



# 3D Analyst: An Introduction

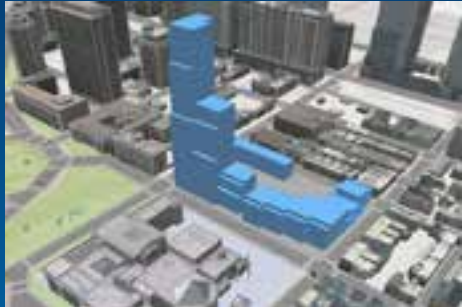
Jinwu Ma

Deepinder Deol

Technical Workshop

# Why use 3D GIS?

*Because our world is 3D*



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

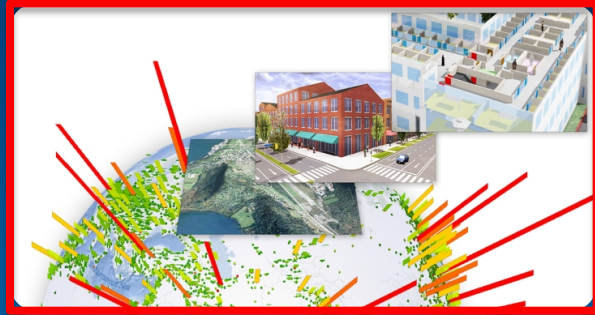


**Solve 3D problems**  
Some spatial problems can only be solved in 3D



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

# What can you do with ArcGIS 3D?



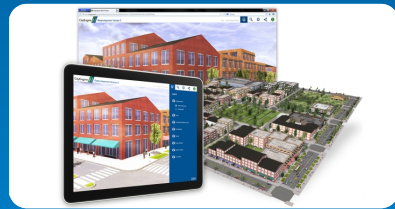
Multiscale 3D Models



3D Geodesign



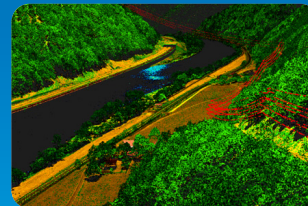
ArcGIS for 3D Cities



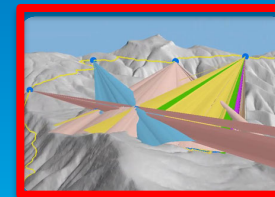
Share 3D scenes



Surface modeling



Native lidar support



3D Analysis



Integrated 3D

# Contents

- **What is 3D Analyst?**
- **3D Visualization**
  - **ArcGlobe**
  - **ArcScene**
  - **3D Symbology, Graphics, ...**
  - **Demo**
- **3D Geoprocessing**
  - **Data processing**
  - **Surface analysis**
  - **Feature-oriented tools**
  - **Demo**

Technical workshop:  
ArcGIS 3D Analyst: An Overview of 3D Analysis  
Where: Room 04  
When: Tuesday (07/15) at 10:15 AM

# What is 3D Analyst?

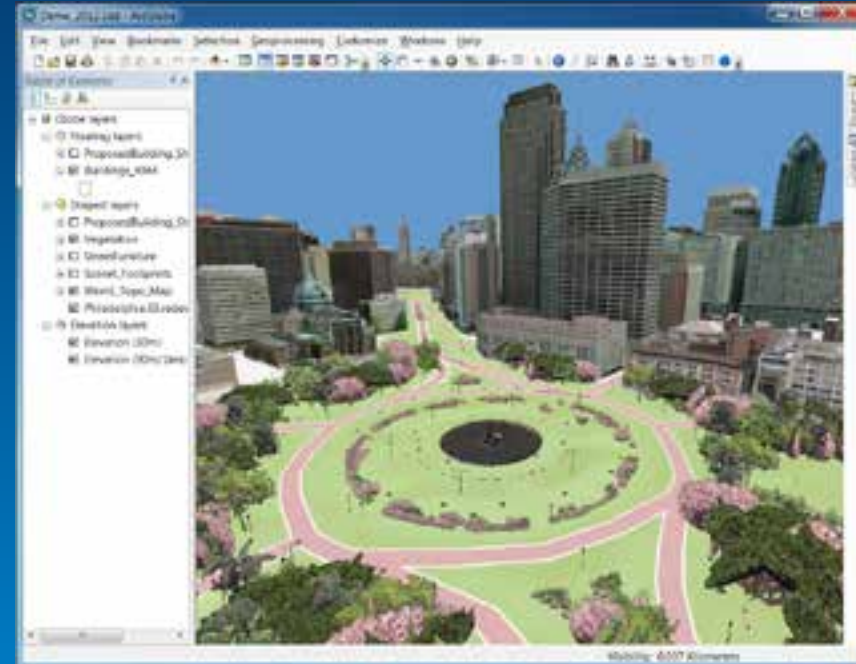
- **ArcGIS extension that provides capabilities for:**
  - **Interactive 3D Visualization of spatial data**
  - **3D Editing of feature data**
  - **3D Geoprocessing tools**
  - **Publish globe services (ArcGIS Server)**
  - **Publish globe documents (Publisher toolbar) for use in ArcReader**
  - **Export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

