

SOFTWARE VALIDATION PLAN AND REPORT
ArcGIS® Desktop 9.0

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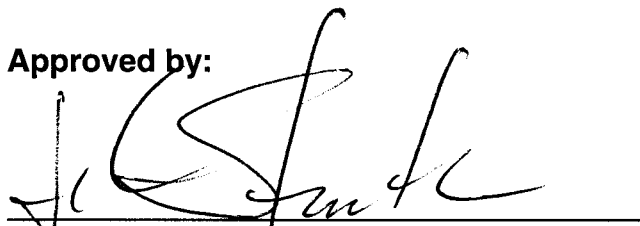
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CONTENTS

Section	Page
FIGURES.....	ii
1 SCOPE OF VALIDATION.....	1
2 REFERENCES.....	1
3 ENVIRONMENT.....	1
3.1 Software.....	1
3.2 Hardware.....	2
4 PREREQUISITES.....	2
5 ASSUMPTIONS AND CONSTRAINTS.....	2
6 TEST CASES.....	2
6.1 Test Case 1 – ArcCatalog and ArcToolbox.....	2
6.1.1 Objectives.....	2
6.1.2 Test Input.....	2
6.1.3 Test Procedure.....	3
6.1.4 Test Results.....	8
6.2 Test Case 2 – ArcMap.....	9
6.2.1 Objective.....	9
6.2.2 Test Input.....	9
6.2.3 Test Procedure.....	9
6.2.4 Test Results.....	12
6.3 Test Case 3 – ArcScene.....	13
6.3.1 Objective.....	13
6.3.2 Test Input.....	13
6.3.3 Test Procedure.....	13
6.3.4 Test Results.....	14
6.4 Test Case 4 – ArcGlobe.....	15
6.4.1 Objective.....	15
6.4.2 Test Input.....	15
6.4.3 Test Procedure.....	15
6.4.4 Test Results.....	17

FIGURES

Figure	Page
Figure 1. TNRIS Grid Depicting Helotes Quad	18
Figure 2. Discover Data with ArcCatalog	19
Figure 3. DEM to Raster	20
Figure 4. Import Helotes from Interchange File	21
Figure 5. Import Bandera from Interchange File	22
Figure 6. Create Highway Coverage by Extracting Features	23
Figure 7. Append Two Coverages	24
Figure 8. ArcCatalog, Edit Metadata Dialog Window	25
Figure 9. Edit Metadata Description	26
Figure 10. ArcMap, Add Layers	27
Figure 11. ArcMap, Clip to Polygon	28
Figure 12. ArcMap, Customize Layer	29
Figure 13. ArcMap, Identify a Feature	30
Figure 14. ArcMap, Select by Attributes	31
Figure 15. ArcMap, Layout Presentation	32
Figure 16. ArcScene, Z Unit Conversion	33
Figure 17. ArcScene, Navigate Perspective View Scene	34
Figure 18. ArcGlobe Functionality	35

1 SCOPE OF VALIDATION

ArcGIS® Desktop 9.0 developed by Environmental Systems Research Institute, Inc. (ESRI®), is a suite of Geographic Information Systems (GIS) software applications “that allow the user to author, analyze, map, manage, share, and publish geographic information”. The applications that will be validated in this Test Plan and Report are ArcToolBox™, ArcCatalog™, ArcMap™, and ArcScene™. These applications cover a variety of functionality as listed below.

- Mapping
- Geographic Analysis
- Data Editing and Compilation
- Data Management
- Visualization
- Geoprocessing

Software validation of ArcGIS® Desktop 9.0 should confirm that the software can correctly perform the above listed functions with original data, maintaining geospatial relationships and coordinates. This list of functions is a subset of the entire list of functions available. It was chosen as a representative sample of commonly used functions necessary for processing data from start to a finished product.

2 REFERENCES

Environmental Systems Research Institute, Inc. “What is ArcGIS?” Redlands, California. 2004.

ESRI product web site for GIS Mapping Software:
<<http://www.esri.com/software/arcgis/index.html>>

Texas Natural Resources Information System (TNRIS) web site for all Helotes data used in this report: <<http://www.tnris.org/index.htm>>

3 ENVIRONMENT

3.1 Software

ArcGIS is a commercially developed integrated suite of advanced Geographic Information Systems (GIS) and mapping software applications by Environmental Systems Research Institute® (ESRI®). The following software items are required to perform validation testing activities:

ArcGIS Desktop 9.0 suite of software with the following applications:

- ArcMap™
- ArcCatalog™
- ArcToolbox™ (Note: ArcToolbox is embedded in ArcMap and ArcCatalog.)
- ArcScene™
- ArcGlobe™

Operating System: Microsoft® Windows 2000

3.2 Hardware

The following hardware will be used to perform validation testing activities:

- Platform: AMD Athlon™ processor
- CPU: 2 GHz
- Memory: 1024 MB RAM

4 PREREQUISITES

Running ArcGIS Desktop 9.0, requires installation of the commercially available software, per the developers' User's Manual.

