What's New in ArcGIS 9.2

A white paper from ESRI   5 March 2007   (includes changes introduced in service packs)

Summary of map navigation shortcuts in ArcMap
Summary of tables shortcuts

Highlights

1. Better quality, productivity & documentation

■ ArcGIS 9.2 features hundreds of productivity enhancements to make it quicker and easier to get results across all areas of the product. We've reviewed your feedback and added many frequently requested features. A very large number of quality issues have also been addressed. Based on your comments, we've also improved the documentation and provided a powerful new search facility in the Desktop help system.

2. Easier to create & use geodatabase data

■ You've asked us to make it easier for you to migrate your data to the geodatabase and deploy multi-user geodatabases with the ArcSDE technology. So at 9.2 we've enhanced the geodatabase so everyone can use it. We've improved the wizards and dialogs for creating data and eliminated the need to specify spatial domains and spatial indexes manually. The new file geodatabase format for single-user databases provides better performance than personal geodatabases, works across platforms, and has no overall database size limit. New lightweight ArcSDE database servers based on the Microsoft SQL Server 2005 Express Edition DBMS mean that anyone can set up a multi-user ArcSDE geodatabase and administer it using ArcCatalog.

3 Comprehensive enterprise solution for your GIS data assets

■ ArcGIS 9.2 lets you manage your enterprise GIS centrally as a strategic asset while making it easy for people throughout your organization to access data for mapping, queries, visualization, and maintenance, including web and mobile access. Replication allows distribution of a single logical database across multiple geodatabases in different physical locations, with updates being performed at any location and then synchronized to all locations. There are also new capabilities for historical archiving, non-versioned editing, and terrain data. New mobile functionality allows devices to update and synchronize attributes and features over wireless connections.

4. Make great looking maps with cartographic representations

■ 9.2 introduces cartographic representations: a major step forward in digital cartography. Representations vastly extend the symbolization capabilities of ArcGIS and allow you to get exactly the look you want without having to export your map to a graphics package like Adobe Illustrator. You can store representations in the geodatabase for easy update management and re-use in multiple map products. A new suite of cartographic editing tools lets you edit the symbology for individual features without changing their underlying feature geometry, so special situations and any level of complex detail can be handled.

5. Easier to deploy GIS maps & applications over the web

■ ArcGIS Server has been significantly improved at 9.2. A new web-based Manager makes it much easier to administer, and you can publish new services such as high performance cached map services, 3D globe services, geoprocessing services, and KML. Application creation has been simplified with a new out-of-the-box web mapping application that supports multiple service layer types (ArcGIS, ArcIMS and OGC WMS) in the same map, geoprocessing tasks, and web-based editing. People can also access your services with the new free ArcGIS Explorer client and combine them with other data sources for visualization and analysis.

6. More powerful visualization, modeling & analysis

■ 9.2 gives you new ways to explore your data and communicate the results of your work, and makes it easier to understand temporal patterns and trends. There's a powerful new graphing engine, the ability to create animations in ArcMap and export them as videos, support for multi-dimensional netCDF data, and easier 3D visualization in ArcGlobe. ModelBuilder now supports iteration, looping, specifying layer symbology, and interactive input of features. There are many new core geoprocessing tools, a new batch mode, and full support for geoprocessing in ArcGIS Server and the ArcGIS Engine Developer Kit.

Overview

Improved documentation

■ The 'What is ArcGIS' book has been completely updated and enhanced to tell the ArcGIS 9.2 story.
■ New search facility in the Desktop Help provides faster and more intelligent search.
■ Major improvements to Desktop Help topics including many new topics, animated tutorials, etc.

Easier working with geodatabases

Easier to create geodatabase data

■ Improved wizards and dialogs make it easier to specify coordinate systems and other key properties.
■ New XY tolerance property stored with feature classes provides consistent cluster processing throughout ArcGIS.
■ Feature data is now stored in double-precision coordinates, eliminating the need to specify XY domains manually.
■ Precision property replaced with new, easier to understand resolution property specified in coordinate system units.
■ Spatial indexes are now automatically created and maintained for you, greatly simplifying data management.

New file geodatabase format

■ New file-based single-user geodatabase format with better performance and no overall database size limit.
■ File geodatabases support all geodatabase functionality except for multi-user editing and versioning.
■ File geodatabases work across platforms and can be created, accessed and updated on Windows and UNIX.
■ Highly efficient compression functionality enables read-only data to use 50% or less of normal disk space.

Easier to use and deploy ArcSDE technology

■ ArcSDE now supports Microsoft SQL Server 2005 Express Edition, a lightweight full-featured free DBMS.
■ This new platform has been leveraged to provide two new ways to deploy ArcSDE technology. These make it quick and easy for anyone to get started using multi-user geodatabases and all the benefits of ArcSDE.
■ Personal ArcSDE technology comes for free with ArcGIS Desktop at the ArcEditor and ArcInfo license levels. It supports up to 4 concurrent users, 1 of who can edit the data at any time.
■ Workgroup ArcSDE technology is included in the new ArcGIS Server Workgroup product. It supports up to 10 concurrent users, all 10 of who can edit the data at any time.

Easier to manage and edit geodatabase data

■ New replication tools allow distribution of a single logical database across multiple geodatabases.
■ New historical archiving capabilities make it easy to store, query and manage database history.
■ Multi-user editing now possible without versioning with new short transaction editing option. GIS and non-GIS applications can share access to a common DBMS without the overhead of versioning.
■ New options for reconciling versions let you resolve all conflicts in favor of either the parent version or your edit session. New option to automatically save changes in all cases, which never notifies you of edits made by others.
■ You can now connect to an ArcSDE geodatabase using your operating system login username & password.
■ ArcSDE is now fully Unicode based, enabling data in multiple languages to be stored in the same dataset.

Improved support for Oracle

■ New spatial type for Oracle for storing ESRI features. Oracle Locator or the Oracle Spatial extension are not required. Provides open access to simple features in geodatabases using ISO Multi-Media/OGC SQL statements.
■ You can now create multiple geodatabases within a single Oracle database instance.
■ Direct read and write support for Oracle Spatial GeoRaster.

Easier working with CAD data

- Single icon for CAD files in ArcCatalog: A CAD drawing is now shown inside the CAD feature dataset.
- The number of fields supported for CAD feature classes has been doubled (tripled for CAD annotation feature classes), letting you query, analyze, and symbolize your CAD data more effectively.
- CAD layers can now be georeferenced using the Georeferencing toolbar, which allows you to move, rotate and scale your CAD layer using the mouse, and create control points, etc.
- CAD features are now rendered by default using the display properties in the CAD drawing.
- CAD annotation feature class rendering has been rewritten and includes full support for True Type fonts.

Raster enhancements

- Reads new formats: BSB, ERMapper ECW, HDF4, IDRISI, PCI, PCRaster, USGS ASCII DEM, X11 Pixelmap.
- Writes new formats: GIF, Jpeg2000 (JP2), JPEG, PNG, Windows BMP.
- Better raster attribute tables, including tables for ArcSDE rasters, table editing, and joins.
- Georeferencing toolbar now supports ArcSDE raster datasets and adds new Adjust & Spline transformations.
- Improved raster projection and transformation, including reading RPC information from vendor's TIFF files.
- Orthorectification and panchromatic sharpening, both on-the-fly and with new geoprocessing tools.
- New hillshading display option allows elevation rasters to be hillshaded without the Spatial Analyst extension.
- Support for the new file-based geodatabase greatly improves performance of geodatabase rasters.
- Set brightness, contrast and transparency for a group layer so it applies to all the raster layers in the group.

New terrain data type for handling elevations and surfaces

- Terrains let you store massive surface datasets, such as LIDAR elevation data, in the geodatabase.
- Terrains provide optimized performance at multiple resolutions through the use of terrain pyramids that quickly retrieve only the data needed for the required level of detail in a given area of interest.
- All users can view terrain datasets. The 3D Analyst extension is required to create them.

Easier working with tables

Support for Excel spreadsheets

- Work directly with Excel spreadsheets in ArcGIS as tables. Excel files listed automatically in ArcCatalog.
- Support for named ranges in Excel lets you access any specific range of cells in a spreadsheet as a table.

Table window productivity enhancements

- New Calculate Geometry dialog makes it easy to calculate area, perimeter, length, xy locations & centroids.
- Turn fields on and off, specify field aliases, & change number format directly from table window.
- New appearance properties enable long field names and long values like comments to wrap in the table window.
- Print tables directly from the table window.
- Navigate directly to features on the map by interacting with rows in the table window.
- Many new shortcuts for working with and editing data in tables.
- When table is showing just the selected records, you can now unselect records by clicking on them.

Editing enhancements

- New set of coordinate geometry (COGO) editing tools.
- New attribute-driven editing workflow option and enhanced Construct Features command.
- Multipatch features have basic editing capability.

ArcMap enhancements

Better map navigation

■ New Go To XY command for navigating to and annotating coordinate locations you type in.
■ Mouse wheel support for zooming, panning and re-centering map reduces need to switch tools while working.
■ Full set of keyboard shortcuts for map navigation and new menu of shortcuts when you right-click map.
■ New option to customize exactly where on your map the Full Extent button zooms out to.
■ Easier to specify scale with new customizable scale control including support for relative scale input.
■ New viewer window lets you work at several scales simultaneously & compare multiple data frames side-by-side.
■ New My Places dialog gives quick access to frequently used addresses, locations & extents from any map or globe.

Improved ability to find and identify

■ Enhanced Find dialog includes built-in web services for finding places and addresses.
■ New Find Nearby Places dialog lets you query web services to find places and information near any map location.
■ Enhanced Identify tool includes ability to drag a box, sort and hide fields, etc.

Easier to select features

■ The Select By Attributes dialog now shows fields with their aliases and hides fields that are turned off.

Easier to work with layers

■ Layer lists in dialogs now show feature type icons and are indented to show group layer structure.
■ Group layers have their own transparency, contrast and brightness properties and support the Swipe tool.
■ New Flicker command supports change detection and data comparison.

Map document improvements

■ Enhanced Measure tool adds area & feature measurement, snapping, running total, etc.
■ New Map Properties option lets you make relative paths be the default for all new map documents you create.

Better symbol drawing performance

■ Fill symbols with outlines in default ESRI style and others now draw up to 65% faster.
■ New ESRI_Optimized style provides additional fast drawing fill and line symbols.

Accessing map services from the web

■ Full datum transformation support greatly increases accuracy and reliability of ArcIMS image services in ArcMap.
■ ArcIMS image service authors can now choose to block access to geometry from ArcMap and other clients.
■ OGC WMS services are now projected on the fly in ArcMap. Secure WMS services are now supported.

New cartographic editing and finishing capabilities

■ Store symbology with the features in the geodatabase as 'representations' and edit the appearance and geometry of these representations on maps.
■ New graphic editing tools and a new suite of symbol effects give you complete control over map symbols.
■ Get cartographic results that previously required exporting maps to separate graphics programs.

Printing and export enhancements

■ New ArcPress 'Universal' drivers provide native support for HP Designjet and EPSON wide-format printers.
■ Support for PDF layers lets you export maps to PDFs in which map layers and graphics can be turned on and off.

New visualization & analysis capabilities

Animation enhancements

■ Animation now available in ArcMap. Create, playback, and export animations showing change over space and time.

New graphing functionality in ArcMap

■ Completely new graphing engine with new options and powerful analysis and visualization.
■ Graph color can be synchronized with the symbology used to display layers. Graphs can also be animated.
■ Better handling of temporal data and time axes.
■ Dynamically linked feature selection between graphs, tables and maps.

Integrate time into your GIS

■ Improved support for visualizing and analyzing temporal change, patterns and trends.
■ Support for netCDF time-based and multidimensional data. Can be displayed, graphed and animated.
■ New toolbox provides multidimensional geoprocessing tools.

New geoprocessing & modeling capabilities

■ Desktop Help for geoprocessing concepts has been completely rewritten.
■ New batch mode lets you execute tools multiple times.
■ Large overlay capabilities now built into standard overlay tools so separate toolset no longer required.
■ New Results tab in ArcToolbox gives you easy access to all your geoprocessing history.
■ Drag tools into the Table Of Contents to create new, easy-to-use tool layers.
■ Many improvements to existing tools, including better Calculate Field and field mapping in Append tool, etc.
■ 81 new core tools and over 40 new tools in various extension products.
■ Uses native Python (no longer requires win32com extension) so Python scripts can now run on any platform.
■ ModelBuilder now supports iteration using list, series, and feedback loops.
■ Specify layer symbology as properties for input and output data in models.
■ Define features interactively on-the-fly as input to models.
■ New in-memory workspace for writing temporary feature classes and tables.
■ In-line variable substitution in models and command line.
■ Full support for geoprocessing with ArcGIS Server. Toolboxes can be published on the Web to provide geoprocessing services which can be accessed via ArcGIS Desktop, ArcGIS Explorer & custom web applications.
■ Full support for geoprocessing functionality in the ArcGIS Engine Developer Kit.

Geocoding & routing enhancements

Geocoding

■ Geocoding performance has been greatly improved with a general speed increase of 4x.
■ Address locators are now self contained and portable as they no longer need to access their reference data.

Routing

■ New Find Route dialog in ArcMap, ArcReader and ArcGIS Engine provides free built-in support for routing and driving directions for the US, Canada, and Western Europe at all license levels.

StreetMap routing

■ Support for barriers, trip planning, speed specification, and network restrictions such as vehicle weight or length.
■ StreetMap routing performance has been increased at least 3x.
■ Driving directions have been improved and now offer stop vicinity maps and turn-by-turn maps.

ArcCatalog and metadata support improvements

■ Rename ArcCatalog folder connections to hide long paths and customize appearance of Catalog tree.
■ The Set Data Source(s) command in ArcCatalog now supports updating references in map documents to ArcSDE geodatabases, coverages, tables, rasters, and all geodatabase data types including topologies, etc.
■ View metadata for any layer's data source directly from ArcMap or ArcGlobe without opening ArcCatalog.
■ New geoprocessing tools for metadata provide metadata export to ISO 19139 format, FGDC validation, etc.

Customization and development

Application Framework enhancements

■ Easier to find commands in the Tools > Customize dialog, and you can define keyboard shortcuts for tools.

ArcGIS Desktop developer resources

■ Resources for Desktop developers have been separated into four unique kits: ArcGIS Desktop VBA Developer Resources, ArcGIS Desktop Developer Kit for Visual Basic 6, ArcGIS Desktop Developer Kit for Visual C++, ArcGIS Desktop Developer Kit for the .NET Framework.

ArcGIS Engine Developer Kit

■ Support for additional extensions: Data Interoperability, Maplex, Schematics, and Tracking Analyst.
■ Many enhancements to existing controls, including mouse wheel navigation and context sensitive help.
■ Many new controls and dialogs provide the same new and enhanced functionality available in the Desktop at 9.2: Go To XY dialog, Measure tool, Identify tool, Find dialog, My Places dialog, Find Route dialog, animations, etc.
■ New engine-based Add Data dialog allows end users to add different types of data into maps and globes.
■ Support for feature editing enables development of editing applications via range of new editing controls.
■ Support for ink-based mark up enables a range of in-the-field applications on tablet PCs.
■ Support for subscription-based ArcWeb Services.
■ New dynamic display capability allows applications to be developed that can display large numbers of moving objects such as aircraft on-screen at sub-second refresh rates for command and control, etc.
■ .NET developer resources and tools have been integrated into the Visual Studio 2005 and Express integrated developer environments (IDEs). Many updates to the Java SDK and API.

Data and services from ESRI

Free services from ArcGIS Online

■ ArcGIS Online is a new family of web-based services and products for ArcGIS users that is being introduced after the 9.2 release. It includes a number of free web services providing basemaps, globes and reference overlays for use in ArcMap and ArcGlobe.

Better integration of ArcWeb Services

■ Separate toolbar download no longer required to use the subscription-based ArcWeb Services in ArcGIS.
■ ArcWeb Services functionality fully integrated into all 9.2 products & exposed automatically once you are logged in.

ESRI Data and Maps datasets

■ Adds 90 meter Shuttle Radar Topography Mission (SRTM) Global Digital Elevation Model (DEM) and shaded relief.

StreetMap data support

■ Secure Feature Layer (SFL) support for SDC datasets provides data vendors with flexible copyright protection.

ArcGIS Server enhancements

ArcSDE technology integrated into ArcGIS Server product

■ ArcSDE is now included as part of the ArcGIS Server product, which becomes our comprehensive solution for managing and serving geographic data both in a multi-user DBMS environment and over the web.

■ Available scaled to two levels, ArcGIS Server Workgroup and ArcGIS Server Enterprise. Basic, Standard and Advanced Editions provide different levels of functionality.

Easier to manage ArcGIS Server

■ New ArcGIS Server Manager makes it easy to publish GIS services, create web applications and administer your server using a web browser.

■ Improved user interface for working with ArcGIS Server in ArcCatalog. New 'Publish to ArcGIS Server' wizard.

■ Contents of servers can be organized into folders which can be browsed in ArcCatalog.

New ways to publish your GIS resources

■ Create new high performance map services cached for rapid display at specific scales.

■ Publish your ArcGlobe documents as globe services so people can visualize your data in 3D over the web.

■ Publish your geoprocessing workflows, models and toolboxes as geoprocessing services.

■ New geodata services support geodatabase replication, synchronization and data extraction over the web.

■ Easier to serve network analysis functionality

■ Extended interoperability allows data to be published in OGC WMS and Google Earth KML format.

■ Maplex extension-based high quality labeling is now supported when you publish a map service.

■ The Data Interoperability extension is now supported by ArcGIS Server.

New client applications

■ Completely new, great-looking web mapping application provided out-of-the-box. Supports multiple map services, seamless panning, mouse wheel navigation and tasks, including tasks based on geoprocessing services. All configuration is done with a wizard in ArcGIS Server Manager so no web development expertise needed.

■ The same web mapping application and set of web controls is included with ArcGIS Server and ArcIMS, simplifying use, support, and development. Services from both products can be seamlessly integrated in one application.

■ Full support for ArcGIS Explorer, a completely new lightweight free desktop client introduced at 9.2. Users can work with maps or globes, and access your geoprocessing services as tasks.

Web Application Development Framework (Web ADF)

■ Single generic Web ADF now supports ArcGIS Server and ArcIMS, and is included with both products.

■ Enhanced web controls provide support for multiple map services, map tips, geocoding, and more.

■ Improved documentation with new ArcGIS Server Help and Developer Help systems.

What's new on the Microsoft .NET framework

■ Full support for Microsoft .NET Framework 2.0 and Microsoft Visual Studio 2005.

■ Complete ArcIMS API for the Microsoft .NET framework now part of Web ADF. This wraps all ArcXML functionality so you can create ArcIMS solutions without having to write ArcXML requests.

What's new on the Java platform

■ 9.2 introduces a set of Geospatial Enterprise JavaBeans (EJB) that perform services such as mapping, query, network solving, geocoding, etc, so that Java developers can now create applications in a pure Java API instead of having to use ArcObjects.

Create mobile GIS applications

■ New Mobile GIS ADF for developing lightweight applications on handheld devices.

■ Supports integrated GPS, quick attribute updating during field inspection, field data collection involving the creation of features, and wireless synchronization.

ArcIMS enhancements

New Web Manager

■ Web Manager makes it easy to create great-looking out-of-the-box web mapping applications.

New out-of-the box web mapping application

■ The new web mapping application provided with ArcGIS Server is also provided with ArcIMS, so your applications have the same look and feel and can integrate services from both products.

New Web Application Development Framework (ADF)

■ ArcIMS 9.2 introduces a Web Application Development Framework (Web ADF) providing consolidated access to ArcIMS, ArcGIS Server, ArcWeb Services, and OGC WMS services.
■ Same Web ADF and web controls used for both ArcGIS Server and ArcIMS.
■ Web ADF provides a full set of Web controls for the .NET Framework and Java platforms.
■ Complete ArcIMS API wraps all ArcXML functionality so you can create solutions without writing ArcXML requests.

Other highlights

■ Better performance: The Spatial Server will now stop processing a request if the Application Server times out, so it is available more quickly for new requests.
■ Better data security: ArcMap users cannot download vector data unless ArcIMS has been configured to allow it.
■ Support for projections in the Spatial Server has been improved, including support for datum transformations.
■ ArcIMS ArcMap Server now supports the Maplex extension, definition queries, field aliases, and honors subtypes and domains.
■ Direct connect is supported in Author for accessing ArcSDE layers.
■ New Metadata Explorer.
■ Support for new geocoding styles.
■ The WMS Connector has OGC Styled Layer Descriptor (SLD) support.

New free ArcGIS Explorer client

■ New lightweight GIS data viewer available as a free download. Supports 3D viewing of maps and globes.
■ Task-based user interface can be customized by developers to expose ArcGIS Server functionality.
■ Fuse data from different sources together to create custom visualizations.
■ Set of ready-to-use globes and base maps available.
■ Support for additional server-based data from ArcIMS, ArcGIS Server, OGC WMS and ArcWeb Services.
■ Support for shapefiles, file geodatabases, raster data, and Google Earth KML/KMZ.

Extension enhancements

3D Analyst (includes ArcGlobe and ArcScene)

■ New terrain data type lets you create multi-resolution surfaces from massive datasets such as LIDAR data. Terrains can be accessed read-only by all users without requiring the 3D Analyst extension.
■ New wizards in ArcGlobe makes it easier to handle newly added data and relocate globe documents and data.
■ Built-in address finding services for US, Canada & Europe, & support for additional services via ArcWeb Services.
■ New Go To XY & My Places dialogs, improved Measure & Identify tools, and ability to set effects for group layers.
■ Google Earth KML files can be added to ArcGlobe as layers. Layers can be converted into KML files.
■ ArcGlobe supports labeling and drawing graphics and text. Annotation and text labels can be draped on the globe.
■ Memory cache management has been enhanced and can be optimized for each data type.
■ Globes can now be published over the web as services using ArcGIS Server and accessed by various clients.

ArcScan

■ New tools for point to point tracing, shape recognition, and measuring raster distance.
■ New vectorization settings for specifying noise level and controlling how corners are resolved.

Data Interoperability

■ Provides free support for OGC GML Simple Features data without need for Data Interoperability extension license.
■ Now based on Safe Software's FME 2006 release which supports Google Earth KML & OGC GML 3.1.1, etc.
■ Now supports ArcGIS Server & ArcGIS Engine.

Geostatistical Analyst

■ New geoprocessing tools including Moving Window Kriging, GA Layer To Contour & GA Layer To Points.
■ New smooth interpolation option.

Maplex

■ Placement quality and performance generally improved. Support added for leader lines.
■ Now supported by ArcGIS Server, ArcIMS ArcMap Server, ArcGIS Engine, and ArcGIS Publisher.

Network Analyst

■ Route analysis supports start time specification, multiple routes, and parameterized attributes.
■ Directions window supports time windows, cumulative distance and time, scale control for inset maps.
■ Service areas can be trimmed and you can create services areas that do not overlap.
■ Reverse geocoding and snapping are supported when adding network locations to a map.
■ Easier to serve network analysis services using ArcGIS Server.
■ New Network Analyst developer controls in ArcGIS Engine including Directions window.

Publisher and ArcReader

■ Support for Maplex so maps with high quality labeling can now be viewed and printed from ArcReader.
■ New ink-based mark-up toolbar for red-lining
■ Includes ability to Find addresses, perform routing & get driving directions in US, Canada & Western Europe.
■ New Go To XY dialog, My Places dialog, Measure tool, full-screen mode, ArcWeb Services support, and more.
■ Ability for ArcReader users to modify the map title that appears on page layout before printing.

Schematics

■ New viewer window lets you work with schematics & geography side-by-side on-screen without using Layout view.
■ New Diagram Type Assistant makes it easier to create new types of custom schematic diagrams.
■ Now supports ArcGIS Engine and network datasets created with the Network Analyst extension.

Spatial Analyst

■ New suite of solar radiation analysis geoprocessing tools, and new math tools.
■ Core 9.2 enhancements such as looping in models & support for netCDF data increase the power of this extension.
■ Using ArcGIS Server Advanced edition you can serve your analytical models and workflows over the web.

Tracking Analyst

■ Improved performance for large datasets, and streaming locations from local GPS connection now supported.
■ More options for symbolizing tracks including event labeling, directional vectors, smoothing, and more.
■ Support for ArcGIS Engine.

Documentation

'What is ArcGIS 9.2' book

■ The 'What Is ArcGIS' book has been updated and enhanced for 9.2. This book comes with ArcGIS Desktop and is also available as a PDF in your arcgis/documentation folder after you've installed the software. This book is a great introduction to ArcGIS 9.2, the concepts underlying the product, and how the different parts of the product work together, and is recommended both for existing users who are familiar with previous releases and for new users:
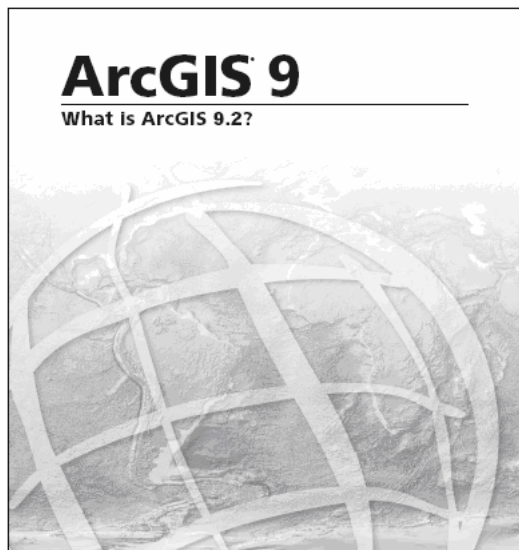
Better search in Desktop Help

■ A new search capability has been implemented in the ArcGIS Desktop Help at 9.2 to provide faster, more effective search. The new search engine provides natural language capabilities, and allows you to search using everyday language, including keywords, phrases, and questions. To use the new search, click the Search tab, type what you want to search for, then click the Ask button. The results are ranked by relevance:

You can customize your search by clicking the Options link under the search input box. By checking boxes in the list, you can include only the subject areas or products you want to search, and exclude the rest. Click the History link to view your previous searches. If you want to repeat the search, just click the link in the list.

This new search capability is not available when you access the Web-based version of the Desktop Help. The Web-based help has a search capability but it is not the same search engine available when you use Desktop Help locally.

Better content in Desktop Help

■   Based on your feedback and requests, we have improved the content of the Desktop Help system and restructured it around key concepts and workflows. Each subject area now has its own high-level overview topic.
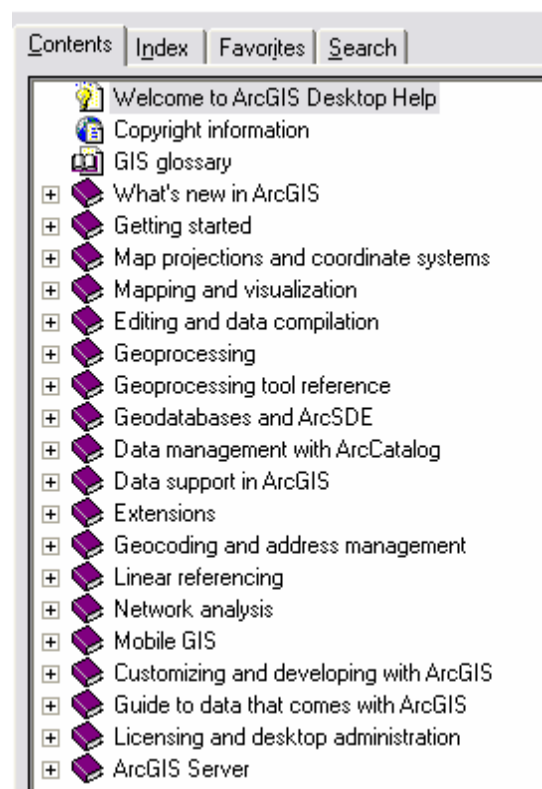
⬜ *Try it now: Click the following link to launch the ArcGIS 9.2 Desktop Help on the Web:*
http://webhelp.esri.com/arcgisdesktop/9.2

■ The "Getting started" section of the help has been rewritten to provide additional topics on fundamental GIS concepts and how to work with the software, including tips and tricks, and descriptions of every toolbar:

⬜ *In the Desktop Help, see: Getting Started > Toolbars > Core ArcMap toolbars*

⬜ *In the Desktop Help, see: Getting Started > Introducing ArcGIS Desktop > Tips and tricks*

Easier to get to the tutorials

■ It's easier to access the PDF workbooks for the ArcGIS Desktop tutorials. The PDFs are now automatically installed with ArcGIS Desktop, and can be opened from links inside the help. You will still need to run the ArcGIS Desktop Tutorial Data Setup Program to install the 'ArcTutor' data used in the tutorials. A link from the Desktop Help welcome page takes you to the 'Tutorials' topic that contains links to all the tutorial PDFs.

■ Animation clips showing you how to perform tasks in each of the tutorials have also been added to the help system. To view the videos, click the "Watch the tutorial" link on the main tutorial topic page, then click the segment you want to watch. Each of the tutorial video segments has additional text below it describing the actions in the segment. Searches with the new search engine will find matches in this text.

⬜ *In the Desktop Help, see: Getting Started > Tutorials > Tutorials*

Other

■ When you launch the Desktop Help from the Help menu in any of the ArcGIS Desktop applications, it is now launched inside a separate process. This eliminates a number of issues that have been reported when the Desktop Help is launched in the same process as the application. It also means that when you launch the Desktop Help in this way, it no longer 'stays on top' of the application window.

■ The contents of Desktop Help topic pages are now always automatically expanded. This minimizes the amount of clicking you need to do to see everything on a page. (At 9.1, sections were always collapsed.)

■ The Desktop Help window has been made simpler and more compact. We've removed the pulldown menus it used to contain.
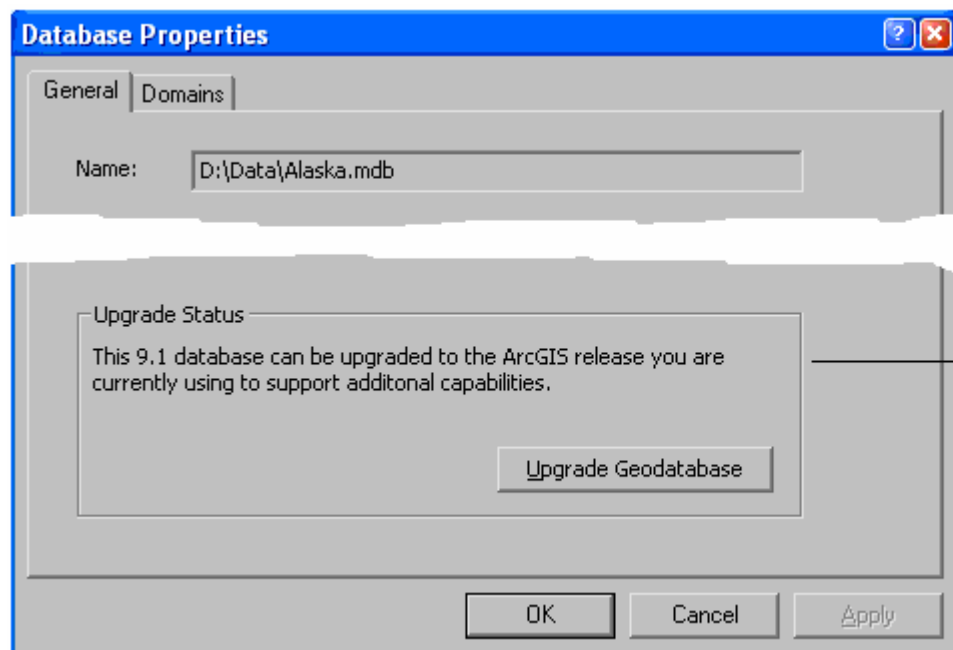
Compatibility

Geodatabase compatibility

■ Existing geodatabases created using previous releases can be opened and used in 9.2 without being upgraded to 9.2. However, to take advantage of new functionality added at 9.2, existing geodatabases have to be upgraded.

In addition to new functionality, ArcGIS 9.2 introduces a high precision data storage format for feature data in the geodatabase. Upgrading an existing geodatabase to 9.2 does not convert it to use this new format. Instead, once you have upgraded a geodatabase to 9.2, you can then upgrade the data it contains to use this new format using a new tool called Upgrade Spatial Reference. You can launch this tool by right-clicking a standalone feature class, feature dataset or raster catalog in ArcCatalog and choose the Upgrade Spatial Reference command. This tool is also available in ArcToolbox.

ArcGIS 9.2 also introduces new tolerance and resolution properties for feature data in the geodatabase. Feature classes and feature datasets in any geodatabase you work with in ArcGIS 9.2 have these new properties, even if you have not upgraded the geodatabase to 9.2. However if you want to be able to specify the tolerance properties for new data you create in a geodatabase, you have to upgrade it to 9.2 first.

■ In the Geodatabase Properties dialog General tab (accessed by right-clicking a geodatabase and choosing the Properties command), the Upgrade Status box now tells you the version of ArcGIS that the geodatabase belongs to. This makes it easier to manage your migrations. For example, here's what you see in 9.2 when you look at the properties of a personal geodatabase that was either created with ArcGIS 9.1 or was upgraded to version 9.1:

Here's what you'll see after you upgrade this geodatabase to 9.2:
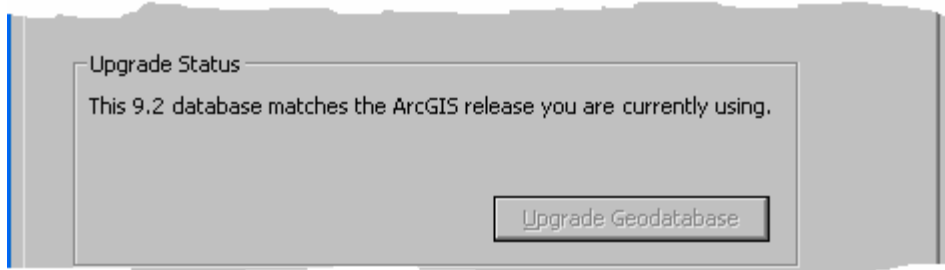
■ To upgrade a geodatabase to ArcGIS 9.2, use the Upgrade Geodatabase button in the tab shown above. This works with all geodatabases except for Enterprise ArcSDE geodatabases (i.e. geodatabases you connect to via the Database Connections folder in ArcCatalog). To upgrade an Enterprise ArcSDE geodatabase, see your ArcSDE installation guide. Upgrading an Enterprise ArcSDE geodatabase can only be performed by the administrator of that database.

Tip: In the Tools > Customize dialog in ArcCatalog, the 'Geodatabase tools' category contains a command called Upgrade Geodatabase that you can add into any pulldown menu or toolbar in ArcCatalog. This command does the same thing as the Upgrade Geodatabase button but can save time if you have a lot of geodatabases to upgrade. This command becomes enabled when you select a geodatabase in ArcCatalog that needs upgrading.

■ Once a geodatabase has been upgraded, it can no longer be accessed from an older version of ArcGIS. If this is a requirement, do not upgrade the geodatabase. You can still work with it in 9.2 but new functionality won't be available.

Other compatibility

■ Once you open and then save an existing ArcMap .mxd document, ArcGlobe .3dd document or ArcScene .sxd document using ArcGIS 9.2 it can no longer be opened with earlier versions of the software because it will now reflect the new functionality added at 9.2. Similarly, new documents you create with 9.2 can also not be opened in earlier versions of the software. To save a copy of a document that has been created or edited in 9.2 so it can be opened in version 8.3, 9.0 or 9.1, use the File > Save A Copy command and choose the version you want to save to from the Save As Type dropdown list in the dialog. Saving a document back to 9.1/9.0 or 8.3 format removes functionality from that file that depends on the version it is being saved out from. For example, terrain layers, which are new in 9.2, are removed from map documents that you save back to an earlier version.

■ Layer files (.lyr) that you create with 9.2 can also not be opened with earlier versions of the software. To create a layer file that can be opened in an earlier version, use the Save As Layer File command in the layer context menu in the application you are using and choose the version you want to save to from the Save As Type dropdown list in the dialog. As with documents, functionality that is not available in the version of ArcGIS you are saving the layer file for use with will be automatically removed.

■ ArcReader .pmf files that you publish with the ArcGIS Publisher extension at 9.2 can't be opened with earlier versions of ArcReader.

■ As mentioned above, once you upgrade a geodatabase to 9.2, it can no longer be accessed with an older version of ArcGIS. This includes any geoprocessing toolboxes contained in the geodatabase. Similarly, once you make a change to a file-based toolbox (.tbx file) in 9.2, it can no longer be opened in a 9.0 or 9.1. However, you can save a toolbox in a geodatabase or a file-based toolbox as a file-based toolbox that can be opened in 9.0 or 9.1 using a new command added at 9.2. You can access this new 'Save As 9.0/9.1' command by right-clicking any toolbox in ArcCatalog or in the ArcToolbox window.

The contents of the file-based toolbox that is created by this command are not automatically modified to remove functionality that is not available in 9.0/9.1. So if the toolbox contains models that include functions added at 9.2, these models can be opened in 9.0/9.1 but they will need to be modified manually in 9.1 to remove those steps in order to run the model.

Geodatabases & ArcSDE

Easier to create data

The wizards in ArcCatalog for creating feature classes and feature datasets have been enhanced to make it easier to specify key properties like the feature type and coordinate system.

■ When you create a new feature class in ArcCatalog, the first panel of the wizard now lets you choose what type of feature class you want to create from a single dropdown list. Previously you had to go into the properties for the Shape field to specify the feature type (point, line, polygon, etc). The feature types shown in the dropdown list depend on the Desktop license you are using and where you are creating the data. The first panel of the wizard also now lets you choose whether the coordinates will have M or Z values. These were also previously specified as properties of the Shape field. The graphic below left shows the first panel of the wizard at 9.2.

When you create a new standalone feature class, the wizard now includes a separate panel for specifying the XY coordinate system. Previously you had to go into the properties for the Shape field and use the Spatial Reference property to specify the coordinate system for a standalone feature class. The new panel shows you the contents of the Coordinate Systems folder in ArcCatalog and lets you browse the tree to the coordinate system you want to use. As in previous releases, a feature class inside a feature dataset always uses the XY coordinate system specified for the feature dataset, so at 9.2 you now see this same wizard panel when you create a new feature dataset. The graphic below right shows the new panel for specifying the XY coordinate system, in this case for a standalone feature class:
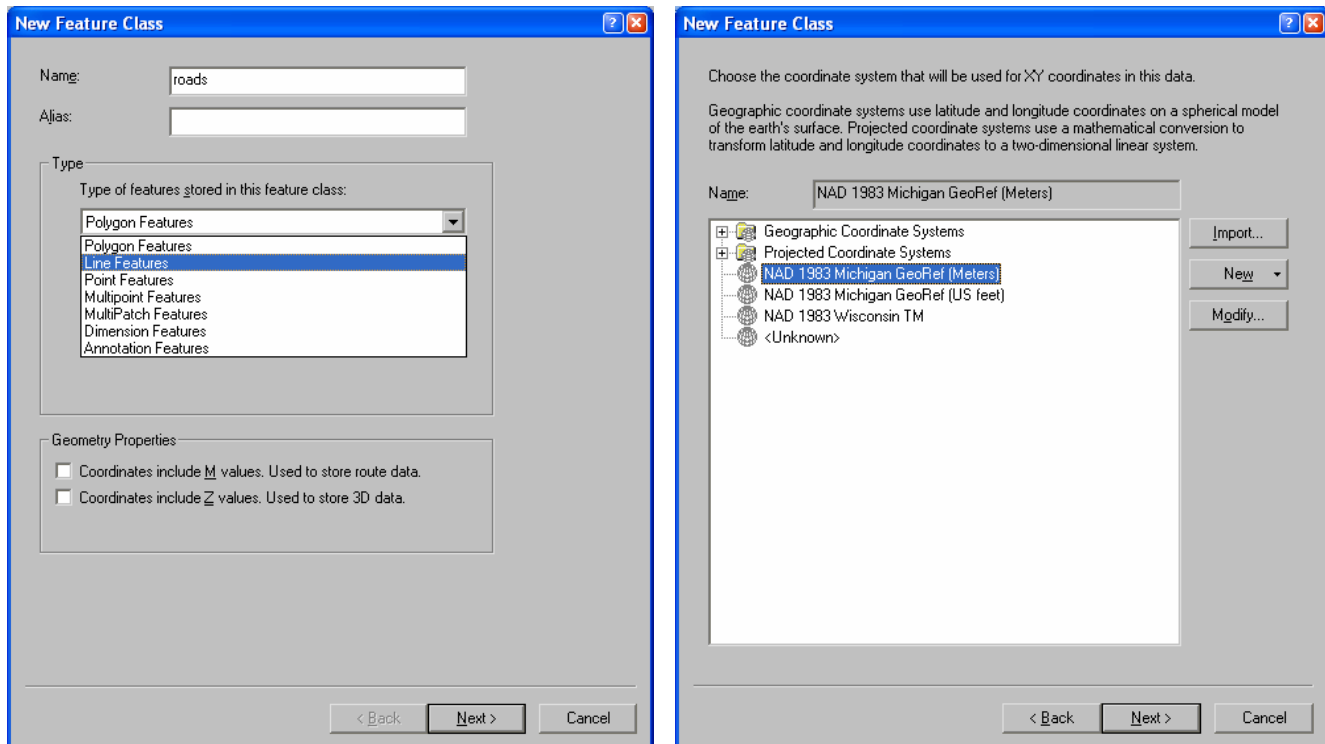
Tip: As you can see in the graphic above right, some frequently used coordinate systems have been placed into the top level of the Coordinate Systems list so they can be accessed easily in the wizard. At 9.2, ArcCatalog lets you copy/paste or drag your most frequently used coordinate systems into the top level of the Coordinate Systems folder if

you have added it into ArcCatalog's tree. Coordinate systems that you have placed at the top level of the Coordinate Systems folder appear at the top level of the same list in the New Feature Class wizard and in all dialogs in ArcGIS that let you browse to coordinate systems.

■ The panel in the wizard for specifying the database storage configuration keyword now only appears if configuration keywords are supported by the geodatabase you are working with.

■ The panel for specifying fields in a new feature class or table now provides a wider and longer fields listing, and you can use the mouse wheel to scroll up and down through the listing. If you click on the Shape field, you'll notice that this field has fewer field properties than it did at 9.1. Properties like whether the data contains Z and M values and the spatial reference are no longer specified from this panel. The Geometry Type field is still shown for compatibility reasons but its setting can no longer be changed in this panel. The number of grid levels shown now respects the type of data you are working with, so you'll only see three levels listed when all three are supported.

■ If you click on a numeric field in the Fields panel, the Scale and Precision field properties are no longer shown if they are not supported by the geodatabase you are working with. So for example, if you create an integer field in a personal geodatabase feature class, you'll no longer see a Precision property for this new field. In 9.1 Scale and Precision properties were always shown even if the geodatabase being used did not require their use. Similarly, the panel no longer lists Blob and Guid as field types when you add a field to a shapefile or dBASE table, because these geodatabase field types are not supported by those formats. These same enhancements have also been made in the Add Field dialog you launch when you add a field to a table window in ArcMap, ArcGlobe or ArcScene.

■ The new high precision data storage introduced at 9.2 eliminates the need to specify the XY domain manually when you create data.

When you create a new standalone feature class or feature dataset in a geodatabase that has been upgraded to 9.2 or created with 9.2, the software now automatically calculates the appropriate XY domain for the coordinate system you chose, and the Min X, Min Y, Max X, Max Y values of this extent are no longer editable, or even shown to you, in the wizard. It also calculates an appropriate XY resolution value, but gives you the option of entering this manually. XY resolution is a new property that replaces the precision property used in earlier releases.

■ Spatial indexes are now automatically created and maintained for you, greatly simplifying data management. This removes the need to have to specify spatial index grid levels when you initially create data. See below for more information.

New XY tolerance property for feature data

■ 9.2 introduces a consistent and unified tolerance environment for specifying the tolerance used when geographic coordinates are processed by GIS operations. In previous releases, there was an internal geometry processing tolerance, a cluster tolerance used by geoprocessing functions specified in the Environment Settings, and a cluster tolerance used by topologies. At 9.2 all feature classes in the geodatabase have a new **XY tolerance** property specified when you create data. This is used consistently by all spatial functions.

The XY tolerance is synonymous with cluster tolerance: the XY tolerance is an extremely small distance used to resolve inexact intersection locations of coordinates during operations such as topology validation, polygon overlay, buffering, clipping, etc. Coordinates whose distance from each other are within the XY tolerance of each other are considered equal ('clustered') and depending on the process being performed, one of these coordinates will be moved to the location of the other coordinate or a new location will be computed as an average distance between the coordinates in the cluster. XY tolerance is not used to generalize the coordinate geometry of individual features. Instead it is used to evaluate, clean up and manage the relationship between features whenever geometry is processed, so that coordinates that fall within very a small distance of one another can be integrated. Because coordinates can move in both X and Y by as much as the XY tolerance, this automatically resolves many potential problems in data creation and maintenance, such as extremely small overshoots or undershoots, sliver removal of duplicate segments, and coordinate thinning along boundary lines.

The default XY tolerance is the equivalent of 1mm in the linear unit of the data's coordinate system on the earth surface at the center of the coordinate system. So if your coordinate system units are meters, the XY tolerance defaults to 0.001 meters. If your coordinate system units are feet, the default value is 0.003281 feet (0.03937 inches).

When you create a new standalone feature class or a new feature dataset, you can normally just accept the default tolerance proposed by the wizard in the new tolerance panel. This gives good results in most scenarios. There are some situations where you may choose to specify the XY tolerance yourself. You may set a larger tolerance value for data that is known to have a lower level of coordinate accuracy, or you may set a smaller value for data that requires extremely high accuracy, such as a survey control network. The graphic below left is the tolerance panel in the New Feature Class Wizard. You can't change the XY tolerance after you have created the data. When you look at the properties of a feature class or feature dataset, the XY tolerance is read-only (below right).
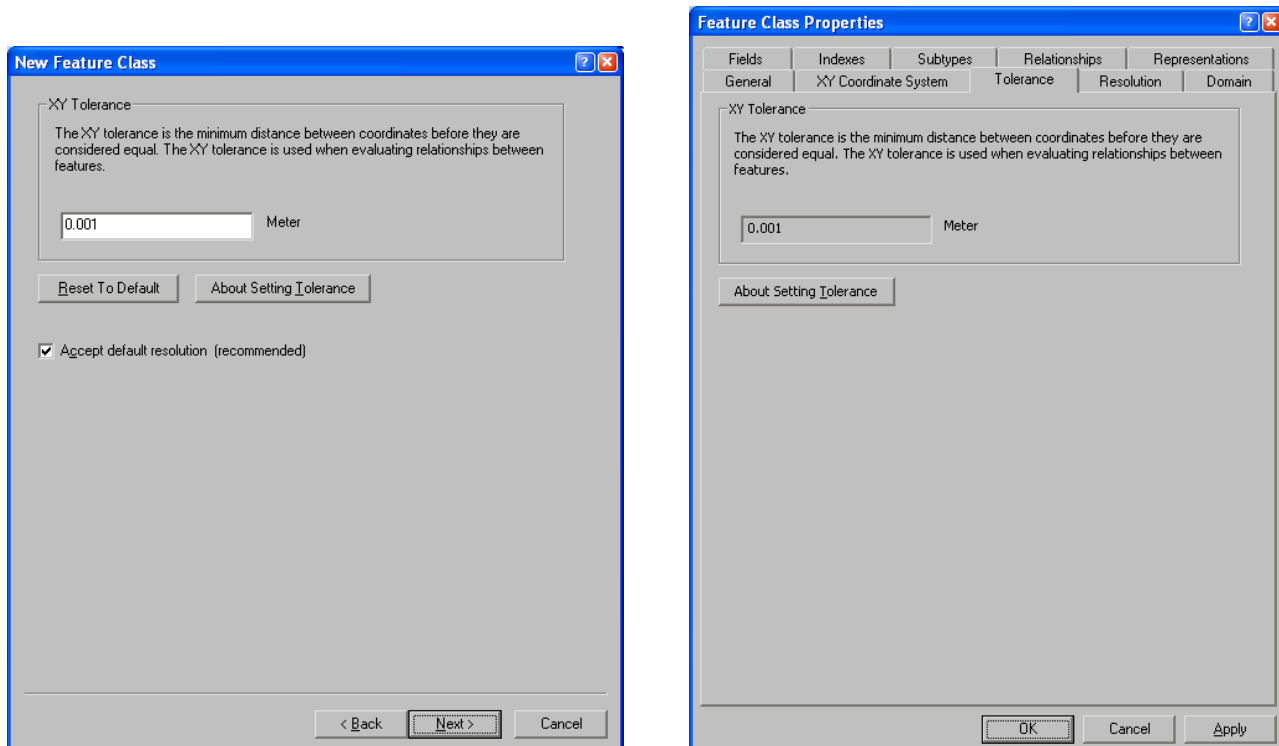
When you create a new feature class in a feature dataset you won't see the tolerance panel in the wizard because feature classes in feature datasets use the XY tolerance specified for the feature dataset they belong to.

XY tolerance and topology

■ When you create a topology in 9.2, the cluster tolerance of the topology defaults to the XY tolerance of the feature dataset in which the topology is being created. You can still specify a cluster tolerance for a topology at 9.2. This allows you to override the XY tolerance of the feature dataset to use a larger tolerance. But you can't specify a cluster tolerance for a topology that is smaller than the XY tolerance specified for the feature dataset.

XY tolerance and geoprocessing

■ When you perform geoprocessing in 9.2, the geoprocessing functions all default to using the XY tolerance property stored for the data being processed:

- If the output is a new standalone feature class, a new raster catalog or a new feature dataset, the XY tolerance of the input will be used and will be set as the XY tolerance of the output. For tools that have multiple inputs (such as Intersect) the tolerance of the first input specified in the parameter list (i.e. the top most input in a geoprocessing tool dialog) will be used as the default.

- If the output is a feature class inside an existing feature dataset, the XY tolerance of that feature dataset will be used.

You can override the XY tolerance stored in the data so that the geoprocessing functions use an XY tolerance you specify instead. You can specify an XY tolerance in the Environment Settings dialog launched from ArcToolbox so that it applies to all your geoprocessing or in the Environments Settings dialog launched from a tool dialog so it applies to that one tool. When geoprocessing functions execute they look at the XY tolerance environment and if it has not been set they use the tolerance properties of the data.

XY tolerance and your existing geodatabases

■ Data in any geodatabase you work with at 9.2 has the new XY tolerance property even if you have not upgraded the geodatabase to 9.2. When you look at the properties of a standalone feature class or feature dataset in a geodatabase that has not been upgraded you'll see a Tolerance tab showing the XY tolerance calculated by the software. However if you create new feature data in a geodatabase that has not been upgraded, the wizard does not give you the tolerance panel and you are not able to specify the XY tolerance manually. If you want to be able to specify the XY tolerance for new data you create in your existing geodatabases, you have to upgrade them to 9.2.

[?] *In the Desktop Help, see: Geodatabases and ArcSDE > An Overview of the Geodatabase > Feature class basics*

High precision data storage

■ Prior to 9.2, coordinate data in the geodatabase was stored in 'low' precision as 32-bit (4-byte) integers. The range of possible integer values this provided meant there was essentially a trade off between the area your data covered (the XY domain), and the resolution with which it could be stored using a given coordinate system's unit of measurement. A large XY domain was only possible at a low resolution. Consequently, storing your data at high resolution demanded undersized domains which were often too small for many projected coordinate systems such as UTM or State Plane. You therefore had to carefully balance the XY domain extent and the resolution of the data as expressed by a precision property representing the number of system storage units for each unit of coordinate system measurement. Deciding how to specify the XY domain could often be quite involved, especially if your application demanded very high accuracy or you wanted to optimize the performance of Enterprise ArcSDE geodatabases.

This situation changes at 9.2. At 9.2, geodatabase coordinates are now stored and processed in **double precision** (53-bit integers corresponding to an IEEE double-precision number). This double precision ('high' precision) data storage provides a much greater range of possible integer values and allows for very fine resolution while allowing your data to span the entire extent of any given coordinate system. With high precision data storage, the extent of your data is defined by the coordinate system and the resolution you choose, therefore eliminating the need for a user-defined domain extent. This greatly simplifies the creation and maintenance of spatial data in the geodatabase and there is no need to strike a balance between domain extent and resolution since high precision storage offers both in unison. Double precision coordinates require only a negligible additional performance and storage overhead.

When you create a new standalone feature class or a new feature dataset at 9.2, the software automatically calculates the appropriate XY domain for the coordinate system and resolution you chose, and the Min X, Min Y, Max X, Max Y values of this extent are no longer editable, or even shown to you, in the wizards, unless you create the data without specifying a coordinate system. If you leave the coordinate system as unknown when you create new data, the wizard can't determine the coordinate range required for data. In this case it uses a generic default XY domain but gives you the option of specifying these yourself in the wizard.
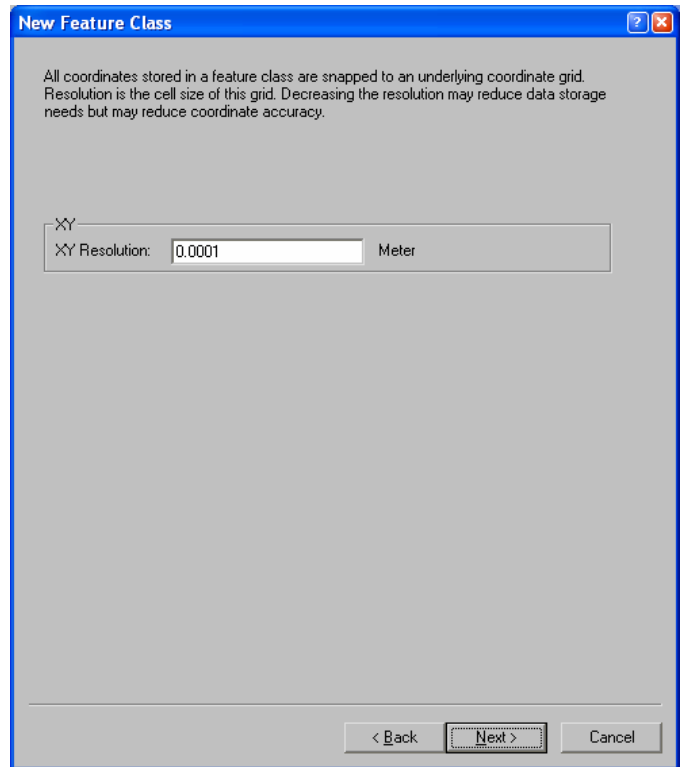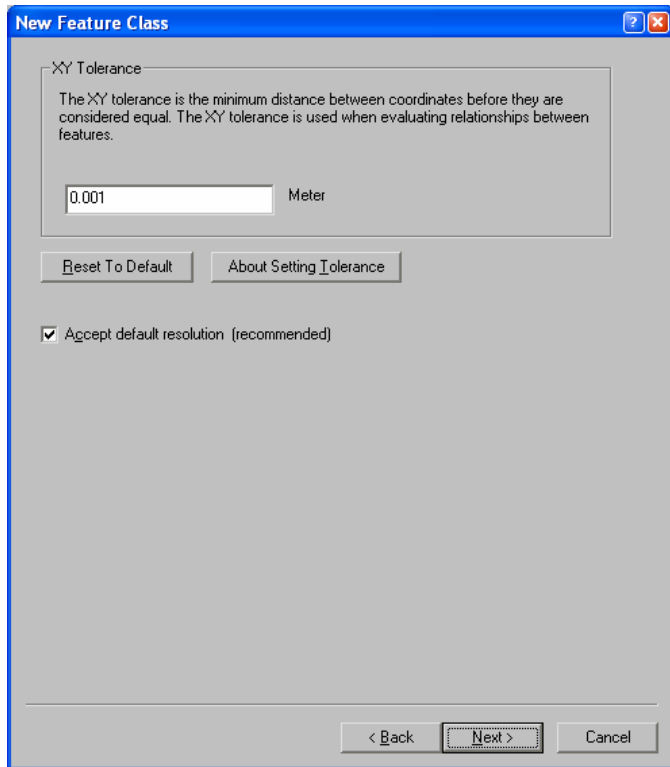
New XY resolution property

■ At 9.2, the precision value associated with the XY domain is replaced with a new property called XY resolution. This resolution value is easier to understand than the precision value used in previous releases because resolution is specified directly in coordinate system units. All coordinates stored in a feature class are snapped to an underlying coordinate grid or mesh. The XY resolution value specifies the cell size of the coordinate grid, so increasing the resolution value decreases the resolution of your data. XY resolution is the inverse of the precision value used previously.

The default XY resolution value for data created in the new high precision data storage, or upgraded to use it, is the equivalent of 0.1 mm in the linear units of the coordinate system. So if your coordinate system units are meters, the resolution defaults to 0.0001 meters. If your coordinate system units are feet, the default value is 0.0003281 feet. This default resolution is precise enough for most data and does not restrict your extent like a low precision value specified in previous releases would.

The default XY resolution for data that has not been upgraded to the new high precision data storage (see below for more on this) is the equivalent of 1 mm in the linear units of the coordinate system. So if your coordinate system units are meters, the resolution defaults to 0.001 meters.

When you create a new standalone feature class or a new feature dataset in a 9.2 geodatabase, you can normally accept the default XY resolution. When you get to the tolerance panel in the wizard, the check box at the bottom of the tolerance panel for accepting the default resolution is checked. (The graphic below left shows the tolerance panel in the New Feature Class wizard). Unless you uncheck this box, you won't see the resolution panel in the wizard or be able to change the resolution. We recommend always accepting the default resolution unless there is a specific circumstance you want to handle. If you uncheck the 'Accept default resolution' box, you'll get the resolution panel next in the wizard. Setting a smaller XY resolution than the default can potentially increase data storage and processing time. (The graphic below right shows the resolution panel in the New Feature Class wizard):

You can't change the XY resolution after you have created the data. When you look at the properties of a feature class or feature dataset, the XY resolution is read-only.

When you create a new feature class in a feature dataset you don't see the tolerance panel in the wizard and there's no option to specify the XY resolution. Feature classes in feature datasets use the XY tolerance and XY resolution specified for the feature dataset they belong to.

High precision data storage and geoprocessing

■ In addition to making it simpler to create data, the move to double precision also unifies geometry processing in ArcGIS and simplifies the geoprocessing of large overlays.

High precision data storage and your existing geodatabases

■ Your existing geodatabase data uses the existing 32-bit 'low' precision data storage format. Data in this format can still be used throughout ArcGIS and you are not required to upgrade it to use the new high precision format, although this is recommended.

■ Upgrading an existing geodatabase to 9.2 does not convert the data it contains to use the new high precision format. Instead, once you have upgraded a geodatabase to 9.2, you can then choose whether to upgrade the data it contains to use this new format.

Each standalone feature class, feature dataset, and raster catalog in a geodatabase has its own spatial reference, so each also has its own precision status. You can upgrade all of these to use the new high precision format, or pick and choose among them. Feature classes inside a feature dataset don't have their own precision status because they use the spatial reference defined for the feature dataset.

You upgrade data to use the high precision format using a new tool called Upgrade Spatial Reference. You can launch this tool by right-clicking a standalone feature class, feature dataset, or raster catalog in ArcCatalog and choosing the Upgrade Spatial Reference command:
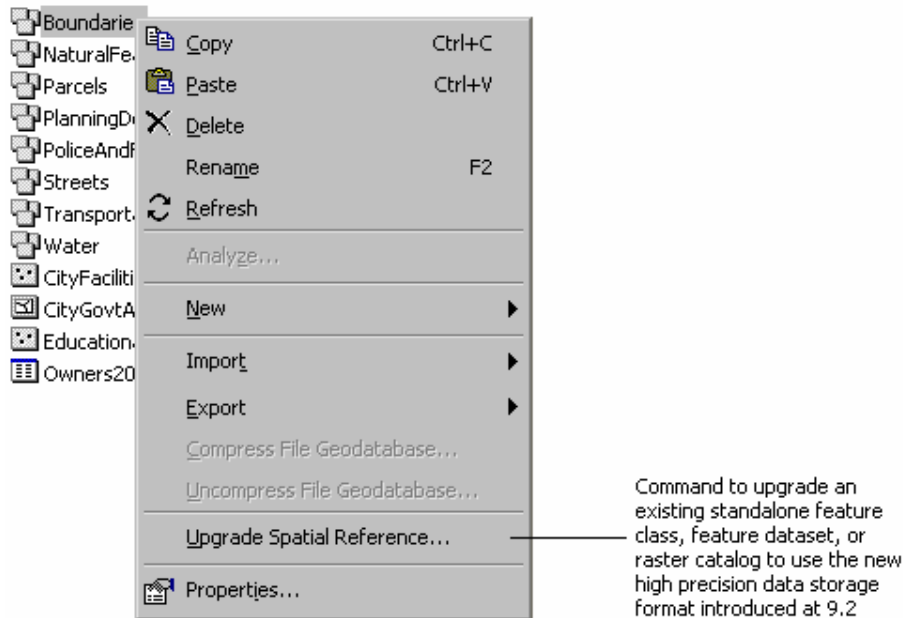
The Upgrade Spatial Reference command is disabled if the geodatabase containing the data has not been upgraded to 9.2, or if the data you right-clicked is already in the new high precision format. The tool is also available in ArcToolbox, where it can be run in the new batch mode or included in scripts or models:

🔨 Data Management Tools > Database > **Upgrade Spatial Reference**

When you upgrade a spatial reference, the tool shows you the default XY resolution that will be applied to the data (the equivalent of 0.1 mm in the linear units of the coordinate system, so 0.0001 meters if the data is in meters), and allows you to specify a different resolution manually if desired. Behind the scenes, the new high precision spatial reference grid will be meshed with the existing low precision grid. Each point of the original grid becomes a point in the new high precision grid. This means that actual data coordinate values are not affected by the upgrade.
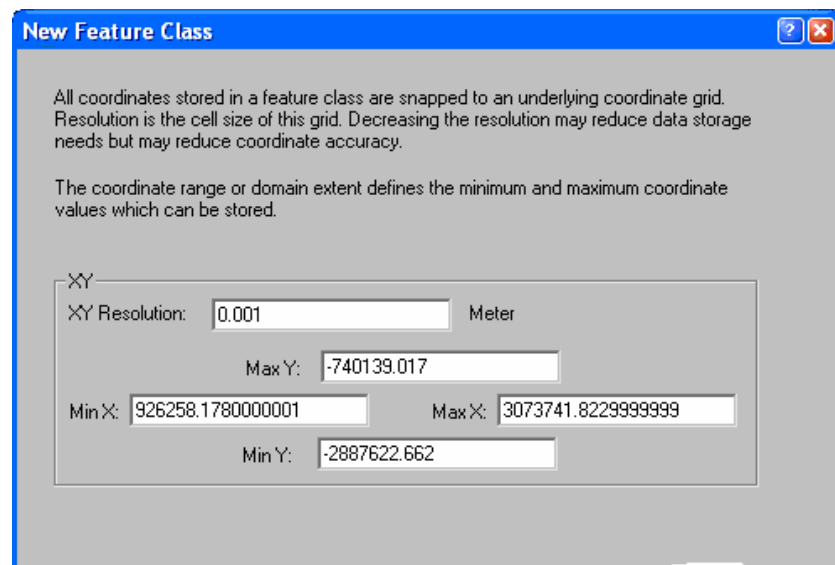
■ Once you have upgraded a geodatabase to 9.2, you are not required to upgrade the data it contains to high precision, although this is recommended. New standalone feature classes, feature datasets or raster catalogs you create in (or copy into) a geodatabase that has been upgraded to 9.2 are always stored in high precision format. New feature classes you create inside a feature dataset in a geodatabase that has been upgraded to 9.2 will have the same precision status as the feature dataset, so they can be either low or high precision. An existing geodatabase that you upgrade to 9.2 can therefore contain some data in low precision and some in high precision.

■ If you work with a geodatabase in 9.2 that has **not been upgraded to 9.2**, all the data it contains and all new data that you add to it will be in low precision. For example, if you copy a feature dataset that is in high precision from a 9.2 geodatabase and paste it into a geodatabase that has not been upgraded to 9.2, the resulting feature dataset will be in low precision.

Feature data in any geodatabase you work with at 9.2 has the XY resolution property, even if you have not upgraded the geodatabase to 9.2. The default XY resolution for geodatabases that have not been upgraded to 9.2 is 1mm for projected coordinate systems (so 0.001 meters if the data is in meters).

When you create new data inside a geodatabase that has not been upgraded to 9.2, the wizard will include a panel prompting you to specify the XY resolution and XY domain of the data. (The graphic below shows this panel in the New Feature Class wizard). Like in previous releases, you can use the default XY domain or you can adjust the values according to whether you want to maximize the coordinate extent covered by the data or the resolution of the data. Remember that the XY resolution is the inverse of the precision value used previously. If you previously used a precision of 1000 to store coordinates to the nearest millimeter, you will now use an XY resolution of 0.001 meter instead. Unlike the precision value used in previous releases, XY resolution has a direct relationship with the XY domain. If the resolution value is increased, i.e. you specify a larger cell size for the underlying coordinate grid, this

results in the data being stored at a lower resolution, and so the XY domain automatically gets larger too, because a wider area can be stored if the data is stored at a lower resolution.

■ Data you create or copy into new geodatabases created with 9.2 automatically use the new high precision format.

■ You can look in the General tab of the Feature Class Properties, Feature Dataset Properties, and Raster Catalog Properties dialogs to find out whether they are stored in high or low precision.

Better support for M and Z coordinates

■ ArcGIS has always supported M and Z values but support for them is improved at 9.2. Ms and Zs are additional numeric values that can be stored with every X, Y coordinate in a feature class. **M values** are most commonly used to store cumulative distance measurements along linear routes, such as highways, for which it is common for pavement conditions, speed limits, accident locations, and other properties and events to be referenced geographically by specifying their distance along the route (such as the highway milepost measurement system used by US departments of transportation) rather than as X, Y locations. **Z values** are typically used to store height above sea level but can be used to store other surface measurements such as annual rainfall or air quality.

When you create a new feature class the first panel of the wizard now includes check boxes lets you choose whether the coordinates will have M or Z values. In previous releases these settings were specified in the fields panel as properties of the Shape field. The check box to store Z values will be disabled if Z values cannot be stored for the type of feature class you are creating. For example, dimension and annotation features can't have Z values. If you are creating a MultiPatch feature class, this box will be checked automatically and disabled, because MultiPatches are a 3D feature class that require the use of Z values.

Vertical coordinate systems for Z values

■ ArcGIS 9.2 adds support for the definition and use of vertical coordinate systems. Vertical coordinate systems allow you to accurately identify the origin, direction and linear unit of your Z data, making it easier to document and share feature data containing Z values. Over 90 predefined vertical coordinate system definitions are provided. You can find these in the Coordinate Systems folder in ArcCatalog in a new subfolder called Vertical (you can add the Coordinate Systems folder into ArcCatalog via a setting in the Tools > Options dialog). This folder is shown below left with some of its contents expanded. The graphic below right shows the properties of a vertical coordinate system, in this case NAVD 1988, the current gravity-related vertical coordinate system for heights that is used in the US:
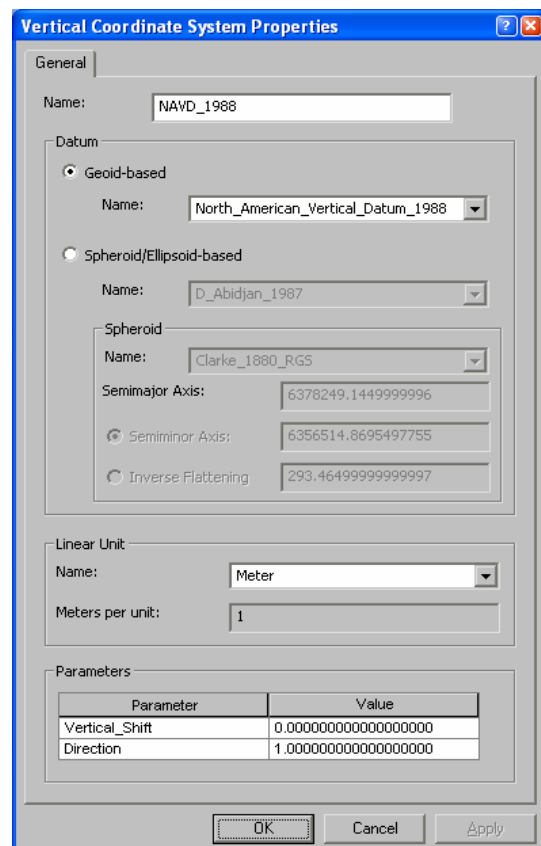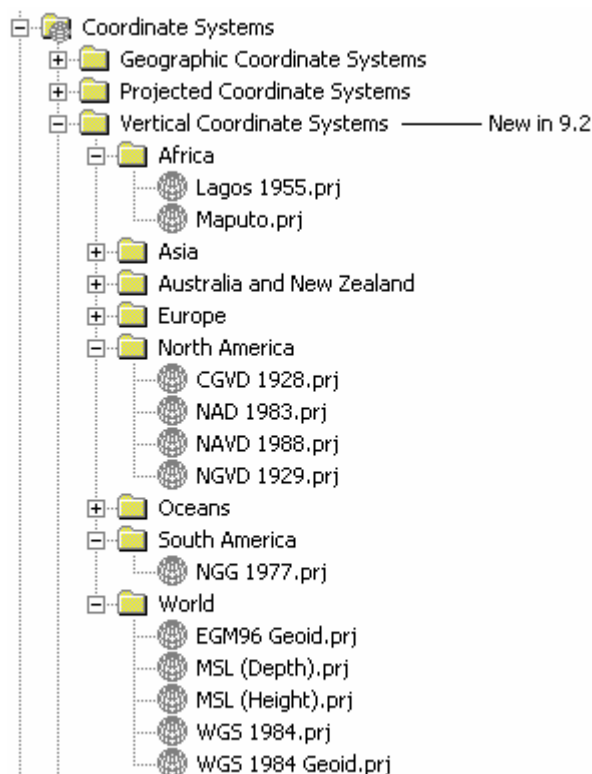
The Direction parameter determines whether the z values are positive up (1.0), increasing against gravity, or positive down (-1.0), increasing with gravity. Depths would use the -1.0 value.

When you create a new standalone feature class and check the box to say it will contain Z values you'll see a new panel for specifying the vertical coordinate system. When you create a new feature dataset you are always prompted to specify the vertical coordinate system that will be used by any feature classes created in that feature dataset for which Z values will be stored. (Specifying a vertical coordinate system for a feature dataset doesn't mean that the coordinates of the feature classes it contains will always have Z values). Here's the new panel for specifying the vertical coordinate system for a standalone feature class in which Z values are being stored:
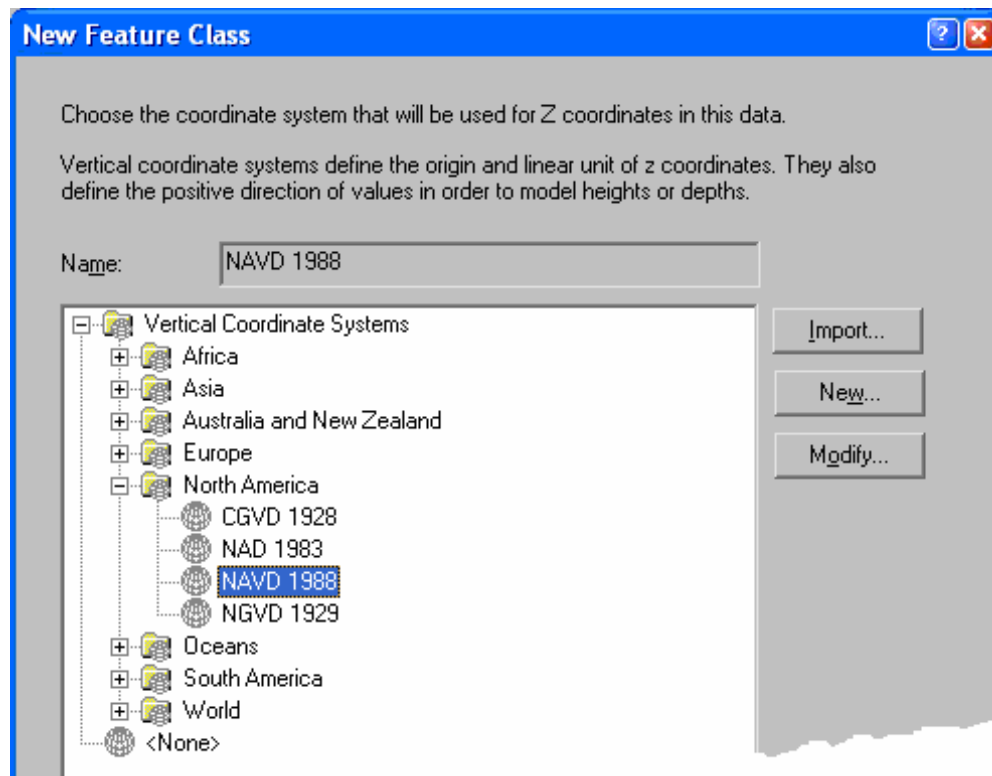
As with the horizontal (XY) coordinate system, you can change the vertical coordinate system of a standalone feature class or feature dataset after you have created it. You can only specify or change the vertical coordinate system if the XY coordinate system has been specified.

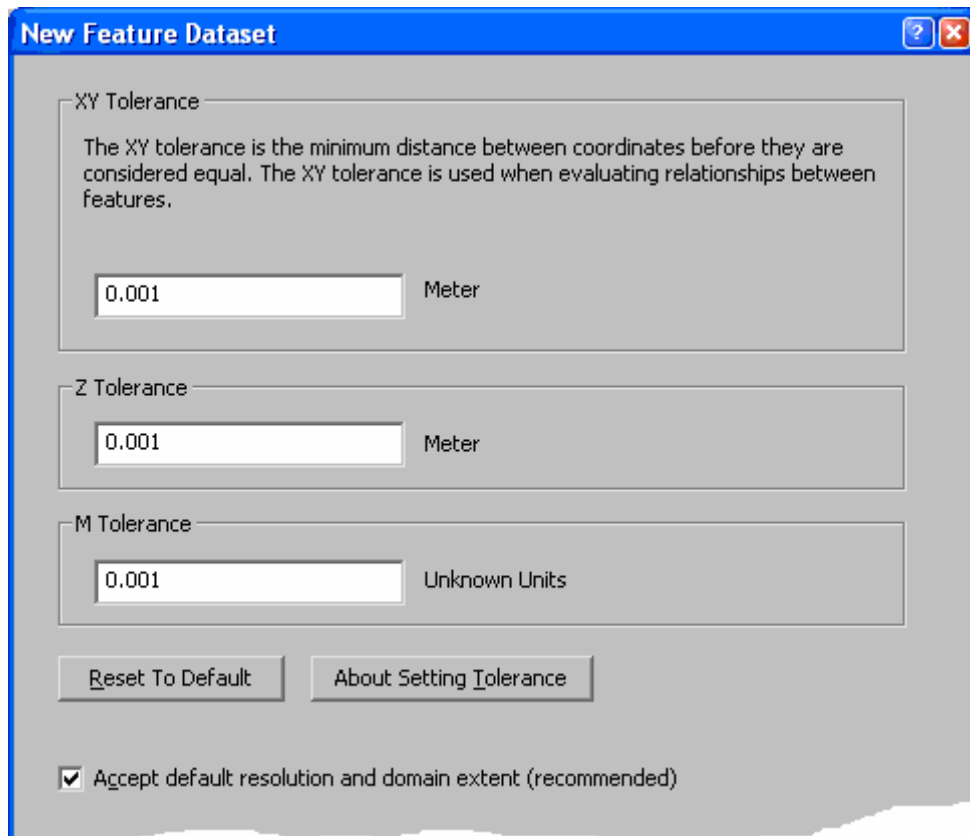Vertical coordinate systems are also supported for shapefiles.

New tolerance properties for M and Z values

■ Similar to the new XY tolerance, 9.2 introduces new tolerance properties for specifying how M and Z coordinates with very similar values will be handled during spatial processing. The **M tolerance** and **Z tolerance** are extremely small values that define the minimum distance between M values and Z values before they are considered equal ('clustered') by spatial processing operations. Coordinates containing M or Z values whose distance from each other are within the M or Z tolerance of each other will be will be given the same M or Z value.

The default M tolerance is 0.001 units. The default Z tolerance is the equivalent of 1 mm in the linear units of the vertical coordinate system used by the data, so if your vertical coordinate system units are meters, the Z tolerance defaults to be 0.001 meters. If no vertical coordinate system is specified, the Z tolerance value is 0.001 Unknown units.

When you create a new standalone feature class and you specify that the coordinates will contain M or Z values, you'll get prompted to specify the corresponding M or Z tolerance. You can normally accept the default M and Z tolerances when you create data containing M and Z values.

When you create a new feature dataset, you always get prompted to specify the M and Z tolerances that will be used by any feature classes created in that feature dataset for which M or Z values will be stored. (Specifying M or Z tolerances for a feature dataset doesn't mean that the coordinates of the feature classes it contains will always have M or Z values). Here's the tolerance panel from the New Feature Dataset wizard:

When you create a new feature class containing Z values in a feature dataset, you won't see the tolerance panel in the wizard because the Z tolerance specified for the feature dataset is used. When you create a new feature class containing M values in a feature dataset, the tolerance panel appears allowing you to specify a different M tolerance than the one used by the feature dataset).

Like the XY tolerance, you can't change the tolerances for M and Z values once the data containing them has been created. Tolerances are always read only for existing data.

M and Z precision becomes M and Z resolution

■ Similar to the changes described above for the XY coordinates, M precision and Z precision used in previous releases become **M resolution** and **Z resolution** at 9.2. Like the XY resolution, these define the resolution of an underlying coordinate grid or mesh onto which coordinates stored in the geodatabase are 'snapped'. The default Z resolution value is the equivalent of 0.1 mm in the linear units of the vertical coordinate system, so if your coordinate system units are meters, the resolution defaults to 0.0001 meters. The default M resolution is 0.0001.

Like in previous releases, you can still specify an M domain and a Z domain when you create data to define the minimum and maximum values for these coordinates. The Z domain now defaults to a range determined by the vertical coordinate system you specify. Both the M and the Z domains can be reviewed and modified in the wizard when you create data.

■ Like in previous releases, you can't change the resolution or domain for M and Z values once the data containing them has been created. These properties are always read only for existing data.

Easier to work with spatial indexes

■ In previous versions, spatial index grid sizes for feature classes in ArcSDE geodatabases that use grid sizes (Oracle, SQL Server, and DB2) were not maintained by ArcGIS. The index could become less than optimal following certain updates to the data, such as after you loaded or imported new features. As a result, you sometimes had to manually update the spatial index grid sizes if you were to keep the index in an optimal state. Knowing the best sizes to set to set was not straightforward: the Calculate Default Spatial Grid Index geoprocessing tool returned only one grid size, even if two or three would work better.

ArcGIS 9.2 provides enhancements that make working with spatial indexes easier. ArcSDE geodatabase feature classes no longer require a spatial index to display in ArcCatalog or ArcMap, and most importantly, the spatial index is now automatically updated for you in to ensure the spatial index is optimal.

When you create an empty feature class with the New Feature Class wizard in an ArcSDE geodatabase that uses grid sizes, a spatial index is created with grid sizes 0,0,0 and left in an unbuilt state. (ArcSDE geodatabases based on Oracle Spatial or Informix RDBMS do not use grid sizes because they use an R-Tree for their spatial index). After loading data with the simple data loader in ArcCatalog or the Append tool, ArcGIS builds the spatial index as a final step of the loading process. It calculates grid sizes that are appropriate for the newly added features. If you import data from a personal geodatabase, shapefile, or coverage, or import CAD or SDC data, a spatial index is automatically computed for the new feature class.

When you use the ArcCatalog Copy and Paste commands to copy a feature class from a personal to a file or ArcSDE geodatabase, the spatial index is automatically rebuilt. The spatial index is also rebuilt if you copy a feature class from Oracle Spatial or Informix. If you copy a feature class from a file or an ArcSDE geodatabase that uses grid sizes (Oracle, SQL Server, or DB2) to another geodatabase that uses grid sizes, the index is copied along with the source data and not recomputed. When you use a geoprocessing tool that creates a feature class, the features in the new feature class are examined and a new spatial index is automatically computed.

When you save edits to a file geodatabase feature class in ArcMap, ArcGIS analyzes the spatial index. If grid sizes are set to 0,0,0, it automatically rebuilds the index with an appropriate grid size given the features that have just been added. This does not occur in ArcSDE geodatabases.

■ When you do need to manually update the index, we've made this easier. The Feature Class Properties dialog Index tab now has a Recalculate button. When you click this button, ArcGIS computes optimal grid sizes for the feature class. When you click Apply or OK, the index is rebuilt with the new grid sizes:
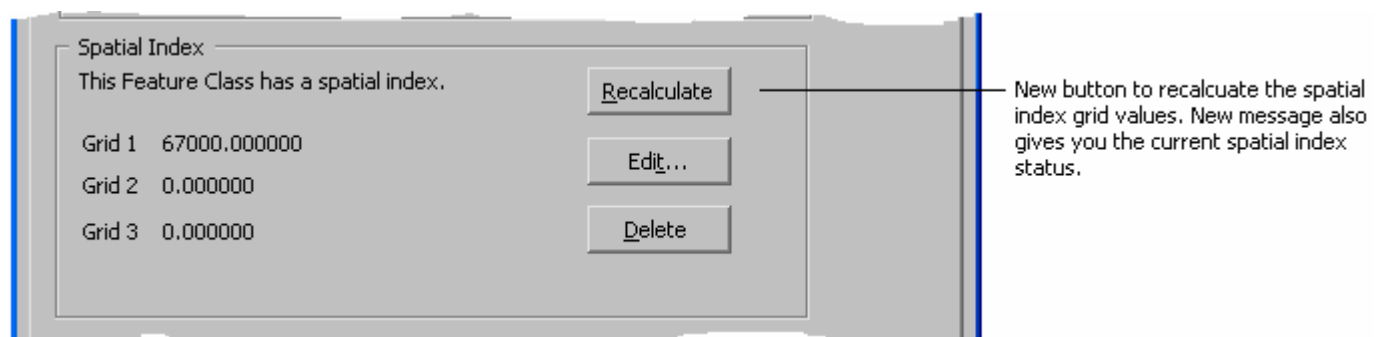
You can still set your own, custom grid sizes in the Feature Class Properties dialog if needed using the Edit button. The Calculate Default Spatial Grid Index geoprocessing tool now returns two or three grid sizes if they are determined to be better than a single grid size.

■ The only difference between 9.1 and 9.2 for spatial indexes in personal geodatabases is that the Grid 1 level (the only level supported by personal geodatabases) now defaults to 0 instead of 1000 in the New Feature Class wizard. If you leave this value as 0, it will default to 1000 once the new feature class is created.

Improved property dialogs for feature data

■ The **Feature Class Properties dialog** includes tabs corresponding to the properties described above. A new XY Coordinate System tab makes it much easier than in previous releases to review or change the coordinate system of a feature class (below left). A new Z Coordinate System tab showing you the vertical coordinate system is present if the feature class has Z values (below right):
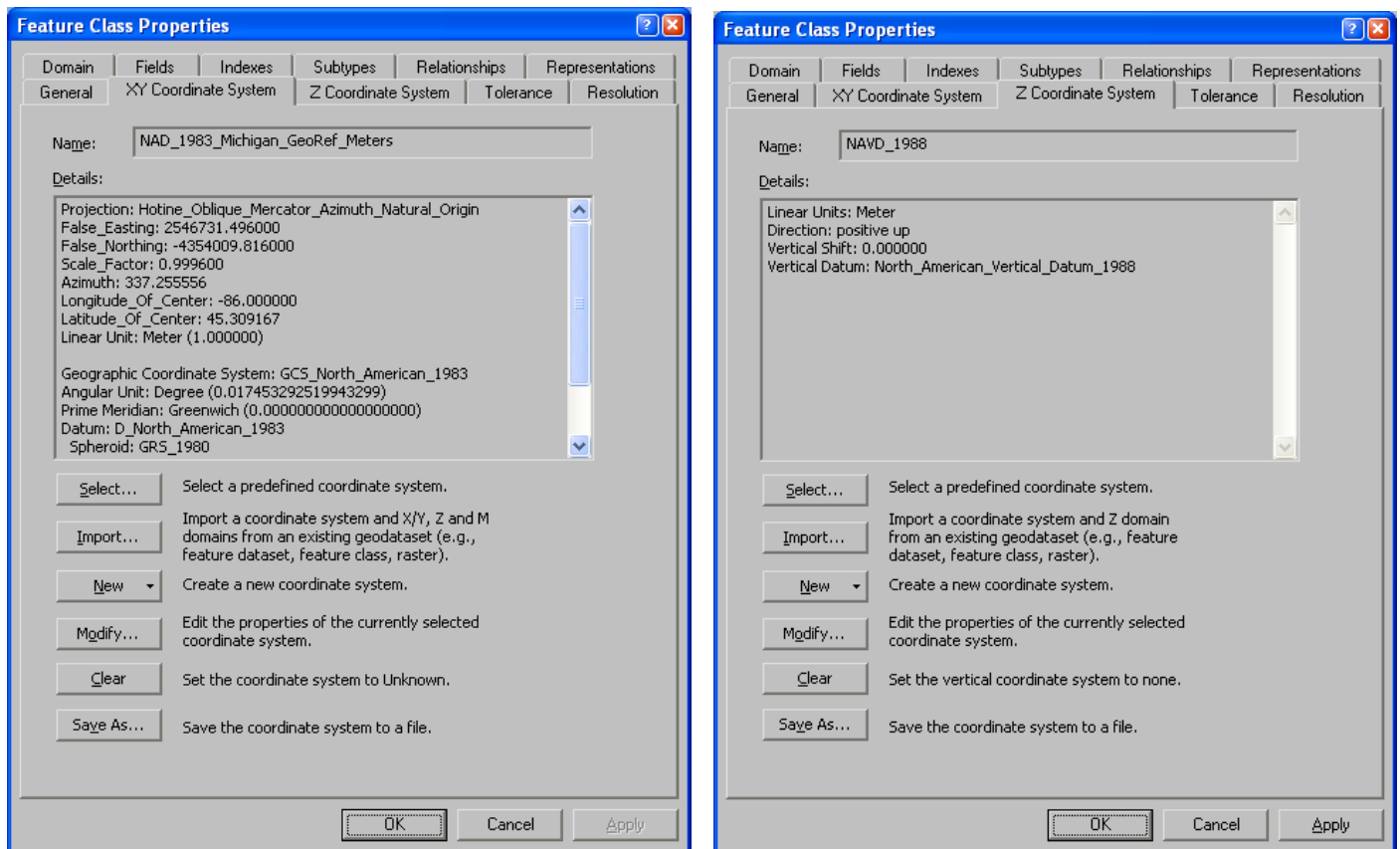
The Representations tab is another new tab at 9.2. It is used to store cartographic representations in the feature class. (☞ *See the 'Cartographic representations' chapter of this document*).

■ The **Feature Dataset Properties dialog** now also includes tabs for XY Coordinate System, Z Coordinate System, Tolerance (below left), Resolution (below right) and Domain.
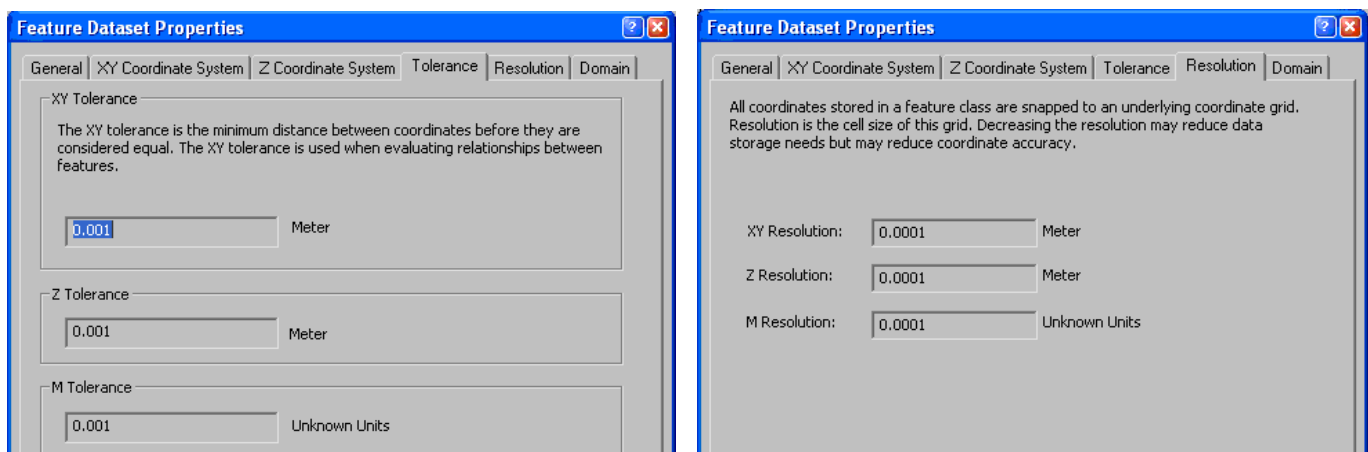
New file geodatabase format

■ Until now, single-user geodatabases in ArcGIS have been personal geodatabases stored in Microsoft Access. Personal geodatabases satisfy basic requirements. However their performance slows markedly as the size of datasets stored in them increases, and they have a 2 GB overall database size limit. Accessing a personal geodatabase over a network concurrently with other users can present additional problems; performance slows further and data locks can stay around longer than you'd expect, blocking other users from accessing the data.

ArcGIS 9.2 introduces an alternative, a new type of single-user geodatabase referred to as the file geodatabase. A file geodatabase stores datasets as a folder of files on your file system, much like you'd store a folder of shapefiles. Individual datasets can be as large as 1 terabyte and there is no overall database size limit. Compared to personal geodatabases, file geodatabases improve performance, store vector data more efficiently, and improve concurrency and multi-user access over a network. You can also optionally store vector feature classes and tables in a compressed, read-only format to reduce storage requirements further. File geodatabases are also fully supported across platforms. One of the driving forces behind introducing this format was to provide support on both Windows and UNIX. For example, you can use Java to create and access file geodatabases on UNIX.

■ To create a file geodatabase, right-click a folder in the ArcCatalog tree view and click New, then click File geodatabase.

■ Personal geodatabases continue to be fully supported at 9.2. You can continue to create and work with personal geodatabases just as you always have. Personal geodatabases can be upgraded to 9.2 in the usual way so that you can use them with all the new functionality introduced at 9.2.

■ Personal geodatabases and file geodatabases look the same in ArcCatalog, and the structure of the data within them is the same. You can easily move data from one to another with the Copy and Paste commands. You also work with them the same way, whether accessing data through ArcCatalog or ArcMap, or through ArcObjects as you're developing a custom application. The only exception to this is the syntax you use to perform a SQL query in ArcMap: there are some slight differences.

