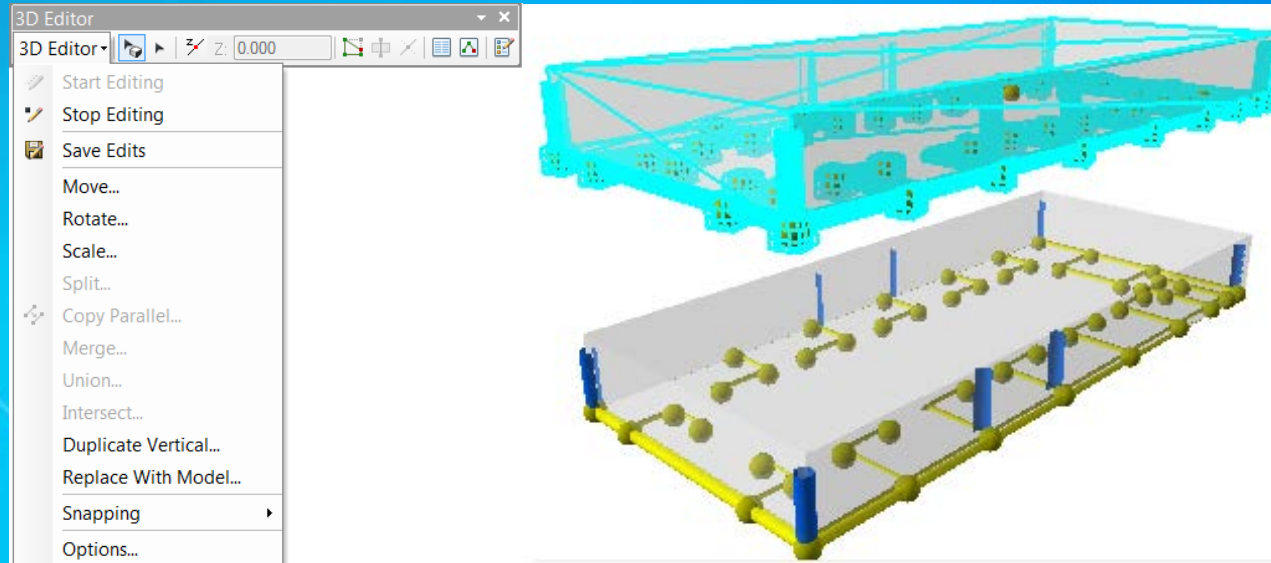
- 3D Texture Line Symbols: **Pavement, Concrete, etc.**
- 3D Geometric primitives (**ArcScene**): **Tube, Strip, Wall etc.**

- **Polygons**

- 3D Texture Fill Symbols: **grass texture...**

# 3D Editing

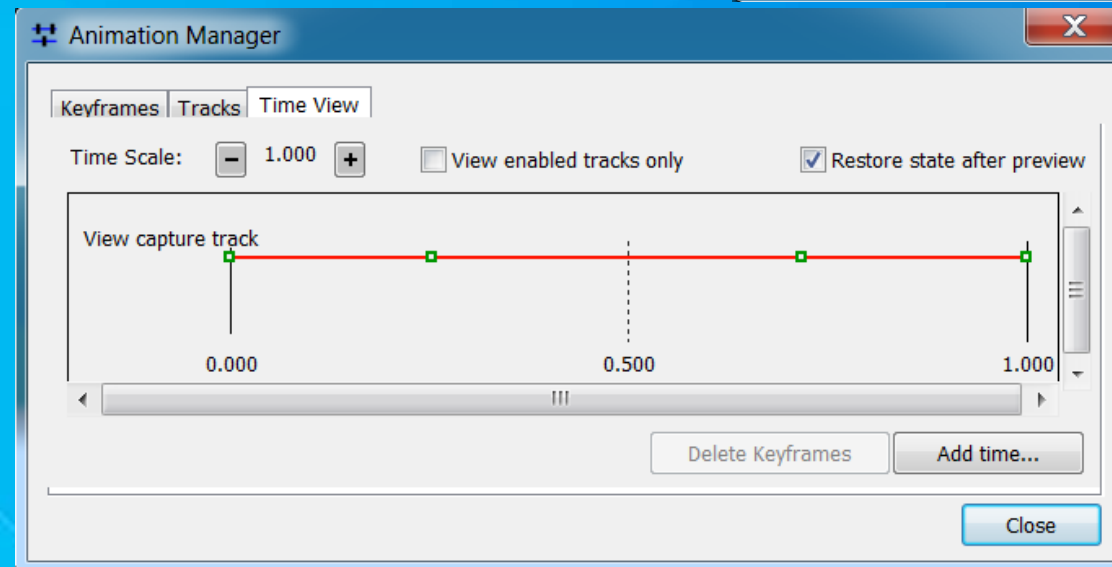
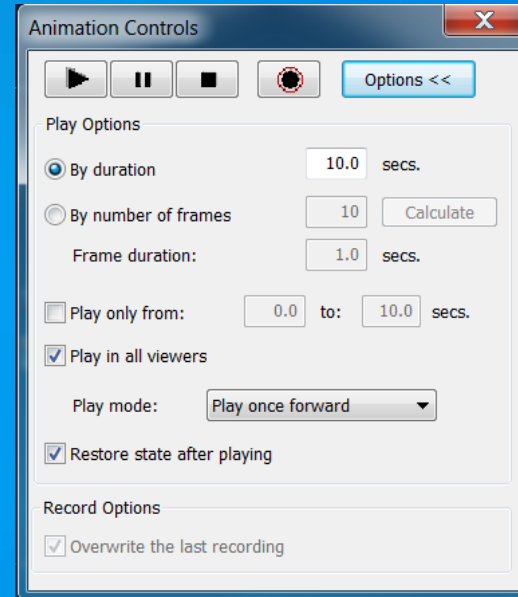
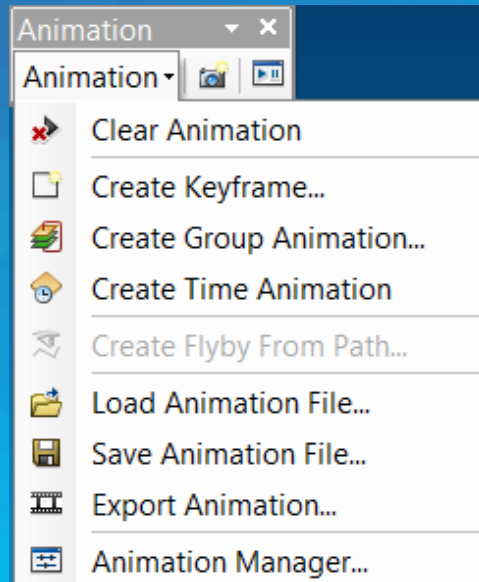
- Feature editing in ArcGlobe and ArcScene
- Template based editing
- Support for snapping