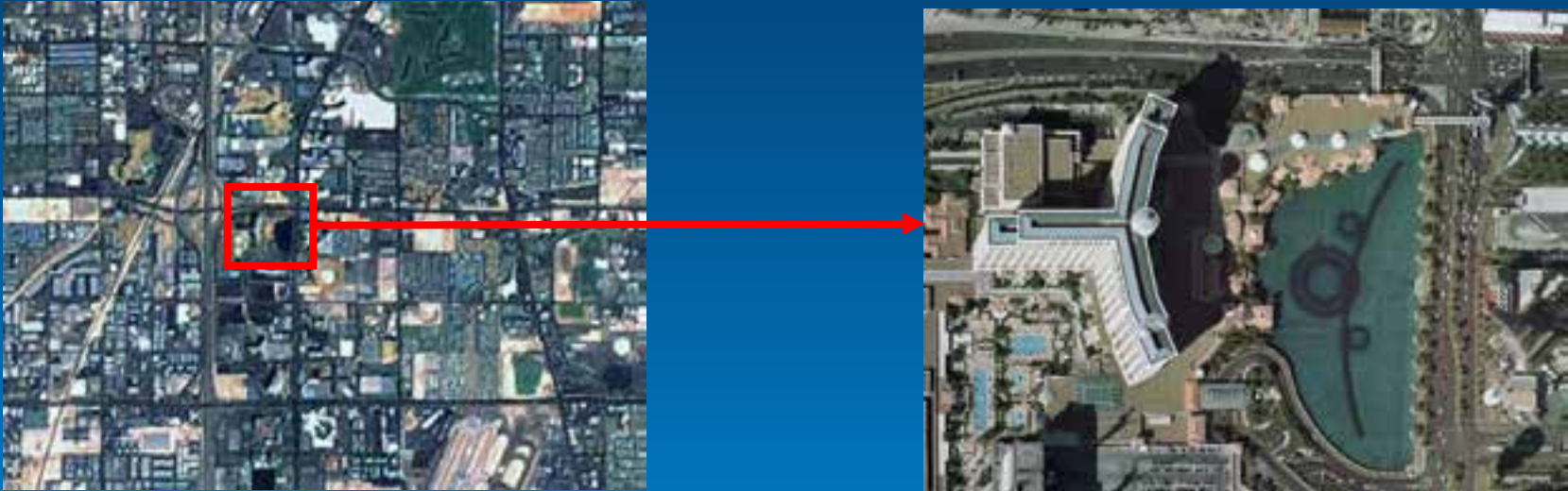
# ArcGlobe

- 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)

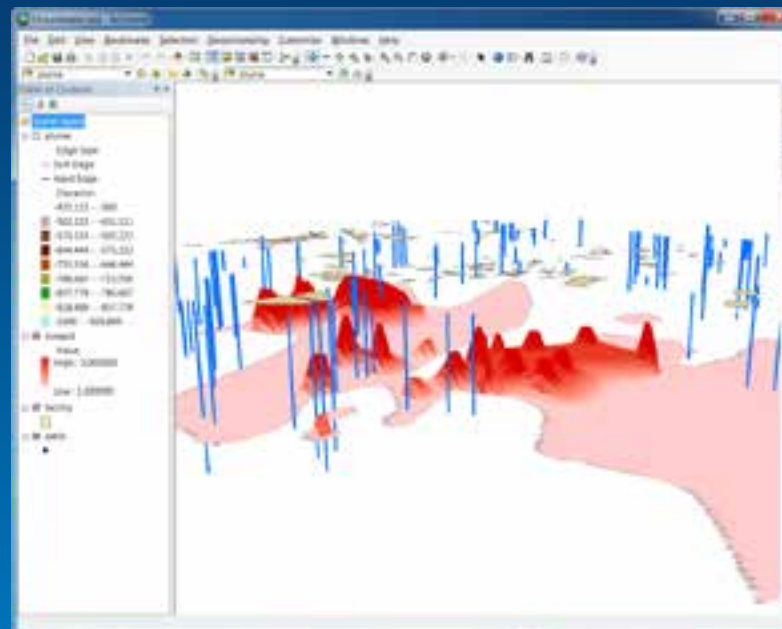


Near  
(more detail)