5 ASSUMPTIONS AND CONSTRAINTS

The user of ArcGIS Desktop 9.0 is assumed to be familiar with GIS and geospatial data sets.

6 TEST CASES

The test cases described in this section involve five applications which, when combined, are the ArcGIS suite of software. Each test covers one or more application and all tests combine to make one complete GIS project. The tests involve locating, managing, processing, displaying, querying, and viewing data.

6.1 Test Case 1 – ArcCatalog and ArcToolbox

ArcCatalog is employed to organize, find, and use GIS data as well as document data holdings using standards-based metadata. ArcToolbox contains a comprehensive collection of geoprocessing functions including tools for data conversion, data management, coverage processing, vector analysis, geocoding, and statistical analysis.

6.1.1 Objectives

- Demonstrate that ArcCatalog can be used to search for and discover GIS data on local network, create GIS data on local network, browse and find geographic information, and record, view, and manage metadata.
- Demonstrate that ArcToolbox functions correctly convert, process, and prepare data for use with other ArcGIS applications.

6.1.2 Test Input

Input data are found on the Texas Natural Resources Information System (TNRIS) web site <http://www.tnris.org/>. TNRIS is a division of the Texas Water Development Board and is the state's clearinghouse for maps, aerial photos, and digital natural resources data (per the website). The data downloaded for this test procedure consists of shapefiles, coverages, and digital elevation models of Helotes, Texas, bundled together in a zipped format. The required archive files are listed in Table 1.

Table 1. Helotes Data Files

Compressed File Name	Download Link	Contents
2998270g.zip	<u>HELOTES - DEM</u>	2998270g.dem, ordr9dem.txt, usgs_dem.txt
2998271a.zip	<u>HELOTES NW</u>	2998271.met, 2998271a.aux, 2998271a.sdw, 2998271a.sid
2998272a.zip	<u>HELOTES NE</u>	2998272.met, 2998272a.aux, 2998272a.sdw, 2998272a.sid
2998273a.zip	<u>HELOTES SW</u>	2998273.met, 2998273a.aux, 2998273a.sdw, 2998273a.sid
2998274a.zip	<u>HELOTES SE</u>	2998274.met, 2998274a.aux, 2998274a.sdw, 2998274a.sid
015urban_dd.zip	<u>BEXAR - TxDOT Urban Data(E00)</u>	readme_dd.txt, txdot_cnty_codes.txt, urban015_dd.e00
010urban_dd.zip	<u>BANDERA - TxDOT Urban Data(E00)</u>	readme_dd.txt, txdot_cnty_codes.txt, urban010_dd.e00

6.1.3 Test Procedure

1. Download and unzip Helotes quadrant data from the TNRIS website (Figure 1).
 - There should be four 1-meter resolution Digital Orthophoto Quadrangle Quadrangles (DOQQs) which are 1/4 Quad and combine to make the Helotes 7.5' Quadrangle, one DEM, and a TxDot Urban Data set.
 - Save each of them in a unique subdirectory under the test directory. Name the subdirectories *helotes_DEM*, *helotes_NE*, *helotes_NW*, *helotes_SE*, *helotes_SW*, and *txdot_a*. Unzip the files using appropriate software. Table 1 lists the contents of the zip files.
2. Download and unzip the Bandera TxDOT Urban Data set and save it to a directory called *txdot_b* under the test directory. Table 1 lists the contents of the zip files.
3. Open ArcCatalog.
4. Search for and discover the data downloaded in the previous step (see Figure 2).