[?] *In the Desktop Help, see these topics:*

Mapping and visualization > Navigating and interacting with maps > Selecting features and graphics > About building an SQL expression

Mapping and visualization > Navigating and interacting with maps > Selecting features and graphics > SQL reference

■ File geodatabases store data efficiently in their default format, but by compressing feature classes and tables in file geodatabases you can make them require significantly less disk space. The amount of compression possible depends on the data and can range from an insignificant amount to a ratio exceeding 10:1. Most file geodatabase data can compress by a ratio of 2:1 or better, meaning that a 100 MB feature class for example could compress down to 50 MB or less.

Once compressed, a feature class or table looks the same in ArcCatalog and ArcMap as when it was uncompressed, and you work with it in the same way. The exception to this is editing: a compressed feature class or table is read-only and therefore cannot be edited or modified in any way, except for changing its name in ArcCatalog. Compressed feature classes and tables can be uncompressed to return them to their original, read-write format. To compress or uncompress a feature classes or table, right-click it in ArcCatalog and use the Compress File Geodatabase Data or Uncompress File Geodatabase Data commands. You can also access these commands by right-clicking the file geodatabase itself or a feature dataset it contains, in which case the operation will apply to all feature classes and tables inside the geodatabase or feature dataset. These two commands launch geoprocessing tools from the new Data Management > File Geodatabase toolset in ArcToolbox:
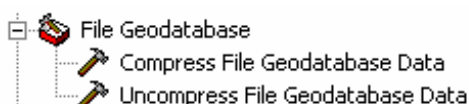
When you look at the properties of a feature class or table in a file geodatabase in ArcCatalog, a section at the bottom of the General tab tells you whether or not the feature class or table is currently compressed:
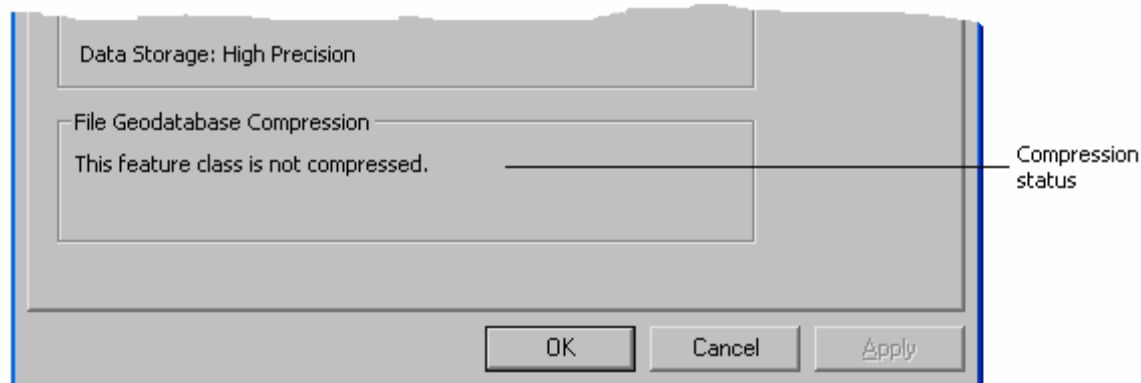
■ File geodatabases are supported in all geoprocessing tools except for MakeQueryTable. At 9.2 file geodatabases don't support the QueryDef object used by the MakeQueryTable tool.

For more information on the differences between a file and personal geodatabase in the Desktop Help, see: Geodatabases and ArcSDE > An Overview of the Geodatabase > Types of geodatabases

Putting your existing data into file geodatabases

■ To convert a **personal geodatabase** into a file geodatabase you use the existing tools for working with geodatabase data. There is nothing special about file geodatabase in this regard, except that they do have configuration keywords that customize the storage. Most users can use the default configuration keyword. The other configuration keywords are intended to be used by advanced users who want to invest time to maximize performance for very large datasets.

- To turn an existing personal geodatabase into a file geodatabase, we recommend using the Export>XML Workspace Document command to export the database to an XML file. You can then create a new, empty file geodatabase and use Import > XML Workspace Document to load the data from the XML file into this geodatabase.

- To copy data from a personal geodatabase into a file geodatabase, we recommend using the normal ArcCatalog Copy and Paste commands. Copy and Paste is flexible because you can easily choose exactly what you want to copy. You can select everything in the personal geodatabase or just particular items such as a set of feature datasets that you want to work with. For example to copy a feature dataset from a personal geodatabase into a file geodatabase, first create a new empty file geodatabase in ArcCatalog, select the items in the personal geodatabase you want and choose Copy, and then go to the file geodatabase and choose Paste.

  When you paste geodatabase data in ArcCatalog a confirmation dialog appears. This lets you see the items you are about to paste. The confirmation dialog also shows you the names of any range or coded values attribute domains that are referenced by the feature classes you are pasting. These attribute domains will be automatically pasted into the target geodatabase. Advanced users can also use this to choose the configuration keyword that will be used for each item. If your file geodatabase already contains data, this dialog will also warn you in red about any naming conflicts.

■ To move **shapefiles** into a file geodatabase, you use the same method that you would use to move them to a personal geodatabase. You can select shapefiles in ArcCatalog, right-click and choose the Export > To Geodatabase command (use the 'Multiple' command to export multiple shapefiles at once). You can also find these tools in ArcToolbox under Conversion > To Geodatabase.

In the Desktop Help, see: Geodatabases and ArcSDE > Building a geodatabase > Creating a geodatabase > Geodatabase migration > Migrating to the file geodatabase

Easier to use and deploy ArcSDE technology

ArcSDE is ESRI's data management technology for managing multi-user, transactional geodatabases using industry standard relational database management software (DBMS). Up to now, ArcSDE has been sold as a separate product. This changes at 9.2 in two respects:

Firstly, the ArcGIS Server product introduced at 9.0 has been expanded to include ArcSDE, so when you purchase ArcSDE you now buy it as part of ArcGIS Server. ArcSDE is no longer purchased on its own as a separate product. This change makes ArcGIS Server at 9.2 our comprehensive solution for managing geographic data in a multi-user environment and deploying data and applications throughout organizations and across the Web. (► *See the 'ArcGIS Server' chapter of this document)*.

Secondly, at 9.2 the ArcSDE technology adds support for Microsoft SQL Server 2005 Express Edition, a lightweight, full-featured DBMS designed specifically for simple setup and administration. SQL Server Express is provided for free by Microsoft and we include it with ArcEditor and ArcInfo. SQL Server 2005 Express Edition is limited to run on 1 CPU (single or dual core within 1 socket) and utilize a maximum of 1 gigabyte RAM memory. The maximum total database size for SQL Server Express is 4 gigabytes. Security is based on your operating system/LAN's existing user authentication, so there are no separate database user names and passwords to administer.

We have leveraged this new platform to make it much easier to deploy ArcSDE and get started using multi-user geodatabases, including a new Personal ArcSDE technology that is included for free with ArcGIS Desktop at the ArcEditor and ArcInfo license levels. With these changes, ArcSDE geodatabases readily scale from the personal and small team level, through to workgroups, and on up to extremely large enterprise geodatabases. These new support levels let organizations take full advantage of ArcSDE technology for any number of users, large or small, with one scalable data architecture that works from single user systems up to large enterprise wide systems.

Here are the details about how ArcSDE technology is delivered at 9.2:

■ **Personal ArcSDE technology included free with ArcEditor and ArcInfo**

At 9.2, anyone using ArcEditor or ArcInfo can now set up and administer their own ArcSDE database server and create multi-user geodatabases. Personal ArcSDE supports all the advanced features found in ArcSDE such as versioning, archival history, multi-generational replication, and advanced dataset-level security. Personal ArcSDE uses the SQL Server Express DBMS included in Desktop at the ArcEditor and ArcInfo license levels, so no additional software or database administration expertise is required. All database administration is performed using a new set of dialogs in ArcCatalog.

Personal ArcSDE database servers support up to 4 concurrent users, 1 of who can edit the data at any time. Use Personal ArcSDE to try out ArcSDE if you've not used it before. Or put it to work immediately on your small team projects. As with all ArcSDE geodatabases, ArcView users can view but not edit Personal ArcSDE geodatabases.

■ **Workgroup ArcSDE technology in the new ArcGIS Server Workgroup product**

At 9.2, ArcGIS Server is available scaled by capacity to two levels: ArcGIS Server Workgroup and ArcGIS Server Enterprise. The ArcGIS Server Workgroup product includes our new Workgroup ArcSDE technology. Like Personal ArcSDE, this is based on SQL Server Express and all database administration is performed in ArcCatalog, so it is very easy to deploy and manage.

Workgroup ArcSDE database servers are licensed to support up to 10 concurrent users, all 10 of who can edit the data at any time. ArcGIS Server Workgroup is designed to be a low cost solution for small to medium sized teams and organizations. Each of the three editions of the ArcGIS Server Workgroup product (Basic, Standard, and Advanced) includes Workgroup ArcSDE.

■ **Enterprise ArcSDE technology in the new ArcGIS Server Enterprise product**

Enterprise ArcSDE technology is the traditional ArcSDE technology that runs on Oracle, SQL Server, DB2, and Informix and can scale to databases of any size and number of users, running on computers of any size and

configuration. Users provide their own DBMS license for this level of ArcSDE use. The DBMS is typically administered and managed by a database administrator (DBA) using ArcSDE administration commands and the standard tools provided by the DBMS being used.

At 9.2, Enterprise ArcSDE technology is included in the ArcGIS Server Enterprise product. Each of the three editions of the ArcGIS Server Enterprise product (Basic, Standard, and Advanced) includes Enterprise ArcSDE.

As in previous releases, an ArcEditor or ArcInfo license is required to create ArcSDE geodatabases and to create and edit data in them. ArcView users can read the data in ArcSDE geodatabases but cannot create or edit this data.

Setting up and working with a Personal ArcSDE or Workgroup ArcSDE database server

■ To setup a Personal ArcSDE database server, you run the Setup program that comes with your ArcGIS Desktop installation media at the ArcEditor or ArcInfo license levels. To setup a Workgroup ArcSDE database server, you run the Setup program that is part of the installation media for ArcGIS Server Workgroup. Both of these setups install Microsoft SQL Server Express and give you administrator permissions. After running the setups, you are ready to connect to the new database server in ArcCatalog.

■ A new Database Servers folder has been added into the ArcCatalog tree that enables you to connect to Personal and Workgroup ArcSDE database servers. In that folder, double-click Add Database Server, and type in the name of the computer that SQL Server Express has been installed onto and the instance name. In the example below, a connection a connection is being made to a Personal ArcSDE database server installed on a computer called 'essinger2' and the server instance name is 'sqlexpress':
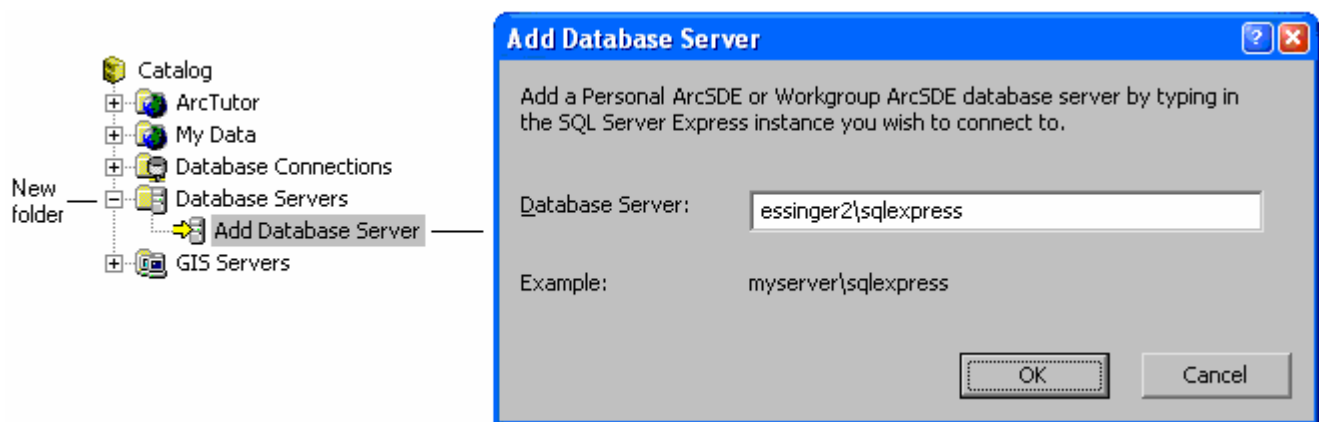
The database server you connected to will appear in the folder:

■ To create a new geodatabase on a database server, right-click it and choose the New Geodatabase command:
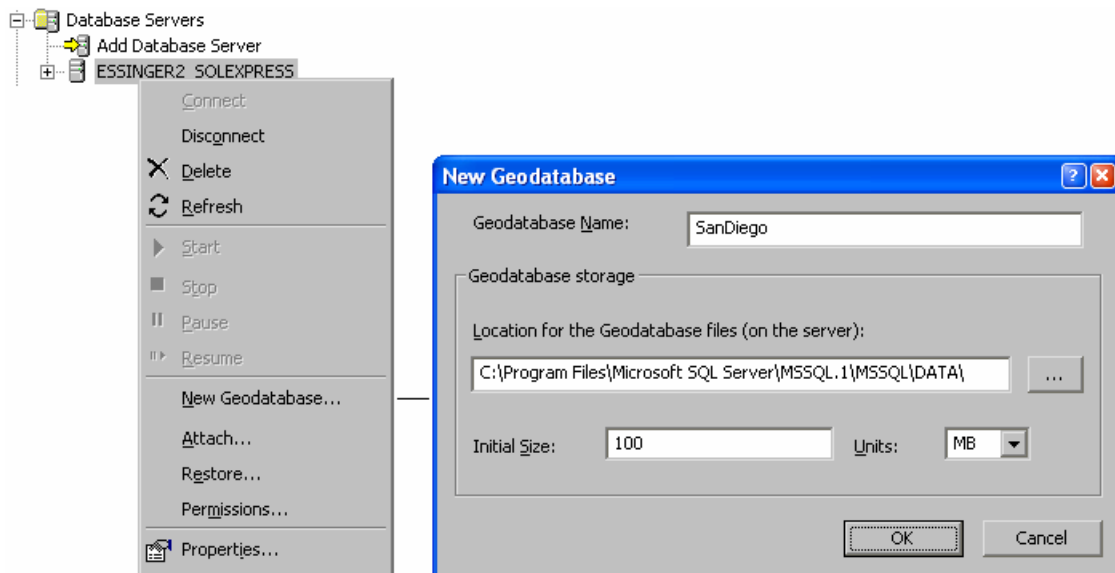
Other administration commands in that context menu include the Permissions command that lets you control which users can access the database server. Only users with administrator permissions can perform administration.

■ Geodatabases are listed underneath the database server they belong to and you can browse down to the data they contain in the usual way. In this example, four geodatabases have been created on the database server:
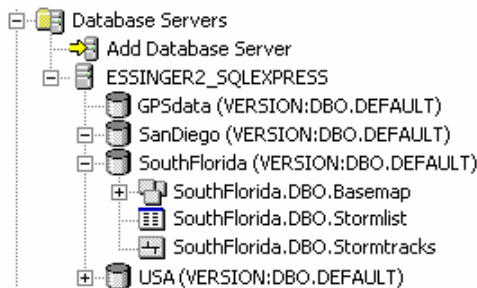
Right-click on a geodatabase in a database server to access additional commands for administering the geodatabase:
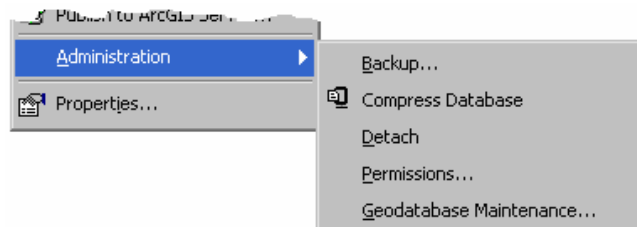
■ The Database Connections folder in ArcCatalog is unchanged at 9.2. This is still where you go in ArcCatalog to create or access connections to Enterprise ArcSDE geodatabases. (Enterprise ArcSDE servers cannot be accessed or administered via the new Database Servers folder). You can also create connections directly to geodatabases on Personal ArcSDE and Workgroup ArcSDE database servers in the Database Connections folder. The main benefit to doing this is if you are working with versioned geodatabases on your Personal ArcSDE or Workgroup ArcSDE database server. A connection to a geodatabase in the Database Connections folder points to a specific version of a geodatabase, so creating a database connection makes it easy to access to a particular version on a regular basis.

In the Desktop Help, see these topics:

Geodatabases and ArcSDE > Administering ArcSDE geodatabases > An overview of ArcSDE geodatabase administration

Geodatabases and ArcSDE > Administering ArcSDE geodatabases > Different types of ArcSDE geodatabases

Data distribution using replication

■ Many organizations require distributing copies of their data to regional offices so they may work on all or part of the geodatabase and submit updates back to the central office. In the past this was done by creating a copy on cd, dvd or onto an ftp site, and changes were coordinated so that the data at the central and regional offices were in sync. This distribution arrangement takes careful coordination and continuous communication between offices to keep the updates in order and the data synchronized.

ArcGIS 9.2 introduces a solution to data distribution through a utility called geodatabase **replication**. New functionality in ArcCatalog and ArcMap allow you to create and manage replica copies of the geodatabase in whole or in part. These replicas can be distributed as necessary throughout an organization and are capable of coordinating data changes through a synchronization process. The model allows for synchronization of replicas even when working independently or in disconnected environments. Geodatabase replication supports the full data model, so geometric networks, topologies and relationship classes are all capable of being replicated. Two or more geodatabases can be synchronized with multiple generations of edits to each database. This extends the checkout/check-in model by allowing the checked-out version to be periodically refreshed from the master geodatabase and allowing multiple check-ins. Database changes are moved between the databases as changes to versions, and standard reconcile and post mechanisms are used to synchronize the changes.

Through the implementation of geodatabase replication advanced workflows and scenarios become available. These workflows can be automated using new geoprocessing tools for replication.

■ The Disconnected Editing toolbar in ArcMap has been replaced with a new Distributed Geodatabase toolbar. This contains the functionality that was available previously but is now fully enhanced to include the new replication functionality:

In the Desktop Help, see:

   Geodatabases and ArcSDE > Data management workflows, transactions, and versioning > Managing distributed data > Understanding distributed data

Historical archiving

■ In past releases of ArcGIS historical records were kept by creating a version of the geodatabase that would represent the data at a specific point in time. These historical versions would capture the entire geodatabase and if your requirements demanded frequent archiving then your database would become cluttered by maintaining multiple instances of the data.

While these historical versions are still supported, ArcGIS 9.2 offers another method of maintaining a historical record of your ArcSDE geodatabase data called geodatabase archiving. With archiving you can select which features you wish to enable archiving on and you do not have to maintain a historical record of the entire geodatabase if it is not necessary. When archiving is enabled, updates are recorded and can later be queried to view the state of the feature throughout its history. You can connect to historical instances of the database and view how it looked at a specific time or see how it has evolved over time. This archive is created automatically as you update data changes and allows for historical records to be maintained at a frequency to suit your workflow.

Historical archiving requires versioning, so is only supported in ArcSDE geodatabases.

In the Desktop Help, see:

Geodatabases and ArcSDE > Data management workflows, transactions, and versioning > Archiving data > Geodatabase archiving

Non-versioned multi-user editing

■ Previously, a geodatabase could only be edited by multiple users if it had been versioned. This included all spatial and non-spatial tables. This satisfied workflows requiring long transactions. Edits spanned as many edit sessions as needed, and changes were isolated from other database users, and no locks applied to the data you edit.

While this presented few problems for GIS-only databases, it did create difficulties for some organizations that used the same database for GIS and non-GIS applications. Versions make integrating geographic data with third-party applications (those not created with software from ESRI) more difficult because any database constraints, triggers, and unique indexes you've set up in your existing applications don't apply to versions. Versions can also add additional overhead if you only need to make simple changes to data that is not part of a topology or geometric network.

At ArcGIS 9.2, multi-user editing is possible without versioning. We have added a short transaction editing model for simple feature databases that can be applied on a table-by-table (feature class-by-feature class) basis. In this way, both GIS and non-GIS applications can share access to a common DBMS without adding the overhead of versioning to those applications that do not need it.

To perform non-versioned editing in an ArcMap edit session, specify in the Editor > Options dialog Versioning tab that you don't want to edit a version of the data:
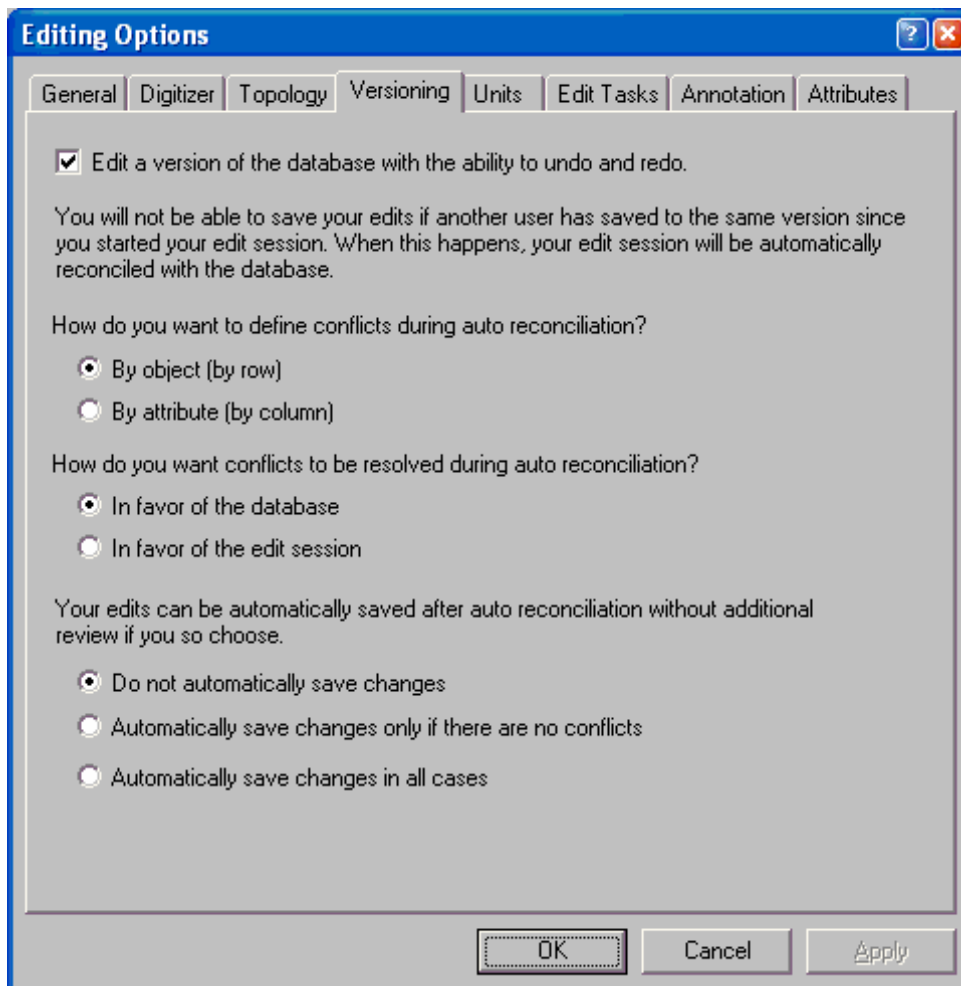
You can then start editing in an ArcMap edit session, and perform individual operations on the data just as in any other edit session – adding, deleting, and updating records. When you save, changes commit as a single database transaction. Any constraints, triggers, and unique indexes you've set up apply. If you quit the edit session without

saving, the edits roll back. ArcGIS uses the underlying DBMS transaction model – rows lock as you edit them and the isolation level you set in the DBMS applies, just as in any standard DBMS transaction.

Non-versioned editing is not available for feature classes in a topology or geometric network. You must edit these feature classes in a versioned edit session.

In the Desktop Help, see: Geodatabases and ArcSDE > Data management workflows, transactions, and versioning > Working with non-versioned data > An overview of working with non-versioned data

Versioned and non-versioned editing on the same data

■ In a heterogeneous computing environment where you have a number of different departmental applications accessing the same database, you may require the ability to support both ArcGIS and third-party applications that were created without software from ESRI. An example of this is if you have one department that maintains the geographic data in the database with ArcGIS and another department that maintains customer records in the same database with a third-party application. The third-party application may not recognize versioned tables, and needs to apply DBMS constraints and triggers as transactions are made. At the same time, the other department needs to edit the geographic data in its own isolated version, not sharing the departmental edits until they are complete and approved.

With these requirements in mind, ArcGIS now allows you to perform versioned editing on a feature class or table while retaining the ability to share edits with other applications. To enable this capability on a feature class or table, you register the data as versioned with the option to move edits to the base table. This option is available in the registration dialog.

When you edit data registered this way, versions work the same way as they always have—changes are saved in the delta tables. The exception to this is the DEFAULT version. Whenever you save edits to the DEFAULT version, either by editing it directly or merging in changes from another version, the edits are saved in the base tables. The edits do not remain in delta tables as is the case when the Move edits to base option is unchecked.

This allows all applications to work on the same database:

- Applications written without software from ESRI can continue to access and modify data with standard transactions, even if it's being edited in the DEFAULT or another version at the same time.

- Whenever ArcGIS or an application written with ArcObjects saves changes to the DEFAULT version or merges changes into the DEFAULT version, any unique indexes, constraints, and triggers defined on the data with the DBMS apply.

- When one application modifies the data, the changes become immediately available to any other application accessing the data. Since changes to the DEFAULT don't store in delta tables, there is no need to adapt third-party applications with multi-versioned views so that they can read these tables.

In previous releases of ArcGIS, you either registered data as versioned and edited versions of the data, or you left the data unversioned and directly modified the data source through an application written with ArcObjects. There was no way to manage data with both capabilities simultaneously.

New options for reconciling versions

■ Reconcile is the operation you perform to check for conflicts before you merge a version into its parent version. A conflict can occur when the same feature is updated in both the current version being edited and the target version. In previous versions, ArcGIS considered it a conflict even when different attributes were edited. If you considered a conflict to be one where only the same value was edited, you had no way to prevent these from being recognized as conflicts. With ArcGIS 9.2 you can now choose one of the following in the Reconcile dialog:

- A conflict occurs when any attribute is updated

- A conflict occurs when the same attribute is updated

In previous versions, ArcGIS initially resolved conflicts in favor of the parent version representation. The only way to resolve a conflict in favor of the version you're editing was to explicitly choose your edit session representation in the conflict resolution dialog. With ArcGIS 9.2 you can now choose to initially resolve all conflicts in favor of either the parent version or your edit session. If conflicts arise between your edited version and the target version when you reconcile, you can resolve these conflicts interactively in the new conflict resolution dialog box. When you resolve conflicts, you are deciding which representation of the features and attributes you want to keep.

Regardless of what version you opted to reconcile in favor of—the target or your edited version—you can specify which representation to keep; either the pre-reconcile representation (how it appeared in your version prior to reconciliation), conflict representation (how it appears in changes made by another editor), or common ancestor representation (how the feature or attribute is in the target version).

Conflicts can be resolved at several different levels: Field level (attribute), Row level (individual feature), Class level (entire feature class), and Root level (all conflicts in all feature classes and features for a particular reconcile operation).

A new Conflicts dialog improves productivity by allowing you to easily visualize spatial conflicts in the pre-reconcile, conflict and common ancestor versions. Additionally the dialog reports which conflicts have been visited and gives you the ability to resolve conflicts at the individual attribute value:
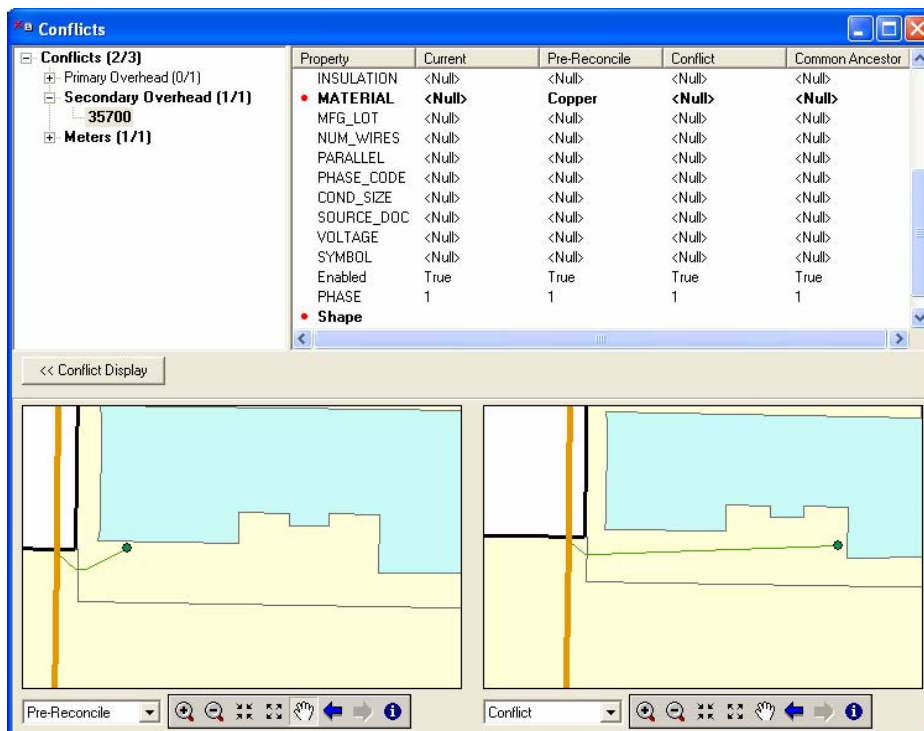
Saving edits to a version edited by others

■ Since you started editing a version, another user may have saved edits to the same version. When you save your edits, ArcGIS must compare the representation in your edit session with the one in the database and reconcile any differences. This process is similar to the reconcile that takes place when you merge a version into its parent version, and contains similar enhancements at 9.2. You can now specify how you want conflicts defined, and whether to initially resolve them in favor of either the representation in your edit session or the representation in the database. You can access these options on the Versioning tab of the Editor > Options dialog (see above).

■ There's an additional enhancement in the Editor > Options. In previous versions of ArcGIS, you could either choose to be notified of the other user's edits so you can review the results of the merge, or you could have ArcGIS perform the reconcile, only notifying you if there are conflicts. ArcGIS 9.2 now provides a third option: "Automatically save changes in all cases" which never notifies you of the other user's edits. With this new option, ArcGIS always merges the two representations of the version. If there are conflicts, it resolves them according to the conflict resolution rule, which states whether conflicts resolve in favor of the edit session or the database.

Improved support for Oracle

■ **New spatial type.** 9.2 introduces a new spatial type for Oracle that allows SQL access to simple ESRI features stored in Oracle using standard ISO Multi-Media/OGC SQL statements. This sort of access was already available to Informix and DB2 users through their spatial extension; this new spatial type extends the same sort of access to Oracle users. It gives you ArcSDE's Binary schema performance and scalability with the flexibility of a standards-conformant SQL interface to the spatial data.

■ **Multiple geodatabases in Oracle.** At ArcSDE 9.2, you can create multiple geodatabases, within a single Oracle database instance. This allows Oracle users to manage different projects or departments whose work is completely independent of each other. Each Geodatabase is created within separate user schemas.

■ **Support for Oracle Spatial GeoRaster.** Oracle introduced the Oracle Spatial GeoRaster data type in their 10g release. ArcSDE 9.2 provides direct read and write ability for Oracle Spatial GeoRaster. As with Oracle Spatial vector data, ArcSDE is also able to read existing Oracle GeoRaster data that has been registered with ArcSDE. Users will be able to manage their Oracle Spatial GeoRaster data just as the regular ArcSDE raster data with a few exceptions: Oracle 10g R1 does not have compression support for their GeoRaster data. Any raster catalogs created using Oracle 10g R1 Oracle Spatial GeoRaster data will be loaded as uncompressed data. If you are using Oracle 10g R2, compression support is available for your raster catalogs. Also Oracle Spatial GeoRaster does not support a partial update or mosaic operation on a raster value, only complete raster objects can be inserted or updated.

Operating system authentication for ArcSDE

In previous versions of ArcGIS in order to connect to an ArcSDE database you needed to supply a username and password. This meant that the network administrator had to set up a separate account for each individual, and had to manage these accounts. For large organizations this can prove to be a nuisance, especially since users most likely already have a log in name and password for their operating system.

With ArcGIS 9.2 a more efficient method of connection is implemented called operating system authentication, or OS authentication. OS authentication is a method of connecting to an ArcSDE database by using your operating system log in username and password as credentials to authorize the connection. Since each user already has a unique identifier for logging into the system, this can be used to authenticate an ArcSDE log in. OS authentication is highly effective for internal web applications and corporate intranets.

Full support for Unicode

■ Single and multi-byte characters (Unicode) are now fully supported throughout ArcGIS. This enables you to store strings in multiple languages in the same dataset. For example, places in Asia can be labeled with their local language name and English language name stacked on top of each other on a map.

■ At 9.2 ArcSDE is fully Unicode based. Unicode applications utilize ArcSDE on Unicode databases without data loss or character set restrictions. This allows ArcGIS Desktop, ArcGIS Server and ArcIMS to work in a multi-language environment with less risk of data loss.

Support for IPV6

■ The Internet is at the beginning of a change in its underlying protocol, from the classic Internet Protocol version 4 (IPv4) to the new Internet Protocol version 6 (IPv6). While there are a number of advantages to IPv6, the most visible is the increased size of the address from 32-bits to 128-bits. This results in an exponentially greater number of available Internet addresses. ArcSDE 9.2 supports both IPv4 and IPv6 protocols. There is no action required on the part of the user or systems administrator. ArcSDE accommodates both protocols when supported by the network over which communication is occurring.

ArcSDE administrators

■ The syntax for the sdesetup command has changed in Enterprise ArcSDE 9.2; it is now generic across DBMSs. You will use the -d option to specify the database with which you want to use ArcSDE: either DB2, INFORMIX, ORACLE9I, ORACLE10G, or SQLSERVER. For example, to install ArcSDE to be used with DB2 you would issue the following:

```
sdesetup -o install -d DB2 -u sde
```

For details and complete command options, please consult the ArcSDE Administration Command Reference for 9.2.

CAD

New CAD dataset organization

We've changed the way CAD datasets are organized in ArcGIS. Previously, each CAD file was represented as two entries in the Catalog: as a CAD feature dataset and as a CAD drawing dataset. Now we have combined these two representations into one location – inside of the CAD feature dataset.

This change is intended to reduce confusion and to make accessing the contents of a CAD file easier. This also reduces the number of entries that you will see when you browse a workspace that contains CAD data by half.

CAD Drawing Dataset now inside CAD Feature Dataset
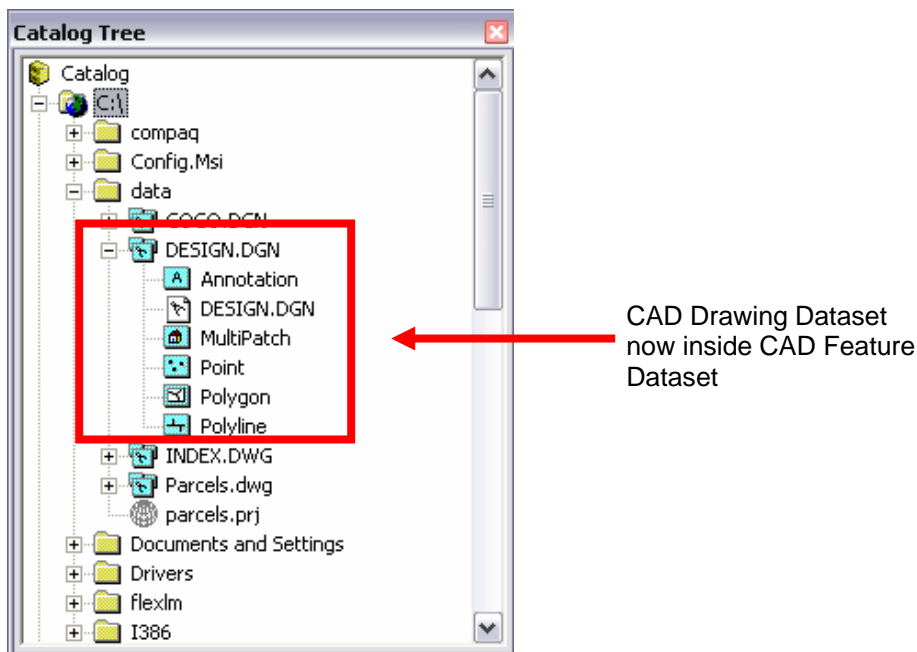
CAD feature dataset content view in Add Data browser.
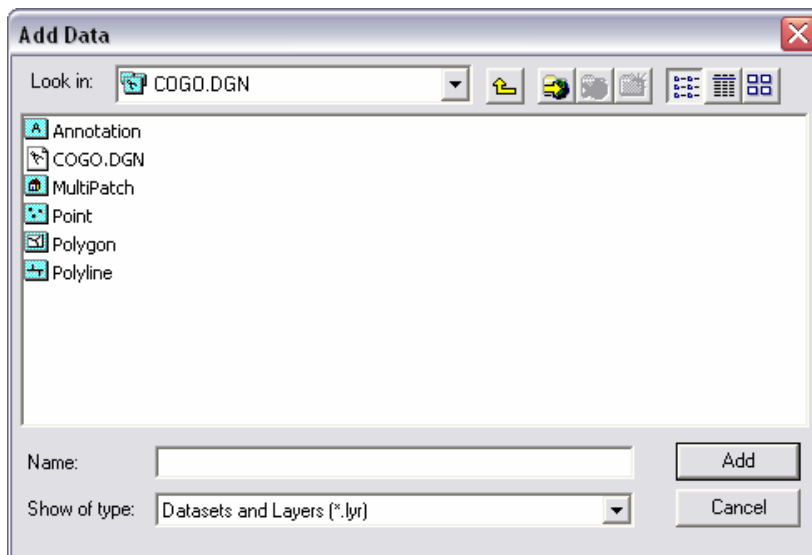
Expanded attribute support

We've expanded our support of CAD properties so you can have access to more information about your CAD drawings. These CAD properties are represented as fields in a CAD feature class's attribute table. Having access to more attributes can help you query, analyze, and symbolize your CAD data more effectively.

We have doubled the number of fields that are supported for CAD feature classes. For CAD annotation feature classes, this support has been tripled. In addition to providing more access to data, another objective for expanding attribute support is to achieve equivalence with other ArcGIS CAD tools, such as the geoprocessing Import from CAD tool and ARC/INFO Workstation's CAD conversion utilities (DXFARC and IGDSARC). The following items summarize the key points of this improvement:

- Increased the number of supported CAD properties
- Established equivalency between the geoprocessing Import from CAD and Workstation's DXFARC and IGDSARC

Some key new fields:

- Point rotation values – for blocks and cells
- Elevation/Z coordinate value – for MicroStation elements
- Line weight values – for DXFARC and IGDSARC users
- Layer and entity drawing properties – not just feature specific (e.g., Color, EntColor, LyrColor, BlkColor)
- Document name and path reporting

Easier to georeference CAD layers

The methods for transforming CAD layers has significantly changed. Previously, all CAD transformations were performed via the Layer Properties Transformation tab. This workflow involved typing coordinate values to define the transformation or browsing to a World File.

We have now implemented CAD layer support in the existing Georeferencing toolbar. This allows you to move, rotate, and scale your CAD layer using the mouse. Additionally, you can add control points in the map with your mouse cursor and use snapping to ensure accurate placement of these from and to points (an edit session and an editable data source is required for snapping). World files are now created by the Georeferencing tool when you commit your transformation. So you no longer have to create them yourself using a text editor.

This design increases productivity by providing you with a more efficient way for georeferencing CAD layers. Below is list of the key items of the improved CAD transformation tools:

- Implementation of CAD layer support in Georeferencing toolbar
- Quickly move, rotate, and scale CAD layers with a mouse pointer
- Add control points interactively
- Snapping is supported to help improve accuracy of control point locations
- Load source and destination coordinates from any World File
- Save World File directly from ArcMap

Control points can now be created with the mouse pointer to define a CAD transformation:
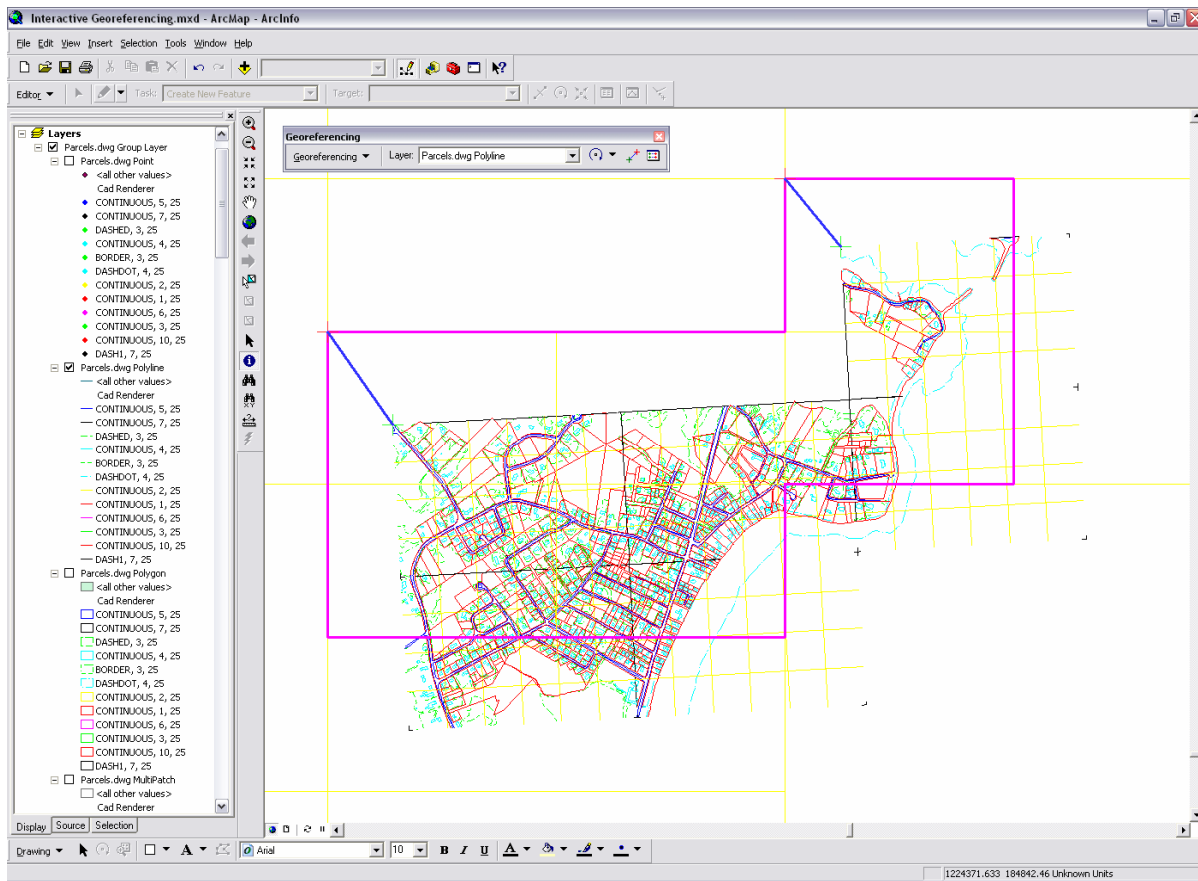
Source and destination coordinates can be viewed and edited via the Link Table dialog; World Files can be created by clicking the Save button:
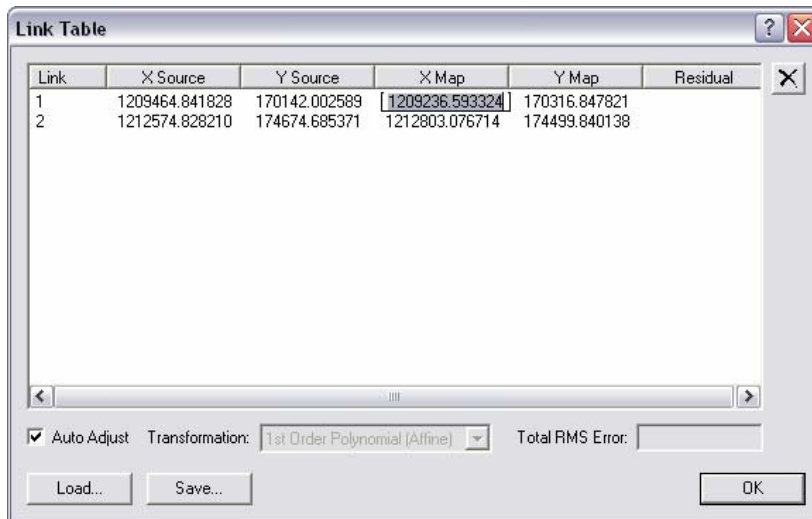
Improved feature rendering

We have improved CAD feature class rendering. Previously, CAD features were rendered using the same default method used for all other feature layers – Single Symbol. We now use the display properties that are inherent in every CAD drawing and symbolize the data based on those values. In conjunction with a new CAD specific map style, we now render CAD features using their original color, linetype, and lineweight values. At this release, we have added support for the most commonly used line type symbols and will continue to add more support in future releases.

We have also improved CAD annotation feature class rendering. Many CAD drawings contain text that use True Type Fonts. Therefore, we now set the fonts for those text entities using the same True Type Fonts that are supported in ArcGIS. This provides a more accurate representation of the CAD annotation and could help eliminate the need for you to modify the text symbols in ArcMap.

Here are the main improvements:

- CAD features are now rendered based on their original display properties ('CAD unique entity values' category).
- Rendering occurs automatically when CAD layers are added to the map.
- New CAD specific map style will support symbology.
- Color, linetype, and lineweight CAD properties are used to define line symbols.
- Annotation symbols are set for all CAD text that use True Type Fonts.
- Original CAD rendering can be restored in case symbols are modified.
- CAD features are rendered using their original color, line type, and line weight values.
- CAD annotation features are rendered using their original True Type Font.

User interface standardization and improvements

To ensure that the user experience is consistent with other data source types, we have standardized the CAD dataset and layer properties dialogs so they better match the ones for geodatabase feature datasets and classes.

In addition to standardization, we have also improved the tabs that support CAD feature layer settings. We have redesigned the Fonts tab so that it reports more information about text styles that exist in your CAD drawing. This will make the process of modifying text symbols more efficient. We have also improved the Drawing Layers tab by implementing a grid control. This will ensure that long drawing layer names are not cut off. We also support color and line type information per drawing layer.

Here are the main improvements:

- Establishes consistency between CAD layer property sheets and geodatabase property sheets
- General, Fields, and Index tabs now standardized
- Drawing Layers tab now uses grid control to support long layer names; reports additional properties
- Fonts tab reports additional text style information
- Drawing Layers tab now lists contents in a common format and additional properties now reported:
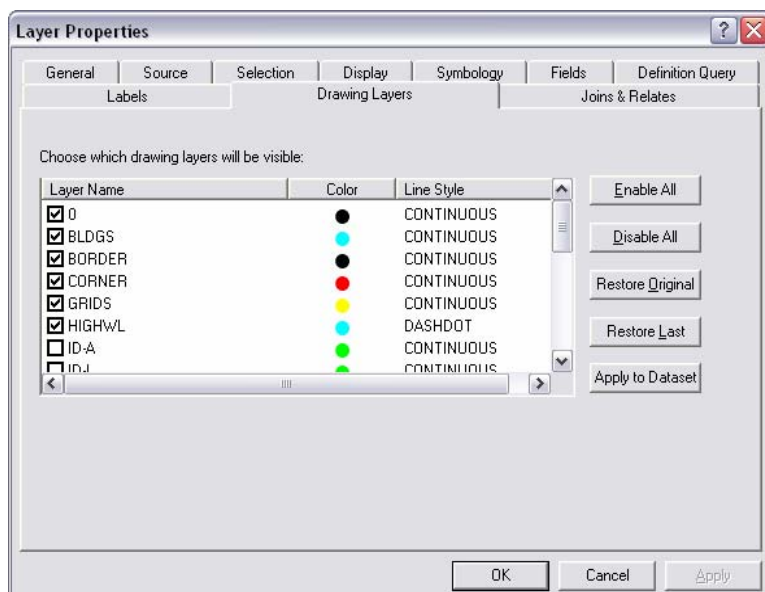
- The Fonts tab now reports additional text style information, and the text symbol control is now standard:
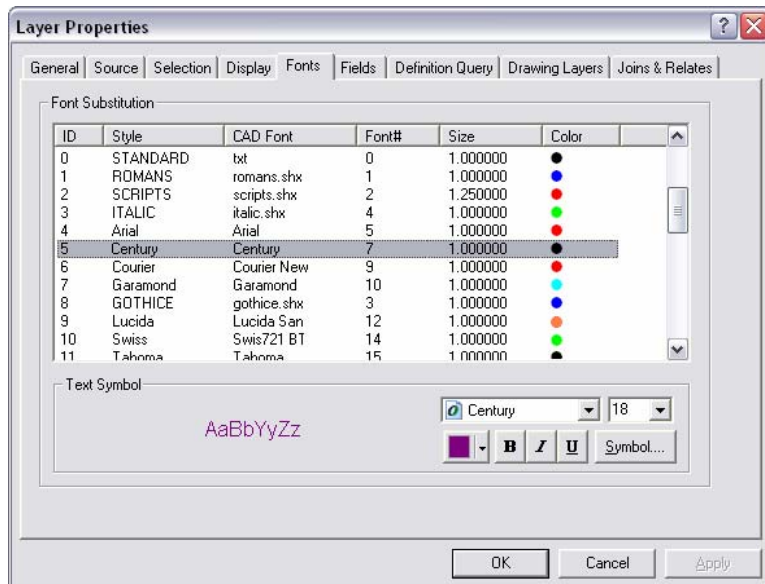
Other CAD enhancements

■ Group layers are now used to represent CAD feature datasets when they are added to ArcMap. This provides a more efficient way to manage the contents of the dataset. It also saves space in the ArcMap Table Of Contents since the new CAD rendering displays significantly more symbols per feature layer. There's also a new button on the Drawing Layers tab that allows you to apply drawing layer visibility settings to the entire CAD feature dataset at one time. Previously, the settings for each CAD feature class had to be managed individually .

■ Block attributes and tags are now supported as CAD annotation features. This is important for those who work with CAD drawings that contain these entities and elements and need access to this data. Along with the pertinent information they provide, they can also be important cartographic elements in a drawing. ArcGIS treats these features the same as text entities, so you can customize the appearance of their symbols as you desire.

■ Drawing layer visibility settings can now be applied to all the feature classes of a CAD feature dataset via the 'Apply to Dataset' button located in the Drawing Layers tab.

■ Improved Multi-line Text display with filtering of special characters and format codes.

■ ArcGIS 9.2 adds support for AutoCAD 2007 DWG/DXF files.

■ AutoCAD Custom Object proxy geometry is now supported as ArcGIS CAD features. Custom objects created with tools like Autodesk Civil 3D or Autodesk Map 3D are now read as ArcGIS CAD features. The tabular object data that may be associated with these custom AutoCAD objects and any special custom geometric representations are still locked away from the standard industry interoperability tools in a proprietary Autodesk encoding format. However, the included proxy geometry, defined by the authoring application for standard CAD users, is now used as the feature geometry in ArcGIS instead of simply omitting the feature.

[?] *See the new CAD section in the Desktop Help: Data support in ArcGIS > CAD data.*

Rasters

Supported raster formats

■ ArcGIS 9.2 can read raster data in these additional formats:

- BSB (.kap)
- ERMapper's ECW (no need to download plug-in from ERMapper)
- HDF4
- IDRISI (.rst)
- PCI
- PCRaster
- USGS ASCII DEM
- X11 Pixelmap

Note: ECW is not supported by ArcIMS and ArcGIS Server by default. Users need to purchase license through ERMapper, and then compile and install an ECW format driver to obtain ECW support for these two products.

■ Performance has been improved for reading MrSID, Jpeg2000, RPF (CIB and CADRG) and some other formats

■ ArcGIS 9.2 can write out raster data in these additional formats:

- GIF
- Jpeg2000 (JP2)
- JPEG
- PNG
- Windows BMP

Improved raster projection and transformation

■ At 9.2, ArcGIS can manage orientation information from satellite imagery (QuickBird's level 1B and level 2A products as well as IKONOS's Geo-Ortho Kit product delivered as TIFF format). The RPC (rational polynomial coefficients) information associated with the TIFF images is now read and applied on-the-fly when displaying in ArcGIS. ArcGIS 9.2 can also store and preserve the orientation information with raster datasets or raster catalogs in any data sources, whether file-based or geodatabase raster.

■ Raster data can now be projected on-the-fly faster and more accurately than ever. In 9.1, the Tools > Options dialog Raster tab (launched from any Desktop application) had a check box option called 'Favor rendering speed over accuracy'. This has been removed at 9.2 because of the improved raster projection and transformation environment in this release. On-the-fly raster projections can now have half pixel accuracy or better. At 9.2, rasters support a collection of transformations, which means that raster projection on-the-fly, raster transformation and data frame rotation can all occur in any sequence. The Project Raster geoprocessing tool, which is used to create a permanent projected raster, is now faster and more accurate, and supports datum transformation and setting registration points.

■ A new setting in the Tools > Options dialog Raster tab (launched from any Desktop application) allows you to specify that ArcGIS should use the geographic information stored in the world file, if present, instead of the AUX or header information when it accesses raster data. If AUX or header information is not present, ArcGIS will attempt to use the world file irrespective of whether this option is checked or not. Check this box if you would prefer ArcGIS to always use the world file instead of the AUX or header information where possible. This option was previously available solely as a registry setting and was not exposed in the user interface:

Options

General | Data View | Layout View | Geoprocessing | Tables

Raster | CAD | Table Of Contents | Data Interoperability

Default RGB Band Combinations

3 band data source

Red: 1   Green: 2   Blue: 3

4 or more band data source

Red: 1   Green: 2   Blue: 3

General | Raster Catalog Layer | Raster Attribute Table

Build Pyramid Dialog Settings

○ Always prompt for pyramid calculation

○ Always build pyramids and don't prompt in the future

○ Never build pyramids and don't prompt in the future

File Formats...

☐ Use world file to define the coordinates of the raster ——————— New setting

Orthorectification

■ Orthorectification is now supported in ArcGIS. Orthorectification allows you to remove distortion from an image resulting from sensor location/orientation and ground elevation so that there is consistent scale across all parts of the image. Orthorectification is the process of stretching an image to match the spatial accuracy of a map. Orthorectification is supported for rasters which have RPC (rational polynomial coefficients) information associated with them. Imagery is usually supplied with this information already associated with it, such as the _rpc.txt file for IKONOS images and the .rpb file for QuickBird images. You can either orthorectify using a constant elevation or by using a DEM raster for the same location. You can find the orthorectification on-the-fly option in the Raster Layer Properties dialog Display tab. The check box is only enabled if the raster layer's data source has RPC information associated with it:

Layer Properties

General | Source | Extent | Display | Symbology | Fields | Joins & Relates

☑ Show Map Tips (uses primary display field)

☐ Display raster resolution in table of contents

☐ Allow interactive display for Effects toolbar

Resample during display using: Nearest Neighbor (for discrete data)

Contrast   0 %   ☑ Orthorectification using elevation

Brightness   0 %   ○ Constant elevation   0

Transparency: 0 %   ● DEM   dem10mp_cut.img

Elevation adjustment

Z factor: 1

Z offset: 0

Geoid: ☑

Display Quality

Coarse   Medium   Normal

New option for turning on on-the-fly orthorectification

OK   Cancel   Apply

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A new geoprocessing tool is also provided enabling you to write out a rectified raster.

🔧 Data Management > Raster > **Create Ortho Corrected Raster Dataset**

❓ *In the Desktop Help, see: Data support in ArcGIS > Raster data > Raster display and visualization > Orthorectifying a raster dataset*

Georeferencing toolbar enhancements

■ ArcSDE raster datasets can now be georeferenced using the georeferencing toolbar. The true convenience of being able to do this without reloading the new rectified raster data is offered through an enhancement made to the Update Georeferencing menu choice. Raster datasets can now be associated with a transformation list, which incorporates all transformations being applied to the raster. Previously, only single transformations were supported through world files and other information contained in AUX files. Now, users can associate a list of transformations with each raster dataset, thereby only resampling the raster data one time, rather than several; this will eliminate many concerns about resampling artifacts.

■ ArcGIS has two new types of transformation capabilities; Adjust and Spline. Both of these new functions allow the raster being georeferenced to be "warped" to a higher degree, thus abiding more closely to the user's choice of control points/links. Lower RMS error values can usually be witnessed by choosing the Adjust transformation technique, and true rubber-sheeting can be attained (no RMS error values) when Spline is chosen as the transformation technique.

Better support for raster attribute tables

■ Any single band integer type raster dataset can now have a raster attribute table (RAT) associated with it, including rasters stored in ArcSDE. Depending on the raster format, some rasters have a native table that can be read and others can have a table built for them.

■ Raster attribute tables can be edited in ArcMap and joins are fully supported.

■ A new setting in the Tools > Options dialog Raster tab accessed in all ArcGIS applications lets you define the threshold number of unique values for which attribute tables will be built for rasters:
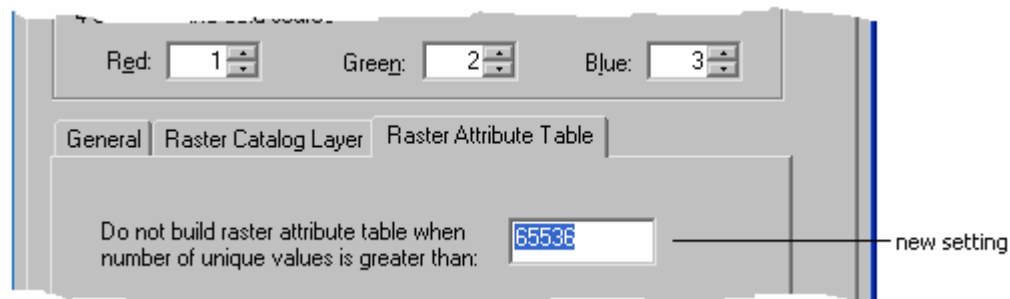
■ The native raster attribute table of an ESRI GRID is a value attribute tables (VAT). ArcGIS treats the VATs of GRIDs in the same way as the raster attribute tables of non-GRID rasters. Like the RATs of non-GRID rasters, VATs can now be used as input in geoprocessing tools that accept tables. Just like a RAT, you can add new fields to a VAT. For example, you can use the Add Field tool to add a field to RAT for a raster showing landuse, then edit the table to include names of landuse types such as Forest, Water, and Urban.

■ Two new geoprocessing tools have been added for working with raster attribute tables:

🔧 Data Management > Raster > **Build Raster Attribute Table**
🔧 Data Management > Raster > **Delete Raster Attribute Table**

Panchromatic sharpening

■ Panchromatic sharpening ('pan-sharpening') allows you to improve the spatial resolution of a low-resolution color multi-spectral raster by fusing it with a higher resolution greyscale/panchromatic raster (or raster band). This results in a multi-band raster dataset with the resolution of the panchromatic raster. This is especially useful because several imagery companies provide low-resolution multi-band images and higher-resolution panchromatic images of same scenes. Here's an example:

Input 1:

Original low resolution color image.
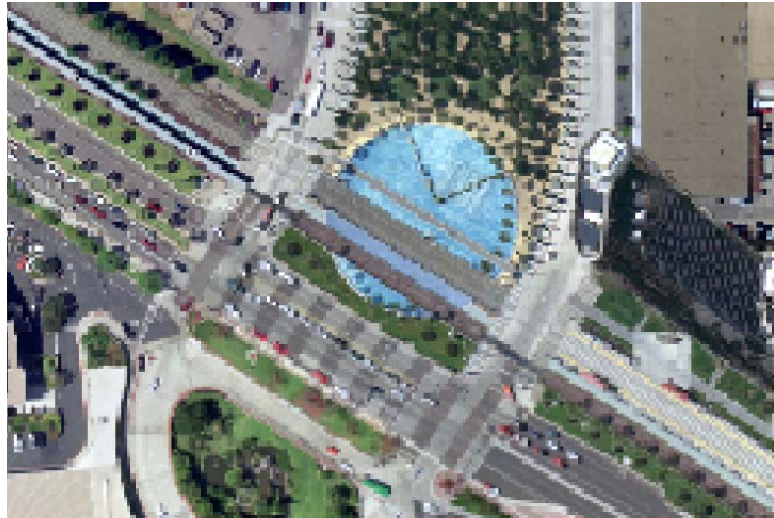
Input 2:

High resolution greyscale image used to sharpen the color image.

Output:

Resulting pan-sharpened image combines the color of the first image with the resolution of the second image.
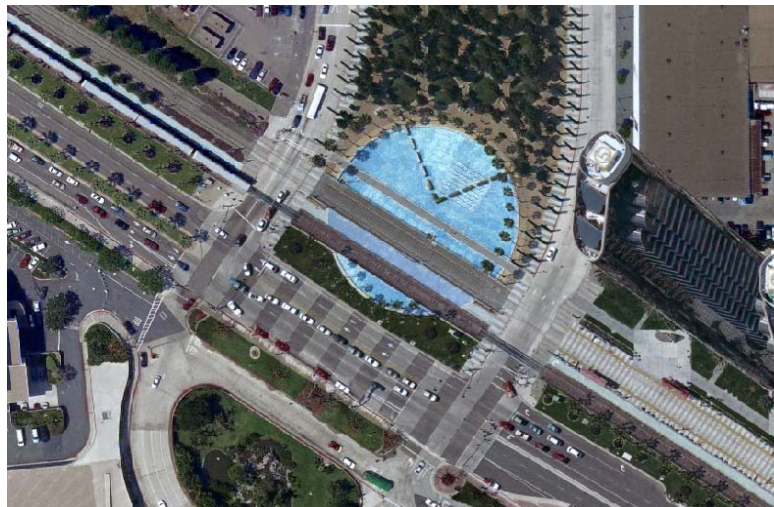
The new option providing on-the-fly panchromatic sharpening is available in the RGB composite renderer panel in the Raster Layer Properties dialog Symbology tab:
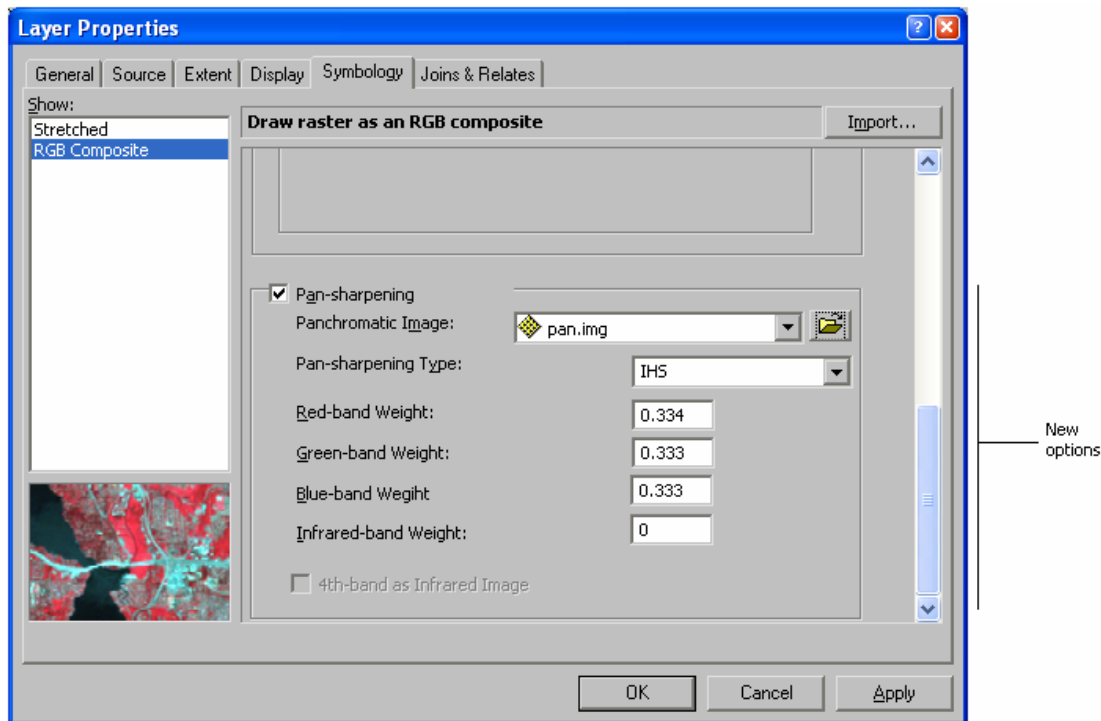
A new geoprocessing tool is also provided:

Data Management > Raster > **Create Pan-sharpened Raster Dataset**

This enables you to generate pan-sharpened raster datasets.

In the Desktop Help, see: Data support in ArcGIS > Raster data > Raster display and visualization > Panchromatic sharpening

Hillshading on-the-fly option

■ A hillshade effect option is provided in the Raster Layer Properties dialog Symbology tab for the Classified and Stretched renderers. Using a simplified hillshade algorithm, this option enables elevation data to be displayed with a hillshade effect and your specified renderer on the same layer, and allows you to quickly explore data without requiring the use of the Spatial Analyst extension to generate a separate hillshade raster dataset:
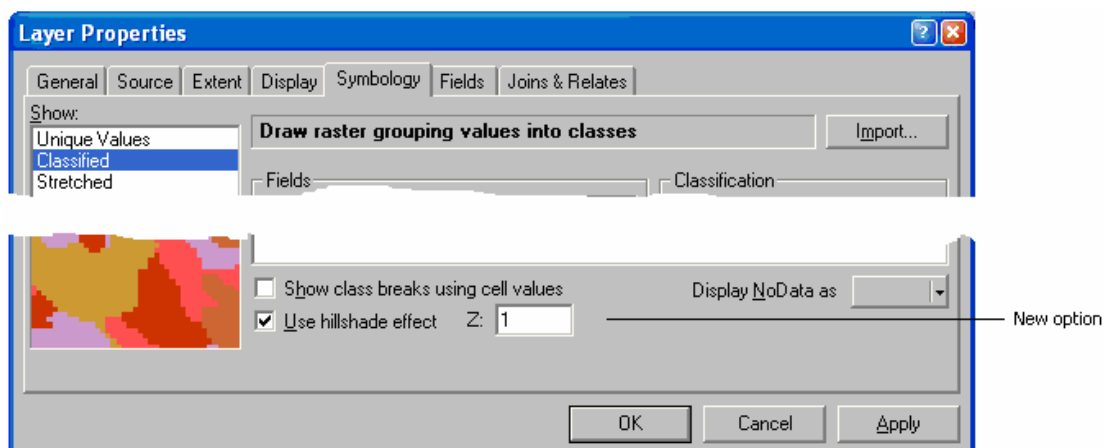
Data loading

■ You no longer need to store all your raster data in one projected coordinate system, as the raster reprojection on-the-fly has been enhanced greatly in terms of performance. Loading/storing of raw imagery with their orientation parameters is also supported, rather than only being able to load previously rectified raster data.
Two new geoprocessing tools now allow the user to load entire directories and sub-directories directly into raster dataset mosaics or raster catalogs:

      Data Management > Raster > **Workspace to Raster Dataset**

      Data Management > Raster > **Workspace to Raster Catalog**

Parallel loading abilities to raster catalogs are then easily accomplished by using more than one ArcGIS Desktop machine, loading into one raster catalog from a single data warehouse (one folder, or many subfolders).

■ Before ArcGIS 9.2, the spatial reference of a raster dataset in a raster catalog had to be the same as the one defined in the raster column. This was challenging for states or regions that are located across multiple UTM zones. You had to create multiple raster catalogs where each catalog held images of the same projection; or project images into one coordinate system if all images were placed into a single raster catalog.

At ArcGIS 9.2, a raster dataset in a raster catalog can have its own unique spatial reference, which can be different from the one defined in the raster column. This means that you can preserve the original spatial references of the images when storing them in a raster catalog. The footprints of the raster datasets are still stored in the spatial reference defined in the geometry column; and the spatial reference of the raster column, if defined, will be used for those datasets that do not have a spatial reference defined.

When a raster catalog is displayed, the raster datasets will be projected on-the-fly to the spatial reference defined in the geometry column. To create this type of raster catalog, you must specify a known spatial reference for the geometry column. The spatial reference could be from one of the raster datasets it contains, or any pre-defined spatial reference supported by ArcGIS. Raster loading tools can preserve the spatial reference of a raster dataset during loading. The new tool Workspace to Raster Catalog tool has an option where you can choose to re-project the raster datasets during loading. Example: The state of Texas lies across UTM zones 13, 14 and 15. The DOQQ data (approx. 17K images) are available in the three UTM zones. A raster catalog can be created to hold all images in their original spatial references.

Geoprocessing tools

■ In addition to the new geoprocessing tools mentioned above, the following new tools are provided for working with rasters:

      Data Management > Raster > **Add Colormap**
      Data Management > Raster > **Create Random Raster**
      Data Management > Raster > **Delete Colormap**
      Data Management > Raster > **Get Raster Properties**
      Conversion Tools > To Raster > **Point To Raster**
      Conversion Tools > To Raster > **Polygon To Raster**
      Conversion Tools > To Raster > **Polyline To Raster**

Geodatabase support

■ ArcGIS 9.2 supports storing rasters in file geodatabases, the database format introduced at 9.2. File geodatabase raster support has a similar implementation as ArcSDE raster, where rasters are stored as tiles, but rather than being in a relational database management system, they are simply stored on disk. This storage type allows ESRI's enterprise geodatabase (ArcSDE) to transfer data to the file geodatabase in a much more simplified manner, which boosts performance and ease of use.

■ Personal geodatabase rasters in ArcGIS 9.2 now support more compression types (JP2000, JPEG and LZ77).

■ Both personal geodatabase and file geodatabase raster catalogs support the unmanaged raster type, where the files on disk are simply referenced from the raster field within the geodatabase.

Pixel Inspector

■ The Pixel Inspector 🔳 is a new tool available in the Tools > Customize dialog Commands tab in the Raster category that you can drag into any toolbar. This tool lets you display an array of pixel values from a raster layer. As you click on the map with this tool, the Pixel Inspector window shows the array of pixel values. The bottom of the dialog contains a dropdown list so you can choose which raster layer to inspect. Tabs below the pixel array allow you to view the raw pixel values of any band, or the rendered values:
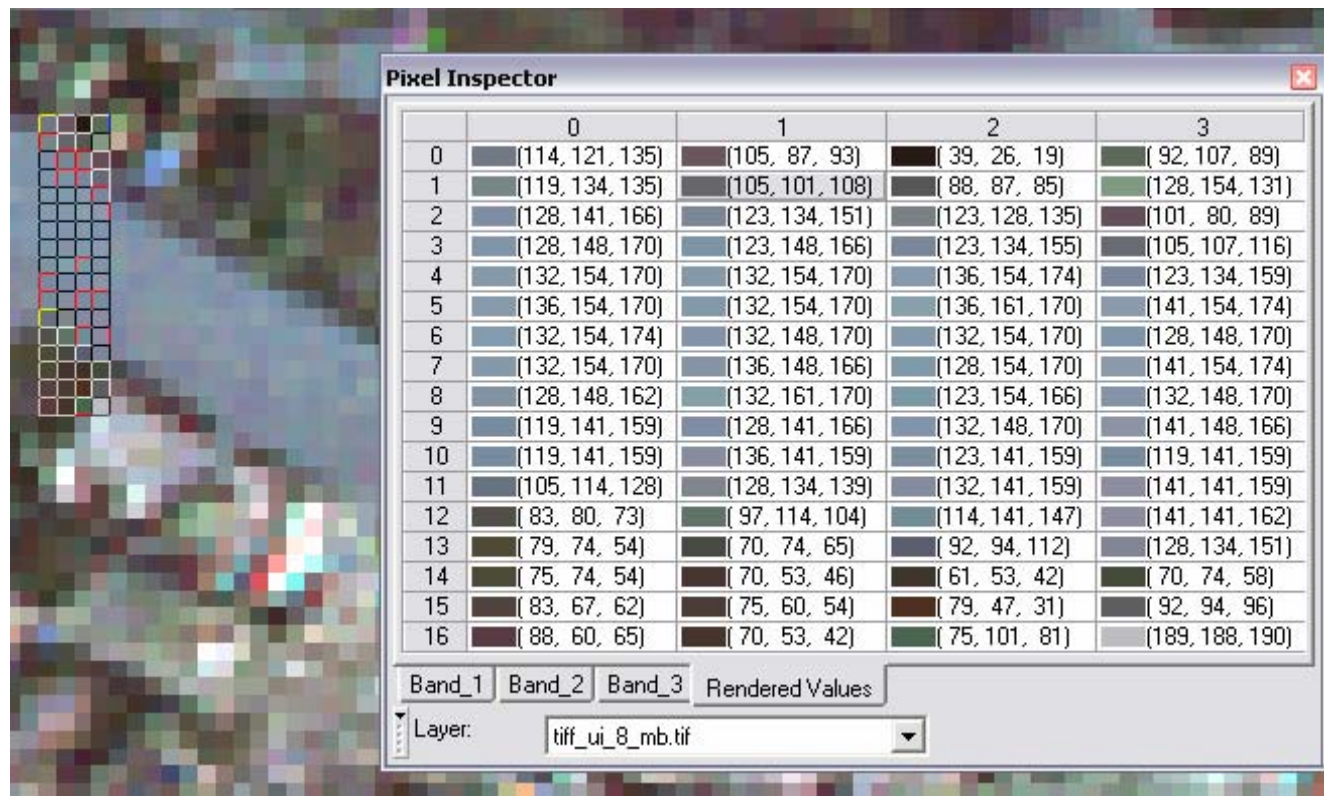
Setting transparency, contrast and brightness

■ Group layers now have their own transparency, contrast and brightness properties. In this way, you can set these properties for all the layers in a group layer to control how they will be displayed without having to visit each layer individually. This is particularly useful when you want to change these settings for a large number of raster layers.

■ Contrast and Brightness fields have been added into the Layer Properties dialog Display tab for a raster layer. You have always been able to change the contrast and brightness of a raster layer using the Effects toolbar (3D Effects toolbar in ArcGlobe and ArcScene) but you've not been able to input contrast and brightness values directly into a raster layer's property dialog:
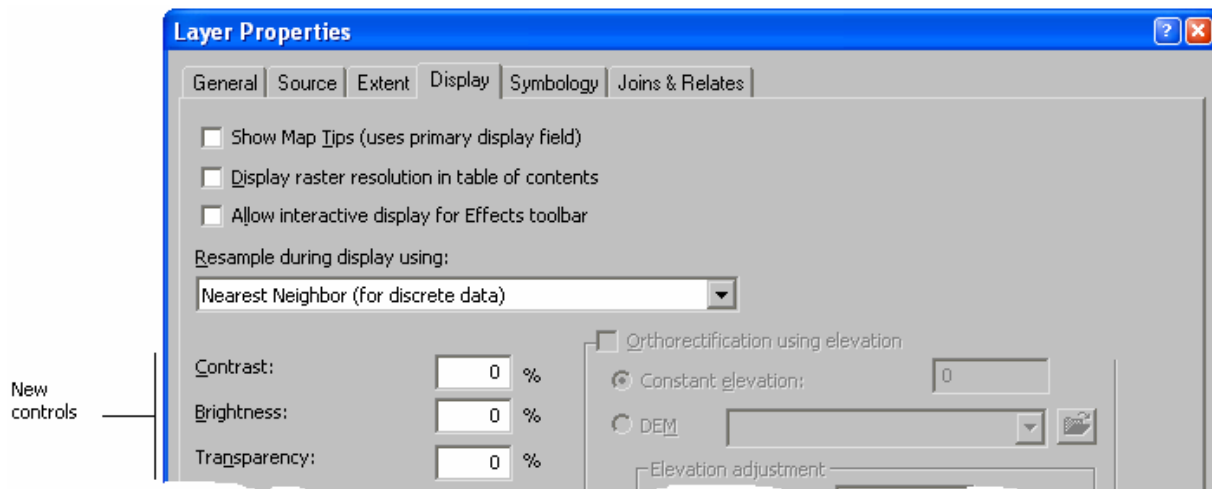
The Raster Catalog Layer Properties dialog Display tab also now has input controls for Contrast and Brightness in addition to the existing transparency control.

Other

■ New vector to raster conversion geoprocessing tools:

    🔨 Conversion Tools > To Raster > **Point To Raster**

    🔨 Conversion Tools > To Raster > **Polygon To Raster**

    🔨 Conversion Tools > To Raster > **Polyline To Raster**

These tools give you more control over the value assigned to a cell in the output raster when there is more than one feature falling into the cell. For example when converting polygons to a raster you can now choose the polygon falling in the cell center, the polygon of maximum area within the cell, or assign the value based on a priority list.

■ Raster layers in ArcMap, ArcGlobe and ArcScene created as temporary layers with a geoprocessing tool now have an option to make them permanent. You can find the Make Permanent command for raster layers in the Data pullright in that context menu. This command is enabled if the raster layer is a temporary layer created with a geoprocessing tool or by a command in the Spatial Analyst toolbar. Choosing this command launches the Catalog Browser enabling you to save the file. The command is disabled if the raster layer is not a temporary layer. (In ArcGIS 9.1, this command was only present and enabled in the context menu for a raster layer if the layer was a temporary layer created by a command in the Spatial Analyst toolbar).

■ The Raster Viewer window launched from the table window and Editor>Attribute window now has a button for flashing the feature on the map that the raster belongs to. This button makes it very easy to see the feature on the map that the raster belongs to.

Terrains

■ ArcGIS 9.2 introduces terrains - a new way to store massive datasets containing elevation or other surface data in the geodatabase. Elevation and surface measurements such as LIDAR (Light Detection and Ranging - a remote sensing system used to collect topographic data) and side scan SONAR (used to collect ocean floor data) can contain several hundred thousand to many billions of points. Until now integrating these huge datasets into GIS and generating 3D surfaces from them has been difficult. Terrains let you store very large point-based datasets in the geodatabase and produce high quality, accurate surfaces on-the-fly for display and analysis at varying resolutions as demanded by your application. A terrain is a multi-resolution, TIN-based surface stored in the geodatabase built from measurements stored as features.

■ The 3D Analyst extension is required to create terrains. The extension is not required to view terrains.

■ Terrains can be stored in any geodatabase (personal, file, or ArcSDE). Similar to a topology, a terrain resides in a feature dataset and references the feature classes in that dataset. Rules control how these participating feature classes are used to model the terrain. In addition to mass point such as LIDAR data, terrains can reference feature classes providing other surface elements such as break lines and other photogrammetrically derived features, lakes, streams, obscured or areas with no data, study area boundaries, etc. A terrain references this measurement and feature data. It doesn't actually store a surface as a raster or TIN. Rather, it organizes the data for fast retrieval and derives a surface on-the-fly. Here's a terrain stored inside a feature dataset called 'topography'. The feature dataset includes all the feature classes that participate in the terrain:
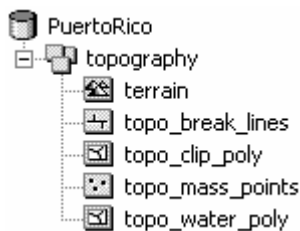

■ Terrains achieve high performance at multiple resolutions through terrain pyramids that quickly retrieve only the data necessary to construct a surface of the required level of detail for a given area of interest. Coarser pyramids are used at smaller scales to boost performance. Terrain pyramids are similar to raster pyramids but are based on vector measurements and are used when the surface is read for analysis and well as for display.

■ To create a terrain, you first assemble the feature classes that will participate in it. With the new tools provided at 9.2, ArcGIS is capable of reading a wide variety of surface measurement formats, including LAS, the LAS is an industry standard file format for the interchange of LIDAR data:
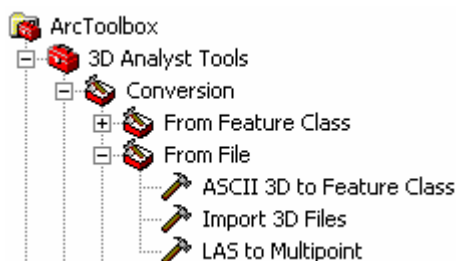
To launch the wizard for creating a terrain once the feature classes have been assembled, right-click the feature dataset containing the data and choose the New>Terrain command. This command is disabled if the 3D Analyst extension is not enabled. You can also create and manage terrains using new geoprocessing tools:
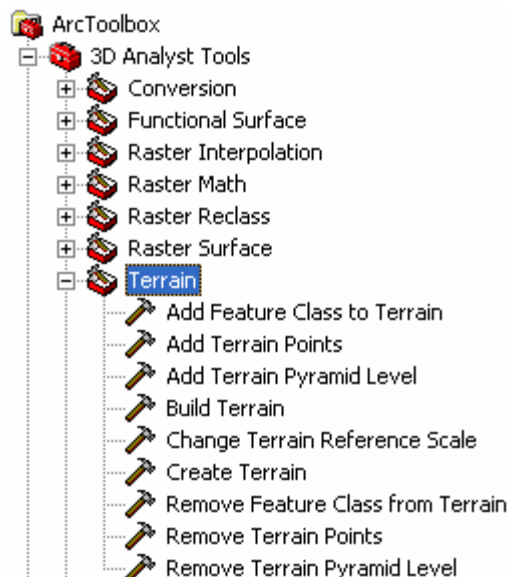
■ Tools are provided for converting terrains to rasters and TINs:
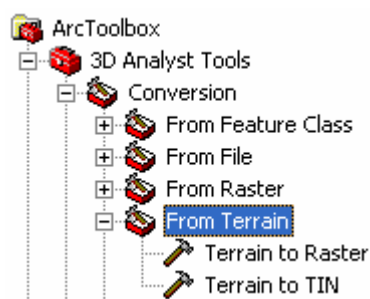
■ Terrains can be edited and modified over time. Terrains stored in ArcSDE can be versioned. As with other data types, versioning offers a powerful approach for editing data in multi-user environments and deriving 'what if' scenarios that can be stored and edited simultaneously in the database.

■ Terrains can be displayed and read by ArcMap and ArcGlobe at all license levels. ArcScene does not support terrains because it only supports static representations: it doesn't support dynamic use of levels of details and pyramids.

■ Terrains are supported in ArcGIS Server.

■ *In the Desktop Help, see: Data support in ArcGIS > Terrains > What is a terrain dataset?*

Tables

Excel support

■ Excel files (.xls) are now supported directly in ArcGIS as read-only tables. Excel files are shown in ArcCatalog and you can expand them to see the individual worksheets and named ranges they contain:
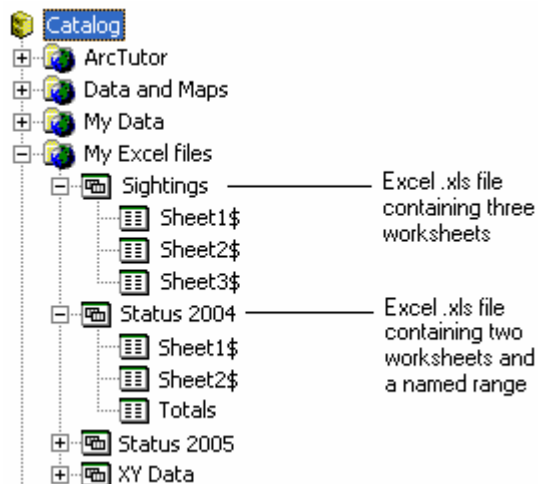
Excel worksheets are always shown with a dollar ($) sign at the end of their name in the Catalog tree.

■ Tables based on Excel data can be used like other tables in ArcGIS with the exception that they can't be edited from inside ArcGIS, and fields can't be added, deleted, calculated, etc.

■ ArcGIS determines the data type contained within fields by inspecting the first 8 rows underneath each field name. If 4 or more rows are found to contain numbers, the field becomes a number field and any text entries will become nulls.

■ The first non-empty row in an Excel worksheet or named range of cells is treated as containing the field names for the data in the columns below it. So for example, the third row in this worksheet is the first non-empty row:

and so it provides the field names for the data in the worksheet:

■ Excel files often contain titles and other information in addition to the columns containing data which mean that the first non-empty row in the file is not the one containing the field names for the data you want to access:

In this case, you don't have to reformat these files in order to use them in ArcGIS. Instead you can define a named range in Excel that references the data you want to treat as the rows and columns of a table. To define a named range, select the area containing the field names and data, and enter a name for this area in the box at the left side of the Excel Formula Bar:

Type the name for the range here

Now when you access this Excel file in ArcGIS you'll see the named range you created listed as one of the tables it contains:

and when you open the table, it will contain just the data in that range:

Named ranges make it easy to access specific data in Excel worksheets. You'll frequently find that Excel files created by financial departments, etc already have named ranges referencing the pertinent tabular data they contain.

Calculating fields

■ When you right-click a field in a layer attribute table, there's a new Calculate Geometry command that opens a dialog that makes it easy to calculate the field to be the area, length, perimeter, x location, y location, x centroid, or y centroid of the features in the layer. As part of this enhancement, the existing Calculate Values command has been renamed to be the Field Calculator command:
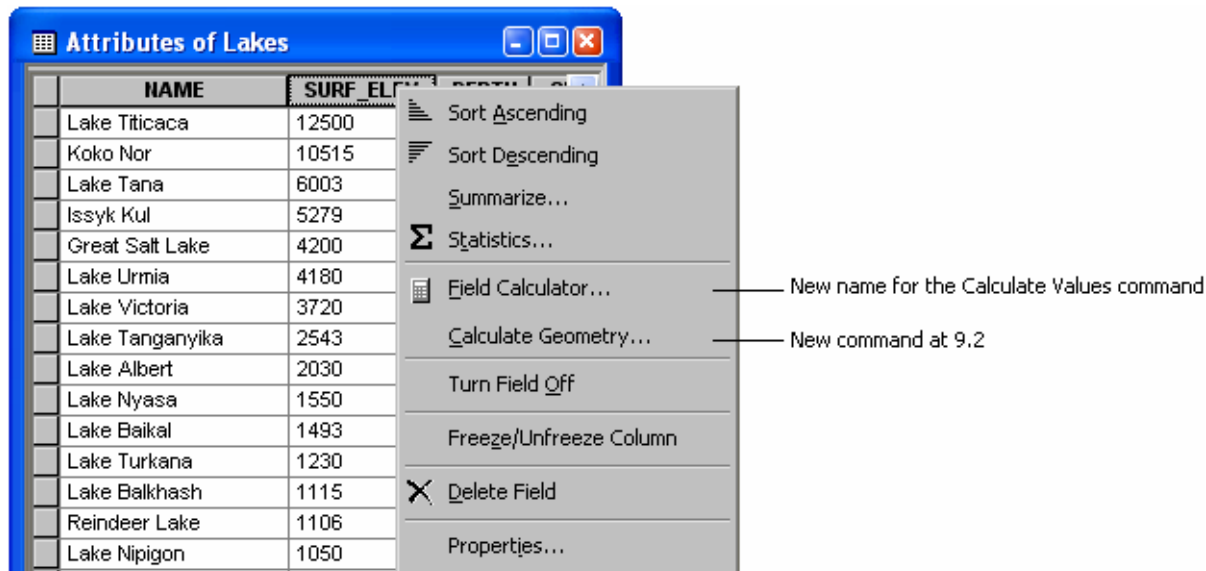
The Calculate Geometry command launches this dialog which lets you choose the property to calculate and the coordinate system and units to be used by calculation:
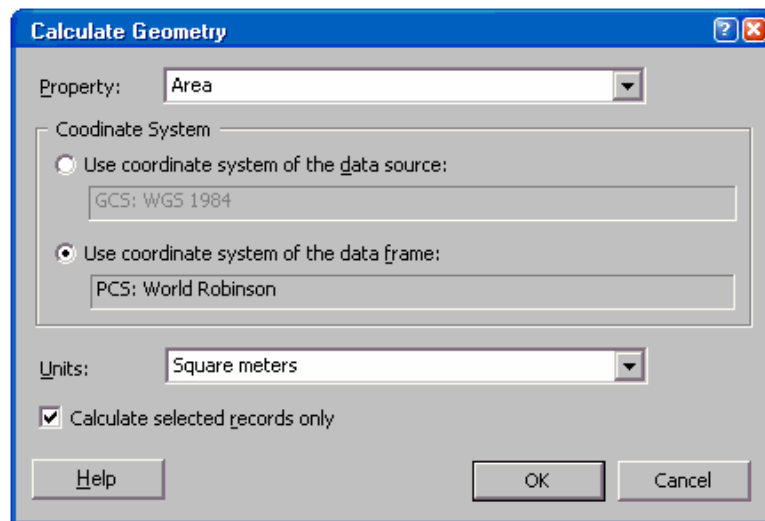
The Calculate Geometry command works with any numeric or text field. For the most precise results, use a 'double' type field, with the desired number of decimal places. If you use an integer field the result will be rounded up to a whole number. If you use a text field you can include unit abbreviation, choose format, etc so it is easy to make a ready-to-use field for labeling.

Remember that geometry calculations in ArcGIS are planimetric (i.e. take place in projected space, not spherical or geodesic space). You can only calculate the area, length or perimeter of features if the coordinate system being used is a projected coordinate system (PCS). If the data source uses a geographic coordinate system (GCS) such as WGS 1984, and is therefore unprojected, you can use the projected coordinate system of the data frame to perform the calculations. Alternately, you can project the data source.

■ The Field Calculator has always respected the currently selected records in the table, so only the currently selected records are calculated. At 9.2 this works the same way but we've added a check box option to the bottom of the Field Calculator to make this more obvious (see below). You can also override this behavior by unchecking the box if some records are currently selected but you want to calculate values for all the records.

■ A new menu in the Field Calculator dialog lets you choose how fields will be listed. This menu is accessed via a small control to the right of the fields list, or by right-clicking the fields list. This menu gives you the option of listing fields with their field aliases instead of their underlying field names. When you choose this option, the fields list respects field alias properties when you are working with layers and tables. This has been requested frequently because many of you use field aliases to make cryptic field names more user-friendly or to make long ArcSDE field names more manageable. The Show Field Aliases option is turned off by default in 9.2 so there is no immediate change to your familiar workflows. Choosing to show aliases in this dialog has no effect on the expression syntax. Field aliases are not shown or supported in the expression itself. If you double-click a field shown with its alias, it will still be added into the expression with its actual name and the required [ ] field delimiters.