## 3D Graphics and KML support

- **3D Graphics Toolbar**
  - Digitize point, line, 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

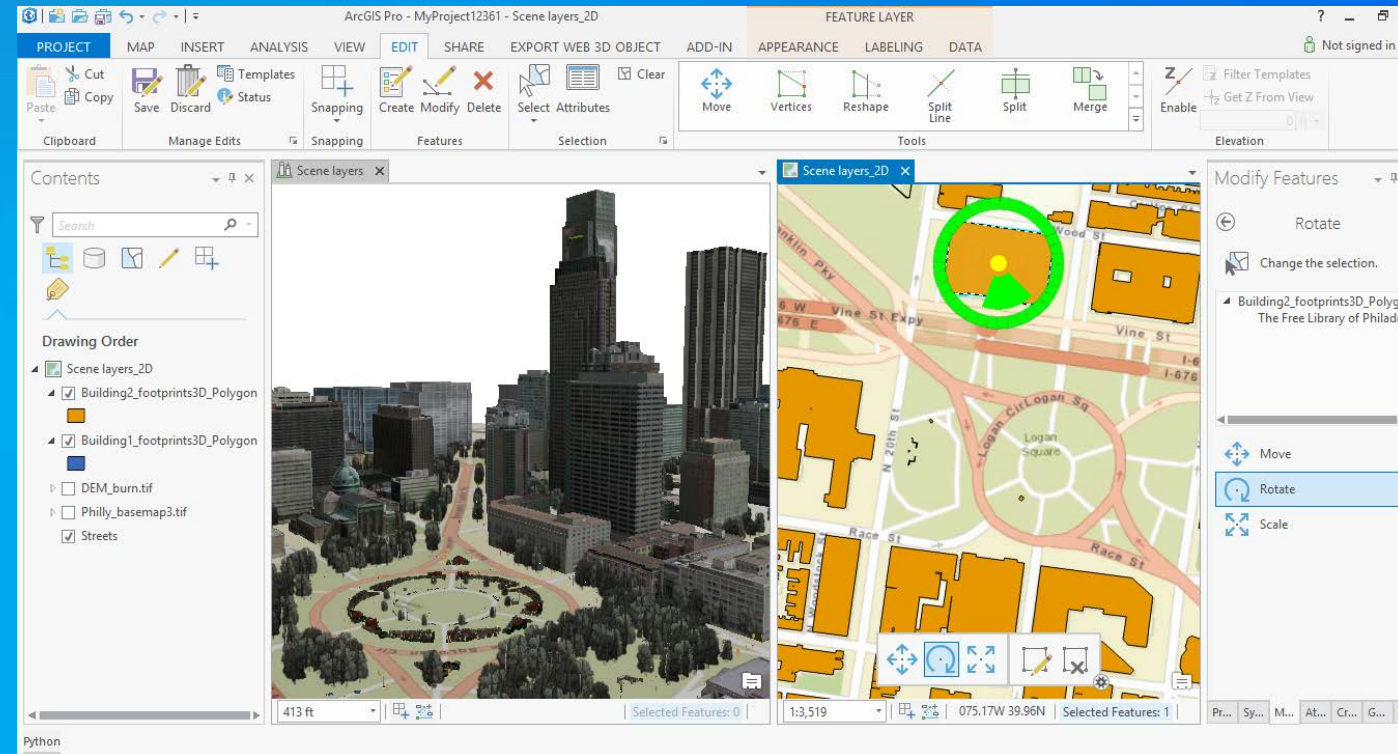
- **Customization environments**
  - Visual Basic for Applications (VBA) in ArcGlobe and ArcScene applications
  - C#, VB.NET, Java, C++, etc.
- **GlobeControl and SceneControl**
  - Used in custom applications
  - Can easily view existing documents