- Notice in Figure 2 that ArcCatalog does not recognize some of the file formats (extensions .dem and .e00). These files will have to be converted to formats that are recognized by ArcGIS. The conversion will be done using ArcToolbox in the following steps.
5. Open ArcToolbox from ArcCatalog by clicking on the red toolbox icon on the standard toolbar. If the toolbox window is a separate window, connect it (also called “docking”) to the ArcCatalog window by pressing down and holding with the left mouse button on the blue title bar that says “ArcToolbox”, dragging it over to the ArcCatalog window and “dropping” it when it touches the directory tree. See Figure 3 for what this should look like after it is docked.
 6. In ArcToolbox use the Conversion Tools Set under the Favorites tab.
 - Convert the DEM file to a raster file using the Conversion Tools >To Raster tool set. Use the “DEM to Raster” tool (Figure 3).
 - Select the file *2998270g.dem* in the *helotes_DEM* directory under the test directory as the USGS DEM input file.
 - Select Float as the Output data type (optional).
 - Set the Z-Factor to 1.
 - Name the Output grid file *helotes_dem* and save it in the *helotes_DEM* directory under the test directory using the default type “Raster datasets”.
 - When DEM to Raster dialog window displays the message “Completed”, click on the “Close” button.
 - Verify that the file name *helotes_dem* appears under the *helotes_DEM* directory on the ArcCatalog directory tree (Figure 3).
 7. In ArcToolbox use the Coverage Tools Set under the Favorites tab located at the bottom of the ArcToolbox window (Figure 4).
 - Use the CoverageTools > Conversion Tool > To Coverage Tool Set to convert both of the TxDOT Interchange files to coverages
 - Select the “Import from Interchange file” tool (see Figure 4).
 - Convert the Helotes TxDOT file to a Coverage.
 - Leave the Feature Type as the default: AUTO.
 - Select the *urban010_dd.e00* file in the *txdot_a* directory as the Input Interchange File.
 - Name the Output Dataset *txdot_e00_a* and save it in the *txdot_a* directory under the test directory (Figure 4). When the Import from Interchange File dialog window displays the message “Completed”, click on the Close button.
 - Convert the Bandera TxDOT file to a Coverage.
 - Leave the Feature Type as the default: AUTO.

- Select the *urban010_dd.e00* file in the *txdot_b* directory as the Input Interchange File.
 - Name the Output Dataset *txdot_e00_b* and save it in the *txdot_b* directory under the test directory (Figure 5). When the Import from Interchange File dialog window displays the message “Completed”, click on the Close button.
- Verify that the *txdot_e00_a* and *txdot_e00_b* file names can be viewed in the appropriate directories on the ArcCatalog directory tree and the coverages can be viewed through the ArcCatalog Preview window (Figures 4 and 5).
- Use the Coverage Tools > Analysis > Extract Tool Set to create a highway coverage from the Helotes TxDOT coverage (Figure 6).
 - Choose the “Select” tool.
 - Use the *txdot_e00_a* coverage as the input coverage.
 - Name the Output Coverage *helotes_hwy* and save it in the *txdot_a* directory under the test directory.
 - Click on the INFO button to the right of the INFO Expression field to build a query. The Query Builder window will open.
 - Build a query; `FEATURE_GENERAL = 'Highway'`.
 - Check Subset as the Selection method.
 - Double click on `FEATURE_GENERAL` in the list of Items. The text string “`FEATURE_GENERAL`” should appear in the Current expression subset text field.
 - Click once on the equals (=) operator under the list of available Operators. It should appear after the text string in the Current expression subset. There is also a list of available Connectors that will not be used for this test.
 - Check the “Update values” checkbox and a list of values applicable to the Item `FEATURE_GENERAL` will appear in the Values list.
 - Double click on “Highway” in the list of Values. The text string “Highway” will appear after the equals sign in the Current expression subset field.
 - The entire query has now been built. If there were more than one query, clicking on the down arrow to the right of the Subset text field would add the current query to a list of queries. Clicking on the direction arrows to the right of the query list will move the query up or down the list.
 - This is our only query, so click on the “OK” button to complete the query and return to the Select window. The newly created expression will appear in the table under Expression column..
 - Select `LINE` as the Feature Type.
 - Leave the optional Selection File text field blank.
 - Leave the optional Output Feature Type blank.
 - Click OK to accept the selection and create an output coverage. When the Select dialog window displays the message “Completed”, click on the Close button.

- Verify that the *helotes_hwy* file name can be viewed in the *txdot_a* directory on the ArcCatalog directory tree (Figure 6).
 - Compare the *helotes_hwy* Preview with the *txdot_e00_a* Preview and verify that *helotes_hwy* contains only highways (figures 4 and 6).
 - Use the Coverage Tools > Data Management > Aggregate Tool Set to combine the Helotes TxDOT coverage with the Bandera TxDOT coverage (Figure 7).
 - Select the Append tool.
 - Select *txdot_e00_a* as an Input Coverage using the browse button (it looks like an open file folder). It should appear in the list directly under the “Input Coverages” text field.
 - Select *txdot_e00_b* as an input coverage using the browse button. It should appear in the list under *txdot_e00_a* in the list under the “Input Coverages” text field.
 - Name the output coverage *all_txdot* and save it in the *txdot_b* directory under the test directory.
 - Select “FEATURES_ATTRIBUTES” as the Append Method.
 - Check the “Select All” button below the Feature Type list to select all feature types then un-check POINT because both input files are line coverages.
 - In the “Create unique IDs” text field, select “NO”.
 - Click on the “OK” button to create an output coverage from the two input coverages. When the Append dialog window displays the message “Completed”, click on the Close button.
 - Verify that the *all_txdot* file name can be viewed in the *txdot_b* directory on the ArcCatalog directory tree (Figure 7). Verify that the Preview of *all_txdot* (Figure 7) shows features for both *txdot_e00_a* (Figure 4) and *txdot_e00_b* (Figure 5).
8. Close ArcToolbox by clicking on the “X” in the top right corner of the ArcToolbox window.
9. In ArcCatalog, view the Contents, Preview, and Metadata tabs to verify correct data. The following steps should be accomplished for all data. Though it will be described for only one file, the procedure and results should be similar for all files.
- Select the file *helotes_dem* in the directory tree.
 - The Contents tab should list the contents of the selected item. A raster file like *helotes_dem* will not have contents listed because it is a single file composed of a table of values. A shapefile will show an image, a coverage will list all of the layers within the coverage, and some image files like .sid and .jpg files will list the bands used to create them.
 - On the Preview tab, an image of the data should be visible. Below the image, a dropdown Preview type can be selected. Depending on the file type and the extensions enabled, not all options may be available. To see the 3D View and Globe View options, the 3D Analyst and Spatial Analyst extensions must be enabled in the Extensions window under the Tools menu on the main menu bar. Verify that