Another option in this menu lets you choose how the fields are sorted in the list. By default the fields are still listed in their original order in the data source so there is no immediate difference to 9.1. Choosing Sort Ascending or Sort Descending can make it easier to quickly locate the field you want. In the example below the fields list has been changed to be sorted in ascending order and to show the field aliases:
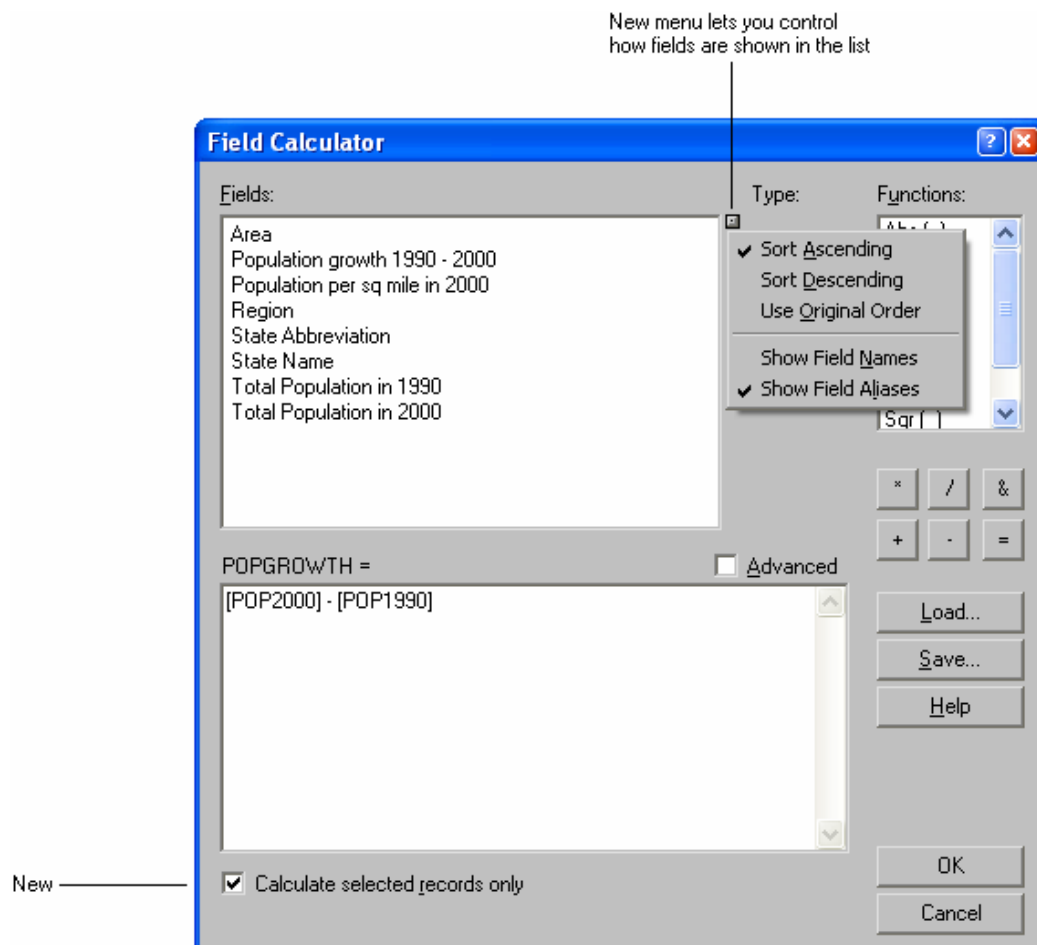
The sorting and field name options you choose remain in force whenever you use this dialog or others that offer the same options: the Select By Attributes dialog, all Query Builder dialogs, and the Label Expression dialog.

■ The Field Calculator now respects field visibility properties. Fields that have been turned off for the layer or standalone table you are working with are no longer listed in this dialog. You turn fields off in the Layer Properties or Table Properties dialog Fields tab or via the table window (a new capability in 9.2). This makes it easier to work with

data sources that have a large number of fields because only the fields you have chosen to work with appear in the dialog.

■ The Field Calculator has been modified so that you now double-click a field to add it into the expression. Previously you single-clicked. This made it impossible to use the keyboard in the fields list and was inconsistent with other dialogs.

■ The message that appears if you calculate a field outside of an edit session now has a check box so you can easily turn the message off. To turn the message back on after turning it off, use the setting in the Tools > Options dialog Tables tab.

Customizing a table's contents

Turn fields on and off, specify aliases, etc directly from the table window

When you are working with a table window, you no longer have to open the Layer Properties dialog Fields tab if you want to change which fields are shown, their aliases and their number format.

■ To turn a field off, right-click the field's name in the table window and choose the new Turn Field Off command. Turning a field off in the table window is the same as unchecking it in the Layer Properties dialog Fields tab:
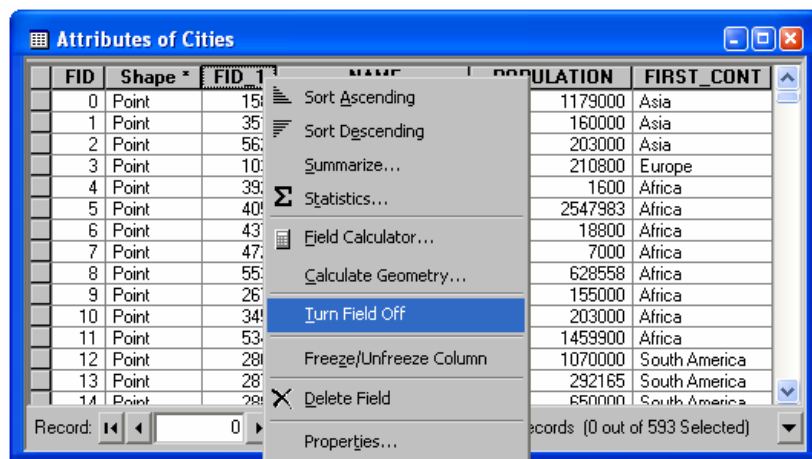
Want to breeze through your tables turning unwanted fields off even faster? Hold down **CTRL** and double-click a field name to turn that field off.

To turn all the fields on again, choose the new Turn All Fields On command in the table window's Options menu. This is the same as going to the Layer Properties dialog Fields tab and choosing Select All. All the fields in the data source will be turned on. This command is disabled if none of the fields are currently turned off.

■ To specify an alias for a field, right-click the field's name in the table window, choose the new Properties command, and type into the Alias box. This new Field Properties dialog also lets you turn the field on or off, make the field the primary display field, change its number format if it is not a string field, and review (not change) the field's other data properties, such as its precision, etc:

Easier to work with column widths in the table window

■ In the table window, fields are shown in columns. You've always been able to drag the column dividers between fields left and right to change their width, including dragging dividers so that fields are completely hidden. However in previous releases it was not possible to automatically reset the column widths to undo changes you made, and it was hard to tell whether any fields were hidden in the table. A new Restore Default Column Widths command in the table window's Options menu resets all the columns to their default widths. This also reveals any fields that are completely hidden because their column has been dragged to have no width. The Restore Default Column Widths command doesn't reset the field order, so if you have dragged and dropped fields around in the table window, this reordering is preserved when you use the command.

■ If a field has been completely hidden in the table, you'll now see a thicker column divider at that position. This makes it easy to see where one or more fields have been hidden. If several fields have been hidden at that position, you'll see an even thicker divider:

To unhide a hidden field, drag the thick divider to the right, or double-click on the divider. (At 9.2 we have fixed the bug where double-clicking on the divider for a hidden field turned that field on in the Layer Properties dialog Fields tab). To reveal all hidden fields, use the new Restore Default Column Widths command in the Options menu. Completely hiding fields in the table window is useful because it lets you choose how you want the table to appear without turning fields off completely which would prevent them being listed in dialogs. Want to hide fields very rapidly? Hold down **CTRL** and **SHIFT** and double-click a field name to hide that field.

New appearance options for the table window

■ A new setting in the Table Appearance dialog (see below) launched from the Options menu button in the table window lets you choose to indicate the primary display field in the table window by adding a special character after its name. If you want to be able to see which field is being used as the primary display field in this way, turn this option on and choose the character you'd like to use (the default is a pound sign #). By default, this option is turned off so you won't see any difference unless you turn this option on.

■ Two new settings in the Table Appearance dialog let you control the height of the column heading row at the top of the table window and the height of the cells in the rows. By default, your tables will look the same as they do in 9.1:
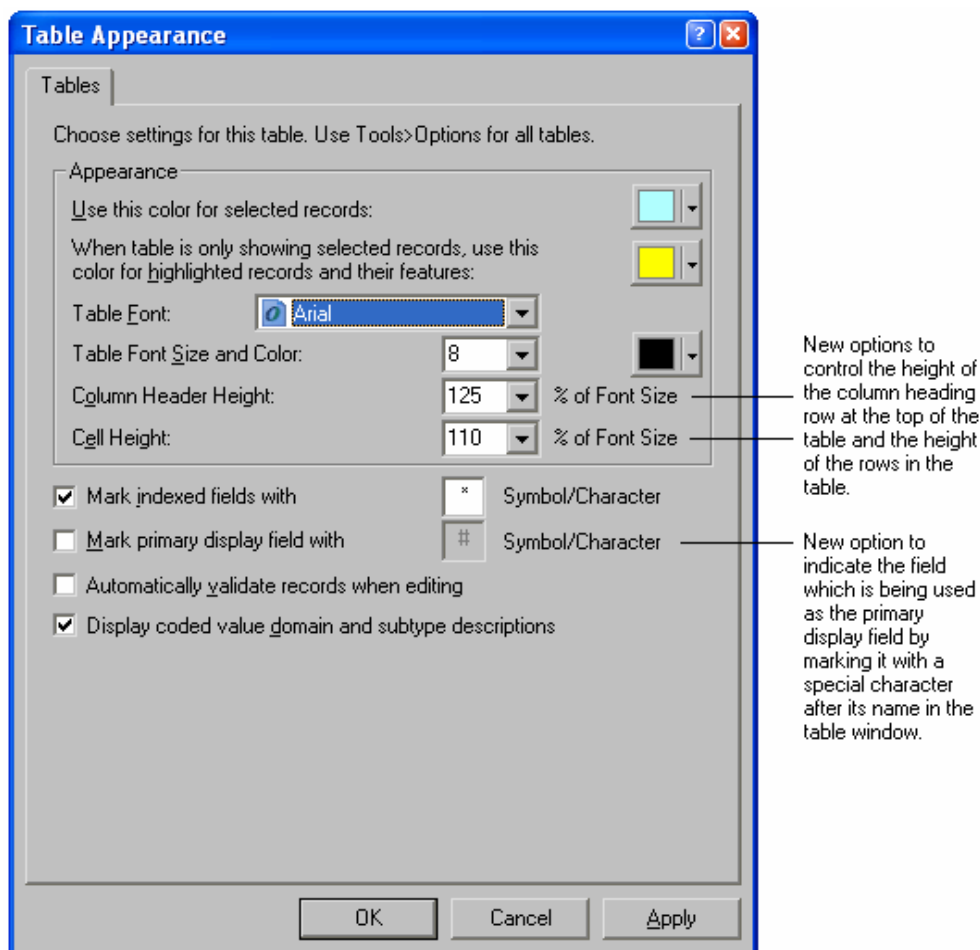
By increasing the % values you can increase the height of the cells in the table window. If the height you specify for the Column Header Height or Cell Height provides enough space in a cell to accommodate additional lines, the content of the column header or cell value will wrap if it exceeds the current width of the column. This is useful if the fields in your table have long names or aliases, and you want to be able to read them without having to work with a very wide table. Increasing the cell height is useful if your table contains long text fields, such as description or comment fields, to make these fields easier to read.

In the example below, the column header height has been set to 340% and the cell height to 450%:

■ If you want the options described above to be used for all the new table windows you open, specify them in the Tools > Options dialog Tables tab. Settings you turn on in that dialog don't apply to tables you have already opened in your existing map, globe and scene documents.

Working with the data in a table

Navigate around your map directly from a table

■ A number of new commands have been added into the context menu you get if you right-click the grey cell to the left of a record. These include commands that let you navigate quickly on the map to the features listed in your table:

- The **Flash**, **Zoom To**, **Pan To** commands show you the feature whose record you right-clicked. These commands don't change the selection, so they are useful for looking at features before deciding if you want to select them.

- We've added the existing **Zoom To Selection** command into this menu for easy access. You can right-click any record to access this command (the record doesn't have to be currently selected).

- **Zoom To Highlighted** is a new command that is enabled when you are in Show Selected Records mode and you have highlighted some of the records (i.e. made them turn yellow). This command is disabled when you are in Show All Records mode (because you can't highlight features in that mode).

■ In addition to these new commands, two navigation shortcuts have been added if you want to navigate to features very rapidly from a table:

> Double-click the grey cell to the left of a record = select that record and zoom to its feature on the map

> **CTRL** + double-click the grey cell to the left of a record = select that record and pan to its feature on the map

If you are in Show Selected Records mode, these shortcuts highlight the feature instead of selecting it, so you can use them to quickly navigate around your set of currently selected features without changing that set.

■ The following keyboard shortcuts are provided so you can navigate to the feature represented by the current record without using the mouse. These are especially useful when combined with other shortcuts like using the arrow keys or **ENTER** to move up and down through the records sequentially because they enable you see where the feature you are currently editing or reviewing in the table is located:

CTRL + 8   Flash current feature
CTRL + =   Zoom to current feature
CTRL + P   Pan to current feature
CTRL + I   Identify the current record
CTRL + SHIFT + =   Zoom to selected features

You can also open the context menu described in this section by pressing the **Application key** .

■ All the navigation commands and shortcuts are disabled if the table you are working with is not the attribute table of a feature layer.

Use the mouse wheel in a table

■ You can now use the mouse wheel to navigate through a table. When you roll the mouse wheel in the ArcGIS Desktop applications at 9.2, the roll applies to the window that the cursor is currently hovering over. There's no need to click inside the table first to make it active before you use the mouse wheel. When the cursor is over a table window, you can perform these operations:

- Roll the mouse wheel to scroll up and down.
- Hold down **SHIFT** and roll the wheel to scroll sideways.
- Hold down **CTRL** and roll the wheel to zoom in and out on the table. This is particularly useful if you want to see the big picture when you reorder fields in a table by dragging them left and right.

Sorting tables

■ You can now double-click a column header (field name) in the table window to sort the table. This is a useful shortcut you can use instead of right-clicking a field and choosing one of the two sorting commands.

■ When you are in Show Selected mode in a table, the sorting you choose is retained if you add records to the selected set or remove records from it. For example, if you sort the selected set of cities on a population field, holding

down SHIFT and clicking on additional cities on the map to add them to the selected set will insert their records correctly into the sort order in your table.

Easier to add fields

■ The Add Field dialog launched from the Table window is now more intelligent. When you use this dialog to add a numeric field to a personal geodatabase or file geodatabase, it no longer prompts you to define the Scale or Precision of the new field. These field properties aren't supported by those data types.

Similarly, the dialog no longer lists Blob as a field type when you add a field to a coverage or shapefile, and no longer lists Guid as a field type when you add a field to a shapefile.

■ The enhancements described above have also been applied to the Fields tab in the Feature Class Properties dialog and Table Properties dialog in ArcCatalog, so you no longer see those unsupported field properties when adding fields in ArcCatalog.

Navigating around inside a table

■ In 9.2, when you open a table window it is automatically given keyboard focus, so you can immediately start navigating around inside it with the keyboard. Previously you had to click inside the table first to give it focus.

■ These existing shortcuts have been improved:

← →	When you use the arrow keys to go left or right, they now wrap back to start of same record when you get to the end of row, and vice versa.
ENTER	Now goes to the cell below the current one in the same field instead of the cell to the right.
TAB	When you press TAB to go to the cell to the right, it now wraps around to the first cell of next record when you get to end of row.

■ These new shortcuts have been added:

HOME	Go to the first cell in the current row (same as existing CTRL + left arrow).
END	Go to the last cell in the current row (same as existing CTRL + right arrow).
SHIFT + ENTER	Go to the cell above current cell.
CTRL + F	Launch Find dialog.
CTRL + G	Go to a record number. This launches a small dialog into which you type the record number to go to. This works the same as typing a record number into the box at the bottom of the table window but doesn't require the use of the mouse:
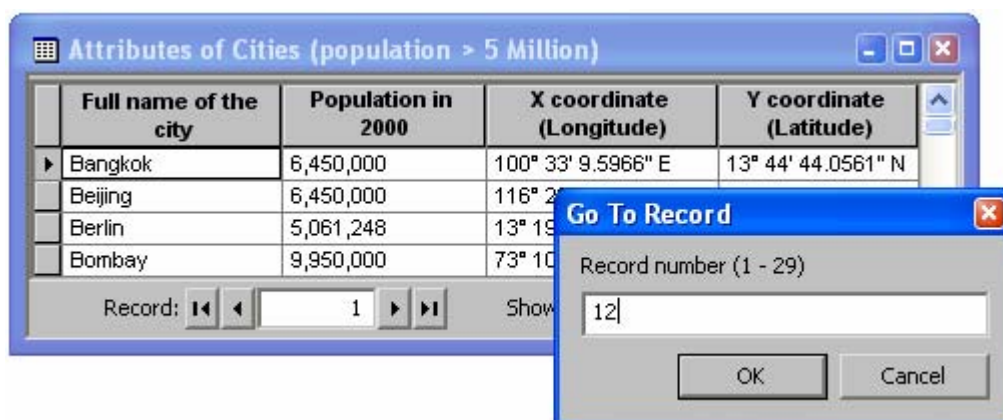
Selecting and unselecting records

■ You can now select a range of records in a table by clicking the first record in the desired range and then holding down **SHIFT** and clicking the last record in the range. This Windows standard method of extending a selection was not previously supported in the table window. You can now also use **SHIFT** + **SPACEBAR** or **SHIFT +** ⬇ or ⬆ to extend a block selection using the keyboard.

■ "Hands-free" record selection: When you are viewing a table in Show All Records mode, you can use the **Select/Unselect** command in the context menu accessed by right-clicking the grey cell to the left of any row to add a record to the selected set, or remove a record from it, without holding down SHIFT or CTRL. Using the Select/Unselect command retains your existing selection and either adds the record you right-clicked to the selected set or removes the record from it.

■ Press **SPACEBAR** to select or unselect the current record. In Show Selected Records mode this shortcut highlights or unhighlights the record. This shortcut makes it easy to work through a table using the down arrow or the ENTER key selecting records you want to work with. Use **CTRL + SPACEBAR** to select or unselect a record with the keyboard if you are in edit mode).

■ We've made it easier to quickly clear the selected set while in the table window. Click the top left hand corner of the table window to clear the selection:

Click here to clear selected records

SHIFT + Click selects all records

CTRL + Click switches the selection

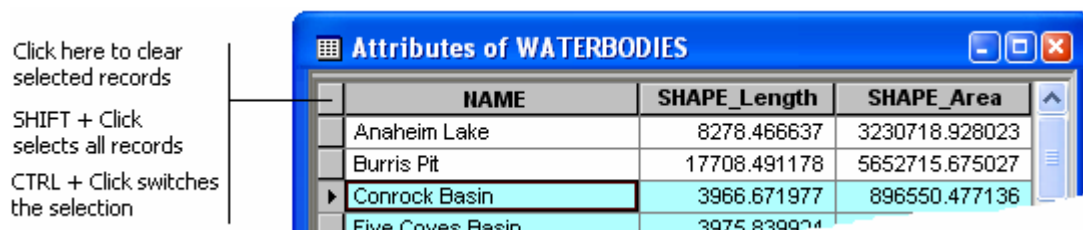|	NAME	SHAPE_Length	SHAPE_Area
	Anaheim Lake	8278.466637	3230718.928023
	Burris Pit	17708.491178	5652715.675027
▶	Conrock Basin	3966.671977	896550.477136
	Five Coves Basin	3975.839924	

Attributes of WATERBODIES

You can also press **CTRL + BACKSPACE** to clear the selection. **CTRL + SHIFT + A** also clears the selection.

As shown in the graphic above, you can **SHIFT** + click the top left hand corner to select all records. The keyboard shortcut for select all records is **CTRL + A**. You can **CTRL** + click the top left hand corner to switch the selection. The keyboard shortcut for switch selection is **CTRL + U**.

If you are in Show Selected Records mode, these shortcuts apply to the set of highlighted records (i.e. the subset of records shown in yellow).

We've also added the Clear Selected command into the context menu you get if you right-click the grey cell to the left of any row. This command always clears the selected set irrespective of which mode you are in.

■ When you are working in Show Selected Records mode, you can now remove records from the selected set to refine your selection by interacting directly with the table. Previous when you were in Show Selected Records mode there was no way to remove records from the selection via the table.

- To remove one record from the selected set, right-click the grey cell to the left of the record and choose **Unselect** from the context menu.

- To remove the current record from the selection using the keyboard, press **BACKSPACE** (this shortcut is not available if you are in edit mode).

- To remove multiple records from the selected set, first highlight the records you want to remove and then right click the grey cell to the left of any record and choose **Unselect Highlighted**. Highlighting records and then unselecting them makes it easy to refine your selection because you can choose which records you want to unselect and review them in the table before unselecting them. You can use any of the new shortcuts described above, such as using the **SPACEBAR** to highlight records while you navigate up and down through the table with the arrow keys.
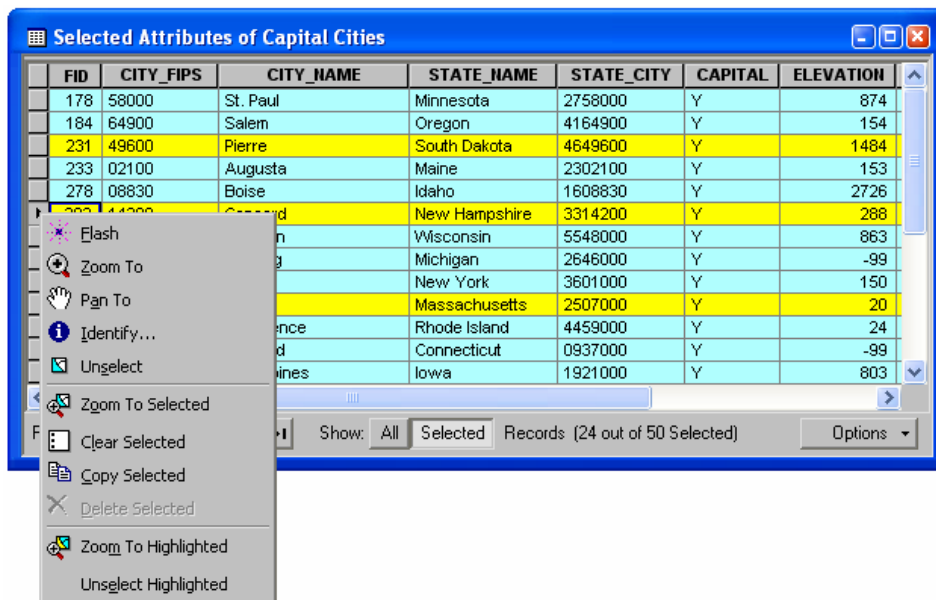
For example suppose you need to find the 5 wireless repeater locations with the best signal strength in a particular area. First select all the wireless repeater locations in that area on your map, then open a table and view these records in Show Selected Records mode. Double-click on the signal strength field to sort them in descending order. Now highlight record number 6 through to the last record in the table using SHIFT + Click or by dragging over these records. Finally right-click and choose Unselect Highlighted. Sorting is preserved when you add or remove records from the selection.

■ To switch between Show All Records and Show Selected Records modes using the keyboard, press **CTRL + TAB**.

■ You may want to work sequentially through a table reviewing each record and seeing where its feature is located on the map. A new shortcut at 9.2 facilitates this: **CTRL + ENTER** moves down to the cell below your current location in the table, selects that record, and unselects the one you began on if it was selected. Rather hard to describe but when you try it you'll see that it lets you work sequentially through a table selecting each record one by one. Try combining this with one of the new table to map navigation shortcuts described above such as **CTRL + P** for pan to current feature. **SHIFT + CTRL + ENTER** does the same thing in the opposite direction.

Easier to copy data

■ To copy records from a table for pasting into other applications, such as Excel, first select the records you want to copy, right-click the grey cell to the left of any record, and choose the new **Copy Selected** command. This command just copies the tabular record data, not the geographic features associated with the records. For this reason, you can't paste copied records back into the table window. You can also press **CTRL + SHIFT + C** to invoke this command. (To copy and paste features in a layer you are editing, use the Copy and Paste commands in the ArcMap window in an edit session in the usual way).

This new Copy Selected command replaces the Copy Records command that was in the context menu for a standalone table in the Table Of Contents Source tab. That command, which did not respect your selected set, has been removed at 9.2.

■ You can now copy the contents of the current cell with the keyboard using **CTRL + C** or **CTRL + INSERT**.

New shortcuts for editing the data in a table

■ You can now press **CTRL + SHIFT + E** to start or stop editing (same as using the Start Editing and Stop Editing command in the Editor pulldown menu).

■ These existing shortcuts have been improved so you can choose whether you want to work down through the current field or across the record as you edit values:

ENTER	Finish editing current cell and go down to the next cell below in same field. Matches Excel.
TAB	Finish editing current cell and go across to next cell to the right in same record. Wraps around to next record below when you get to the end of the row.

■ With the new **CTRL + ENTER** shortcut you can work sequentially down through a table editing each value in a field while at the same time seeing where the feature represented by the current record is on the map. This shortcut works the same as pressing ENTER but it also selects the next record you land on and unselects the one you just updated. In this way you can see the feature you are currently editing selected on the map. **SHIFT + CTRL + ENTER** does the same thing in the opposite direction.

■ You can use the new **Delete Selected** command to delete the currently selected records (and their features if you are working with a layer). This command is in the context menu accessed by right-clicking the grey cell to the left of any record. The Delete Selected command is disabled if you are not in an edit session.

Like in previous releases, the keyboard shortcut for deleting the selected records is DELETE. An additional shortcut at 9.2 is **CTRL + D**. In Show All Records mode, this deletes the currently selected records(s) the same as DELETE. In Show Selected Records mode, this deletes the currently highlighted (yellow) records in your selection, providing a useful way to delete a subset of the features in your current selection.

■ These additional new shortcuts have been added:

|	
SHIFT + INSERT	Paste the contents of the clipboard into the current cell. (**CTRL + V** is already supported).
CTRL + Z and **CTRL + Y**	Undo/Redo edits to a record.

■ If you are editing a value in a text field, you can press **SHIFT + ENTER** to insert a line feed into the string to make it occupy more than one line (for example, to use as stacked text for labeling or annotation). At 9.2 you can now see these multiple line text strings in the table window by setting the cell height to 200% or more in the Options > Appearance Properties dialog as described earlier.

■ It is now easier to paste data into vertical consecutive cells in a column when you are populating a table. This can save time if you are updating an existing table and want to use information in other applications, such as Excel and Word. For example, you may want to use Excel to assemble and spell check updates to an existing field in an ArcMap table and then simply paste the values from Excel into the table instead of loading the Excel table into ArcMap and joining it to your table.

In this example, these four consecutive cell values in a column in an Excel spreadsheet will be pasted into four consecutive cells in a field in an ArcMap table. First select the cells in Excel as a block and copy the block to the clipboard:

Next right-click the first cell at the top of the vertical block of consecutive cells in ArcMap and choose Paste:
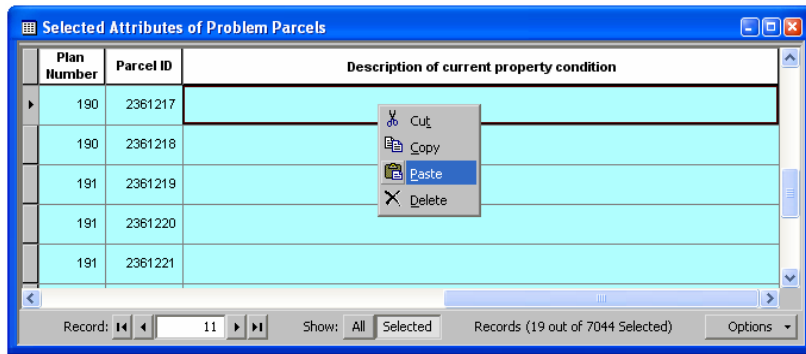
The values get pasted into the field in the same order they appeared in the Excel file:
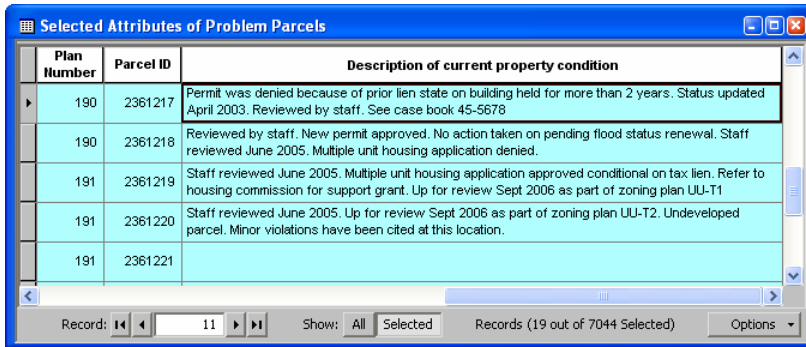
This functionality was available in previous releases but at 9.2 we have fixed the issues it had.

Print tables directly without creating reports

■ You can now print tables directly from the table window, without having to create a report or add the table to your map layout. In the Options menu for a table, choose the new Print command. The table will be printed as it appears on-screen. Tables are printed using the current font, font size, and font color specified in the Appearance dialog accessed from the Options menu. Records that are currently selected or highlighted in the table are printed in bold by default. To see additional printing options or to override the defaults, go to the Advanced Options tab in the Print dialog. For example, the font size setting lets you override the font size specified in the Appearance dialog.
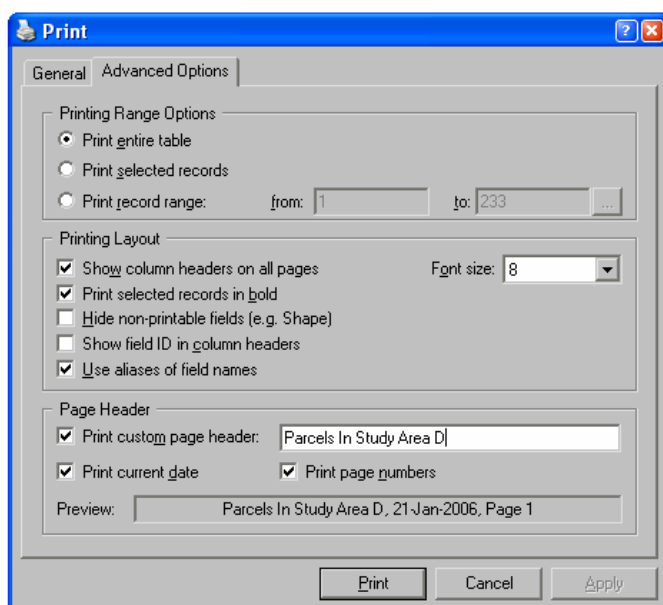
Creating reports

■ The Reports pullright in the Tools pulldown menu that contains the commands for creating reports has been added into the Options menu in the table window. This makes it more convenient to make reports containing data from the table you are currently working with.

■ The first panel of the Crystal Report Wizard has been improved to make it easier to work with: The layer list is now much larger, includes feature type icons and reflects any group layers in your Table Of Contents organization. A radio button option has been added so you can restrict the layer listing to layers that are checked as selectable in the Table Of Contents Selection tab. Buttons have been added for selecting all and clearing all check boxes. In addition, when you press Next the wizard no longer prompts you if the 'Use selected records' box is checked but one or more of the layers you checked do not have any features selected. In these cases, the wizard now just automatically uses all the features in those layers. Finally, the wizard now automatically increments the default name of the output geodatabase into which the data your report will be saved if a geodatabase with that name already exists:
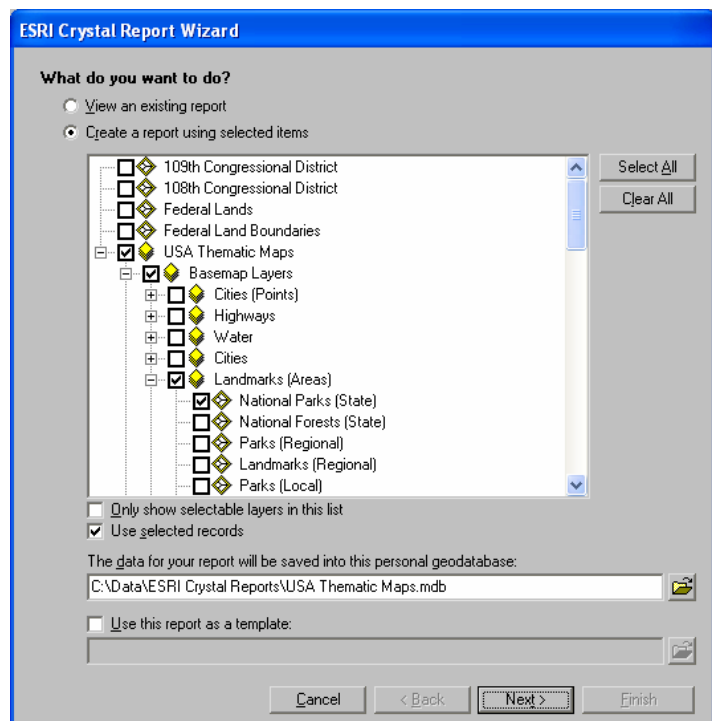
Other

New shortcuts for opening and closing tables

■ When you right-click a feature layer and choose Open Attribute Table, this opens the table in 'Show all records' mode. At 9.2 there's a new command called 'Open Table Showing Selected Features' that opens the table window directly in 'Show selected records' mode. You can find this in the Selection pullright when you right-click a feature layer in the Table Of Contents. The command is disabled if no features are currently selected.

■ To open the table window for a layer or table in the Table Of Contents, hold down **CTRL** and double-click it.

■ Press **CTRL + T** or **CTRL + ENTER** to open the table windows for the currently selected layer(s) or table(s) in the Table Of Contents.

■ These new keyboard shortcuts are also supported:

CTRL + T in table window	Minimizes the window.
CTRL + SHIFT + T	Toggle all currently open tables between displayed and minimized state. Makes it easy to hide all the tables you have open and then show them again.
CTRL + SHIFT + TAB	Toggles between the currently open tables when you have multiple open.
CTRL + SHIFT + F4	Close all currently open tables.

Working with a small table window

■ It is easier to work with table windows when you make them small to fit next to your map on screen. In 9.2, if the Options menu button is hidden due to the width of the table window, a small control appears at the bottom right hand corner of the window. You can click this control to access the Options menu:
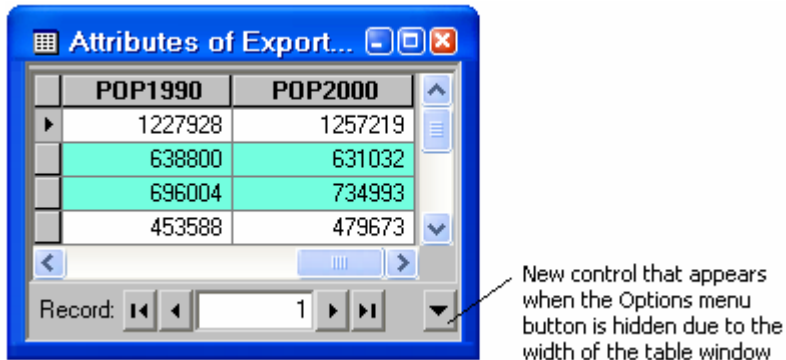
You can also right-click any of the empty 'grey space' at the bottom of the table to access the Options menu.

To open the Options menu using the keyboard, press **CTRL + Application key** 📄.

■ To switch between Show All Records and Show Selected Records modes, press **CTRL + TAB**. This enables you to switch modes even if the buttons at the bottom of the table for switching modes are hidden.

Add XY Data & Add Route Events dialog now tell you if resulting layer has limitations

■ The Tools > Add XY Data command and Tools > Add Route Events commands now inform you if the layer that will be created in your map will have restricted functionality because the input table it is being created from does not have an Object-ID (OID) field. This will be the case with text files (txt files), Excel files (new in 9.2) and OLE DB data, such as non-registered Oracle files accessed through OLEDB. A new check box added to both dialogs lets you turn this notification message off:
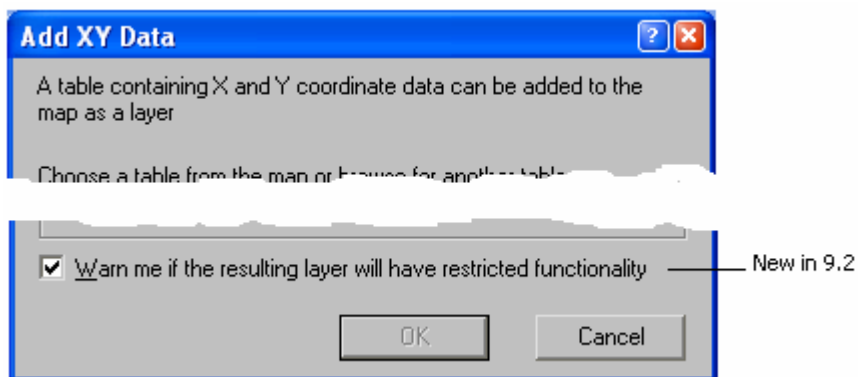
Layers created from tables that don't have an Object-ID field have certain restrictions: their features can't be selected on the map, you can't start an edit session, and relates can't be defined. The message mentions the simplest way to handle this issue: after you've created the event layer from a table with no Object-ID field, export the data to a feature

class and then add the exported data to the map as a new layer. Saving the event layer's data to a feature class writes out an Object-ID field. Click on the check box in the dialog with the ? tool to get more information about this.

Improved properties dialog for standalone tables

■ Standalone tables added into ArcMap, ArcGlobe and ArcScene now have General and Source tabs in their Properties dialog. To open the Properties for a standalone table, right-click the table in the Table Of Contents Source tab and choose Properties. The details in the Source tab enable you to see the name and location of the table's data source. They tell you whether or not the table has an Object-ID (OID) field. Standalone tables that don't have Object-ID fields, such as text files (txt files), Excel files (new in 9.2) and OLE DB data, such as non-registered Oracle files accessed through OLEDB, have some limitations when they are used to create XY and route event layers (see the section above). It also lists what type of table data source is being used:
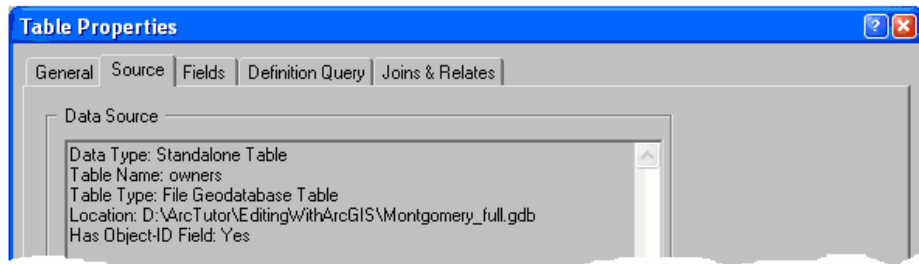
New number format

■ You can now specify that the data in a numeric field represents a direction:
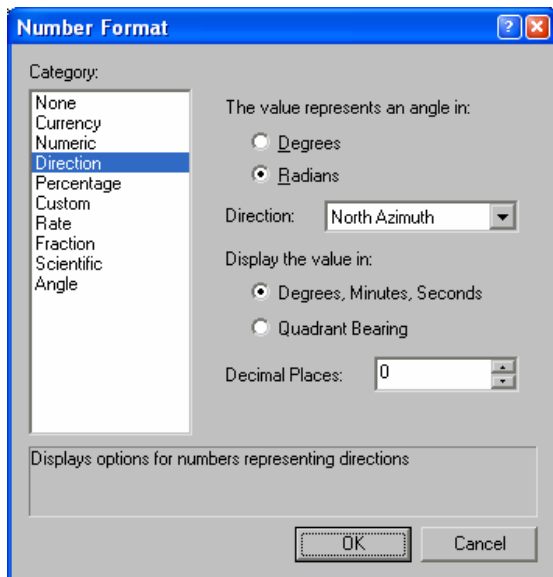
How to find out about tables shortcuts while you are working in a table

■ To get a list of tips and shortcuts while you are working with a table window, click inside the window to give it keyboard focus and then press **F1**. (You can also find a list of tips and shortcuts in the ArcGIS Desktop Help and at the end of this document). To find out whether a particular command you access regularly via a menu in the table window has a shortcut, highlight the command in the menu and press **SHIFT + F1** to get context sensitive help about it.

Editing

New COGO functionality

ArcGIS 9.2 has a new set of coordinate geometry (COGO) functionality for ArcEditor and ArcInfo users. COGO provides a number of different methods for creating features from surveyed bearings, distances, and angles. This is commonly used when creating land records databases.

New COGO toolbar and changes to the Advanced Editing toolbar

■ There is a new COGO toolbar available at 9.2 that contains commands specific to creating COGO features as well as querying and interacting with COGO features. The commands on the COGO toolbar are available for ArcEditor and ArcInfo licenses only.

	Displays the Traverse window
	Displays the 2-Point Line window, so you can construct a 2-point line using COGO methods
	Create a line at a specified distance and perpendicular from a selected line
	Construct a cul-de-sac from a street centerline
	Splits the selected feature proportionally
	View and change the current direction offset and distance factor
	Displays the COGO Report window
	Reports the COGO area and other information for selected lines
	Reports missing parameters for curves
	Splits selected line features into new 2-point line features
	Updates the COGO attributes from the geometry of the selected features

■ As part of the new COGO enhancements, we've made the following changes to the Advanced Editing toolbar:

- The existing Traverse command , Proportion command , and Inverse command have been moved from the Advanced Editing toolbar into the new COGO toolbar to consolidate the coordinate geometry functionality.

- The Inverse command has been renamed to Update COGO Attributes.

- The existing Copy Features tool , Fillet tool , Generalize command and Smooth command can now be used with an ArcView license, so at 9.2 all the controls on the Advanced Editing toolbar can be used with ArcView.

Here's the Advanced Editing toolbar at 9.2:

Interactively setting the ground to grid correction

■ When you enter direction and distances when editing, you can specify a ground to grid correction that is applied to the values you enter. New at 9.2 is the Ground To Grid window that allows you to interactively set the correction by clicking points on the map.

New construction tool

■ The Line Intersection tool is a new tool that finds intersections between two lines you click. The lines will be split at the location where you click the mouse. There can be many potential intersections between the lines features and the intersection points can be either at explicit locations in the middle of both lines or at implied intersections along extensions to one or both lines. You can use this tool to cleanup intersections you create with other commands such as Cul-de-sac and Copy Parallel.

Commands for creating COGO Boundaries

■ There are three new commands for creating COGO boundaries in your land records database.

2-Point Line Window - The 2-Point Line window creates line features from COGO descriptions you read from a survey plan. This window works similar to the existing Traverse window but allows you to enter lines more quickly. You simply need to enter a start point and the parameters for the line you are creating. The start point can be a point you enter from an X and Y, a point you click on the map, or the end of an existing lines in your database. The lines are created in the target line feature class.

Cul-de-sac Command - The Cul-de-sac command is used to create cul-de-sac lines from a selected centerline. Once you have created your centerline, you enter the radius and other parameters for the cul-de-sac and new line features are created in the target line layer.

Offset Line window - Occasionally land boundaries are described in a "strip description" survey plan. A strip description describes boundaries on either side of a specified centerline. This is used to describe easements or right of ways in land records. The Offset Line window lets you create an edit sketch from selected lines. After you enter a start distance, which you read from your survey plan, you can add offset points by setting a distance along the selected line, an offset distance and the side you want the offset point to be on. Each offset point is added to the end of the edit sketch.

Reporting on COGO lines

■ One important pre-phase required before you enter COGO boundaries, is examining the existing boundaries in the geodatabase and determining how accurate they are. Over time as you build your parcel layers, each new parcel that gets added could require the boundaries to be adjusted. Understanding how the existing parcels fit together is essential for guiding you on how you fit new parcels. There are three new 9.2 commands that will help you with this task.

COGO Report window - use the COGO Report window to measure COGO directions and distances for features in your database, as well as the directions and distances between points in your map.

COGO Area command - The COGO Area command allows you to calculate the grid area and perimeter of selected lines as well as the legal area described by the COGO attributes of the line features.

Curve Calculator window - The Curve Calculator window lets you determine the characteristics of a curve from two known parameters.

Managing COGO Lines

■ There are several new commands and updates for existing editing commands that allow you to manage COGO lines:

Split into COGO Lines **-** A new command at 9.2, the Split into COGO Lines command on the COGO toolbar is used to split selected lines at each vertex into new features. You will get one new feature for each vertex in a selected line. The new features are created in the current target layer. If the target layer and the selected lines are the same feature class, the selected lines are deleted and new features are created. COGO descriptions are created if the target layer has COGO fields.

Update COGO Attributes - The command was named Inverse at 9.1. It calculates the COGO description for selected lines and populates the COGO fields. At 9.2 you will be warned if any of the existing features already have their COGO fields populated.

Merge command - The Merge command on the Editor menu of the Editor toolbar allows you to merge COGO lines and update the COGO attributes. When you select lines that form either a single continuous straight line or a circular arc, a checkbox appears that allows you to *Merge into a single COGO line*. The resulting feature has a shape with a single line or circular arc segment. If the features have COGO attributes, you can also update them by checking the *Update COGO attributes* option.

Writing COGO attributes to line features

■ The following commands write COGO descriptions to the COGO attributes of a line feature class:

Merge command - Merges two or more selected features into a single feature. If you select lines that are entirely straight or curved and they have COGO fields, you can update the COGO descriptions.
Traverse window - Create a feature from a series of COGO descriptions that form an open or closed traverse. This only writes COGO descriptions when you use the Create 2-Point Line Features task.
2-Point Line window - Create a COGO line feature from a COGO description.
Offset Line window - Create COGO line features from a strip description or right of way plan.
Cul-de-sac Command - Create a symmetrical or asymmetrical cul-de-sac from a street centerline.
Proportion command - Split the selected line into a number of segments.
COGO Report - List the COGO descriptions for lines and features in the map.
Split Into COGO Lines command - Split the selected lines at every vertex and update the COGO fields.
Update COGO Attributes command - Calculate COGO descriptions for selected lines from the feature geometry.

■ Also for 9.2, we've changed the way specific editing commands and tools copy COGO values from existing features. The following commands will clear the COGO attributes for features when they are copied attributes:

*Copy Parallel comman*d - when your target is the same as the selected lines, the existing attributes can be copied to the new features.
Split command
Split tool
Merge command - where you don't use the Update COGO attributes option.
Line Intersection tool
Extend tool
Trim tool
Extend fix
Trim fix

A setting is stored in the Windows Registry, where the default is to always clear the COGO attributes for the commands above. You can use the Advanced ArcMap Settings utility to change this.

Enhancements to existing editing functionality in support of COGO

■ *Traverse Window -* The Traverse Window now remembers the previous location you loaded a traverse file from.

The "+" and "/" keys on the numeric keypad can be used to tab forward and backward between the controls in the Traverse Window. This improves your productivity when you are entering traverses.

Navigation commands have been added to the context menu for courses. Now you can zoom to a specific course or the entire traverse. Spacebar is a shortcut to zooming to a course. Courses flash when you navigate with the arrow keys.

The Traverse Window now responds to when ground to grid correction changes, the courses in the traverse are immediately modified based on the ground to grid settings.

■ *Proportion Command -* We have made several productivity enhancements to the Proportion command. At 9.2 you can reorder the lengths you have added. You can also add duplicates of a highlighted length—this gives you a way to easily break your line into segments the same length.

■ *Sketch Tool -* The Sketch Tool now honors the ground to grid correction when it writes the direction and distance of the sketch segment.

In the Desktop Help, see: Editing and data compilation > COGO > An overview of COGO

Entering attributes after creating a new feature

■ You can turn on a new setting on the Attributes tab of the Editing Options dialog so you will be prompted to enter attributes into the Attributes dialog after any editing operation that results in new features, in either all layers or just specific ones in your map. As soon as you complete a sketch or an operation resulting in new features, the Attributes dialog will appear. You will need to close the dialog before you can do anything else with ArcMap.
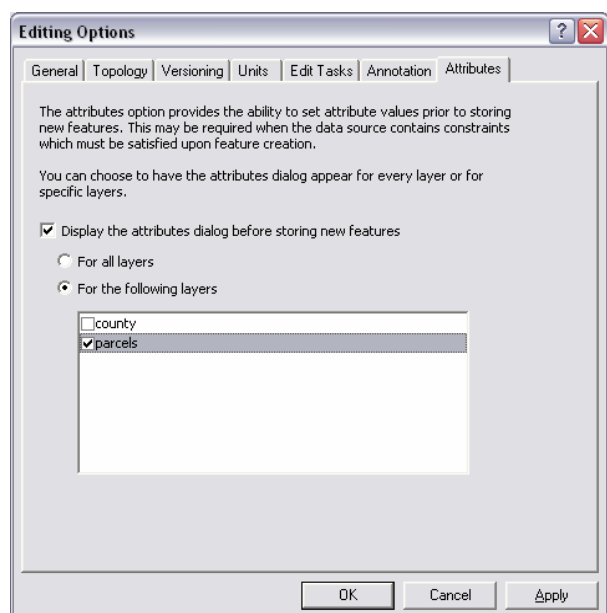
Turning on this setting will be most useful when:

- Your geodatabase does not allow features to have null attribute values. When prompted, you can edit and replace null values before the new feature is stored in the geodatabase.

- You are creating new features and want to attribute them immediately. This is especially true when you are creating a few new features at a time, and they have known attributes or subtypes.

This setting applies to using the Create New Feature edit task, cutting, mirroring, splitting, intersecting, buffering, or exploding features, and using topology functions such as Planarize Lines, Construct Features, and the Create Feature error fix.

Other editing enhancements

Copy Parallel command enhanced

■ The Editor menu > Copy Parallel command has been enhanced to ensure that the parallel lines are copied to the side you want and work better with multiple selected lines. Arrows are now drawn to show you the direction of the selection.

You use a new dropdown list to specify whether you want the lines copied on the left or the right of the originals, so you no longer enter a negative offset distance to copy a line to the left. Multiple selected lines can now be treated as a single line, even if the directions of the lines are different. You can choose to create a single new line, or one feature for each line in the selection:
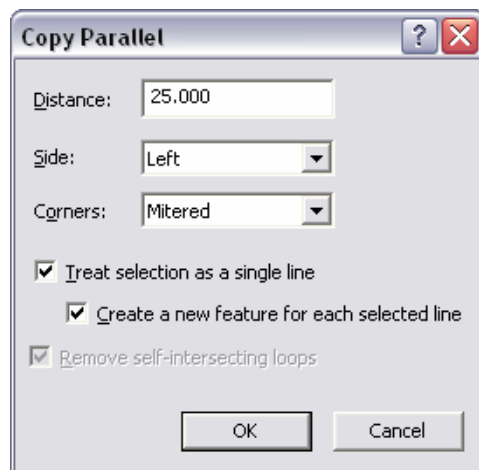
Construct Features command enhanced

■ The dialog that appears when you click the Construct Features button on the Topology toolbar has changed to clarify and let you choose the outcome of the operation. If you have set a polygon layer as the target on the Editor toolbar, you will see new options on the Construct Features dialog box. You can now choose whether you want to create new features or split existing features:
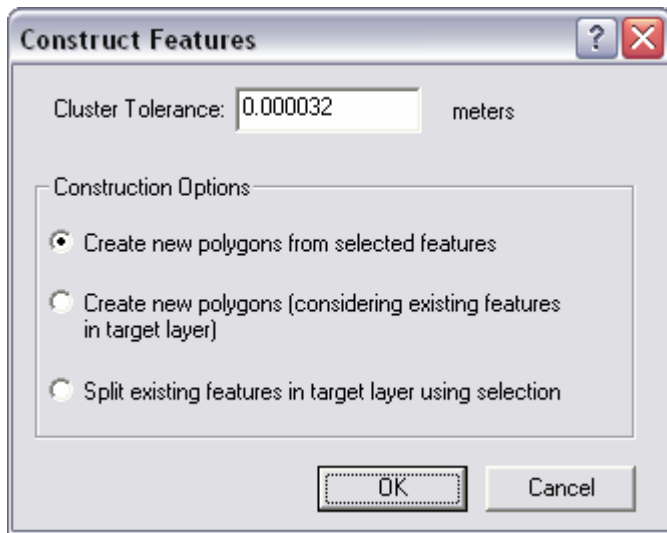
These changes do not apply when a line layer is the target, so in that case the dialog box remains similar as in previous releases. However, at 9.2 you have the option to replace the target features also in the selection.

Split and Divide commands enhanced

■ The Editor > Split command, which allows you to split a line into two lines using a distance, percentage, or M value from either the start or end point of the line, now shows arrows on the feature to indicate the line's direction. These arrows will help ensure that the line is split from the proper orientation.

■ The Editor > Divide command, which allows you to create new line or point features by dividing a line, now has an option to delete the original selected line after it is divided.

Editing multipatches

■ Multipatch features can now be edited in ArcMap like other feature types. This provides a basic level of editing for multipatches. The ArcGIS editing environment for multipatch editing focuses on whole feature management. That is, you can move, rotate, scale, delete, and copy multipatch features, as well as define and populate attributes for the features.

Multipatch features are 3D features used to represent anything from simple to complex objects including spheres, cubes, and buildings.

[?] *In the Desktop Help, see: Extensions > 3D Analyst > 3D features > Editing 3D multipatch features*

Improved mark-up and Tablet PC support

■ The tools on the ArcMap Tablet toolbar are used to draw digital ink and highlighting on your map, as well as to recognize handwriting as text and complete editing tasks. The Tablet toolbar looks the same as it did in 9.1, but ink functionality and options have been enhanced at 9.2. At 9.2, the Tablet tools are no longer a separate component of the ArcGIS setup program and are installed on all Desktop machines. (Previously, non-Tablet PC users had to choose to install Tablet PC support.) While many of the tools on the Tablet toolbar can be used on any computer, the text and gesture recognition functions are only available on a Tablet PC. The ArcMap Tablet Options dialog has been renamed Ink Settings, and some new options have been added.
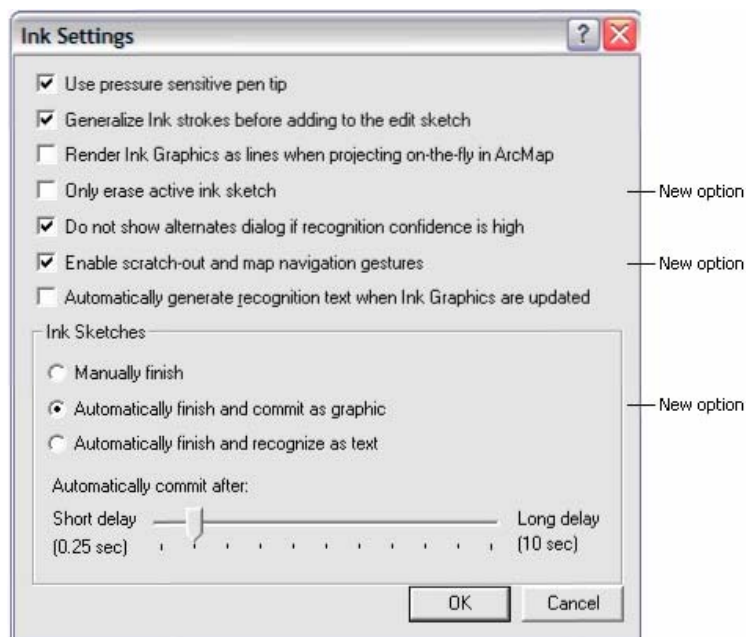
You can now use four new gestures to pan the map in a particular direction on a Tablet PC:

Gesture	Map navigation task
∧	Pan up
∨	Pan down
<	Pan left
>	Pan right

These gestures are available with the Pen and Highlighter tools, and can also be used with the markup tools in ArcReader. You can turn on or off the ability to use these gestures on the Ink Settings dialog.

■ You can now use the Eraser tool to remove ink from any ink element in your map, including ink that has already been converted to graphics. The Eraser tool can be applied to all ink on your map when both of these two options are set as follows: ink is committed automatically and the 'Only erase active ink sketch' setting is not checked. If either the manual finish or the 'Only erase active ink sketch' option is checked, the Eraser tool will only work on active ink sketches that have not been committed as graphics. Like at 9.1, you will need to re-activate ink graphics if you want to erase ink from them. You will also not be able to convert ink that has been recognized as text and erase it with the Eraser tool. Therefore, if you have ink set to automatically convert to text, you will only be able to erase highlighter ink, since it always converts to graphics. The default finish option has been changed from 'Manually' to 'Automatically finish and commit as graphic.' This change will help you take advantage of the new Eraser functionality.

Non-versioned multi-user editing

■ With ArcGIS 9.2, you can now edit data in ArcSDE geodatabases without having to first create a version of the data.
► *See the Non-versioned Multi-user Editing section in the 'Geodatabases and ArcSDE' chapter of this document.*

Attributes window

■ In the tree on left of the Attributes window, when you right-click a layer's name the Zoom To command is available in the context menu so that you can zoom to all the selected features in that layer. The Unselect command is also now present in the context menu so you can unselect all that layer's features.

ArcMap

Navigating

New Go To XY command lets you find coordinates on the map

■ The new Go To XY command in the Tools toolbar opens a dialog that makes it easy to enter coordinate locations, navigate to them, and draw them on the map.

New Go To XY command

A menu in the dialog lets you choose the units you'll be specifying the coordinates in. Your data frame's map units are listed first (meters in the example below) along with several other common formats:
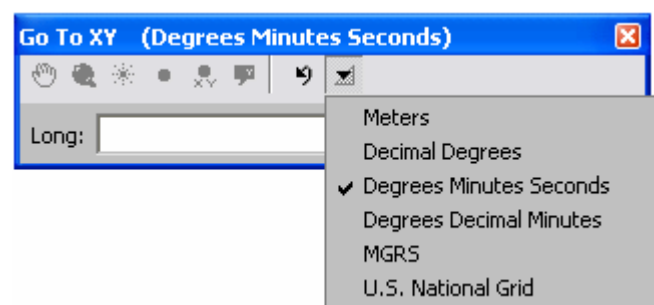
Once you've entered the coordinates, click one of the buttons across the top of the dialog or press ENTER to pan to the location and flash it:
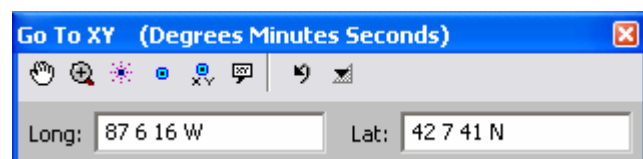
- Pan to the location
- Zoom to the location
- Flash the location
- Draw a point at the location
- Draw a point at the location labeled with its coordinates
- Draw a call out pointing at the location showing its coordinates
- Return to a location you've already entered in this session by choosing from history list.

■ Get context sensitive help on the Go To XY button in the Tools toolbar (by clicking it with the What's This ? tool from the Standard toolbar) to find out more about the supported coordinate entry formats.

■ The Go To XY command is in ArcMap, ArcGlobe and ArcReader. It is also an ArcGIS Engine control, so if you are a developer creating applications using ArcGIS Engine, you can easily include it in your applications.

Navigate maps with mouse wheel

■ You can now use the mouse wheel to zoom and pan, so you can navigate without having to change tools.

Roll wheel forward	= **Zoom out**
Roll wheel forward + CTRL	= Zoom out at finer increment
Hold down wheel & drag mouse	= **Pan**
Hold down wheel & drag mouse + CTRL	= Zoom in on area you define
Click mouse wheel	= **Center**
Click mouse wheel + CTRL	= Center & zoom in
Roll wheel back	= **Zoom in**
Roll wheel back + CTRL	= Zoom in at finer increment
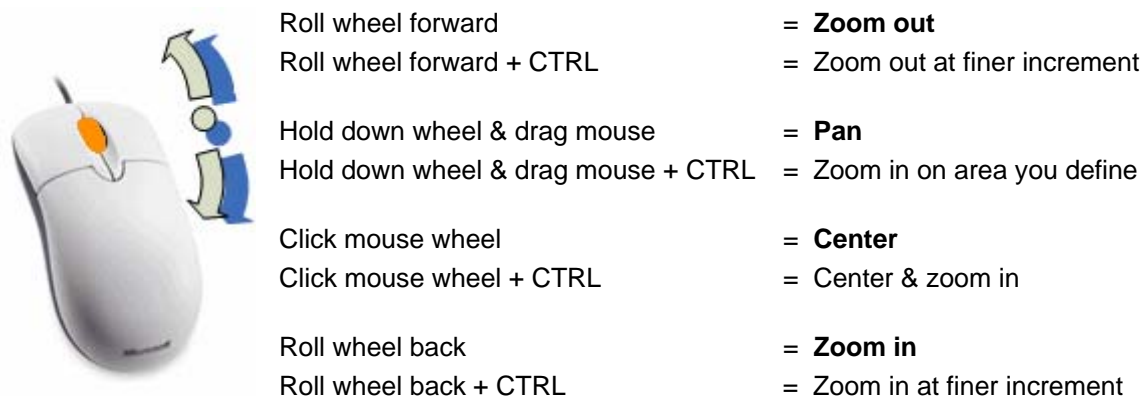
These operations work in Data View and Layout view. In Layout view they apply to the page by default. In Layout view hold down **SHIFT** when you use the mouse wheel to navigate the data frame instead of the page.

When you roll the mouse wheel in the ArcGIS Desktop applications at 9.2, the roll applies to the window that the cursor is currently hovering over. So for example, if you are working in the Table Of Contents or in a table window, you can zoom the map in and out by just moving the cursor over the map and then rolling the wheel. There's no need to click on the map first to make it active.

You can reverse the zoom in/zoom out convention used by the mouse wheel. To change this setting, go to the Tools > Options dialog and make your choice at the bottom of the General tab:
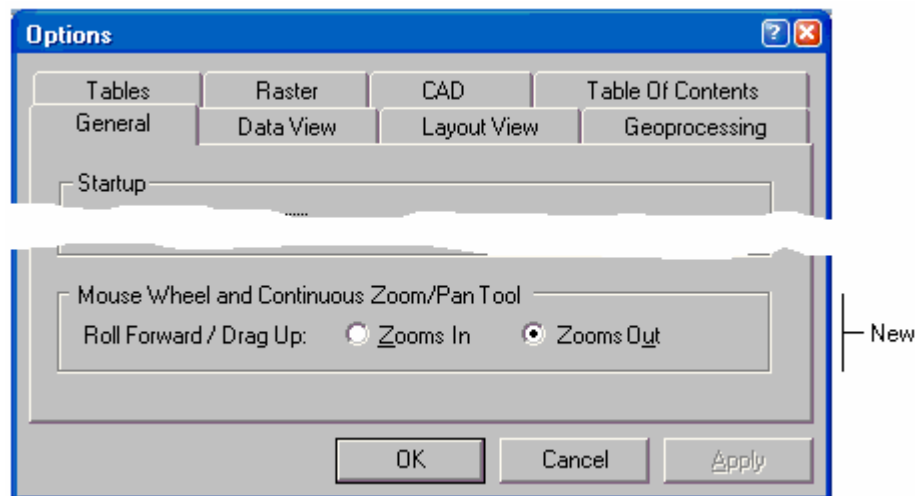
If you are using the 3D Analyst extension, you'll find the same setting in the Tools > Options dialog in both ArcGlobe and ArcScene so you can choose your preferred zoom in/out mouse wheel roll direction for each application.

Temporarily change any tool into a navigation tool by holding down a key

■ Hold down one of these keys on the keyboard to temporarily turn your current tool into a navigation tool:

Z = Zoom In tool: Single-click or drag a box
X = Zoom Out tool: Single-click or drag a box
C = Pan tool: Single-click or drag
B = Continuous Zoom/Pan tool: drag up/down with left mouse button held down zooms in/out, right button pans.

These shortcuts work in Data View and Layout view. In Layout view they apply to the page by default. Hold down **SHIFT** as well to apply it to the data frame instead of the page. (Note: The Z, X and C shortcuts have been available since ArcGIS 8.x when an editor tool was selected. At 9.2 they now work with any tool that is selected).

Tip for developers: If a custom tool you have developed needs to override one of these built-in global keyboard shortcuts, implement the IToolKeys interface on your tool and use the OverrideKey method to return True for all the shortcut keys the tool will handle.

Other navigation enhancements when using the mouse

■ Pan tool: single-click now centers the data frame at location you clicked.

■ Layout Pan tool: single-click now centers page at location you clicked.

■ When the Zoom In tool, Zoom Out tool, or Pan tool is active, **F6** toggles between these three tools. F6 also toggles between the corresponding three layout tools as well when you are in Layout view.

■ Continuous Zoom/Pan tool (which can be added into any toolbar from the Pan/Zoom category in the Tools > Customize dialog Commands tab): single-click with right mouse button now centers map at location you clicked. The tool now works on the page by default when you are in Layout view. In Layout view hold down **SHIFT** to operate on the data frame instead. You can also temporarily turn any tool into this tool by holding down the **B** key on your keyboard. This tool is particularly useful if you want a dynamic zoom in/out capability when you are using the input device on a laptop keyboard instead of a mouse.

■ Hold down **ALT** and click the name of a layer in the Table Of Contents to zoom to the extent of that layer.

Better support for map navigation with the keyboard

■ **Arrow keys** on the keyboard scroll the map in the direction you press (unless a graphic or map element is selected, in which case they nudge that element like they've always done).

■ **HOME** and **END** keys page map left/right. **PAGE UP** and **PAGE DN** page map up/down.

■ The **-** and **+** keys zoom out and in (same as the Fixed Zoom Out and In buttons)

■ The **<** and **>** keys zoom go back to previous extent or forward to next extent (same as Back and Forward buttons).

■ **INSERT** key takes you to the full extent.

■ **CTRL + TAB** switches between data frames when your map contains multiple, making each one active in turn.

■ At 9.2 keyboard shortcuts can now be defined to invoke any interactive tool, such as the Zoom In tool, Edit tool, etc. To specify a keyboard shortcut for a tool, go to Tools>Customize and click the Keyboard button.

How to get a list of the map navigation shortcuts

■ To get a list of navigation tips and shortcuts while you are working with ArcMap, click inside the Table Of Contents to give it keyboard focus and then press **F1**.

■ You can also find a list of tips and shortcuts in the ArcGIS Desktop Help and at the end of this document.

■ To find out whether a particular tool or command you access regularly has a shortcut, get context sensitive help about it by clicking the What's This tool in the Standard Toolbar and then clicking the item. To get context sensitive help on a command in a context menu, highlight the command and then press **SHIFT** + **F1**.

Quick access to useful shortcuts by right-clicking map

■ ArcMap 9.2 gives you easy access to map navigation commands and other useful shortcuts when you right-click the map in Data view. Right-clicking the map gives you this new menu containing a set of commonly used commands:
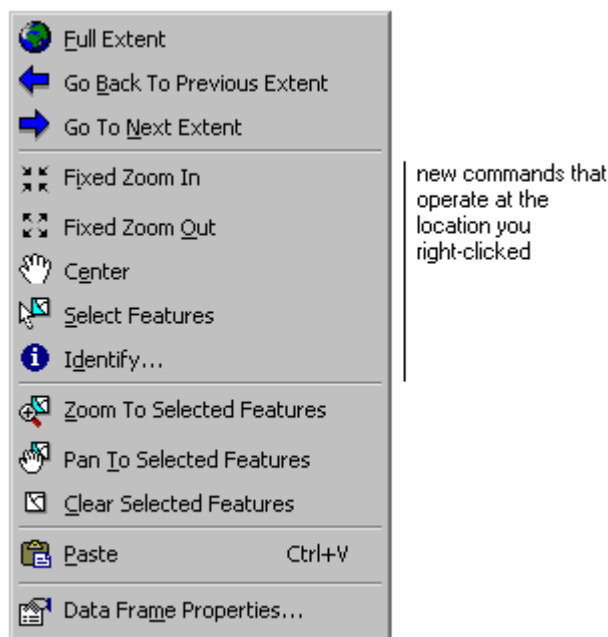
The menu includes some new commands that operate at the location you right-clicked. These new commands enable you to perform an interactive operation, such as identifying a feature, without changing your current tool. For example, suppose you are selecting features on the map with the Select Features tool from the Tools toolbar and you'd like to find out more about a particular feature before you go ahead and add it to the selected set. Instead of revisiting the Tools toolbar to switch to the Identify tool, you can now just right-click that feature and choose Identify from the menu, without changing the tool you are currently using.

You can also customize this new context menu to add additional commands from the pulldown menus into it as shortcuts. To customize this context menu, choose Tools>Customize, check the Context Menus entry in the Toolbars list, and then look for the Data View Context Menu in the list of menus that appears. For example, at 9.2 we removed the Add Data command from this menu to keep it short. But if you are used to accessing Add Data by right-clicking the map you can customize this menu to add that command back in.

Tip: You can also access this menu, and any other context menu, by pressing the **Application key** ▣ which is available on Windows-compatible keyboards. **SHIFT + F10** can also be used on keyboards without an application key. (These are standard Windows shortcuts not specific to ArcGIS).

Tip: This menu doesn't appear if you right-click the map in Data view when you are using certain tools, like some of the editing tools, that have their own specialized context menus. However you can customize the existing context menus of those commands to include any of the commands in the new context menu. If you customize ArcMap's menus, remember that some commands only work in particular menus. For example, the commands in the context menu you get when you right-click a layer in the Table Of Contents won't become enabled if you add them into a pulldown menu or into the context menu you get if you right-click the map.

■ The Zoom To Selected Elements command has been added into the menu that appears when you right-click any map element in Data View or Layout View. For example, in Layout view right-click a data frame and choose this command to fit the entire data frame into your display.

■ The Zoom To Whole Page command has been added into the menu that appears when you right-click the page or any map element in Layout View. This provides a quick way to see the whole layout in your display.

■ The Go Back, Go Forward, Cut, Copy, Delete commands have been added into the menu that appears when you right-click the page in Layout view, making it easier to get to these commands when you are working on a layout.

Customizable Full Extent

■ You can now choose where the Full Extent command 🌐 takes you. Full Extent is perhaps the most useful navigation command because in one click it zooms you out so you can see everything in the map, such as the whole state or your entire study area. However, this extent often zooms you further out than you expected. For example, suppose you are using a map of France that includes some data sources that cover the whole world. In 9.1 pressing the Full Extent button always zooms you out to the whole world, which may be inconvenient if you just want to work with France. In 9.2 you can now control where the Full Extent button will take you, or any user accessing your map, when it is used in ArcMap, ArcReader, an ArcGIS Engine application, or ArcGIS Server application.

You can customize the full extent for each data frame in your map. Look in the Data Frame Properties dialog Data Frame tab to set this new property:
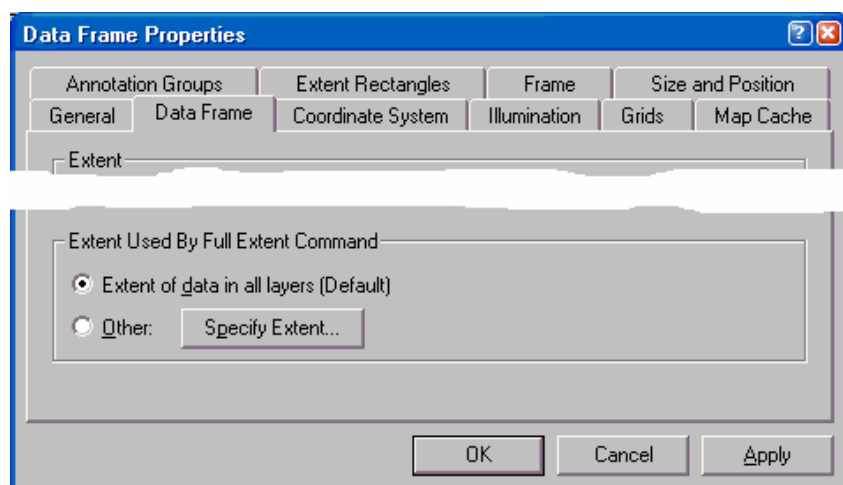
If you don't set this property, there's no difference from 9.1: By default the Full Extent command will be extent of all the layers in the map. To set this property, click the 'Other' radio button and then press the Specify Extent button. The following dialog appears giving you several ways to specify the extent you want to use for full extent:
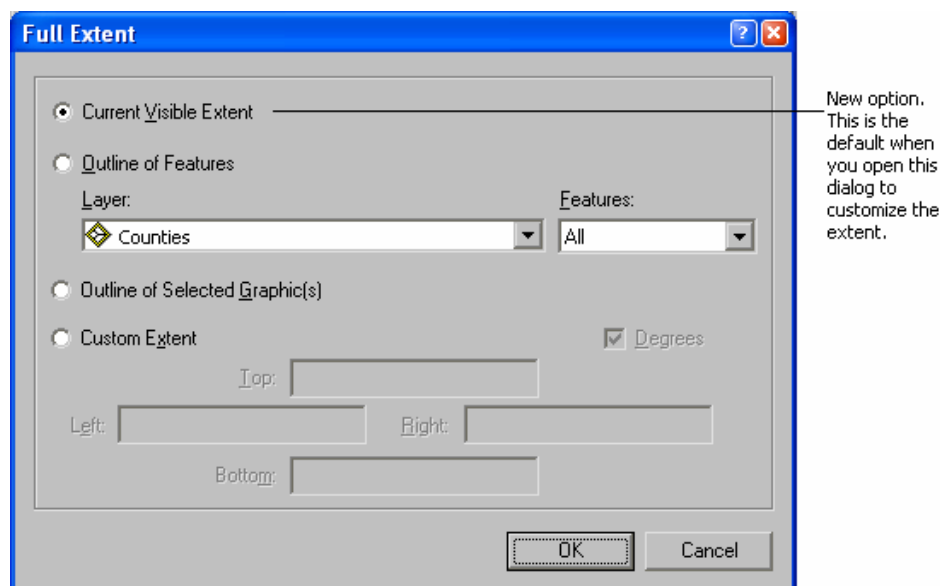
Note: This same dialog also appears when you use the existing options in the Data Frame Properties dialog Data Frame tab to specify a fixed extent for the data frame or to clip its contents. We've added a new Current Visible Extent radio button option to this dialog to make it more obvious how you set the extent to be the current extent of the map.

Tip: Customizing Full Extent doesn't affect other commands, such as Zoom To Layer. For example, if you've specified a custom Full Extent for a data frame, you can still right-click any layer in the Table Of Contents and choose Zoom To Layer to see the full extent of that layer, even if this extent is larger than the custom full extent you've specified for the data frame.

Tip: One way to use this functionality is to simplify map navigation when you are editing. Suppose you have a map covering a city and you'll be spending a few days editing the parcels in one area of the city. If you set the Full Extent to be the extent of the area you are working in, you can use the Full Extent button as a very quick way to zoom to that area instead of always zooming out to the extent of the entire city. Once you've finished your edits you could change Full Extent to be the next area of work, and so on.

■ The USA and World templates accessed via File>New have been updated to take advantage of the new custom full extent property described above. Now when you use a template such as Northeastern USA, if you zoom in on the map, and then press the Full Extent button you get taken to the full extent of the subject of the map, the North Eastern USA, as you'd expect, not the full extent of the USA, even though the data used in the map covers the whole USA. The custom full extent property is specified in the View>Data Frame Properties dialog Data Frame tab, and can be modified or reset to the default there.

We've also changed the reference scale on the templates to be <none> to make them easier to use as the basis for interactive maps and a wider range of printed maps. With this change, the size of the symbology and labels remain the same as you zoom in and out instead of being sized relative to the reference scale.

Easier to specify scale

We've standardized and improved how scale is specified in ArcMap and fixed the inconsistencies where some dialogs required that scale be input in a particular format.

■ In the Scale control in the Standard toolbar, and in all dialogs in which you specify scale, you can now type or paste in scale values using almost any format, including relative formats (such as "1 mile = 2.5 inches"). When you specify a scale in a relative format, it is automatically converted to absolute format (such as 1:25,344). A variety of formatting is supported to make it easy to copy and paste scales into the scale control without modification. Here are the options:

In absolute format, the "1:" prefix and thousand separators can be present or absent:

    1:1,000,000   1,000,000   1:1000000   1000000

Any character or word can be used as the separator in absolute format:

    1:25000   1 - 25000   1 to 25000   1/25000

You can use the following unit abbreviations in relative format:

    in pt ft yd mi nm mm cm m km dd dm

You can also specify units using their full name in relative formats. The scale control recognizes units by the first part of their names, so it doesn't care whether unit names are plural or not. You can type any characters after the first part of the names shown here:

    inch poin feet yard mile naut mill cent mete metr kilo decima decime

Values can be specified in any order:

    1:1,000,000   1,000,000:1   1 in to 5 mi   5 miles to 1 in

"One" can be given as a number or a word:

    1 to 1,000,000   One to 1,000,000   One inch = 5 miles

Any word or character can be used for "equals" in relative formats. A space isn't required between a numeric value and the units abbreviation or name:

    One inch = 5 miles   1in equals 5mi   1inch = 5miles   5 mi to 1 in

■ When you type scales into the scale combo, they are now displayed at the top of the scales list rather than the bottom to make them easier to access.

Scales you've typed in during your current ArcMap session
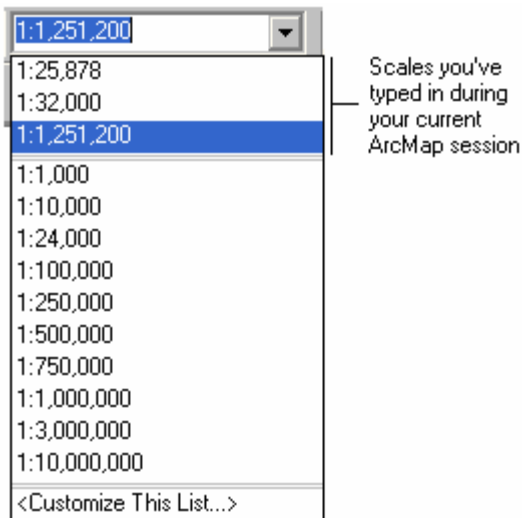
As in previous releases, the 'scale history' of scales you've entered is maintained for the duration of your current ArcMap session. If you want a particular scale to appear in your scales list permanently, use the new <Customize This List...> option in the dropdown list described next.

■ You can now customize the pre-defined scales that appear in the scale dropdown. In this way you can add scales that you use frequently as permanent entries in the scale list, so it is easy to access them. When you look in the Scale dropdown on the Standard toolbar at 9.2, you'll see a new <Customize This List...> option. Choosing this option displays the new Scale Settings dialog. The Add Current button adds the data frame's current scale into the list. The Reset button lets you restore the factory default list of scales. The Save button lets you save your scale list to a file so that, for example, someone else can use it to customize their scale list. The Scale Format tab in this dialog lets you customize how the scales appear:
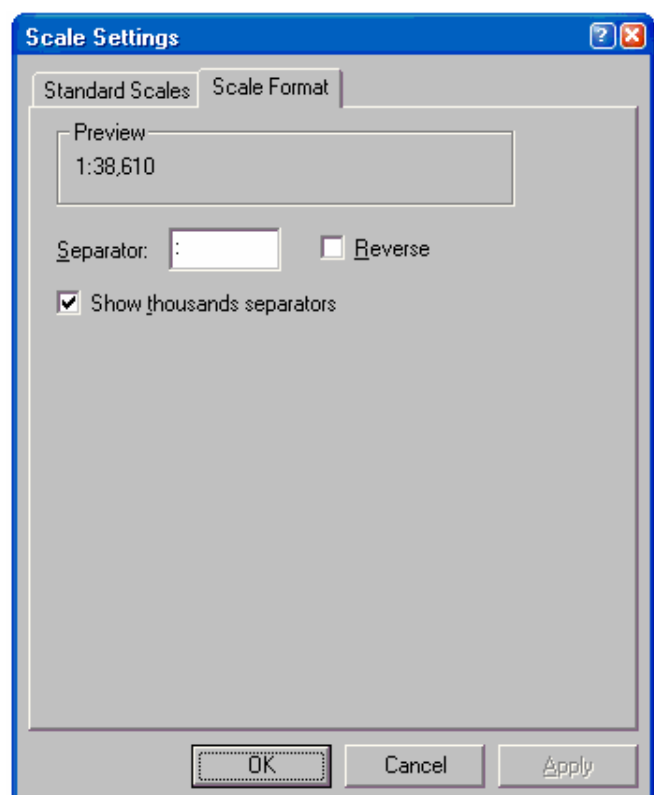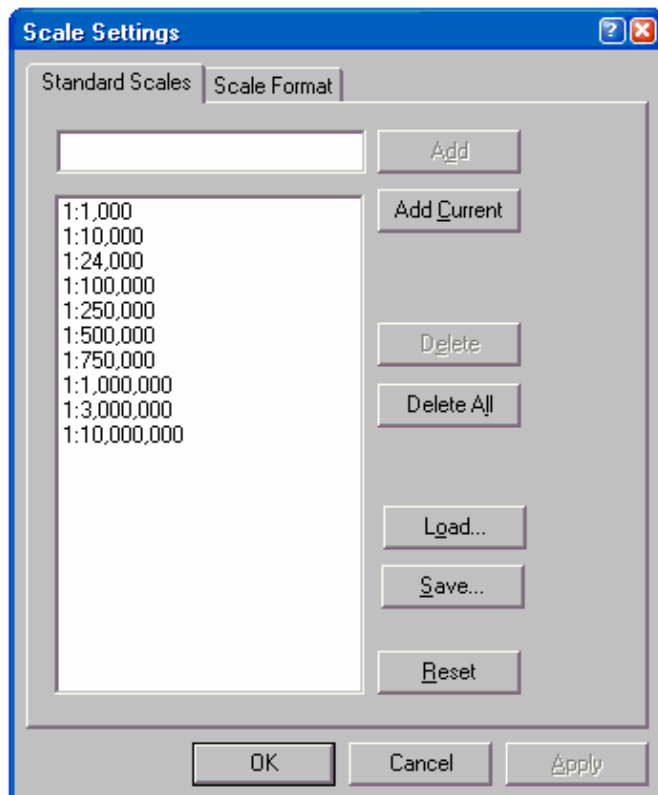
The customization you specify in the Scale Settings dialog is reflected in all your ArcMap sessions (it is stored in the Windows registry). It is not stored in the map document.

■ The scale dropdown list in the Standard toolbar is now used in all dialogs in which scale is specified. When you specify scale in any dialog in ArcMap, you now have easy access to your 'scale history' of scales you've typed in during your current session, along with the pre-defined scales in your list, including any customizations you've made:
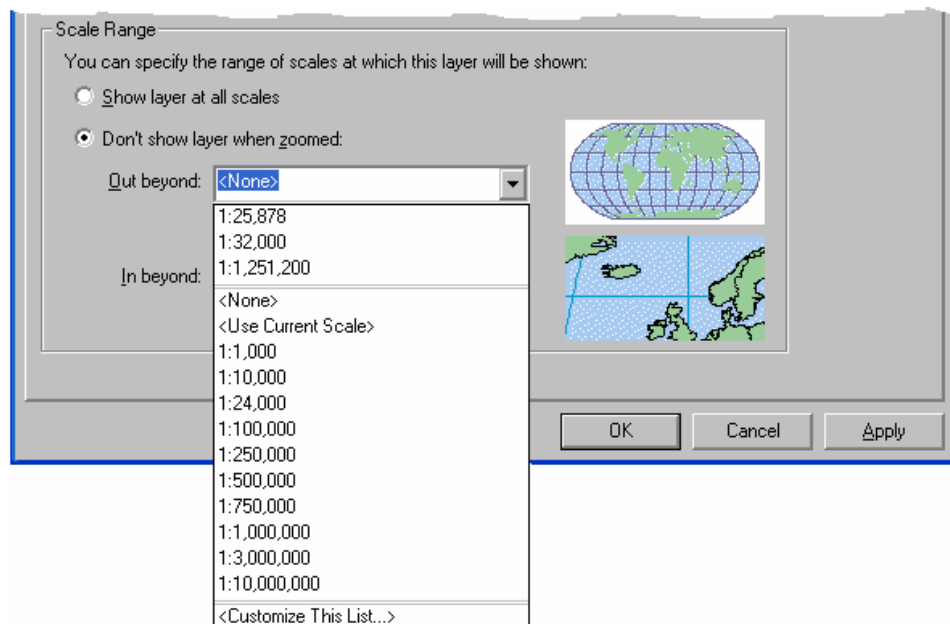
You'll also see these two additional options in the dropdown list:

<None> - Choose this option to clear the scale so that no scale is used. In previous releases you had to enter a scale of 0 to clear the scale. As a shortcut to choosing <None> from the list you can type in 0, none or <None>.

<Use Current Scale> - If you choose this option, the current scale of the active data frame as it is displayed in the current view will be automatically inserted into the field. This makes it very easy to set the scale to be the same as the current scale you are working at. So if you choose this option when the current scale of the data frame in your map is 1:45,678, that value will appear in the scale field.

■ We now prevent unnecessary decimal places that appear in many dialogs. We only show decimal places for scales when the scale is larger than 1:100 (e.g. 1:23.456). At scales smaller than 1:100 the scale is rounded up to the nearest whole number, and maps are drawn at the rounded up scale.

■ When the Scale control in the Standard toolbar is disabled, such as when you first start ArcMap, or if the data in the map doesn't have spatial reference information, we show the scale as <None> instead of 0:0. The Scale control also no longer shows the scale as a negative in any situation. In previous releases, the Scale control sometimes reported the scale as being negative when the map contained certain combinations of data with unknown or incorrect spatial reference information.

■ Advanced users can use a Windows registry setting to specify that the scale control should display scales in relative format (e.g. 1 inch = 2.5 miles) instead of converting relative scales that you type in into absolute format (e.g. 1:63,360) like it does by default in 9.2.

Here is the registry key that lets you control this:

```
HKEY_CURRENT_USER\Software\ESRI\ArcMap\Settings\Scale Format
```

If you don't see this registry key, start ArcMap, choose the Customize This List command in the scale control, and then make a change in the Scale Settings dialog that appears and press OK. This will write out this registry key with the following default values:

```
format=0, sep=:, puv=1.000000, pu=1, equals= =, mu=5, cf=, cap=false, abbr=false, rev=false,
```

Here's what the different parameters mean:

format: Format used by scale control: 0 = absolute scale, 1 = relative scale.

sep: Separator character for absolute format, i.e. ":" in 1:50,000. (Set automatically via Scale Settings dialog).

puv: Page unit value for relative format, i.e., "1" inch.

pu: Page units for relative format: uses values from the esriUnits enumeration (see separate list below).

equals: The equals sign or text string used for relative format.

mu: Map units for relative format: uses values from the esriUnits enumeration (see separate list below).

cf: Leave this blank or delete: not currently used.

cap: Capitalize units.

abbr: Abbreviate units.

rev: Reverse the absolute format, i.e., 10,000:1 (Set automatically via Scale Settings dialog).

esriUnits enumeration used for pu and mu:

1 - esriInches
2 - esriPoints
3 - esriFeet
4 - esriYards
5 - esriMiles
6 - esriNauticalMiles
7 - esriMillimeters
8 - esriCentimeters
9 - esriMeters
10 - esriKilometers
11 - esriDecimalDegrees
12 - esriDecimeters

For example, setting the registry key as follows:

```
format=1, sep=:, puv=1.000000, pu=1, equals= =, mu=5, cap=false, abbr=true, rev=false
```

specifies that scale will be displayed in the format: 1 in = 10 mi.

While the scale is displayed in relative format, you can still enter the scale in absolute format, and it will be immediately converted to relative format for you. You can also enter scale in relative format in different units than you specified in the registry key, and the scale will be converted automatically to use the units you specified.

Magnifier window enhancements and new viewer window

ArcMap 9.2 has been enhanced to make it easier to browse and edit data at multiple scales simultaneously.

■ In 9.1 the magnifier window launched by the Magnifier command in the Window pulldown menu had a mode called 'snapshot' that turned the window into a live view that let you interact with your data at a different scale than the main ArcMap display. In snapshot mode you could move the magnifier window to the side of your map so you can see detailed data in the window while also looking at the larger geographic context in the main ArcMap display. At 9.2 we've retained this ability but have made it easier to access in the user interface and easier to use.

Snapshot mode has been renamed to be 'viewer' mode to make it clear that it is a live view. When you are in this mode we now simply call the window a viewer window.

■ A new command called Viewer in the Window pulldown menu lets you launch a viewer window. This command launches a viewer window at the same scale as your map with its extent centered on the center of your map. You can then move the window, resize it, zoom in or out on it, etc.
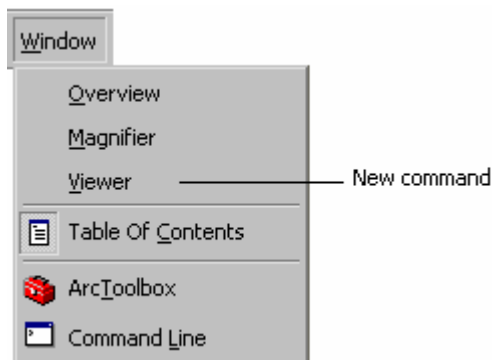
■ A new tool called the Create Viewer Window tool 🔍 has been added into the Data Frame Tools toolbar:

Create Viewer Window tool
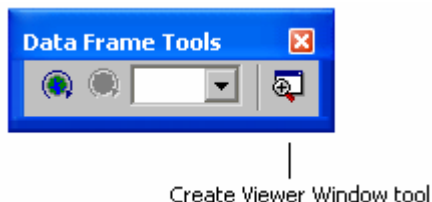
This tool makes it easy to open a viewer window showing you a specific area on your map. Select the tool and then drag over the area on your map you would like to view in more detail. A viewer window will be launched displaying that extent.

Like the Window > Magnifier command, the new Window > Viewer command and the new Create Viewer Window tool are disabled in Layout view.

■ The window used for the viewer and magnifier has been given a toolbar. The menu for the window can now be accessed by clicking a button to the right of the toolbar (previously this menu could only be accessed by right-clicking the title bar of the window). Some new commands have also been added into the menu to enable you to pan and zoom a viewer window to match the location shown in the main ArcMap display, and vice versa.