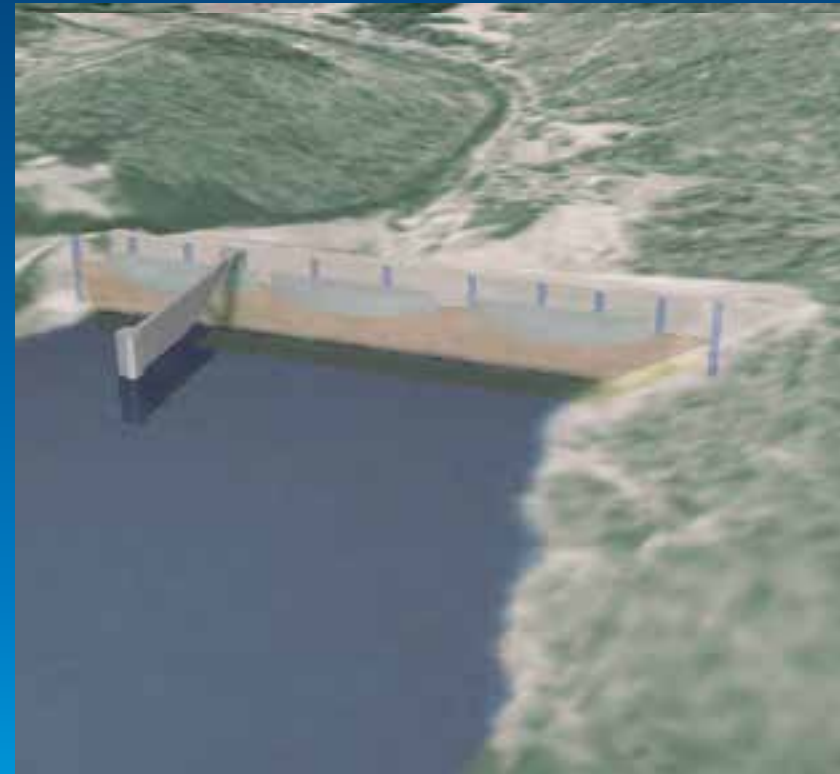
# ArcScene

- 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**

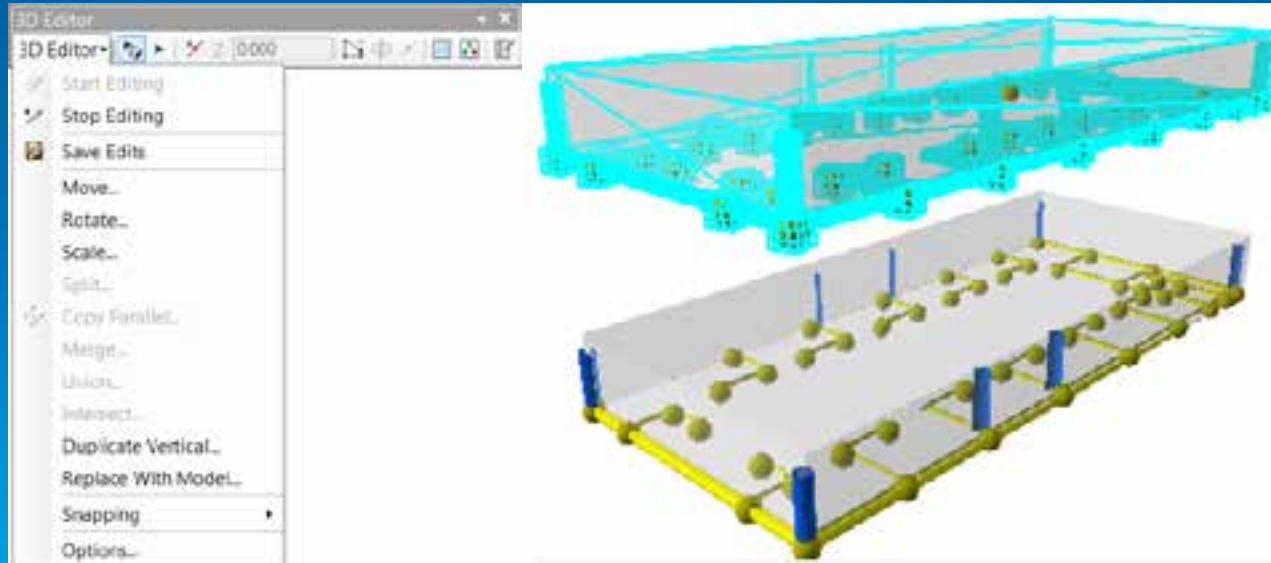
- **3D Texture Line Symbols: Pavement, Concrete, etc.**
- **3D Geometric primitives (ArcScene): Tube, Strip, Wall etc.**

- **Polygons**

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

# 3D Editing

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

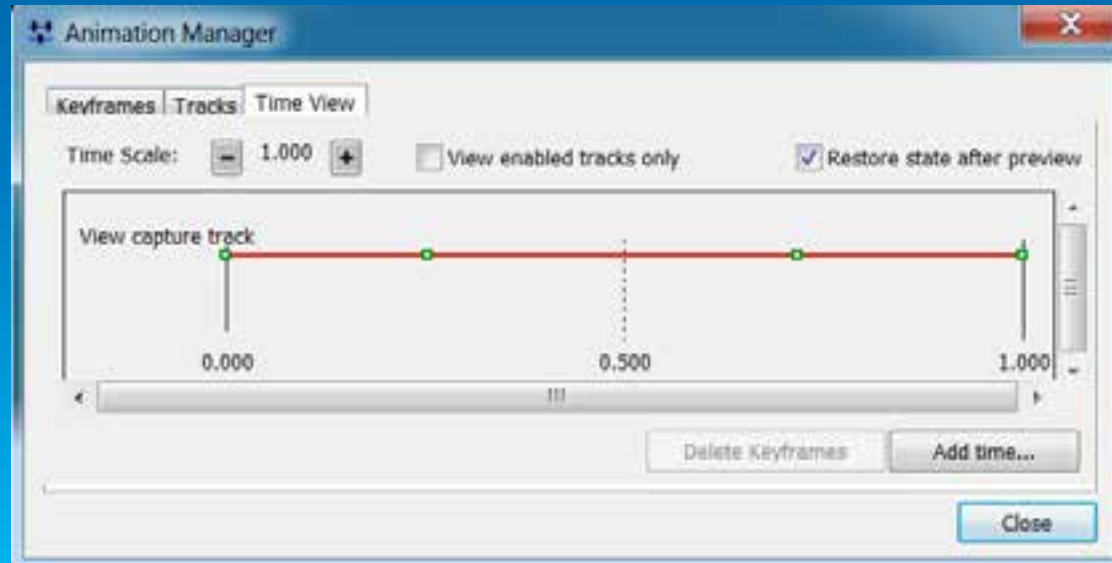
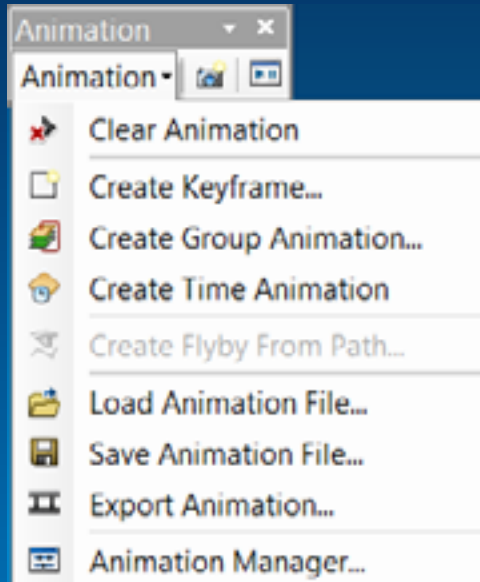