when Geography is selected, a two-dimensional image appears. When 3D View or Globe View is selected, a three-dimensional interactive image of the data is shown. The fourth option is Table. This option will show a table of values that is used to produce the image.

- On the Metadata tab, there should be three tabs, Description, Spatial, and Attributes. These tabs should contain information about the data such as keywords, descriptions, coordinate system, dates, and other information.

10. Modify a metadata page.

- Select the file *helotes_dem* in the directory tree and view the Metadata tab.
- Modify the text on a metadata page.
 - Click on the “edit metadata” icon (it looks like a piece of paper with a pencil writing on it) and a dialog window will appear. (Figure 8) Add a brief narrative summary of the data set to the abstract on the Description tab and click the “Save” button. You should see the metadata screen immediately update the abstract. Also, verify under the Description tab that the “contents last updated” date under “Details about this document” heading has changed to the present date and time.
- Add a thumbnail of the DEM image to the metadata tab.
 - View the Preview tab for *helotes_dem*.
 - Find the “Create thumbnail” icon on the toolbar. It looks like a yellow, down facing arrow over a grid of four white rectangles. This button is active only when the Preview tab is selected. Click on this button to create a thumbnail image of the preview and add it to the Metadata page.
- Select the Metadata tab and verify that the thumbnail was added to the Metadata and the Abstract was changed to the narrative entered in the previous step (Figure 9).

11. Create a new polygon shapefile. This file will be used later in Section 6.2, Test Case 2 – ArcMap.

- Select the *txdot_a* directory on the directory tree and select the Contents tab. Right click inside the contents tab and select new ->shapefile. A Create New Shapefile dialog window will appear. Name the shapefile *helotes_clip*. Make it a polygon feature type. Select the geographic coordinate system by clicking the “edit” button and then the “Select” button, and choosing Geographic Coordinate System ->North America ->North American Datum 1983.prj. Click “Add,” “Apply,” “OK,” and “OK,” to create the polygon shapefile.
- Verify the filename *helotes_clip.shp* appears in the directory and that when selected, all of the appropriate data appear under the Contents, Preview, and Metadata tabs.
 - The Contents tab should contain the filename, file type (Shapefile), and a polygon icon.
 - The Preview tab should be blank.

- The Metadata tab should include the file name, type (Shapefile), and three sub-tabs; Description, Spatial, and Attributes. The following information should be automatically updated:
 - Description
 - Under “Data storage and access information” File Name, Type of data (vector digital data), Location of the data, and Data processing environment
 - Under “Details about this document” heading, the Contents last updated field and Standards used to create this document
 - Spatial
 - Horizontal coordinate system and Geodetic Model should have the same Datum assigned to the shapefile when it was created earlier in this step
 - Spatial bounding coordinates should be given
 - Attributes
 - Contains default values that define the attribute table for *helotes_clip*. It should contain three fields, FID, shape, and ID. These fields will be populated in Test 6.2.3, Step 3, when the shapefile is edited.

12. Open ArcMap from ArcCatalog.

- Click on the ArcMap icon on the toolbar (it looks like a globe with a magnifying glass over it) to prepare for Test Case 3. The ArcMap application should open.
- Select “A new empty map” to start using ArcMap and click “OK”.

13. Close ArcCatalog by clicking on the “X” in the top right corner of the ArcCatalog window.

6.1.4 Test Results

PASS/FAIL: The test is successful if all required results are obtained in Section 6.1.3.

This test **PASSED**. The following comments substantiate the PASSING grade.

- ArcToolbox.
 - The Conversion Tool Set successfully converted a Digital Elevation Model (DEM) to a grid file and all four Interchange files to coverages. All files could be viewed with ArcMap.
 - The Analysis Tools Set correctly extracted highway features from the coverage *txdot_e00* and saved them to a new coverage *helotes_hwy*.
 - Data Management Tools were used to successfully combine two separate coverages into one coverage with the Append Wizard tool.