In the **magnifier window**, all the buttons in the toolbar are disabled except for a combo box that lets you specify the magnification percentage used by the window. At 9.2 the magnification percentage you choose is persisted at the application level in the registry so it will be used as the default the next time you open a magnifier in any ArcMap session. The percentage combo box automatically turns into a scale combo box if you choose the option in the Properties dialog to specify the magnification as a scale. As you can see from the window's menu, you have the option to turn a magnifier window into a viewer window:
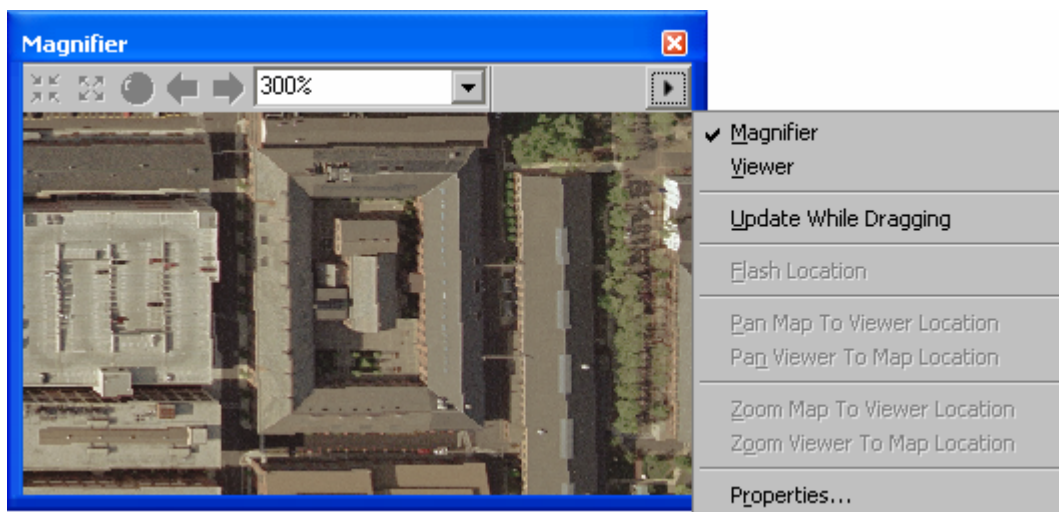
In the new **viewer window**, all the buttons in the toolbar, and the new commands in the menu, are enabled:
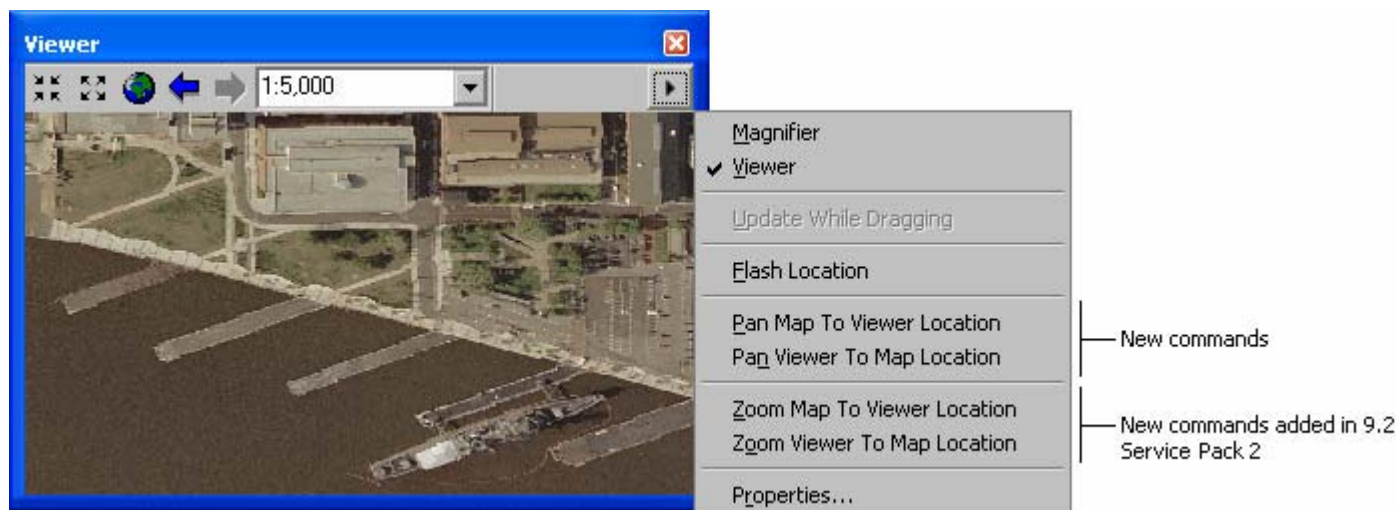
The Pan Map To Viewer Location and Zoom Map To Viewer Location commands in the viewer window's menu let you re-center the main ArcMap display to match what is shown in the viewer window, so if you find an important detail while working in a viewer you can easily center the main ArcMap display on that location. Similarly, the Pan Viewer To Map Location and Zoom Viewer To Map Location commands let you re-center the viewer to match the main ArcMap display. For example, if you use the Go To XY dialog to center the main ArcMap display on a particular location, and you want to see this location in your viewer window, simply choose the Pan Viewer To Map Location command.

Tip: When you right-click inside a viewer window with most ArcMap tools, the new context menu of shortcuts described earlier in this section of the document gives you access to commands like Zoom To Selected Features.

■ You can use the new mouse wheel navigation shortcuts inside a viewer window. As rolling the mouse wheel zooms the window the cursor is over, simply move the mouse over the viewer window before you roll the wheel.

■ You can open multiple viewer windows. In this example, two viewer windows have been opened so that different locations can be compared in detail while the main ArcMap displays shows the general geographic context:
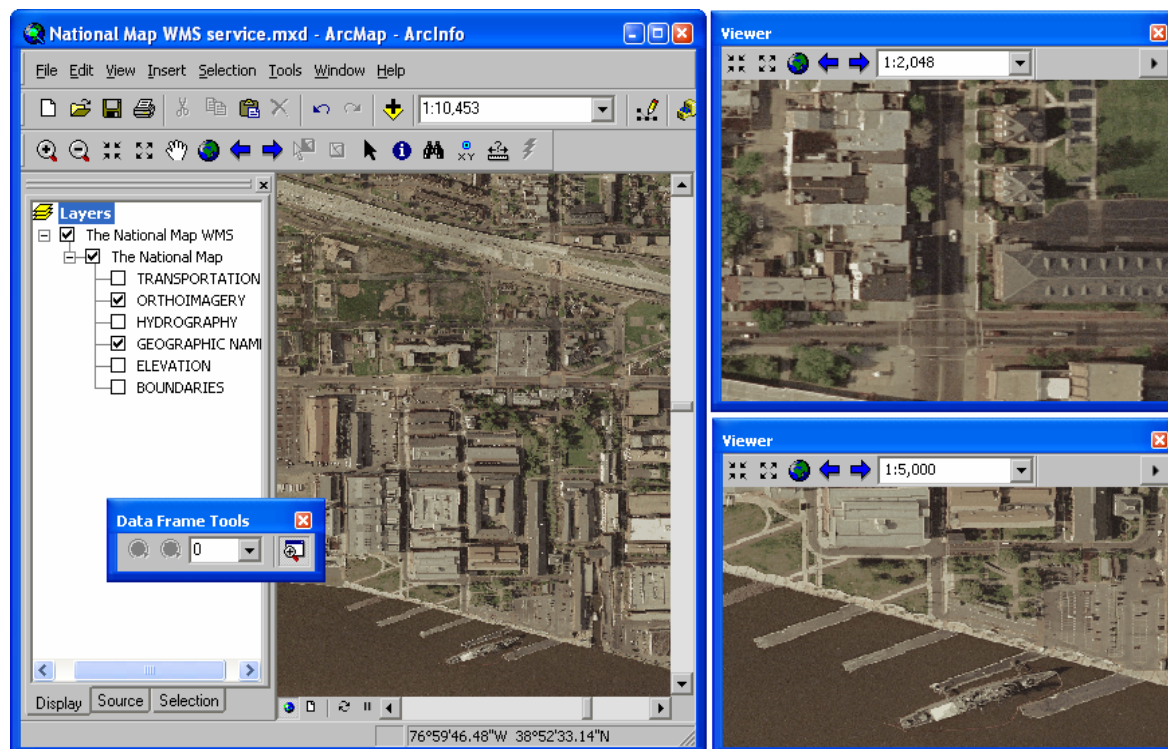
■ If you are using a dual monitor configuration you can put a viewer window onto the second monitor so it doesn't overlap your main ArcMap display. The example below shows a dual monitor configuration in which a viewer window has been opened on the second monitor and maximized to provide a large scale uncluttered view of the area currently being edited. Editing can be performed in both displays and graphic feedback shown while you edit appears simultaneously on both displays. To maximize a viewer window, double-click its title bar:
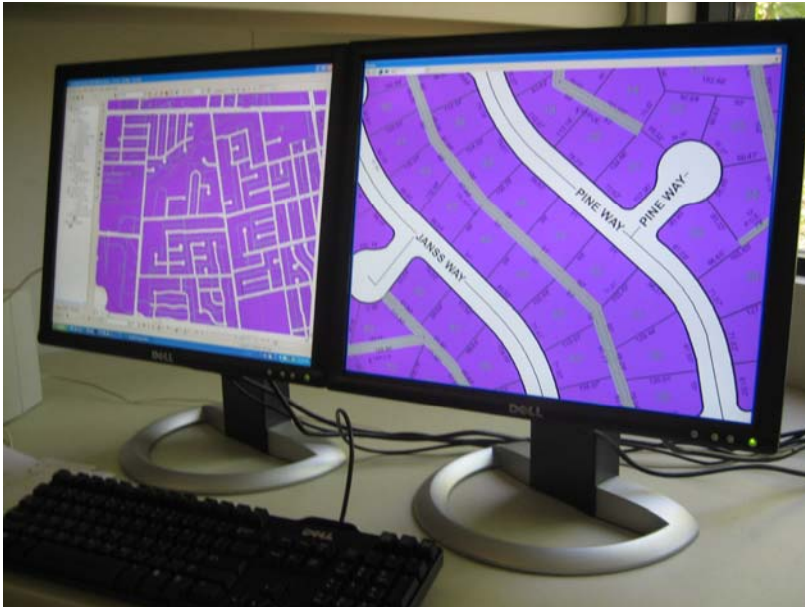
■ In 9.2 Service Pack 2, we have introduced the ability to use viewer windows to work with multiple data frames side-by-side. Previously, if your map document contained more than one data frame, the only way to work with the contents of these data frames simultaneously was to switch to Layout view and arrange the data frames on the layout page. In 9.2 before Service Pack 2, if you opened a viewer window and then activated a different data frame in your map document, the viewer window was automatically closed. With Service Pack 2, viewer windows remain on-screen if you activate a different data frame, enabling you to work with multiple data frames side-by-side.

In this example, a viewer window is being used to compare two data frames showing different data for the same area:
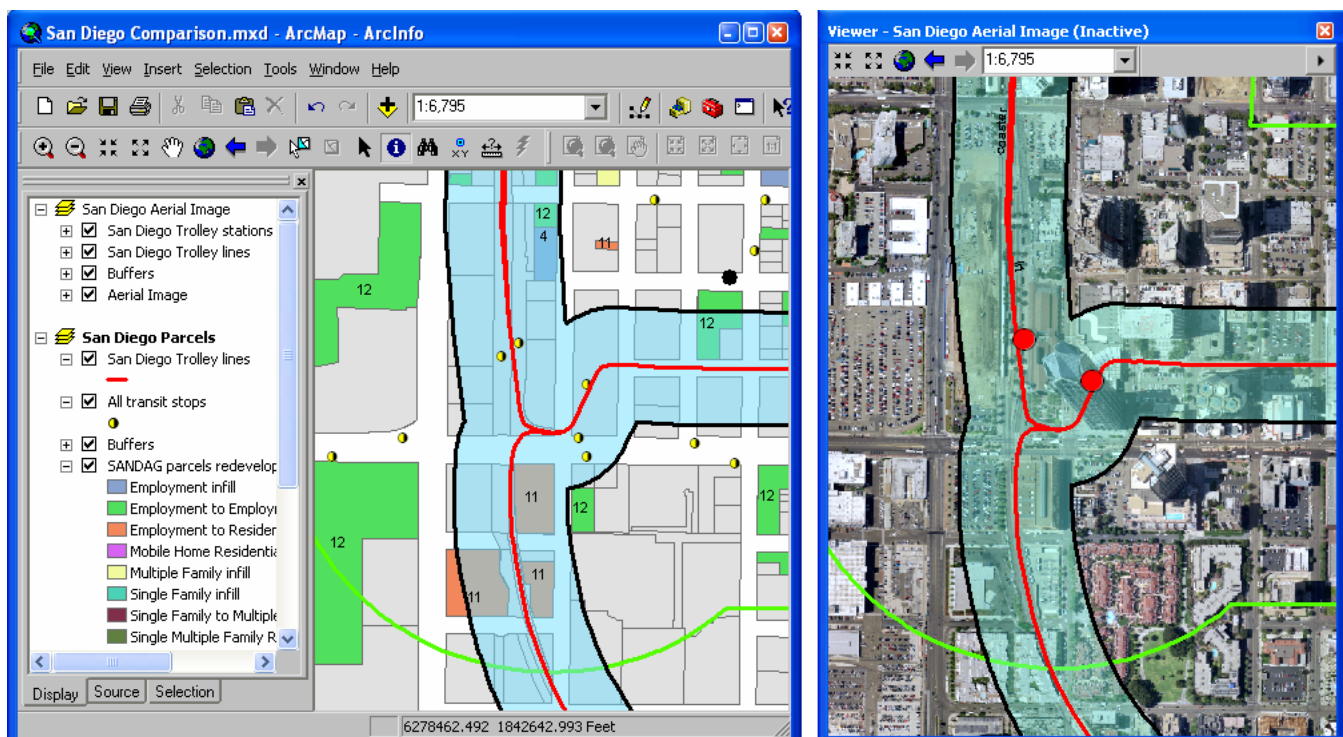
When you work with an inactive data frame in a viewer window, you can easily make the viewer show the same location that is currently displayed in the active data frame in the main ArcMap window. The set of commands in the viewer window's menu described earlier for zooming and panning the viewer window to match the main ArcMap window also work across data frames. Similarly, you can use the commands to update the location shown in the active data frame in the main ArcMap window to match the location shown in any of your viewer windows showing inactive data frames.

There are some restrictions on which operations you can perform inside a viewer window that is displaying an inactive data frame. You can generally perform map navigation, query, and selection, but you can't edit graphics or features. If a tool can't be used on an inactive data frame displayed in a viewer window, the cursor will change when you hover over the viewer to show you that the tool is not available. There are no restrictions on the operations that can be performed inside a viewer window displaying the active data frame.

In this example, four viewer windows have been arranged on-screen so that four different sources of street data for the same area can be compared. Each viewer window is showing the contents of one data frame in the map document:
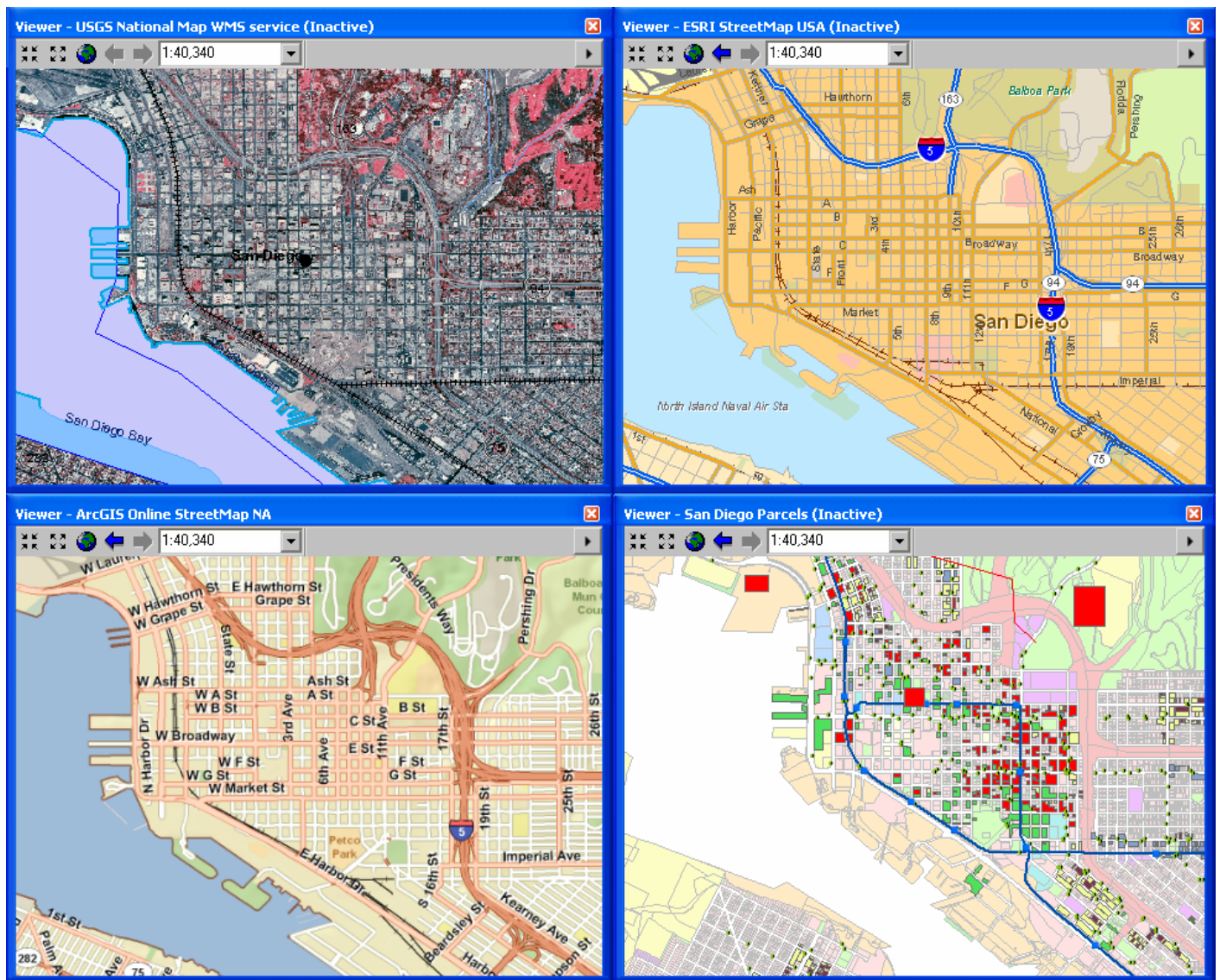
The ability to work with multiple data frames side-by-side in ArcMap can be useful for analysis, historical change assessment, data evaluation, and other applications where you want to be able to see different datasets for the same area side-by-side, as opposed to working with all the data in one data frame, or working with multiple map documents.

If you use the Schematics extension, you can use a viewer window to work with a schematic side-by-side with the geography it represents without having to work in Layout view. (☛ *See the 'Schematics' section of this document).*

New My Places dialog lets you store frequently used locations & access them from any map

■ The My Places command 🏠 in the Tools pulldown menu launches a new dialog that gives you immediate access to your favorite or most frequently locations regardless of which map document you are working with. Unlike bookmarks, your places list is stored in a separate file on your computer, not in the map document or globe document you are working with.

You can use your list of places to navigate around your map, and add the places to your map as graphics. You can also add point locations such as addresses and places as input locations into the route finding dialogs and the Network Analyst window directly from the My Places dialog.

The My Places command has also been added to ArcGlobe and ArcReader, so all these applications use the same common list of places, so adding a place in one application makes it available in the others.

You can add any place, address, or feature that you find using the Find dialog into the list by right-clicking it and choosing Add To My Places from the menu that appears. You can also add selected features, selected graphics and your map or globe's current extent into the list by using the options in the Add From button in the My Places dialog. In the My Places dialog, right-click a place to access additional commands:
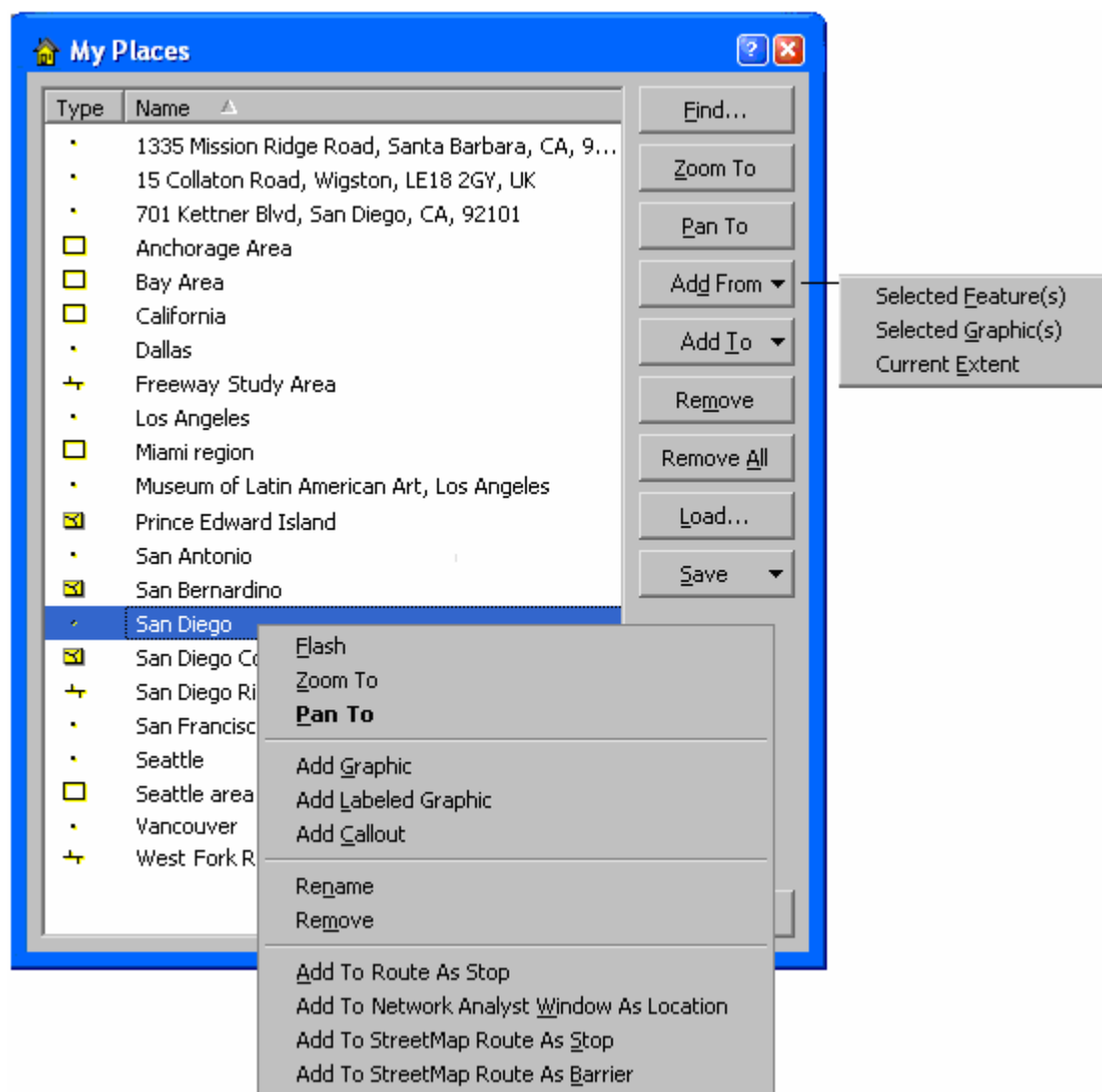
Like in the Find dialog at 9.2, single-clicking a place in the My Places dialog flashes it on your map or globe, and double-clicking pans to it and then flashes it.

The file in which your list of places is stored is:

`C:\Documents and Settings\<user name>\Application Data\ESRI\Controls\Commands\MapNavigation\myplaces.dat`

Using the Load and Save buttons, you can save some or all of your places to a file to share them with other users or transfer them between different computers. (The ability to save a subset of your places to a file has been added in 9.2 Service Pack 2. Prior to that you can only save all of your places to a file).

The My Places command is an ArcGIS Engine control, so if you are a developer creating applications using ArcGIS Engine, you can easily include it in your application. When the My Places dialog is used in an ArcGIS Engine application it access the same list of places as the ArcGIS Desktop applications.

Advanced setting for controlling how panning works

■ In 9.2 when you pan a map you can immediately commence another pan without waiting for the first one to complete redrawing the display. The first pan gets interrupted by the next, so you don't have to wait.

You may prefer to be able to do several successive pans without interrupting the drawing by adding a slight delay to the pan function via an optional registry setting. The delay tells ArcMap to wait for a specified number of milliseconds after a pan before starting to redraw the map to see if another pan is started. This can make the pan function smoother and less 'jumpy', especially when your maps contain a large number of layers because it allows you to do multiple small pans before the display starts to redraw. However because it adds a delay it does slow down the time it takes for a single pan to complete. For this reason, there is no delay by default.

To add a delay to the pan function, you can add the following DWORD value registry setting into the Windows registry:

`HKEY_CURRENT_USER\Software\ESRI\Display\Scroll Delay`

Specify the number of milliseconds delay as a decimal number. A delay of 400 or 500 is suggested if you want this behavior. To have no delay, either set the value to 0, or delete the registry setting. ArcMap behaves as normal if it doesn't find this registry setting. This setting is not exposed in the arcgis/utilities/Advanced ArcMap Settings utility but it is mentioned in the ArcGIS Desktop Advanced Settings Registry Keys.doc that is in that folder.

Finding and identifying

Find dialog enhancements make it easier to find places and addresses

■ A new Places tab has been added to the Find dialog in ArcMap (previously this functionality was only available in ArcGlobe and ArcReader). This provides access to the free ESRI World Gazetteer web service and lets you search for places by name anywhere in the world. Anyone with an internet connection can use this service. A dropdown list in the tab lets you choose between searching for places in the full extent of your map or just the current visible extent.
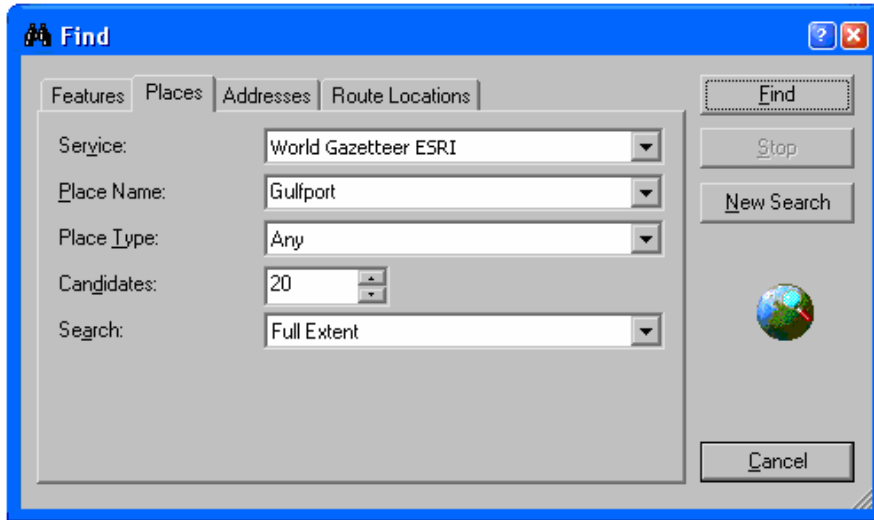
Tip: In the Find dialog, click the ? tool and then click the Place Name control to read about how to specify state names and provinces, etc.

■ Up to now, finding addresses in ArcMap has required that you first load an address locator into your map document, such as the ESRI StreetMap USA locator, your own file-based locator, or your own geocoding service running on ArcGIS Server. These are still fully supported, but at 9.2 the Find dialog Addresses tab now contains some free address locator web services by default that let you find addresses in the USA, Canada and more than 15 European countries. All you need to use these is an internet connection:
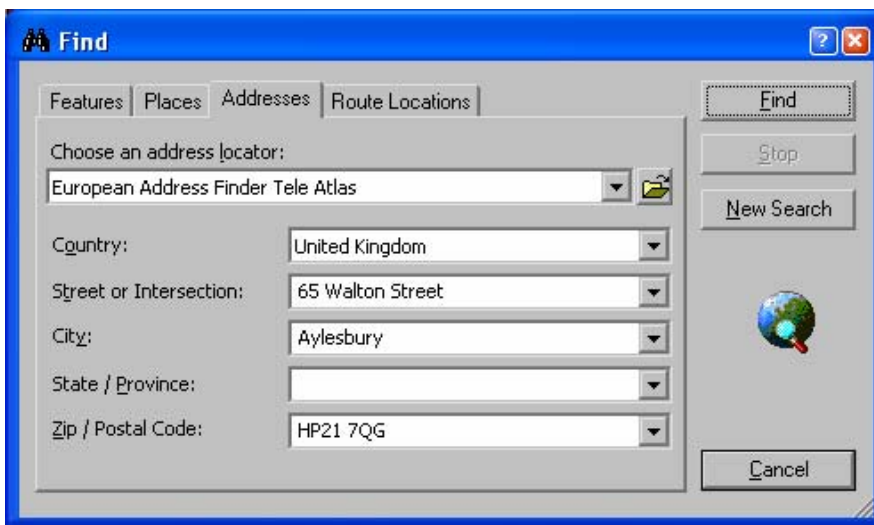
Note: the free address locator web services provided in the Find dialog can't be used in the Geocode Addresses dialog to perform bulk geocoding of addresses in tables.

■ The experience for working with the results you find in the Find dialog has been improved. The context menu you get when you right-click a result has been enhanced to add a Pan To command so you can center the map on the particular location without changing your map's scale. In the Places tab and the Addresses tab you can also annotate your map with point graphics, labeled point graphics, or callouts showing the location you found. If you have selected multiple results in the Find dialog, the commands in the context menu operate on all the selected results. This graphic shows the context menu you get if you right-click a place in the new Places tab:
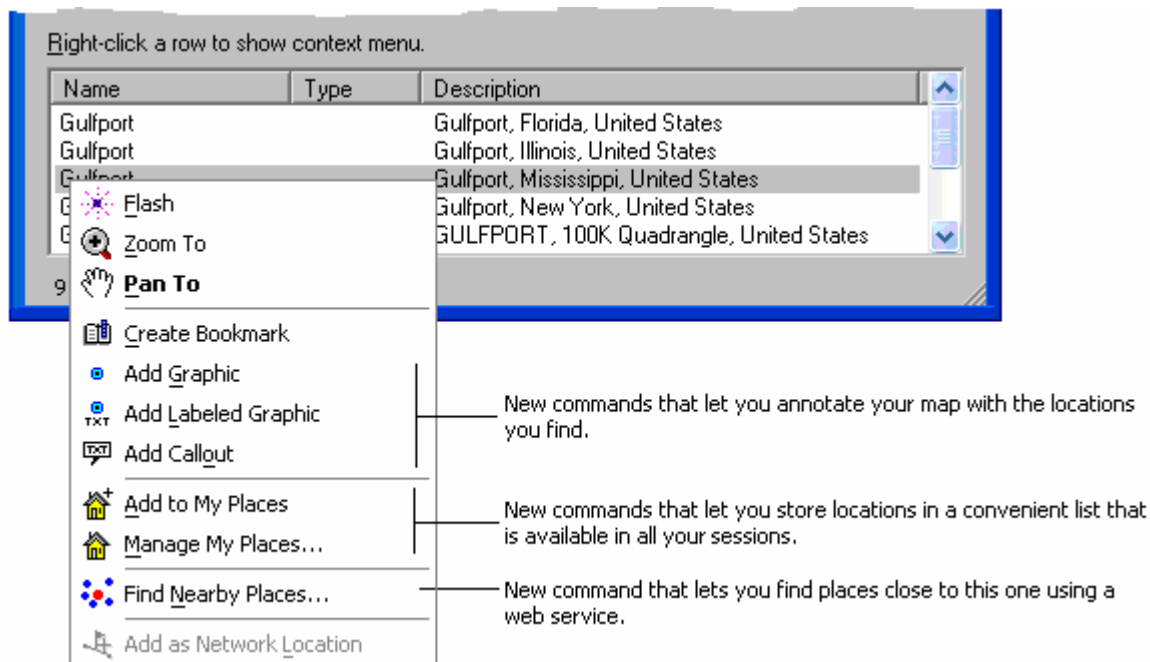
The Add To My Places command lets you add any feature, place or address that you find into the My Places dialog (described in the previous section). The Find Nearby Places command lets you find places that are near the location you right-clicked. See below for more about the Find Nearby Places functionality.

In addition to the menu accessed by right-clicking a result, the following shortcuts are also available.

- **Single-click** an entry in the results list to flash it on the map.

- **Double-click** an entry to pan to it and flash it.

■ In addition to the free services for finding places and addresses that appear in the Find dialog, other more specialized place and address services are available. If you are an ArcWeb Services subscriber and you have already signed in to your account via the new Tools > Online Services > Sign in to ArcWeb Services command, you can access additional, premium services in the Find dialog. ► *See the 'Data & services from ESRI' chapter in this document.*

■ The Find dialog is now resizable. In this way, you can make it smaller instead of closing it if it gets in the way of your map. If you make the dialog very small you may not be able to use all of the fields it contains, but you can still work with the results you have found.

■ The Find dialog enhancements described above are in ArcMap, ArcGlobe, and ArcReader (with the exception of certain commands in the results context menu that may not apply in a particular application, such as Create Bookmark in ArcReader). The Route Locations tab (which lets you find linearly referenced locations such as highway mileposts along route features) is only found in ArcMap.

■ The Find dialog used in ArcMap, ArcGlobe and ArcReader at 9.2 is an ArcGIS Engine control, so if you are a developer creating applications using ArcGIS Engine, you can easily include the Find dialog in your applications to provide users with the 9.2 Find functionality and user interface.

New dialog for finding nearby places

■ At 9.2 a new dialog called Find Nearby Places is provided that lets you find different types of places near any location on your map. The places you can find are provided by several free web services, including a World Cities service and a more detailed USA Cities service. When you find places, they are sorted in order of how near they are to your origin location, and their distance from the origin is one of the columns shown in the results list. You can right-click the results to navigate to them or add them to your map as graphics.

To launch this dialog, choose Tools > Online Services > ⁑ Find Nearby Places. You can also launch this dialog by right-clicking a result in the Find dialog. In the example below, the dialog has been used to find cities within 100 miles of a location in France:
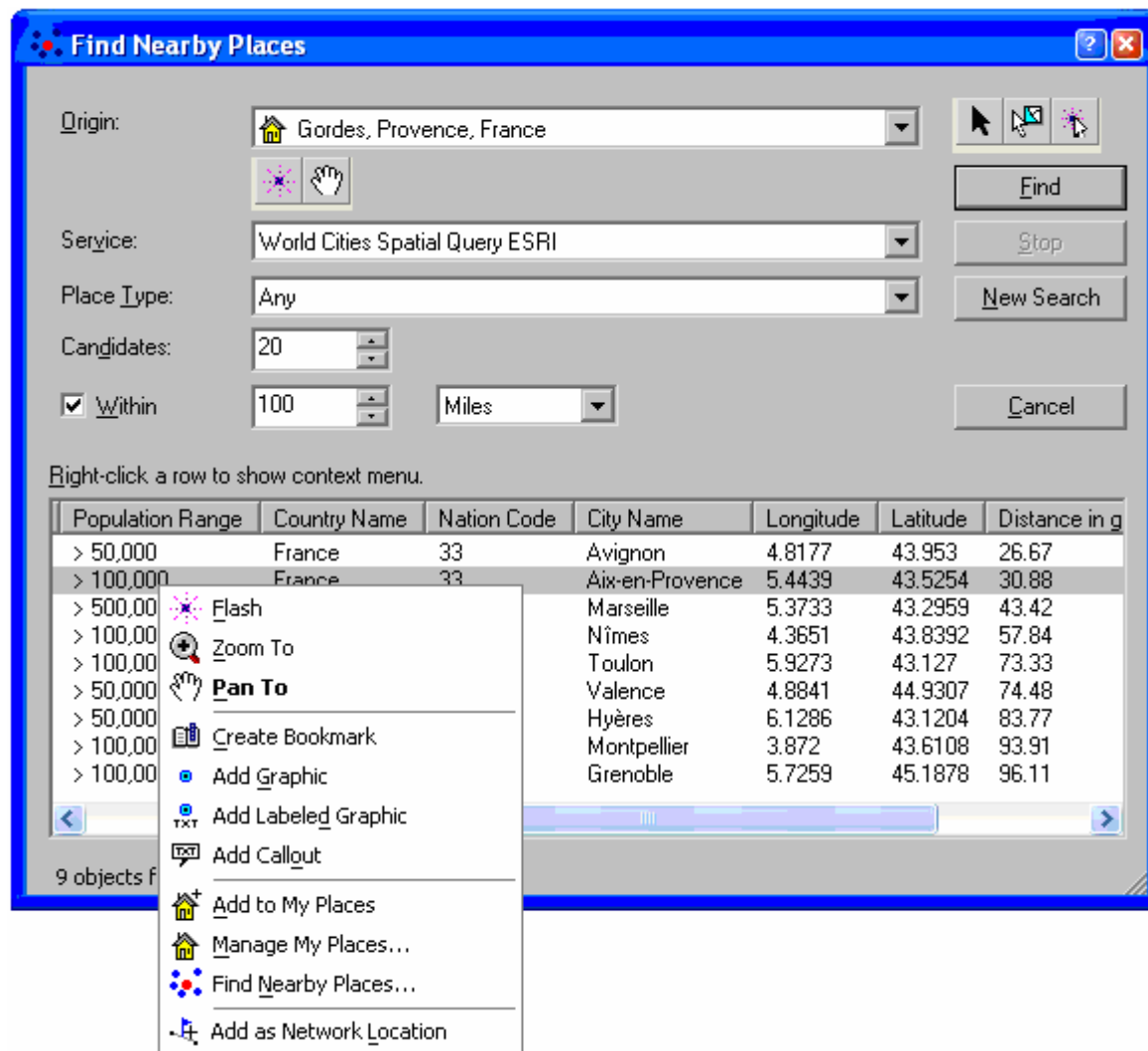
This dialog is also available in ArcGlobe, ArcReader and as an ArcGIS Engine control.

In addition to the free services, if you are an ArcWeb Services subscriber you'll have access to specialized premium place services in this dialog, including business, demographic, and traffic information. etc. ► *See the 'Data & services from ESRI' chapter in this document.*

Improved Identify tool

■ When you click on the map with the Identify tool, the Location field shows you the x, y coordinates of the location you clicked. You can now choose the units with which these coordinates are displayed and you can select the coordinates and copy them. When you click on a feature in the left hand side of the Identify dialog, the Location field now gives you the x, y location of that feature (in the case of a point feature) or the x, y location of that feature's centroid (in the case of a line feature, polygon or annotation feature). The current map units of your data frame are shown in bold in the units list:
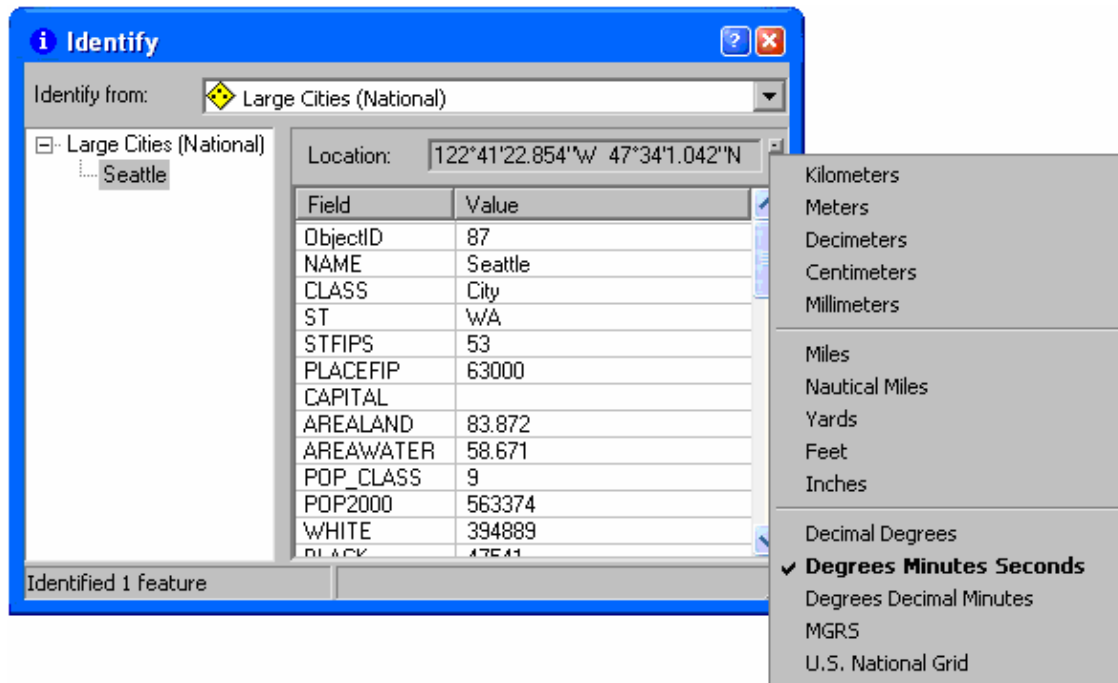
■ When you right-click a feature in the left side of the dialog, the menu has several new commands that make it easier to work with features you have identified. You can now sort the features and remove unwanted ones from the dialog. Copy Record copies all the attributes of the feature you right-clicked:
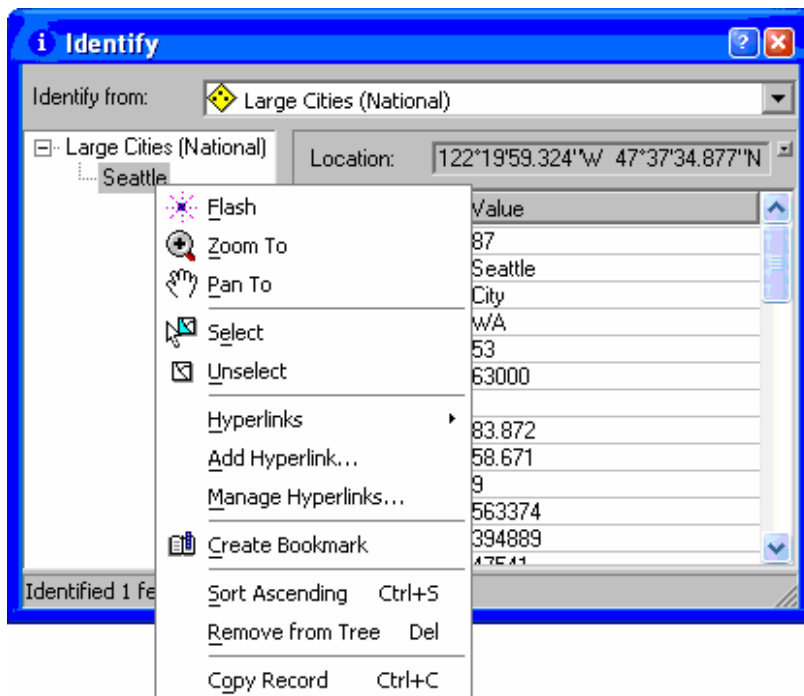
■ If you right-click in the right side of the Identify dialog, you'll see a new menu of commands. In this menu the Copy command copies the contents of the cell you right-clicked, so you can use it to copy either the field name or the value that field has. The Copy Selected Field(s) command copies the field name and field value for all of the currently selected fields in the list. For example, if you want to copy four fields and their values and paste them into Excel, select them in the right side of the Identify dialog and choose Copy Selected Field(s):
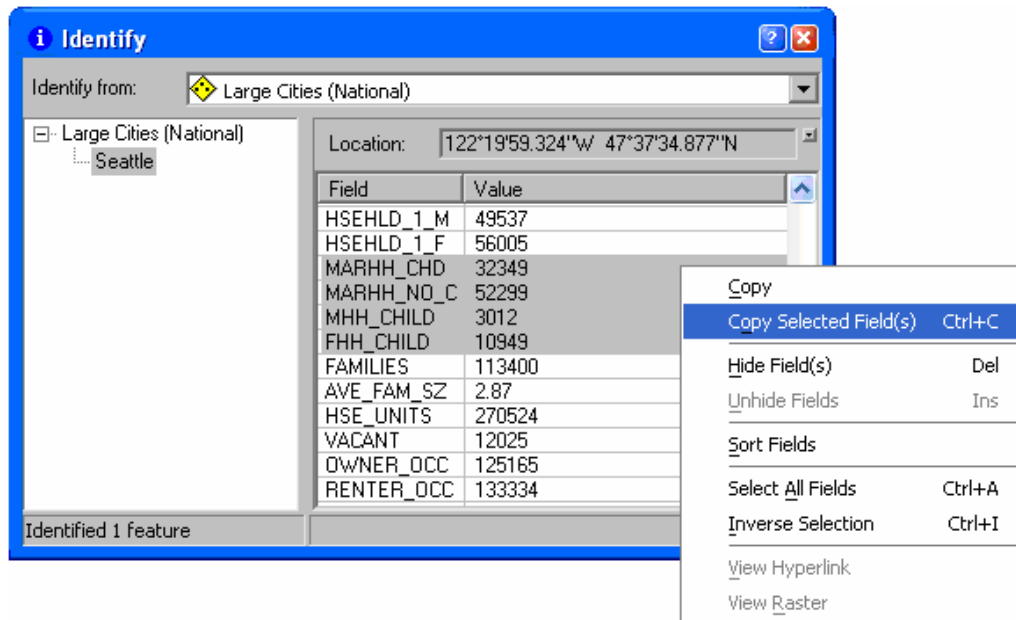
You can also hide unwanted fields to simplify the listing by selecting the field(s), right-clicking and choosing the Hide Field(s) command. Use Show All Fields to unhide fields that you have hidden. Hiding fields in the Identify dialog is temporary and only affects your current Identify session. It does not affect which fields are shown or not shown in any other dialogs or when you open the attribute table window for the layer. The View Hyperlink command is enabled if the value for a field is a complete URL or path to a document and the View Raster command is enabled if the field is of type raster. In both cases you'll also see a clickable icon next to the value.

■ The Identify dialog now lists related records in the left side of the dialog with the record's value for the default primary display field for the related data source. At 9.1 Identify always listed related records with the record's Object-ID. For example, here's what you see in 9.1 if the features in a States layer are related to a Cities layer and you expand the relate after identifying Nebraska to see its related cities:
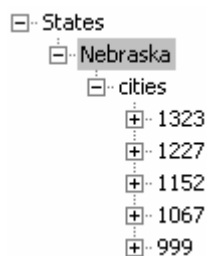
At 9.2 you see the cities listed with the default primary display field selected automatically by ArcGIS based on the names of the fields in the related data source. In this case, it uses a city name field as the primary display field:
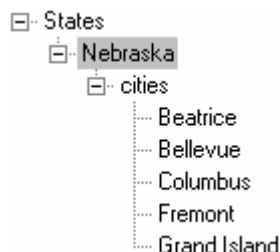
In the example above the related cities were also sorted in the tree on their name by right-clicking one of them and choosing the new Sort Ascending command. Note: It is a limitation of the Identify dialog that it will only use the default primary display field to list related records. So for example if you go into the Table Properties dialog Fields tab for the related table and choose a different primary display field, your choice is not respected by the Identify dialog.

■ You can now drag a box with the Identify tool to identify all the features inside it. Whether you click or drag with the Identify tool, you can hold down either SHIFT (or CTRL) if you want to identify features without clearing away the current contents in the Identify window. When you hold down SHIFT (or CTRL), a small plus sign now appears in the Identify cursor to show that you are in 'add' mode.

■ In the right side of the Identify dialog, you can click the top of the Field or Value column to sort the attributes on that column. Click on a field to select it. When a field is selected, it will remain visible in the right-side of the dialog as you identify additional features from that layer or switch between features from that layer in the left side of the dialog. This makes it easy to compare the attributes for multiple features especially when the layer has a large number of fields.

■ The improved Identify tool is in ArcMap, ArcGlobe and ArcReader. It won't be supported in ArcScene or ArcCatalog, which will both continue to use the same Identify tool they had at 9.1. The improved Identify tool is an ArcGIS Engine control, so if you are a developer creating applications using ArcGIS Engine, you can include it in your applications.

Selecting features

■ When you create a selection layer (right-click a layer in which features have been selected and choose Selection > Create Layer From Selected Features) this operation no longer clears the selected set of features in your layer. So if a layer has 10 features selected and you create a selection layer to represent those 10 features, the original 10 features will still remain selected in your map. In ArcMap 9.1 they were automatically deselected. This enhancement allows you to perform another operation on the selected set of features. For example, you may want to create a selection layer from one set of features in a layer, then switch the selection so that the unselected features become selected, and then create another selection layer.

■ The way that layers are listed in the Table Of Contents Selection tab and the Selection > Set Selectable Layers dialog has been improved so that the listing shows you how the layers are organized into groups. Feature-based sublayers of ArcIMS image services in which features can be selected are also now correctly grouped under the service they belong to:
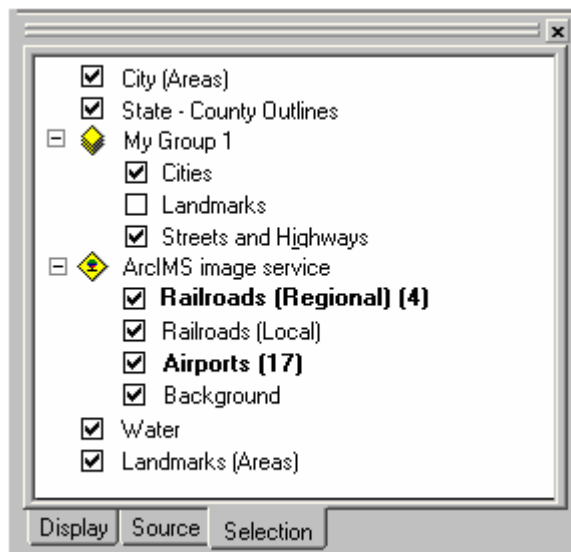
You can toggle all the layers in the data frame to be selectable or not by holding down CTRL and clicking on the check box next to any layer, irrespective of where the layer is in the hierarchy shown in the tree.

The Open Attribute Table command and the Properties command have been added to the menu that appears if you right-click a layer in the Selection tab, along with a new command that lets you open a table window directly in Show Selected records mode:
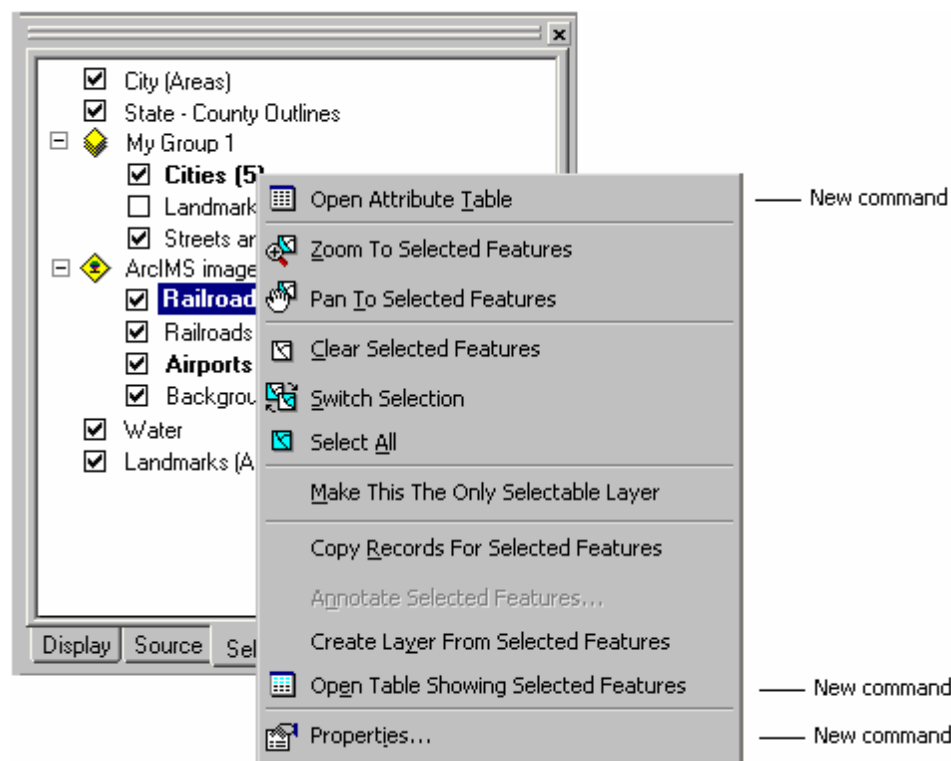
This context menu is now a separate menu that you can customize via Tools>Customize. (In previous releases, this context menu was the same as the Selection pullright in the layer context menu). So at 9.2 you can add any commands from the layer context menu into this menu.

You can also now open the properties of any layer listed in the Selection tab by double-clicking it or highlighting it in the list and then pressing **ENTER** or **F12**. Another useful shortcut is hold down **CTRL** and click any expansion +/- sign in the tree to expand or contract all of the groups in the tree (this shortcut is also available in the Display tab).

Tip: You can make one layer selectable and make all the other layers unselectable in one go by right-clicking the layer and choosing the Make This The Only Selectable Layer command that was added at 9.1. This command is available in all the tabs in the Table Of Contents, not just the Selection tab. In situations where you just want to make one particular layer the only selectable layer, this command saves you having to visit the Selection tab or Set Selectable Layers dialog.

■ The Clear Selected Features command has been added into the ArcMap Tools toolbar so you can now clear all feature selections at any time with one-click:

■ The Selection > Select By Attributes dialog and other dialogs that use the Query Builder control have been enhanced so that:

- Fields that have been turned off for the layer or table you are working with are no longer listed in this dialog. In other words, the dialog now respects field visibility properties. You turn fields off in the Layer Properties or Table Properties dialog Fields tab or via the table window (a new capability in 9.2). This makes it easier to work with data sources that have a large number of fields because only fields you have chosen to work with appear in the dialog.

- A new menu in the dialog lets you choose how fields will be listed. This menu is accessed via a small control to the right of the fields list, or by right-clicking the fields list. This menu gives you the option of listing fields with their field aliases instead of their underlying field names. When you choose this option, the fields list respects field alias properties when you are working with layers and tables. This has been requested frequently because many of you use field aliases to make cryptic field names more user-friendly or to make long ArcSDE field names more manageable. The Show Field Aliases option is turned off by default in 9.2 so there is no immediate change to your familiar workflows. Choosing to show aliases in this dialog has no effect on the expression syntax. Field aliases are not shown or supported in the expression itself. If you double-click a field shown with its alias, it will still be added into the expression with its actual name and its field delimiters. In the example shown below, the field list is showing aliases and the field with the alias 'Depth last recorded (cm)' has been added into the expression, where you see the field's actual name not its alias:
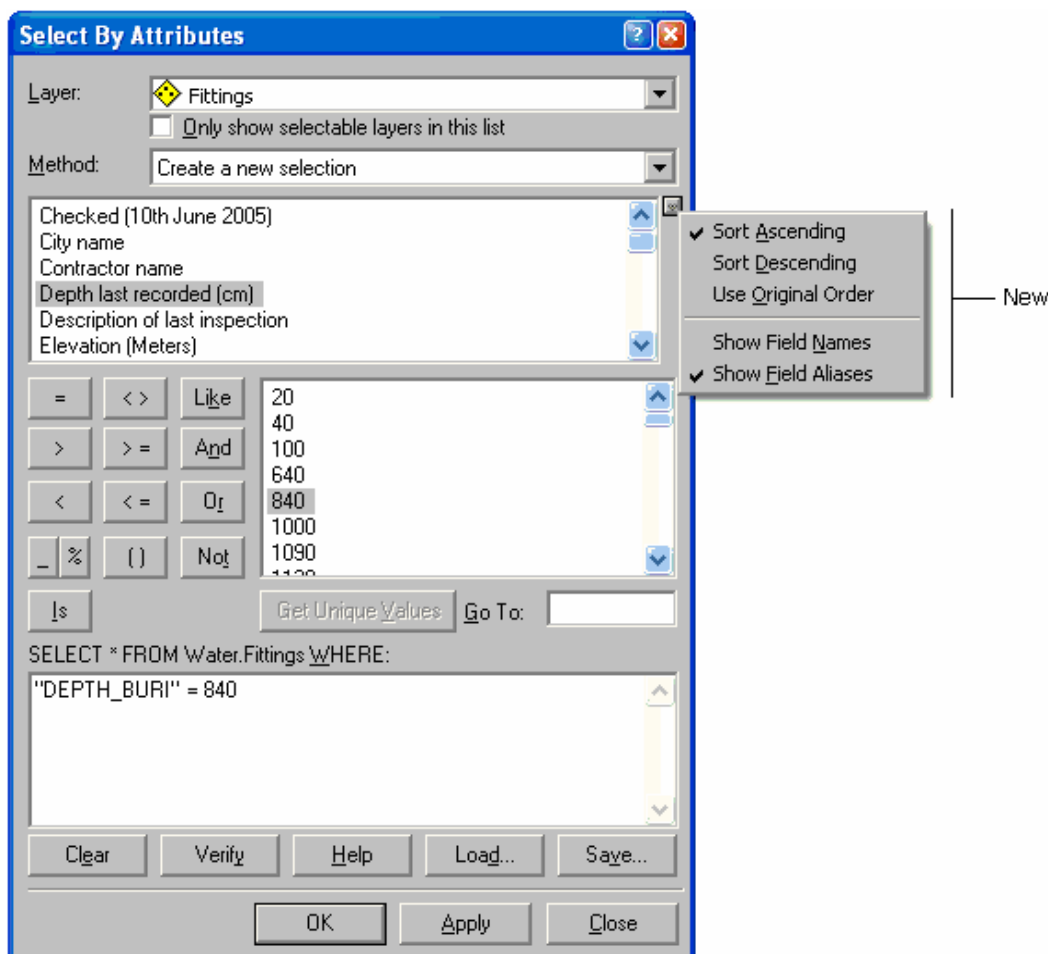
- As you can see in the example above, you can now also choose how the fields are sorted in the list. By default the fields are still listed in their original order in the data source so there is no immediate difference to 9.1. Choosing Sort Ascending or Sort Descending can make it easier to quickly locate the field you want.

The sorting and field name options you choose remain in force whenever you use this dialog or others that offer the same options (the Field Calculator and the Label Expression dialog). These enhancements also apply to ArcGlobe, ArcScene, the query builder in the geoprocessing environment (when working with a layer) and custom dialogs that use the Query Builder COM object.

■ The Selection > Select By Attributes dialog and Selection > Select By Location dialogs both have check boxes that let you choose to only show selectable layers in the layers dropdown list. At 9.2 if you check this box ArcMap now remembers this setting between sessions. In this way, you can check this box once and it will be checked whenever you use this dialog. Previously if you checked the box, the applications didn't retain this setting between sessions. This makes it easier when you are working with a document containing a large number of layers and you have made the layers that you want to be able to query selectable by checking them in the Table Of Contents Selection tab (or in the Selection > Set Selectable Layers dialog). This setting also applies to ArcGlobe and ArcScene.

■ You can now copy statistics out of the Selection Statistics dialog by selecting the values and then right-clicking:
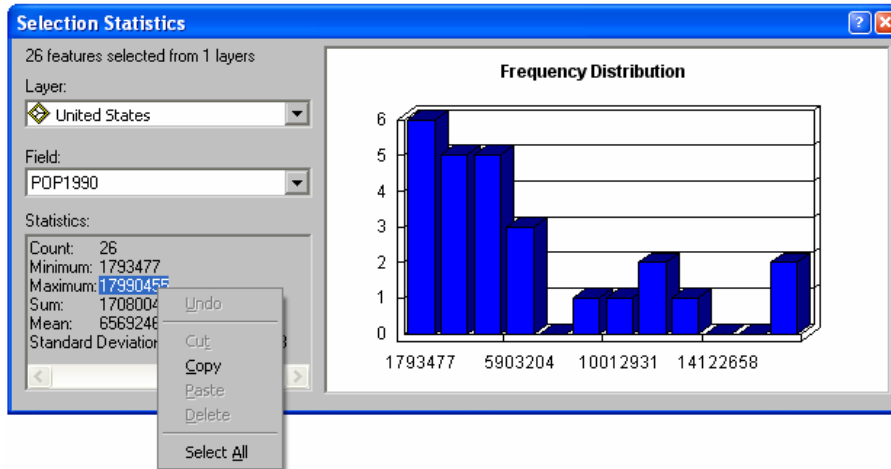
■ The Selection > Select By Location dialog's layout has been improved to provide more space for the checkable list of layers from which features will be selected. The checkable list of layers uses the new standard layer list control that presents layers organized into the same group or composite layers as the Table Of Contents. An OK button has been added so you can execute a query and dismiss the dialog in one click. A Help button has also been added. The preview graphics have been removed but they are still available in the 'Using Select By Location' topic in the Desktop Help. (This enhancement also applies to ArcGlobe and ArcScene):

Working with layers

Easier to choose layers in dialogs

■ A lot of dialogs in ArcMap contain a dropdown list that lets you specify which layer you want to perform an operation on. At 9.2 we have updated this dropdown list to make it easier to work with:

- The dropdown layer list now shows you which layers belong to group layers or layers such as ArcIMS image services, so the list matches the way that the layers are organized in your Table Of Contents. You can expand and contract the list to quickly access the layer you want to use.
- Each layer is listed with its layer icon from ArcCatalog so you can easily see what type of data each layer contains.
- If the layer names are very long, a horizontal scroll bar at the bottom of the dropdown list lets you scroll the listing sideways.

Here's what the new control looks like. In this particular dialog, group layers aren't valid inputs so the name of the group layer is shown in grey text:
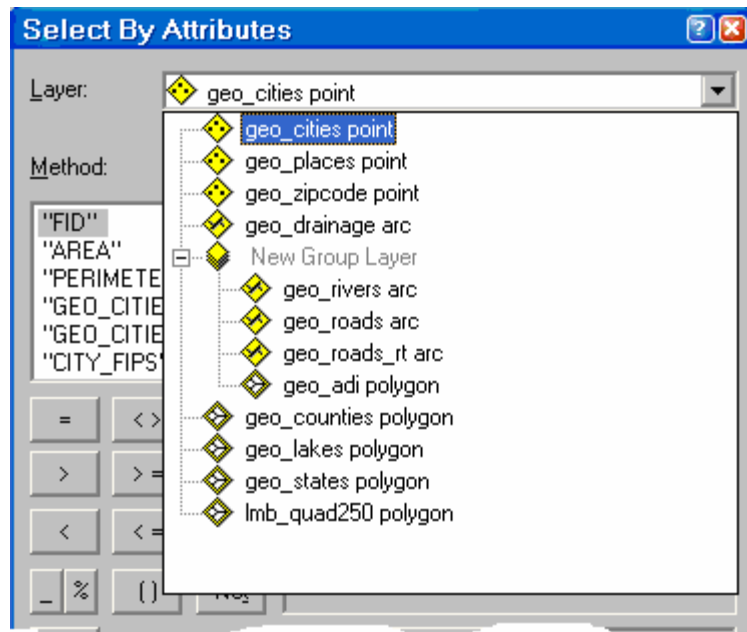
This improved layer dropdown list is also used in ArcGlobe and ArcScene.

Set transparency, contrast and brightness for group layers

■ Group layers now have their own transparency, contrast and brightness properties. In this way, you can set these properties for all the layers in a group layer to control how they will be displayed without having to visit each layer individually.

When you set a transparency, contrast or brightness property for a group layer to be anything other than 0%, this overrides the existing setting for that property in each layer in the group which has that property. If you have set one of these properties for the group layer but decide you want all the layers inside to group to use their own settings instead of being overridden by the group layer's setting, simply change the group layer's setting back to be 0%. So for example, if the group layer's transparency is 0%, the layers in the group will each be drawn using their own transparency setting. In this way, you can switch between setting transparency at the group layer level or using the transparency settings of the layers in the group.

You can set these properties for a group layer by either using the Effects toolbar (in ArcGlobe and ArcScene this toolbar is called 3D Effects):
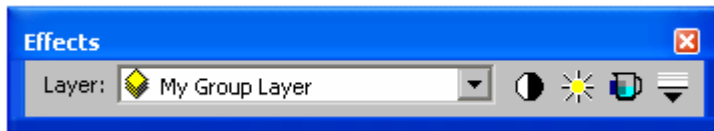
or by going to the new Display tab in the Group Layer Properties dialog where you can type the values in:
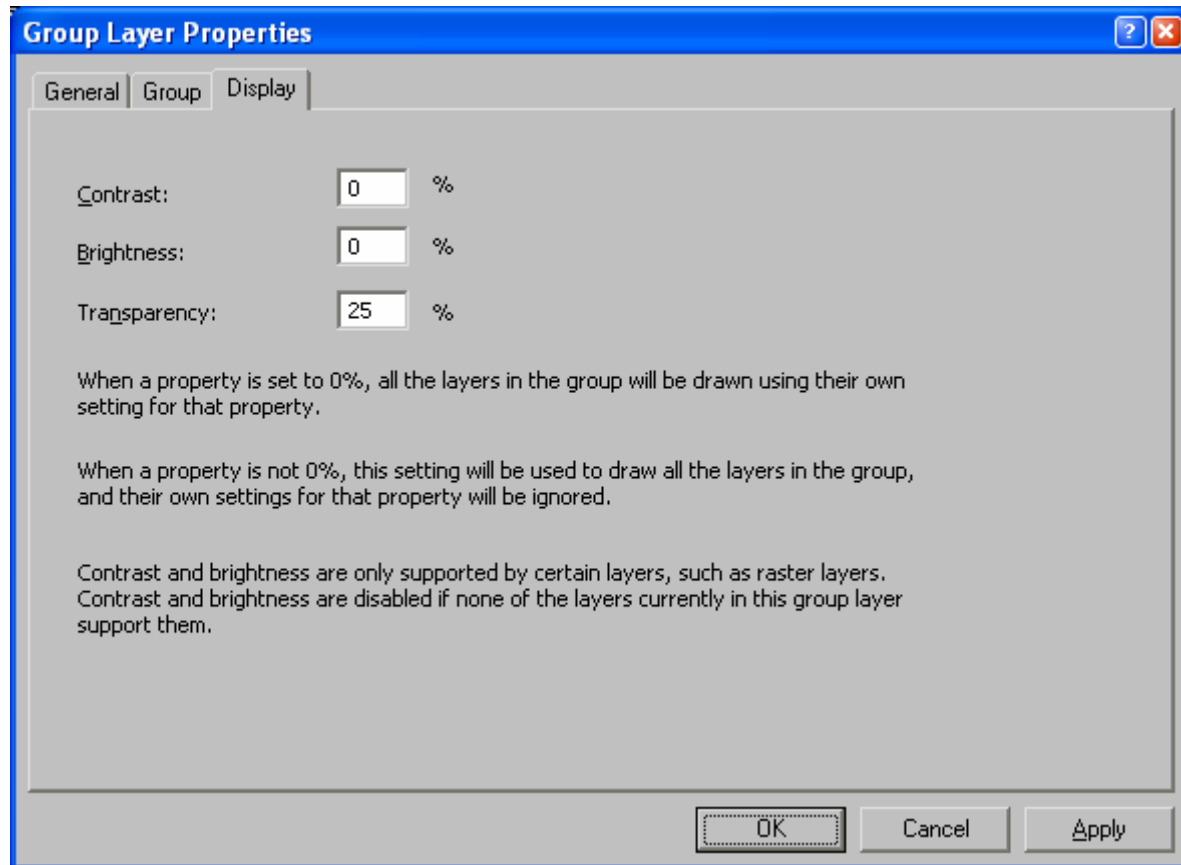
In both the Effects toolbar and the Display tab, the controls for specifying contrast and brightness are disabled if your group layer currently does not contain any layers that support these properties. Contrast and brightness are only supported by certain layers, such as raster layers and CAD drawing layers. All layers support transparency.

This enhancement applies to ArcMap and ArcGlobe. ArcReader also now supports group layer transparency via the Layer Effects toolbar.

Labeling and annotation enhancements

■ Label Manager dialog: new Summary button: Click this button to generate a summary analysis of your labeling rules. The summary will point out potential problems with your labeling rules that may impact labeling performance, map readability, and the ability to convert labels to annotation.

■ The Label Expression dialog (accessed from Layer Properties dialog Labels tab) has been enhanced to make it easier to work with the fields list.

- Fields are no longer listed in multiple columns and the horizontal scroll bar lets you scroll to see the ends of long field names. This makes it easier to work with long names.

- A new menu in the dialog lets you choose how fields are listed, including the ability to list fields using their aliases. This is the same menu that has been added into the Select By Attributes dialog. ► *See the Feature Selection section above for details:*
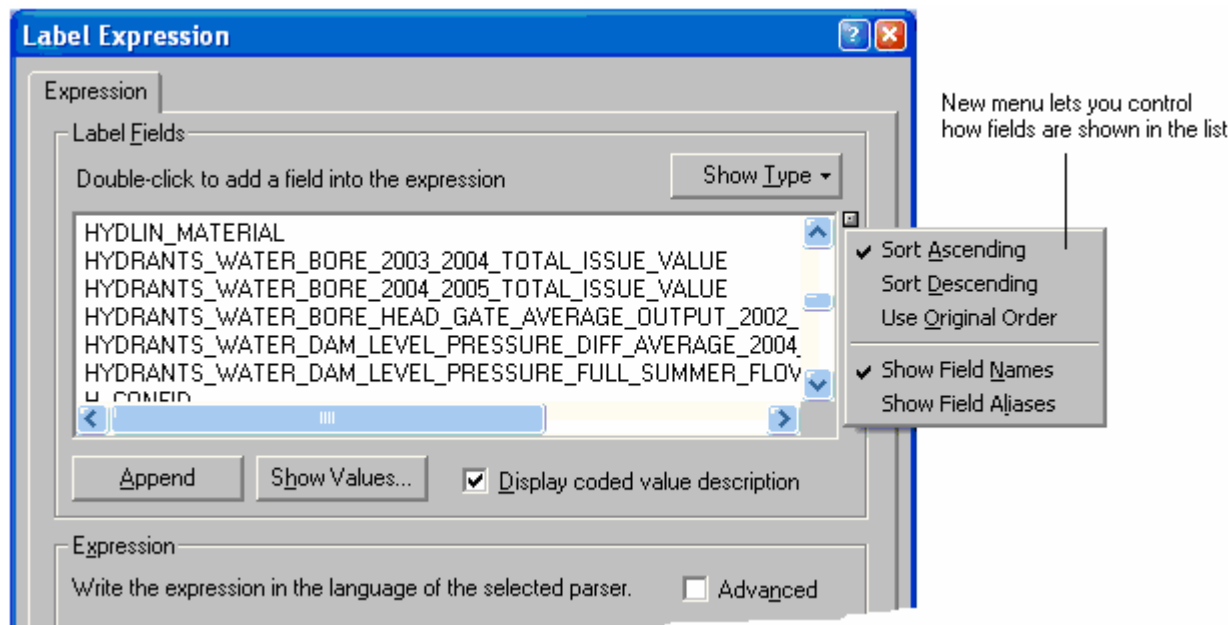
■ Converting labels to annotation: The ability to append annotation into an existing feature-linked annotation feature class has been added to the convert labels to annotation process. This gives you the ability to create feature-linked annotation in multiple conversion processes when producing annotation for specific extents and still store the annotation in one feature class. The way that developers convert labels to annotation has also been simplified.

■ The dialog launched by the Annotate Selected Features command accessed by right-clicking a layer has been enhanced to make it easy to quickly select all or none of the annotation feature classes that are listed. In previous releases each item would have had to be checked or unchecked individually. You can either use the new Select All and Clear All buttons, or use the shortcut of holding down CTRL and clicking on any check box in the list.

■ The Label Priority Ranking dialog now shows you which group layer each layer belongs to. The dialog is also now resizable. (This dialog is launched from the Labeling toolbar or from the Labeling pullright in the context menu for a data frame).

Choose how hyperlinks are shown

■ You can now choose whether hyperlinked features will be highlighted on maps when the Hyperlink tool ⚡ is selected. If they are highlighted, you can also choose which color will be used. You can find this setting in the ArcMap Tools > Options dialog General tab. Like all the settings in the General tab, this setting applies to all your ArcMap sessions and is not stored in your map document. The default for this setting is to highlight the features in blue:
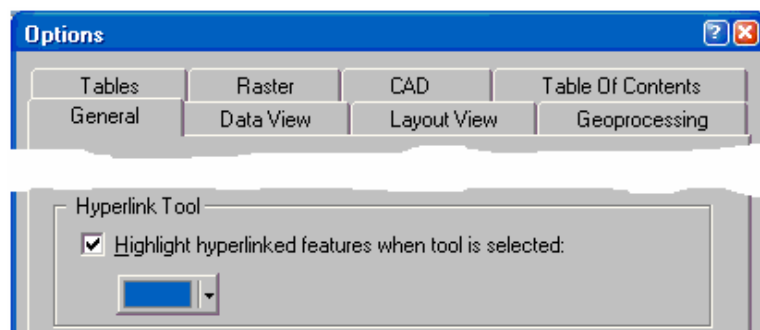
Improved handling of different geographic coordinate systems

■ We have improved the dialog that appears in ArcMap to warn you that the data you have added to the map uses a different geographic coordinate system (GCS) than the one used by the data frame. Here's the dialog you get in 9.2:
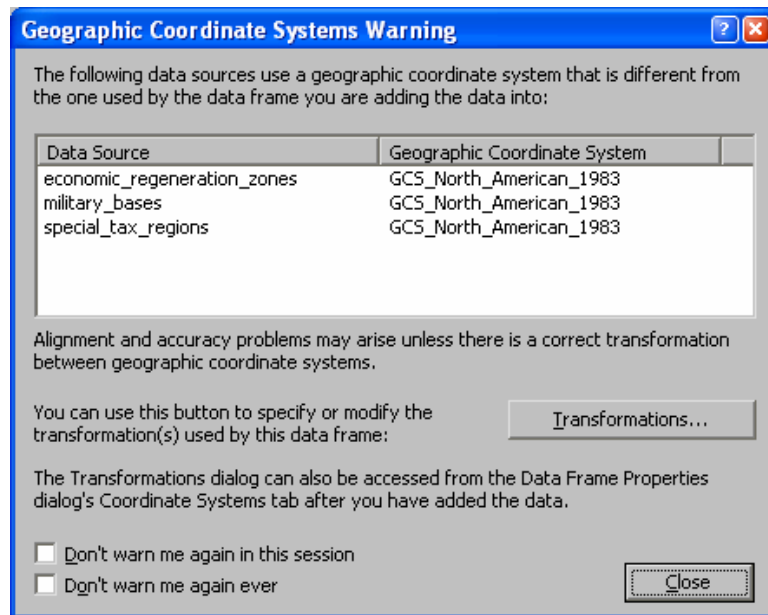
- The wording in the dialog has been improved to remove the implication in the old dialog that ArcMap always automatically chooses a geographic transformation for you to handle the transformation between the GCS of the data you are adding and the GCS of the data frame. There is only one situation where ArcMap does this: if the two GCS involved use the NAD27 and NAD83 datums and the data is in the lower 48 US states, then the "NAD_1927_To_NAD_1983_NADCON" transformation is chosen automatically. This transformation shouldn't be used if the data covers Alaska and Canada. The warning dialog still appears even when this transformation is chosen automatically.

- When you add multiple datasets into ArcMap and one or more of them use a different GCS than the data frame, the warning dialog appears just once, instead of appearing repeatedly for each dataset. The dialog now lists all the data sources involved and gives the name of the GCS each one uses.

- You can now launch the Geographic Coordinate Systems Transformations dialog directly from the warning dialog to choose, modify or just review the current transformations used by the map so you can make any adjustments or additions immediately.

- The 'OK' and ' OK To All' buttons on the old dialog have been replaced a simple 'Close' button to make it clear that you are not choosing whether or not to add the data. The data always gets added, irrespective of whether there's a transformation specified for the particular GCS to GCS combination that is involved or not.

Note: You may have turned this warning dialog off in which case you won't notice these enhancements. If you want to restore this warning you can launch the \Program Files\ArcGIS\Utilities\AdvancedArcMapSettings.exe utility and check the Datum Warning check box in the Miscellaneous tab.

These enhancements have also been made in ArcGlobe. The wording in the warning message box is now specific to whether you are using ArcMap or ArcGlobe.

■ In the Geographic Coordinate Systems Transformations dialog, the list of available pre-defined transformations for the selected GCS to GCS pair no longer defaults to the first entry listed. Instead if now defaults to <None>. This reduces the chance of an unsuitable transformation being used without the user's knowledge. This enhancement is also reflected in ArcGlobe.

New Zoom To Make Visible command

■ A new command called ⟨⟨ Zoom To Make Visible has been added to the context menu you get if you right-click a layer in ArcMap. (This same command has been in ArcReader since 8.x). The command is enabled if the layer has a scale visibility range and is currently not being drawn because of the map's scale. Choosing the command zooms the map in or out to a scale at which the layer will become visible. ArcMap chooses the nearest scale to the map's current scale at which the layer will become visible. The center point of the map is maintained during this zoom.
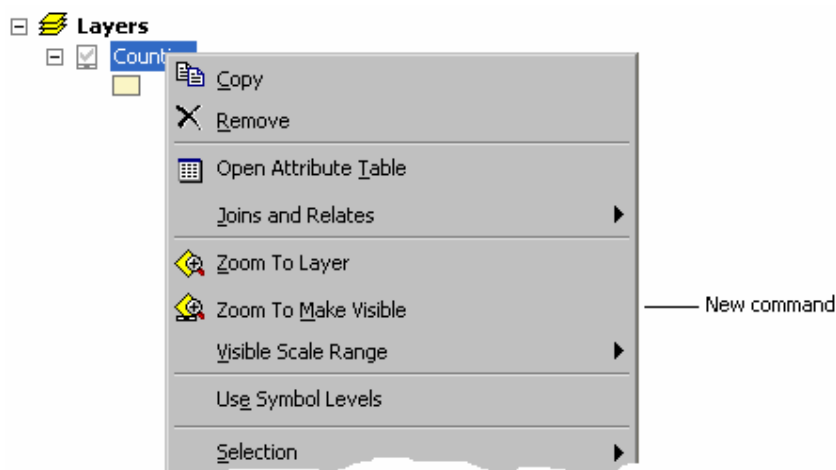
This makes it easier to zoom your map to a scale at which the selected layer will become visible. Previously the only way to do this was to inspect the layer's scale range properties and then manually change the scale of the map to match it. Using the Zoom To Make Visible command doesn't mean you will necessarily see the layer's features on your map, because you may be looking at part of the map in which none of these features are located.

Swipe tool enhancements

These changes also apply to the Swipe tool in ArcGlobe and ArcReader.

■ The Swipe tool now works on group layers.

■ The Swipe tool has a new option for swiping the full display. Select the tool then hold down **CTRL** (or **SHIFT**) and hold down the left mouse button to reveal what is underneath the layer being swiped across the full display. This lets you immediately see what is underneath a particular layer without having to drag the mouse to swipe left/right or up/down. See the information about the new Flicker command below too, which is a full display swipe that repeats automatically.

New Flicker command

■ The new Flicker command in the Effects toolbar in ArcMap automatically flickers the layer chosen in the layer dropdown list on and off using the time interval specified in milliseconds in the control next to it:

Flicker is particularly useful for temporal change detection (especially of satellite images or air photographs taken at different times of the same location), data quality comparison, and other analysis where you want to see small differences between very similar looking layers. Very fast rates of flicker can be used to make differences between layers appear to 'jump out' due to the optical effect of the eye being attracted to changes between rapidly alternating displays (an effect also exploited by the early experiments in cinematography).

■ The Flicker command is in ArcMap and ArcGlobe (3D Effects toolbar). It is also an ArcGIS Engine control, so if you are a developer creating applications using ArcGIS Engine, you can easily include it in your applications.

New credits property for layers

■ A new property called 'credits' has been added into the Layer Properties dialog General tab. This provides a place where you can specify copyright, legal, or any other acknowledgement information about the data in the layer:
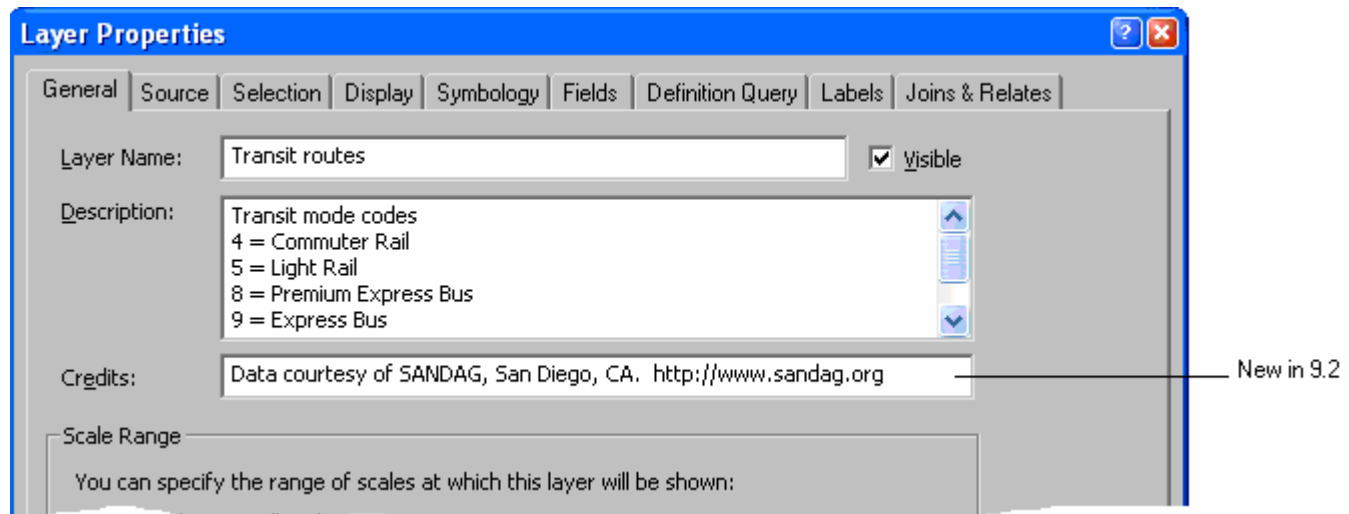
This is supported in ArcMap and ArcGlobe by most layer types.

With this new property, this information is easily available if you share a layer with others as a layer file, or share or publish your map or globe document. If you publish a map using ArcGIS Server, this information is published too, so it is available in client applications such as ArcGIS Explorer when your map service is accessed. If your map service is accessed in ArcMap, the credits fields for the layers it contains are read-only, so that the user accessing your service can't change them.

To specify credits information for data represented in a particular data frame, the credits property has also been added into the Data Frame Properties dialog (see the Map Documents section below). When you publish a map document with ArcGIS Server, the credits information specified for the data frame is used as the overall credit information for the resulting map service.

Other

■ The Convert Features To Graphics command (right-click a feature layer or a data frame to access) no longer unselects the selected set of features in your input layer. So for example, if you select a set of features for a layer and then convert these features to graphics, the features in the layer will now remain selected after the graphics have been created. This makes it easier to complete workflows where you want to retain the selected set of features, such as switching the selected and unselected features and then converting those features to graphics.

Map documents

Improved Measure tool

■ ArcMap 9.2 features a new Measure tool 🏗 in the Tools toolbar with its own compact popup dialog that lets you measure lines and areas. You can also click on features to get their area, length, etc. An option in the dialog lets you choose to snap to features as you define the line or area to be measured. The snapping tolerance is fixed at 8 pixels on the display. You can choose the units for the measurements, and also turn on a running total for all the measurements you make. Measurements are displayed inside the dialog instead of in the status bar so it is easy to copy and paste them into other apps.
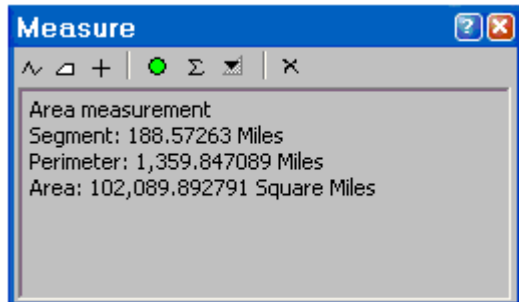
ᴧ	Measure a line. Double-click to complete the line.
◿	Measure an area. Double-click to complete the polygon.
✛	Click on a feature to measure its length (line), perimeter and area (polygon or annotation) or x y location (point feature). This option makes it easy to measure features in your map without having to trace over them.
●	Turn on snap-to-feature mode. In this mode, the line you define to measure length or area will automatically snap to the nearest vertices in line or polygon features, or to the nearest point features. The snapping radius is 8 pixels. This enables you to perform very accurate measurements between or along features. For example, you may want to measure the distance between the corners of two buildings, measure the distance along part of a street, the distance between two point features, or the area of part of a parcel. Hold down **CTRL** while you draw in this mode to snap anywhere along line and polygon features instead of just to vertices. For example, holding down CTRL enables you to measure the width across the middle of a straight-sided polygon such as a building footprint, by snapping to the edges of the polygon even though there are no vertices in those locations.
Σ	Turn on a total showing the total of all the measurements you make.
▼	Choose the distance and area units you want to use.
✕	Clear the dialog.

Like in the Measure tool at 9.1, you can hold down **SHIFT** when you measure a line to get a geodesic distance measurement. By default if the data frame is using a projected coordinate system, 2D Cartesian mathematics is used to calculate distances, so the measurement reflects the projection of the 3D data onto the 2D surface, and does not take into account the curvature of the earth. You can hold down SHIFT while measuring to get the geodesic distance instead. This is calculated using the spheroid/ellipsoid of the data frame's projected coordinate system's geographic coordinate system. If the data frame is using a geographic coordinate system and the display units are linear, the measurements are geodesic by default and you don't have to hold down SHIFT.

■ The improved Measure tool is in ArcMap and ArcReader (for published 2D maps). At 9.2, the 3D Measure tool that was introduced in ArcReader at 9.1 for measuring published 3D globes has been added into ArcGlobe where it replaces the existing Measure tool.

■ The Measure tools for maps and globes are ArcGIS Engine controls, so if you are a developer creating applications using ArcGIS Engine, you can easily include them in your 2D and 3D applications.

Enhanced map document properties dialog

■ The File > Map Properties command, which launches the Properties dialog for the map, has been renamed to File > Document Properties to make it clearer that these are the properties of the .mxd file (not the properties of the data frame), and to match ArcGlobe and ArcScene.

■ A new read-only File field has been added to the ArcMap File > Properties dialog showing you the full path and name of the your current .mxd file. In other words this field shows you the ArcObjects Path Property. You can drag over this text, right-click and then copy it to the clipboard which makes it easy to paste the pathname into emails, documents, or into the layout as text, etc.
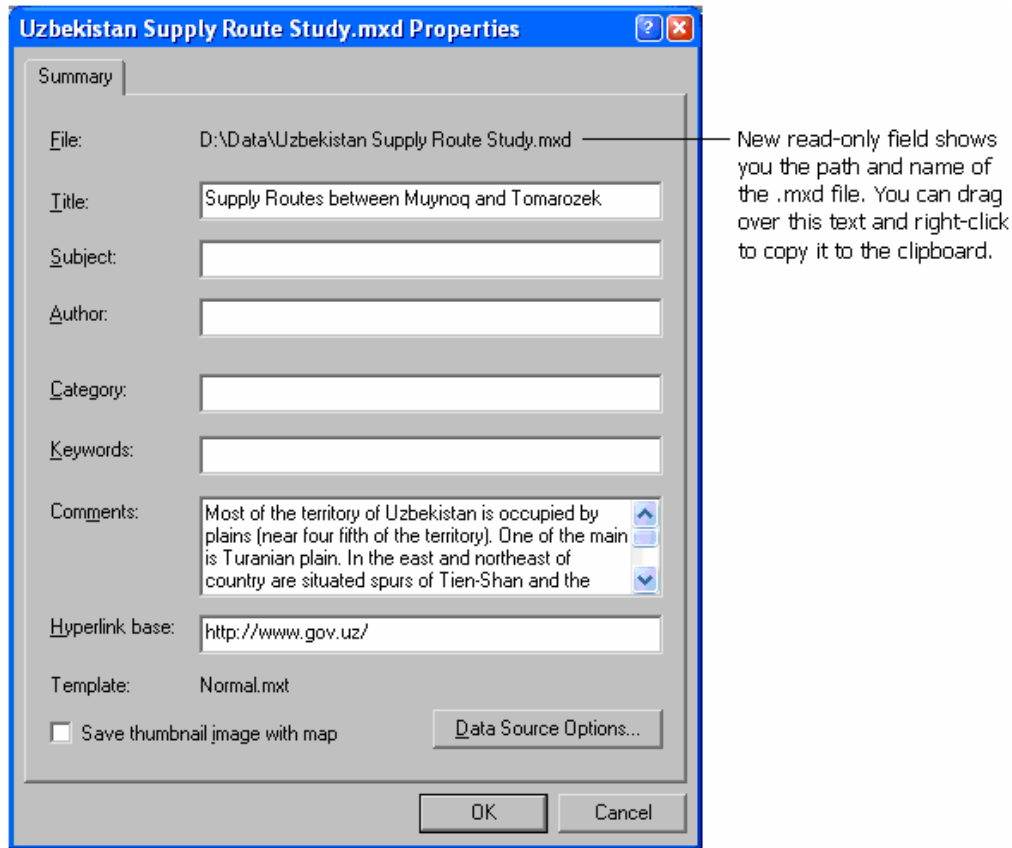
■ The Title field has been fixed to eliminate the bug where saving the map document reset the field to the name of the mxd file if you typed in your own title. The Title field now correctly defaults to the name of the .mxd file, but you can enter any text into this field to provide a title for your map. This text in this field is used automatically when you use the Insert > Title command when you are in Layout view.

■ In the File > Document Properties dialog > Data Source Options subdialog there is a new check box option that lets you choose what the default path option will be for file-based data sources in new map documents you create.

Leave this new option unchecked for new map documents to default to using absolute paths, as they did in previous releases. Check this box for new map documents to default to using relative paths. This setting is stored in the system registry for the application and does not affect the current map document you are working with, or your existing map documents. It just determines which of the two radio buttons in this dialog will be selected by default for maps you create from this point in time onwards.

Support for degrees decimal minutes as display units

■ You can now specify the display units for a data frame to be Degrees Decimal Minutes.

Improved coordinate display in status bar

■ We have widened the area used for coordinate display in the status bar at the bottom of the ArcMap window.

■ The area in the status bar used to display the location of the cursor in page units when you are working in Layout View is now no longer shown when you are working in Data View. In previous releases this area was shown, but remained blank while you were in Data View. This change provides more space for messages, measurements, etc in the status bar while you are in Data View.

■ You now have more control over how coordinates are displayed in the status bar. You can choose the number of decimal places and you can turn on thousand separators and zero padding:
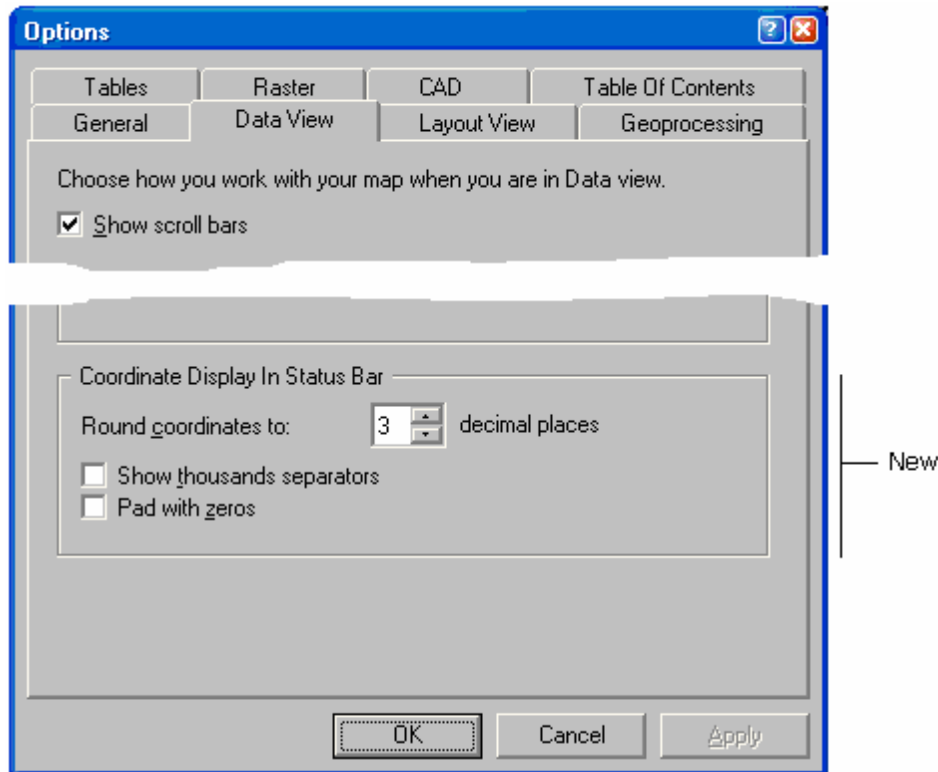
When the display units are degrees minutes seconds (DMS) the number of decimal places in this dialog controls how many decimal places are used to show the seconds. When the display units are degrees decimal minutes (new in 9.2), the setting controls the number of decimal places used to show the minutes.