# 3D Graphics and KML support

- **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



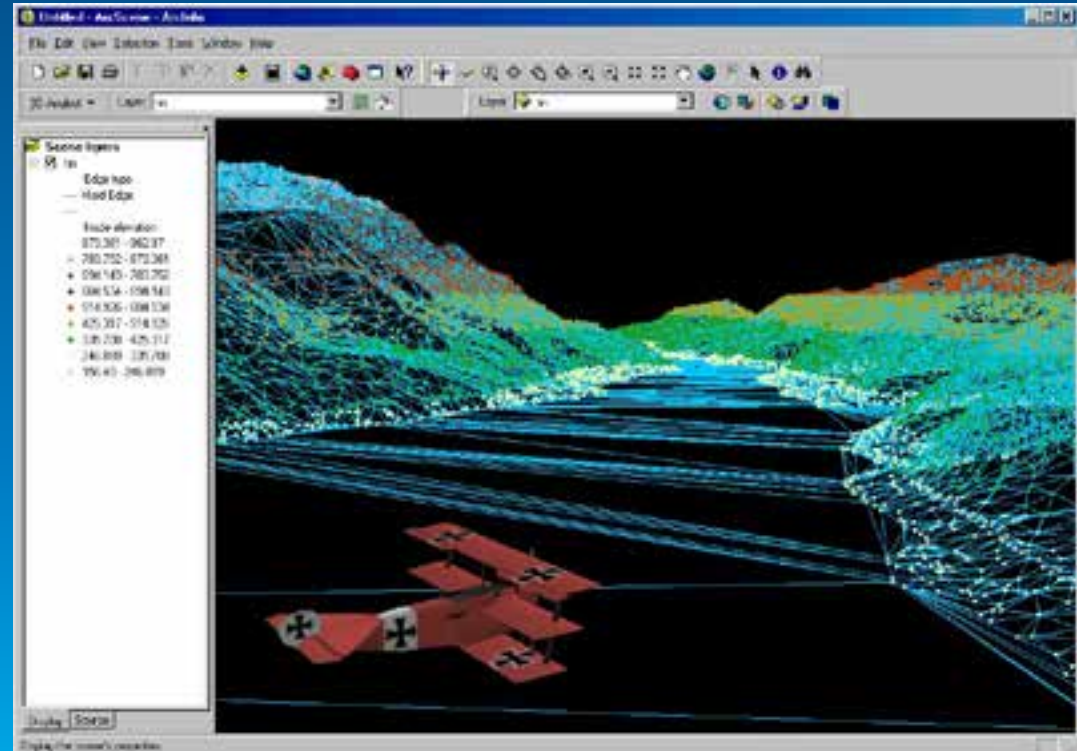
# Customization framework

- **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

# Why 3D Analyst?

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



# What Is a Surface?

- **Functional Surface**