- ArcCatalog.
 - All of the downloaded data were found and viewed. The View Contents, Preview, and Metadata screens all contained appropriate data.
 - Metadata was successfully edited, both adding a thumbnail image as well as modifying the text. The last modified date changed automatically as expected.
 - GIS data was successfully created, in the form of a polygon shapefile.

6.2 Test Case 2 – ArcMap

ArcMap offers two types of map views: a data view and a page layout view. In the data view, geographic layers are symbolized, analyzed, and compiled into GIS data sets. In the layout view, map pages contain the geographic data view as well as other map elements, such as scale bars, legends, north arrows, and reference rids. A table of contents interface organizes and controls the drawing properties of the GIS data layers in the data frame.

6.2.1 Objective

Demonstrate that ArcMap can be used to perform the following functions:

- Assemble data and refine GIS data set extents.
- Organize and control drawing properties of the GIS data by utilizing the table of contents view.
- Query GIS data with Attribute tables and selection and identification tools.
- Create a layout view with a geographic data view and map elements.

6.2.2 Test Input

The input files for this test are the same files obtained from the TNRIS website in test procedure 6.1: 2998272a.sid, 2998271a.sid, 2998274a.sid, 2998273a.sid, txdot_e00_a, and txdot_e00_b.

6.2.3 Test Procedure

1. Start using ArcMap with a new empty view. Save the file as SVTP.mxd in the test directory.
2. Add the Helotes data to the map (Figure 10).
 - Click on the “Add data” button on the toolbar to add data to the project. It is a black plus sign on a yellow base for displaying the layer. Each time the “Add data” button is clicked, it creates a new layer from the chosen data. This layer name should appear in the table of contents interface on both the Display and Source tabs. The Display tab shows the file name and the Source tab shows the name and location (path name) of the file. Add the files helotes_NE/2998272a.sid, helotes_NW/2998271a.sid, helotes_SE/2998274a.sid, helotes_SW/2998273a.sid, txdot_a/txdot_e00_a/arc, and txdot_b/txdot_e00_b/arc. Do not add the DEM file. It will be used in a later test. If you accidentally add the DEM file and then remove it,

ArcMap will have set the project coordinate system to the DEM coordinate system. Because it is different from the other files, when you try to add the other files, a dialog window will open with a warning that the layer you are trying to add has a different coordinate system. It does and ArcMap will simply adjust the coordinates “on the fly” to match those of the current project. Check the box “Don’t warn me again in this session” and Click the “OK to all” button.

- After adding the four DOQQs, rename the layers to reflect the quadrant it represents (i.e., *helotes_NW*, *helotes_SE*, etc.). To do this, double click on the layer name in the table of contents interface to open the Layer Properties dialog window. Under the General tab, type the desired name in the text field called Layer Name and hit the enter key or click on the “OK” button.
 - Check the selection boxes for each .sid quadrant and verify that the images are correctly aligned. The streets and other features should seamlessly overlap to create the appearance of one image.
 - Check the selection box for both the *txdot_e00* data coverages and verify that they correctly overlay the .sid quadrant data. The streets and other features should line up.
3. Clip the *txdot_e00* data to the extent of the .sid quads (Figure 11).
- Add the *helotes_clip* polygon file created in test procedure 6.1 to the project.
 - Ensure that the Editor toolbar is visible by checking “Editor” under View → Toolbars on the Main menu. Select the *helotes_clip* name under the table of contents interface. Select “start editing” under the Editor toolbar and select the sketch tool. The sketch tool looks like a pencil. Draw a box around the outer edge of the four quadrants by clicking once on each corner and double clicking on the last corner to close the polygon. This will create one rectangle that encompasses all the quadrants. Select stop editing under the Editor toolbar. A window dialog will prompt “Do you want to save your edits.” Click “Yes” to save the edits.
 - Open ArcToolbox by clicking on the red toolbox on the Main toolbar. Under Analysis Tools, select Extract toolset and use the Clip tool.
 - Select *txdot_e00_a/arc* as the Input Feature.
 - Select *helotes_clip* as the Clip Feature.
 - Name the Output Feature Class *clip_output.shp* and save it in the *txdot_a* directory.
 - Leave the optional field Cluster Tolerance blank.
 - Accept the default Decimal degrees.
 - Click OK to create the new clipped Feature set.
 - When the Clip dialog window displays the message “Completed”, click on the Close button.
 - Close ArcToolbox by clicking on the “X” in the upper right corner of the toolbox window.