# Demo - ArcGlobe

# ArcGIS Pro

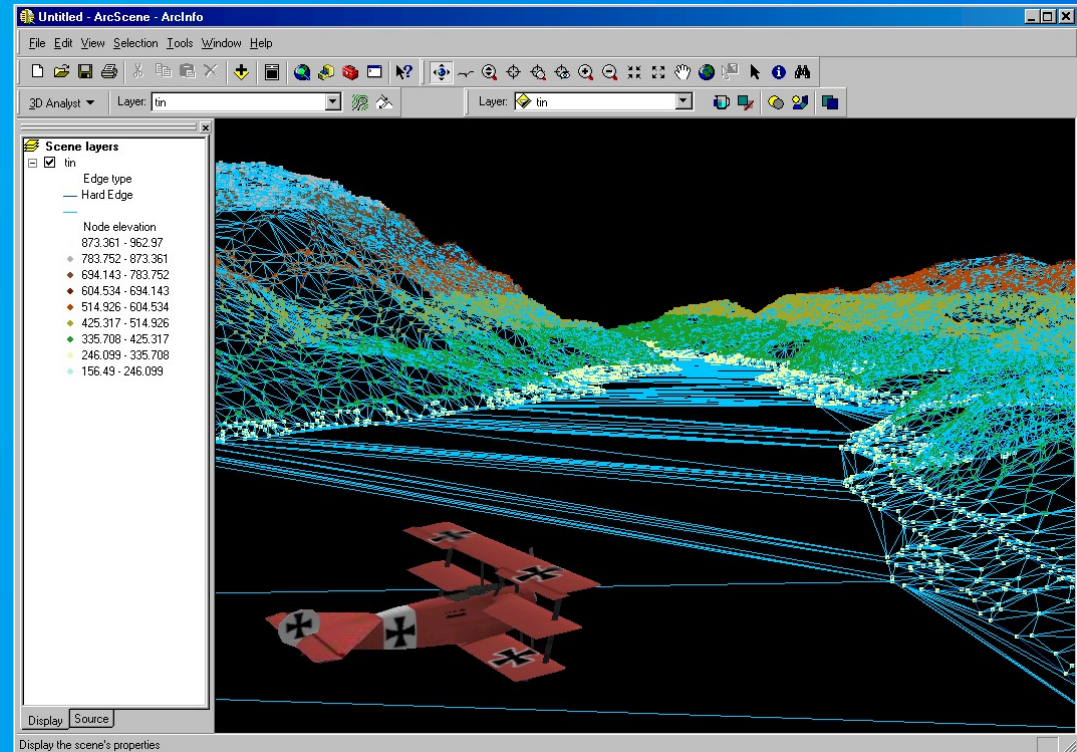
- 64-bit desktop application
- Multithreaded processing
- New graphics engine
- Modern user interface
- Visualize, design, edit (2D/3D)
- Geoprocessing tools
- Share
- Customize
  - SDK for Microsoft .NET
  - ArcPy