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

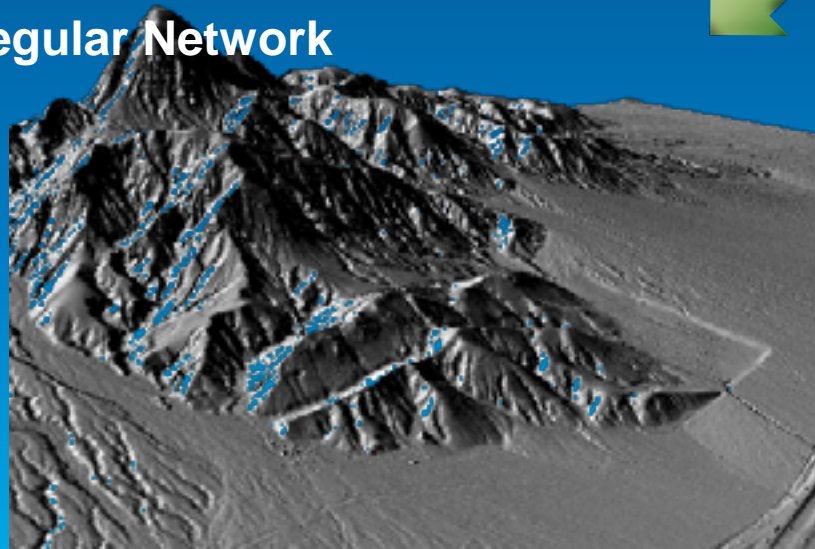
- **Raster Surface**

- **TIN Surface**

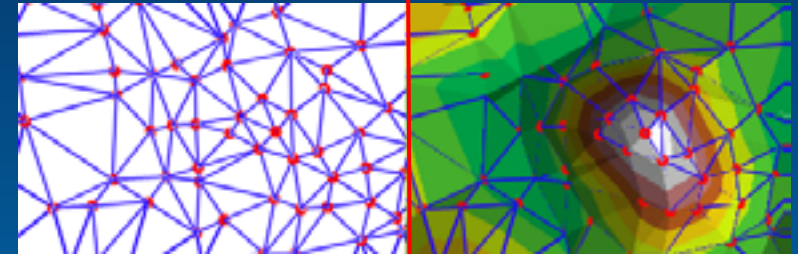
- **Triangulated Irregular Network**

- **Terrain**

- **Las Dataset**



TIN/Terrain

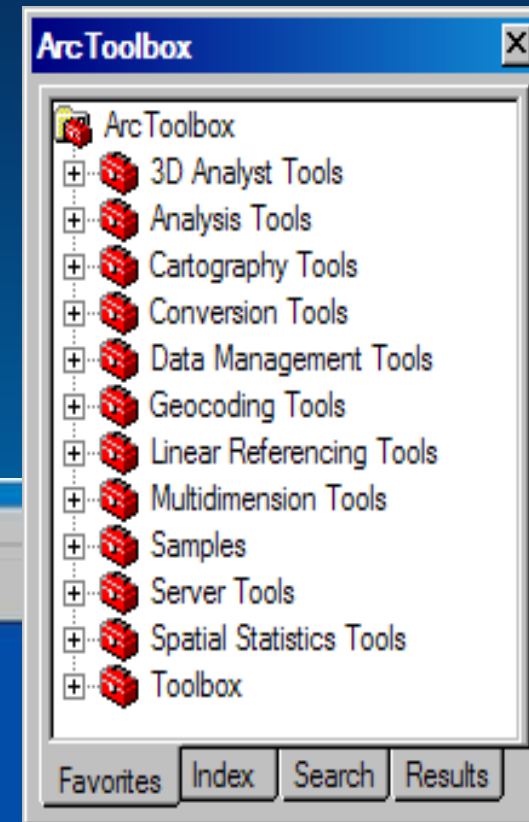
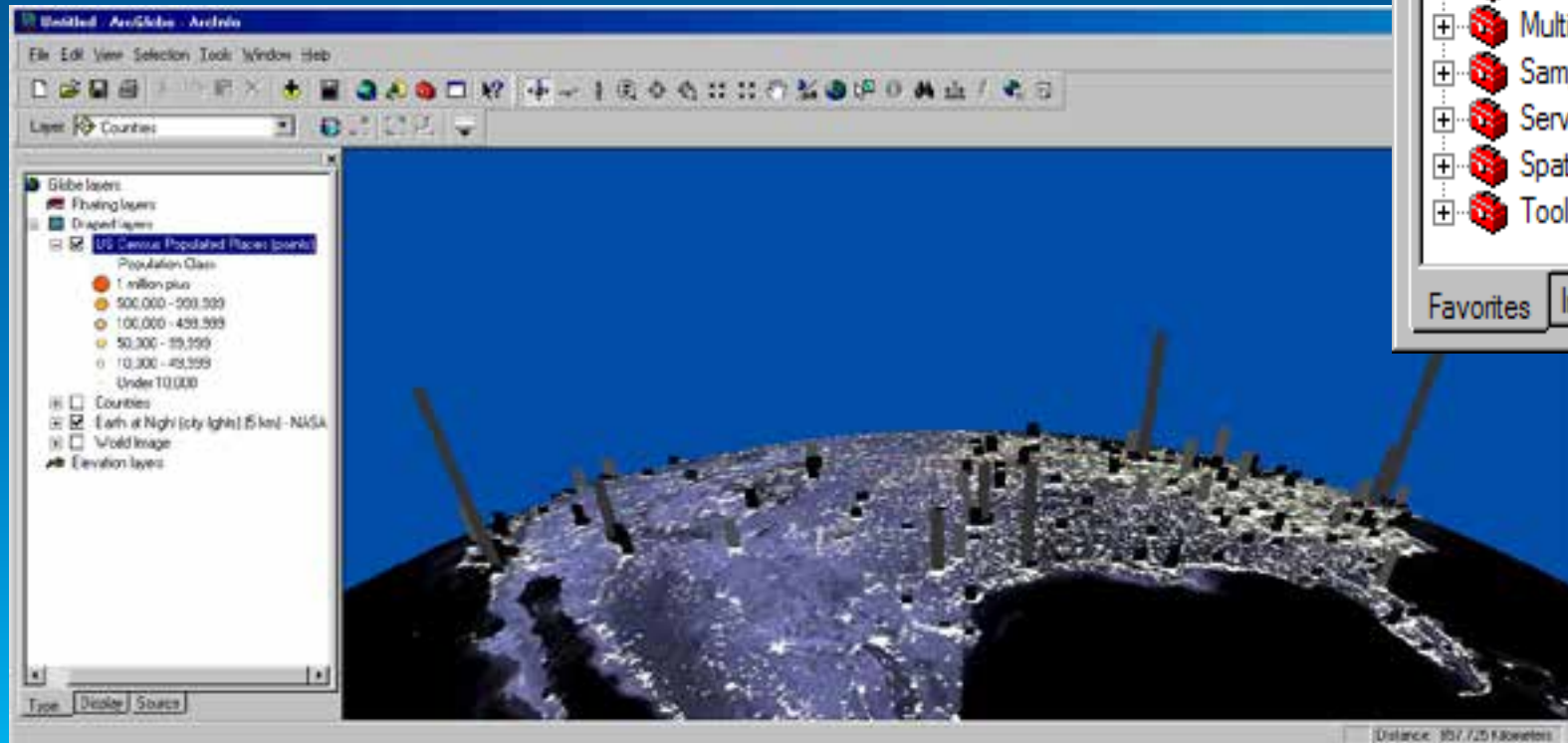