- The new shapefile will appear on the layer table of contents interface. Verify that it contains only the roads and other features located within the boundaries of the four .sid quadrants as represented by the clipping boundary *helotes_clip* (Figure 11).
 - Turn off the *helotes_clip* and *txdot_e00_a arc* layers by un-checking them in the table of contents interface.
4. Modify the layer properties (Figure 12).
- Make sure the *clip_output* layer is turned on by checking the checkbox next to it in the table of contents interface.
 - Double click on the *clip_output* layer name under the table of contents interface to open the Layer Properties dialog window. Select Unique values under Categories in the Show window, select the Value Field "FEATURE," and pick a color scheme that will give each feature a unique color. Click the "Add all Values" button to assign the color scheme to the feature. Close the Layer Properties dialog by clicking "OK." Verify that the specified colors are associated with the correct features.
5. Query the map (Figures 13 and 14).
- Click on the "Select Features" icon on the main toolbar. The cursor should change so that it has a yellow symbol attached to it. Click on a feature anywhere on the map. It should turn a bright aqua-blue color. Under the Selection Menu there is an option to Clear Selected Features so that a different feature may be selected. Ensure that at least one feature is selected and remains highlighted for the next steps.
 - Right click on the *clip_output* layer name on the outline table of contents interface and select "Open Attribute Table." When the table opens, select "Show selected" at the bottom of the table. All lines except the selected feature should go away and the selected feature row will be highlighted the same bright aqua-blue color as the feature on the map. There may be one or more features selected. Scroll all the way to the right of the table and verify that the Feature column lists the appropriate name.
 - Select the "Identify" tool on the main toolbar (looks like a dark circle with a white "i" in the center). The cursor will change when this tool is selected. It will have a black circle with a white "i" in the center, attached to the arrow pointer. Click on the same feature that was previously selected. A window will appear showing the Results and the corresponding data from the attribute table. Verify that the data in the Results window match the highlighted data in the Attribute table (Figure 13). Notice the difference between the "Select" tool and the "Identify" tool. The "Select" tool will highlight the feature both in the viewer and in the attribute table. The "Identify" tool will highlight the item only momentarily in the viewer and not at all in the attribute table, but it will cause a window to appear with information from the attribute table to identify the feature that was selected.
 - Under the Selection menu on the toolbar, pick "Select by Attributes". A query calculator window will appear.
 - Select the layer *clip_output*.
 - Check the box "Only show selectable layers in this list".

- Select the method “Create a new selection”.
- Scroll down in the Field window and double click on the Field “FEATURE”. Click on the equals “=” sign.
- Add values to the Unique Values list by clicking the button “Get Unique Values” and double click on the unique sample value ‘City Limit Lines’. The equation should be visible in the text field.
- Click on Apply and verify that all of the city limit lines in the data frame are highlighted a bright aqua-blue. They should also be highlighted in the Attributes table (Figure 14).
- Close the Attribute table and the Select by Attributes windows by clicking on the “X” in the upper right hand corner of each window.

6. Create a Layout presentation (Figure 15).

- Under View on the main toolbar, click layout view.
- Under Insert on the main toolbar, add the following elements:
 - North arrow
 - Scale bar
 - Legend
 - Title
 - Text box (for Metadata)
- Modify these elements for an aesthetically pleasing and informative presentation (Figure 15). In doing this, verify that all elements can be manipulated.

7. Open ArcScene from ArcMap in preparation for the next test.

- Make sure the 3D Analyst extension is turned on. Under the Tools dropdown menu on the Main Menu, select “Extensions...” and check the box next to “3D Analyst.” Click the “Close” button. Now make sure the 3D Analyst toolbar is visible. Under View, Toolbars on the main menu, check 3D Analyst. This will open the 3D Analyst toolbar and enable its functionality.
- Click on the ArcScene icon on the 3D Analyst toolbar to prepare for Test Case 4. The ArcScene application should open.

6.2.4 Test Results

PASS/FAIL: The test is successful if all required results are obtained in Section 6.2.3.

This test **PASSED**. The following comments substantiate the PASSING grade.

- All data were correctly displayed in ArcMap. Features (streets, boundaries, water features, etc.) overlapped correctly. All four quadrants of .sid data overlaid to create one seamless image.

- Data were clipped to the proper extent using ArcToolbox.
- Queries and selections highlighted the correct features on the data map as well as in the Attributes table. Identifications returned the correct results.
- Layer properties were rendered as selected in the outline table of contents interface and Layer Properties dialog windows.
- Layout presentation was successfully created. It included the geographic data view as well as the map elements north arrow, text box, title, scale bar, and legend.

6.3 Test Case 3 – ArcScene

ArcScene provides the interface for viewing multiple layers of 3D data for visualizing data, and creating and analyzing surfaces. ArcScene lets you make perspective view scenes in which you can navigate and interact with your geographic information system (GIS) data. You can drape raster and vector data over surfaces and extrude features from vector data sources to create lines, walls, and solids.

6.3.1 Objective

Demonstrate that ArcScene can overlay images over a digital elevation model to create a 3D surface and that perspective view scenes can be made from this surface as the user navigates through it.