These settings are stored in the current map document (.mxd file) and apply to all the data frames in the map.

Tip: These settings also control the feedback you get in the status bar when you draw graphics with the tools in the Draw toolbar. To control the feedback you get when you edit features in an edit session, you use the settings in the Editor > Options dialog General tab and Units tab.

■ The number of decimal places with which coordinates are displayed in the status bar now defaults to 3 decimal places for new map documents you create. This setting is stored inside each map document, so your existing map documents will still default to using 2 decimal places. To change an existing map document to use more decimal places for the coordinate display, go to the Tools > Options dialog Data View tab shown above.

Grids and graticules

■ Six new reference system styles have been added to the default ESRI.style file to make it easier to specify Military Grid Reference System (MGRS) and US National Grid as grids. These grids were supported previously but you had to create new styles for them manually in the Style Manager:
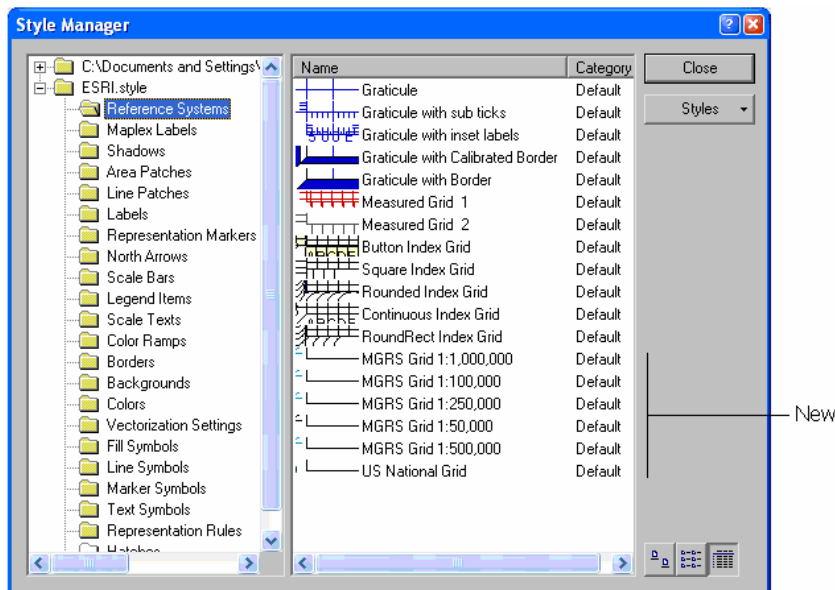
To use one of these new styles, in the View > Data Frame Properties dialog go to the Grids tab. To change an existing grid to use of one these new styles, select the grid from the list and press the Styles button. To create a new grid using one of these styles, press the New Grid button. If wizards are turned on (Tools > Options dialog General tab), use the wizard that appears to create a new grid (press Next to go through the wizard and then press Finish, it doesn't matter what settings you choose in the wizard) and then press the Styles button. If wizards are turned off, choose the style you want to use when the Reference System Selector dialog appears after you press the New Grid button.

■ There are now more options for specifying intervals for graticules. When you define graticules for a data frame (Data Frame Properties dialog Grids tab) you now have the option to specify the graticule intervals in decimal degrees or degrees and decimal minutes instead of degrees minutes and seconds. Degrees minutes and seconds is still the default. You can find the new options in the Reference System Properties dialog Intervals tab:
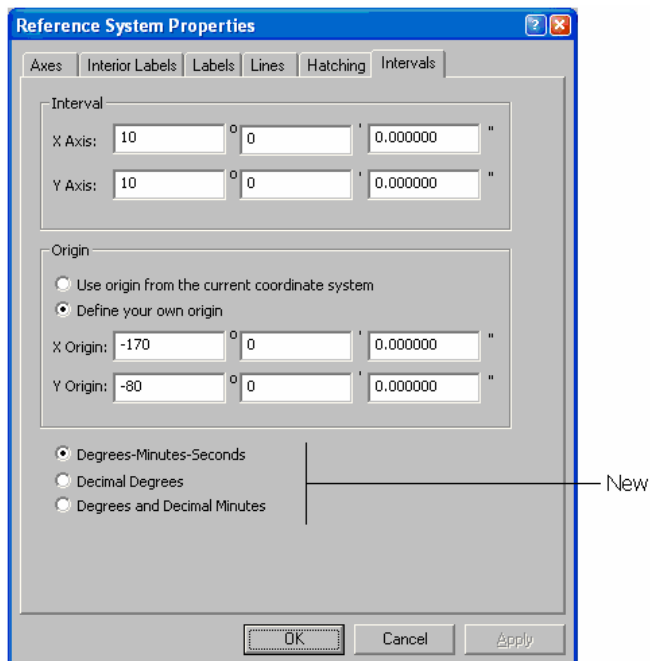
Note that these options aren't available in the Grids and Graticules wizard. If you launch the wizard to create a new graticule, intervals are specified in degrees minutes and seconds, but you can use the other options once you have created the graticule by opening the graticules properties dialog. (To use the Reference System Selector dialog instead of the wizard when you define a new grid or graticule, uncheck the 'Show wizards when available' box in the Tools > Options dialog General tab.

Coordinate system GCS_Assumed_Geographic no longer assigned to shapefiles

■ The shapefile format originally did not support coordinate system metadata. The ArcView GIS 3.x software allowed shapefiles to be projected on-the-fly if it determined that from the range of coordinates that they were in longitude, latitude. To help people transition from the ArcView GIS software to ArcGIS, a similar procedure was implemented in ArcMap. If a shapefile had coordinate values that looked like latitude and longitude values, a 'dummy' or 'fake' coordinate system was temporarily assigned to the data in ArcMap. This dummy coordinate system, called GCS_Assumed_Geographic_1, used the NAD 1927 datum. Using an assumed datum is problematic because if the data really uses a different datum, it causes some confusion and inaccuracy.

At 9.2, we have stopped assigning shapefiles this dummy coordinate system. Now that shapefiles have full support for coordinate system metadata, it is a much better practice for the software to no longer make assumptions about the actual coordinate system being used. So in 9.2, you no longer see shapefiles with GCS_Assumed_Geographic_1.

If you have any data whose metadata lists this coordinate system, please realize that the data does not have a valid coordinate system. You should check with the data provider or colleagues to see if you can identify the correct coordinate system, and define the data as such. You can use the geoprocessing environment to define the projection for multiple shapefiles. You may still see GCS_Assumed_Geographic_1 being used by data that was created by exporting or converting shapefiles that used it. We recommend that you, similarly, update the projection information for any data like that to use a valid coordinate system.

ArcMap can now automatically open your most recently used map

■ The ArcMap Start Up dialog has a new 'Load last map on startup' check box option that lets you tell ArcMap to automatically reopen the last map you were using when it starts. If you check this box, ArcMap will load your last map the next time it starts and display a message box while that map is loading that lets you press ESC and return to the Start Up dialog. By pressing ESC and unchecking the option, you can return to normal operation.

Map graphics and elements

■ A common request has been to provide the ability to name an element on a map or page so that code can be used to search for specific elements and perform operations on them. In ArcView 3 this was done through an object tag. In ArcMap elements using the ElementProperties base class (which is almost every ESRI element) have two properties CustomProperty (a variant) and Name (a string) that can be used for this purpose.

At 9.2 we have exposed this Name property in the properties dialog for all map elements and graphics in the Size and Position tab. In this way names can be specified directly through the user interface. Developers can take advantage of this by being able to find and manipulate elements by name:
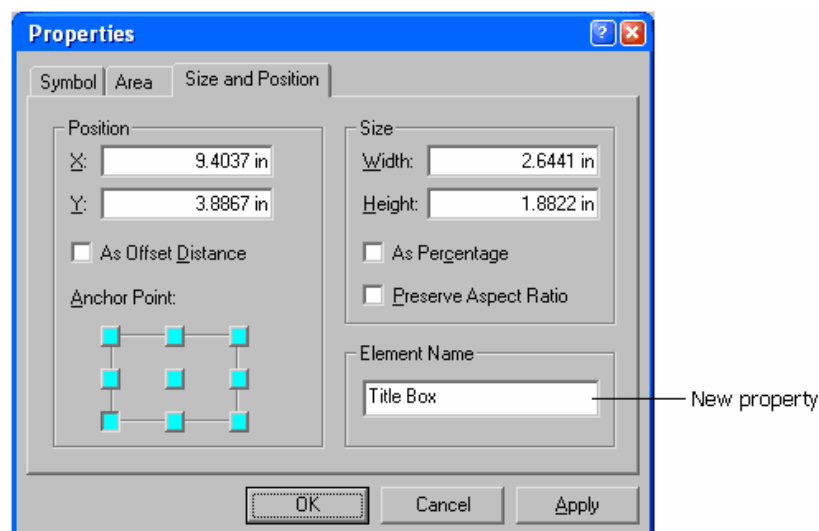
■ The anchor point (see the graphic above) is the location on an element from which the x and y positions are measured. At 9.2 each element has its own anchor point. Elements that can resize automatically in response to changes in the map, such as legends and scale bars, will keep their anchor point in place. For example, if you set the anchor point of your legend to the lower left the legend will expand or contract while keeping the lower left corner anchored to that spot. This applies when elements resize automatically in response to changes in the map and when editing the size and position values in this dialog. When you resize an element by dragging handles it will still resize in whichever direction you drag the handles. Previously, the anchor point used to be an application level setting, all elements used the same anchor point, and automatic resizing ignored the anchor point and always resized from the lower left.

■ When you use the drawing tools on the Draw toolbar you now press **SHIFT + F6** instead of the C key to enter the coordinates of a vertex by typing it in, because at 9.2 the C key is now the key you hold down to turn any tool into the Pan tool. The ability to draw by entering coordinates has also been added to the Ellipse tool and the Marker tool. For example when you use the Marker tool to draw a point on the map you can press SHIFT + F6 or **E** to type in the coordinates. When you use the Rectangle Tool you can press SHIFT + F6 or **E** to define the two corner points.

Tip: Get context sensitive help on any tool by clicking it with the What's This tool from the Standard toolbar to find out what shortcuts are supported specifically by the tool. (This help won't include generic shortcuts for map navigation that are available irrespective of which tool is currently active).

Improvements to map templates accessed via the File > New dialog

■ In the USA templates, the polygons in the 'United States' layer have been given a border so you can still see state boundaries if you turn off the separate 'State Boundaries' layer.

■ In the USA and World templates, graphics have been given a Label Weighting of None instead of High in the Labeling toolbar > Label Weight Ranking dialog so that drawing graphics on the maps, such as lines and study areas, don't cause labels to be suppressed in their immediate area.

■ In the USA and World templates, custom full extents (see earlier in this chapter) have been applied to the data frames so that when you press the Full Extent button you get taken to the extent of the region that the map is intended to show, not the extent of all the data in the map.

Drawing Errors window

■ The Drawing Errors window that appears if a layer cannot be drawn correctly is now much smaller and appears in the lower right corner of the ArcMap window, to make it less obtrusive. You can enlarge the window if you want to read the entire error message. This same window is also used for any errors that occur during export, printing, or print preview. Advanced users can suppress the Drawing Errors window using a new check box in the arcgis/utilities/ArcMapAdvancedSettings.exe utility. In that utility, go to the Data Frame/TOC tab to find the new check box.

Data Frame Properties dialog

■ The layout of the Data Frame Properties dialog Coordinate System tab has been improved so there is more space for the list of coordinate system details and the coordinate system tree. The coordinate system tree has been fixed so that folders containing folders now list those folders correctly (together as a group at the top of the list rather than sorted alphabetically with the coordinate systems). The coordinate system details listed in this tab now include the linear units used by the data frame's Projected Coordinate System and the datum of the Geographic Coordinate System used by the data frame's Projected Coordinate System.

■ A new property called 'credits' has been added into the View > Data Frame Properties dialog General tab. This provides a place where you can specify copyright, legal, or any other acknowledgement information about data or map represented in a data frame:
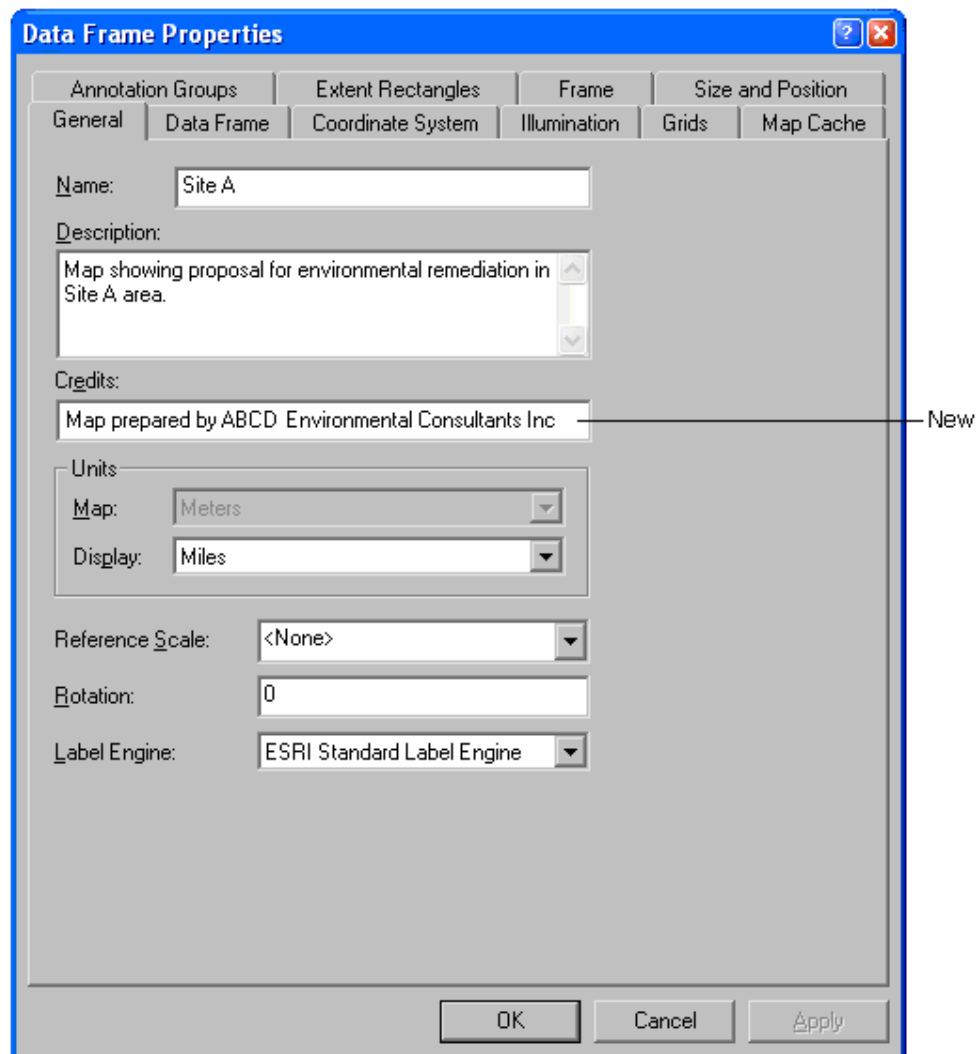
This complements the 'credits' property that has been added into the Layer Properties dialog General tab. If you are preparing a map document for publication and you want to include copyright information, you can choose whether to add it into the Data Frame Properties to specify copyright for the whole map, or to specify it for each individual layer, or both.

Symbology

Advanced symbology and symbol editing with cartographic representations

■ Whether you are making maps for reports and presentations, creating publication quality cartographic products, or publishing onto the web, you want to make great looking maps. 9.2 vastly extends the symbolization capabilities of ArcGIS with the introduction of cartographic representations. Representations allow you to get exactly the look you want without having to export your map to a graphics package like Adobe Illustrator. Using representations not only eliminates that step, it also allows map designers to store their work in the geodatabase for easy update management and re-use in multiple map products. ▶ *See the 'Cartographic representations' chapter of this document.*

Faster drawing fill symbols

■ All fill symbols with outlines in the ESRI default style, and a number of other styles, have been changed so that they now use simple line symbols instead of cartographic line symbols for their outlines. This change yields a drawing performance improvement when working with polygon data of up to 65% in many cases, with an average improvement of almost 25%. For example, the solid blue Lake symbol in the ESRI default style now draws 65% faster than previously with our test data.

Simple line symbols have better drawing performance than cartographic line symbols because cartographic lines support additional properties such as line caps and joins, dot dash patterns, etc. In symbols where these additional properties are not being used, using a simple line symbol instead provides faster drawing performance. Cartographic line symbols are only needed where you require the use of these properties and for additional line quality. Existing fill symbols that take advantage of cartographic line symbols to provide a particular appearance for their outline are not affected by this change and continue to use a cartographic line symbol in 9.2.

This solves the issue in ArcMap where people have sometimes reported reduced drawing performance after simply selecting a polygon symbol with a different color. When you add a polygon feature class to ArcMap, the default symbol it is drawn with always uses a simple line symbol for its outline. In previous releases, if you changed the color of the symbol by double-clicking it and choosing a different symbol from the Symbol Selector, this could reduce performance because the commonly used symbols in the default style used a cartographic line symbol for their outline. This is no longer a problem now that cartographic line symbols used for fill outlines have been replaced with simple line symbols where this change could be made without changing the appearance of the symbol.

The styles impacted by this change are:

- Civic
- Conservation
- Environmental
- ESRI (the default style)
- Forestry
- Geology 24K
- Hazmat
- Ordnance Survey
- Petroleum
- Public Signs
- Real Estate
- Soils Euro
- Survey
- Transportation
- Utilities

When you use the Symbol Selector in 9.2, the symbols you see will reflect this change. There are no additional steps you need to perform in order to start using the faster drawing fill symbols.

This change does not affect your existing map documents or layer files, so your existing maps and layers will continue to use the symbols you have already assigned to them. Remember that when you assign symbols to features, these symbol definitions are stored in the map document (or layer file if you save a layer out to disk) and there is no link back to the contents of the style files. If you want to take advantage of the faster drawing fill symbols in your existing map documents and layer files, you will have to update the symbology used in them. You can either replace the existing fill symbols with the same symbols from one of the 9.2 styles affected by this change, or you can simply edit the existing fill symbols to replace any cartographic line symbol outlines with simple line symbol outlines.

New style provides symbology optimized for drawing speed

■ A new style called the ESRI_Optimized style is provided at 9.2. This is a version of the ESRI default style that contains line symbols and fill symbols that are designed to perform while still maintaining a close visual appearance of their counterparts within the default ESRI style. The performance improvement is up to 65% in many cases. The fill symbols in the ESRI_Optimized style use simple line symbols for their outlines instead of cartographic line symbols. The picture fill symbols make use of emf files instead of the bitmaps that are used in the ESRI default style. The line symbols, as well as line fill symbols, use fewer layers and reduced widths to make up the performance improvements. There are a few symbols where the performance could not be improved and these were dropped from the optimized version of the ESRI style.

New classification method

■ A new classification method called geometrical interval has been added to the Classification dialog accessed from the Layer Properties dialog Symbology tab when you work with graduated colors or symbols. This method creates class ranges based on intervals that has a geometric sequence based on a multiplier (and its inverse). It creates these intervals by minimizing the square sum of elements per class; this ensures that each interval has an appropriate number of values within it and the intervals are fairly similar. This algorithm was specifically designed to accommodate continuous data. It produces a result that is visually appealing and cartographically comprehensive.

In the Desktop Help, see: Mapping and Visualization > Symbolizing data > Applying symbology > Standard classification schemes

Other

■ When you import symbology into a layer from another layer, the problem where the import sometimes doesn't match fields with aliases correctly has been fixed.

Accessing map services from the web

Improved support for ArcIMS image services

■ In previous releases, ArcMap sent no datum transformation information in requests it made to ArcIMS when accessing image services. At 9.2, support for projections has been upgraded in the ArcIMS Spatial Server. Many projections that did not work at all or worked incorrectly are supported. In addition, if a service uses a datum transformation, the datum transformation will be honored. ArcMap now takes advantage of these improvements because it now includes a datum transformation string in FEATURECOORDSYS and FILTERCOORDSYS tags in the GETIMAGE request made on the ArcIMS server. As a result, ArcMap will then receive an image from the ArcIMS server that has been properly transformed. This greatly increases the accuracy and reliability of working with ArcIMS image services inside ArcMap.

There may be instances where there is in error on the server or an erroneous transformation set in the services map configuration file, or maybe even an issue with the data and it's assigned coordinate system that causes spatial inaccuracy.

■ With ArcIMS 9.2, map service authors can now choose to block the ability of a client application such as ArcMap and ArcGlobe to access the geometry (the actual vector feature data) from an ArcIMS image service. Prior to ArcIMS 9.2, feature data could be extracted from an ArcIMS image service in various ways, which was problematic in situations where the map service was designed specifically to allow client applications to view the map but not access the underlying data. At 9.2, ArcIMS map service authors can now choose to prevent geometry data from being extracted.

What this means for you as an ArcMap or ArcGlobe user, or a user of a published map or globe in ArcReader, is that when you access certain ArcIMS image services, certain functionality will not be available to you and will be disabled in the user interface of the program you are using. When you access an ArcIMS image service that restricts access to its geometry, the functionality that is now disabled includes:

- Export
- Geoprocessing
- Buffering (Buffer Wizard)
- Flash (Identify & Find results)
- Set/Create Bookmark (Identify & Find results)
- Select by Location
- Create Selection Layer
- Change Selection symbol
- Zoom to (Selection & Find results)
- Pan to (Selection & Find results)

Functionality that is still available with these restricted services include:

- Identify
- Select by Attribute
- Selection rendering (if output image type supports transparency)
- Change selection color (if output image type supports transparency)

ArcIMS services which have geometry blocked can be identified in the service layer properties Source Tab. There is a new attribute within the Data Source information called "Query Results". This attribute will state whether the query results from this service "Do not include geometry" or "Include geometry". If you see "Do not include geometry" expect certain restrictions. The Source Tab also includes additional information regarding server restrictions: Disabled Output Types and Forbidden Requests:
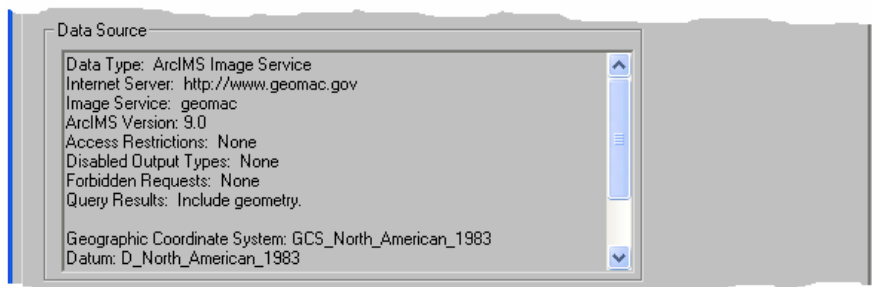
If ArcMap does not have access to the feature's geometry, all rendering will be done by the ArcIMS server impacts your ability to select ArcIMS image service features, how you can render this selection and how you can interact with this selection.

First, the ArcIMS server can restrict the kind of images it generates. If this restriction includes both png and png8, which support transparency, the ArcIMS server is sending ArcMap an image type that does not support transparency. In this case you will not be able to see selected ArcIMS image service features in your map. (Note: you will also not be able to give the background of the service transparency - this functionality will be disabled in the service layer's properties Advanced Tab). The reason for this is ArcMap needs to request a 2nd image from the server. This image is

limited to the selected features and is overlaid on the map. Since it is overlaid, the image needs to be transparent so that you can see features in the map that are not selected. You can still select features and view them in the layer's attribute table.

The second limitation concerns the rendering of the selected features. Since all the rendering in this case is done by the ArcIMS server, rendering options are limited by what the server supports. In this case, only the selection color can be changed. The "with this symbol" radio button in the Selection Tab of the ArcIMS service sub layer's properties dialog will be disabled.

Lastly, when using a 9.2 ArcIMS image service where the query results do not include geometry, you will not be able to perform map navigation tasks based on the selection. This includes, Zoom To, Pan To or creating spatial bookmarks. This also goes for the same and similar commands found in the context menus for Identify and Find results. These commands will be disabled in this case.

Tip for ArcIMS administrators: To restrict an image service as described above, you use the new parameter provided in ArcIMS 9.2 called 'returngeometry', in the configuration files for the ArcIMS query server (aimsqs.cfg) and the ArcIMS ArcMap Server (aimsamsrv.cfg). This parameter blocks a feature's geometry from being returned to a client as part of a response to a query request. This parameter has no affect on image requests. ► *See the documentation for ArcIMS 9.2 for more about this.*

■ When you add an ArcIMS image service into ArcMap or ArcGlobe, the legends for all of the sublayers in the service are now hidden by default in the Table Of Contents. Some ArcIMS image services have a large number of sublayers so this enhancement reduces the size of the entry that appears in the Table Of Contents when you initially expand the entry for a new ArcIMS image service. So for example, when you add an ArcIMS image service into a map (in this case the Calif_Watershed service from the Geography Network connection in ArcCatalog), and then expand its entry in the Table Of Contents, the legends for the sublayers are hidden by default:
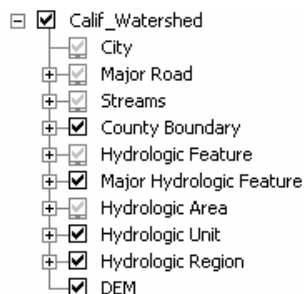
Tip: Don't forget you can hold down **CTRL** and click on any expand/contract box next to a sublayer to show or hide all of the legends in any map service or group layer in one click.

Support for new high performance cached map services from ArcGIS Server

■ At 9.2 all ArcGIS client programs (i.e. ArcMap, ArcGlobe, ArcReader, ArcGIS Engine applications, etc) can now take advantage of the new high performance cached map services that can be served using ArcGIS Server at 9.2.

These cached map services dramatically improve the rendering speed of complex maps. A cached map service serves a collection of map tiles that have been created in advance and organized by scale levels in a directory hierarchy. These services are designed to provide very fast drawing, especially when they are displayed at the scales at which they have been cached. Connecting to a cached map service is the same as connecting to other ArcGIS Server map services, whether the connection is via a LAN or over the internet. You connect to the server using the Add ArcGIS Server command in the GIS Servers folder in the Catalog tree, and then browse to the map service you want to add.

When you have added an ArcGIS map service to ArcMap, you can tell whether or not it is a cached service by looking at the new 'Map Service Type' field in the Data Source details list in the Layer Properties dialog Source tab. This indicates whether the map service is cached or not. When a service is cached the details window will also indicate the scales in which the service has been cached and the resolution of each pixel at each scale.

Layer Properties

General | Source | Layers | Advanced

Extent
Top: 3413668.044355 m
Left: -4204657.068511 m   Right: 3789752.366745 m
Bottom: -3331367.238409 m

Data Source
Data Type: ArcGIS Map Service
Connection: Internet
Server: http://drax/arcgis/services
Name: CachedMaps/USA_cached
Operations Allowed: Map (Display), Query (Identify), Data (Find) —— Lists the capabilities of the service
Map Service Type: Cached —— Tells you whether or not the map service is cached
Restriction: Sub-layers can't be turned on or off
Cache Scales:
1:4,000,000 (1 pixel = 1058.335450 m)
1:5,000,000 (1 pixel = 1322.919313 m)
1:10,000,000 (1 pixel = 2645.838625 m) —— If the map service is cached, the scales for which a cache exists are listed
1:20,000,000 (1 pixel = 5291.677250 m)
1:30,000,000 (1 pixel = 7937.515875 m)

OK   Cancel   Apply

One functional restriction when using cached map services is that you can't turn the sublayers contained in the service on or off. If you attempt to do this, you'll get a message. You can turn the layer representing the service on and off, but not its sublayers. You also can't turn the labels of the sublayers in a cached map service on or off. In the Data Source details listed above, the new 'Restriction' field highlights this restriction to make sure the end user of the service in ArcMap is aware of it.

All the other functionality that can be performed on non cached ArcGIS map services such as Identify and Find can be performed on cached map services (unless they have been restricted by the publisher). ArcGIS Desktop is able to request images from cached map services at map scales that are between the scales specified by the cache. In these cases, the client, ArcGIS Desktop, generates a new image by down-sampling map tiles (or rasters) from the next largest (represented by the smaller number) cached scale.

For example, the cached map service "cached_service" has three caches: one at 1:32,000,000, another at 1:16,000,000 and the final one at 1:8,000,000. Here is the service displayed at 1:16,000,000.
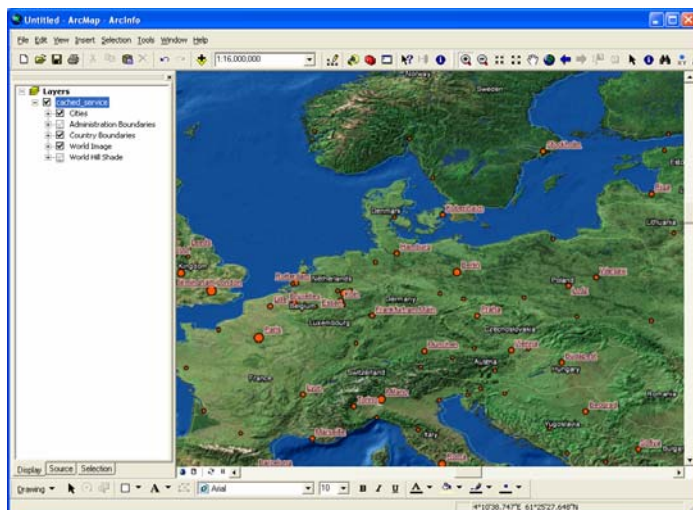
When zoomed out to 1:25,000,000, the display is down-sampling the map tiles from the next largest cache scale, the 1:16,000,000 cache. Therefore, the labels and symbology appear smaller:
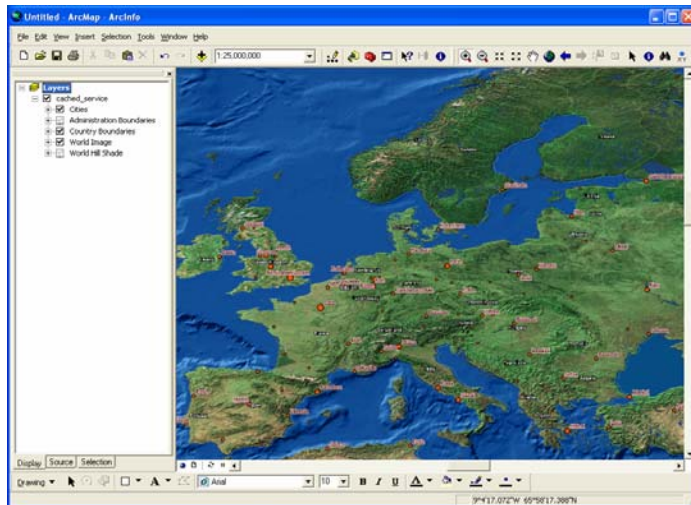
As you zoom past the last cache, in this case 1:8,000,000, labels and symbology will appear larger:
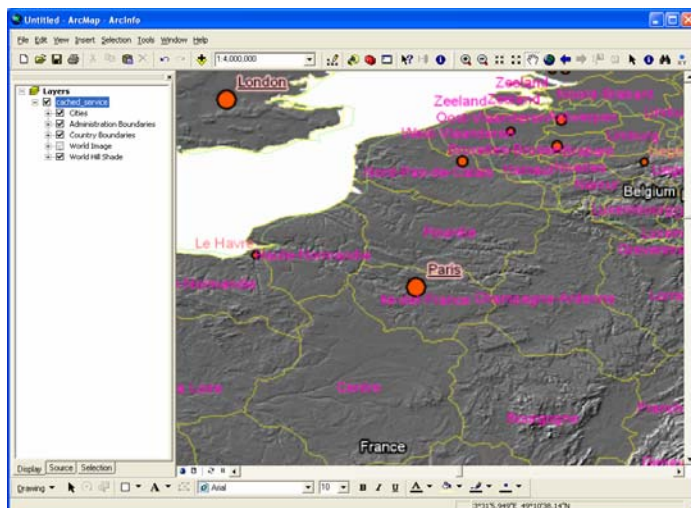
When an ArcGIS application connects to a cached map service a new directory, esrimapcache, is created under the current user's temp directory (ex: C:\Documents and Settings\<username>\Local Settings\Temp\esrimapcache) and a local map tile cache is created. This local cache greatly improves performance.

A button has been added into the Layer Properties dialog Advanced tab that enables you to clear this local cache. For example you may be working with a map service that is occasionally updated on the server by its publisher. By clearing your local cache you can ensure that ArcMap will get the most up-to-date version of the service the next time your map is drawn. You might plan on doing this prior to printing out the map. You may also decide to clear the local cache because you need to maximize the amount of free disk space you have:
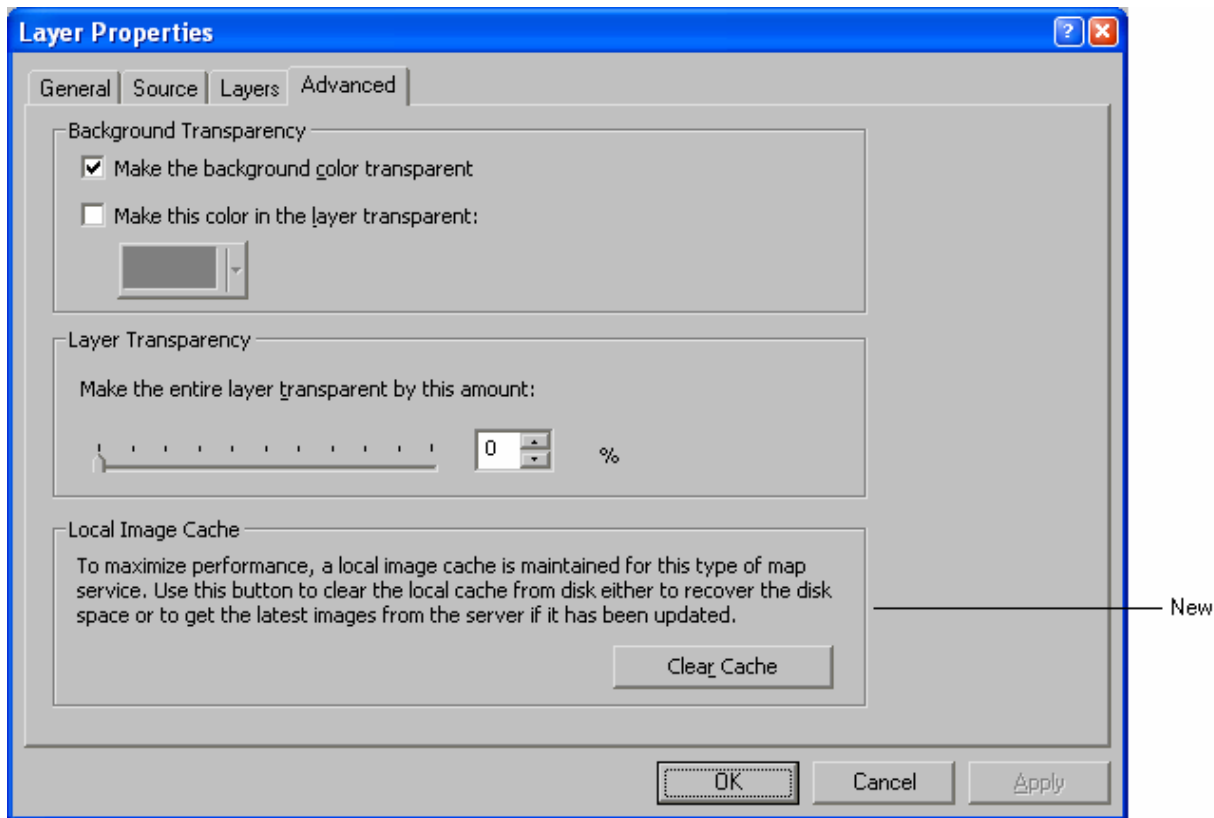
The Clear Cache button has no effect if you are working with a map service that is not cached. You can look in the Source tab of the Layer Properties dialog for information about whether the service you are working with is cached or not. The Clear Cache button is also present when you access a map service in ArcGlobe.

■ You can now tell what capabilities a map service you are connecting to via the Internet provides by looking at the new 'Operations allowed' field in the Data Source details list in the Layer Properties dialog Source tab. See the graphic at the start of this section. The three possible map service capabilities are:

- Map (ability to display the service)
- Query (ability to use the Identify tool to obtain the attributes of features)
- Data (ability to use the Find dialog Features tab to find features based on their attributes)

When you connect to a map service via a Local Area Network (LAN) connection, all operations are always allowed, so the Operations Allowed field isn't present.

■ When you add an ArcGIS Server map service into ArcMap or ArcGlobe, the legends for all of the sublayers in the service are now hidden by default in the Table Of Contents, the same way that they are for ArcIMS image services and WMS services.

■ All ArcGIS Server map services accessed through ArcCatalog or the Catalog Browser (Add Data dialog) are now listed as being 'map services' in the Type column in the ArcCatalog Contents view and in all properties dialogs. Previously they were called 'mapservers'. The same change has been made to the names of ArcGIS services to make the distinction between the servers you connect to and the services that are available on these servers.

Improved OGC WMS support

OGC (Open Geospatial Consortium, Inc) WMS (Web Map Service) is an OpenGIS standard specification for interactive mapping based on requesting map images from a server over the Internet. OGC WMS client support, which has been available in ArcGIS Desktop since 9.0 SP2, allows you to access these services over the Internet and add them to your maps and globes as layers. ArcGIS 9.2 supports OGC WMS 1.2.

■ ArcMap now supports transparency on all WMS image formats. Previously, transparency was only supported for GIF and PNG formats. 9.2 adds BMP and JPG format. Transparency is enabled by default when you work with WMS services, and by default the background color is used as the transparent color.

■ One of the biggest limitations of using OGC WMS in ArcGIS Desktop has been the inability to view WMS layers in a coordinate system not supported by the WMS server. At 9.2 we've changed how ArcMap handles WMS layers. WMS layers are now handled internally as a raster layer. This allows ArcMap to draw WMS layers irregardless of what coordinate systems are supported by the WMS server. WMS services are now automatically projected on the fly just like any other data source. Identify is fully functional in all coordinate systems provided that the WMS server supports GetFeatureInfo in the first place. You are still informed what coordinate systems are supported by the server. This information is available in the Source Tab of the WMS Sub Layer Properties dialog in ArcMap and in the WMS Service Properties dialog in ArcCatalog.

■ ArcCatalog now supports connecting to WMS services being served from web servers on which authentication has been enabled. The Add WMS Server dialog now has inputs for user name and password that you can fill in when you connect to such a WMS server:
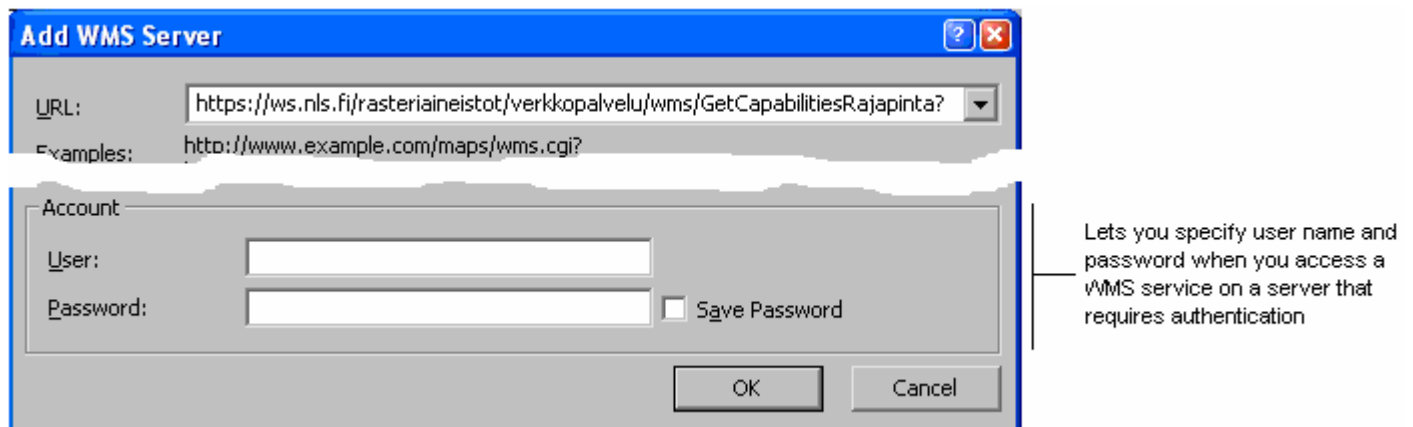
Web servers protected with certificate-based security are also supported (in which case a dialog will popup with information about the certificate).

Adding data into applications from GIS portals

■ The 'Add Data From Internet' pullright in the File menu in ArcMap has been removed at 9.2. The commands it contained are still available via the Tools > Customize dialog.

The primary function of this pullright was to add live services from the Geography Network into ArcMap. It was also used to add links to websites based on ArcIMS Metadata Explorer, from which live data can be added into ArcMap. Portal websites URLs launched from this pullright had the parameter 'mode=arcmap' appended to notify the website that 'Add to ArcMap' buttons were to be added next to any live services displayed in search results.

The pullright has been removed at 9.2 because it was not clear enough to many users which websites could be added into this pullright, especially as a number of important GIS portals, such as the US federal government's Geodata.gov system, don't utilize the 'mode=arcmap' parameter. The pullright also did not provide the ability to add services based on OGC WMS into ArcMap.

The recommended way to add live services from any GIS portal into ArcMap, ArcGlobe or ArcGIS Explorer is to find the connection information in the detailed information or metadata provided in the portal for the service and use that to establish a connection to the server.

For example, here's the connection information for an ArcIMS service available in the Geography Network. To make a connection, you copy and paste the map server URL into the Add ArcIMS Server dialog in ArcCatalog or into the Add Content panel in ArcGIS Explorer, and then access the service called OCTOP.
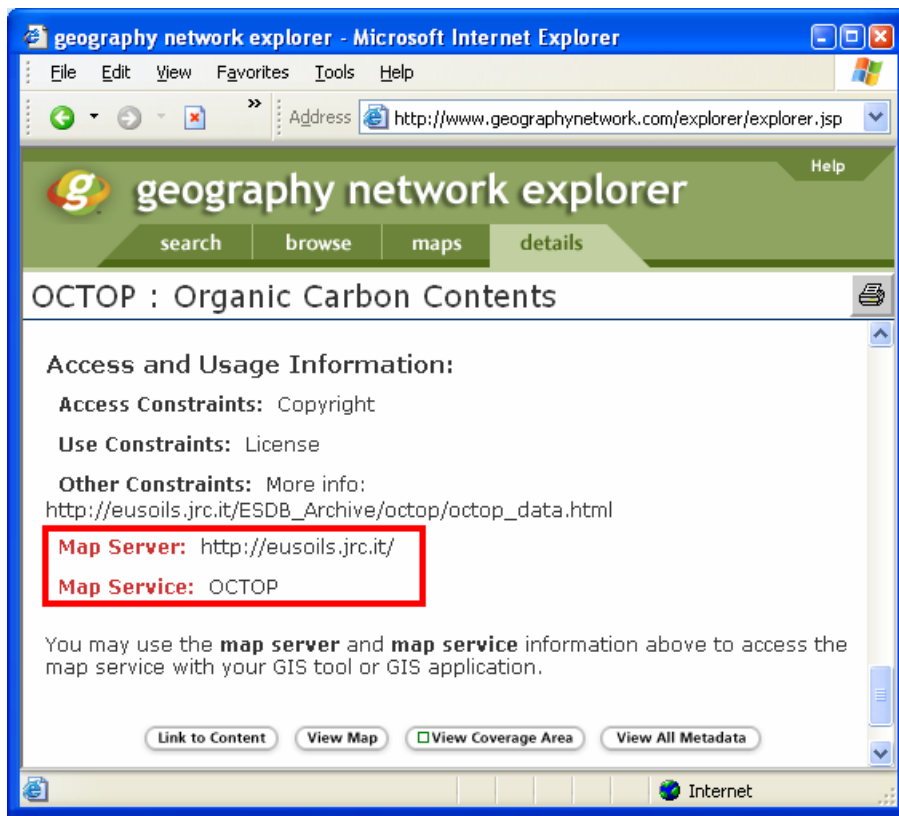
The example below, from the Geodata.gov portal, shows the connection information for a service in OGC WMS format. You can copy and paste this string into the Add WMS Server dialog in ArcCatalog or the Add Content panel in ArcGIS Explorer to connect to this service.
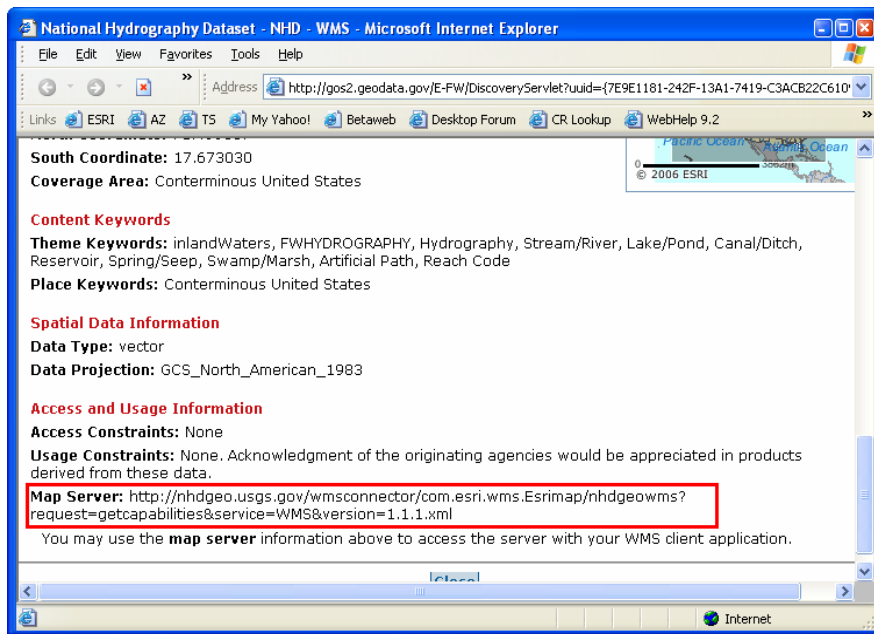
Note to ArcIMS Metadata Explorer users: you can still launch your Metadata Explorer-based website in 'ArcMap aware' mode by simply appending the parameter ?mode=arcmap to the end of its URL. This will ensure that 'Add To ArcMap' buttons appear next to any live ArcIMS services shown in the website. However, due to a technical issue in ArcMap at 9.2 resulting from a third party software compiler, the 'Add To ArcMap' button does not work correctly. We cannot guarantee that a fix for this will be available in a 9.2 service pack. (This issue was another motivation for removing the Add Data From Internet pullright at 9.2).

Cartographic representations

ArcGIS 9.2 introduces a new way to symbolize features using *representations*. With representations you can store symbology with your features in the geodatabase, and edit the appearance of these symbols on your maps without having to modify the geometry of the actual features being represented. Multiple representations can be stored for a feature class, enabling you draw the same features with completely different symbology, including edits you have made to individual symbols, on different maps.

A new layer symbology option is available to symbolize layers with a representation, a new interface is provided for configuring individual symbols within a representation, and a new set of editing tools are included to modify the appearance of features symbolized with representations.

Representations in ArcMap let you control the appearance of features in a way that previously required exporting your map to a dedicated graphics program. For example, you can symbolize line features with representations to have more control over dashed-line symbology:
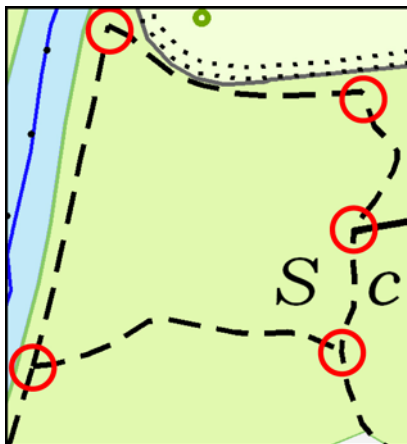
Lines with a regular dash symbol:
Ambiguous joins at line ends
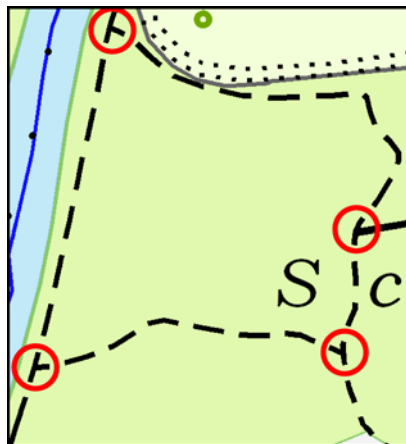
Lines symbolized by a representation:
Proper joins at line ends managed
automatically

You can interactively manage the
appearance of individual dashes

Representations can be created and edited with an ArcEditor or ArcInfo license. Representations can be displayed using any license level. Only geodatabase feature classes can store representations. Representations are not supported for other feature data, such as shapefiles.

New Representations layer symbology option

ArcGIS 9.2 includes a new layer symbology option for symbolizing a feature layer with stored representation information. A new *Representation* category appears in the Symbology tab in the Layer Properties dialog. The Representation category is only listed for layers whose data sources contain one or more representations. Representation information is stored with the layer's data source in a *feature class representation*. A single feature class can have multiple representations to support a variety of maps from a single data source:
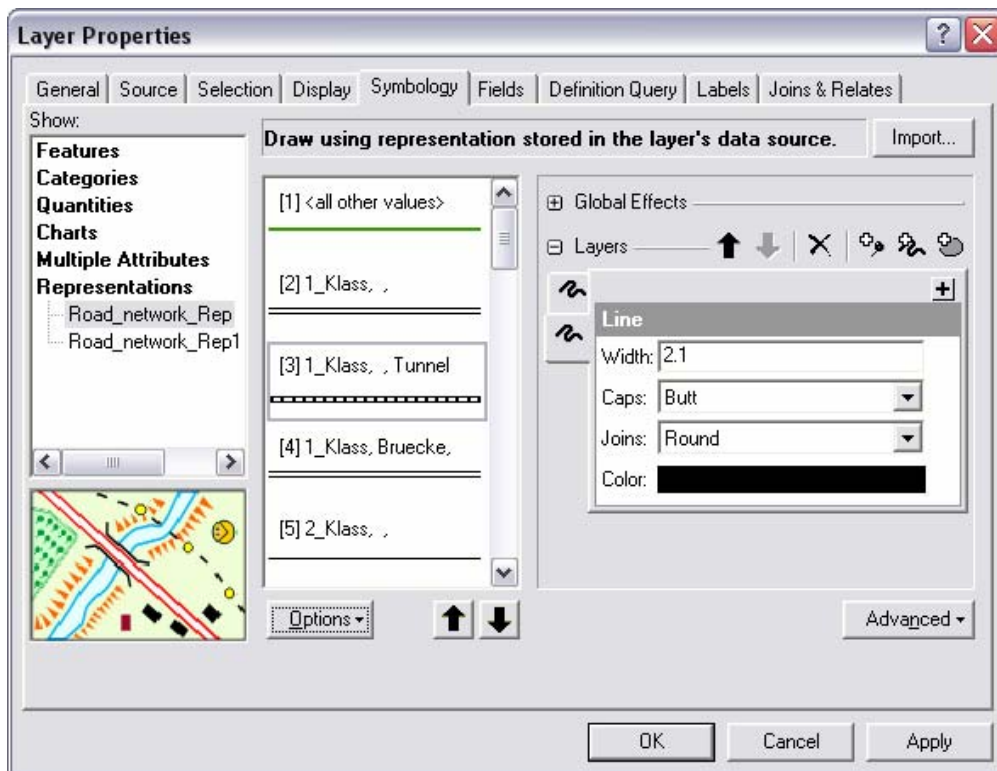
Convert existing symbology to representations

To create representations for an existing layer, right click the layer in the ArcMap Table of Contents and choose the new Convert Symbology to Representations command. This creates a new feature class representation for the layer's data source and translates the current symbology into representation symbology that you can edit with the new tools:
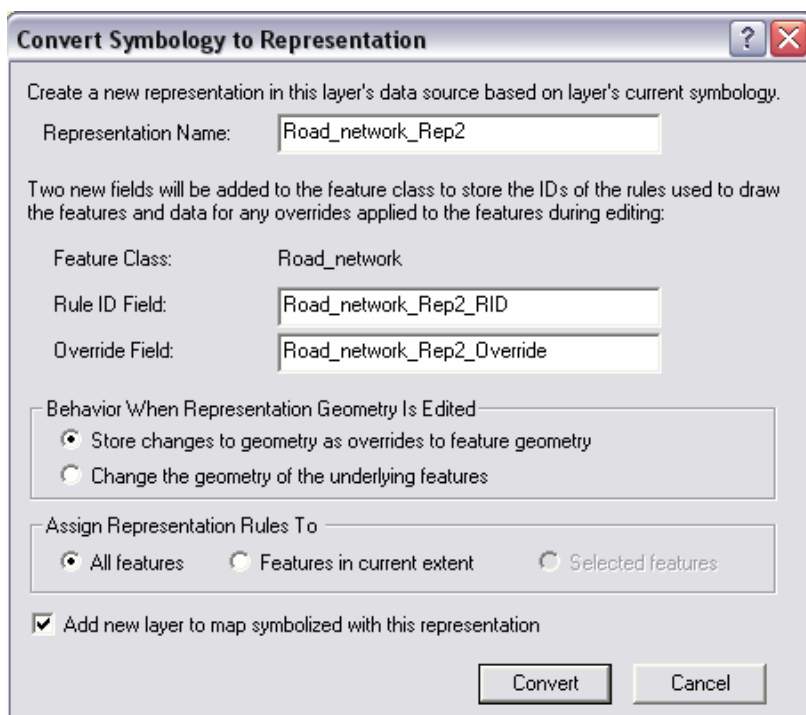
The Convert Symbology to Representations command is disabled if you are not using ArcEditor or ArcInfo or if the layer's data source is not a point, line or polygon feature class in a geodatabase.

New Representations tab on the Feature Class Properties dialog in ArcCatalog

Representation symbology information is stored in additional columns added to your geodatabase feature class. A new Representation tab is available in ArcCatalog on the Feature Class Properties dialog for working with representations. Here you can see a list of all of the feature class's representations. Multiple representations can be associated with a single feature class, so that the same data can be portrayed uniquely on different map products. You can also use this tab to create new representations, delete existing representations, and import *representation rules* from other representations:
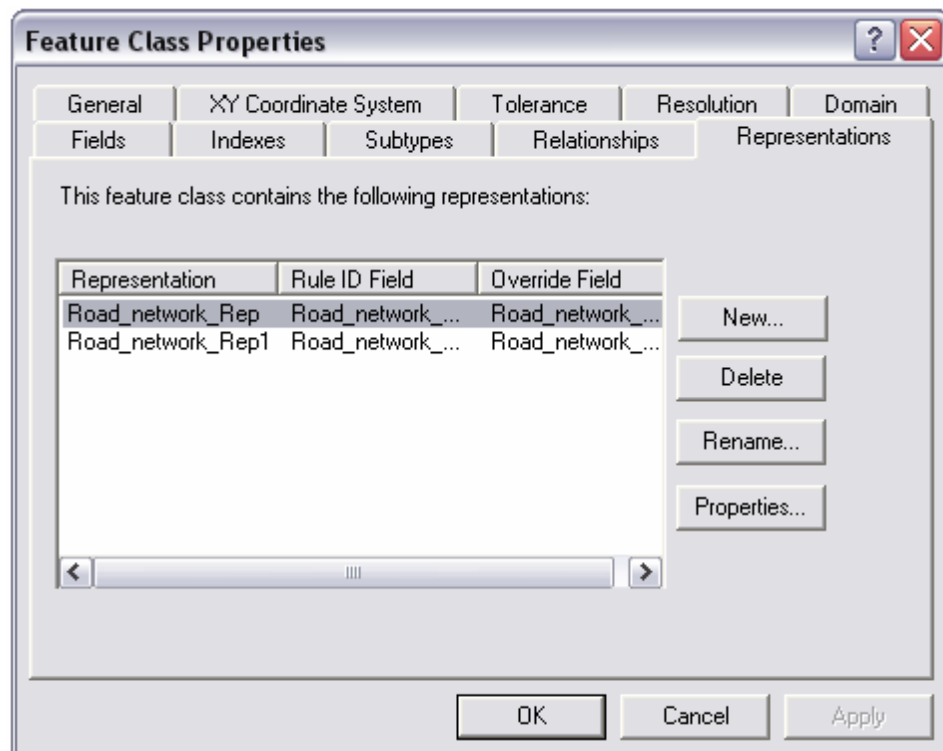
Representation rules

■ You display representations using representation rules rather than standard ArcGIS symbols. A new dialog is provided to interact with the individual properties that make up a representation rule. Existing ArcGIS symbols can be converted to representation rules through the symbology to representation conversion process.

Representation rules are made up of *symbol layers* and *geometric effects* that work in sequence to define how a feature will appear on your map. Symbol layers are the basic building block of the representation rule and can be one of three types: marker, line, or fill. A representation rule must have at least one symbol layer, but may have many to support complex depictions.

Geometric effects are optional components of representation rules. Geometric effects alter the geometry of features dynamically at draw time to achieve the desired appearance, without affecting the underlying shape of the feature itself. This means that a complex view of the data can be achieved without affecting existing spatial relationships. For example, you can use the *Dashes* geometric effect to draw one line layer with a dash pattern, and use the *Offset Curve* geometric effect to draw the entire line representation away from the feature geometry. Geometric effects can apply to just one symbol layer, or globally to all symbol layers in a representation rule. Geometric effects work in sequence, so the dynamic result of one geometric effect becomes the input for the next:
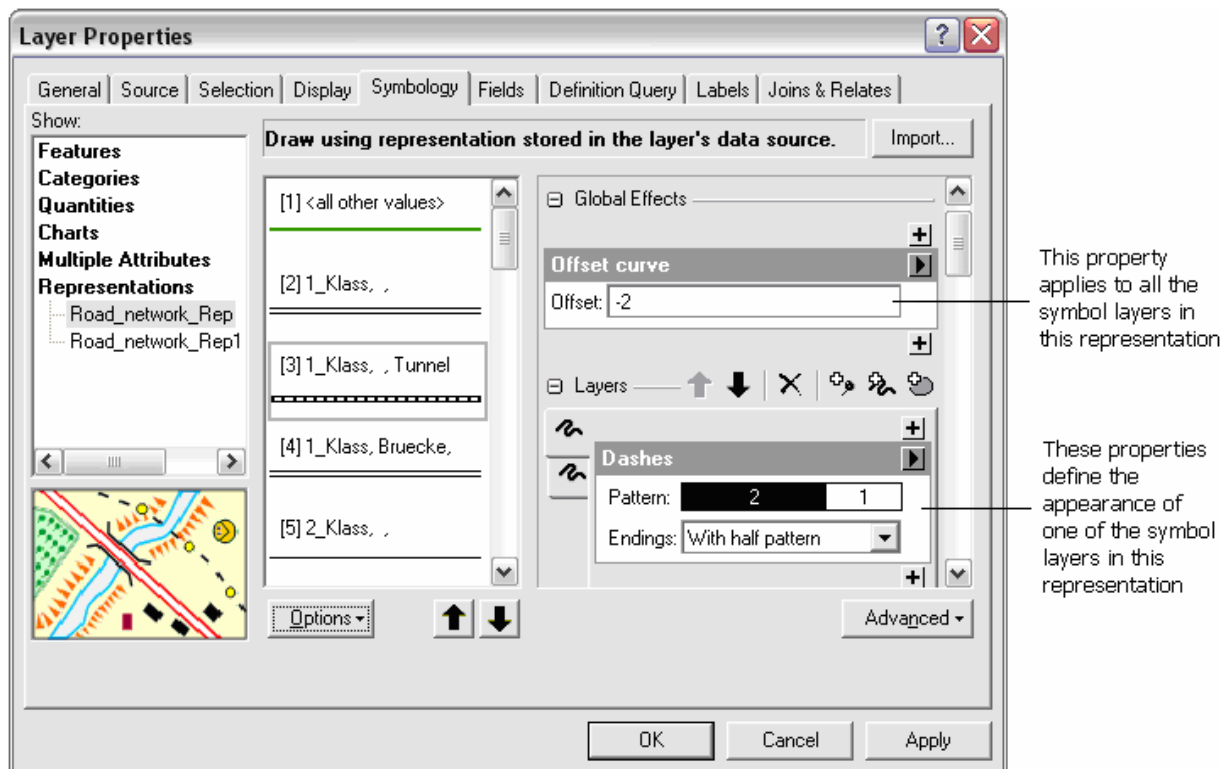
Representation properties can be mapped to fields in the feature class's attribute table:
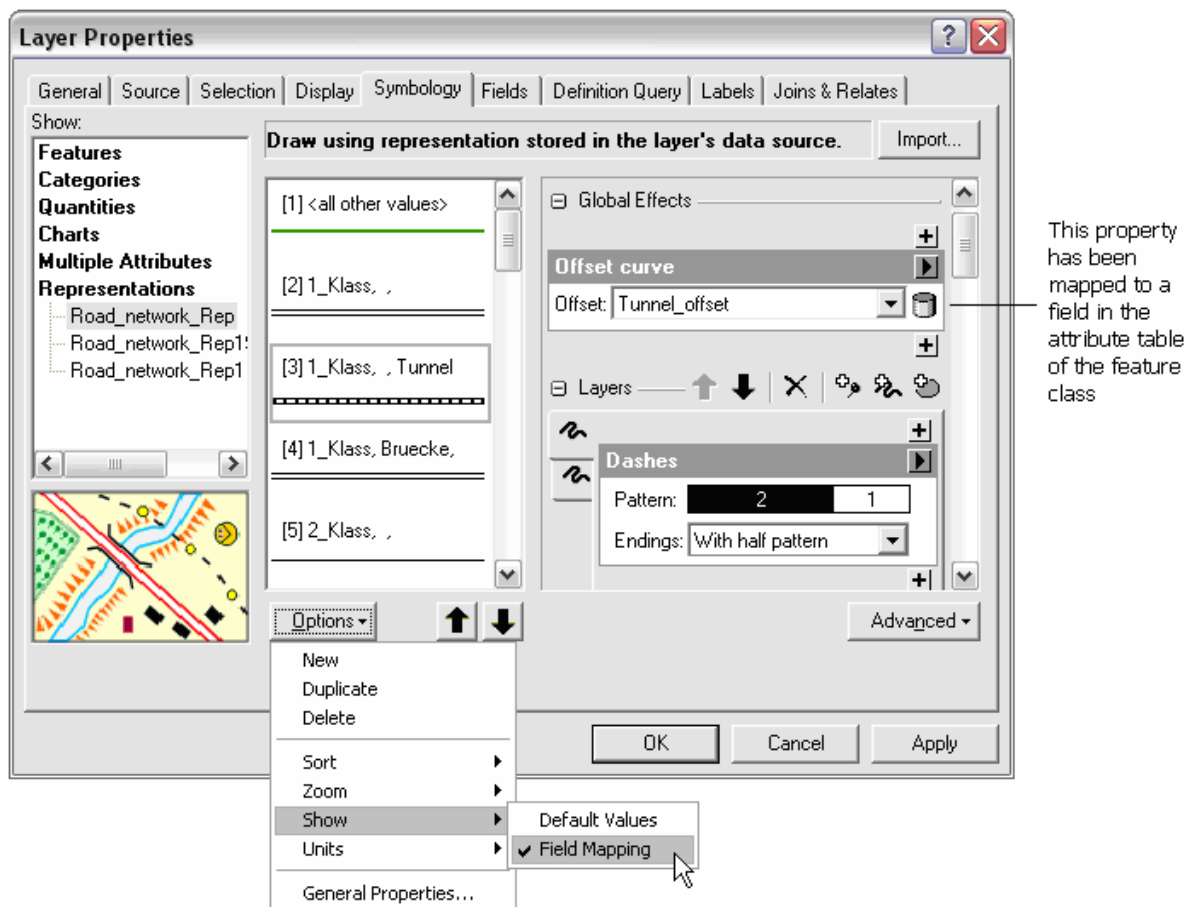
Using overrides and editing representations

■ A representation rule defines how a set of features in a feature class will be drawn. Representations allow an exception to be made to the representation rule in a manageable way to accommodate features whose circumstances warrant special treatment. For example, a single building or set of buildings could be changed to be symbolized in red with a white outline. These changes are stored and maintained in the geodatabase as *overrides.*

Geometry can also be overridden using representations. Geometry overrides allow you to modify feature geometry on your maps without affecting the geometry source features, which you may be using for other purposes (e.g. analysis, other mapping). Overrides can be further modified, or easily removed at a later time to re-apply the representation rule to the feature.

Representations allow you to change the spatial location or shape of features or properties of representation rules. For example, you can change the location of a line symbol to avoid an overlap with a nearby symbol, and you can edit one of the individual dashes in a dashed line and move it to improve the line's appearance. A set of representation editing tools is provided specifically for making these types of modifications. Representation editing tools are found on the Representations toolbar:

Representation edits are stored in the extra columns added to a feature class to store representation information, and these edits are available for any map on which the features are shown. To use the representation editing tools: add a feature class that has representations to ArcMap, on the layer properties dialog's Symbology tab choose to symbolize with one of the representations, start Editing (using the Editing toolbar), show the Representations toolbar, select a tool, and perform your edits.

In extreme cases where a feature requires a unique or complex rendering, its representation can be converted into a *free representation*, which gives you full artistic control of its appearance, even to the point of modifying the individual graphic elements that make up the representation. For example, a line feature may be represented by a series of markers spaced equally along the length of the feature. You can convert this line to a free representation and then manually delete or reposition individual markers to resolve conflicts with other map features or text:
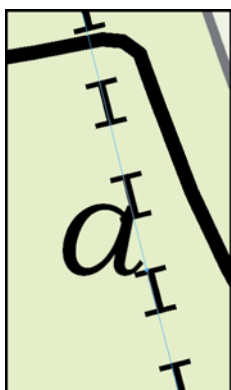
Original representation
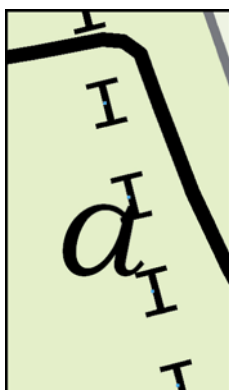
Free representation
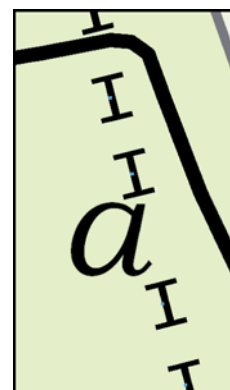
Free representation with repositioned markers

Representation geoprocessing tools

■ New geoprocessing tools have been added for working with representations. These tools can found be in the existing Cartography toolbox in three new toolsets: Graphic Quality, Representation Management, and Symbolization Refinement. All the tools in the Cartography Toolbox require an ArcInfo license:
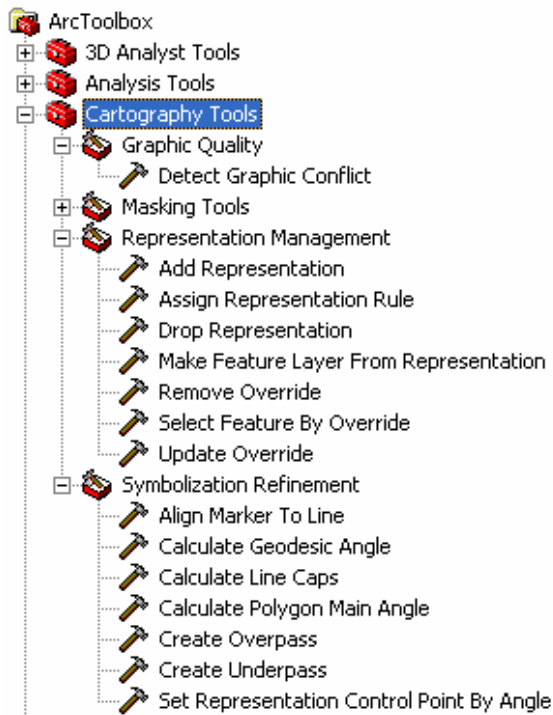
Here's an example of one of these representation geoprocessing tools, the Detect Graphic Conflict tool. This tool allows you to detect where the representation symbology of one or more feature classes overlaps on a given map, even if the underlying spatial geometry of the features does not overlap. Previously, identifying graphic conflicts on a symbolized map involved a time-consuming manual examination of features either on screen or on a plotted map.

The graphic on the left is before using the Detect Graphic Conflict tool. The graphic on the right is after using it.
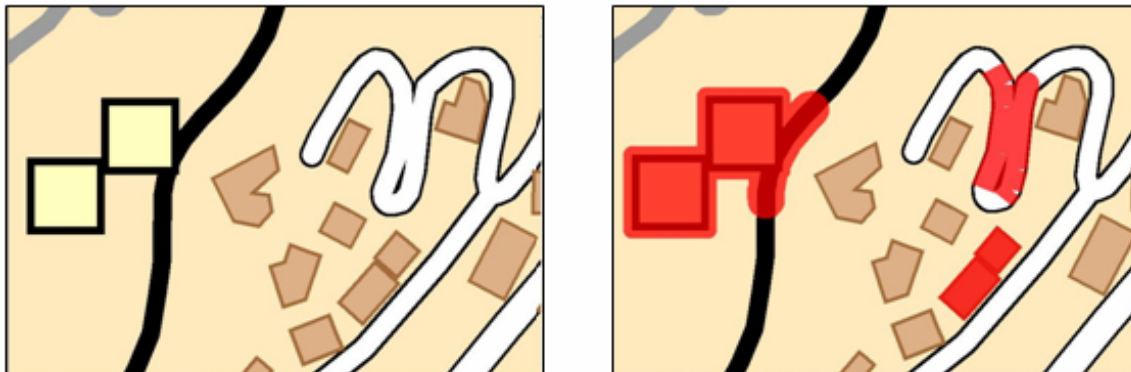
🔲 *In the Desktop Help, see: Mapping and Visualization > Using cartographic representations > Getting started with representations > An overview of representations*

To open the Representation Tutorial PDF workbook from the Desktop Help, go to the 'Getting Started > Tutorials > Tutorials' page.

Exporting & printing maps

Support for layers when exporting to PDF

■ When you export a map to a PDF, the resulting PDF now contains native PDF layer information reflecting the layers in the map. Anyone using Adobe Acrobat Reader version 6 or higher to view the exported PDF can turn the layers in the PDF on or off via the Layers control in Acrobat Reader. This makes exporting maps to PDF format even more useful as a way to distribute maps because now people viewing your PDF can choose what they want to see in the map for on-screen use or for printing.

Each layer in your map that is turned on at the time you export it becomes a layer in the resulting PDF. Each annotation group in the map is also shown as layer so that end users can turn the graphics drawn on top of the map on and off. In the example below, the three red labeled rectangles are in an annotation group called 'Test sites':
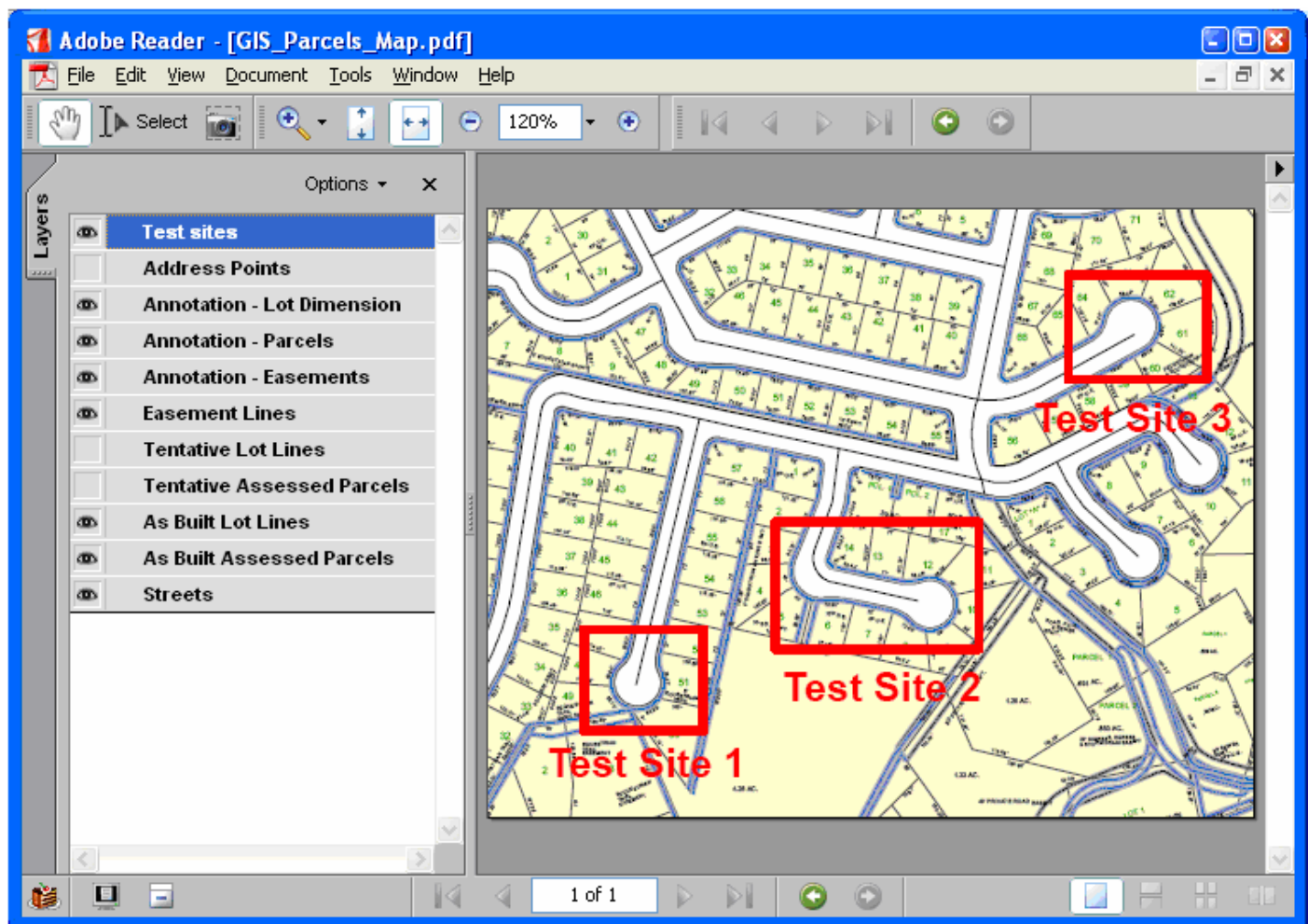
Other export enhancements

■ A new Picture Symbol option has been added into the File > Export Map dialog. This lets you choose how the symbols in layers will be handled. You can specify that picture symbols be handled by either rasterizing them or tracing them as vector symbols:
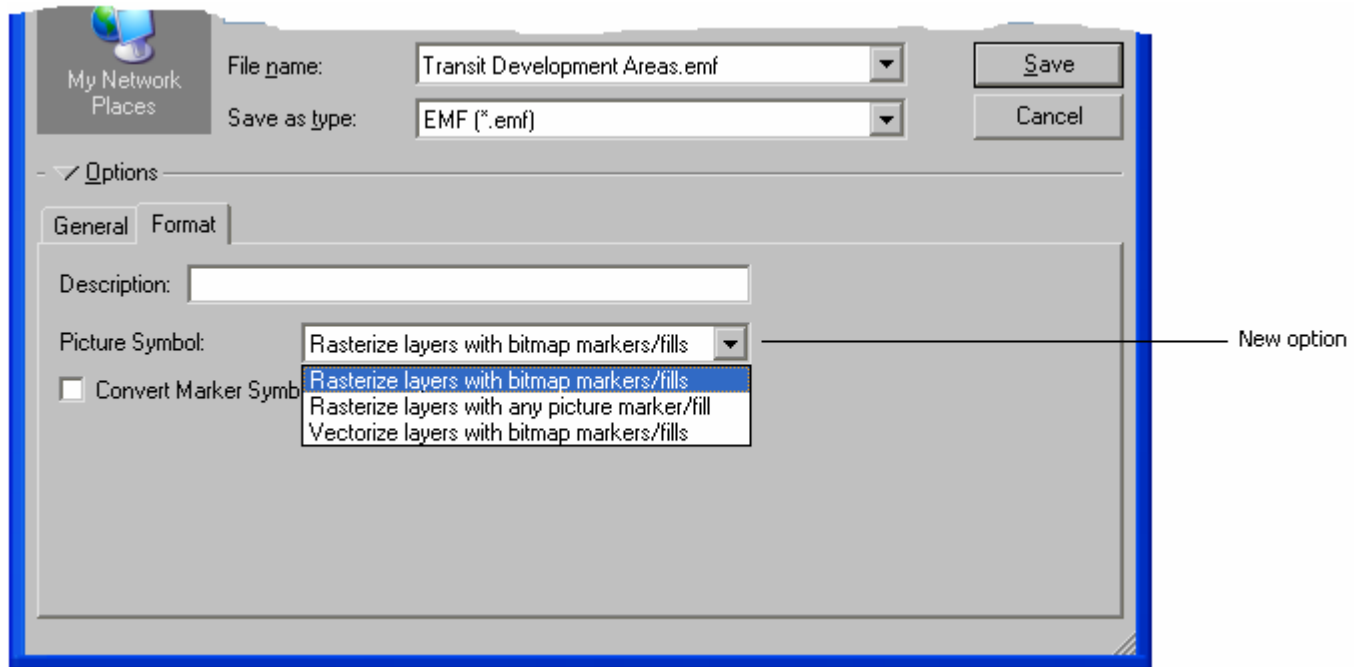
The main benefit of this is that it preserves the vector data below the picture symbols. Before this change, any map that used a picture symbol symbology that originated as a .bmp file had to be rasterized on output. Vectorizing the symbol results in much higher output quality.

Printing enhancements

■ New ArcPress 'Universal' drivers for HP and EPSON. Created in conjunction with the printer vendors, these drivers provide native support for HP DesignJet and EPSON wide-format printers with the ArcPress printer engine.

■ "Print to File" is now enabled when using the "Scale Map to Fit" and "Tile Map" printing options.

■ ArcMap no longer polls the printer multiple times when you open a document.

Visualization & analysis

Animation

■ Until now, the ability to create animations in ArcGIS has been limited to the 3D Analyst extension (ArcGlobe and ArcScene). ArcGIS 9.2 introduces the ability to create animations in ArcMap. Using the new Animation toolbar in ArcMap, you can create visualizations that might, for instance, animate data through time, make layers transparent or turn them off to reveal layers underneath, or alter the view by zooming in and out or panning the display.

Animations can be run in the ArcMap window or they can be exported to standalone video files and played separately:
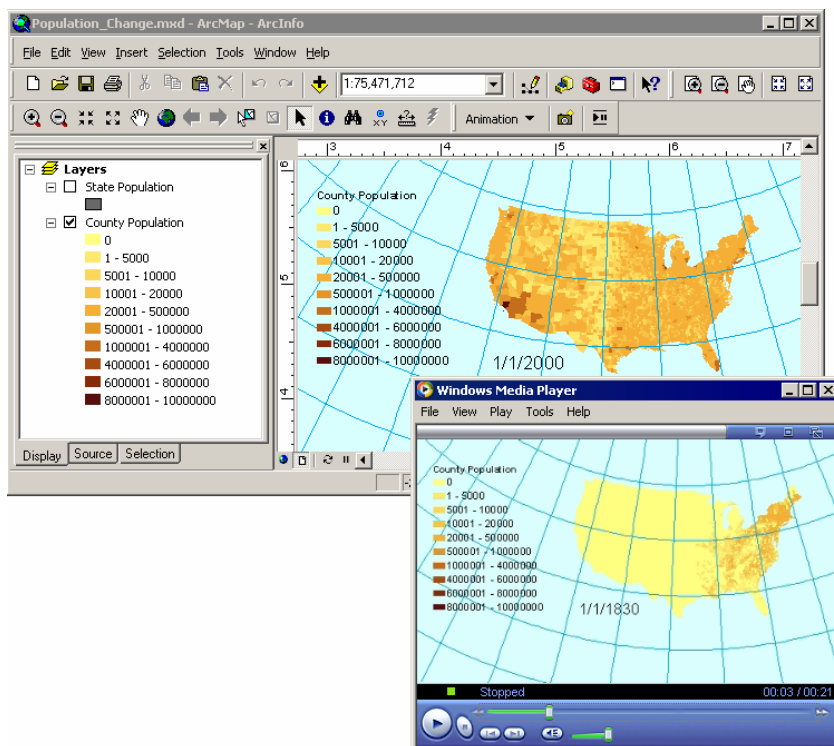
Animating through time

■ We've added the capability to animate through time in all three applications (ArcMap, ArcScene and ArcGlobe) through the addition of a Time Layer track. Any data with a date or value field in the attribute table can be animated through time. Feature classes, raster catalogs, netCDF data, and charts are supported.

Other improvements

These additional enhancements apply to all three applications (ArcMap, ArcScene and ArcGlobe):

■ Keyframes can be deleted on the Time View tab of the Animation Manager, and time can be added to the beginning or the end of an animation in the Animation Manager's Time View tab.

■ A keyframe can be added adjacent to an existing one on the Keyframes tab of the Animation Manager.

■ An animation can be played by setting up the number of frames to display.

■ Animations can be exported with a set duration.

■ The Create Group Animation dialog has been improved with new layer visibility options.

■ Animations are now supported in the ArcGIS Engine Developer Kit.

■ (ArcMap only). Graphs in ArcMap can be animated. For example, you can create an animation that shows the map content and/or extent changing while one or more graphs illustrating the same changes update dynamically.

■ (ArcGlobe only) You can now publish your animations over the web with ArcGIS Server. When you publish a globe document as a globe service with ArcGIS Server, the animation tracks in the document are also available in the service (► *See the '3D Analyst' section of this document for more information).*

Graphs

A new graphing engine has been added to ArcMap providing more options and better support for interactive analysis and visualization using graphs. The Tools > Graphs > Create command launches a new wizard:
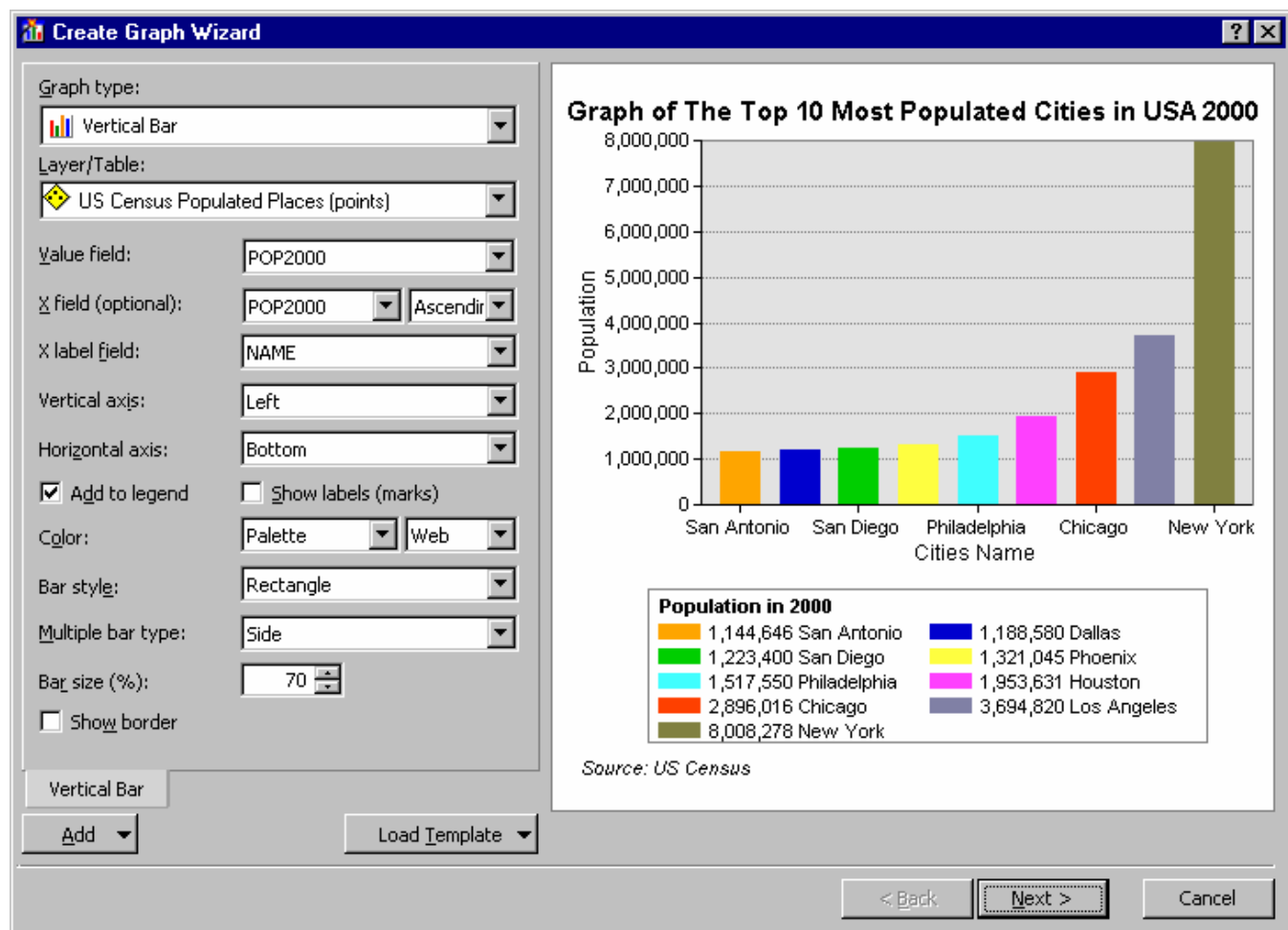
Graph types

■ The graph types below are supported in the new graphing engine:

```
⊟ 🗀 Bar
    ▮▮▮ Vertical Bar
    ▤ Horizontal Bar
    🏠 Histogram
⊟ 🗀 Line
    ⋀ Vertical Line
    〰 Horizontal Line
⊟ 🗀 Area
    ◢ Vertical Area
    ▶ Horizontal Area
    ⋰ Scatter Plot
    🖽 Box Plot
    ◓ Pie
```
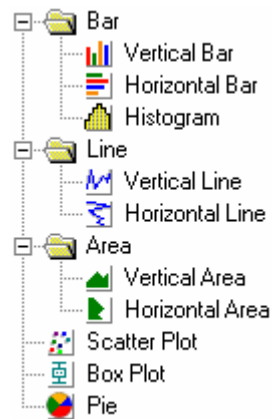
■ Each graph type can be displayed with a 3D effect if desired.

■ The Histogram is a type of bar graph that shows the frequency distribution of a dataset. The range of the values is split into equal-sized classes, called 'bins', and for each bin, the frequency (number of values it contains) determines the bar height.

■ Box plot (or Box-and-Whisker plot) graphs are an effective way of examining the statistical distribution of values between different datasets. (See below left).

■ It is easier to overlay graphs together in the new graphing engine. Any number of overlays can be defined and each one has the full set of graph properties. In the example on the right below, a bar chart and an area chart have been overlain, both drawn with a 3D effect:
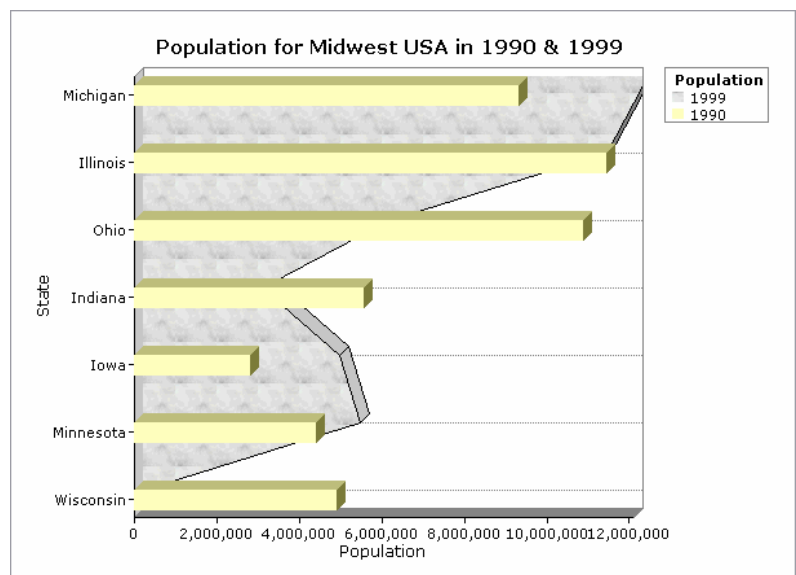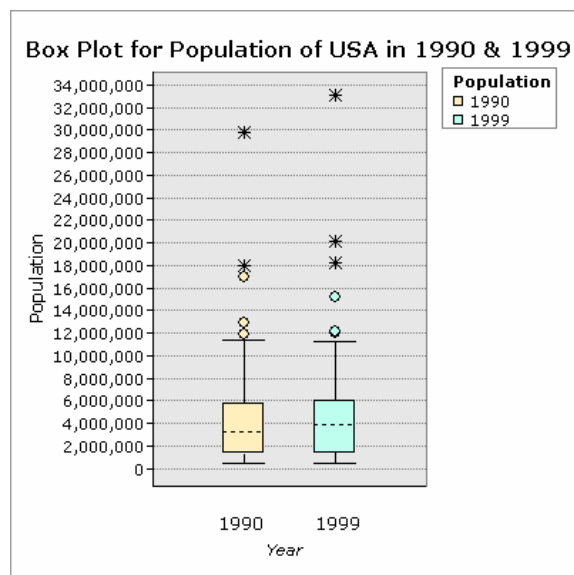
Appearance & Color

■ Graphs can now use the same colors as the symbology used for a layer. The screenshot below shows a chart using the same colors as the features in the map in represents:
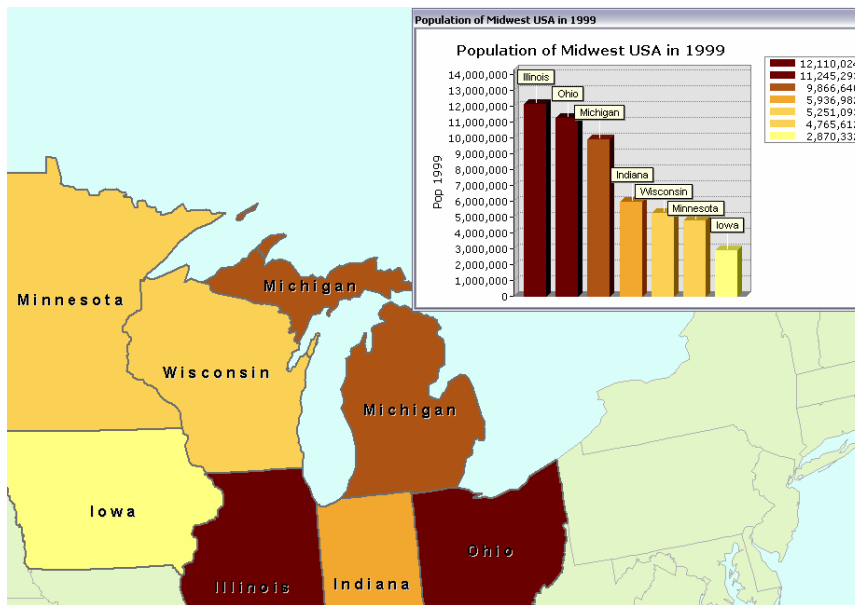
■ More control over the printing of graphs, including a Print Preview dialog.