# 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**

- $f(X) = aX + b$
- $Z = a + bX + cY$

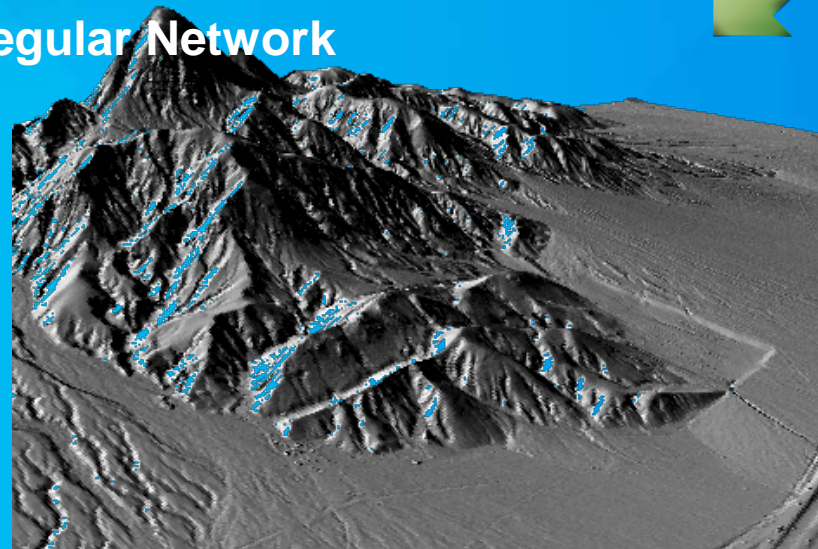
- **Raster Surface**

- **TIN Surface**

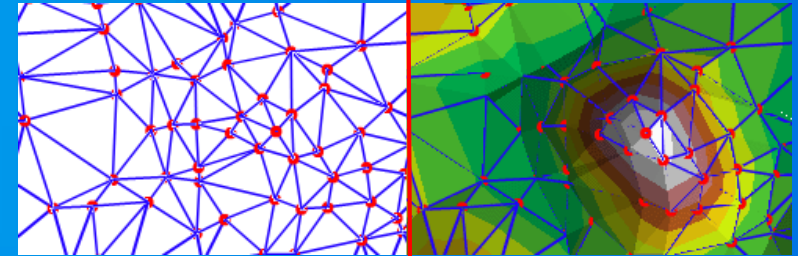
- **Triangulated Irregular Network**

- **Terrain**

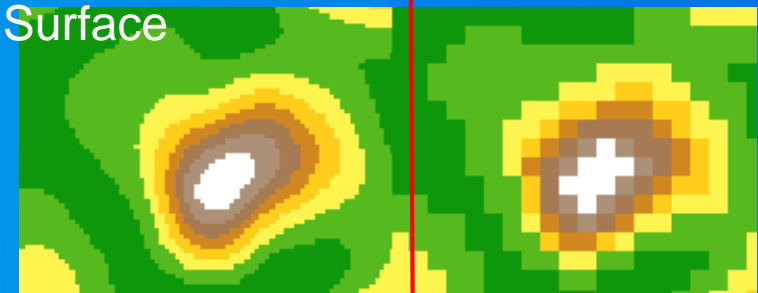
- **Las Dataset**



TIN/Terrain

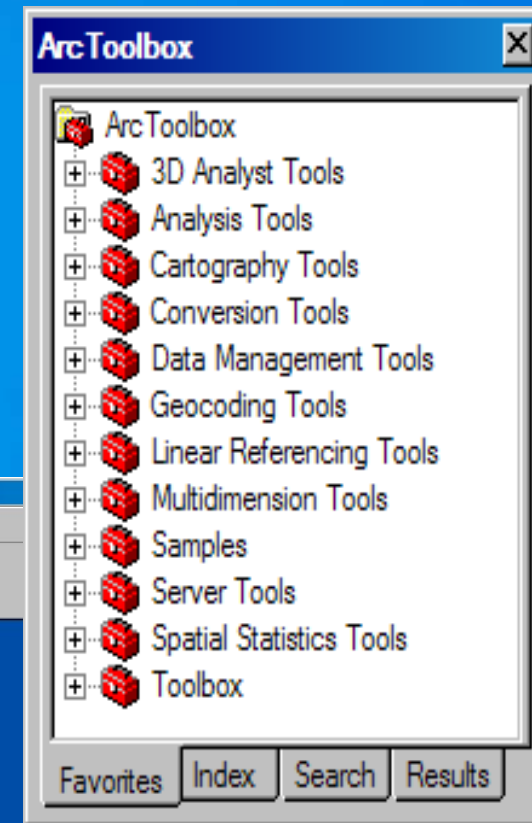
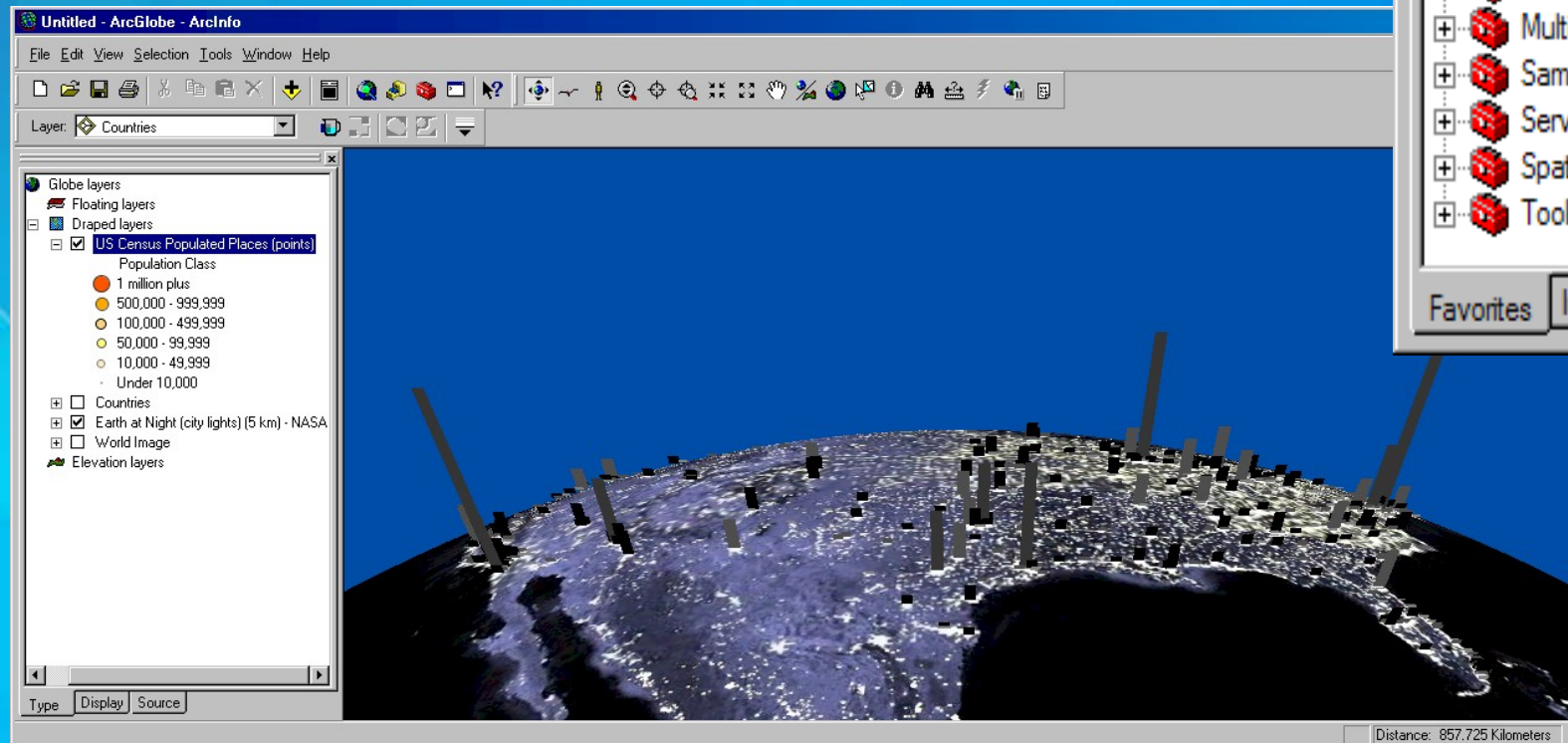