Raster Surface



# Why GeoProcessing?

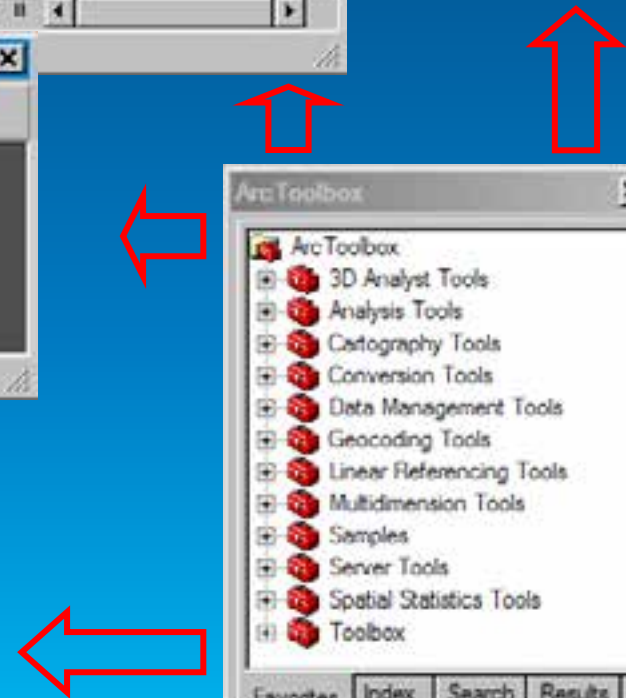
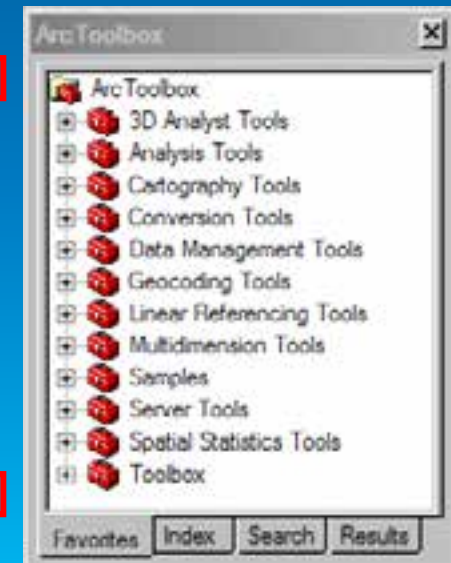
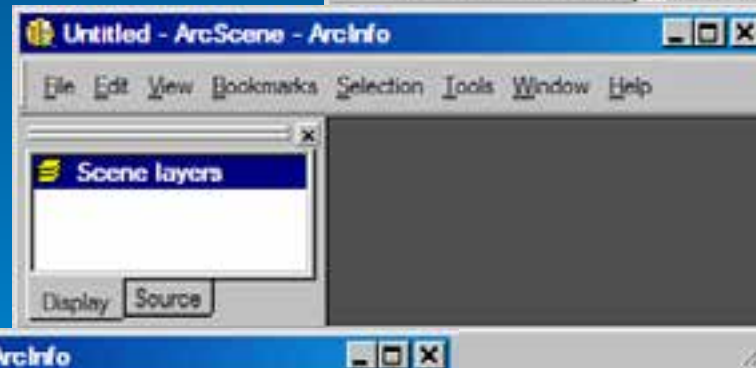
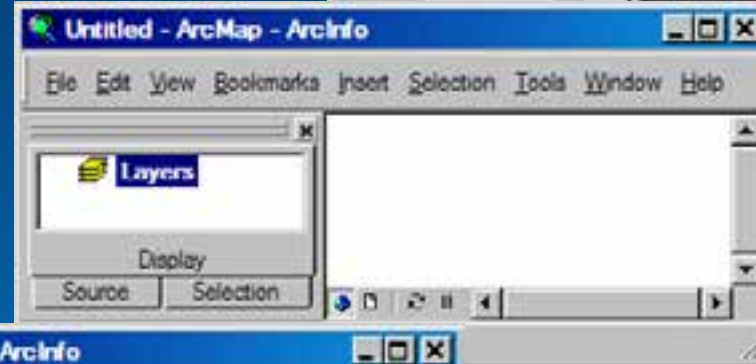
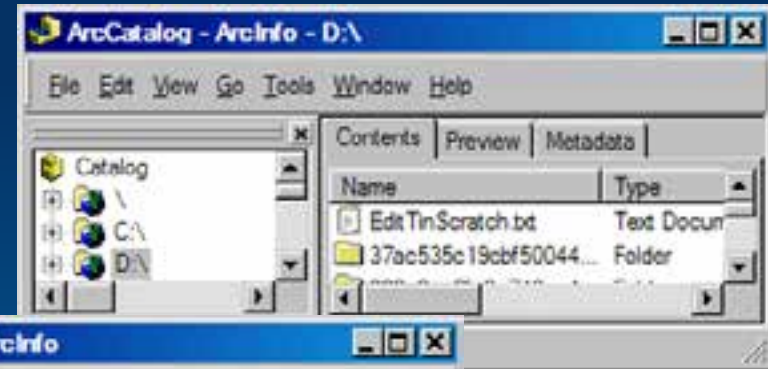
- Prepare data for visualization and analysis
- Performing surface & visibility analysis
- Batch/non-interactive data processing