■ Set the transparency of individual series for Area and Histogram graphs.

■ Many types of fills and gradients"are available for graph components.

Data handling and representation

■ You can plot data from several different datasets on the same graph. Each plot is called a "series".

■ The order of series and functions can be changed.

■ Select a different field as the independent variable for certain graphs. For vertical bar, line, and area graphs, the independent variable is the X field. For the horizontal versions of these, it is the Y field.

■ Sort (rank) the fields for bar, line, area, and pie graphs.

■ The independent axis can be labeled with other fields.

■ Axes can be independently logarithmic, allowing semi-log and log-log plots.

■ Better handling of temporal data and time axes. You can use time as a graph axis and have its display dynamically updated between months, days, hours, minutes, and seconds as you zoom in.

■ Mathematical functions (previously called 'trends') for any available series can be plotted. The following new mathematical functions are available: Count, Cumulative, Exponential Moving Average, Exponential Trend, Median, Mode, Moving Average, Root Mean Square, Standard Deviation, Trend, and Variance.

■ No restriction on the number of overlay lines. Overlay line graphs can be created from any field of any available dataset.

■ Graphs can be included in animations created in ArcMap.

Dynamic feature selection

■ You can choose how a graph will represent the selected set of features using these options in the New Create Graph wizard:

■ Better feature selection linking between maps, tables and graphs. Selecting features on the map, in a table or in a graph is immediately represented in each of these views (like it did in ArcView 3.x). In the example below, features have been selected by dragging a box in the graph, and this feature selection is immediately reflected on the map and in the table:
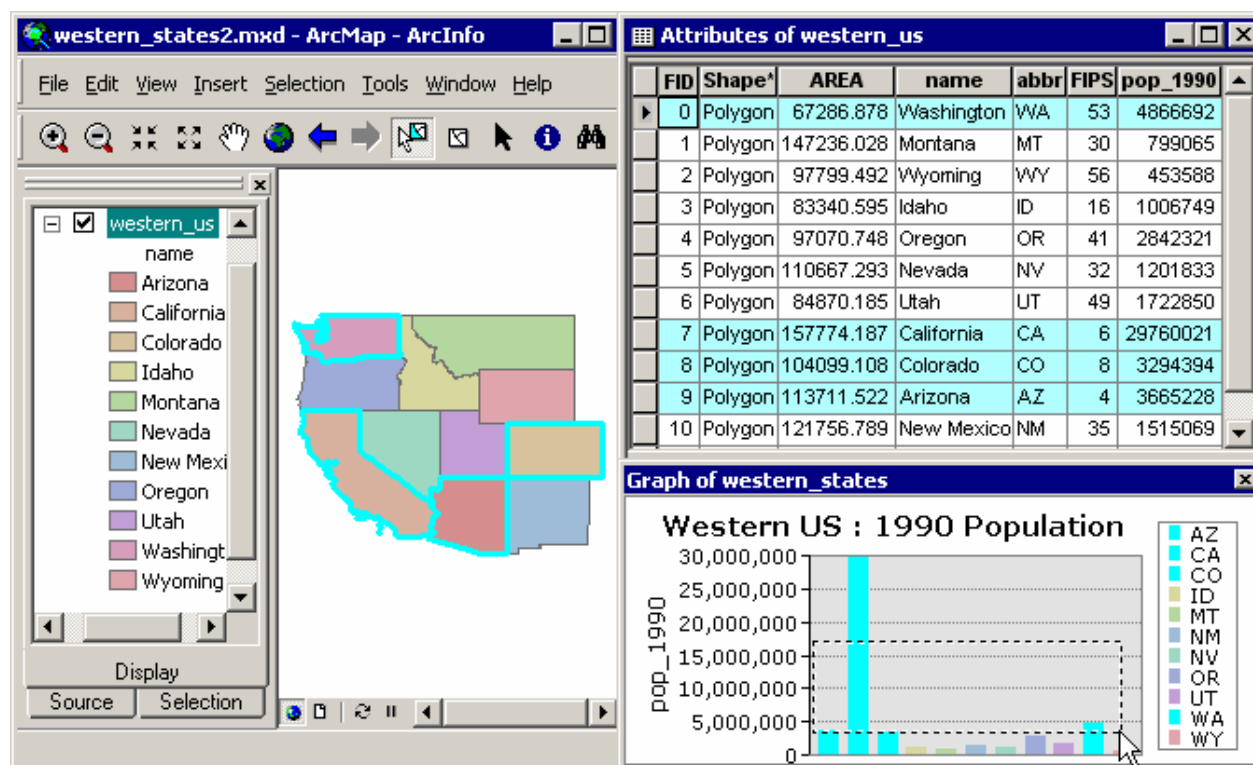
Graph Manager

■ The Graph Manager has been improved. It is now modeless and resizable, and displays the name of the source layers and tables for each of your graphs. Graphs can be sorted alphabetically by name and by graph type:
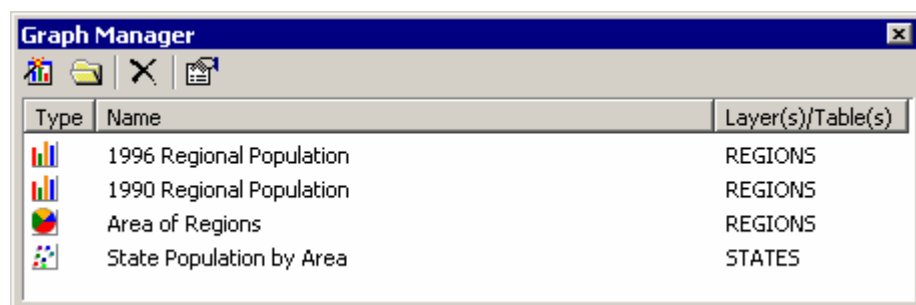
■ Graphs can be exported to some additional formats.

Compatibility of existing graphs

■ Graphs created with the new graphing engine and your existing graphs can co-exist in the same map document. Your existing graphs can still be opened, modified, and so on. The existing ⬛ Create Graph wizard is still available via the Tools > Customize dialog Commands tab in the DataGraph category. Graph types not available in the new graphing implementation are: Bubble, Polar, and High-Low-Close. If needed, these types can still be generated by using the old Create Graph wizard.

In the Desktop Help, see: Mapping and Visualization > Working with graphs and reports > Looking at data with graphs > About looking at data with graphs

Time

■ There have been enhancements to many areas in ArcGIS 9.2 to improve its capabilities with temporal and multidimensional data, and to make it easier to integrate the variable of time into the GIS. Together, these enhancements let you integrate time more easily into your GIS visualization and analysis. This includes analyzing historical change, understanding recurring patterns at different time scales (such as annual, seasonal, and diurnal changes), and predicting likely trends and iterations in the future.

These enhancements include support for new types of data (such as the multidimensional netCDF data and feature history stored in the geodatabase), improvements in display and visualization with improved animation and graphing, and improved iterative analysis capabilities with the addition of looping and batch processing to the geoprocessing framework and ModelBuilder.

NetCDF data support

■ ArcGIS 9.2 adds support for netCDF data. This is a binary data format commonly used for storing temporal and multidimensional data, especially in atmospheric, climate, and oceanographic applications. It is used for both observational data as well as storing the results of numerical models, such as large scale weather forecasting or climate change models. It can be displayed, graphed, animated, and used in analysis, like any other data source. You can also export GIS data to netCDF.

A new Multidimension geoprocessing toolset is provided at 9.2 for creating and working with data in the netCDF format. The tools for reading netCDF data allow you to create raster layers, point feature layers, and table views of netCDF data by selecting a variable of interest and the desired dimension variables, such as which dimension should be mapped to the x axis, y axis, or time. ArcGIS reads and writes the CF convention of netCDF, including a definition of how to store map projection information, which is critical to its effective use in a GIS. netCDF layers and netCDF table views can be used just like other layers and table views. They use the same display renderers, can be included in graphs and animations, and used as input to geoprocessing tools. You can also export native raster, raster catalog, feature, and table data to netCDF format.

```
Multidimension Tools
    Feature to NetCDF
    Make NetCDF Feature Layer
    Make NetCDF Raster Layer
    Make NetCDF Table View
    Raster to NetCDF
    Select by Dimension
    Table to NetCDF
```
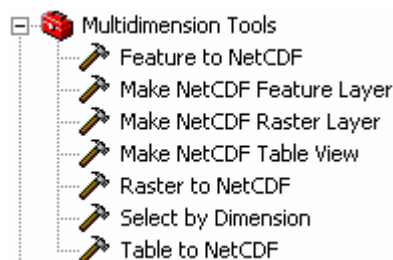
If a netCDF file contains multiple variables, you can create layers for each variable and for various combinations of dimensions for each variable.

Variables in netCDF files can be used in various ways. For example, from the wind direction variable (wind by x, y, and time) you could create the following layers and tables in ArcMap:

- A raster of wind direction for a given time.
- A point feature class of wind direction for a given time.
- A point feature class of wind direction over the entire time period (overlapping points).
- A table of wind direction, x, y for a given time.
- A table of wind direction, time, x, and y.
- A table of wind direction, time for a given x and y pair.

For example, the screenshot below shows a netCDF dataset with wind speed, wind direction and temperature data from the US National Weather Service's National Digital Forecast Database (NDFD). Two layers have been defined, one to show wind speed and direction, the other to show the temperature:
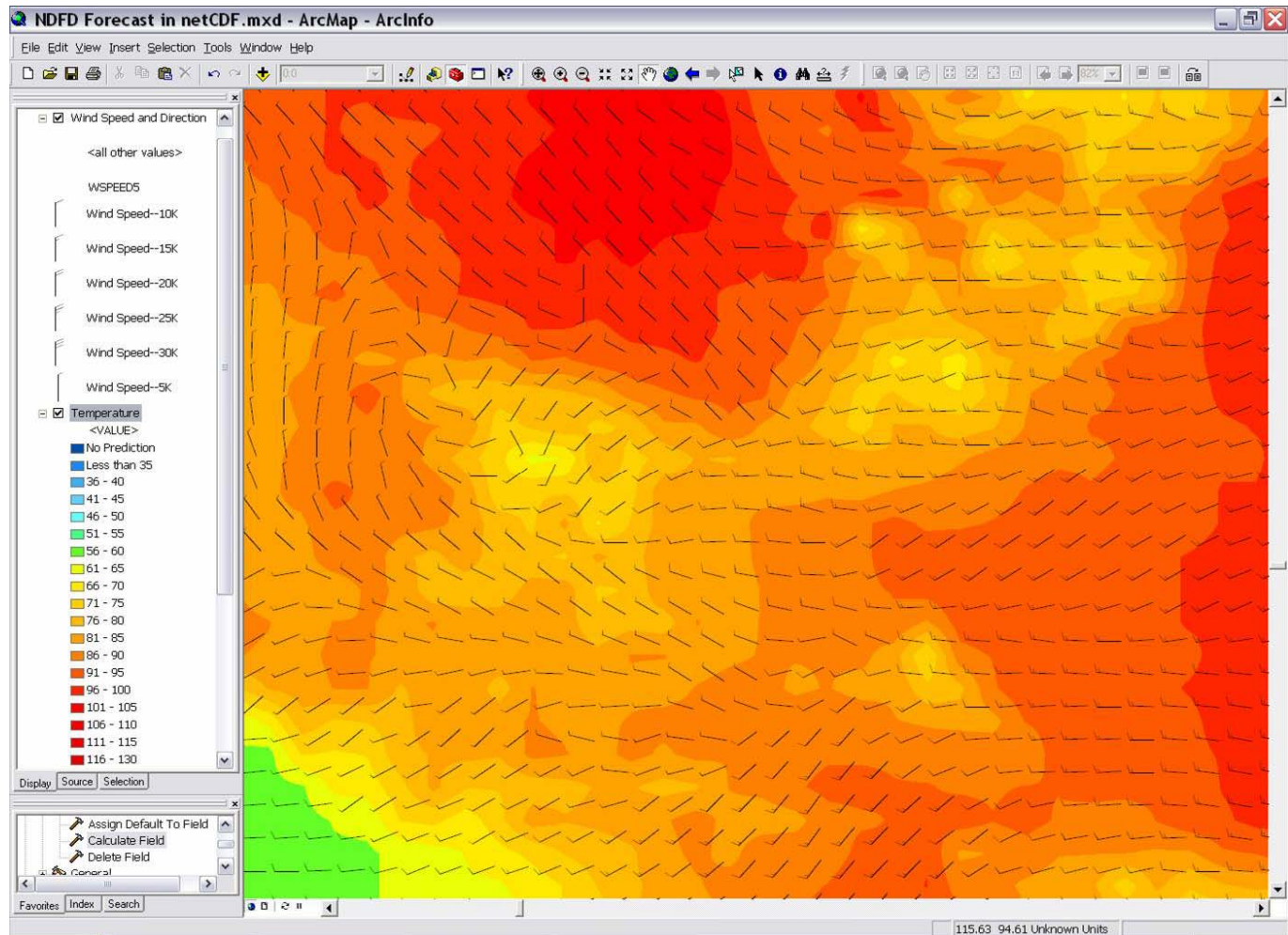
📄 *In the Desktop Help, see ' Data support in ArcGIS > netCDF: multidimensional, time series data > An overview of netCDF data > What is netCDF data ' in the Desktop Help.*

Other enhancements related to time

■ **Graphs:** Graphing has been greatly improved at 9.2. It is now possible to use time as a graph axis and have its display dynamically updated between months, days, hours, minutes, and seconds as you zoom in. Graphs can now also be animated and synchronized with the map. ► *See the separate section above.*

■ **Animation:** At 9.2 the ability to create animations has been added into ArcMap. Previously, animation was only available in ArcGlobe and ArcScene in the 3D Analyst extension. The Animation Manager has been enhanced to support temporal animation, so that you can synchronize the display of multiple layers on the same time interval or time step. Feature classes, raster catalogs, and netCDF data can all participate in a temporal animation. In addition to animating maps, scenes, and globes, it is also possible to now animate graphs and synchronize their update with the time display of the map. ► *See the separate section above.*

■ **Looping and iteration in models:** The geoprocessing framework and ModelBuilder now have the ability to perform looping and iteration. This enables the output of a process be the input to a previous process in the same model. Batch processing is now also supported. These capabilities are critical to temporal analysis where you may have 50 time steps that all need the same processes applied to them. ► *See the 'Geoprocessing' chapter of this document.*

■ **Historical archiving of data:** The new geodatabase archiving capability introduced at ArcGIS 9.2 makes it easier to maintain, query and analyze the historical record of changes to features over time without working with versions. You can connect to historical instances of the database and view how it looked at a specific time or see how it has evolved over time. ► *See 'Geodatabases and ArcSDE' chapter of this document*

■ **Tracking Analyst extension:** The ArcGIS Tracking Analyst extension provides tools for playback and analysis of time series data. Tracking Analyst helps visualize complex time series and spatial patterns and interactions and integrating this data into the GIS. Tracking Analyst deals with the location of moving objects, such as hurricanes, vehicles, aircraft, etc whereas netCDF data handles continuous phenomena such as temperature that vary constantly over time and space. At 9.2 Tracking Analyst offers improved support for very large historical datasets, support for date and time stored in separate fields and more. ► *See the Tracking Analyst section of this document in the 'Extensions' chapter.*

Other

A number of additional enhancements have been made that improve the analysis capabilities of ArcGIS:

Random data generation

■ Random data is used in sensitivity analysis, simulation and stochastic modeling. The following new geoprocessing tools are provided for random data generation:

🔧 Data Management Tools > Raster > **Create Random Raster**

Creates random rasters based on a variety of distributions, from Normal to Binomial. The tool also respects the new Random Number Generator environment setting that gives you the flexibility to set one of three random number generators (Mersenne Twister, ACM599, and Standard C). This tool is ideal for use with looping models (new in 9.2) that analyze error, sensitivity or seek to model processes.

🔧 Data Management Tools > Feature Class > **Create Random Points**

Places a user specified number of random points within a specified extent. A variety of options gives you the power to place points within features of another feature class and base the number of random points placed on a field or a number.

Spatial Statistics

■ In the Spatial Statistics geoprocessing toolbox, the following tool has been added:

🐾 Spatial Statistics Tools > Analyzing Patterns > **Multi-Distance Spatial Cluster Analysis (Ripley's K function)**

This tool analyzes features at multiple distances and scales to see where spatial processes causing clustering are most pronounced.

■ The following spatial statistics tools have also been enhanced: Mean center, Central feature, Hot Spot Analysis, Cluster Outlier, Spatial Autocorrelation, and High/Low Clustering tools

Spatial Analyst extension

■ At 9.2, the ArcGIS Spatial Analyst extension adds new geoprocessing tools for solar radiation, three new math tools, and more. ► *See the Spatial Analyst section in the 'Extensions' chapter of this document.*

Geostatistical Analyst extension

■ The ArcGIS Geostatistical Analyst extension provides a variety of tools for spatial data exploration, identification of data anomalies, optimum prediction, evaluation of prediction uncertainty, and surface creation. At 9.2 this extension adds smooth interpolation, moving window kriging and more. ► *See the Geostatistical Analyst section in the 'Extensions' chapter of this document.*

Geoprocessing

Working with tools

New batch mode for tools

■ When you right-click a tool in ArcToolbox you'll see a new Batch command:
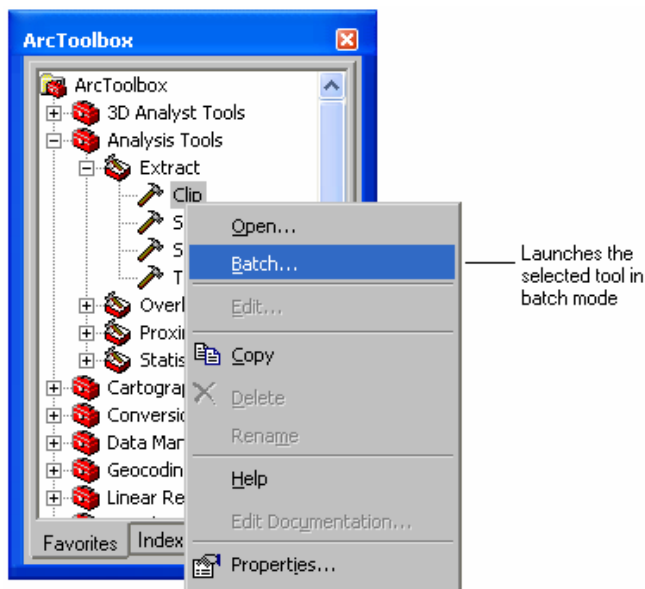
This command opens the tool for batch processing. The tool's parameters are exposed as cells in a grid and you can fill in the cells with a variety of methods, such as typing, pasting, browsing, by opening the tool dialog, or filling with values from cells above or below using the context menu:
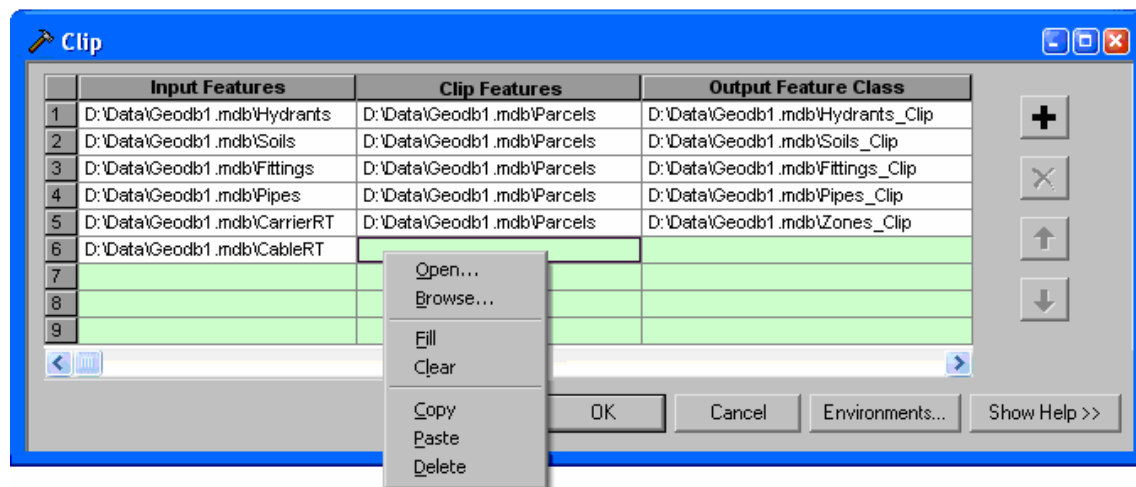
■ *In the Desktop Help, see: Geoprocessing > Using geoprocessing tools > Batch processing > An overview of batch processing*

New Results tab in ArcToolbox window

■ The new ArcToolbox window Results tab makes it easy to review and re-use the geoprocessing steps you've performed in your current and previous sessions. It's a record of everything you've done. You can see each operation you've performed, including all inputs, outputs and messages:
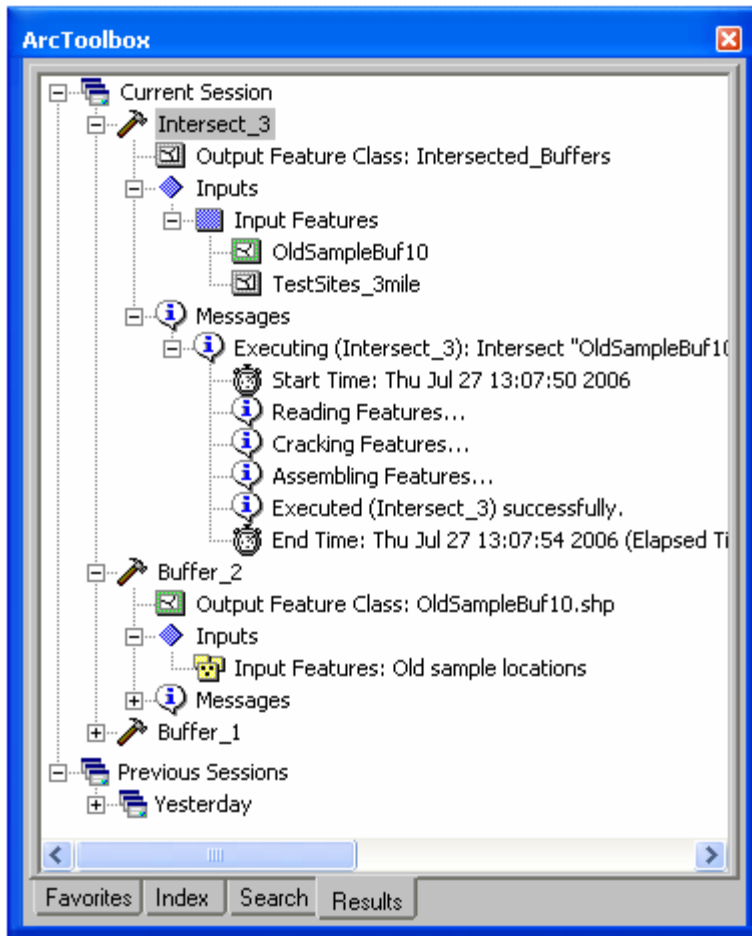
You can right-click any operation and open the tool dialog so you can re-execute it, remove it from your results, or delete it, which also automatically deletes all of its output data:
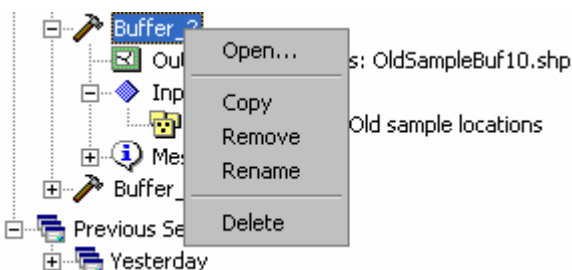
You can also drag and drop objects from the Results tab, such as adding an input or output into the ArcMap Table Of Contents or ModelBuilder.

The history toolbox in ArcCatalog remains unchanged at 9.2, but the Results tab is a richer and more convenient environment for working with your geoprocessing history.

New tool layers

■ 9.2 introduces the ability to drag a tool from ArcToolbox into the ArcMap Table Of Contents to create a tool layer. A tool layer is a special type of group layer that provides a convenient new way to use a tool. Outputs from the tool are listed as sublayers in the Table Of Contents, and you can right-click on the tool layer to open the tool dialog. The parameters used to execute the tool and the symbology of the outputs are stored as properties of the layer, making it easy to re-execute the tool and display the new results.
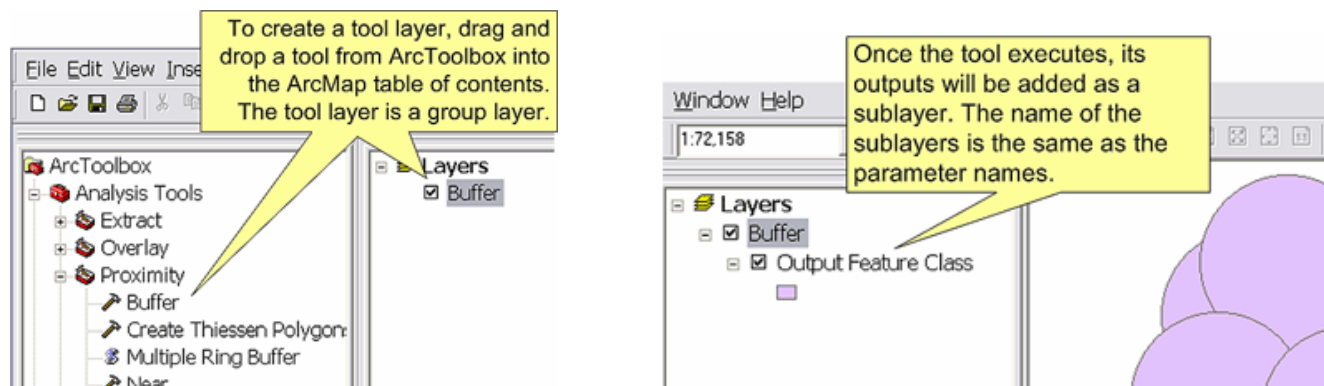
In the Desktop Help, see: Geoprocessing > Using geoprocessing tools > Tool Layers > An overview of tool layers

Large overlay capabilities

■ 9.2 has removed limitations imposed by computer memory when doing analysis and feature manipulation. The Union, Intersect, Identity, Dissolve, Feature to Polygon tools, and the new Spatial Join tool will work with millions of features and are not limited to the amount of computer memory you have.

More platform flexibility

■ In scripting, native Python support for the Geoprocessor object has been exposed. Native Python is not dependant on Windows or the Python Win32com extension, so you no longer need to add the win32com extension to run your Python scripts. This gives you flexibility of platform choice, and also enables support for geoprocessing in ArcGIS Server and in the ArcGIS Engine Developer Kit.

The Geoprocessor assembly is a .NET specific assembly containing a managed class called the geoprocessor. In most cases, .NET developers would interact with this assembly rather than the Geoprocessing assembly which exposes geoprocessing objects via COM.

At 9.1 (supported at 9.2 as well):
```
import win32com.client
gp = win32com.client.Dispatch("esrigeoprocessing.gpdispatch.1")
```

At 9.2:
```
import arcgisscripting
gp = arcgisscripting.create()
```

■ Executing tools using ArcObjects has been simplified with the introduction of the IGeoprocessor interface. The existing technical papers on writing new tools at the ArcObjects level have been expanded, and more detailed samples have been provided.

Calculate Field tool now supports script expressions

■ You can now use both VBScript and Python to write script expressions in the Calculate Field tool. A new dropdown control in the tool lets you choose between these, and if you choose Python you can specify additional Python code in an optional code block:
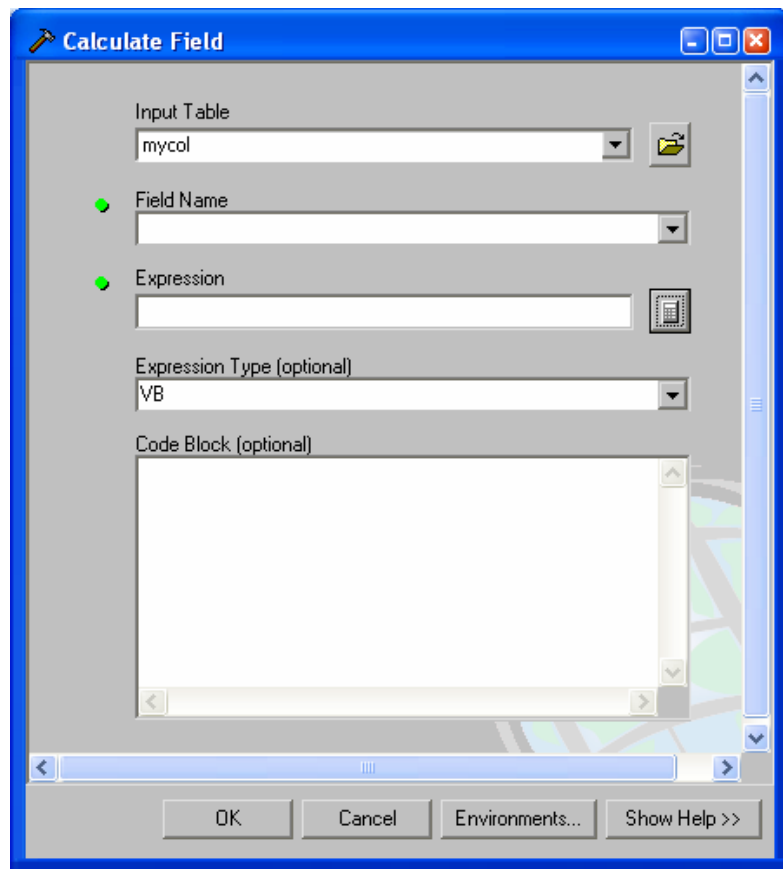
The Field Calculator dialog launched from this tool has also been enhanced so it is now the same as the one that is launched from the table window, including full support for VB Script and advanced expressions written using the pre-logic script block in the dialog. These enhancements enable you to use Calculate Field to calculate areas, length, perimeters, xy locations and xy centroids. You can use either the VBScript or Python for calculating these values.

Other improvement for working with tools

■ The performance of cursors in scripting has been greatly improved. New options added for limiting the fields returned and sorting the returned values.

■ Hundreds of issues have been corrected as reported by you in our technical support and user forums.

■ Performance has been improved for many tools, including Add XY, Frequency, and Summary Statistics.

■ Greater control over field mappings has been introduced for those tools that update fields, such as the Append tool and Table To Table tool.

■ The Make Permanent command in the context menu for a feature layer in the ArcMap Table Of Contents has been moved into the Data pullright in that context menu to reflect that you don't normally need to use this command.

■ Numerous new scripting methods for file management have been added.

■ INFO is now supported as a valid output table type.

New tools

■ 81 new core tools have been added. Core tools are those delivered with ArcView, ArcEditor, and ArcInfo product licenses. The new core tools are listed below. For details about these about these tools, consult the Help for each tool. This list does not include new tools in ArcGIS extensions.

Analysis tools
     Create Thiessen Polygons
     Spatial Join

Cartography tools
     Add Representation
     Align Marker To Stroke Or Fill
     Calculate Geodesic Angle
     Calculate Line Caps
     Calculate Polygon Main Angle
     Calculate Representation Rule
     Create Overpass
     Create Underpass
     Detect Graphic Conflict
     Drop Representation
     Remove Override
     Select Feature By Override
     Set Layer Representation
     Set Representation Control Point By Angle
     Update Override

Conversion tools
     ESRI Metadata Translator
     ArcIMS Metadata Publisher
     Point To Raster
     Polygon To Raster
     Polyline To Raster
     USGS MP Metadata Translator
     XSLT Transformation

Data Management tools
     Add Colormap
     Add Global IDs
     Adjust 3D Z
     Aggregate Polygons
     Build Raster Attribute Table
     Calculate End Date
     Calculate Value
     Collapse Dual Lines To Centerline
     Compare Replica Schema
     Compress File Geodatabase Data
     Create Custom Geographic Transformation
     Create File Geodatabase
     Create Fishnet
     Create Ortho Corrected Raster Dataset
     Create Pan-sharpened Raster Dataset
     Create Random Points
     Create Random Raster
     Create Replica
     Create Replica Foot Prints
     Delete Colormap

Delete Raster Attribute Table
Export Acknowledgement Message
Export Data Change Message
Export Replica Schema
Feature Compare
File Compare
Generate Globe Server Cache
Generate Map Server Cache
Generate Map Server Cache Tiling Scheme
Get Raster Properties
Import Message
Import Replica Schema
Merge Branch
Raster Compare
Re-Export Unacknowledged Messages
Simplify Building
Simplify Polygon
Synchronize Changes
Table Compare
Tin Compare
Transpose Time Fields
Uncompress File Geodatabase Data
Upgrade Spatial Reference
Workspace To Raster Catalog
Workspace To Raster Dataset

Geocoding tools
Rebuild Address Locator
Rematch Addresses

Multidimension tools (new toolbox for NetCDF data)
Feature To NetCDF
Make NetCDF Feature Layer
Make NetCDF Raster Layer
Make NetCDF Table View
Raster To NetCDF
Select By Dimension
Table To NetCDF

Samples
CAD to Feature Class with Attribute of Nearest Point

Spatial Statistics tools
Calculate Distance Band from Neighbor Count
Multi-Distance Spatial Cluster Analysis (Ripley's K Function)

■ Over 40 new tools have been added to various extension products, such as Spatial Analyst and Network Analyst. For details on these tools, consult the What's New sections for these extensions.

Working with models

Iteration in models

■ ModelBuilder now supports lists, series, and feedback looping to enable iteration in models. Below is an example of using both lists and series:
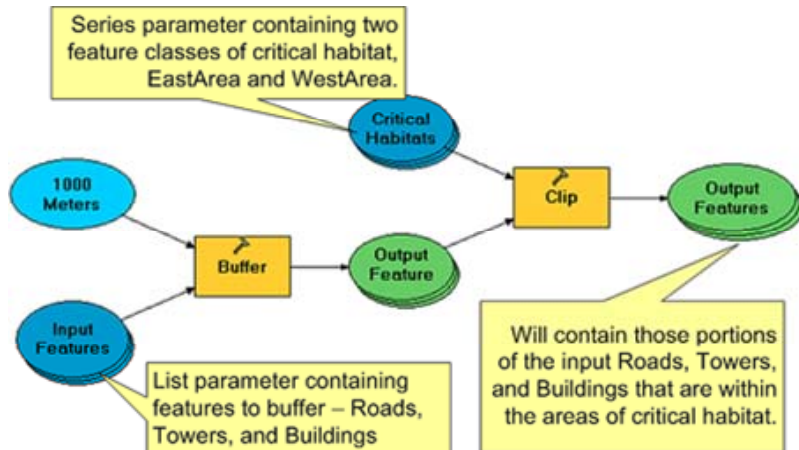
■ List and series properties are specified for inputs in the General tab of the new Properties dialog for variables. In this example, an input to a buffer has been defined as a list of inputs.
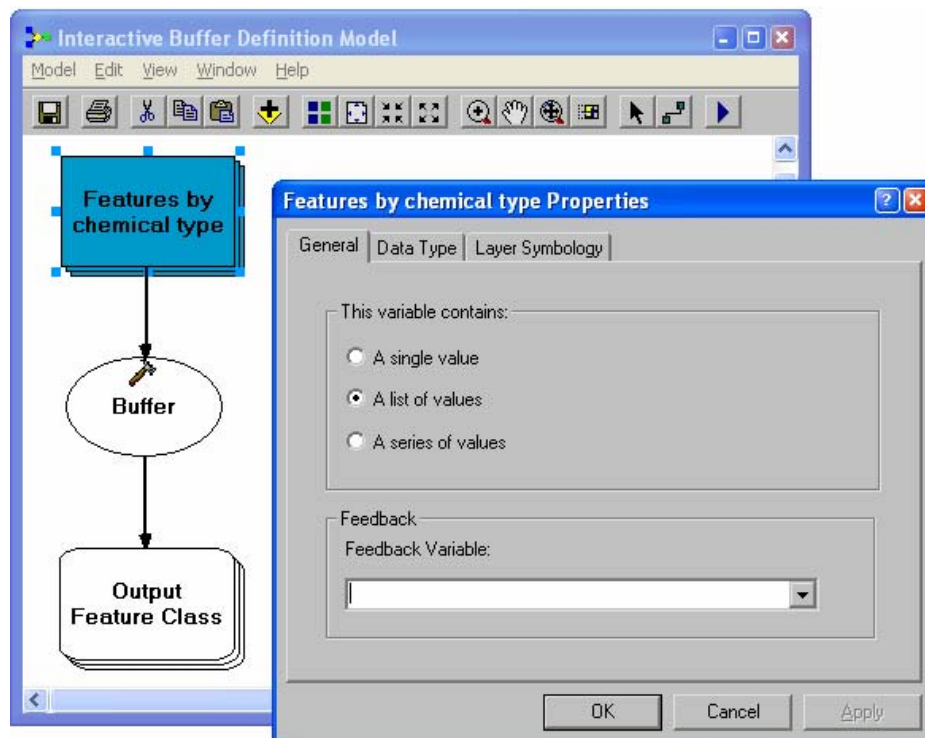
In the Desktop Help, see: Geoprocessing > Automating your work with models > Model iteration > An overview of model iteration

Specify layer symbology for model inputs and outputs

■ In the ModelBuilder, the new Properties dialog for variables contains a Layer Symbology tab if the variable represents data. This enables you to specify how inputs and outputs will be symbolized when they are added to maps and globes and store these properties in the model. Symbology is defined by importing it from a layer in your current document or a layer file (.lyr file).

In this example, the layer symbology for the output of a clip is being defined. The dropdown list in the dialog shows all the polygon layers from the current map document:
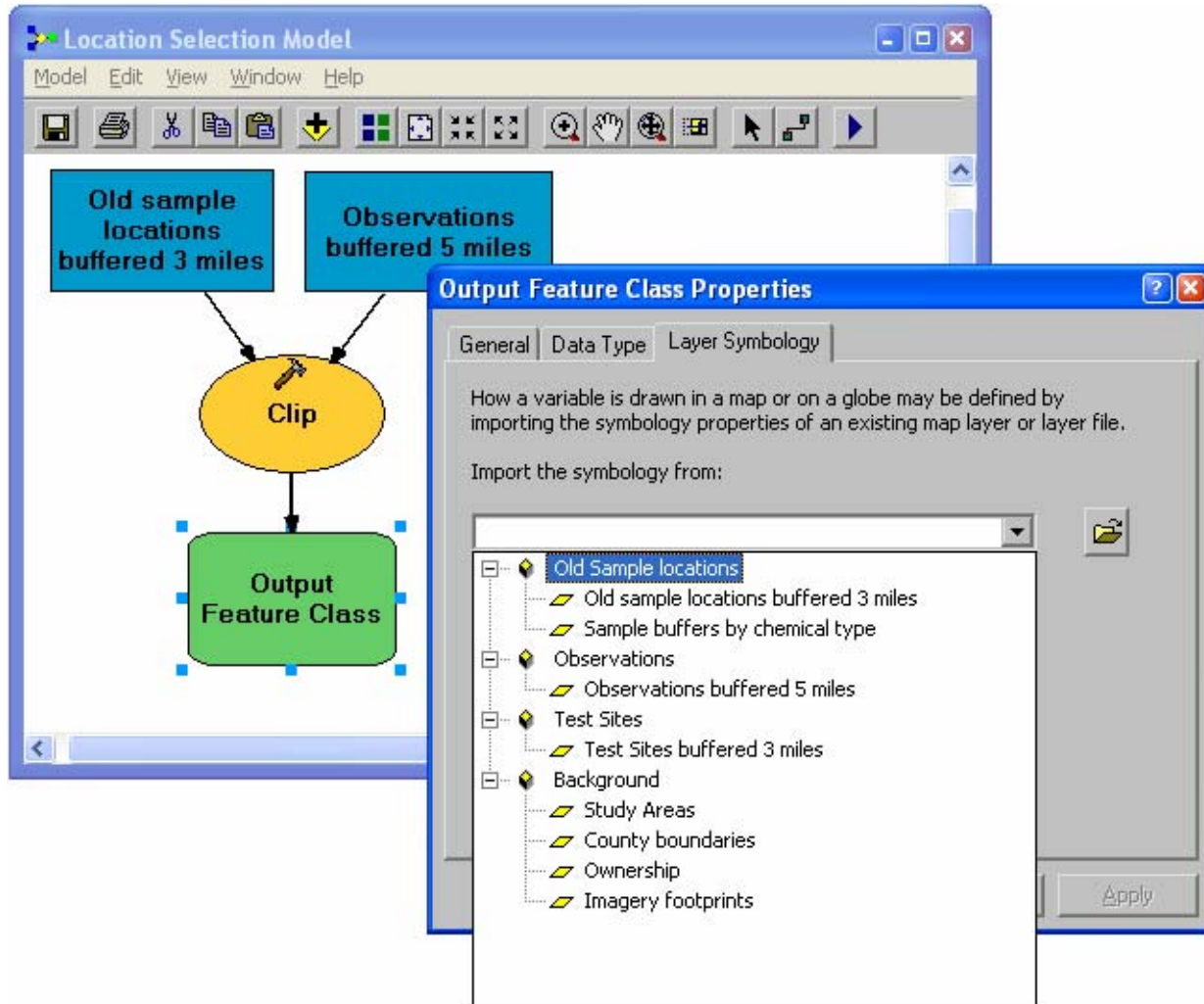
Specifying the layer symbology for inputs lets you control, for example, how an input layer will be drawn in ArcMap if it is added to the display. It is also used to specify the appearance of features that are defined interactively as input to a model (see the next section below).

Define features interactively on-the-fly as input to models.

■   In 9.2 you can add interactive feature input into your models so that when the model is run you or the end user of the model can draw features on-the-fly and have them used as input to the model. For example, you can create a buffer model that lets you draw a line on the map that the model will then buffer. A new 'feature set' variable type has been added that enable you to specify interactive inputs.

You can specify a feature set input in the Data Type tab of the new Properties dialog for variables. This tab also lets you choose the layer in the current document, layer file (.lyr file) on disk or existing dataset that will be used to provide the schema and symbology of the features in this feature set:
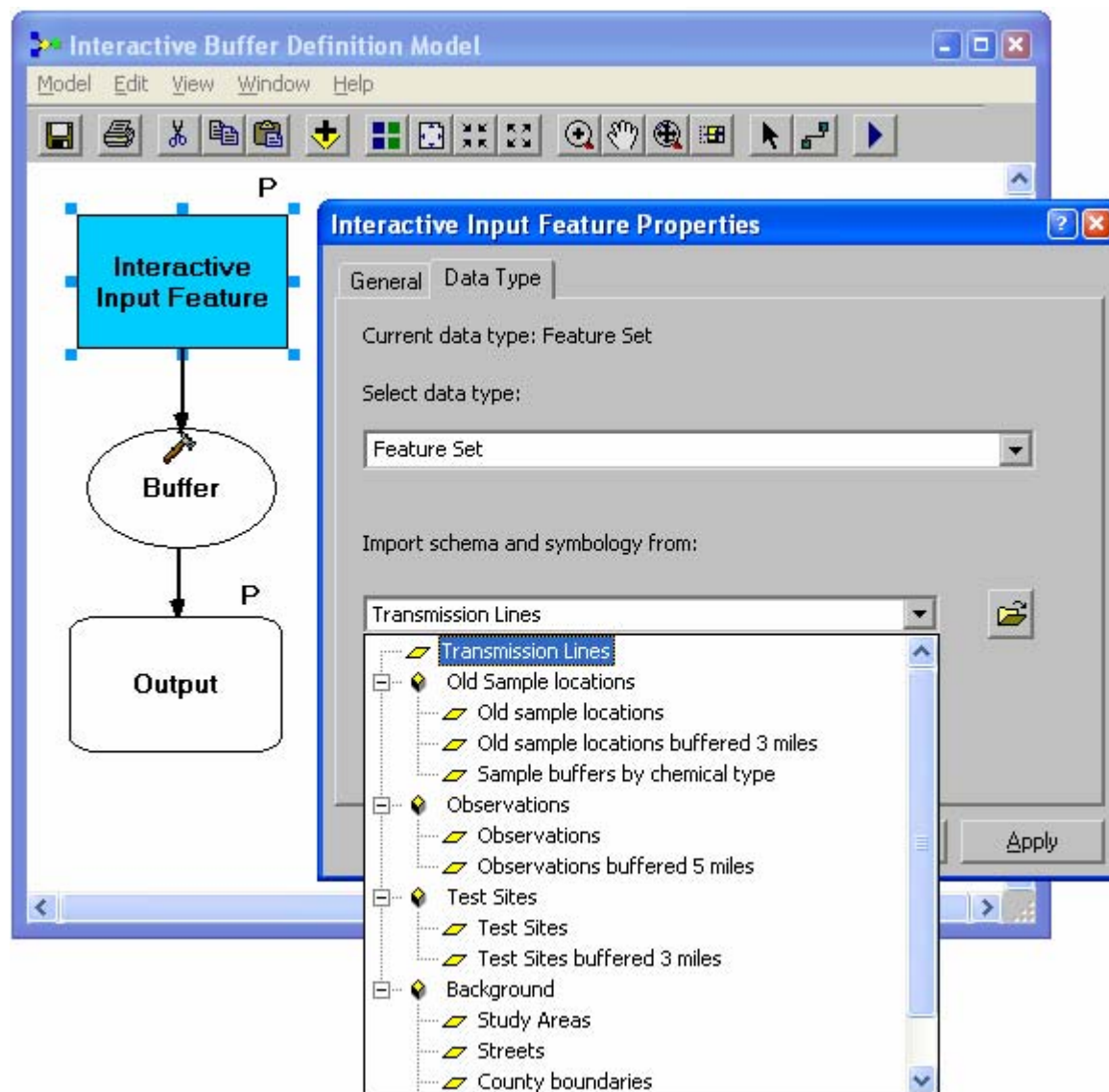
Here's what you see when you run this model. Click the drawing tool in the dialog to draw the input features. You can also specify the attribute values for these features (a pop up window appears to let you enter values):
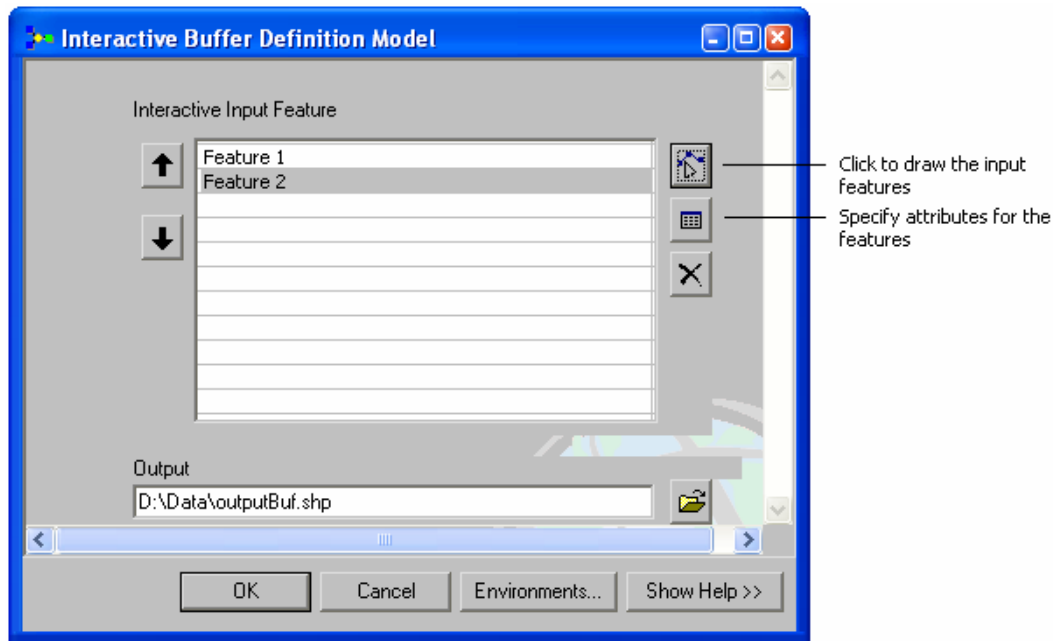
New in-memory workspace

You can now write feature classes and tables to an in-memory workspace. This can greatly improve the performance of models, especially when writing intermediate (scratch) data. Data you write to the in-memory workspace can be copied to disk using the Copy Features or Copy Rows tools. In memory workspaces are also how the interactively defined features described in the previous section are stored in current map document.

In the Desktop Help, see: Geoprocessing > Automating your work with models > Model concepts and terms > Intermediate data and the scratch workspace

In-line variable substitution in models and command line

■ In-line variable substitution allows you to use the value of another variable in any parameter text. The example below shows a model using the scratchWorkspace environment variable in an output pathname. To substitute a variable, you enclose the variable name in percent signs (%). This allows you much greater flexibility in defining parameter values in models and in the command line.

In the Desktop Help, see: Geoprocessing > Automating your work with models > Model concepts and terms > In-line variable substitution

Other

■ You can customize the appearance of your model by substituting images for tools and variables. In addition, you can change many of the symbology properties for individual elements, such as shape, color, and font.

In the Desktop Help, see:
Geoprocessing > Automating your work with models > Using ModelBuilder > Model appearance: Using pictures for elements
Geoprocessing > Automating your work with models > Using ModelBuilder > Model appearance: Display properties

■ You now get a tooltip if you hover the cursor over a tool in the ModelBuilder toolbar.

Geoprocessing with ArcGIS Server

■ All geoprocessing tools are available on ArcGIS Server. This means that all geoprocessing functionality is now available cross-platform. This greatly extends your options in deploying geoprocessing-based applications.

■ Toolboxes can be served using ArcGIS Server to create geoprocessing services that enable users to access geoprocessing functionality over the Web or over your LAN. If you are connected to an ArcGIS Server in ArcCatalog with administrative privileges, you can right-click any toolbox and publish it to the server using the Publish To ArcGIS Server command. All the tools in the toolbox you publish become geoprocessing services:
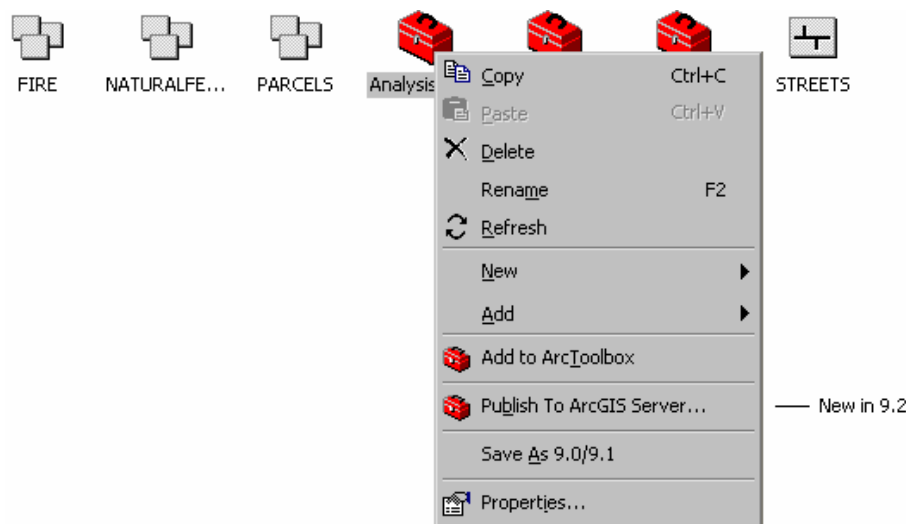
■ Geoprocessing services can be used in ArcGIS Desktop, the free ArcGIS Explorer client (new at 9.2) and web applications. In ArcGIS Desktop your users can add a server-based toolbox directly into ArcToolbox by using the Add Toolbox command and browsing to the server the toolbox belongs to.

In ArcGIS Explorer, your users can access geoprocessing services as tasks and work with them in the task panel:
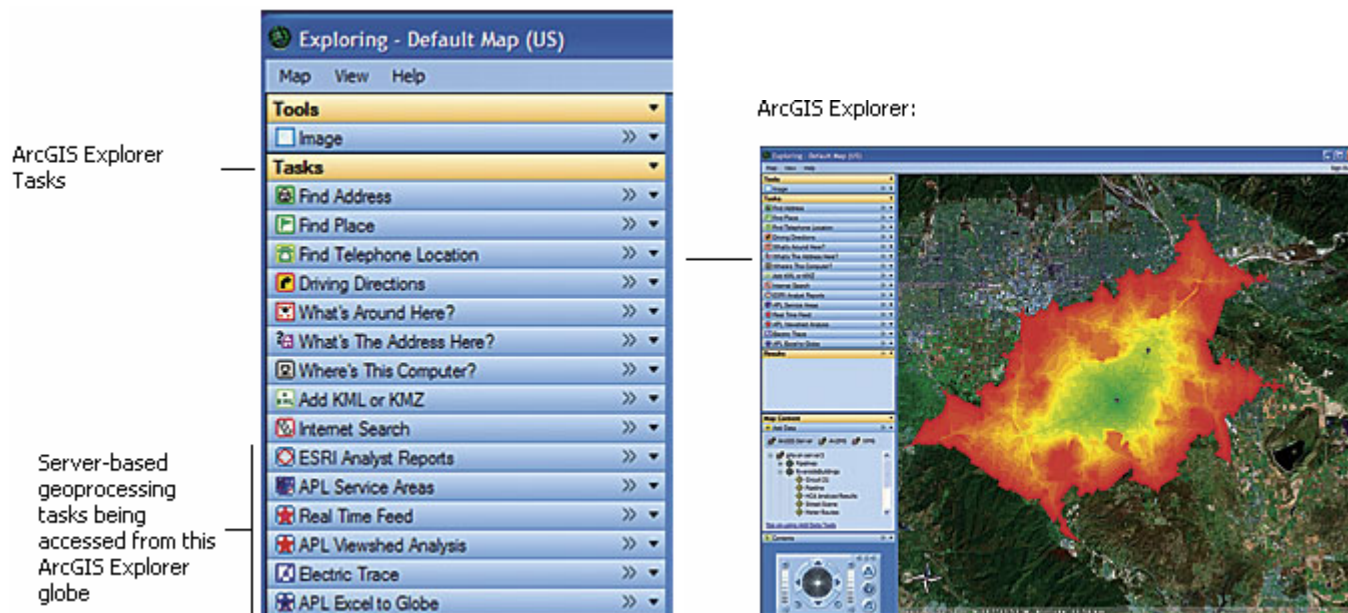
When you run a geoprocessing service the main local **inputs** that can be sent to the server are interactively defined features. For example, you cannot browse to a local shapefile or feature class and send that across the Web to the service, because that could involve sending a very large volume of data. However, publishers can create a geoprocessing service based on a custom script that includes an input variable of type file that allows end users to specify .zip files as input. When such a service is accessed, the model will access and unzip the file and then use it as input.

Output from running a geoprocessing service can be of two types:

- Asynchronous outputs are always saved on the server. Client applications can either retrieve the features themselves or access the results as an ArcGIS map service if they have been published to the server. During the publishing phase, the publisher sets the maximum number of records that can be returned to the client (Maximum Records property). This can prevent extremely large results from being passed across the Web.

- Synchronous outputs are always returned to the client. As with asynchronous outputs, the number of features returned is limited by the Maximum Records property set during publishing.

When you access and run a geoprocessing service in Desktop, you can use the new ArcToolbox Results tab to check on the status of these processes. Icons in the Results tab show you whether the process is executing ⧖, pending ⧗, etc.

Geoprocessing in the ArcGIS Engine Developer Kit

■ 9.2 provides full support for geoprocessing functionality in the ArcGIS Engine Developer Kit. Applications you create with the ArcGIS Engine Developer Kit can now include any underlying geoprocessing functionality.

The ArcGIS Engine Runtime at 9.2 includes the geoprocessing framework. The geoprocessing tools available to custom ArcGIS Engine applications depend upon the license the application is using. ArcGIS Engine applications can run ArcView level GP tools and edit shapefiles and personal geodatabases using an ArcGIS Engine Runtime or ArcView license. ArcGIS Engine applications can run ArcEditor level geoprocessing tools and edit enterprise geodatabases using an ArcGIS Engine Runtime with Geodatabase Update extension or ArcEditor license. In order to run an ArcInfo level tool, an ArcInfo license is required.

Improved documentation for geoprocessing

■ The Geoprocessing section of the ArcGIS Desktop Help has been reorganized and rewritten. The new conceptual topics make extensive use of graphics to show you concepts, examples, and procedural steps.

Geocoding & routing

Geocoding

Improved geocoding performance

The speed for creating address locators and geocoding addresses is greatly improved. In general geocoding is now approximately four times faster. You can geocode about 1 million addresses per hour on a PC with a Pentium 4 or faster processor and 1 GB memory. The performance may vary depending on the type of addresses and how they are stored in the databases.

Working with address locators

■ Once created, address locators are now independent of their reference data. You can move or copy Address Locators to new workspaces without copying or being concerned about the location of the reference data. Address locators may require more disk space depending on the size of the reference data.

■ When you create an address locator, the reference data will be standardized on the fly and the locator will store the standardized attributes of the reference data. Moreover, the geocoding rule base will also be stored in the locator. This option is helpful if you build an address locator based on a geocoding rule base that has been modified. You can distribute this address locator to others without packing the geocoding rules.

These two functions can be disabled in the new Advanced Locator Properties dialog. This dialog is accessed from a new Advanced button you'll see on the Address Locator Properties dialog:
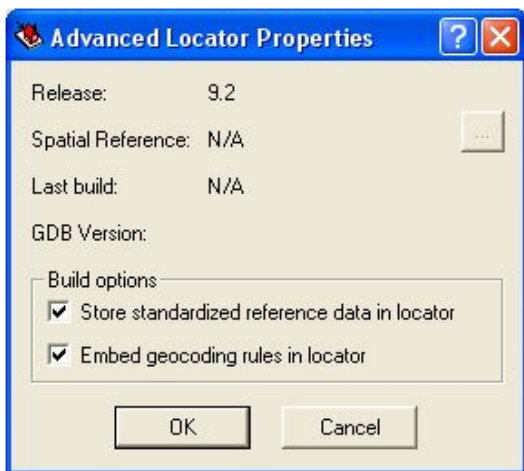
■ You can now create address locators directly in a file folder workspace or inside a geodatabase. The Address Locators folder in the ArcCatalog tree is no longer used and has been removed. To create a new address locator, right-click on a folder or a geodatabase, and select the New > Address Locator command. You can also copy, delete, or rename address locators in ArcCatalog.

■ Address locators now support metadata. In ArcCatalog, select an address locator and click the Metadata tab to view the metadata.

■ Existing address locators created can still be used for geocoding but many additional features, such as embedded standardization and rule bases, are no longer supported on pre 9.2 locators, so we recommend that you migrate your all existing locators to 9.2. A topic in the Desktop Help describes how to migrate your existing address locators to 9.2. *See: Geocoding and address management > Building an address locator > Migrating address locators created with ArcGIS prior to version 9.2.*

New address locator styles

■ New address locator styles supporting nationwide geocoding using multiple zone fields including city, state, and ZIP have been added. Here are the styles you can use for creating nationwide address locators:

US Alphanumeric Ranges with City State ZIP and AltName
US Alphanumeric Ranges with City State ZIP
US Hyphenated Ranges with City State ZIP and AltName
US Hyphenated Ranges with City State ZIP
US Streets with City State ZIP and AltName
US Streets with City State ZIP

New Match_addr string in geocoding candidates list

■ The new Match_addr field displays the address that is actually geocoded and located based on each returned candidate. This information is particularly helpful if the input address is geocoded to a candidate that does not match exactly. For example, 201 New York St can be matched to the location of 301 New York St on the candidate of 301-381 range street segment. In other words, Match_addr is the location that ArcGIS will use to represent the address you typed in if you choose that particular candidate. This field is only shown in the candidate list in the Find dialog and the Interactive Review dialog:
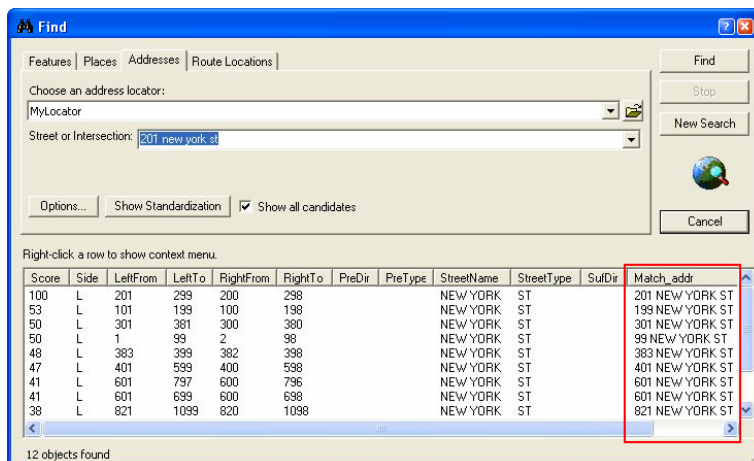
New Geocoding geoprocessing tools

■ Two new geoprocessing tools have been added to the geocoding tool box.

🔨 Geocoding Tools > **Rebuild Address Locator**

🔨 Geocoding Tools > **Rematch Addresses**

Address locators can be rebuilt to reflect changes in the reference data. This tool only applies to address locators created with ArcGIS 9.2. The Rematch Addresses tool allows you to rematch addresses in a geocoded feature class.

Some tools have been removed at 9.2 because they are no longer applicable due to the changes to address locators.

New built-in routing & driving directions capabilities

■ At 9.2 a new Find Route dialog is provided in ArcMap, ArcReader and ArcGIS Engine that enables you to perform routing and get driving directions using built-in access to a set of free online services. All you need to use these is an Internet connection. No account or sign-in is required. Unlike the existing StreetMap Find Route dialog, the new Find Route dialog doesn't require that you have access to any locally installed StreetMap datasets, so it makes it easy and convenient to perform routing.

The dialog supports routing in North America (USA + Canada) and Western Europe, and is also provided in ArcReader and ArcGIS Engine, so end users of your published map documents and custom ArcGIS applications can now easily get routes and print driving directions too. It is not supported in ArcGlobe.

In ArcMap and ArcReader the new routing dialog is accessed by choosing Tools > Online Services > 🔶 Find Route.

The new routing dialog also supports ArcWeb Services. If you are an ArcWeb Services subscriber and you are currently signed in, you'll see additional premium routing services in the Find Route dialog.

The following screenshots show the new Find Route dialog being used to find a driving route across Western Europe, and to investigate two potential tourist bus routes in San Diego, California:

San Diego Tour Bus Routes.mxd - ArcMap - ArcInfo

La Jolla Cove
Mission Trails Park
SeaWorld
Qualcomm Stadium
San Diego Convention Center
Hotel Del Coronado

Viewer 1:66,660

Find Route

Stops | Options | View Directions

Route Units: ● Miles   ○ Kilometers

Driving distance: 18.8 mile(s), Driving time: 26 minute(s)

Directions	Distance(miles)
Depart La Jolla Cove	0
Go South East on Coast Walk toward Torrey Pines Rd	0.05
Turn left on Torrey Pines Rd	0.85
Continue on Ardath Rd	1.06
Take ramp and go East on SR 52	6.45
Take ramp and go South East on I 15 (Escondido Fwy)	4.25
At exit 7 take ramp to Friars Rd	0.33
Bear right on Friars Rd	0.1
Take ramp to Mission Village Dr	0.17
Turn left on Mission Village Dr	0.09
Bear right on Parking Lot	0.04
Turn left to stay on Parking Lot	0.35
Arrive at Qualcomm Stadium	0
Depart Qualcomm Stadium	0
Go back North West on Parking Lot	0.35
Turn right to stay on Parking Lot	0.04
Bear left on Mission Village Dr	0.01
Take ramp to Friars Rd	0.1
Continue on Friars Rd	1.25
Continue on Mission Gorge Rd	3.21
Turn left on Echo Dell Rd (Father Junipero Serra Trl)	0.01
Continue on Father Junipero Serra Trl	0.09
Arrive at Mission Trails Park	0

English | Copy to Clipboard | Create Printable Version

Find Route | Cancel Find | Close

Tip: Remember that performing routing with the new Find Route dialog doesn't demand that your map contain any particular layer representing streets or transportation. Routing services are self-contained which means you can add routes to any map and get driving directions, irrespective of what data is represented in your map.

Enhancements to the StreetMap routing dialog

At 9.2 we have continued to enhance the StreetMap Find Route dialog in the StreetMap toolbar available in ArcMap. The StreetMap Find Route dialog works with StreetMap file-based routing services and, since ArcGIS 9.1, has been provided free at all ArcGIS Desktop license levels.

The entry level StreetMap USA dataset, address locator, and routing service are part of the free ESRI Data And Maps data collection that is provided with ArcGIS Desktop, ArcGIS Server, and ArcGIS Engine. Additional StreetMap data products offering more current data with improved address and routing accuracy can also be licensed from ESRI: StreetMap Pro and the more frequently updated StreetMap Premium cover the USA and Canada, and StreetMap Premium Europe covers more than 20 European countries. The StreetMap products provide a multi-scale, high quality cartographic basemap, the ability to find addresses individually, high performance batch geocoding of addresses in tabular form, and multi-stop route finding. The StreetMap products can also be used with the Network Analyst extension as a multi-purpose, ready-to-use transportation network. For more about the StreetMap Pro and StreetMap Premium products, see: http://www.esri.com/data/streetmap/index.html

Barrier support

■ A new tab in the StreetMap Find Route dialog provides support for defining barriers so that you can prevent routes going through certain locations. Barriers are shown on the map with red crosses (you can change this symbol in the Options tab). Barriers make it easy to generate routes to reflect current traffic or emergency situations, and also to perform what-if scenarios for planning and route design:
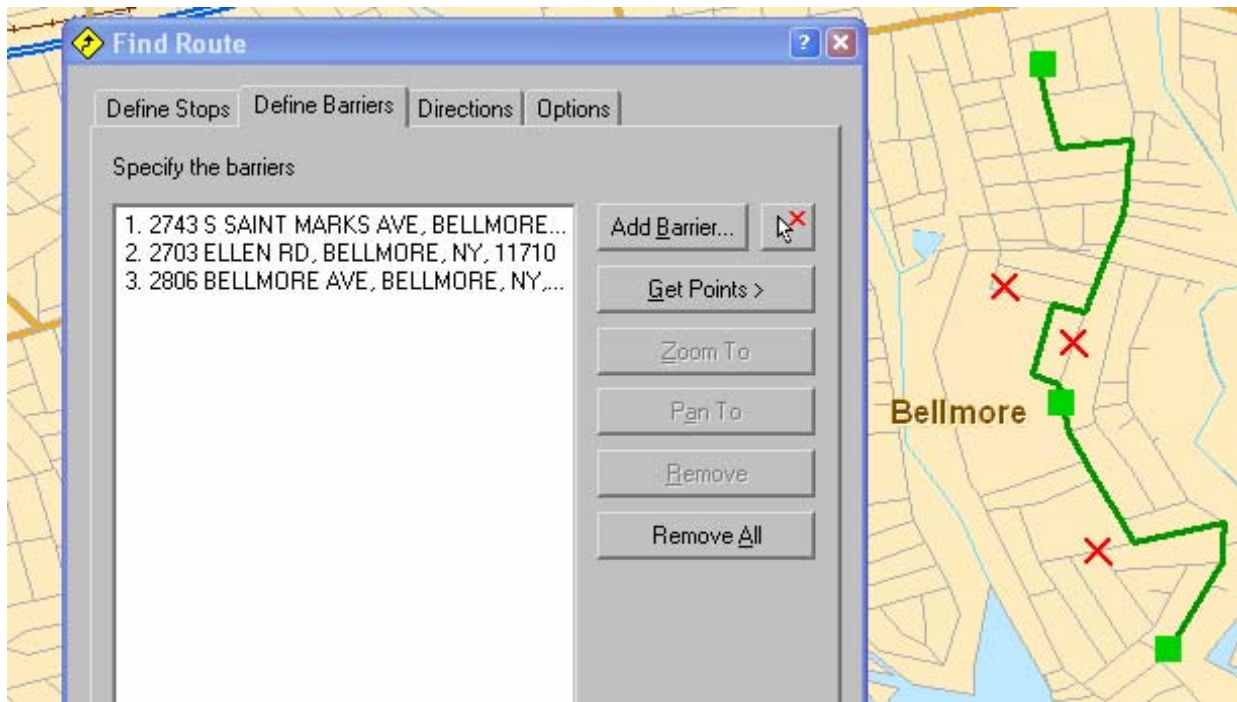
Trip planning

■ A new trip planning option has been added to the Options dialog. Here is the new Trip Planning Settings dialog accessed from the Find Route dialog Options tab:
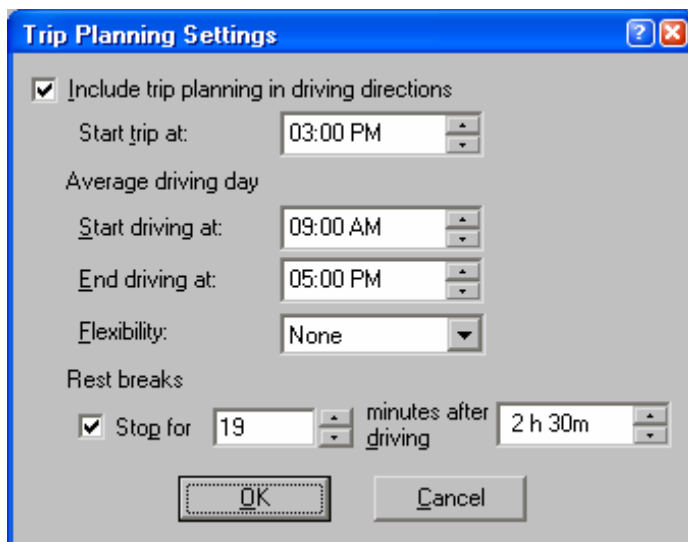
Support for specifying speed and restrictions

■ The new speed and restrictions options enable you to investigate different scenarios and better model the transportation conditions in your areas of interest. The ability to specifying speed and restriction is dependent on attributes in the StreetMap data you are using and is not supported in the free, entry level StreetMap USA data.

The ability to specify speeds has been added via a new Speeds button on the Find Route dialog Options tab. This lets you display the various road classifications defined in your street dataset network and assign typical travel speeds to them:
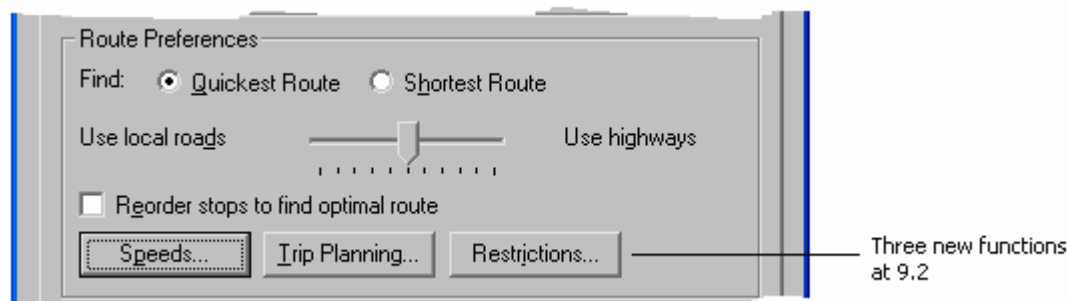
Network restrictions enable you to include parameters such as vehicle type, weight, length and others in route calculations for more accurate results. These parameters determine whether a particular street segment is passable or not. Supported restrictions are: Boolean (either true or false), such as restrictions on certain types of vehicles on certain streets, 'MaxAllowed' restrictions, such as vehicles exceeding a certain height not being allowed, and 'MinAllowed', such as vehicles not able to reach a certain minimum speed not being allowed. Restrictions can be strict, which can never be violated, or relaxed, which may be violated if there is no alternative. Here is the dialog launched by the Restrictions button in the Find Route dialog Options tab. This lets you control the restrictions that are being used:
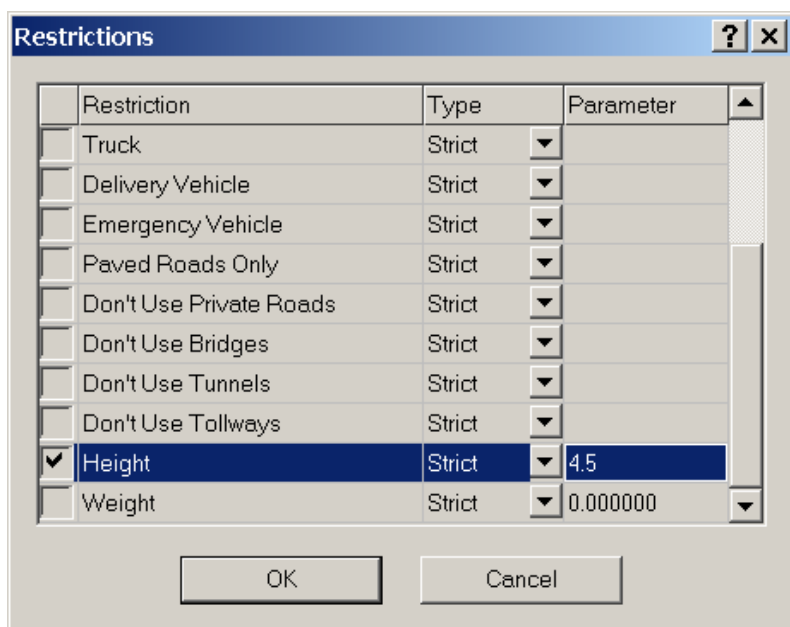
Other

■ Route calculation performance has been increased 3+ times.

■ Support for complex turns: Multi-part turn restrictions are now supported by the routing engine.

■ Driving directions have been enhanced in a number of ways to improve usability, flexibility and output:

- Directions now offer enhanced printing options including stop vicinity maps and turn-by-turn maps.

- Support for different distance units in driving directions (feet, yards, miles, kilometers, meters).

- Reports turns at intersections when street name does not change. This situation occurs when a street turns at an intersection, but the street name does not change. A turn instruction generated, for example, "Turn right at State St to stay on SR 154":
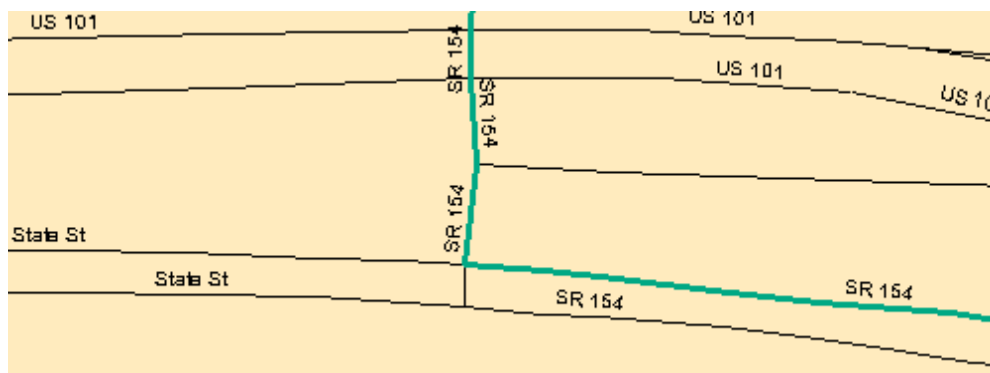
- Recognizes U-turn on divided roads so that they are reported as a single U-turn instruction, rather than two left turns. In the example below, directions will contain the following instruction: "Make U-turn at Ash St and go back on Brookside Ave":
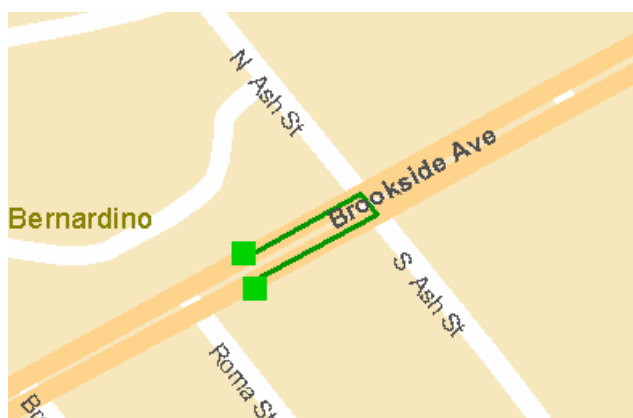
- Reports toward street in first directions item: Adds 'toward <intersection street name>' to the first item in directions for better driver orientation. Example: "Go North on New York St toward State St".

- Makes use of signpost information in the source data: Adds target street/highway name and destination city name from sign information as contained in source data. Example: "Take ramp to CA-299 West toward Central Redding / Eureka".

- Driving directions are now provided in HTML format compared to the plain text used in 9.1.

- Text now appears in the directions saying whether the destination is on the left or on the right of the street (see the step highlighted in red below:
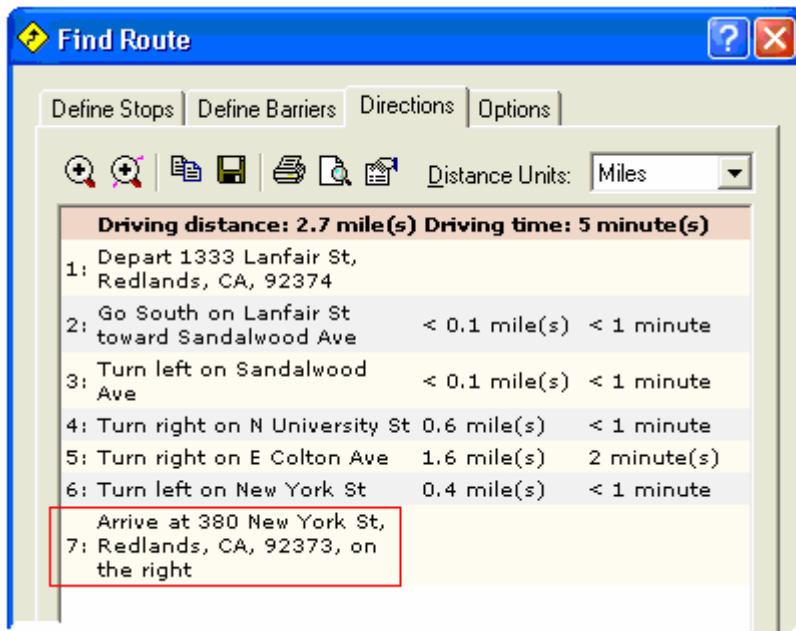
■ The StreetMap Find Route dialog now remembers the address locator that you specify in the dialog's Options tab for finding the addresses of locations you click on. When you open the StreetMap Find Route dialog it automatically loads the locator (usually one of the StreetMap locators) you used last into the current map document. Tip: Opening this dialog is therefore an easy way to load a StreetMap address locator into a new map without having to browse for the locator on disk.

■ Configurable U-turn policy: The StreetMap Router API has been extended to support setting a backtrack policy which affects how the solver processes u-turns.

ArcCatalog & metadata

ArcCatalog enhancements

Renaming folder connections

■ You can now rename folder connections in ArcCatalog. This makes it easier and more convenient to access data with both ArcCatalog and the Add Data dialog launched from ArcMap. Now you can not only add folder connections pointing at your most frequently used folders, you can also give these connections shorter, more useful names. In this way, folder connections work more like shortcuts or bookmarks to data. By default, ArcCatalog gives you folder connections for the drives on your computer:

To get quicker access to your frequently used folders on these drives and on network drives, you can create new folder connections. In the example below, a number of folder connections to data on the D:\ drive and on a network drive have been created, and the connection to the C:\ drive has been removed. (Tip: You can drag any folder you see in the Contents tab in ArcCatalog onto the 'Catalog' node at the top of the catalog tree to quickly create a connection in the tree to that folder):

Here's what the same folder connections look like after being renamed in 9.2 to give them shorter names:
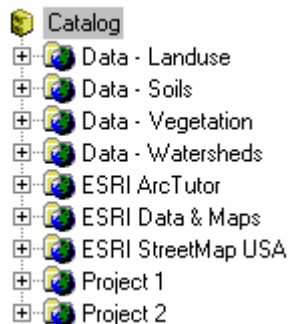
To rename a folder connection right-click it and choose Rename or select it and press F2. You can rename any folder connection, including connections to read-only folders on network drives. A folder connection works like a shortcut, so renaming a connection doesn't change the name of the folder it is connected too. To see the target folder of a folder

connection you've renamed, select it and look in the status bar. When you select a folder connection the status bar shows you the full path of the folder that the connection points to.

Coordinate systems

■ You can now drag/drop or paste coordinate systems into the top level of the Coordinate Systems folder in ArcCatalog. In previous releases, you could use Windows Explorer to copy coordinate systems into the top level of your arcgis/coordinate systems folder but it wasn't possible to do this in ArcCatalog. If you drag and drop a coordinate system from a subfolder in the Coordinate Systems folder into the top level of that folder, it automatically gets copied rather than moved (no need to hold down CTRL when you drag and drop) so the contents of the subfolders are preserved.
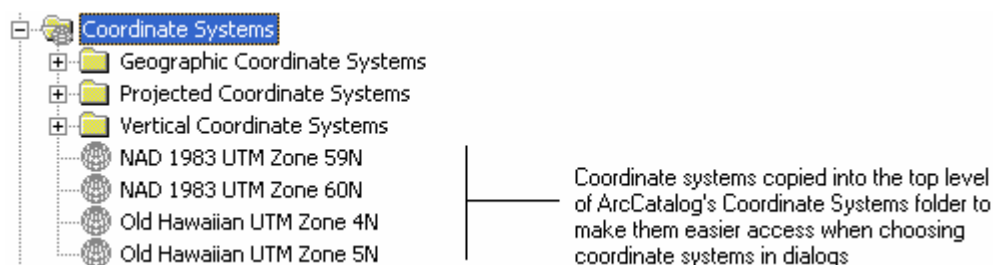
This enhancement can save a lot of repetitious clicking down through the Coordinate Systems sub folders. Copying coordinate systems into the top level of this folder makes it easy to select them when you specify coordinate systems in dialogs. For example, when you select a coordinate system in the XY Coordinate System tab in the Feature Dataset Properties dialog in ArcCatalog, coordinate systems you've put at the top level of the Coordinate Systems folder are accessible in the Catalog Browser directly without having to browse down into the sub-folders in that folder:
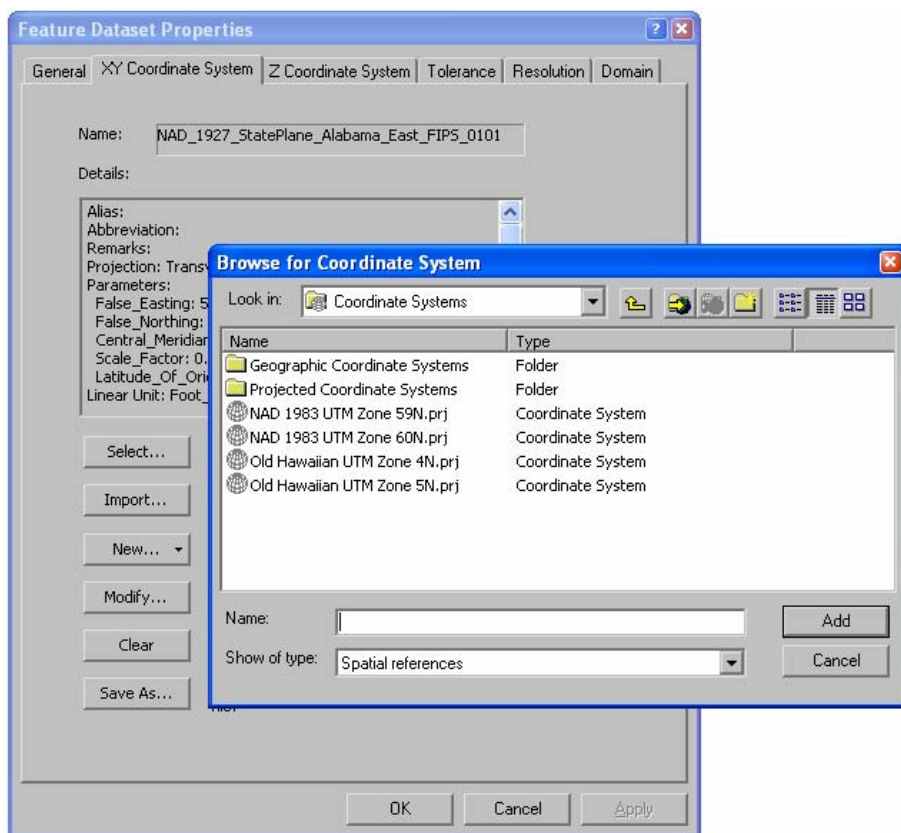
Note: The Coordinate Systems folder is hidden in the ArcCatalog tree by default, but you can turn this folder on via the Tools>Options dialog General tab. When this folder is turned on it now gets sorted correctly in alphabetical order instead of appearing between Database Connections and Database Servers like it used to.

■ In the Coordinate Systems\Projected Coordinate Systems folder, there's a new sub-folder for the Arc Raster Chart (ARC) equal arc-second projection system. This projection system underpins various military raster datasets (ASRP, ADRG, CADRG) and is designed to tessellate seamlessly across the globe. The projection system divides each hemisphere into nine zones of ten degrees of latitude to minimize distortion and uses a rectangular coordinate projection based on the WGS84 datum:
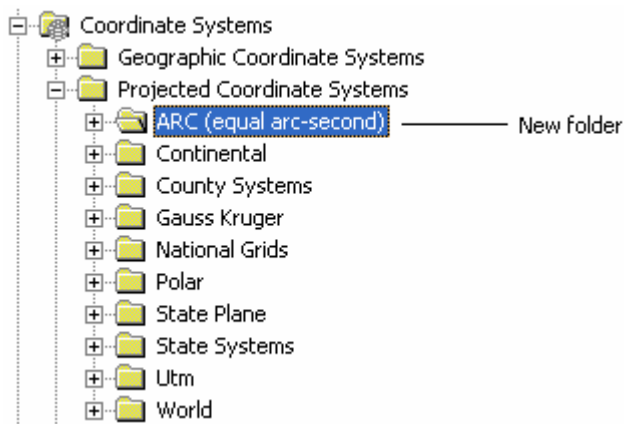
■ In the Coordinate Systems\Projected Coordinate Systems\World folder, there are two new World coordinate systems that use the Goode Homolosine projection:

Goode Homolosine (Land)
Goode Homolosine (Ocean)

■ ArcGIS 9.2 adds support for the definition and use of vertical coordinate systems. Over 90 predefined vertical coordinate system definitions are provided in the new Coordinate Systems\Vertical Coordinate Systems folder. (☛ *See the 'Better support for M and Z coordinates' section in the 'Geodatabases & ArcSDE' chapter in this document).*

Other

■ You can now sort data listed in ArcCatalog's Contents tab by the feature type of the data using a new optional column you can add into the listing. To add this column, go to the Tools>Options dialog Contents tab and click the Add button. In the dialog that appears, choose Feature Type. This will add this new column into the list of available columns. Check the Feature Type column to turn it on. Note: if you are installing ArcGIS onto a machine which does not currently have ArcGIS installed, you'll see the Feature Type column already in the list, and you won't have to press the Add button to add it in.

■ You can now press ENTER to open the currently selected item in the Contents view in ArcCatalog (i.e the right hand side of the ArcCatalog window). So for example, to open the properties of a feature class in a feature dataset listed in Contents view, use the arrow keys to navigate to the feature class you want to look at the properties for and press ENTER.

■ When ArcCatalog starts up, it looks for the contents of the Database Connections and Database Servers folders in this system folder:

C:\Documents and Settings**All Users**\Application Data\ESRI\ArcCatalog\

in addition to this folder:

C:\Documents and Settings**<user_login>**\Application Data\ESRI\ArcCatalog

In this way, system administrators can place the files that define connections to ArcSDE geodatabases (.sde files), OLE DB connections (.odc files) and database servers (.gds files new at 9.2) into the All Users folder to ensure that all the users who use this computer can get access to the same databases. ArcCatalog already looks for the connection files belonging to the GIS Servers folder (.ags, .ims, .wms files) in both locations. For example, the connection called

'Geography Network Services hosted by ESRI' that comes with ArcGIS Desktop is installed into the All Users location when you install ArcGIS Desktop so that it is always available irrespective of who is logged onto the machine.

Note: When you create a connection in the Database Connections, Database Servers, or GIS Servers folder in ArcCatalog, it always gets saved into the <user_login> location. If you want the connection you created to be in the All Users location, you have to copy the underlying connection file into that location manually using Windows Explorer.

■ The Set Data Sources dialog you can access by right-clicking a map document in ArcCatalog has been enhanced so that it works with ArcSDE geodatabases, file geodatabases and coverages. Support has also been added for tables, rasters and all geodatabase data types (including topologies, etc). For example it is now easier to use it to transition from personal geodatabases to file geodatabases. Assuming the schemas are the same and feature dataset/feature class names are identical, you can now simply right click a map document and change all paths to redirect personal geodatabase paths to file geodatabase paths. If the feature dataset and feature class names are different, it still works but you have to explicitly open the Catalog Browser from the dialog and point to the new feature dataset/feature class name.