6.3.2 Test Input

Raster file created by ArcToolbox in Test Case 1 and .sid quadrant files from Section 6.1.2 of this document.

6.3.3 Test Procedure

1. Add the four .sid quadrant files and helotes_dem raster as layers to the scene using the “add data” button on the toolbar. Use the same naming convention as in Section 6.2.3, (i.e., helotes_NE_sid, helotes_NW_sid, etc.).
2. Save the project under the test directory as SVTP.sxd.
3. Make a perspective view scene (Figure 16).
 - Un-check the helotes_dem raster file on the Layers outline tree.
 - Modify the Layer Properties of one of the .sid quad files.
 - Double click on the layer name helotes_NE_sid in the Layers outline tree to open the Layer Properties dialog window.
 - Under the Base Heights tab, select the checkbox for “Obtain heights for Layer from surface” and choose the DEM file from the helotes_DEM directory under the test directory as the surface. It should already be the default surface because it is the only layer currently in the project that has a z-value.
 - Apply a Z Unit Conversion factor of 5.00 so that the elevation is exaggerated and leave the units as custom. Do not add an offset.

- Click the “Apply” button to apply the changes and then click “OK” to close the Layer Properties dialog window.
- The northeast quadrant should be elevated above all of the other quadrants in the data view (Figure 16).
- Select the “Zoom In” tool icon on the Tool toolbar. It looks like a magnifying glass with a plus in the center. Zoom in to the northeast quadrant. The surface should be three-dimensional.

4. Navigate and interact with GIS data (Figure 17).

- Use the “Fly” button on the navigation toolbar and verify that it allows the observer to move through the 3D space.
 - The “Fly” button looks like a black outline of a bird flying. Click on the button and the mouse cursor will turn into an image of a bird sitting on a cloud.
 - Move the cursor over the 3D map image and left or right click on the image to navigate through it. A left click will cause the observer to move forward. A right click will cause the observer to move backward.
 - A display of the current speed can be seen in the lower left corner of the ArcScene window. When the speed is at zero, the user can exit the “Fly” command by selecting another navigation tool from the toolbar.
- Zoom in and out and navigate with the various tools.
 - Center on Target
 - Zoom to Target
 - Set Observer
 - Zoom In/Out
 - Navigate
- Copy scene to clipboard using the Edit menu on the main toolbar.
 - The “Fly” speed must be zero to capture the scene.
 - Under Edit, select “Copy Scene to Clipboard”.
 - Verify this copy can be pasted into documents, for example, a Word document (Figure 17).

6.3.4 Test Results:

PASS/FAIL: The test is successful if all required results are obtained in Section 6.3.3.

This test **PASSED**. The following comments substantiate the PASSING grade.

- The data files were successfully added to the scene.
- Modifying the Layer properties as described in section 6.3.3 step 3 caused the two dimensional .sid images to appear three dimensional.
- Navigating through the perspective view scene was successful.

- Capturing a copy of the scene to the clipboard and pasting it into a word document was successful (see Figure 17).

6.4 Test Case 4 – ArcGlobe

The ArcGlobe application in ArcGIS 3D Analyst allows you to manage and visualize, from a local or global perspective, extremely large sets of three-dimensional geographic data. ArcGlobe provides the capability to seamlessly interact with any geographic information as data layers on a three-dimensional globe

6.4.1 Objective

Demonstrate that Globe can interact with geographic information as data layers on a three-dimensional globe.

6.4.2 Test Input

Raster file created by ArcToolbox in Test Case 1 and .sid image files from section 6.1.2 of this document. Polygon, vector, and point shape files (lakes, rivers, and cities) from the ESRI samples directory.

6.4.3 Test Procedure

1. Open ArcGlobe from the Start menu: Start → Programs → ESRI → ArcGIS → ArcGlobe
2. Under the Tools → extensions menu, ensure that the extension 3D Analyst is checked.
3. Add data to the project.
 - The two coverages “World Image” and “Countries” should have been pre-loaded to the project when ArcGlobe was opened.
 - Add Helotes data from the test directory using the “Add Data” button. Add the files helotes_NE/2998272a.sid, helotes_NW/2998271a.sid, helotes_SE/2998274a.sid, and helotes_SW/2998273a.sid. A dialog window will open with a warning that the layer you are trying to add has a different coordinate system. It does and ArcGlobe will adjust the coordinates “on the fly” to match those of the current project. Check the box “Don’t warn me again in this session” and Click the “OK to all” button.
 - Add polygon, vector, and point shape files.
 - Go to the directory C:\Program Files\ESRI\ESRIDATA\WORLD and add the following files: the polygon shapefile LAKES.shp, the line shapefile RIVERS.shp, and the point shapefile CITIES.shp.
 - Go to the directory C:\Program Files\ESRI\ESRIDATA\USA and add the polygon shapefile STATES.shp.
4. Save the project as SVTP.3dd under the test directory.