Raster  
Surface



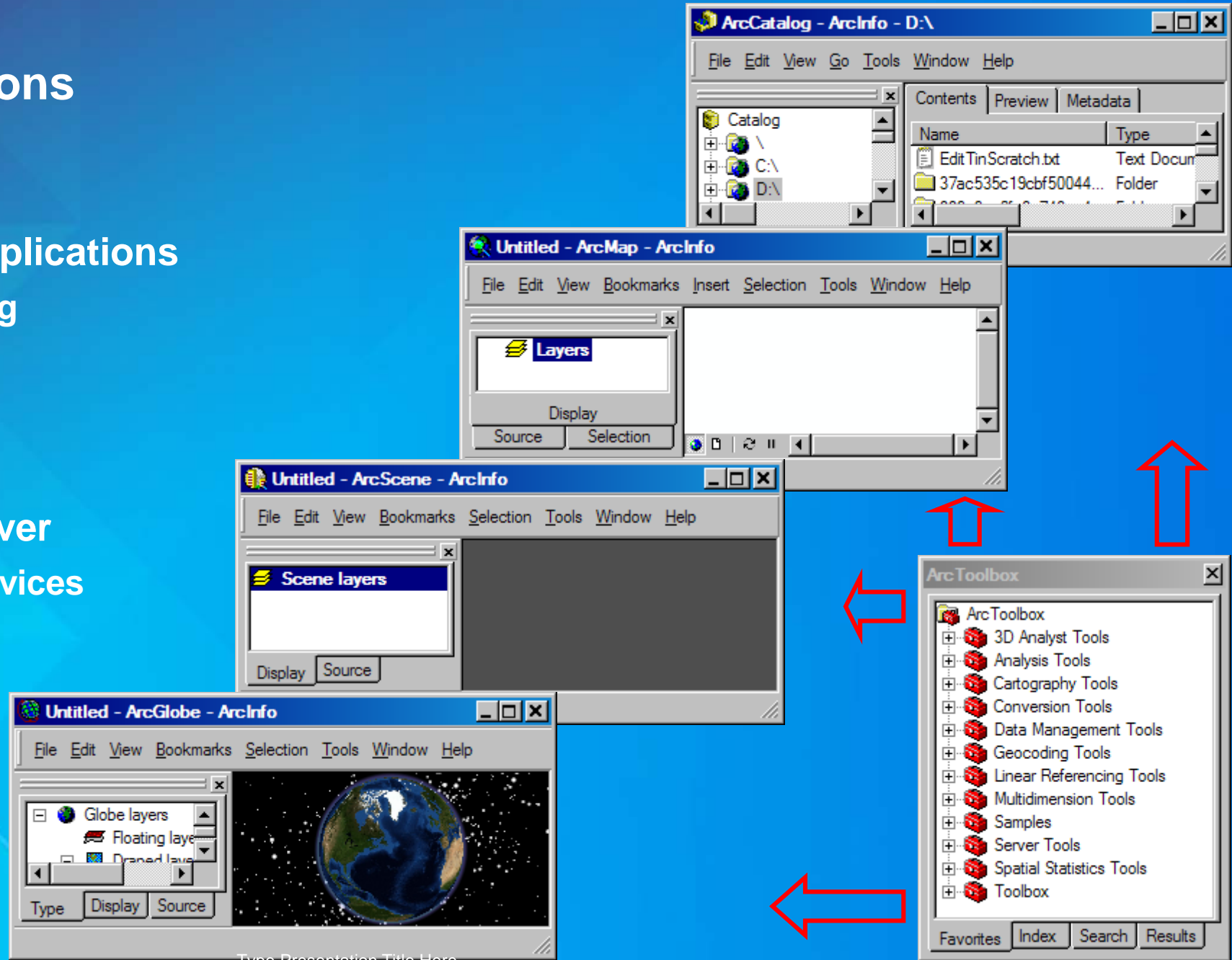
# Why GeoProcessing?