Note: The Set Data Sources dialog has the limitation that it removes certain additional properties from the map document: customizations (VBA code, UI controls and custom toolbars), graphs, and table window appearance properties. For this reason the dialog is really only recommended preparing map documents for publication or for advanced users. At 9.2 we have added a note to the top of this dialog to describe the limitation:
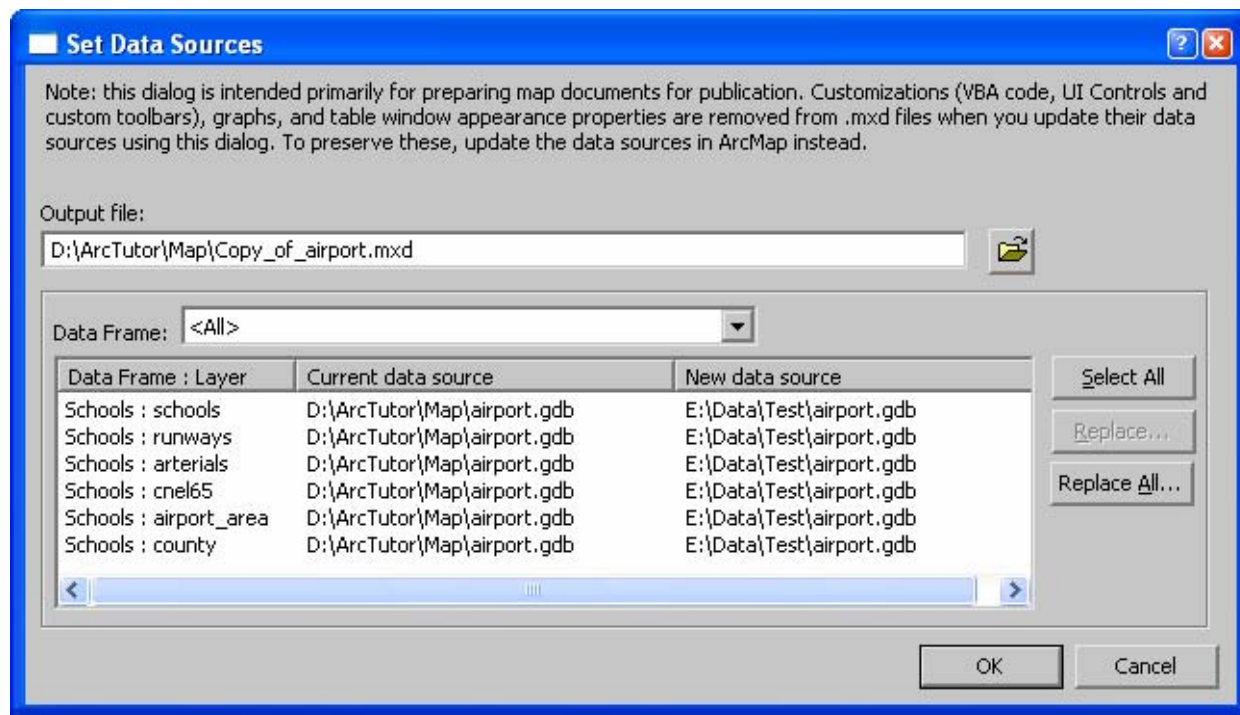
You can also now resize the Set Data Source(s) dialog, which makes it easier to work with long paths.

■ The Tools > Options dialog Proxy Server tab has been renamed to be the Connections tab. Starting with 9.2 Service Pack 2, you use the Internet Options in the Windows Control Panel to specify proxy server and https/SSL connection information, and ArcCatalog automatically uses these settings for all your GIS Server connections. You only need to enter information into the Connections tab if your proxy server requires authentication, in which case you simply specify the user name and password in those two fields in the tab.

■ Graphics layer files now have their own icons in ArcCatalog. Your existing layer files based on these data types won't be shown in ArcCatalog with these icons. Only new graphics layer files you create will adopt the new icons.

 2D graphics layer created in ArcMap   3D graphics layer created in ArcScene or ArcGlobe

Metadata

View metadata from ArcMap, ArcGlobe and ArcScene without launching ArcCatalog

■ You can now access metadata about any layer's data source directly without having to open ArcCatalog. Right-click any layer in the Table Of Contents and choose the new View Metadata command from the Data pullright:
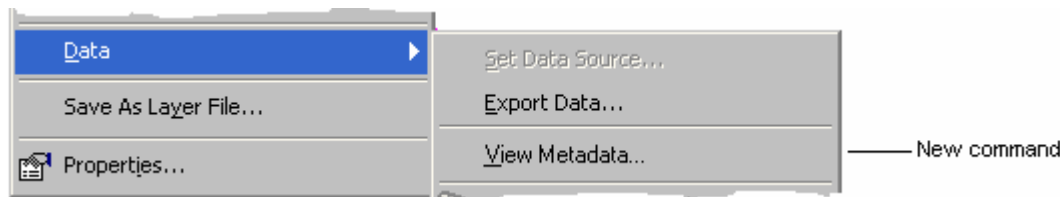
Choosing the View Metadata command opens the metadata for the layer's data source in a new floating Metadata window. This window works the same as the Metadata tab in ArcCatalog. It also enables you to choose the stylesheet you want to view the metadata with. Each time you use the View Metadata command, a separate instance of the Metadata window appears. This makes it easy to compare the metadata for different layers. In this screenshot, metadata for two layers has been opened:
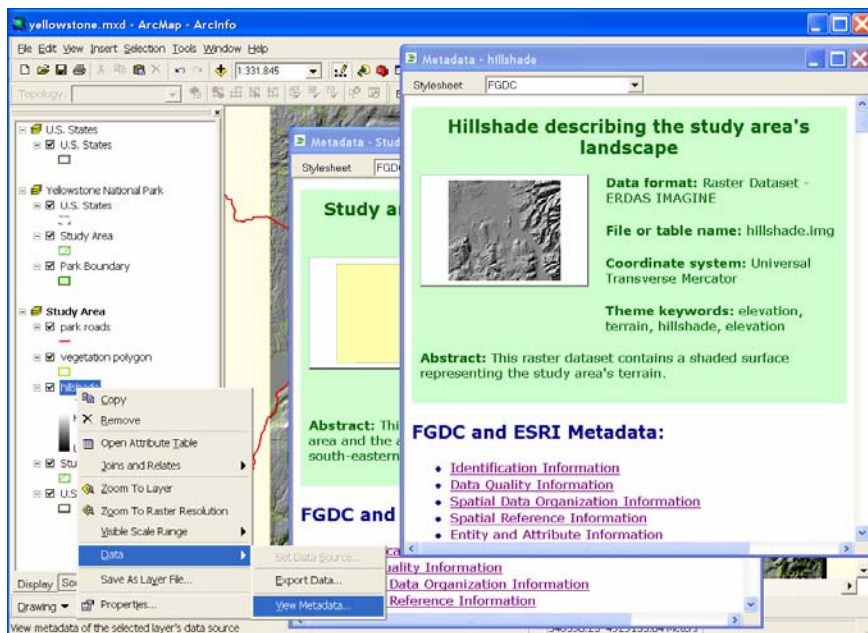
If the data source of the layer you access metadata for does not have metadata created for it yet, the View Metadata command will automatically initiate metadata creation if the option to 'automatically create metadata' is enabled in the ArcCatalog Tools>Options dialog Metadata tab (it is enabled by default). If that setting is disabled, or if you don't have write access to the data source's location, the Metadata window will show you the standard message that metadata cannot be created.

Tip: If you'll be using the new View Metadata command frequently, you can customize the Layer context menu using the Tools>Customize dialog to move the command out of the Data pullright and into the main part of the context menu.

New geoprocessing tools for working with metadata

These tools provide new metadata functionality and also enable you to include these functions in scripts, batch processes, and models to automate metadata handling.

■ **Support for ISO 19139 format:** You can export your existing FGDC or ESRI-ISO format metadata into a standalone XML file in the new ISO 19139 format. This tool also enables you to convert an XML document in ISO 19139 format to ESRI-ISO format so that it can be loaded into an ArcIMS metadata service. The ESRI Metadata Translator can be customized to support any metadata profile or standard, for example, a regional profile of ISO 19139:

🔧 Conversion Tools > Metadata > **ESRI Metadata Translator**

Note: There are no changes to the editors or synchronizers or internal metadata management in ArcGIS for 9.2.

■ **Validate FGDC metadata:** Lets you validate FGDC metadata using the USGS Metadata Parser tool (MP) which is now included with Desktop:

🔧 Conversion Tools > Metadata > **USGS MP Metadata Translator**

■ **Publish XML metadata to an ArcIMS metadata service:**

🔧 Conversion Tools > Metadata > **ArcIMS Metadata Publisher**

■ **Support for XSLT style sheet:** You can now transform an XML metadata document using an XSLT style sheet and export the result to a standalone file. For example, before publishing metadata to an ArcIMS metadata service, you might transform it using an XSLT style sheet:

🔧 Conversion Tools > Metadata > **XSLT Transformation**

Other

■ You can now create standalone XML files directly in ArcCatalog using the new File > New > XML Document command when you are working in a folder. This makes it easier to create metadata templates. To edit an XML file after creating it, select it in the Catalog tree, switch to the Metadata tab, and launch the Metadata Editor from the Metadata toolbar.

■ When you browse the contents of an ArcIMS metadata service in ArcCatalog, the Contents view has been enhanced to include new information about each metadata document. You can now see which documents you own, which documents are public or private, and other document properties in the Details list on the Contents tab:

You can also change a metadata document's public/private property by right-clicking it and using two new commands in its context menu: Change To Public and Change to Private.

► *See the 'ArcIMS' chapter in this document for what's new in the ArcIMS metadata service..*

■ The File > Print command in ArcCatalog has been renamed to File > Print Metadata to make it clear that this only lets you print metadata and is only enabled when you are using the Metadata view.

Customization & development

ArcGIS Desktop application framework

■ In the Tools > Customize dialog the Macros, Menus, New Menu and UIControls categories are now grouped together at the end of the categories list and enclosed in [ ] brackets to make them easier to find and make it clearer they are special categories. See graphic below).

■ A new option has been added into the Tools > Customize dialog and Tools > Customize > Keyboard dialog to make it faster to find a particular command in the commands list. You can type a command name or any part of a command name into the new 'Show commands containing' field. The Commands list will immediately be restricted to the commands in the currently selected category that match or contain the text string you typed in, and the Categories list will be restricted to categories containing commands that match or contain the text string you typed in. For example, in this screenshot the Commands list only shows commands containing the string 'zoom', and the Categories list only shows categories containing commands like that:
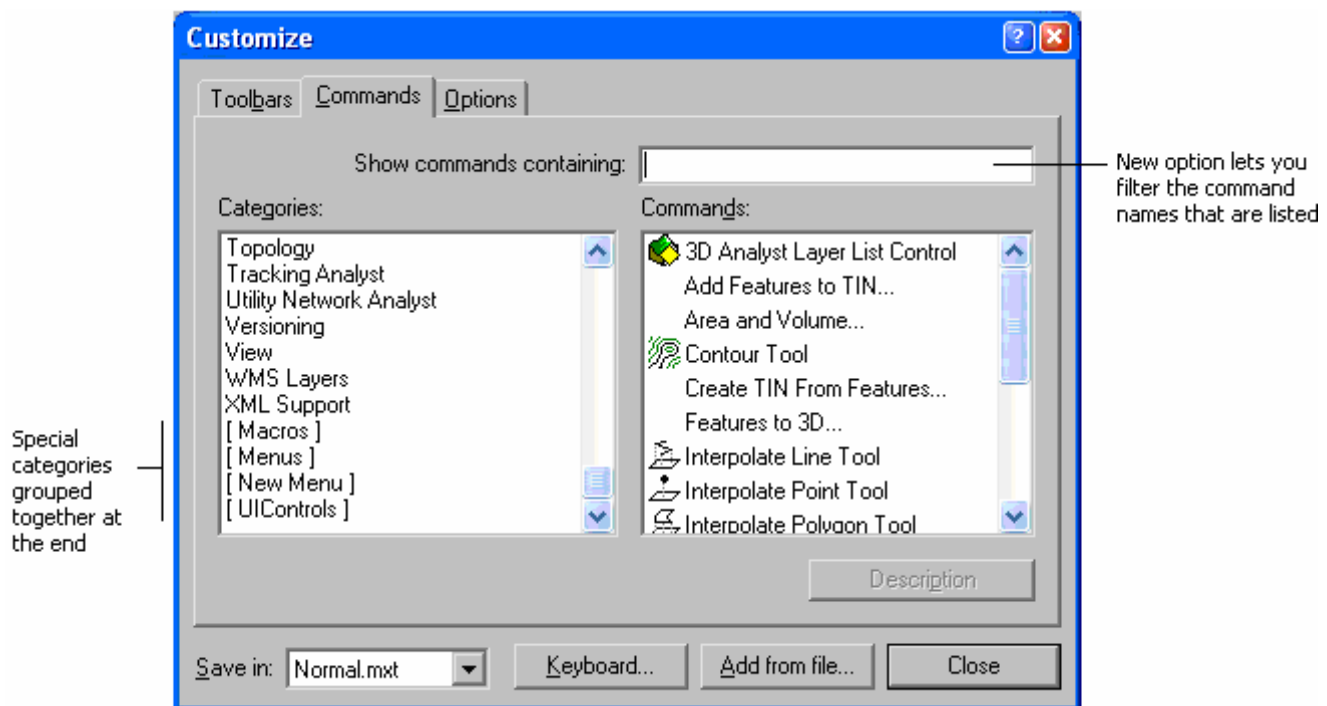
To return to seeing all of the commands and categories, clear the 'Show commands containing' field.

Note: Irrespective of what you enter into the field, the four special categories Macros, Menus, New Menu and UIControls are always shown in the categories list on the left (and if you are using the Customize Keyboard dialog, the Macros category is always shown in the categories list on the left).

■ Keyboard shortcuts can now be defined to invoke any interactive tool, such as the Zoom In tool, Edit tool, etc. To specify a keyboard shortcut for a tool, go to Tools>Customize and click the Keyboard button to launch the Customize Keyboard dialog. Tools are now listed in the Commands section of that dialog.

■ The list of context menus accessed via Tools>Customize is now sorted alphabetically to make it easy to find context menus so you can customize them. To customize the contents of a context menu, go to Tools>Customize and check the box next to the 'Context menus' entry in the list.

■ If you reduce screen resolution or change dual monitor setting during an application session, any floating toolbar or dockable window that is out of the screen area, will now be brought back into the viewable screen area when you toggle its visibility. If you reduce screen resolution between application sessions then they will be bought back into the viewable screen area the next time you start the application.

■ ArcGIS 9.2 fixes a number of issues relating to toolbars becoming stacked.

ArcGIS Desktop developer resources

■ At 9.2, the ArcGIS Desktop developer resources have been separated into four unique Developer Kits.

- ArcGIS Desktop VBA Developer Resources
- ArcGIS Desktop Developer Kit for Visual Basic 6
- ArcGIS Desktop Developer Kit for Visual C++
- ArcGIS Desktop Developer Kit for the .NET Framework

Each of these developer kits include a detailed help system for ArcObjects along with sample code, developer tools and other documentation to help you customize and extend the ArcGIS Desktop applications.

The ArcGIS Desktop Developer Kit for the .NET Framework supports development with Visual Studio 2005 and includes several Visual Studio project templates, wizards, commands and code snippets to help with programming ArcObjects and .NET.

■ For the latest information, including how to migrate and upgrade your code, see the 'What's new for ArcGIS Desktop developers at 9.2?' page in the ESRI Developer Network (EDN) website at:
http://edndoc.esri.com/arcobjects/9.2/NET/cae8305f-3d33-45cc-9af8-fb8270e0e571.htm

ESRI Developer Network (EDN)

■ At 9.2, EDN includes:
- ArcGIS Engine Developer Kit
- ArcGIS Engine Runtime
- ArcGIS Server Workgroup
- ArcGIS Server Enterprise
- ArcIMS
- ArcWeb Services
- .NET Developer Kit
- Java Developer Kit
- C++ Developer Kit

■ At 9.2, EDN has an option to add an ArcView single use license (with the 3D Analyst, Spatial Analyst and Network Analyst extensions). You can purchase this option at any time during your current EDN subscription at price that is a substantial discount over buying these products separately.

■ Additional developer content has been added to the EDN library in the form of technical articles, samples, developer guide scenarios, and more. See the EDN website: http://edn.esri.com

ArcGIS 9.2 Engine Developer kit

At 9.2, ArcGIS Engine increases developer productivity by providing out of the box coarse grained components in the form of new extensions, API's, controls, commands and tools, together with focused software developer kits (SDKs). Cross platform support has also been improved with complete Engine support offered on Linux Red Hat 4, Solaris 9, 10 and SUSE 9.

New extensions for ArcGIS Engine

A key focus of the 9.2 release for ArcGIS Engine was the addition of some more advanced extensions. The new extensions to ArcGIS Engine Runtime: Data Interoperability, Maplex, Schematics, and Tracking Analyst, follow the existing Engine Runtime extension pricing and licensing model.

■ **Data Interoperability:** The ArcGIS Data Interoperability extension for ArcGIS Engine Runtime provides real data interoperability that works with all the major formats. The extension includes direct data access, transformation, and export capabilities and enables custom ArcGIS Engine applications to dynamically fuse together various data sources. The Data Interoperability license is needed when a custom application requires the functionality exposed via the extension. This functionality is exposed to developers through the DataInterop assembly, new at 9.2.

■ **Maplex:** Maplex allows for automation of high-quality cartographic text placement and labeling. Without the Maplex extension, the baseline labeling functionality, prioritizes label placement based on which layer a feature is in. This powerful and flexible extension allows features from many layers to be prioritized equally and independently. This functionality is exposed to developers through the Maplex assembly, now available in ArcGIS Engine.

■ **Tracking Analyst:** The Tracking Analyst extension, allows your application to explore, visualize, and analyze change relative to time and location. The extension provides tracking of temporal data from GPS and other tracking and monitoring devices in real time and includes the playback and analysis of the time series data. This functionality is exposed to developers through the Tracking assembly, now available in ArcGIS Engine.

■ **Schematics:** The Schematics extension, provides the ability to manage and view network data in a wide variety of geo-schematic and schematic representations. This functionality is exposed to developers through the Schematic assembly, now available in ArcGIS Engine.

New assemblies at 9.2

■ **ADF** contains the .NET base classes, component category unique IDs (CATIDs), and utility classes that were previously delivered in the ESRI.ArcGIS.Utility assembly that has been deprecated for the 9.2 release. Also includes the following new base classes: BaseCommandBar, BaseMenu, BaseToolbar, CustomLayerBase, and GlobeCustomLayerBase.

■ **ADF.Connection** contains .NET classes to establish connections with ArcGIS Server and ArcIMS services. Also provides a set of classes to manage fail-over and round-robin properties of a connection

■ **Animation** contains objects to work with animations in ArcMap, ArcScene, or ArcGlobe. An animation in ArcMap, ArcScene or ArcGlobe is composed of animation tracks (AGAnimationTracks) which are further composed of keyframes (AGAnimationKeyframes) of the same type. Each keyframe stores properties of the animation objects. When an animation is played, keyframes are interpolated and the interpolated properties are then applied to the animated objects to create the dynamic visual effect.

■ **ArcWeb** provides objects to access a Simple Object Access Protocol (SOAP) based collection of ArcWeb Services. ArcWeb Services communicate with any local application that can connect to the Web and understand Extensible Markup Language (XML). ArcWeb Services use a SOAP wrapper to transfer information back and forth to a local client application using hypertext transfer protocol (HTTP).

■ **Controls** provides access to all ArcGIS Engine Controls (LicenseControl, MapControl, PageLayoutControl, GlobeControl, SceneControl, ToolbarControl, TOCControl, SymbologyControl) and all out of the box ArcGIS Engine commands, menus, palettes and multi-items. All controls, commands and HookHelper objects have been moved from the ControlsCommands, 3DAnalyst, and GlobeCore assemblies to the new Controls library.

■ **DataSourcesnetCDF** provides objects to access a netCDF file as a workspace and to create a raster layer, feature layer or table view from a netCDF.

■ **GeodatabaseExtensions** contains objects to aid in the creation, management, and use of terrain datasets and cadastral fabrics. *(At the 9.2 release, the cadastral fabrics related objects are not yet fully implemented and we recommend that developers do not utilize them until the Cadastral Editor for the Survey Analyst extension is released).*

■ **Geoprocessor and Geoprocessing**: ArcGIS Engine Runtime at 9.2 includes the geoprocessing framework. The geoprocessing tools available to custom ArcGIS Engine applications depend upon the license the application is using. ArcGIS Engine applications can run ArcView level GP tools and edit shapefiles and personal geodatabases using an ArcGIS Engine Runtime or ArcView license. ArcGIS Engine applications can run ArcEditor level geoprocessing tools and edit enterprise geodatabases using an ArcGIS Engine Runtime with the Geodatabase Update extension or an ArcEditor license. In order to run an ArcInfo level tool, an ArcInfo license is required.

The Geoprocessor assembly is a .NET specific assembly containing a managed class called the geoprocessor. In most cases, .NET developers would interact with this assembly rather than the Geoprocessing assembly which exposes geoprocessing objects via COM.

■ **Publisher:** The Publisher Library was extended for the ArcGIS 9.2 release to include an ActiveX Control (the ArcReaderGlobeControl) for viewing Published Map Files (PMF's) authored in ArcGlobe. Prior to the ArcGIS 9.2 release, the Publisher Library contained a single ActiveX Control (the ArcReaderControl) that enabled viewing of Published Map Files authored in ArcMap. The term PublisherControls refers collectively to the ArcReaderControl and the ArcReaderGlobeControl.

Enhancements to existing developer assemblies

■ **Carto** exposes the new cartographic representation functionality. Custom applications can view and work with cartographic representations using an ArcGIS Engine Runtime or ArcView license; however, creating or editing a cartographic representation requires an ArcGIS Engine Runtime with Geodatabase Update extension or an ArcEditor license. In addition, the following layer factories have been added to the Carto library:
  - CadastralFabricLayerFactory *(see the note above for the GeodatabaseExtensions assembly).*
  - EngineCadAnnotationLayerFactory
  - EngineCadFeatureLayerFactory
  - EngineCadLayerFactory
  - EngineCoverageAnnotationLayerFactory
  - EngineIMSLayerFactory
  - EngineNetworkLayerFactory
  - EngineTopologyLayerFactory
  - EngineWMSMapLayerFactory
  - FeatureLayerFactory
  - netCDFLayerFactory
  - RasterCatalogLayerFactory
  - RasterLayerFactory
  - TerrainLayerFactory
  - TinLayerFactory

■ **DataSourceRaster** includes a new set of components that perform raster transformations such as polynomial transformation, RPC transformation, Coordinate transformation, and Spline transformation. In addition, APIs to build and retrieve raster attribute tables for all raster data sources are now available and the SaveAs capability has been extended to enable saving to raster formats such as PNG, JP2, BMP, JPG, PCRaster, X11 PixelMap, and file geodatabase.

■ **Display** provides new components for editing feature class representations so that cartographic editing and finishing maps is a more convenient process. A representation is symbology stored in the geodatabase for each feature. Representation rules define how a set of features in a feature class will be drawn, using representation symbology rather than standard ArcGIS symbols. New symbols called Basic symbols (BasicMarkerSymbol, BasicLineSymbol, BasicFillSymbol) are provided with ArcGIS 9.2. In addition, methods are provided to convert standard ArcGIS symbols to Basic symbols. Basic symbols are then used along with GeometricEffects to define RepresentationRules. GeometricEffects are special processes that allow you to dynamically alter the geometry of features as they are drawn on your map, without affecting their underlying shape or spatial relationships. GraphicAttributes enable you to define attributes for GeometricEffects (width, dash style, simplify options, etc), MarkerPlacements (X, Y offsets), Basic symbols (patterns, strokes, etc), and feature class representation properties (visibility). Features can be displayed using the feature geometry or shape overrides from the representation or as a free representation graphic.

GeoAnalyst added two new interfaces: IInterpolationOp3 and IRasterNeighborhood2.

Geodatabase components have been added that create and manage feature class representations. Representation is symbology stored in the geodatabase for each feature. Creating new representations for a feature class results in the addition of two new fields (RuleID and Override) to the feature class. A new workspace extension called RepresentationWorkspaceExtension maintains information about representations present in a workspace. RepresentationClass, RepresentationClassName, RepresentationClassNames, and Representation are some of the new classes added to this library.

GeodatabaseDistributed now provides components for geodatabase replication and a high level object model for using this functionality with ArcGIS Server.

Geometry now enables the creation of high precision spatial references and supports vertical coordinate systems to vector data, including shapefiles and feature classes.

A spatial reference is composed of two parts. The first includes the horizontal and vertical coordinate systems. The second includes storage and processing parameters for a dataset. Prior to this release storage parameters for a dataset were defined by the domains or area of interest (xy, z, and m) and the precision or scale values. The maximum precision value was 2147483647 if a domain had an extent of 1. This type of spatial reference is now called low precision. A high precision spatial reference, new at 9.2, has a maximum precision value of over 9000 trillion (9E15). The spatial reference concept of precision is difficult to understand so a new concept of 'resolution' is now in use. The resolution is the inverse of the precision and directly reflects the data's accuracy. Tolerance values are also supported. They are used with all geometric and relational operators.

The spatial reference coclass now supports ISpatialReferenceResolution and ISpatialReferenceTolerance interfaces. With the ISpatialReferenceResolution.ConstructFromHorizon method, you can automatically set the xy domain to the valid area of interest for a projected or geographic coordinate system. Use ISpatialReferenceFactory.ConstructHighPrecisionSpatialReference to create a high precision version of an existing low precision spatial reference.

Vertical coordinate system metadata is now supported for vector data including shapefiles and feature classes. A vertical coordinate system includes information on the origin and linear unit of z coordinates of a dataset. The ISpatialReferenceFactory3.CreateVerticalCoordinateSystem method to instantiate a predefined vertical coordinate system. Use IVerticalCoordinateSystemEdit.Define to create a custom vertical coordinate system. Set or retrieve the vertical coordinate system on a spatial reference with ISpatialReference3.VerticalCoordinateSystem.

SpatialAnalyst added two new interfaces, IHydrologyOp2 and ILogicalOperatorOp2, have been added to the SpatialAnalyst library. All GPValue, GPDataType, GPValueTableType, GPDomain and few other objects have been moved from SpatialAnalystUI assembly to SpatialAnalyst assembly.

Enhancements to existing controls

■ **LicenseControl**: updated with new ArcGIS Engine Runtime extensions and licensing levels.

■ **MapControl**: mouse wheel and keyboard display navigation has been enabled.

■ **PageLayoutControl**: mouse wheel and keyboard display navigation has been enabled.

■ **TOCControl (Table of Contents control)**: enhanced with the following:
- Getting and setting the selected layer
- Layer drag and drop from ArcMap
- Layer re-ordering by drag and drop
- Copying layers

■ **ToolbarControl**: now includes the following:
- Appearance properties for vertical orientation, transparency, background color, and shading
- Support for XP themes
- Hidden items menu when ToolbarControl is not large enough to display all items
- Support for multi-item objects on ToolbarMenus
- ToolbarPalette object providing a popup palette of tools
- Right to left ToolbarMenus and ToolbarPalettes
- Customizable ToolbarMenus and ToolbarPalettes
- Support for buddy swapping
- Persisting and loading ToolbarControl items
- Context sensitive help tool enables your users to get popup context help about any control in a toolbar

New controls, commands and tools

■ **Add Data command**: this addresses the number one enhancement request for the Engine by providing a way for your users to add data into Engine applications. The Engine-based Add Data dialog doesn't require ArcCatalog objects and doesn't use the Desktop Add Data dialog framework, so data at any folder location can be accessed. Users choose what they want to add from the options on the left of the dialog. Shapefiles, file geodatabases, personal geodatabases, web services (ArcIMS, ArcGIS Server, WMS), rasters, and layer (.lyr) files are supported. Layer file support makes it possible for users to add data types that are not supported directly via the other options in the dialog, such as ArcSDE geodatabase data. Support for layer files is also convenient because it enables you to define how the data that a user adds into an Engine application will appear.
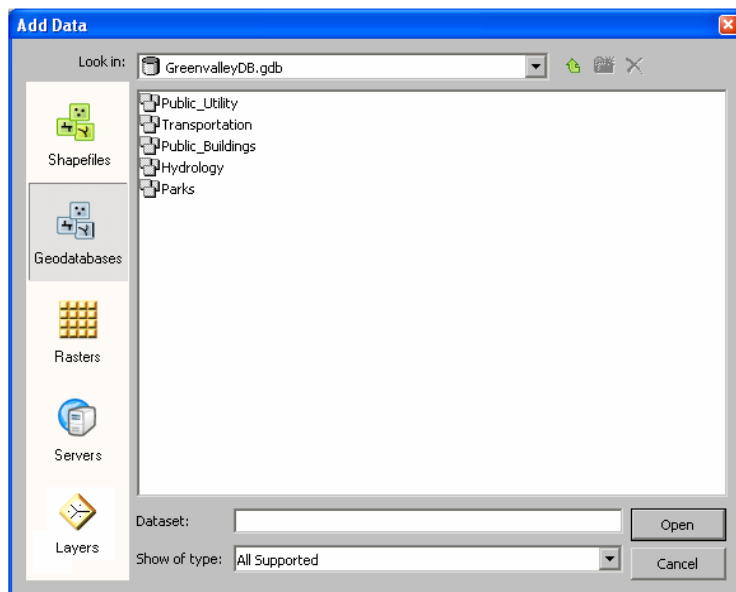
This dialog is also exposed in the Desktop environment via the Tools > Customize dialog where you can find the command in the new 'Generic' category. When the dialog is launched from ArcGIS Desktop, it automatically contains an additional option on the left hand side called 'All Types'. This option provides full access to the entire ArcCatalog tree and makes the dialog have the same functionality as the standard Add Data dialog. The 'All Types' node isn't available when the dialog is launched from ArcGIS Engine.

■ The **Symbology Control** provides access to the contents of style files and custom symbology. The control displays the contents of one symbology style class at any one time (for example, marker symbols or color ramps) and allows the selection, removal and preview of individual symbols. Selected symbols can be used to update part of an application, such as a layer's renderer, an element's symbol, or cartographic marginalia such as scale bars and north arrows.

■ New set of **QT Controls** for cross platform development include QT widgets for Windows, Linux and Solaris and GTK widgets for Windows.

■ **Full Screen command**: toggles between full screen and windows mode.

■ **Map and Globe commands and dialogs**: these provide the same new and enhanced functionality that has been introduced into Desktop at 9.2: Go To XY dialog, My Places dialog, Find dialog, Find Route dialog, Find Nearby Places dialog, Identify, Measure, Swipe, Flicker, Bookmarks, etc. A command for adding KML data from the Internet has been added for use with the GlobeControl.

■ **Ink commands**: provide ink markup pens, highlighters and erasers, together with a find ink command. In addition the *EngineInkEnvironment* object manages the ink environment used by these commands and any custom commands you create.
　　Ink tools:
　　　Pens: Create graphics on a map using various pen widths
　　　Erasers: Erase part or all of a sketch using various eraser widths
　　　Highlighter: Emphasize areas with various semitransparent colors
　　　Find Ink: Lets you search for graphics in a graphics layer

■ **ArcWeb Services commands**: provide commands for signing in to and managing an ArcWeb services account. Support for ArcWeb Services provides additional premium services in the Find dialog Addresses tab, Find Route dialog and Find Nearby Places dialog.

■ **Editing commands**: provide commands for managing an edit session (starting, stopping, saving), managing selected graphics or features (cut, delete, copy, paste, move), managing the snapping environment, editing attributes, sketching and displaying sketch properties and a context menu for managing the current sketch (direction, deflection, length, endpoint, midpoint, vertex, streaming, absolute xy, delta xy). In addition the *EngineEditor* object manages the editing environment used by these commands and any custom commands you create. Editing commands do not require additional license and the data sources editable depend on the level of Engine runtime license. ArcGIS Engine applications can edit shapefiles, personal geodatabases, and file geodatabase with these commands using an engine runtime or ArcView license. ArcGIS Engine applications can edit ArcSDE geodatabase data using an engine runtime with a geodatabase license or ArcEditor license.
　　Editing tools:
　　　　Edit Tool: Select feature/vertex for modification
　　　　Sketch Tool: Create point or vertex for polyline, polygon
　　　　Editing Target: Provide a list of layers that user can choose as current editing target
　　　　Attributes Editing: Show attributes window for user to edit attributes
　　　　Edit Sketch properties: Edit sketch geometry properties by inputting value
　　Editing context menu commands/shortcuts:
　　　　Snap To Feature
　　　　- Endpoint (CTRL + F5): Snap to endpoint
　　　　- Vertex (CTRL + F6): Snap to vertex
　　　　- Midpoint (CTRL + F7): Snap to midpoint
　　　　- Edge (CTRL + F8): Snap to Edge
　　　　Direction (CTRL + A): Sketch based on direction
　　　　Deflection (CTRL + F): Sketch based on the direction of last segment
　　　　Length (CTRL + L): Specify segment length
　　　　Change length: Change segment length
　　　　Absolute X, Y (F6): Specify next vertex by X, Y
　　　　Delta X, Y (CTRL + D): Specify next vertex by the difference from last added vertex
　　　　Streaming Checkbox (F8): Turning on streaming will automatically add points
　　　　Delete Sketch (CTRL + Delete): Delete current sketch
　　　　Finish Sketch (F2): Finish current sketch
　　　　Finish Part: Finish current sketch as a geometry part

■ **Network commands**: provide commands for managing network locations (creating, selecting, moving), solving networks (route, closest facility, service area, OD cost matrix) and displaying directions. In addition the *EngineNetworkAnalystEnvironment* object manages the network environment used by these commands and any custom commands you create. Custom ArcGIS Engine applications must have a Network extension checked out in order to use these commands.

■ **Schematics commands**: provide commands for managing schematics diagrams (create, update, save), managing schematics elements (edit, move, select) and managing label and symbol size. Custom ArcGIS Engine applications must have a Schematic extension checked out in order to use these commands.

Dynamic display support

■ Developers applications can take advantage of dynamic display support, a completely new capability introduced at 9.2 that enables a map display to display large numbers of moving objects at sub-second refresh rates, all while sustaining smooth and uninterrupted navigation and support for GIS data query. This capability is available within ArcMap and ArcGIS Engines so it can be used and configured using ArcObjects and supported development environments in both ArcMap and the MapControl.

In this example, an ArcGIS Engine application is dynamically displaying the continuously updated location of hundreds of aircraft, along with associated identification information:
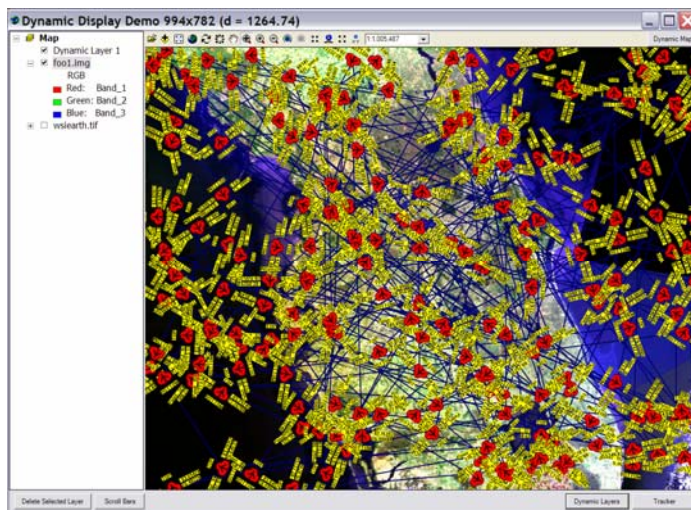
GIS applications often require the ability to display information with frequent refresh rates. This information must be rapidly updated without interruption, including animating moving objects, updating the location, orientation, size, status and attribute information, particularly in critical Command and Control (C2) applications. Up to now the ability to handle very rapid refresh rates for large numbers of dynamic objects has been limited.

This enhancement brings dynamic display capabilities to ArcObjects, allowing smooth pan, zoom, rotation, navigation and display of dynamic graphics through the use of OpenGL display rendering and fast refresh rate technology. Dynamic display allows the display performance required of real-time applications, while using the existing query and editing tools and layer functionality of ArcObjects.

The *DynamicMap* can be enabled using the *IDynamicMap* Interface that is implemented by the *Map* CoClass. The *Map* CoClass is implementing the interface *IDynamicMap*. Use the interface *IDyanmicMap* to enable or disable the *DyanmicMap* (which is the dynamic display). When enabled, the dynamic display is creating an OpenGL rendering context to draw the basic map layers, and on top of the base layers, draws the dynamic layers.

► *For more information on implementing dynamic display, see the 'Dynamic Display Capabilities in the ArcGIS Framework' document in the Engine SDK documentation in the ESRI Developer Network (EDN).*

Changes to the licensing model

All custom ArcGIS Engine applications must perform license initialization at application start time using the LicenseControl or the AoInitialize object. Any existing 9.0 or 9.1 custom ArcGIS Engine applications not containing license initialization will fail when run on the 9.2 platform.

■ **ArcGIS Desktop 9.2 can now run Engine Applications**
You can now run your Engine Applications on a Desktop machine. Basically if you want to run an Engine Application and you already have a 9.2 Desktop installed, you need not install the Engine Runtime to run your applications.

■ **API support**
ArcGIS Engine Developer Kit has been divided up into several toolkits for building and deploying custom ArcObjects based solutions based on individual API's. This includes .NET Developer Kit, C++ Developer Kit, COM Developer Kit (VB6 and VC ++) and Java Developer Kit. See below for what's new in each of these.

.Net Developer Kit

■ Developer resources and tools have been integrated into the Visual Studio 2005 and Express integrated developer environments (IDEs) to make developing ArcGIS Engine applications easier. These include:
  - **Code Converter**: wizard that converts Visual Studio projects and solutions built against ArcGIS 8.3 to work with ArcGIS 9.2. You can convert either the projects in the current solution, or use the batch option to convert many solutions or projects at a time.
  - **Project templates**: help you quickly get up and running with your ArcGIS Engine application.
  - **New item templates**: provide a simple, quick way to create common customizations such as commands and tools.
  - **Code snippets**: small sections of ArcGIS code that perform common tasks and can be pasted into your project using Visual Studio's Insert Snippet feature.
  - **Add ArcGIS Class**: wizard that creates a .NET class for a range of typical ArcObjects components.
  - **Add references**: dialog enabling you to add ArcGIS references to your project based on product, functional area, or feature area.
  - **Component Category Registrar**: registers classes in the current project to ESRI component categories.
  - **License Initializer**: selects which ArcGIS product and extension licenses your application will initialize upon startup.
  - **ArcGIS Toolbox Reference**: creates a managed assembly for your custom ArcGIS Toolbox of geoprocessing tools.

C++ Developer Kit

■ C++ API Updates

■ QT support

COM Developer Kit (VB 6 and VC++)

■ Tools and Add-ins:
  - Modified Automatic references Add-ins
  - Geoprocessing Help Add-in

Java Developer Kit

■ ArcGIS Desktop 9.2 is a superset of Engine Runtime. It now lays down the files necessary for running Java applications (along with the arcobjects.jar). You can use the boot strapping mechanism explained in the Deployment doc to locate the "arcobjects.jar" when deploying to the ArcGIS Desktop machines.

■ Java API Updates:
  - Update Visual Beans to make use of Control customize dialog.
  - Improved Java samples.
  - More technical documents and Walkthroughs.
  - Updated Engine Runtime for Java (9.1 functionality).
  - No Java Developer Kit resources.
  - Support for *casting* and *instanceof* - No need for QI (use of proxy classes).
  - GeoProcessing:
      - The GeoProcessing library implements the Geoprocessing framework in addition to the base set of Geoprocessing tools.
      - "ToolGenerator" to creates Java tools from custom tools or models. It can be used to generate Java classes for the custom model or tool.
  - IDE Integration:
      - Bundled Eclipse with integrated samples for out of box experience.
      - New templates to quickly create applications by going through a series of wizards. The templates included are:
          Routing
          Basic Viewer
          Geocoding
          UI Samples
      - ArcObjects help bundled with Eclipse.
      - The above features can be added to any Eclipse Version 3.1 or greater by using ArcGIS Engine Plug-ins.
  - Improved SDK structure and Content:
      - Improved javadoc:
          - Unnecessary constructors have been removed and generally improved content.
      - Samples:
          - New Domains - Tracking, Network Analyst, Geoprocessing and samples showcasing the new control and tools.
          - Executable jars available for the samples. You can find the jars in the sample/bin folder and simply execute them to run the application.
          - Samples have been provided to highlight each of the following or they are used within the templates in Eclipse:
              Measure, Identify and Find
              More navigation tools for Globe
              Editing Tools.
              Tools for Network Analysis
              Tools for Sketching
              Tools for connecting to ArcWebSymbologyControl
  - Visual Components
      - Symbology Dialog, Attribute Table, Select By Location, Query Dialog, Buffer Dialog and Find Dialog are introduced as samples to use and view in code.
      - Eclipse plug-in to view a UI Samples components palette in design time; drag and drop in IDE when creating an engine application.

Linux/Solaris support

■ Moved to MainWin 5.04 at 9.2.

For the latest information, see the 'What's new for ArcGIS Engine developers at 9.2?' page in the ESRI Developer Network (EDN) website:
http://edndoc.esri.com/arcobjects/9.2/CPP_VB6_VBA_VCPP_Doc/Cpp/new_92_win.htm

Data & services from ESRI

ArcGIS Online

■ ArcGIS Online is a new family of web-based services and products for ArcGIS users. Powered by ArcGIS Server, ArcGIS Online offers ready-to-use live content and capabilities, such as basemaps, globes, and overlays. It also provides online data delivery and hosting services.

The free services provided by ArcGIS Online include street maps, imagery, shaded relief, topographic base maps, and overlays containing place names and boundaries:

For more information on ArcGIS Online and to access the free map documents and services , see
*http://arcgisonline.esri.com*

Improved ArcWeb Services integration into Desktop

■ ArcWeb Services from ESRI are subscription-based services that give you access to premium GIS data from leading commercial data publishers, such as GlobeXplorer, NAVTEQ, Meteorlogix, and Tele Atlas and a collection of high performance, reliable GIS services providing additional capabilities and functionality.

ArcWeb Services subscribers get a user name and password that enables them to access the services. New users can register for a free evaluation subscription. ArcGIS Desktop users who subscribe to ArcWeb Services can work with these services directly in their applications. ArcWeb Services can also be included in web mapping applications, custom ArcGIS Engine applications, maps and globes published with ArcGIS Publisher, or embedded in applications using the ArcReader Control.

■ Support for ArcWeb Services in ArcGIS Desktop was previously provided by the 'ArcWeb Toolbar For ArcGIS' which was available to ArcWeb Services subscribers as a separate free download. In 9.2 support for ArcWeb Services has been built into ArcGIS Desktop and there is no longer a separate toolbar that has to be downloaded. ArcWeb Services subscribers can access the services from ArcGIS Desktop out-of-the-box without having to install or download anything else.

■ A new ArcWeb Services folder is available in ArcCatalog that makes it easy to access the various data services available to you as an ArcWeb Services subscriber. This folder is hidden in ArcCatalog by default but you can turn it on by going to the Tools > Options dialog General tab and checking it in the list you'll see there. The first time you connect to this folder, you'll be prompted for your ArcWeb Services user name and password. After you sign-in, you'll see all the available data services listed. ArcWeb data services are all in ArcIMS image service format:
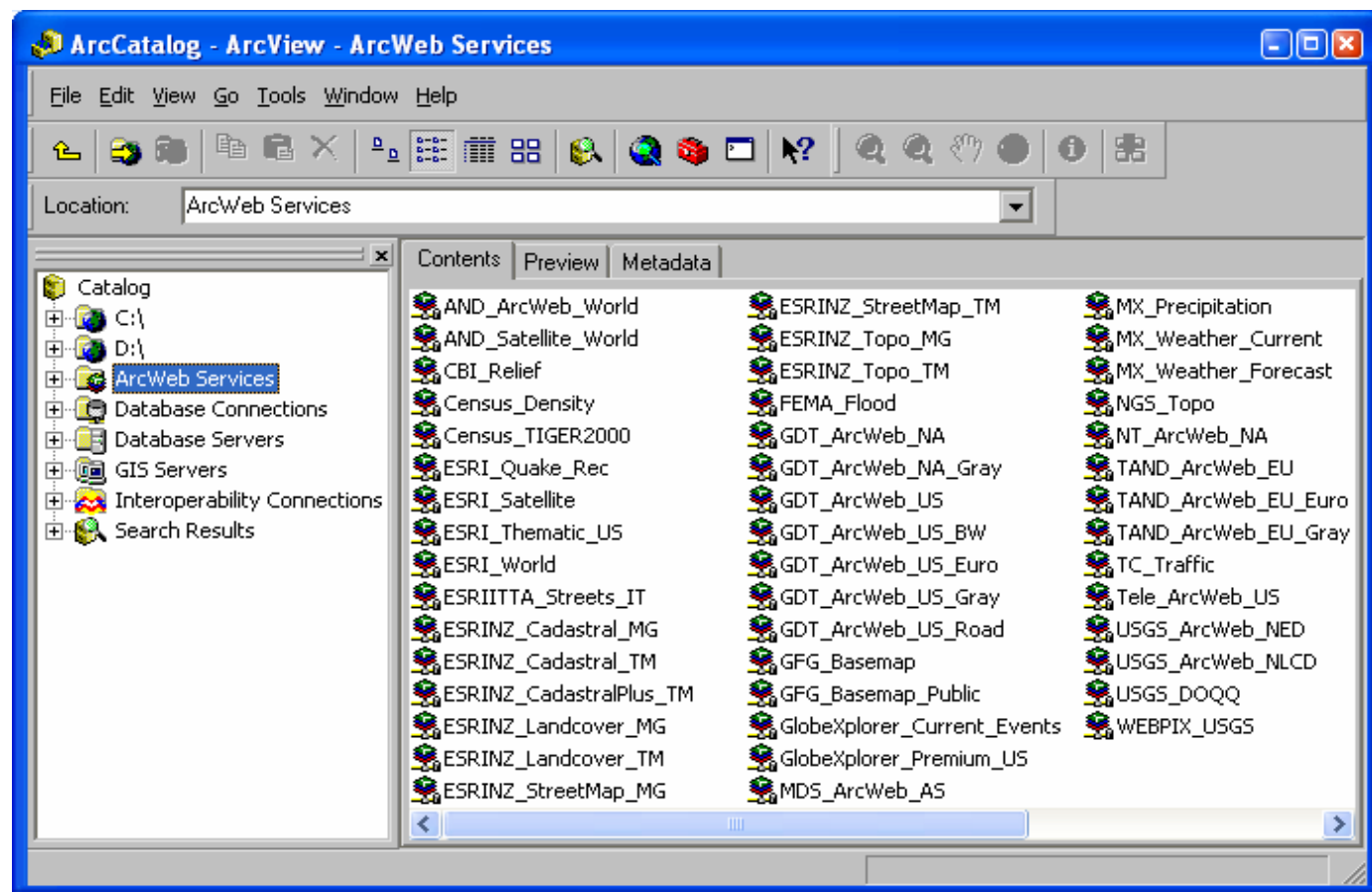
■ As an ArcWeb Services subscriber, you also have access to a set of additional specialized services in ArcMap, ArcGlobe or ArcReader. The new Tools > Online Services pullright in all three applications contains commands for signing in to and managing your ArcWeb Services account:
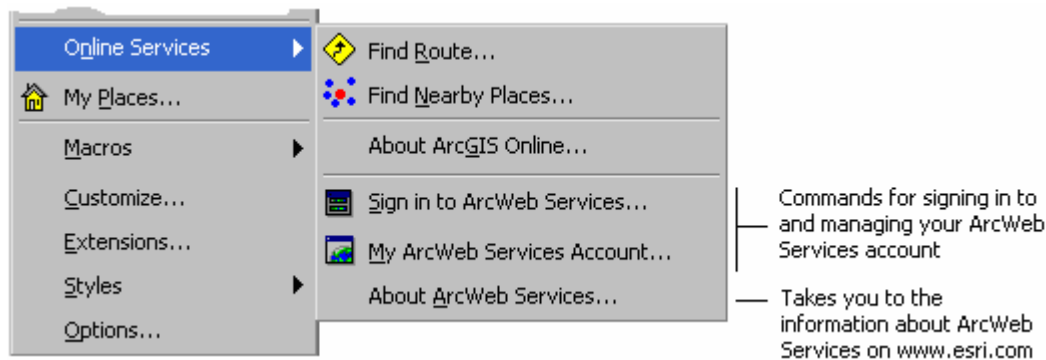
After you have signed into ArcWeb Services you'll see the additional specialized services in these dialogs:

- the Find dialog's Addresses tab
- the Find dialog's new Places tab
- the new Find Route dialog
- the new Find Nearby Places dialog

In the example below, the TrafficCast Inc. real-time traffic information service is being accessed in the Find Nearby Places dialog to find the latest traffic accidents or construction delays within 5 miles of downtown Los Angeles. You can work with the incidents that are returned by selecting one or more of them in the list and then right-clicking. The menu that appears has commands for navigating to the incidents, adding to your map as graphics or callouts, etc:
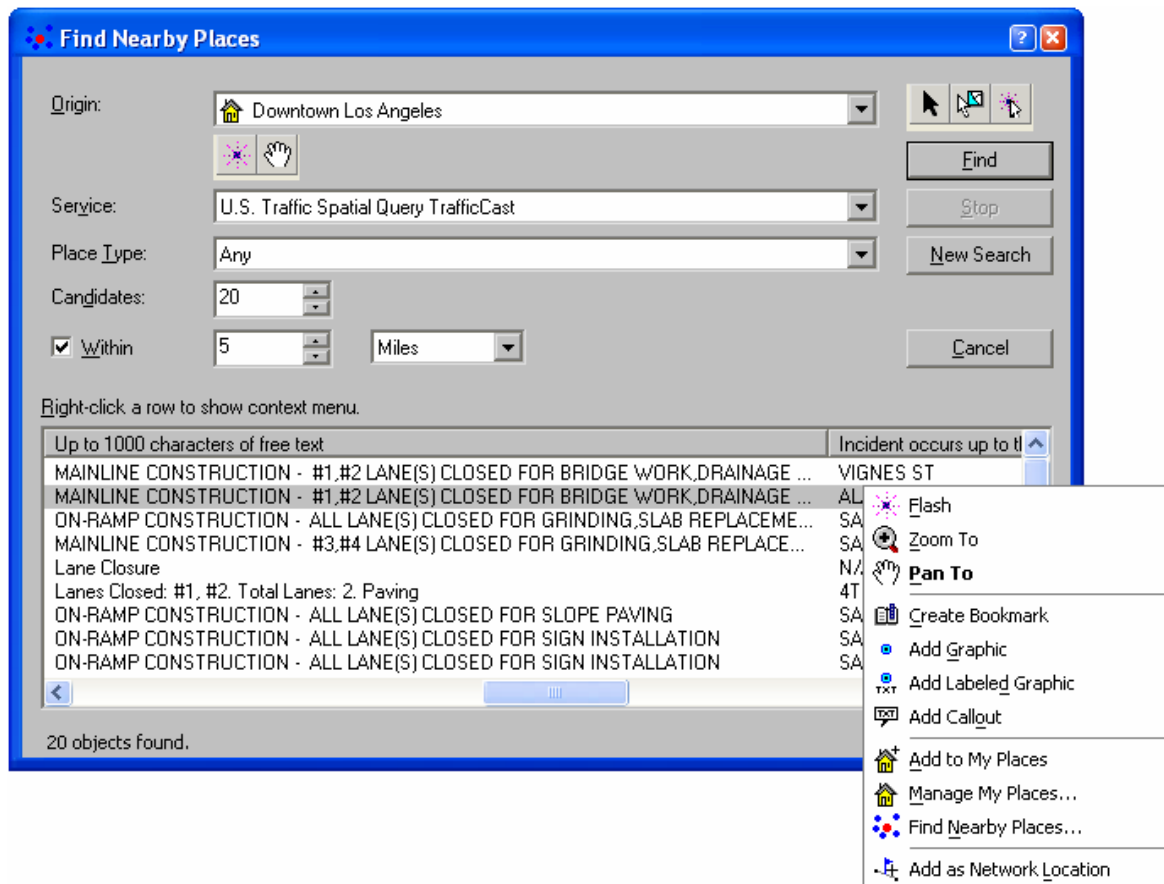
► *To find out more about ArcWeb Services and get a free evaluation see:* *http://www.esri.com/arcwebservices*

ESRI 'Data & Maps'

At ArcGIS 9.2, an updated version of the ESRI Data & Maps datasets, ESRI 'Data & Maps 2006', is available. The ESRI Data & Maps 2006 media kit contains five DVDs and is included for free with ArcGIS Desktop and Server.

■ **New dataset: 90 meter Shuttle Radar Topography Mission (SRTM) dataset.** This dataset includes the SRTM Global Digital Elevation Model (DEM) with all void areas filled, as well as a shaded relief derived from the DEM. Here are two screen shots of the SRTM data. The shaded relief on the left is part of the Island of Hokkaido and the map on the right shows elevation along part of the Tajikistan-Afghanistan border:
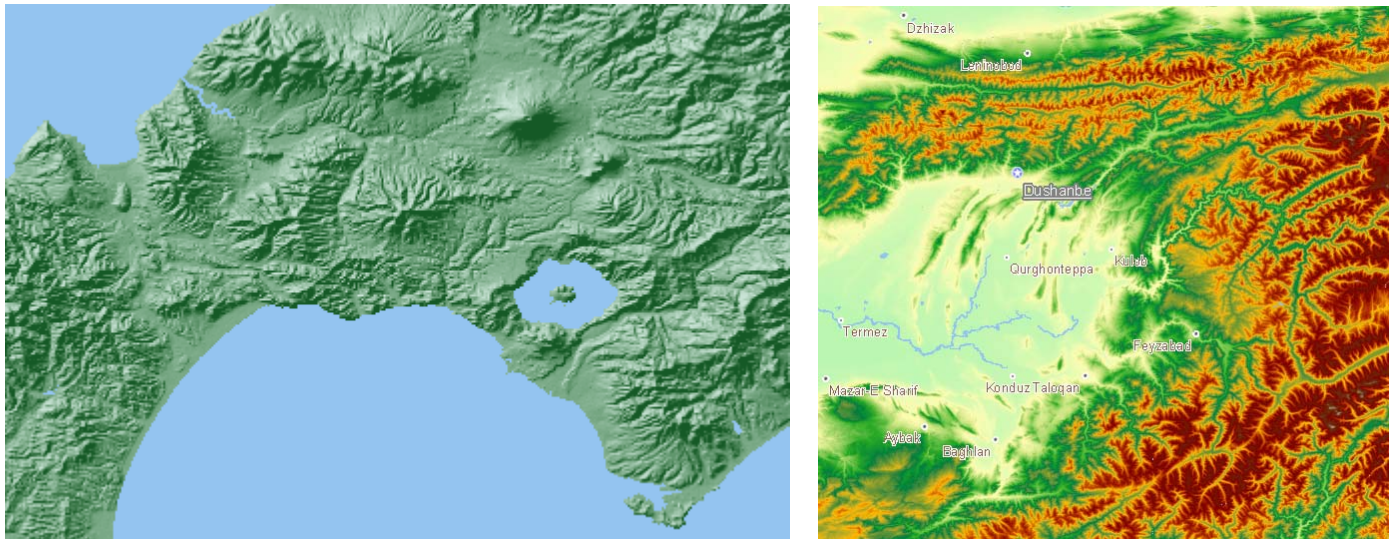
■ Many U.S. datasets have been updated to their most current version. These include the Tele Atlas Census boundary and landmark layers, and the National Atlas layers.

■ Updates to datasets at the world level include updates for 2005 to the Country population values, the Political Organizations table, the AND (Automotive Navigation Data) basemap layers for Europe, and the Demographic and socioeconomic thematic data at the NUTS (Nomenclature of Units for Territorial Statistics) 0, 1, 2, and 3 level. In addition, updates have been made to many of the data layers for Canada and Mexico, and other datasets.

StreetMap data support

■ The Smart Data Compression (SDC) format is an encrypted and highly-compressed format used by commercial data vendors who distribute street data for geocoding and routing with various ESRI software products. The ability to create data in SDC format is provided via a separately available kit. 9.2 introduces Secure Feature Layer (SFL) support in SDC datasets. This greatly expands support for flexible data copyright protection. SFL provides data vendors with a system for distributing data and protecting access to it through a matrix of licensing options. An SFL SDC dataset can be protected for access by geography, layer, attribute, time window, and mode (mapping, routing, and geocoding) as well as being protected from export.

SFL functionality is controlled by a single digital license file which can be generated and delivered by ESRI, ESRI international distributors and data partners. End users of published data can license additional data access such as adding new geographies or modes or extending the data license period by simply requesting and installing a new license file. End users can review their current access rights via a new Security tab in the Layer Properties dialog for SDC data layers that are protected with SFL that have been added into ArcMap.

ArcGIS Server

Introduction

ArcGIS Server changes significantly at 9.2. With the release of ArcGIS 9.2, ArcGIS Server becomes a complete, integrated GIS server that supports spatial data management, mapping, and spatial analysis across distributed systems.

■ The ArcSDE technology has been integrated into ArcGIS Server to provide a single comprehensive solution for managing geographic data in a multi-user environment and deploying data and applications throughout organizations and across the Web. ArcSDE is no longer purchased on its own as a separate product. To purchase ArcSDE, you now purchase ArcGIS Server.

ArcGIS Server 9.2 is available scaled to two levels: ArcGIS Server Workgroup and ArcGIS Server Enterprise. The ArcGIS Server Workgroup product includes our new Windows-only Workgroup ArcSDE technology, which offers a new way to deploy and manage ArcSDE geodatabases, using SQL Server Express as the DBMS and with all the database administration performed directly in ArcCatalog. The ArcGIS Server Workgroup product is designed to be a low cost, easy-to-install multi-user geodatabase solution for small teams and departments that also includes the full range of web-based GIS functionality provided at 9.2. ArcGIS Server Enterprise features our existing Enterprise ArcSDE technology that supports Oracle, DB2, SQL Server, and Informix databases on a range of platforms.

■ At 9.2, we've made it much easier to serve maps and other GIS resources over the web with ArcGIS Server and to build web applications that access your services without writing any code. We've created a new web browser-based tool, ArcGIS Server Manager, that makes it easy to setup and administer your server, publish GIS services, and create web mapping applications, including applications that combine services from ArcGIS Server, ArcIMS, ESRI ArcWeb Services, and OGC WMS servers.

■ ArcGIS Server 9.2 also greatly expands the web-based GIS functionality in the product. You can now dramatically improve the performance of your map services by caching them for rapid display at specific scales. You can now publish 3D globes, geoprocessing services that allow users to run models and workflows on the server, and geodata services that enable users to perform database replication and synchronization. 9.2 also introduces out-of-the-box web-based editing functionality and the ability to publish data in OGC WMS and Google Earth KML formats. The introduction of the new free ArcGIS Explorer client at 9.2 provides a new way to distribute your maps and globes to allow users anywhere to visualize and interact with your data, including accessing custom tasks that you develop.

Many enhancements have been made for developers, with numerous new controls, full support for Microsoft .NET Framework 2.0 and Microsoft Visual Studio 2005, a set of Geospatial Enterprise JavaBeans (EJB), and more. ArcGIS Server 9.2 also introduces a completely new framework for developing mobile GIS applications including support for integrated GPS, attribute and feature editing and wireless synchronization.

ArcGIS Server editions

■ ArcGIS Server 9.2 offers a scalable line of server product editions built on a common set of technology components that are distinguished by both functionality and capacity.

The functionality in ArcGIS Server is provided via three different editions. See the diagram on the next page.

ArcGIS Server 9.2 functionality

Basic Edition	Standard Edition	Advanced Edition
ArcSDE	**ArcSDE**	**ArcSDE**
Geodatabase management - Multi-user access and editing - Requires ArcEditor or ArcInfo on the Desktop to create & edit data	**Geodatabase management** - Multi-user access and editing - Requires ArcEditor or ArcInfo on the Desktop to create & edit data	**Geodatabase management** - Multi-user access and editing - Requires ArcEditor or ArcInfo on the Desktop to create & edit data
Web-based GIS	**Web-based GIS**	**Web-based GIS**
Replication - Geodata services for replication and check in/out over web to ArcGIS Desktop clients	**Replication** - Geodata services for replication and check in/out over web to ArcGIS Desktop clients **Mapping** - Map services - Geocoding services - OGC WMS support - Maplex support **3-D services** - Globe services - KML support **Client applications** - Web mapping applications - ArcGIS Explorer - ArcGIS Desktop - Custom ArcGIS Engine apps - Standard WMS and KML clients **Geoprocessing** - Geoprocessing services & tasks - ArcView level GP tools only **Application development** - Web ADF (.NET & Java)	**Replication** - Geodata services for replication and check in/out over web to ArcGIS Desktop clients **Mapping** - Map services - Geocoding services - OGC WMS support - Maplex support **3-D services** - Globe services - KML support **Client applications** - Web mapping applications - ArcGIS Explorer - ArcGIS Desktop - Custom ArcGIS Engine apps - Standard WMS and KML clients **Geoprocessing** - Geoprocessing services & tasks - ArcInfo level GP tool support - Full spatial analysis capabilities with optional extensions **Web-based editing** - Editing dialog in web mapping application **Application development** - Web ADF (.NET & Java) - Geospatial Enterprise Java Beans (EJB)
	Optional server extensions - Network Analyst - Data Interoperability	**Optional server extensions** - Network Analyst - Data Interoperability - Spatial Analyst - 3D Analyst
		Mobile GIS
		ArcGIS Mobile ADF - Mapping with integrated GPS - Field data collection - Wireless synchronization

■ Each of these three functional editions is provided at two separate levels, scaled according to capacity:

- **ArcGIS Server Workgroup.** This runs on Windows only and includes Microsoft SQL Server 2005 Express Edition, which is the DBMS supported by ArcSDE at this level. This is limited to run on a single computer (1 CPU socket with one or two cores).

- **ArcGIS Server Enterprise.** This provides the greatest capacity and can scale to databases of any size and number of users, running on computers of any size and configuration. It includes Enterprise ArcSDE technology, the traditional ArcSDE technology that runs on Oracle, SQL Server, DB2, and Informix. This can run on one or more computers. The base license is for 2 sockets, with additional licensing in increments of 1 socket.

The diagram below outlines the full differences between these levels.

ArcGIS Server 9.2 capacity

	ArcGIS Server Workgroup	ArcGIS Server Enterprise
DBMS for ArcSDE	SQL Server Express	Oracle, DB2, SQL Server, Informix
Maximum concurrent users on ArcSDE	10	Unlimited
ArcSDE database size	4 GB	Unlimited
ArcSDE memory limit	1 GB	Unlimited
ArcSDE configuration	Direct Connect	Direct Connect and Application Server
Operating system	Windows	Windows, Solaris, Linux
Sockets (Single or dual core)	1	Unlimited (Base license = 2)
Number of users over the Web	Unlimited	Unlimited

So for example, the lowest cost ArcGIS Server configuration is **ArcGIS Server Basic** edition at the **Workgroup** level. This gives you the Workgroup ArcSDE technology so you can create multi-user geodatabases on one machine that up to 10 concurrent users can access and edit. This configuration doesn't allow you to serve maps, etc, to the web.

At the other end of the scale, our most comprehensive and powerful ArcGIS Server configuration is **ArcGIS Server Advanced** edition at the **Enterprise** level. This gives you unlimited capacity to serve geographic data and tasks throughout your organization, over the web, and onto mobile devices, with the complete range of functionality including web-based editing and ArcInfo-level spatial analysis.

► *The remainder of this chapter describes what's new with publishing services and applications on the web with ArcGIS Server. See the 'Geodatabases and ArcSDE' chapter in this document for more about what is new in geodatabase management with ArcSDE at 9.2.*

Easier server administration

■ You can use the new ArcGIS Server Manager to publish GIS services on the web, create web applications, and administer your server. You'll find the Manager to be an easy way to accomplish everything you need to do with ArcGIS Server. The Manager runs inside a web browser and includes access to the ArcGIS Server Help system:
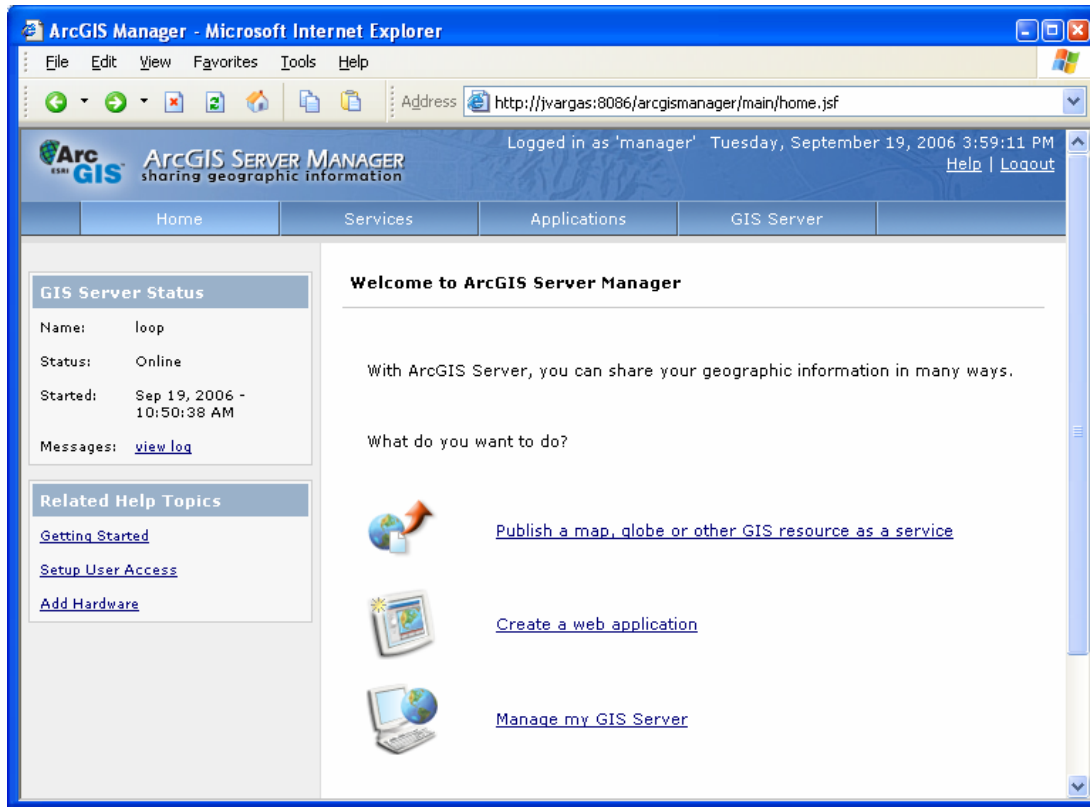
■ In 9.2, you can organize the contents of your ArcGIS server into different folders.

■ ArcCatalog has also been updated at 9.2 to make it easier to connect to ArcGIS servers and create services on them. One of the things you'll immediately notice when you connect to your ArcGIS server is that you're now asked what type of connection you want to make:
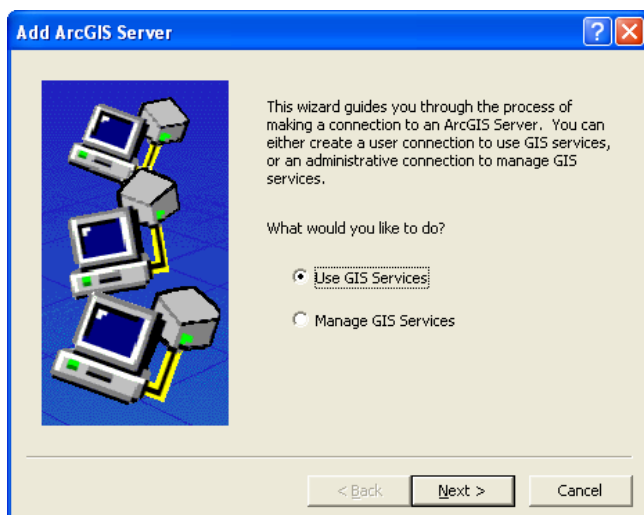
■ The format of the URL you use to connect to ArcGIS servers over the Internet has also been simplified. You no longer have to specify .agsx, etc. All you have to type in is http://<server>/arcgis/services, e.g.

   http://www.example.com/arcgis/services

When you connect to a server in ArcCatalog, you'll see the services and the optional folders that they may be organized into. If you want to connect directly to an individual folder on a server when you connect to it in ArcCatalog, simply append /<folder name> after /services, e.g.

   http://www.example.com/arcgis/services/world

■ To make it easier to publish your GIS resources, such as your maps and globes, to the server, there's a new publishing wizard in ArcCatalog. Simply navigate to the document you want to publish and right-click it. You'll see the new option to publish it to the server:
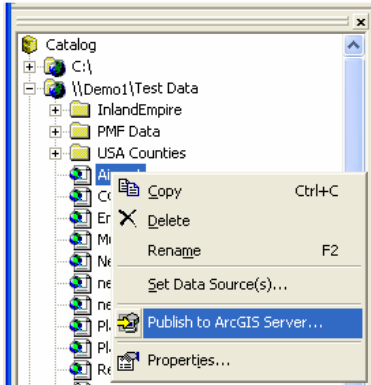
In the wizard that appears, just fill in the name of the ArcGIS server you want to publish to (that you've connected to as a manager), provide a name and folder location, and enable the GIS functionality, or capabilities, you need:
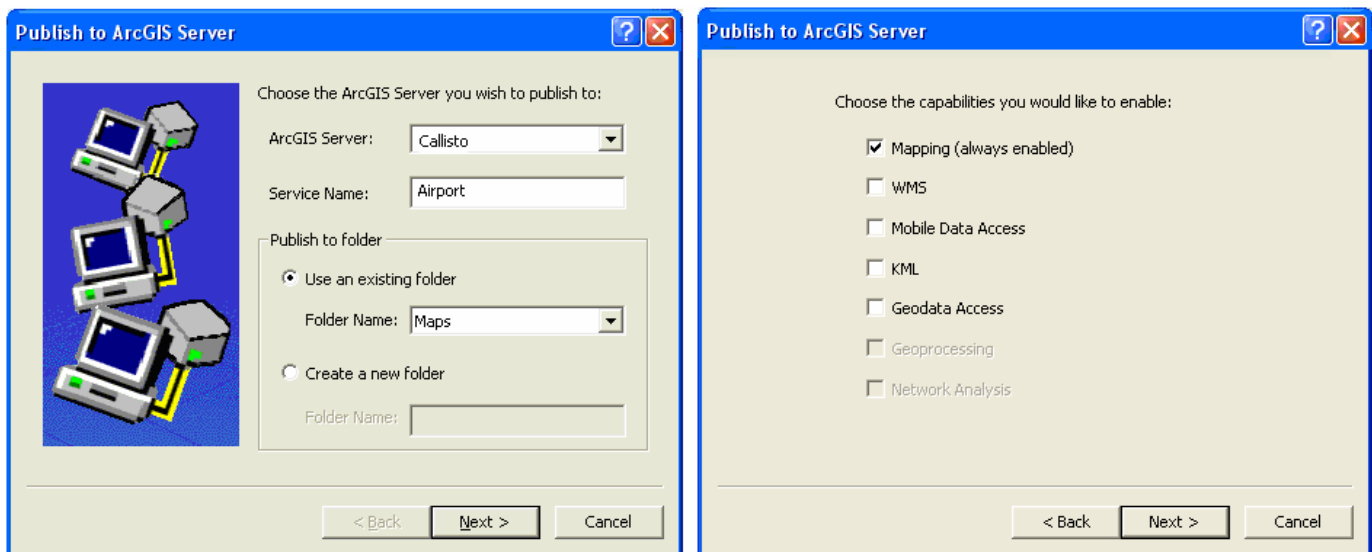
New ways to publish your GIS data

■ Previous versions of ArcGIS Server only allowed you to create map services and geocoding services. At 9.2 you can also create globe services, geoprocessing services, and data management services called geodata services. In addition to these new service types, map services now have capabilities to support network analysis and the WMS and

KML specifications. 9.2 also introduces the ability to publish high performance map services by caching them for use at particular scales.

High performance cached map services

■ You can now greatly improve the drawing speed of map services you publish by creating caches for them. The map cache consists of pre-created images of the map service at specific scales. These images are stored on the server and returned to clients that want to draw the map service. Map services with a map cache will draw much faster than those without a cache because the server simply returns one or more pre-created images to the client instead of dynamically creating one at the time of the request.

To create a cache for a map service, you use the new Caching tab in the Map Service Properties dialog in ArcCatalog. This lets you specify the different scales at which you'd like the service to be cached:
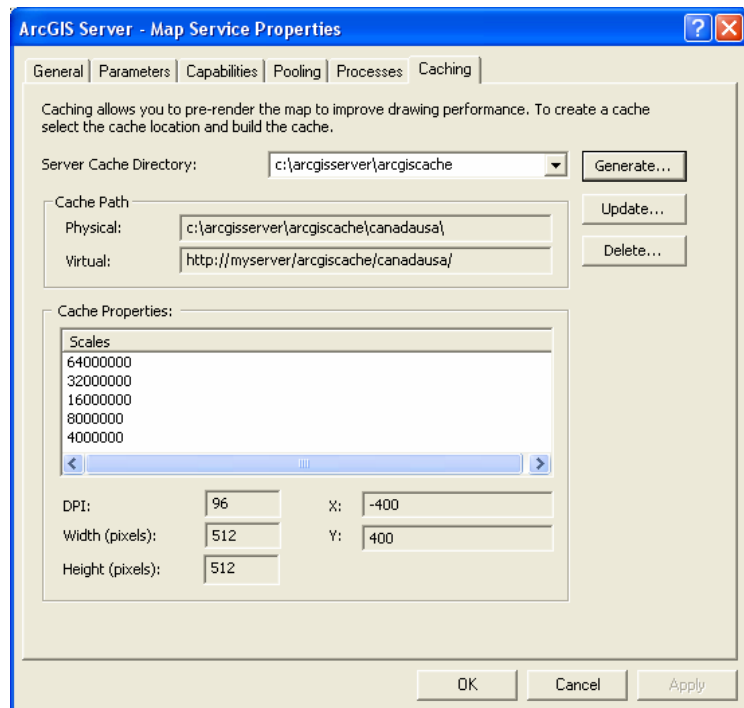
New tools are also provided in ArcToolbox for creating map caches for a map services.

Globe services

■ ArcGIS Server now supports publishing globe documents (.3dd) over the web as globe services. Users can access globe services in ArcGIS Explorer, ArcGlobe, ArcReader, and ArcGIS Engine applications built with the Globe control. (Globe services are not supported in web mapping applications built with ArcGIS Server Manager). Globe services are cached for high performance using the caching mechanism of ArcGlobe, which is carried over to the server. Globe services also contain the animation tracks present in the globe document that was published.

The 3D Analyst extension is not required on ArcGIS Server in order to publish globe services. However, you need the 3D Analyst extension on ArcGIS Desktop in order to author globe documents using ArcGlobe.

The ability to publish globe services to the web for access with the new free ArcGIS Explorer client is particularly powerful. This lets you deliver interactive globes containing exactly the content you want onto the Internet, whereas solutions like Google Earth are limited to a single standard globe onto which additional content is added. In other words your users can choose between a variety of application-specific globes containing particular datasets, and then augment these globes by add additional data sources. Plus, ArcGIS Explorer's ability to access geoprocessing services enables advanced analysis and workflows to be performed directly in the 3D client.

Geoprocessing services

■ Geoprocessing is a fundamental part of every phase of GIS. Now, the functionality available in the ArcToolbox can be run on servers and served over the web as geoprocessing services. End users can access your geoprocessing services in web mapping applications and in the new ArcGIS Explorer client as tasks. Geoprocessing services can also be accessed inside ArcGIS Desktop by adding them into the ArcToolbox window.

Geodata services

■ A geodata service allows access to a geodatabase through the LAN, WAN, or Internet using ArcGIS Server so that geodatabase replication, synchronization and data extraction can be performed. A geodata service may be published for any type of geodatabase including ArcSDE geodatabases, personal geodatabases, and file geodatabases.

When publishing a geodata service, you can start with a geodatabase or a map document that has a layer with a geodatabase connection. If you start with a map document, enable geodata access support on a map service by checking the Geodata Access capability when you publish the map. Once published, the service can be used to access a geodatabase remotely and perform operations such as replica synchronization. If you choose to publish a map document with a geodatabase connection, you can perform geodata service operations on the data published in the map service from ArcGIS Desktop. For example, you can add the data from the map service to ArcMap and then use the distributed geodatabase toolbar to create replicas and extract the data.

Network Analysis support: routing, closest facility, and service area analysis

■ You can publish map documents containing network analysis layers to create map services with network analysis capabilities. Use these services to perform routing, closest facility and service area network analysis. You can enable network analysis support on a map service by checking the Network Analysis capability when you publish the map. You could perform network analysis with ArcGIS Server at 9.1, but it required a lot of custom code.

KML support

■ ArcGIS Server now outputs KML, enabling the server to communicate with KML clients such as Google Earth. You can enable the KML output on a map service by checking the KML capability when you publish the map.

WMS support

■ ArcGIS Server now outputs OGC WMS versions 1.0.0, 1.1.0, 1.1.1, and 1.3.0, enabling the server to communicate with WMS clients. You can enable the WMS output on a map service by checking the WMS capability when you publish the map.

Other

■ The ArcGIS Data Interoperability extension (see separate section in this document) is now available with ArcGIS Server. The ArcGIS Data Interoperability extension provides real data interoperability that works with all major vendor and open GIS formats and is dynamically updated to add additional formats or variations as they become available. The extension enables GIS users to dynamically fuse together various data sources within ArcGIS and allows ArcGIS users to exchange data with other GIS users in many formats as well.

■ The Maplex extension enables high quality automatic placement of labels. Map documents published to the server that contain labels generated by Maplex will now display with those labels intact.

■ Map services published with ArcGIS Server can contain cartographic representations.

New client applications for Server

Web mapping applications

■ ArcGIS Server 9.2 makes it easy to create web mapping applications using the geographic information on your server. The ArcGIS Server Manager contains a great looking ready-to-use application template that you can quickly configure through Manager's easy-to-use wizard interface, which requires no web development expertise. Here's what the application looks like:
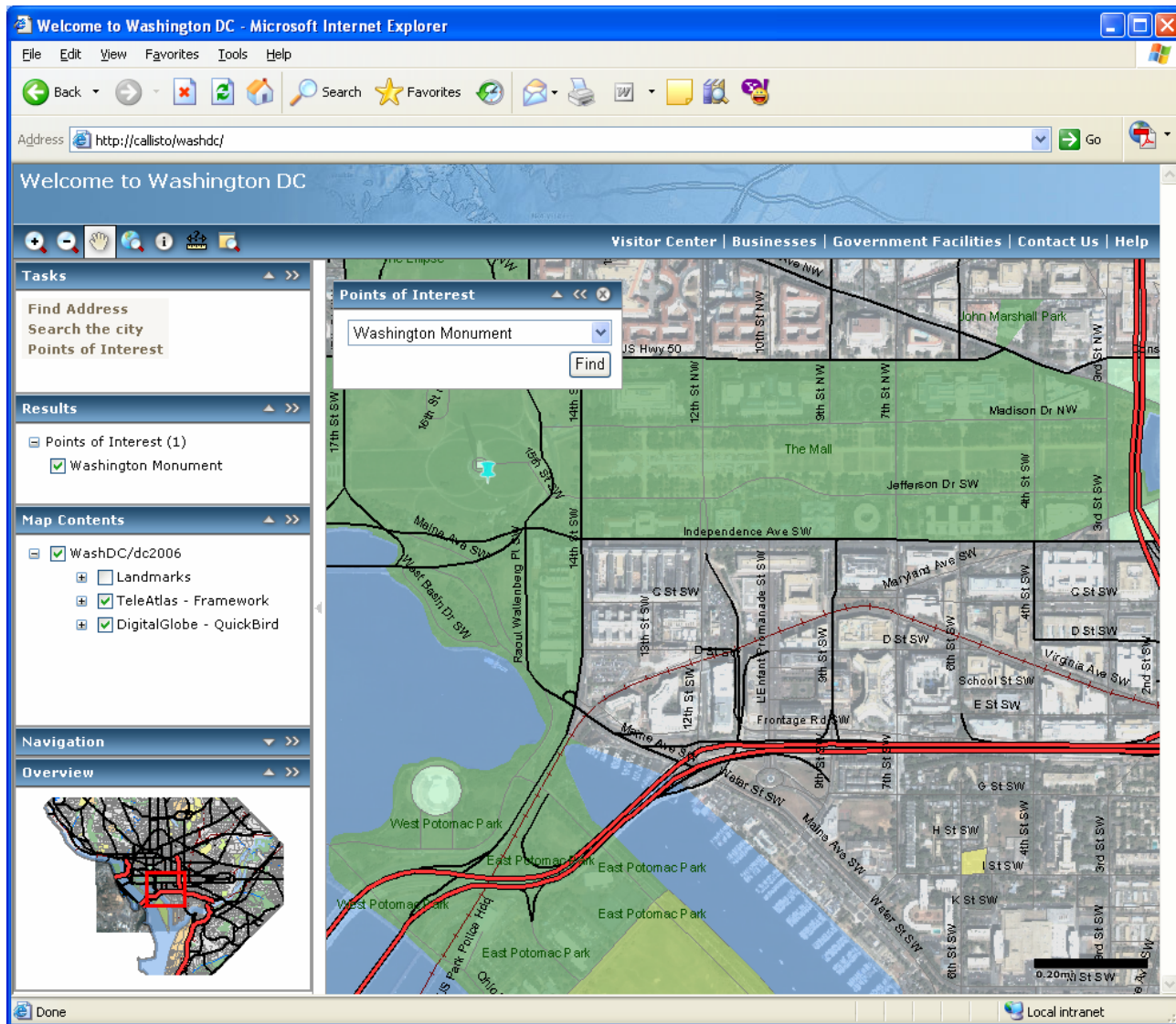
Supporting controls like the table of contents, overview window, etc are presented in collapsible side panels that can be easily hidden away if end users want a full screen view of their map. Various tools and shortcuts are provided, including click-and-drag to pan the map, using the scroll wheel on the mouse to zoom in and out, and expandable popup map tip windows for finding out about points of interest. The application supports high performance drawing with seamless panning.

■ You also use Manager to choose and configure the functionality you want your application to include. These are presented in the tasks panel in the application. For example, the application shown above presents a number of tasks in its top left hand corner. The task panel provides one place from which all the additional functionality exposed in your application can be launched, keeping the application's interface simple and uncluttered.

Manager comes with out-of-the-box tasks that you can incorporate into your application. This makes it much easier than before to add functionality to your application. You can configure these tasks to make them specific to your application and your data. ArcGIS server includes ready to use tasks for:

- finding map features, addresses and places

- querying attributes

- editing

- geoprocessing

Each task has its own specialized dialog. When you configure tasks you link them up to the underlying services that they'll access. For example, each geoprocessing task you define accesses a geoprocessing service.

The screenshot below shows the panel for the editing task:
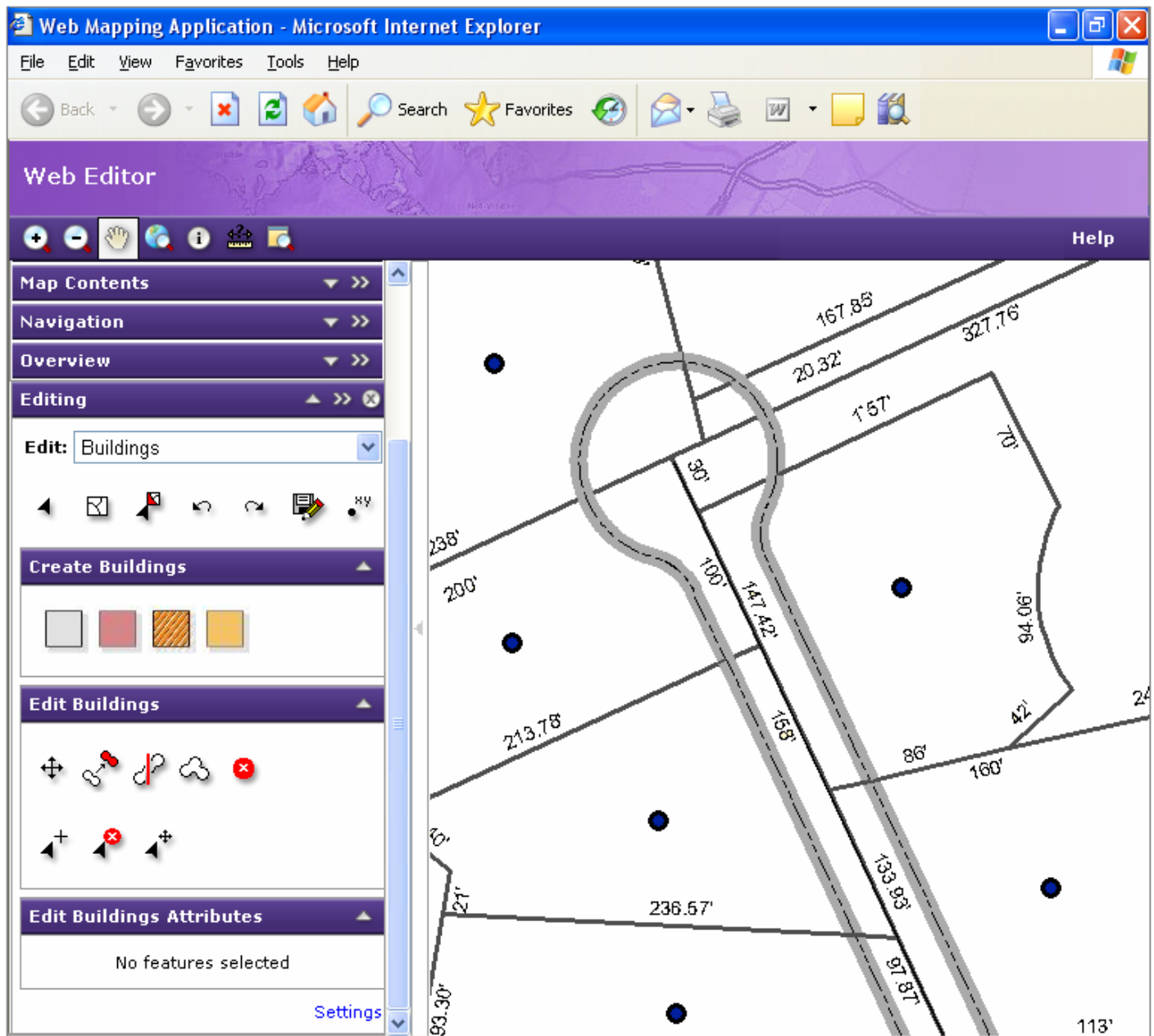
■ Previously, ArcGIS Server allowed you to build a web application that displayed a single map service. In 9.2 you can combine multiple map services on a single map allowing you to seamlessly integrate map services running on the

same server or different servers. Transparency is supported so you can overlay and 'fuse' different map services. For example, you can combine a map service running on an ArcGIS server with one running on an ArcIMS server. You can add services from any ArcGIS server or ArcIMS server into your application, along with any OGC WMS services. This includes the various services provided by ESRI as ArcWeb Services.

■ This same web mapping application template is included with ArcIMS at 9.2, greatly simplifying the use, support and development of your web applications. Tasks based on ArcIMS functionality are included but the editing task and tasks based on geoprocessing services require the use of ArcGIS Server.

New ArcGIS Explorer client

ArcGIS Explorer is a new lightweight desktop client that makes it easy for users to access map services and globe services that you publish. Working with ArcGIS Explorer is fast and easy, with smooth and seamless panning and zooming. Users can combine your services with other sources of data. ArcGIS Explorer lets users work in both 2D and 3D. ArcGIS Explorer also supports a range of different tasks, with support for tasks based on geoprocessing services.
☛ *See the 'ArcGIS Explorer' chapter in this document for more details.*

ArcGIS Desktop client enhancements

Support for accessing and using ArcGIS map services has been improved in the ArcGIS Desktop applications (☛ *See the 'ArcMap' chapter in this document).* Geoprocessing services you publish with ArcGIS Server can be added into the ArcToolbox window in the Desktop applications as new server-based toolboxes. This includes support for models that accept graphical input. So for example, you can publish a spatial analysis model as a geoprocessing services that ArcGIS Desktop users can access over the web and run from the ArcToolbox window in which they draw features on the map and have these used as input to the model. ☛ *See the 'Geoprocessing' chapter in this document.*

Developing applications with ArcGIS Server

Single Web ADF works across ArcGIS Server and ArcIMS

■ The Web Application Developer Framework (ADF) has been completely re-architected at 9.2. Previously, the Web ADF only supported building applications with ArcGIS Server. Now the Web ADF includes support for ArcGIS Server and ArcIMS and is part of both products. OGC WMS services are also supported. The range of ArcWeb Services from ESRI can also be incorporated into applications (requires appropriate licensing from ESRI). In this way, the Web ADF provides one framework for building web applications and services no matter what services you need to use. This simplifies your development experience because you can focus on what you want to deliver to users and not worry about which server is hosting the services you need to include in your application.

New and enhanced web controls

■ As part of the new Web ADF, a number of new controls have been added to support the development of applications using the framework provided by the new web mapping application. The functionality encapsulated in the web controls makes it easy for you to develop your own applications. Here's a list of some of the new controls:

Map Tips control
Displays information about points on your map when you hover the mouse over them.

Navigation control
A new navigation control incorporates pan and zoom functions within a single control. You can use this control instead of or in addition to the classic pan and zoom controls that are typically placed on the toolbar.

Geocode component
Simplifies access to a geocode service allowing a web application to locate addresses. Supports geocode services on any supported GIS server.

ZoomLevel
Provides a set of levels, or map scales, representing different extents the map control can zoom to, corresponding to the scales at which the map services being used have been cached.

■ The existing controls have been enhanced and rewritten, including the following changes:

Map control
Now supports displaying multiple map services. The map services are transparently overlaid and appear as group layers in the table of contents. The map control also supports continuous, seamless panning, zooming with the scroll wheel on the mouse, and keyboard navigation shortcuts.

Table of Contents control
Now supports the display of multiple map services as group layers.

Support for existing ArcGIS Server 9.0 and 9.1 web applications

■ Because the ArcGIS Server web application architecture has been completely re-defined, the new web mapping applications are completely different from those you built with 9.0/9.1. However, this doesn't mean you can't run the applications you've already built. ArcGIS Server includes runtime support for existing applications and they'll continue to work as you expect. But, there is no longer any IDE or documentation support for the 9.0/9.1 applications. When you edit one of your existing applications in 9.2, you'll still see the 9.0/9.1 web controls in that application, you just won't be able to create new applications with those controls because they're no longer available by default in the Toolbox; only the new web controls are there.