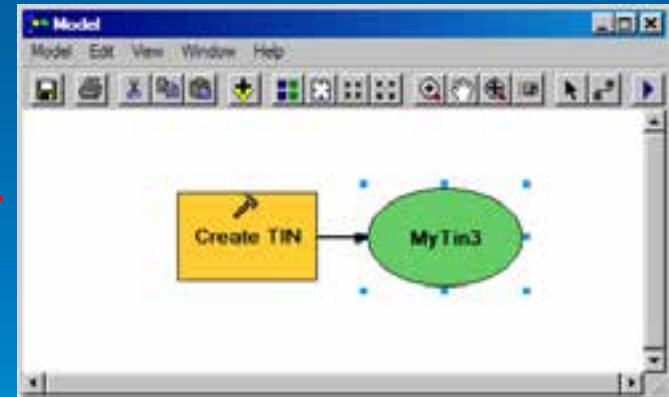
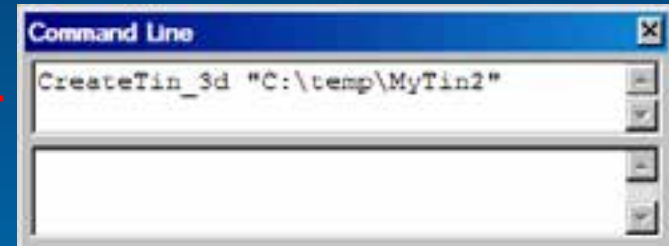
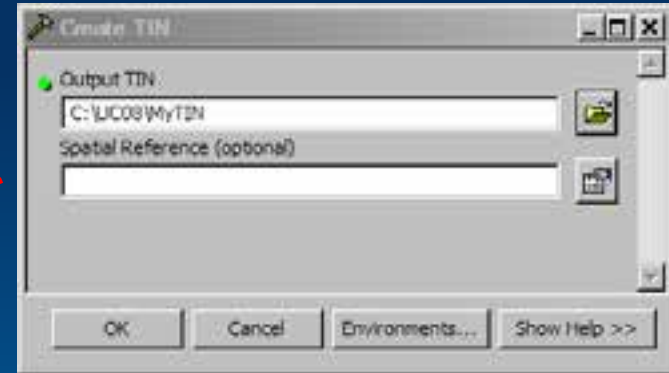
# Host Applications