5. Modify data properties.

- Change the color of LAKES and RIVERS to blue by clicking on their respective symbols (below the layer names in the layer directory tree) to open the Symbol Selector window. Either choose the color blue from the Color Option or select River (for RIVERS) or Lake (for LAKES) under the available symbols. Verify that the changes were implemented when the OK button is clicked.
- Change the symbol for CITIES to a yellow triangle of size 18 on the Symbol Selector window. Verify that the changes were implemented when the OK button is clicked.
- Change the STATES symbol to have an Outline Color of black with an outline width of 2 and no fill color. Verify that the changes were implemented when the OK button is clicked.

6. Zoom to extents of project.

- Select all of the Helotes DOQQs by highlighting the names in the list, right click, and select "Zoom to layer." Then using the Navigate button (looks like a globe with an arrow pointing out to each of the four directions, north, south, east, and west), right click holding the mouse button down and drag the cursor down until the image zooms in to the smallest recognizable feature such as a road intersection. The image will be pixelated; however, you should be able to detect trees, houses, and roads. The image should be as clear as it was in earlier tests of ArcMap. Right clicking and dragging the cursor up when the navigation tool is selected will zoom out.
- Click on the "Full Extent" button (looks like a globe). Verify that the project zooms out to the extent of the project. The entire earth will be visible. Using the Navigation tool to rotate and zoom in and out, verify that the Countries layer highlights all of the countries on the globe.
- Verify that it is possible to navigate to the United States, Texas, and Helotes and that all pertinent layers are visible at each of these extents

7. Verify Spin and Animate Controls.

- Under the View → Toolbars menu, ensure that the "Spin" and "Animation" toolbars are enabled. On the Tools toolbar, click on the "Full Extent" button to zoom to the extent of the project. This should show the entire earth with a space buffer around it.
- On the Spin toolbar, click the "Spin Counter Clockwise" and "Spin Clockwise", and "Stop Spin" buttons. Verify that the globe and all layers rotate in the correct direction and stop rotation when directed to stop. Verify that increasing or decreasing the speed using the controller on the Spin toolbar causes the expected results.
- On the Animation toolbar, click the "Open animation controls" button.
- On the Animation Controls dialog window, accept all of the default options under the Options menu. Click the record button (looks like a solid black circle with a red circle around it). Once clicked, the black circle will turn red.

- On the Spin toolbar, click the “Spin Clockwise” button, let the earth model make a complete rotation and then click on the “Stop Spin” button. Using the navigation mouse pointer, right click on the globe and zoom in, out, and back to the original view. Now click on the “Stop” button (looks like a solid black square) on the Animation Controls dialog window. The recording is complete.
- Click on the Play button (looks like a right facing solid black triangle) on the Animation Controls dialog window. The earth model should perform the same rotation and zooming motions that were just recorded.
- On the Animation toolbar, select “Export to video” on the dropdown menu. Save the animation file as *SVTP.avi* under the test directory. Accept the default compression values. Note: ensure that there are no other applications covering any part of the ArcGlobe view screen as they will appear in the saved video.

8. Extrude Features in a layer.

- Right click on the Countries layer in the layer tree and select Properties to open the Layer Properties dialog window.
- Under the “Globe Extrusion” tab, check the box next to “Extrude features in layer...”.
- Click on the calculator button to the right of the Extrusion value text field to open the “Expression Builder” dialog window. Select “POP_CNTRY” and click the OK button.
- Apply the extension by using it as a value that features are extruded to and click the “Apply” button to apply the new properties. Notice that some of the values are so large that they will not fit on the screen. Open the properties dialog again and in the Extrusion value text field, divide the value by 100 to get more manageable numbers.

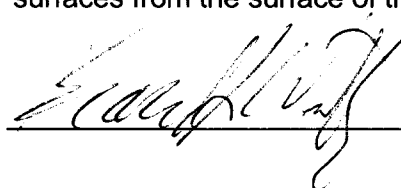
6.4.4 Test Results:

PASS/FAIL: The test is successful if all required results are obtained in Section 6.4.3.

This test **PASSED**. The following comments substantiate the PASSING grade.

- Raster, line, point, and polygon data files were successfully added to the scene and their properties modified.
- The project could be viewed from both a global and a local scale.
- The Spin and Animate functions allowed the user to interact with the globe and create a video file of the interaction.
- Layer features could be queried and modified to visualize results in the form of extruding layer surfaces from the surface of the globe based on numerical values.

Tester: Brandi L. Winfrey



Test Date:

1/19/05

Information on pages 18 through 35 contains copies of various maps from Texas Natural Resources Information System that are copyright information and are therefore not included in this file.