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



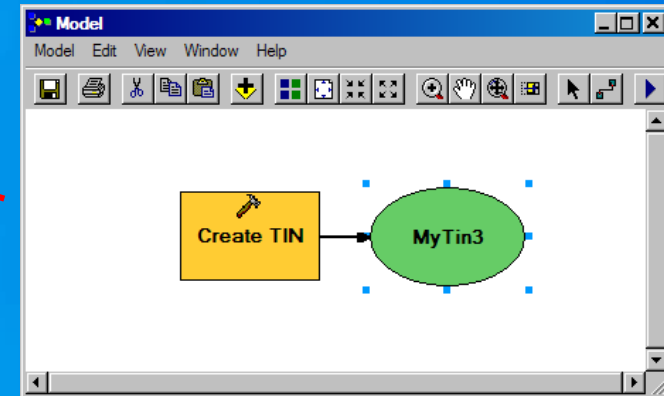
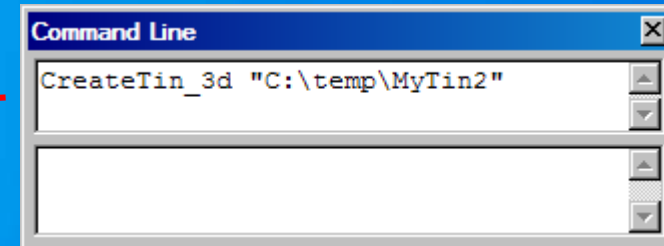
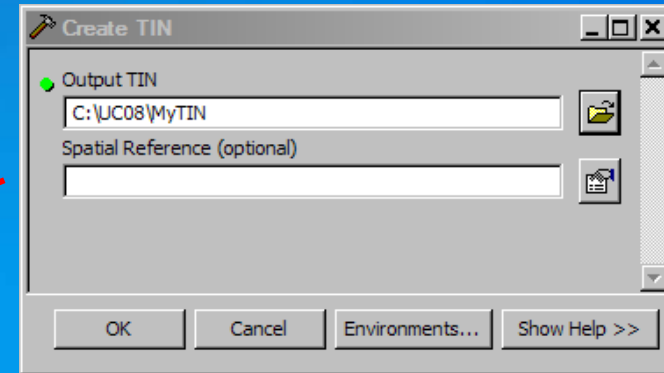
# Host Applications

- Desktop applications
  - ArcCatalog
  - ArcMap
  - ArcScene
  - ArcGlobe
- ArcGIS Server
  - As GP services