- 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")
```

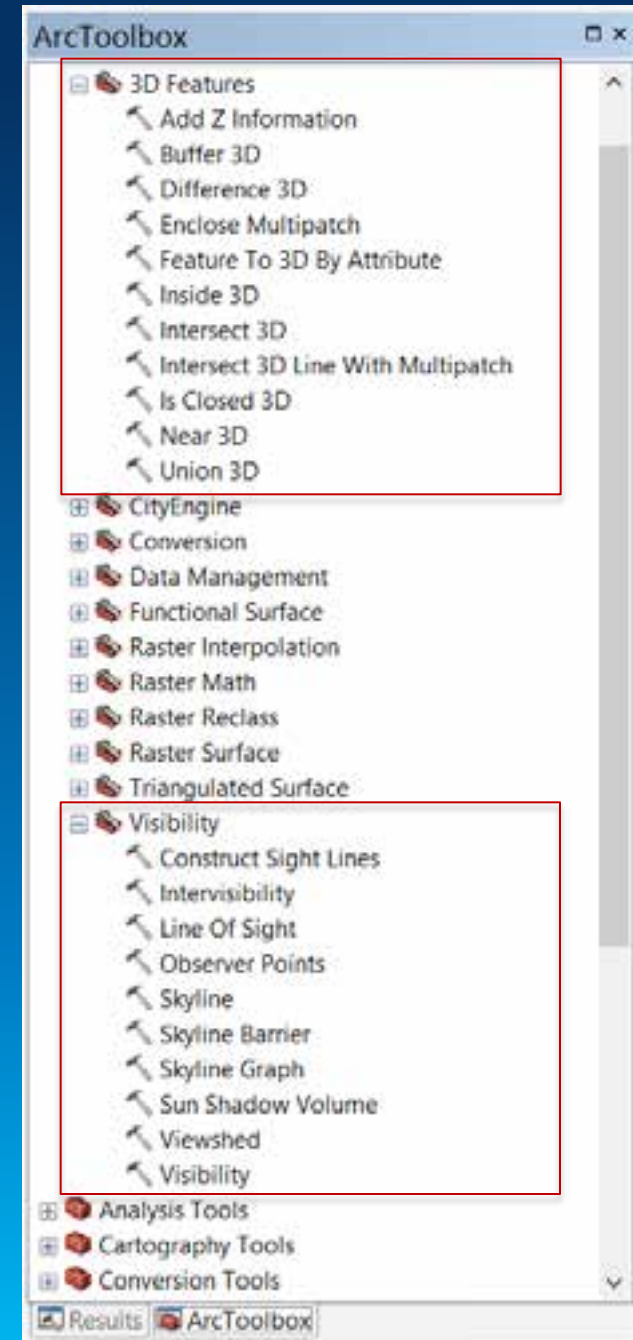
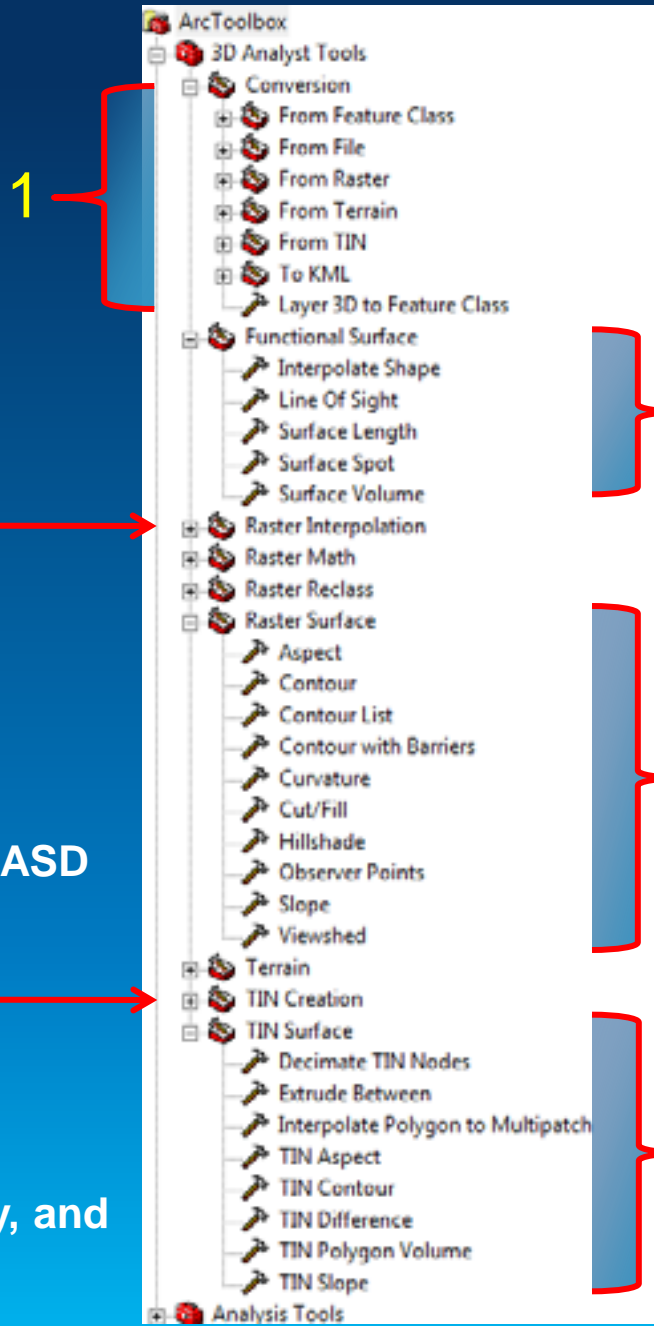
# Categorization of 3D GP Tools

- 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

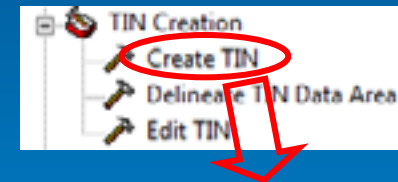
- **Level of GP tasks (from high to low)**

- UI/Model
- Command line/scripting
- ArcObjects

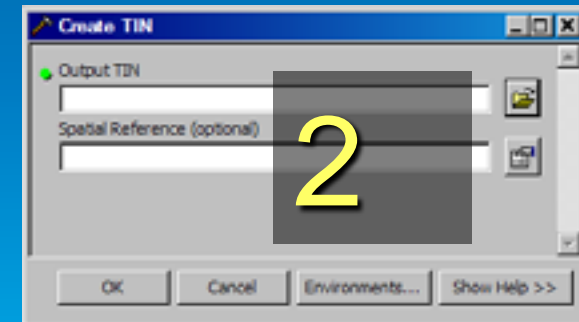
- **Example: Creating a TIN Surface**

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:**

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Understanding our world.