# 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

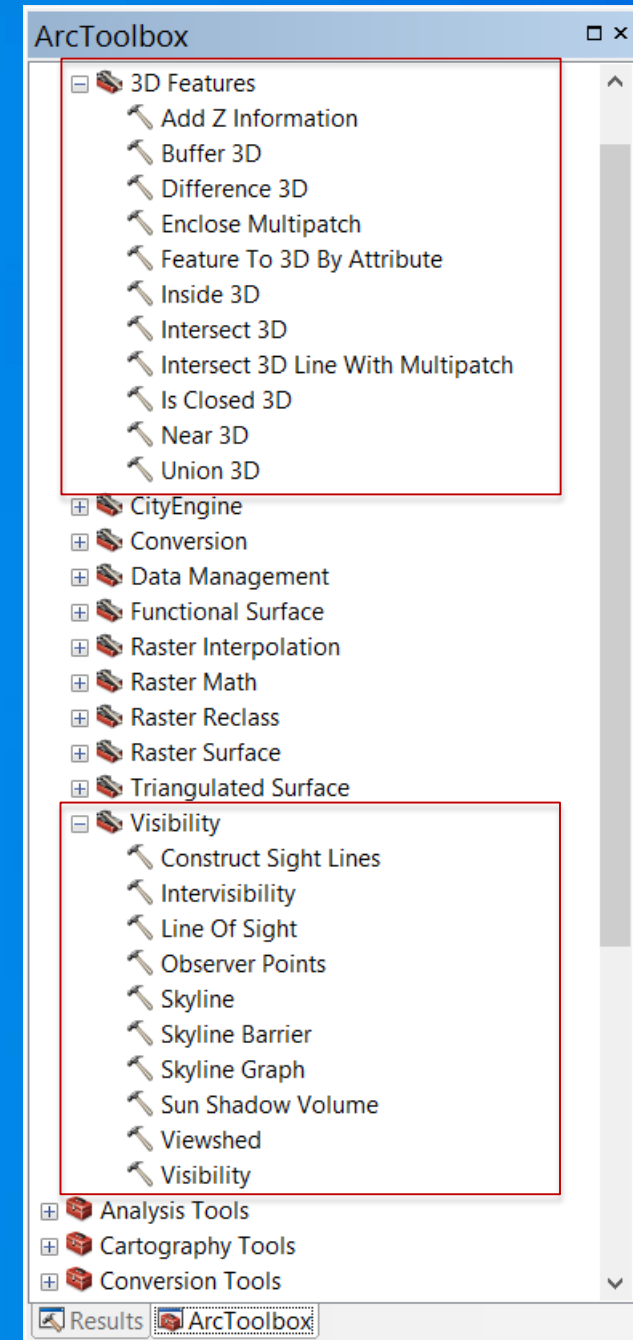
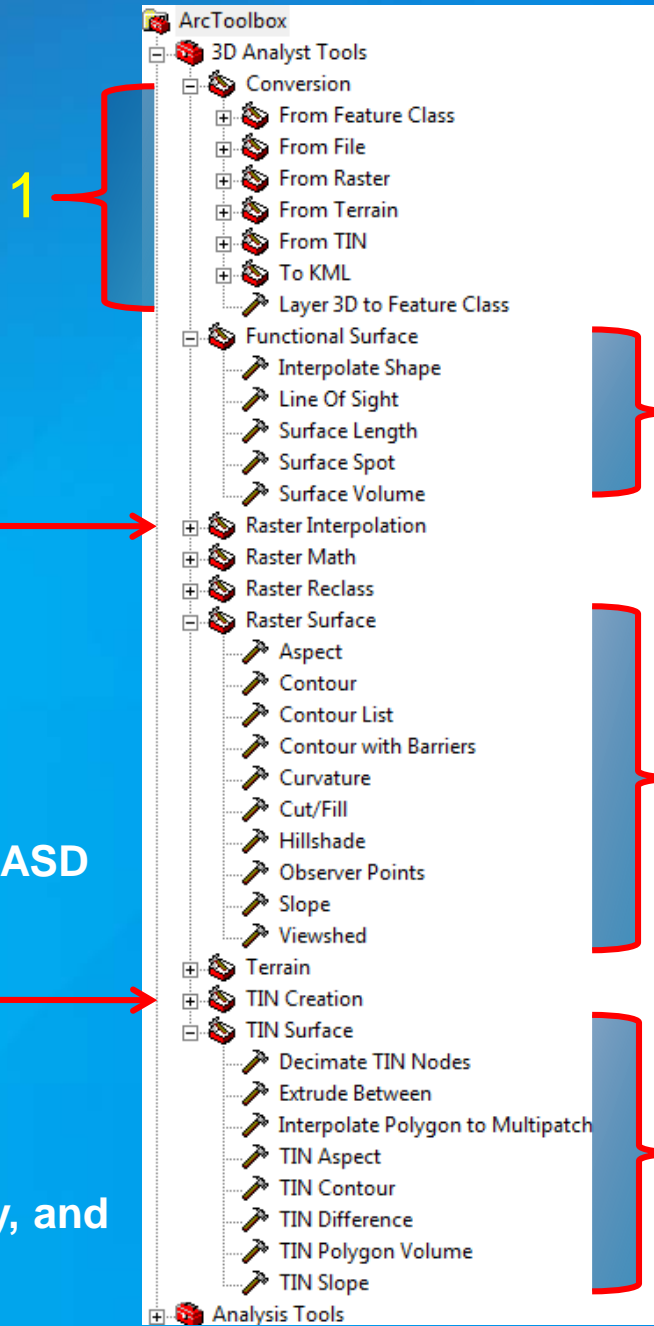
- Raster interpolation, TIN/Terrain/LASD creation

3. Surface analysis

- Aspect/slope, Contour, Feature interpolation

4. 3D operator & visibility

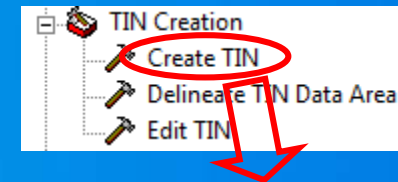
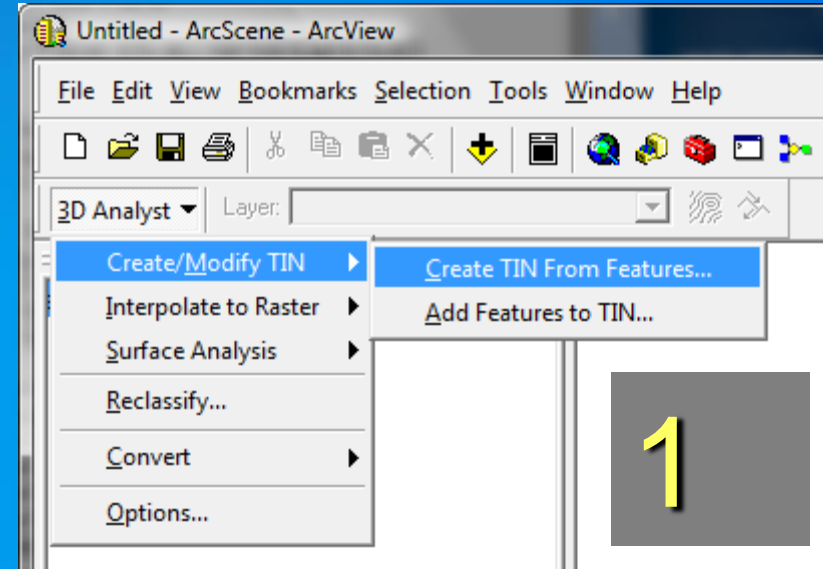
- Intersect3D, Skyline, Intervisibility, and Sun Shadow analysis



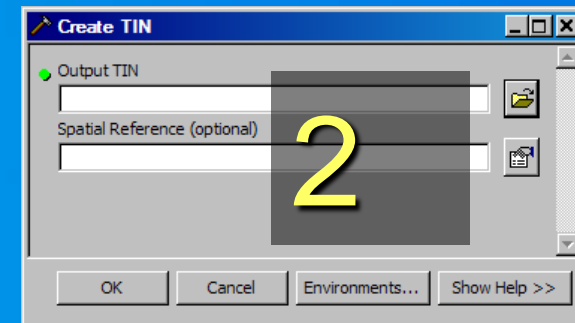
# Task Levels

- **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



# Demo

- **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**

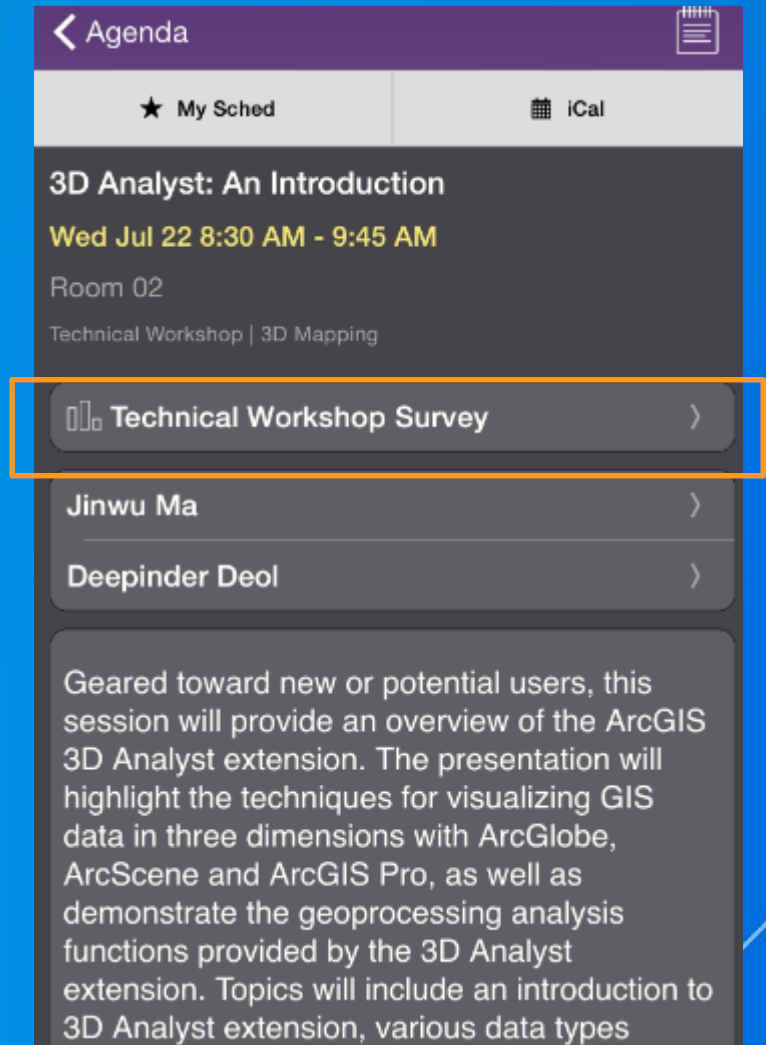


# 3D Analyst Geo-Processing Summary

- **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**

# Thank you...

- Please fill out the session survey in your mobile app
- Select **3D Analyst: An Introduction** in the Mobile App
  - Use the Search Feature to quickly find this title
- Click “Technical Workshop Survey”
- Answer a few short questions and enter any comments





Understanding our world.