Changes on specific platforms

■ The next two sections of this chapter tell you what's new on the two ArcGIS Server platforms: Microsoft .NET and Java.

ArcGIS Server for the Microsoft .NET framework

Web Application Developer Framework (ADF)

■ **Microsoft Visual Studio 2005 IDE Integration:** The Web ADF web controls, templates and Developer Help have all been completely integrated with Microsoft Visual Studio 2005.

■ **Complete ArcIMS API for the Microsoft .NET Framework:** The ArcIMS API wraps all ArcXML functionality into a complete .NET solution for ArcIMS developers. As part of the Web ADF, the ArcIMS API contains classes that allow you to drill down into ArcIMS services that you make available in your web applications. This means that you can create ArcIMS solutions completely in the .NET Framework, without having to write ArcXML requests.

■ **New graphic display capabilities:** The Web ADF now supports the ability to draw graphic elements on the map control. See the GraphicsLayer class in the ESRI.ArcGIS.ADF.Web assembly for more information.

Developing custom server components

■ Previously, the recommended way to efficiently execute your custom GIS functions on the server was to create a simple utility COM object in VB, C++, or .NET that encapsulated the majority of the fine-grained ArcObjects work and exposed a single coarse-grained method that a web application could call. Now, you can alternatively create a server object extension that extends the server object itself with your custom code. Unlike utility COM objects, server object extensions are registered and configured with specific server objects and are not meant for ad-hoc use or use with an empty server context.

The main advantage of creating a server object extension is that doing so allows the server to initialize and manage the extended functionality along with the core server object. Thus, developers don't need to initialize server object extensions in their own code. Also, if the functionality required by a server object extension is costly to acquire, such as connecting to a database, this cost is paid only once when the server object and its associated extensions is initialized.

Software Installation

■ **.NET Framework Support:** ArcGIS Server for the Microsoft .Net Framework requires the Microsoft .NET Framework 2.0.

■ **Install:** A new install feature named Web Applications has been added. The Web Applications feature adds to your web server the ability to create and manage Web Mapping Applications, ArcGIS Explorer Maps and GIS Web Services. The ArcGIS Server Manager is installed with the Web Applications feature.

■ **ArcGIS Server Post Install:** The ArcGIS Server Post Install has been renamed to GIS Server Post Install. Some of the wording has been changed and there is a new dialog for creating a GIS Server Web services account. This account is used by your Web server to connect to an ArcGIS server in order to process Web service requests. You will need to specify the exact same account for your GIS Server Web Service account in the GIS Server Post Install and the Web Applications Post Install.

■ **Web Applications Post Install:** A Web Applications Post Install has been added. This post install will prompt for the name of your ArcGIS Server Instance ("arcgis" by default) and the name of your ArcGIS server. You will also need to provide the GIS Server Web Services account that you specified during the GIS Server Post Install. If you are installing all of the ArcGIS Server software on a single machine, you should choose the Existing Local or Domain Account during the Web Applications Post Install and specify the same account that was created during the GIS Server Post Install.

ArcGIS Server for the Java platform

Web Application Developer Framework (ADF)

■ **Support for Java 5.0:** Java version 5.0 is now supported. The Web ADF components are now certified to run in application servers that support Java 5.0.

■ **Support for Eclipse and Sun Java Studio Creator:** ArcGIS Server for the Java Platform provides tight integration with plugins for Eclipse and Sun Java Studio Creator IDEs. These plug-ins give developers a very rich programming experience with integrated help, wizards, code snippets, importable samples and templates for building ArcGIS-based web applications.

■ **Web Graphics API:** The Web Graphics API is a pure java library for adding graphics to a Map Control. This API is useful for building red-lining capabilities into your GIS applications. It supports points, lines, polygons and text and a number of different symbols.

Geospatial Enterprise JavaBeans

■ At 9.2 ArcGIS Server for the Java platform introduces a set of out-of-the-box Geospatial Enterprise JavaBeans™ that perform GIS tasks such as mapping, geodata querying, network solving, geocoding, print-layout management, and more. Enterprise JavaBean (EJB) technology is the server-side component architecture for the Java 2 Platform, Enterprise Edition (J2EE) platform. EJB technology enables rapid and simplified development of distributed, transactional, secure and portable applications based on Java technology. The Geospatial EJBs support the EJB 2.1 specification.

Until now, Java developers have had to learn ArcObjects in order to perform more sophisticated GIS operations that the Web ADF for Java didn't provide. The Web ADF provided a hook into ArcObjects, and Java developers had to program in ArcObjects. Now, with these new EJBs, we are exposing more GIS functionality so that Java developers can manipulate these directly with a pure Java API instead of programming in ArcObjects.

■ This suite of Geospatial Enterprise JavaBeans make all the functionality of the ArcGIS MapServer and GeocodeServer objects available to J2EE enterprise applications. These capabilities are available on a transactional basis for on-demand queries. Here are the capabilities that are supported:

Mapping:
- Export MapServer Object maps as images at any given map extent/scale.
- Export MapServer Object maps as images at a given image size (reasonable). Supported image formats will be png, jpg, bmp, wbmp, gif, png24.
- Export MapServer Object maps as images in any of the ArcGIS Server supported image formats.
- Compute the distance between 2 points on a map.
- Coordinate System Conversion and Map Projection Transformation support. All projections, spheroids and datums supported by ArcGIS.
- Convert a map coordinate to a screen location.
- Convert a screen location to a map coordinate.
- Return references to a layer or a collection of layers in a map.
- Get information about the bean's MapServer Object.
- Get the dimensions of the MapServer Object.

On-demand performance is rated at 7 map images/second, 16 vector maps/second, and 25 coordinate systems and/or map transformations/second on Windows 2000, 1.7GHz dual processor Pentium III with 1GB RAM.

Queries:
- Perform query/Identify actions against layers in a map.
- Return a field value of a given feature on the map.
- Return feature objects in a given layer of a map.

Geocoding:
- Geocode a single address, using any of the ESRI-supported geocoding styles. This will support full address inputs as well as partial address inputs. The addresses can be an intersections.
- Available on transactional basis for on-demand queries.
- Geocode multiple addresses, synchronously.
- Geocode a list of addresses in "batch" mode, asynchronously.
- Return a list of candidates for an address.
- Display the geocoding results in a map image provided by the MapServer EJB.
- Reverse geocode a point to generate an address or zone name conventions. These could be centroids of regions or zones.

On-demand performance is rated at 30 geocode requests/second on Windows 2000, 1.7GHz dual processor Pentium III with 1GB RAM.

Network Analysis/Routing:

The Routing EJB provides a convenient API that performs the following functions utilizing the NetworkAnalyst API:

- Solving transportation networks, and support for all solvers featured in the Network Analyst extension.
- Managing stops and barriers along transportation networks.
- Determining geographic regions ("trade areas", for example) based on travel time.
- Finding the shortest path.
- Dijkstra routing.
- Point-to-Point routing.
- Multipoint routing.
- Multimodal routing.
- Support for considering real-time traffic and weather impedances.
- International border crossing.
- Support full address inputs for origin/destination.

On-demand performance is rated at 7 route calculations per second on Windows 2000, 1.7GHz dual processor Pentium III with 1GB RAM.

Command-line administration of your GIS Server

■ Administrators of the ArcGIS Server system can now take advantage of a JMX-based command-line interface for starting, stopping, and configuring services. Because it is a JMX implementation, these administration tools can plug into other standard Java-based enterprise administration console systems.

Developing custom server components

■ A new utility has been added to the Server SDK to allow for programmers to write custom extensions to ArcObjects and the Server in a COM-compliant language, and expose these customizations as Java objects.

Solaris and Linux Support

The experience for both GIS professionals and developers for the Linux and Solaris platforms has been greatly improved at 9.2:

- Re-designed installation and configuration experience.
- Improved quality of performance, stability and installation user experience.
- Improved SDK and documentation.
- Pure UNIX-based user authentication to the system. The Windows PDC is no longer needed. External users of the system are now stored in an LDAP server (customers can use the default OpenLDAP server that we install or configure to use their own) and are no longer required to be OS-level users.

New Mobile GIS ADF

■ The Mobile GIS Application Development Framework (ADF) is a software development kit for mobile devices. The framework is intended for developers creating lightweight, easy-to-deploy, server-oriented applications that have a robust, responsive, and rich user experience on the client device used in the field. The Mobile GIS ADF can extend your mobile business application in the following ways:

- You can embed a map in your mobile application.

- Spatial and tabular data can be captured and updated when connected or disconnected from the server.

- Edits in the field and in the office can be synchronized when connected.

- GPS location can be captured or used as a navigation aid.

■ The Mobile GIS ADF field editing model allows users to edit both existing versioned and unversioned databases stored in the server-side ArcSDE geodatabases. The ADF can be deployed to two families of clients - Windows 32-based clients like laptops or Tablet PCs and Windows Mobile devices like Pocket PC and Windows CE devices. The Mobile ADF allows the development of occasionally connected applications on both platforms. With the Mobile ADF, users have the ability to survive network outages without losing their work. Application logic can specifically be designed around sometimes connected scenarios for mobile computers as well as always connected scenarios for desktop computers.

Administering your ArcGIS server

Setting the capacity for a server object container (SOC) machine

■ The maximum number of instances a SOC machine can host depends on the amount of memory on that machine. As more instances get created, more memory is consumed. As SOC machines have a finite amount of memory, there is a finite number of instances that they can host. Now, you can manually control the maximum number of instances that can be run on a SOC machine by setting its capacity. Capacity is exposed as a property of a SOC machine in ArcCatalog and can be set programmatically through the server API as well. In many cases, you don't need to worry about setting capacity. However, in the event that you notice memory problems on a given SOC machine, one reason may be that you're running too many instances on it. In this case, you can set the maximum number of instances though its capacity.

Accessing server log files programmatically

■ While you could always view the contents of the server log files on disk with a text editor, you can now programmatically retrieve the contents. A new property, ServerLog, of the IServerObjectAdmin2 interface provides a reference to an IServerLog interface. The IServerLog interface allows you to query and retrieve records from the logs on disk.

Pre-creating instances of non-pooled services

■ You can now set the minimum number of instances to create on initialization for non-pooled services. Just like pooled services, pre-created non-pooled services are immediately available for client use. By pre-creating services, you can reduce the start up time for client applications that access them because the client doesn't have to wait for the server to create the object if one is already available.

Better server documentation

■ The *ArcGIS Server Administrator and Developer Guide* book has been replaced at 9.2 with the online 'ArcGIS Server Help' and 'Developer Help' systems.

- The ArcGIS Server Help is Web-browser-based help that you can launch either from the Start menu or directly from ArcGIS Server Manager.

- The Developer Help is the comprehensive source for information about the server. In addition to all of the information from the ArcGIS Server Help, it contains details on how to develop applications. You can launch Developer Help from the Start menu, or from within Visual Studio 2005. It includes the following sections:
  - Getting started
  - Migrating Applications
  - Developing Web Applications using the Web ADF
  - Developing Mobile Applications using the Mobile ADF
 - Developer APIs
 - Developer scenarios
  - Samples

■ All of the ArcGIS Server developer documentation is now available on the ESRI Developer Network (EDN) website at http://edn.esri.com. Information provided on EDN connects you to code samples, the latest documentation, discussion forums, and much more.

ArcGIS Explorer

■ ArcGIS Explorer is a new, free application that enables anyone to access GIS data over the Internet, work with it in 3D, integrate it with web and local data, and perform queries and analysis drawn from the range of geoprocessing capabilities found in ArcGIS.

ArcGIS Explorer is fully integrated with ArcGIS Server and is a great way to deliver the maps, globes and geoprocessing services that you publish with ArcGIS Server to users around the world. You can assemble the content using data from your own servers or from any other GIS services accessible on the web: ArcGIS services, ArcIMS services, ESRI ArcWeb Services, OGC WMS, Google Earth KML/KMZ, etc. End-users working with ArcGIS Explorer can further customize their display by adding additional layers based on any of those services or on local data, including shapefiles, file geodatabase data, and a wide variety of raster files.

Geoprocessing services appear as tasks in the ArcGIS Explorer user interface, enabling users to go beyond simply browsing to using and analyzing data.
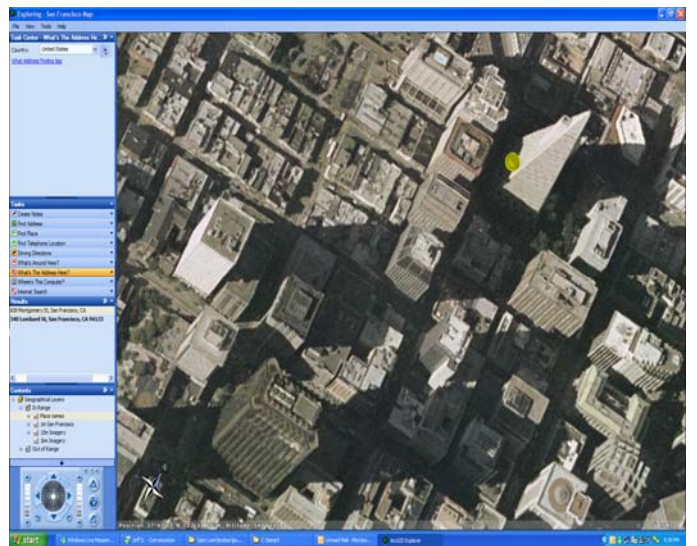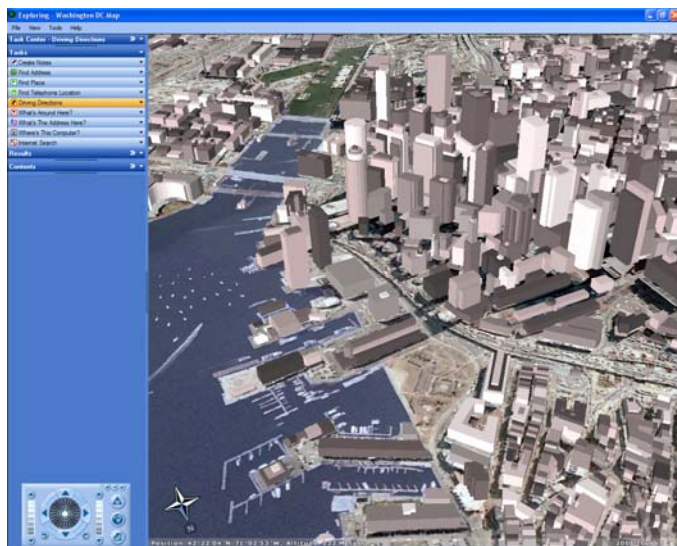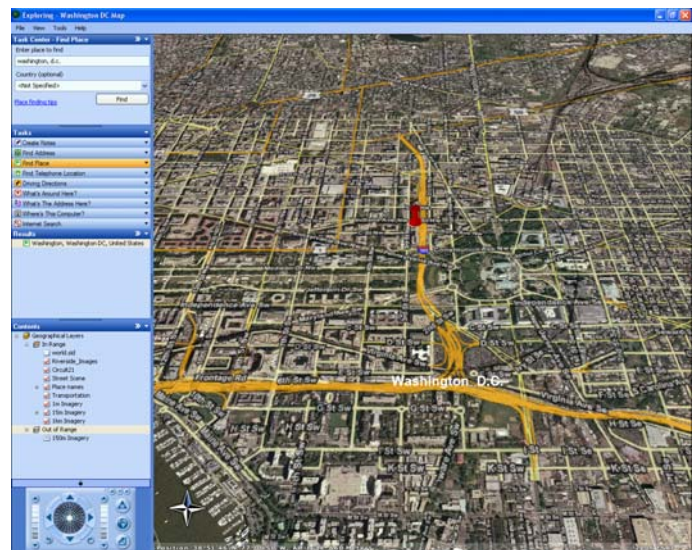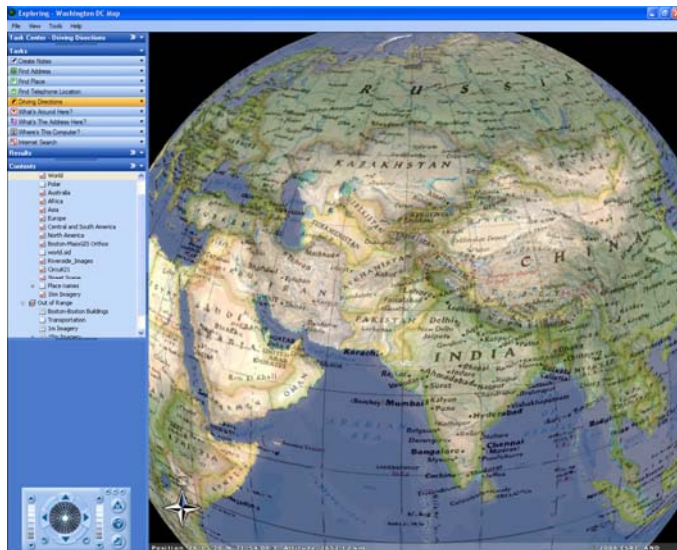
For more about ArcGIS Explorer and to download the program, go to: http://www.arcgisexplorer.com

ArcIMS

Creating web mapping applications

New Web Manager

■ ArcIMS 9.2 introduces a Web Manager for creating web mapping applications. The Web Manager provides step-by-step instructions that guide you through the process of building web mapping applications. The Web Manager has the same look and feel as the new ArcGIS Server Manager. The ArcIMS Web Manager comes in two versions ArcIMS Web Manager for the Microsoft .NET Framework, and ArcIMS Web Manager for the Java Platform.

New web mapping application

■ At 9.2, ArcIMS utilizes the same new out-of-the-box web mapping application template that is included with ArcGIS Server. So whether they include services from ArcGIS servers or ArcIMS servers or both, your web apps can have the same appearance and behaviour. The web mapping application supports seamless panning, zoom with the mouse wheel, keyboard navigation, a fully functional table of contents with symbology, and a task panel presenting the additional functionality you choose to include. Tasks based on ArcIMS functionality, such as searching for attributes, are included. All configuration is performed using a wizard in the ArcIMS Web Manager, so no web development expertise is required.
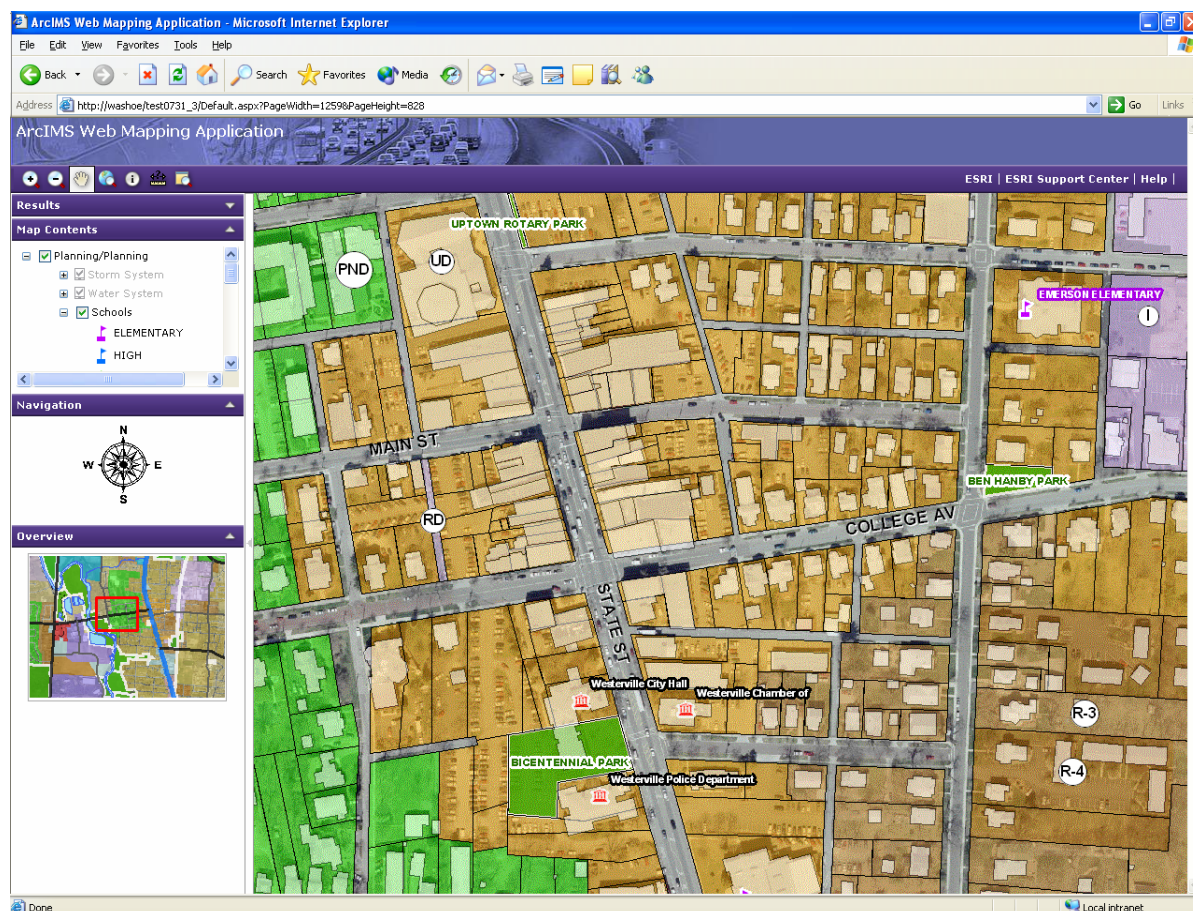
■ The web mapping application lets you combine multiple map services onto a single map allowing you to seamlessly integrate map services running on the same server or different servers. Transparency is supported so you can overlay and 'fuse' different map services. You can add ArcIMS image services, ArcGIS Server map services and any OGC WMS services into your application.

New Web ADF

■ At 9.2, ArcIMS includes a new Web Application Developer Framework (Web ADF). The new Web ADF includes integrated support for both ArcIMS and ArcGIS Server and is part of both products. Like Web Manager, the Web ADF is available for the Microsoft .NET Framework and for the Java Platform. When using the Web ADF, you can work with image services, services from ArcGIS servers, OGC WMS services, and ESRI ArcWeb Services

As a developer, you have access to a full set of mapping-related Web controls and an API that wraps ArcXML functionality. Since the Web Mapping Application is built using these components, you can take the output from Web Manager into an Integrated Development Environment (IDE) and modify the output. You can also use the Web controls and build your own application from scratch.

The Web ADF includes comprehensive online support via the ESRI Developer Network (EDN), including Getting Started guides, detailed API discussions, Scenarios and Samples, and Library References.

Web ADF for the Microsoft .NET Framework

■ The .NET 2.0 framework is required. Visual Studio 2005 or Visual Studio Web Express Edition must be installed to work with the Web controls and templates.

The Web ADF also includes a .NET ArcIMS API, which replaces the .NET Link. The API has an object model that comprehensively wraps all ArcXML functionality. The exception at ArcIMS 9.2 is that Metadata elements are not part of the API.

Web ADF for the Java Platform

■ The Web ADF for the Java Platform uses Java Server Faces (JSF), which provides the framework for the Web controls and tasks. The Web ADF uses the Java Connector for communication with ArcIMS services. While developers can use any IDE that supports JSF, the recommended IDE's are Eclipse or Sun Studio Creator.

■ For those who use Metadata Services, a new, ready-to-use Metadata Explorer application based on the Web ADF for the Java Platform is provided for accessing Metadata Services.

Spatial Server

The Spatial Server has been updated to improve performance and stability. The following enhancements have been made.

■ Image services and ArcMap image services will not include geometry by default in the response to a GET_FEATURES request if the output mode is binary. With this change, ArcMap cannot be used to download vector data served in ArcIMS without the knowledge of the service provider. ArcIMS administrators have the option to allow geometry when the output mode is xml or newxml, to allow geometry for all cases, or to disallow geometry for all cases.▶ *See the 'ArcMap' chapter in this document.*

■ The Spatial Server will stop processing a request if the Application Server times out. This should make Spatial Server instances available more quickly for new requests.

■ Support for projections has been upgraded.
- Many projections that did not work at all or worked incorrectly are supported.
- More datum transformations are supported.
- If a service uses a datum transformation, the datum transformation will be honored, even if the request does not include any datum transformation information.

■ The following improvements have been made for data support.
- To support faster service creation time of very large ArcSDE Raster catalogs, a server parameter has been added to disallow preloading the entire catalog into a cache. The initial service creation time is less and raster rows are loaded by demand when that portion of image is first requested.
- Support was added for using attribute indices with shapefiles. This improves performance of queries using IN and OR.
- Querying shapefiles with mixed case field names is supported.
- Query responses return geometry of polygon features containing a hole correctly.
- On Solaris platforms, the 256 file handle restriction has been removed.

■ Additional font directory locations for the Spatial Server can be specified. This allows the Spatial Server to automatically locate ESRI fonts, system fonts, and other fonts in a specified directory.

■ Spatial Server log files have been updated.
- Log files can now be output in XML and CSV format in addition to the existing text format..
- The time logged in Spatial Server log files is synchronized with the local system time.

■ ArcMap Image Services support the following ArcMap functionality:
- Reading file geodatabases
- Maplex labeling
- Cartographic representations

■ ArcMap Image Services have the following improvements:
- Domain descriptions, Subtype descriptions, and field aliases set in the ArcMap document or geodatabase are returned in query responses. The GET_FEATURES request must included *outputmode*="newxml".
- Definition queries are supported in requests. Layers containing the results of a definition query can be dynamically rendered using SIMPLERENDERER.
- Annotation, multipatch, and group layers are identified when requesting service information.

■ When using Extract Server, if there are no layers to extract in a request, an error message is returned instead of returning an empty zip file.

■ Support has been added for new geocoding styles: World Cities with Country, US Cities with State and US Streets with City, State and Zip.

Administrator

■ Dynamic logging can be enabled and disabled from the ArcIMS Administrator Tools menu without restarting.

Author

■ Direct connect is supported in Author for accessing ArcSDE layers.

Metadata Services

■ Metadata Explorer has been updated to use the Web ADF for the Java Platform. Existing JSP-based Metadata Explorer applications will continue to work with ArcIMS 9.2, but the Metadata Explorer and Advanced Metadata Explorer sample included in ArcIMS 9.1 are no longer available. Here's a screenshot of the new Explorer:

■ In the Metadata Service configuration file, you can set the following attributes:
  - A DBTUNE keyword to use when the Metadata Service tables are created in the database.
  - A toggle to store metadata documents uncompressed in the database.
  - A custom XPath index definition file.

■ Search results can be ordered by the date when the metadata documents were published or updated, either from newest to oldest or oldest to newest.

■ New metadata services have a unique constraint placed on the DocUUID column in the Metadata Service business table and its associated deleted table. This eliminates the possibility of duplicate records.

■ Contents of the feature class associated with a Metadata Service can be previewed, but not copied or pasted, in ArcCatalog.

■ The CSW Connector has the following new features:
  - It is easier to extend the connector to support alternative CSW profiles.
  - The connector has a new Web administration page, similar to the WMS and WFS Connectors.
  - Support has been added for two CSW profiles: *OpenGIS® Catalogue Services Specification 2.0 - ISO1915/ISO19119 Application Profile for CSW 2.0* and *OGC Catalogue Services - ebRIM (ISO/TS 15000-3) profile of CSW*.

■ New RDBMS support for Metadata Services includes SQL Server 2005 and SQL Express with Advanced Services with either Enterprise ArcSDE or Workgroup ArcSDE.

■ The following changes have been made to the gazetteer:

  - Data to support a Gazetteer Metadata Services is provided on a separate disk with the ArcIMS product. The data can be accessed directly from the disk or copied locally.
  - A world gazetteer is provided as well as U.S.-only subset of the gazetteer places.
  - ArcSDE export files containing pre-loaded Gazetteer Metadata Services continue to be provided along with shapefiles containing the source gazetteer data.
  - Scripts for loading the ArcSDE export files have been improved; they continue to be provided with the ArcIMS install.

WMS Connector

■ The WMS Connector has OGC Styled Layer Descriptor (SLD) support. SLD uses a Styled Layer Descriptor XML file to define symbolization of a map. The XML file must follow the SLD schema as defined in the OGC Styled Layer Description Implementation Specification. You can use your own XML file or reference an XML file at a different location. The file reference must be included in the WMS GetMap request URL or as an embedded XML fragment.

■ Requests to WMS-enabled services will honor the datum transformation parameters set in the service.

■ A problem with messages about invalid SRS values in GetMap requests has been resolved.

WFS Connector

■ The WFS Connector has OGC Filter encoding support. With Filter support, you can describe a set of features on which to operate. The OGC Filter is defined in the "OGC Filter Encoding Implementation Specification".

ArcXML

■ The following are some highlights for ArcXML.

  - Support has been added for requesting acetate objects such as a scale bar in a separate image.
  - The scale dependency set for a layer or label can be requested as a relative scale rather than units per pixel.
  - For Image Services, the relative scale of the map can be requested along with the image.

■ For a complete list of updates to ArcXML, refer to the *ArcXML Programmer's Reference Guide*.

Internationalization/localization

■ For the Metadata Explorer, locales that use a comma for a decimal delimiter will function correctly for searches.

■ ArcXML builder for metadata requests can be localized like the other map ArcXML builders.

■ The layer name can be internationalized in the Active X Connector.

■ Gazetteer Search can work correctly on locales that use a comma as a decimal delimiter (European locale).

■ Able to render TIFF images using a comma as the decimal in the world file on non-English locales.

■ Additional font directory locations for the Spatial Server can be specified. This allows the Spatial Server to automatically locate ESRI fonts, system fonts, and other fonts in a specified directory.

■ The WFS Connector has been internationalized.

Documentation and online help

■ ArcIMS documentation is accessible from one location and has been enhanced with new content and better organization. On Windows, the documentation is accessible from the Start menu. The list includes the ArcIMS Help, Errors and Warnings, ArcXML Programmer's Reference Guide, Metadata Services, WMS Connector, WFS Connector, and customizing guides.

■ An overview section has been added that provides steps for creating a successful ArcIMS site.

■ Checklists have been added that focus on best practices for optimizing ArcIMS services and administering your site.

■ The Web ADF's have documentation installed when the respective ADF is installed. This documentation is separate from the main ArcIMS documentation.

ArcIMS 9.2 installation notes

■ Versions 9.0 and higher of ArcIMS must be registered before they can be used. The end result of the registration process is an authorization file that is used to enable the software for use. **All users must obtain a 9.2 authorization file to enable ArcIMS 9.2, even if you had an authorization file for an earlier release**.

■ The Windows ArcIMS installation is separated into three parts. The first is for the core components such as the administrative tools and the server components. The others are for the Web ADF for the Microsoft .NET Framework and the Web ADF for the Java Platform. All features needed to support these frameworks have been moved to their own setup programs.

■ The UNIX and Linux ArcIMS installation id separated into two parts: one for the core components of ArcIMS and one for the Web ADF for the Java Platform.

■ The documentation for the Web ADF for the Java Platform is on a separate CD and is installed separately.

■ A separate CD containing gazetteer data for Metadata Services is included with ArcIMS. This CD is in its own folder and is not part of the media kit.

■ The core ArcIMS installation features for all platforms have been reorganized and offer the following:
  - Administration components including Author, Designer for the HTML, Java Custom and Java Standard Viewers, Administrator, and Service Administrator
    - Manager that was included with ArcIMS 3.x, 9.0, and 9.1 has been removed from ArcIMS. Use the stand-alone versions of Author, Designer, and Administrator instead.
  - Server components including the Application Server, Spatial Server, ArcMap Server, and Servlet Connector
  - Metadata solutions including connectors and applications
  - WMS, WFS, ActiveX, and ColdFusion Connectors
    - The .NET Link has been removed. It has been replaced by the ArcXML object library as part of the Web ADF for the Microsoft .NET Framework.
    - The Java Connector has been moved and is part of the Web ADF for the Java Platform.
  - Samples and tutorial data
    - World datasets from the sample data have been removed.

■ The Web ADF for the Microsoft Framework CD contains the following:
  - ArcIMS Web Manager for the Microsoft .NET Framework
  - Web Application Developer Framework for the Microsoft .NET Framework, including the runtime components and the software developer kit. The ArcXML object library is part of the software developer kit.

■ The Web ADF for the Java Platform CD contains the following:
  - ArcIMS Web Manager for the Java Platform
  - Web Application Developer Framework for the Java Platform
  - Java Connector
  - Metadata Explorer

■ ArcIMS 9.2 ships with J2SE Runtime Environment 5.0 Update 6 on Windows, Solaris, and Linux, J2SE Runtime Environment 5.0 Update 3 on HP-UX, and J2SE Runtime Environment 5.0 on AIX.

■ The Data Delivery Extension (DDE) is supported only on Windows platforms. For all other platforms, please contact SAFE Software.

Platform, web server, and servlet engine updates

■ New platform support:
  - RHEL (Red Hat Enterprise Linux) 4.0
  - HPUX 11.23 (PA-RISC)

■ Support removed for
  - RHEL (Red Hat Enterprise Linux) 3.0

■ Newly supported servlet engines and web servers for **PC-Intel Windows**:
  - Apache 2x with Tomcat 5.5
  - Oracle 10g R2 (10.1.2.0.1)
  - Sun Java System (Sun ONE) Application Server 8
  - WebLogic 9
  - Websphere Application Server 6.0

■ Newly supported servlet engines and web servers for **Sun Solaris**:
  - Apache 2x with Tomcat 5.5
  - Oracle 10g R2 (10.1.2.0.1)
  - Sun Java System (Sun ONE) Application Server 8
  - WebLogic 9

- Websphere Application Server 6.0

■ Newly supported servlet engines and web servers for **Linux-Intel Red Hat**:
- Apache 2x with Tomcat 5.5
- Oracle 10g R2 (10.1.2.0.1)
- Sun Java System (Sun ONE) Application Server 8
- WebLogic 9
- Websphere Application Server 6.0

■ Newly supported servlet engines and web servers for **Linux-Intel SUSE**:
- Apache 2x with Tomcat 5.5

■ Newly supported servlet engines and web servers for **HP**:
- Apache 2x with Tomcat 5.5
- Oracle 10g R2 (10.1.2.0.1)
- Sun Java System (Sun ONE) Application Server 8
- WebLogic 9
- Websphere Application Server 6.0

■ Newly supported servlet engines and web servers for **IBM AIX**:
- Apache 2x with Tomcat 5.5
- WebLogic 9
- Websphere Application Server 6.0

► *For a list of all supported platforms, servlet engines, and Web servers, see the System Requirements for ArcIMS document.*

Deprecation Notes

As ArcIMS adds new features and functionality, older components are marked for deprecation. Deprecation means that a particular feature is completely supported but may be removed in a future release. Features are not normally removed from ArcIMS unless there is a new feature to replace it.

Features deprecated in ArcIMS 9.2

■ The following features are deprecated in ArcIMS 9.2. They continue to be fully supported; however, they may be removed in a future release:

- ArcSDE connection administration in the Service Administrator (not the entire Service Administrator)
- Java Viewer API for use with the Java Custom Viewer. Note: The Java Custom Viewer itself is not being deprecated.
- ActiveX Connector

Features removed from ArcIMS 9.2

■ The following features have been removed from ArcIMS 9.2:

- Browser-based ArcIMS Manager available in ArcIMS 3.x, 9.0, and 9.1. You will need to use the Author, Designer, and Administrator applications. For remote management, the Service Administrator is available. This Manager should not be confused with the ArcIMS Website Manager, which is a new feature.
- Metadata Explorer and the Advanced Metadata Explorer sample are no longer available from the setup. They have been replaced with a new Metadata Explorer that takes advantage of features in the Web ADF for the Java Platform.
- The ArcXML elements AVIMSWORKSPACE, MOIMSWORKSPACE, GET_USER, and PUT_USER.
- World and cities shapefiles from the sample data.

Extensions

3D Analyst

ArcGlobe enhancements

■ When you add data into ArcGlobe, a new wizard now appears to help you make key decisions about how the data should be handled in ArcGlobe:
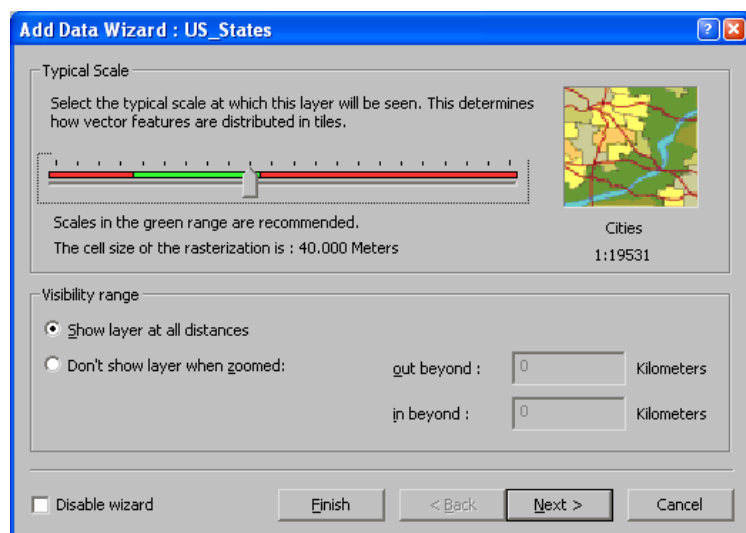
This wizard reduces the amount of time it takes to create a 3D view and provides instruction on which properties are important for different layer types. The panels that appear in the wizard vary with the type of data being added. The wizard doesn't appear if the data being added has no 3D options or if it already has 3D display properties, such as a layer file (.lyr) file already created with ArcGlobe.

This wizard is turned on by default but you can disable it using a check box on the wizard. If you disable it you can re-enable it using an option in Tools > Options dialog Messages tab.

■ The order of the tabs in the ArcGlobe Table Of Contents has been changed so that the Type tab is now the first tab, instead of the Display tab. The new tab order is Type, Display, Source. This was done to highlight that a layer's type (Floating, Draped or Elevation) is the most important property for displaying it in ArcGlobe. You also define the draw order of all draped layers on the Type tab.

■ The same improvements to ArcMap's Find dialog have been made in ArcGlobe too. This includes the ability to find addresses in the USA, Canada and more than 15 European countries using new web services that are built into the dialog. All you need to use these is an internet connection. This enhancement means that you can now search for addresses without having to load an address locator into your globe document first. In addition the ArcWeb Place Finder tab in the Find dialog has been renamed to be just the Places tab and it uses a new place finding service with improved performance.

■ The same improvements to ArcMap's Identify tool have been made in ArcGlobe too. Both applications now use the same ArcGIS Engine-based Identify tool.

■ The Swipe tool in the 3D Effects toolbar now works on group layers and now supports holding down CTRL (or SHIFT) and the left mouse button to swipe the full display instead of having to drag the mouse.

■ The new Flicker command in the 3D Effects toolbar automatically flickers the layer chosen in the layer dropdown list on and off using the time interval specified in milliseconds in the control next to it. Flicker is particularly useful for temporal change detection (especially of satellite images or air photographs taken at different times of the same location), data quality comparison, and other analysis where you want to see small differences between very similar looking layers:


■ The Clear Selected Features command has been added into the Tools toolbar to match ArcMap and enable you to clear the selected set with one click at any time.

■ The Go To XY command has been added into the Tools toolbar. This launches the same dialog as the new command added into ArcMap's toolbar.

■ At 9.2, the 3D Measure tool ⏱ that was introduced in ArcReader at 9.1 for measuring published 3D globes has been added into ArcGlobe where it replaces the existing Measure tool.

■ ArcGlobe now supports drawing graphics on a globe. The new Globe 3D Graphics toolbar lets you draw points, lines, polygons and text on a globe. This is the same toolbar that is already present in ArcScene:
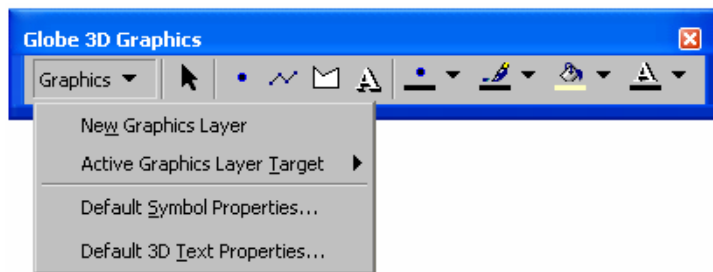
Like graphics in ArcScene, graphics in ArcGlobe can be organized into different graphics layers which appear in the Table Of Contents Type and Display tabs. Graphics layers from both ArcGlobe and ArcScene can be saved to disk as layer (.lyr) files and shared. Graphics layer files are self-contained - they contain the graphic elements and don't reference a separate data source like other layer files.

■ When you right-click a 3D graphic element, there are three globe-specific options: Rasterize Graphic, Billboard Graphic, and Illuminate Graphic,

- The Rasterize Graphic option allows you to drape a graphic element on the surface of the globe such that it follows the terrain of the globe.

- The Billboard Graphic option allows you to billboard the 3D text graphic elements or points symbolized with 3D symbols. Billboarding the graphic element keeps the element aligned to the screen such that it faces the camera at all times.

- The Illuminate Graphic option allows the 3D graphic elements to utilize the globe lighting properties such that the element is rendered with realism. For example, based on the sun lighting, this option will cast realistic shadows on the 3D graphic elements.

■ Google Earth KML and KMZ files can now be added into ArcGlobe as layers. These are the file formats used in Google Earth for storing placemarks, features, 3D objects and other location-based information. KML stands for Keyhole Markup Language. A KMZ file is a zipped version of a KML file that can contain custom images, symbols, etc. KML and KMZ files do not appear in ArcCatalog. This screenshot shows a KMZ file of the Acropolis that was originally created as a Sketch-Up model displayed inside ArcGlobe:
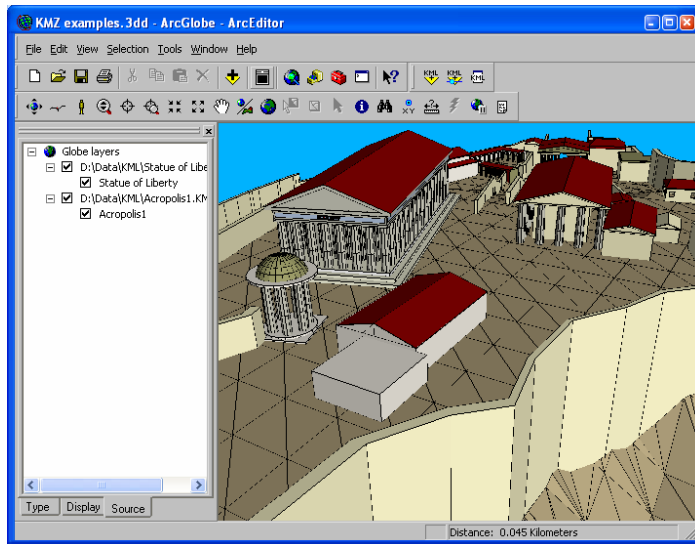
To add local KML or KMZ data into ArcGlobe, use the Add KML Data command on the new KML toolbar. To add KML directly from the internet or from a local server, use the Add KML Network Link command:
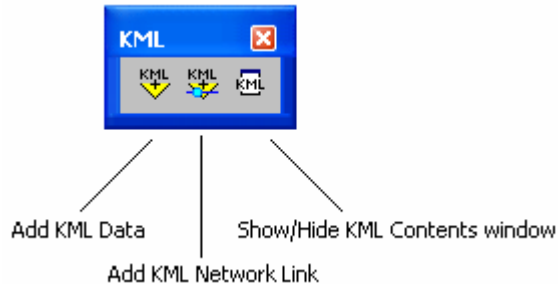
The usual way to add KML is the Add KML Data command. For example, if you have a local KML or KMZ file that contains network link information to other resources on the web, use the Add KML Data command to add this into your globe.

KML and KMZ layers are similar to WMS layers and other web service based layers in that they can contain a large number of individual elements or nodes arranged in a tree. With KML and KMZ, this contents tree can sometimes be extremely large. For this reason, KML and KMZ layers are shown in the ArcGlobe Table Of Contents as single entries, and there's a new KML Contents window dockable window you can open if you want to review or interact with the contents tree. You can show and hide this window using the command in the KML toolbar. In the KML Contents window you can right-click the different nodes in the contents tree to interact with them, including the ability to replay KML tours:

■ You can create KML files from layers and maps using two new geoprocessing tools:

🔧 3D Analyst Tools > Conversion > To KML > **Layer To KML**

🔧 3D Analyst Tools > Conversion > To KML > **Map To KML**

■ ArcGlobe now supports labeling. Turning labels on for a feature layer in ArcGlobe works the same as it does in Arcmap: you right-click the layer in the Table Of Contents and choose the Label Feature command, or go to the Layer Properties dialog Labels tab. You can now drape text on the surface of the globe. Both annotation feature classes and text labels can be draped, or rasterized, on to the globe. This screenshot shows a USA States annotation feature class draped on the globe. As you can see, this includes draped halos and leader lines:

■ The option to specify a Globe cache for group layers has been included in 9.2. When you create or add a group layer into ArcGlobe, you have the option to also create a cache it. The group layer cache can be calculated in two ways. The first option is to consolidate the existing child layer caches into a single rendering pass. This option is best when the child layers already have mature caches and represent a variety of display resolutions. The second option is to create a single rasterized image of all the child layers, thereby creating a single cache for the entire group layer. This option is best when the child layers operate as a single unit, such as a background group layer copied in from ArcMap. You'll see the new options in the group layer Properties dialog:
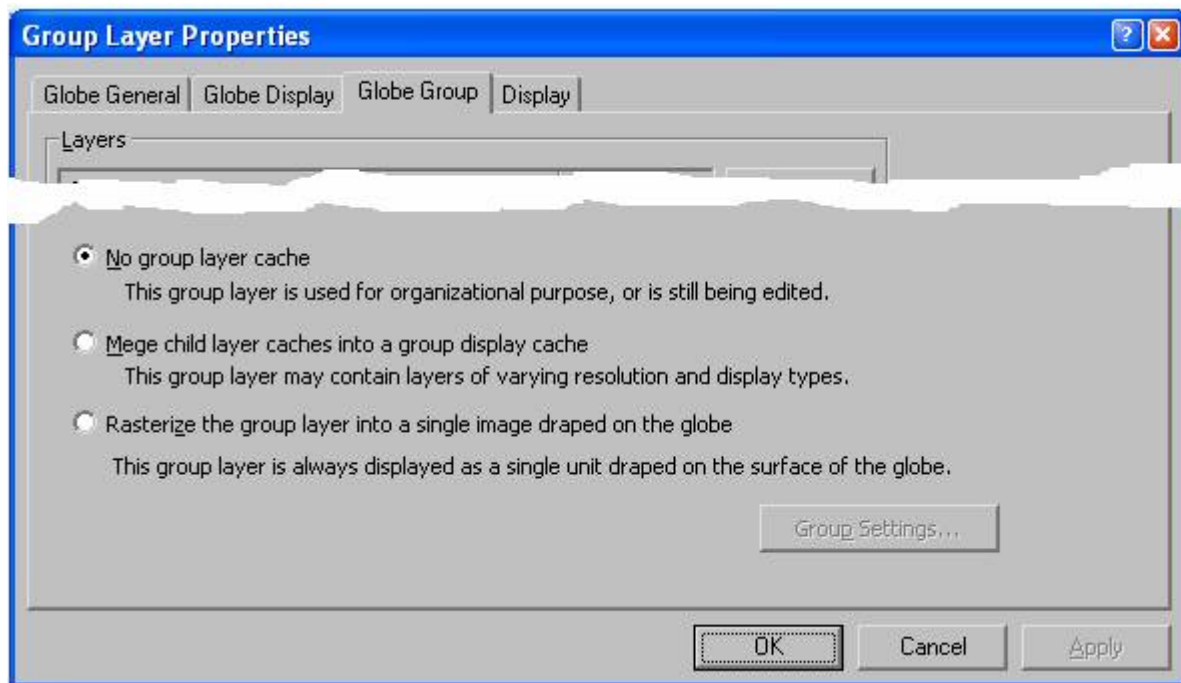
and in a new dialog you can access via a new Group Cache Settings command accessed by right-clicking a group layer in the Table Of Contents Display tab:
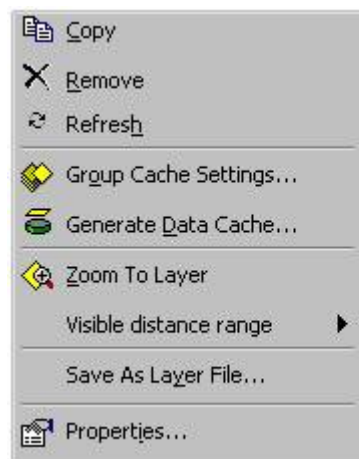
■ ArcGlobe now has a draft mode. While you are in draft mode, the rendering and navigation speed of the 3D view is improved by reducing the quality of the view without invalidating any cached data or modifying any layer properties. Press the new button in the Tools toolbar to enter draft mode:


The button turns orange while you are in draft mode.

Draft Mode operates as a set of overrides. Properties are not changed within the layer itself, but rather applied after each layer is read. The improvement in rendering speed will vary depending upon the layer types in the document and the current symbology properties.

Draft Mode is particularly useful during the initial design of a camera animation. Often, you have already spent a great deal of time developing the 3D view, but now find you need to move swiftly around the view to place camera keyframes. Rather than having to turn off layers or temporarily change symbology, you can enable Draft Mode to develop and preview your fly-through with faster performance. Then simply disable Draft Mode when you are ready to create the final video.

You can configure draft mode using new options at the bottom of the Tools > Options dialog Level Of Detail tab:
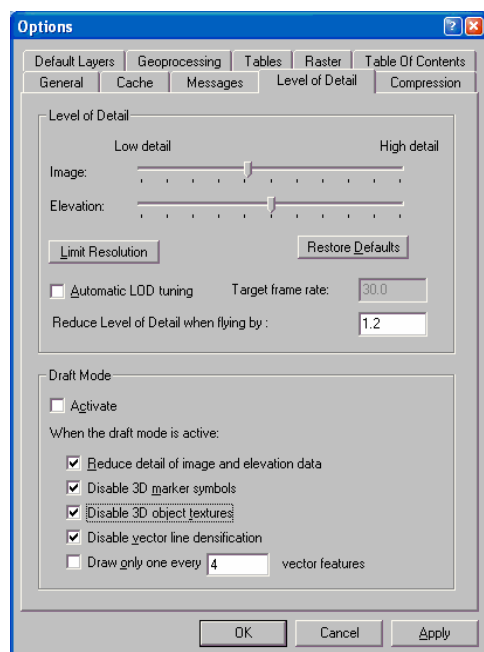
■ Memory cache management has been enhanced. Memory caching refers to assigning an amount of physical memory (RAM) for use by ArcGlobe. For optimum performance you can now set the amount of memory assigned for each type of data used. In the Tools > Options dialog Cache tab, press the Advanced button to launch the new Memory Cache dialog:
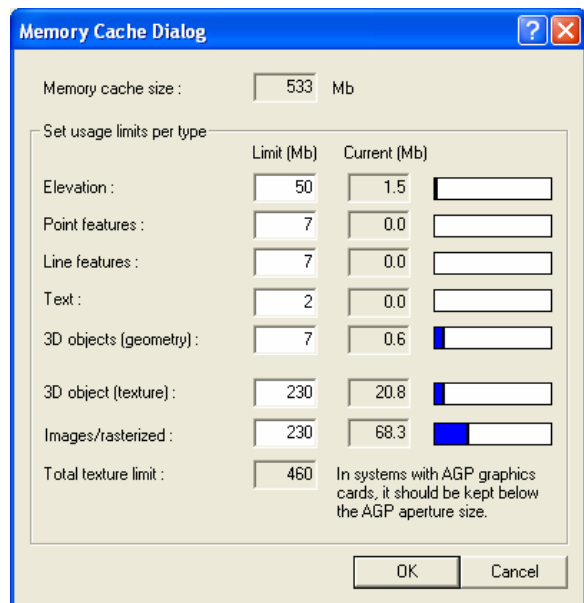
For example, if your 3D view contains many elevation data sources and very few 3D features, you can allocate more RAM for the elevation layers. Often an ArcGlobe document that is performing poorly can become very interactive through well defined memory cache settings. It is important to note that the settings defined in this dialog will apply to this document and all future ArcGlobe documents opened.

■ Hardware compressed textures. Multipatch features often have textures – images or repeating patterns on each face of the 3D object. A common example is 3D buildings, which can display either a digital photograph or simply a repeating window pattern on each face of the multipatch. Reducing the in-memory requirements to render the textures will free up machine resources and improve the display performance for the layer.

■ New texture down-scaling capability. You can reduce the volume of texture pixels (texels) that are sent to the graphics card to render a multipatch feature class by downscaling the resolution of textures. For instance, a 640x480 texture can be downscaled to 320x240, thus lowering its in-memory size by a factor of 4.

The amount of downscaling that can be applied to a texture without greatly reducing the quality of the display will vary from texture to texture. For example, a repetitive window texture will absorb a greater reduction in resolution than that of a shop sign.

Texture downscaling is applied as a layer property. Reducing the in-memory requirements to render the textures will free up machine resources and improve the display performance for the layer. The user can optionally choose to persist the reduced texture resolution when using geoprocessing tools to export the layer to a new feature class.

■ TINs are now supported in ArcGlobe as elevation layers.

■ New deployment wizard. The Deployment Wizard is designed to assist you move completed ArcGlobe documents and their disk caches to new locations. This will be of particular interest for those publishing globes documents to the internet or LAN using ArcGIS Server.

The command to launch the globe deployment wizard is called Deploy Document and can be found in the Tools > Customize dialog Command tab in the File category. You can drag this command into any pulldown menu or toolbar.

■ ESRI ArcWeb Services are now supported inside ArcGlobe. If you are an ArcWeb Services subscriber, you sign can into ArcWeb Services from the new Online Services pullright in the Tools pulldown menu. Once you are signed in, you'll see additional premium services in the Find dialog Places tab, the Find dialog Addresses tab, and the new Tools > Online Services > Find Nearby Places dialog. This matches the way that ArcWeb Services are exposed in ArcMap and ArcReader at 9.2. In addition, you'll be able to add layers based on ArcWeb Services into ArcGlobe from the new ArcWeb Services folder in the ArcCatalog tree. ☛ *See the 'Data & services from ESRI' chapter in this document.*

■ New bonus controls available in the Tools > Customize dialog Commands tab in the Globe category. You can add these into any toolbar:

    Look Around tool

    Fixed Line of Sight tool

    Return To North command

■ More keyboard shortcuts are now supported when you are working in the ArcGlobe Table of Contents:

- Expand/Collapse multiple items via **CTRL-Click**

- **ENTER** or **F12** opens the currently selected item's property dialog.

- **F2** renames the selected item.

- **SPACE** turns drawing of the selected layer(s) on or off.

- **ESC** returns keyboard focus to the map from the Table Of Contents.

- **CTRL + SPACE** toggles all layers on and off if you press it when one layer is highlighted in the TOC.

- **F1** gives you a list of tips and shortcuts for working with ArcGlobe

■ ArcObjects developers using the GlobeControl can now can have two or more globes on a single application window, looking at different documents and having their own navigation properties. Previously you could only have one GlobeControl per form.

■ You can save ArcGlobe documents (.3dd files) and layer files (.lyr files) so they can be opened and used in ArcGlobe in ArcGIS 9.0 and 9.1. This makes it easy to share those files with other ArcGlobe users who have not yet upgraded to ArcGIS 9.2.

- To save a globe document from ArcGlobe 9.2 so it can be used in 9.0 and 9.1, use the new Save A Copy command in the File pulldown menu. At the bottom of the dialog that appears, choose 'ArcGlobe 9.0 Documents (*.3dd)' from the Save As Type dropdown list. This will save a copy of your current map document in 9.0 format.

- To save a layer file from ArcGlobe 9.2 so it can be used in 9.0 or 9.1, right-click the layer in the Table Of Contents and choose the Save As Layer File command. At the bottom of the dialog that appears, choose '9.0 Layer files (*.lyr)' from the Save As Type dropdown list. This will save the layer file in 9.0 format.

■ You can now set contrast, brightness and transparency on group layers in the 3D Effects toolbar, the same as in ArcMap.

Before a raster catalog is displayed in ArcGlobe, the program scans through all the raster datasets inside the catalog to find out their cell size. This typically slows down the caching and display of raster catalogs. At 9.2 a new setting in the Tools > Options dialog Raster tab in ArcGlobe lets you specify that the cell size of the first raster dataset in a raster catalog should be used by ArcGlobe as the cell size for all the other raster datasets inside the catalog. Check this option if you typically work with raster catalogs that contain raster datasets that all have the same cell size. In this way, ArcGlobe will only scan the first raster dataset in raster catalogs and the performance of display and caching will be optimized. If the raster datasets in your raster catalogs typically have differing cell sizes, then checking this option is not recommended. It is unchecked by default:
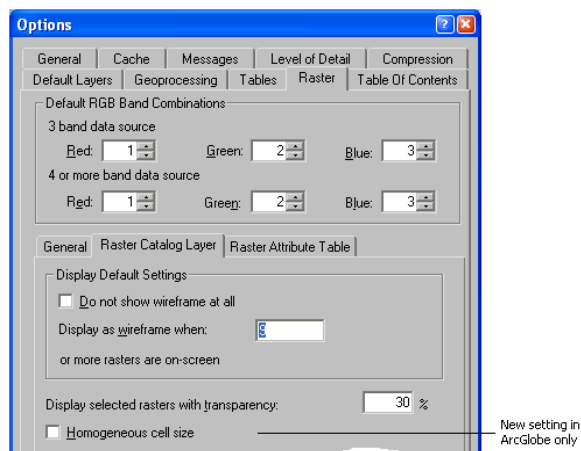
This option applies to all your ArcGlobe sessions and is not used or available inside ArcMap, ArcScene or ArcCatalog because these applications don't have the caching mechanism used by Globe.

■ 3D graphics layers saved as layer files at 9.2 use this new icon:

  3D graphics layer

3D graphics layers didn't have their own distinctive layer file icon in previous releases. Your existing 3D graphics layer files won't be shown in ArcCatalog with this new icon. Only 3D graphics layer files created with 9.2 will have the new icon.

■ New fog effect property on the Globe Properties dialog Background tab. If you enable the fog effect, you'll see an atmospheric haze when you are in surface navigation mode and the observer is looking up at an oblique angle to the horizon. Enabling fog will mask distant objects and makes the display more realistic.

ArcGIS Server can now serve globes

■ You can now publish globes documents to the web as globe services using ArcGIS Server. Globe services are cached for high performance using the caching mechanism of ArcGlobe, which is carried over to the server.

Unlike a map service, users accessing a globe service can choose which layers available in the service they wish to access, so they can access all of the layers it contains or just some of them. Here's what a globe service looks like if you access it in ArcCatalog. The service has been expanded to expose the different layers it contains:
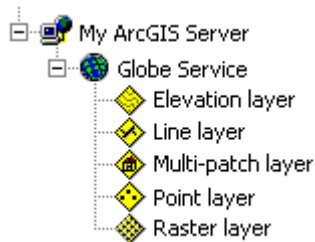
The following clients can access globe services:

- ArcGIS Explorer
- ArcGlobe
- ArcReader
- GlobeControl in ArcGIS Engine

Globe services also contain the animation tracks from the globe document that was published to the server, so a user accessing your globe service over the web can also play back your animation. Playing animations that were published in globe services is not currently supported in ArcGIS Explorer. To access the animation in a globe service, you have to add the globe service itself into the ArcGlobe, rather than one of the individual layers contained in the service.

ArcGIS Server Standard and Advanced editions support publishing globes (☛ *See the 'ArcGIS Server' chapter in this document for information about the different server editions)*. The 3D Analyst extension is not required on ArcGIS Server in order to publish globe services. However, you will require the 3D Analyst extension on ArcGIS Desktop in order to author globe documents using ArcGlobe.

Serve your 3D Analyst geoprocessing models to the web with ArcGIS Server

■ ArcGIS Server can be used to publish 3D Analyst geoprocessing tools and models as geoprocessing services that can be accessed by users in web mapping applications, ArcGIS Explorer, and ArcGIS Desktop. This provides a completely new way to deliver your 3D processes and analytical visualization to a wider audience. You'll need ArcGIS Server Advanced Edition and the 3D Analyst extension on your server. ☛ *See the 'ArcGIS Server' and 'Geoprocessing' chapters of this document.*


Enhancements made to both ArcGlobe and ArcScene

■ A lot of dialogs in ArcGlobe and ArcScene contain a dropdown list that lets you specify which layer you want to perform an operation on. At 9.2 we have updated this dropdown list to make it easier to work with:

- The dropdown layer list now shows you which layers belong to group layers or layers such as ArcIMS image services, so the list matches the way that the layers are organized in your Table Of Contents. You can expand and contract the list to quickly access the layer you want to use.

- Each layer is listed with its layer icon from ArcCatalog so you can easily see what type of data each layer contains.

- If the layer names are very long, a horizontal scale bar at the bottom of the dropdown list lets you scroll the listing sideways.

Here's what the new control looks like. In this particular dialog, group layers aren't valid inputs so the name of the group layer is shown in grey text:
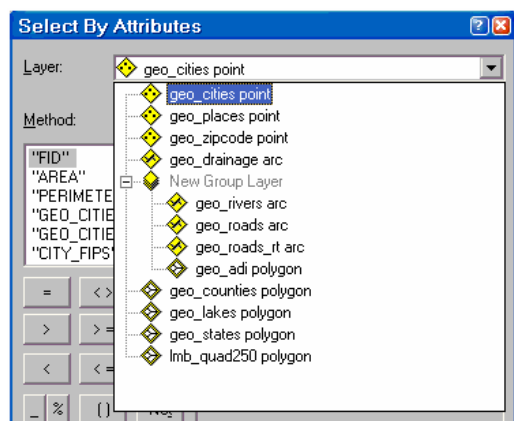
■ You can now access metadata directly from ArcGlobe and ArcScene without having to open ArcCatalog. Right-click any layer in the Table Of Contents and choose the new View Metadata command from the Data pullright. Choosing the View Metadata command opens the metadata for the layer's data source in a new floating Metadata window. This window works the same as the Metadata tab in ArcCatalog. It also enables you to choose the stylesheet you want to view the metadata with.

If the data source of the layer you access metadata for does not have metadata created for it yet, the View Metadata command will automatically initiate metadata creation if the option to 'automatically create metadata' is enabled in the ArcCatalog Tools>Options dialog Metadata tab (it is enabled by default). If that setting is disabled, or if you don't have write access to the data source's location, the Metadata window will show you the standard message that metadata cannot be created.

■ A check box has been added into the Selection>Select By Attributes and Selection>Select By Location dialogs that enables you to restrict the list of layers from which you choose to select features to layers which are currently set as **selectable**. When this box is checked, the list will only contain layers that are currently set as selectable.
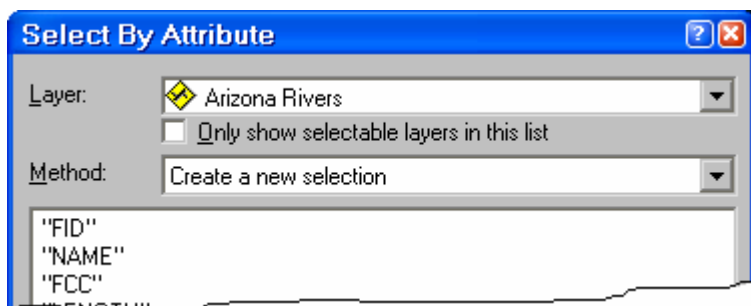
You can set layers as selectable by choosing the Set Selectable Layers command from the Selection pulldown menu.

By default, all the feature layers in a data frame are selectable, so checking this new check box has no effect on the length of the list of layers if you have not yet turned off some of the layers in the Set Selectable Layers dialog.

■ As described in the map navigation part of this document, at 9.2 rolling the mouse wheel gets applied to whichever part of the user interface the cursor is currently over. In this way, you can just move the cursor over the map and then roll the wheel to zoom in or out, irrespective of which window or dialog has keyboard focus. For example, this makes it easier to use the mouse for zooming in and out on a globe because you no longer have to make the main ArcGlobe window active after you've been working in the Table Of Contents in order for your wheel roll to be applied to the globe.

■ You can now reverse the zoom in/zoom out convention used by:

- the mouse wheel

- dragging with right mouse button with the Navigate tool

- the Zoom In/Out tool

To change this setting, go to the ArcGlobe or ArcScene Tools>Options dialog and look at the bottom of the General tab. Both applications have this setting and setting it for one sets it for the other.
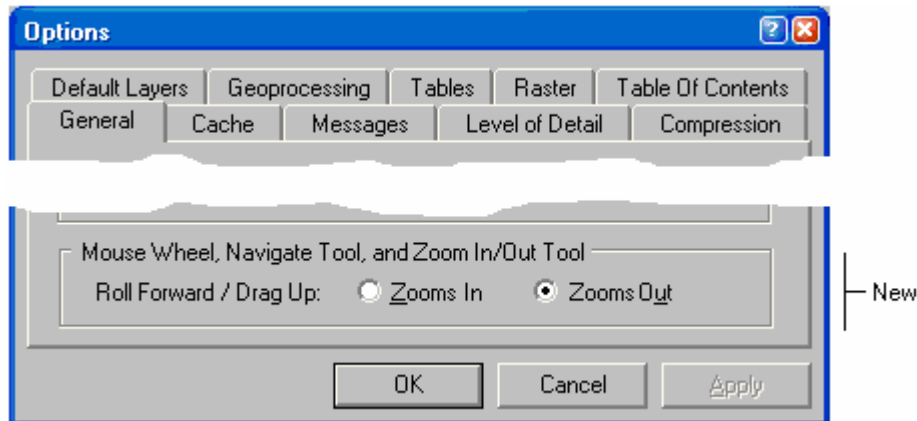
For example, if you want ArcGlobe and ArcScene to match the convention used by the new mouse wheel support added to ArcMap in 9.2, change this setting to use the "Zooms In" option instead.

■ 3D graphics layer files now have their own distinctive icon in ArcCatalog (see above).

■ Improved support for animations:

- New Time layer, Map layer, and Map View animation types

- New layer visibility options in group layer animations

- Improved developer experience with new animation objects

■ In the Table Of Contents in ArcScene or ArcGlobe:

   Hold down **ALT** and click the name of a layer in the Table Of Contents to zoom to the extent of that layer.

   Click inside the Table of Contents to give it keyboard focus and press **F1** to get a list of tips and shortcuts.

Terrain datasets

■ ArcGIS 9.2 introduces a new terrain data type that enables you to store massive surface datasets, such as LIDAR and SONAR data, in the geodatabase. The 3D Analyst extension is required to create terrain datasets. The extension is not required to view terrains. ► *See the 'Terrains' chapter of this document.*

■ The interactive tools in the 3D Analyst toolbar in ArcMap can be used on terrains.

3D geoprocessing enhancements

■ The 3D Analyst Tools > Conversion toolset has been reorganized and a number of new conversion tools have been added (in addition to the terrain conversion tools mentioned above). The new conversion tools are:

🔧 3D Analyst Tools > Conversion > From Feature Class > **FeatureClass Z To ASCII**

🔧 3D Analyst Tools > Conversion > From Feature Class > **MultiPatch Footprint**

🔧 3D Analyst Tools > Conversion > From File > **ASCII 3D to Feature Class**

🔧 3D Analyst Tools > Conversion > From File > **Import 3D Files**

🔧 3D Analyst Tools > Conversion > From File > **LAS to Multipoint**

🔧 3D Analyst Tools > Conversion > From Raster > **Raster Domain**

🔧 3D Analyst Tools > Conversion > To KML > **Layer To KML**

🔧 3D Analyst Tools > Conversion > To KML > **Map To KML**

🔧 3D Analyst Tools > Conversion > **Layer 3D To Feature Class**

■ Other new 3D geoprocessing tools are:

🔧 3D Analyst Tools > TIN Creation > **Delineate TIN Data Area**

🔧 3D Analyst Tools > TIN Surface > **Decimate TIN nodes**

🔧 3D Analyst Tools > TIN Surface > **Extrude Between**

🔧 3D Analyst Tools > TIN Surface > **TIN Difference**

🔧 3D Analyst Tools > TIN Surface > **TIN Polygon Volume**

■ Changes to existing geoprocessing tools:

🔧 3D Analyst Tools > Functional Surface > **Interpolate Shape**
Method parameter added

🔧 3D Analyst Tools > Functional Surface > **LineOfSight**
Now accepts 2D line input and utilizes attributes for parameters

🔧 3D Analyst Tools > Functional Surface > **Surface Spot**
Method parameter added

🔧 3D Analyst Tools > TIN Surface > **Interpolate Polygon To Multipatch**
Now outputs surface area too

ArcScan

New tools

🖊 **Point To Point Tracing tool:** This new tool in the ArcScan toolbar vectorizes raster linear features by tracing the shortest path between two or more points that you specify on the target raster. It is similar to the vectorize trace tool but can be more efficient as the trace does not stop at raster intersections between the two specified points. Use this tool when you need to vectorize a relatively long raster line that may have few raster intersections or a logical path such as a stream. If you need more control over the precise direction of the trace then use the vectorization trace tool.

🔷 **Shape Recognition tool:** This new tool in the ArcScan toolbar allows you to capture features such as building outlines or similar structures that may be represented as circular, rectangular or orthogonal shapes in the raster. Previously you would have to trace or snap or vectorize the raster to obtain one of these features. This new tool allows you to simply click once inside the feature to vectorize the approximate shape into the current editor target.

Measure Raster Distance tool: This is a bonus tool you can add into the ArcScan toolbar. It allows you to measure a distance in raster pixels for the current raster target on the display. It is useful in determining pixel distances for parameters such as gap closure tolerance in the vectorization settings dialog. This tool is not present on the ArcScan toolbar by default but can be found under the ArcScan category in the Tools>Customize dialog Commands tab. This functionality was previously available as a developer sample.
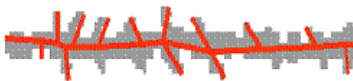
New vectorization settings

■ Noise level: This parameter sets the roughness or noise threshold for features in the raster. Raster linear features may be rough or noisy due to poor quality line work on the source map or the map may have been scanned at a low resolution.

The noise level determines how much noise to ignore during a vectorization process. Setting this value to high may result in some features being missed while setting it too low will result in noise being picked up as features.

The following diagrams depict a noisy raster feature overlaid with a vectorization preview showing the effects of differing noise levels.

Vectorization with low noise level: Vectorization with high noise level:

■ Resolve corners: The resolve corners settings allows you to control how ArcScan will recognize and resolve corners during vectorization functions. When enabled, ArcScan will assume that any bend in a raster linear features less than the corner angle (also specified on the vectorization settings dialog) should be treated as a sharp corner during snapping, tracing and automatic vectorization. This is usually important while capturing information from parcel or engineering plans that feature right angle or similarly sharp corners. Enabling this option will make ArcScan operations slower however and should be generally disabled while working with contour or polygon features.

New raster cleanup operations

■ Four new raster morphological operations have been added to the raster cleanup menu, which offer you additional ways to cleanup a raster prior to vectorization.

- **Erosion** decreases the thickness of all raster features. Features may be deleted during this operation if the value is set too high.

- **Dilation** is the opposite of erosion in that it will thicken raster features. This is useful to give better definition to thin raster features that you so wish to capture.

- **Opening** is erosion immediately followed by dilation. This operation tends to "open" small gaps and spaces between touching objects in an image. It also can delete thin lines. It is useful to quickly remove features you may not want to capture such as thin grid lines in the source map.

- **Closing** is dilation immediately followed by erosion. It is used to "fill-in" any cracks in the image and to "close" small gaps and spaces between touching objects in an image.

Opening and closing create an image that is simpler and has fewer details than the source one.

Tip: Remember that since 9.1, the ArcScan for ArcGIS extension can now be used by ArcEditor and ArcInfo users at no additional charge. The ArcScan extension is installed when you run the ArcGIS Setup using the Complete or Custom installation options. ArcView users still have to purchase a license if they wish to use the ArcScan extension.

Data Interoperability

Free support for OGC GML Simple Features

■ If you install the Data Interoperability extension, you can now use it to access OGC GML Simple Feature data without needing to have a Data Interoperability extension license. This free support provides this functionality:

- OGC GML Simple Feature access
- OGC GML Simple Feature import/export
- OGC GML Web Feature Service access for Simple Feature based services

Support for the full list of formats and additional functionality provided by the extension, such as custom formats and custom tools built using Workbench, require that you have a license for the Data Interoperability extension.

Tip: To install the Data Interoperability extension, use the Complete option when you install ArcGIS Desktop 9.2, or use the Custom option and enable the extension in the list of extensions. If you have already installed ArcGIS Desktop 9.2 without the extension and now want to install it to try the free GML Simple Features support, run the Setup program again and choose the Modify option to add the extension.

Support for ArcGIS Engine and ArcGIS Server

■ The functionality of the Data Interoperability extension is now available for ArcGIS Engine and ArcGIS Server as extensions for those products. This allows any of the extension's data handling and support capabilities to be embedded in custom desktop or server-based applications.

Based on Safe Software FME 2006

The Data Interoperability 9.2 extension is based on the FME 2006 product release by Safe Software, and benefits from the new functionality added in this new product release:

■ Workbench improvements:

- Ability to publish parameters to use multiple times

- Build custom transformers from reusable workbench workflows

- Shared Directories: a shared environment to allow multiple users access to custom formats and custom transformers from a central location

- New numbered counters show how many features passed through each link in the Workbench canvas

■ New formats:

Read/Write:
    Access Database (ADO)
    ESRI File Geodatabase
    Google Earth Data Exchange (KML)
    MapInfo TAB (replaces old MapInfo TAB reader)
    Tabular Data

Read:
    ESRI ArcGIS 9.x Layer

Write:
    GML 3.1.1 (read access was added at 9.1 Service Pack 1)

■ New Transformers:

AreaOnAreaOverlayer
AreaSmoother
Bufferer
CommonSegmentFinder
ConvexHullReplacer
KMLStyler
Labeller
LineOnAreaOverlayer
LineOnLineOverlayer
SchemaMapper
SectorGenerator
SpatialRelator
TopologyBuilder

■ The Quick Import and Spatial ETL tools (see below) support the new file geodatabase format introduced in 9.2.

Note: The 9.1 version of the extension was based on FME 2004. The 9.1 Service Pack 1 version was based on FME 2005.

New Spatial ETL Tool

At 9.1, you had the option to create three different types of custom interoperability tools, Import, Export and Transform. At 9.2, we have consolidated these three options into a single tool called Spatial ETL Tool.
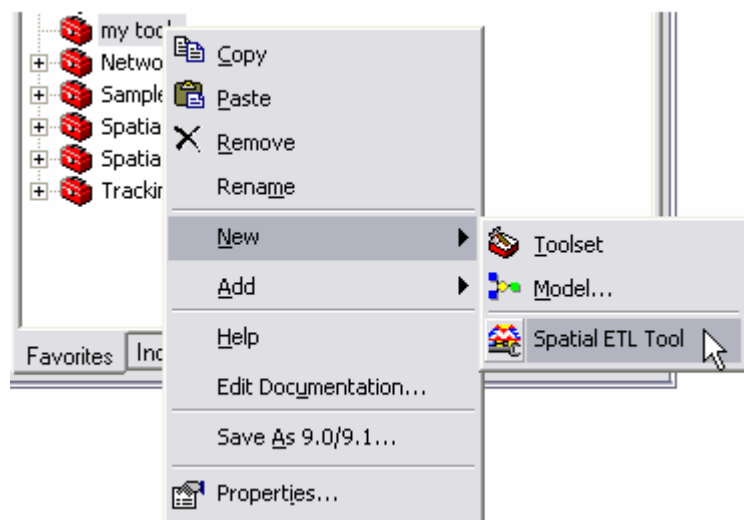

The Spatial ETL Tool retains the functionality of the original tools. Tools built in previous versions will be forward compatible, meaning you can run them without modification, or you can edit the tool in Workbench, which will allow you to upgrade the tool to a Spatial ETL Tool.

More information about the Spatial ETL Tool is available in the online help for ArcGIS 9.2, or in chapter three of the Data Interoperability Tutorial.
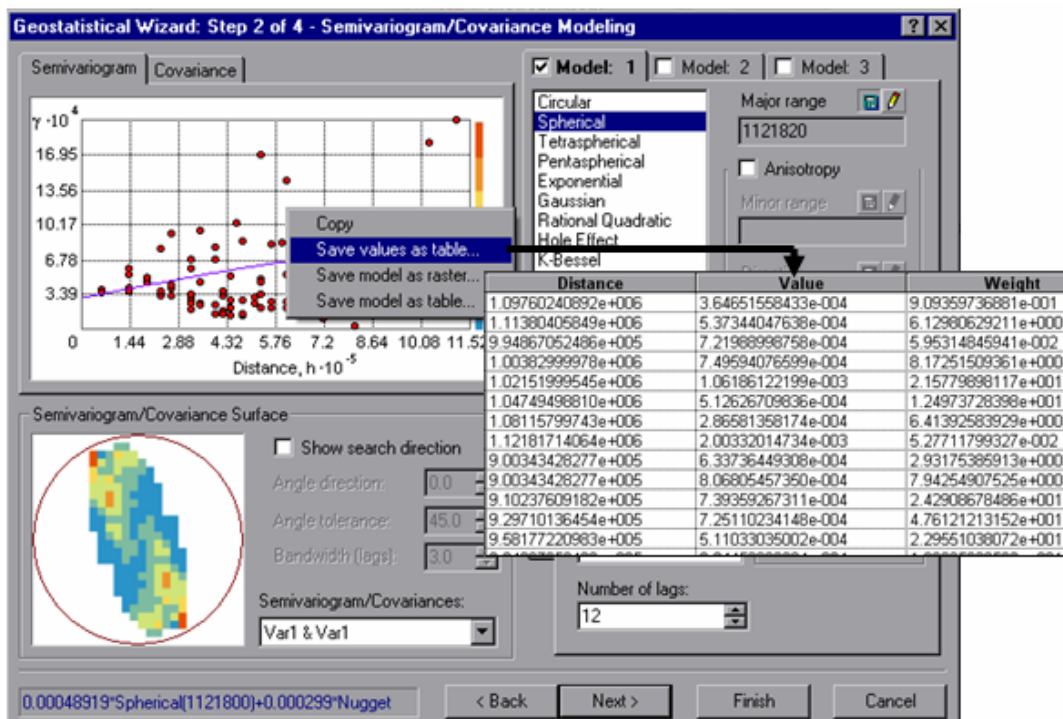
# Geostatistical Analyst

Geostatistical Wizard enhancements

■ The weights that are used in the different interpolation methods are now displayed in the Geostatistical Wizard:
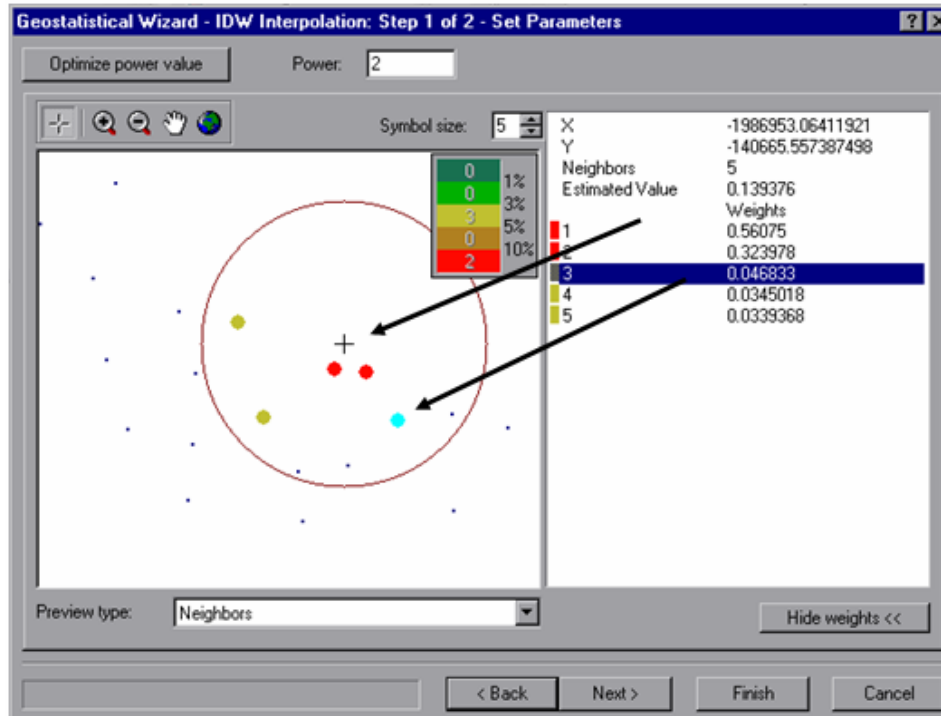
■ The semivariogram can now be exported as a table or as a raster for further analysis:

■ The Geostatistical Wizard now supports smooth interpolation. The graphic below on the left shows kriging interpolation with a circular searching neighborhood using a radius of 20 feet. The graphic on the right shows the kriging prediction using the smooth interpolation option:
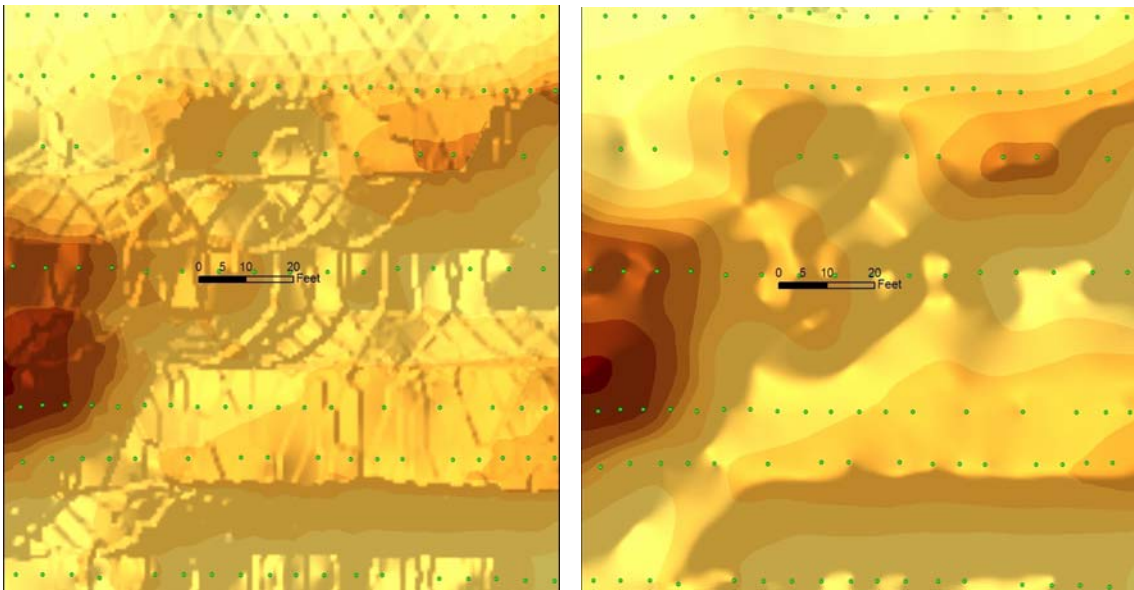
In smooth interpolation, the search neighborhood creates an outer ellipse and an inner ellipse. All the points within these three ellipses are used in the interpolation. The points that fall outside the smaller ellipse but inside the largest ellipse are weighted using a sigmoidal function with a value between zero and one that you can specify.

■ The first panel of the Geostatistical wizard now uses the improved dropdown layer list described in the ArcMap chapter of this document. There is also better support for working with long field names in the wizard.


New geoprocessing tools

A number of new geoprocessing tools have been added into the Geostatistical Analyst Toolbox. All the Geostatistical tools in the toolbox can also now be used in scripting to automate and customize a variety of applications.

■ A geostatistical layer is created using the complete input dataset. The kriging parameters can be adjusted or left as the initial default values that are automatically determined by the Geostatistical Wizard. This new geoprocessing tool:

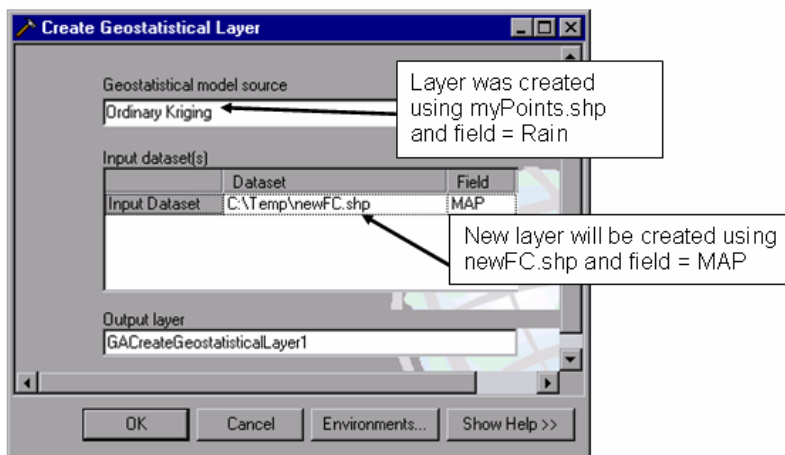🔨 Geostatistical Analyst Tools > **Moving Window Kriging**

lets you create a new feature class by recalculating the Range, Nugget and Partial Sill semivariogram parameters based on a smaller neighborhood. When the data is non-stationary, you must estimate a heterogeneous semivariogram. In other words, use a moving window centered on the location to be predicted and create a semivariogram for each local neighborhood:
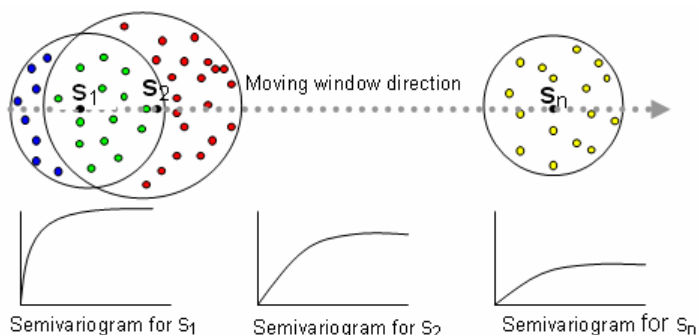
■ You can now create a new geostatistical layer from an existing one using a different input dataset or field variable than was used for the original layer:

   Geostatistical Analyst Tools > **Create Geostatistical Layer**

■ The new Semivariogram Sensitivity tool lets you automatically vary the Nugget, Partial Sill and Range parameters to perform a sensitivity analysis:

   Geostatistical Analyst Tools > **Semivariogram Sensitivity**

■ Other new tools added:

   Geostatistical Analyst Tools > **Calculate Z-value**

   Geostatistical Analyst Tools > **GA Layer To Contour**

   Geostatistical Analyst Tools > **GA Layer To Points**

   Geostatistical Analyst Tools > **Get Model Parameter**

   Geostatistical Analyst Tools > **Neighborhood Selection**

   Geostatistical Analyst Tools > **Set Model Parameter**

Maplex

■ Added support for Leader Lines to Maplex: Leader lines are now taken into account during the labeling process resulting in less ambiguity in label-feature relationships. Text positions are produced to avoid crossing leader lines.

■ Minimum feature size: A new minimum feature size property has been added to allow users the ability to specify the minimum size feature that will be labeled. This option is available for polygon and line labels and allows users to reduce visual clutter on map by quickly specifying the smallest feature that should receive a label:
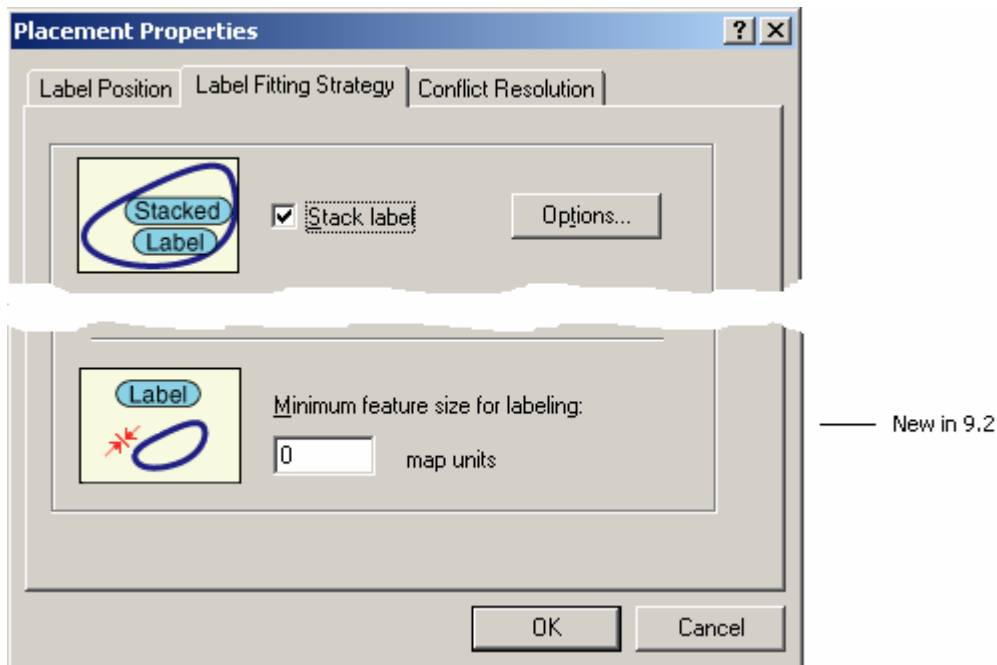
■ Polygon offset: Additional control over the offset labeling of polygons has been added. When combined with the improved functionality for leader line placement, this option results in clearer label placement for polygon labels:
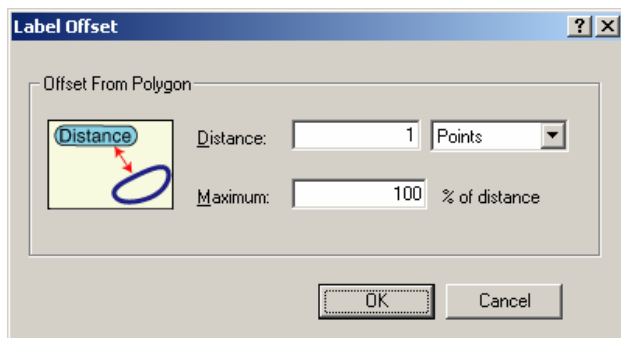
■ The Maplex extension is now supported by ArcGIS Server and ArcIMS ArcMap Server. This allows web-based applications to display high Maplex labels.

■ The Maplex extension is now supported by ArcGIS Engine so embedded applications can take advantage of Maplex label placement for high quality mapping.

■ The Maplex extension is now supported by the ArcGIS Publisher extension. Maps containing layers with Maplex labeling properties can now be published via the Publisher extension and viewed using ArcReader.

■ Quality: The placement quality, performance, and scalability of the Maplex label engine have been improved.

Network Analyst

Route analysis enhancements

■ You can now specify the start time that the route is to begin. This is useful when using time windows to control the time you want the vehicle to start. It's also useful if you simply want your directions to display the running time starting at the time specified.
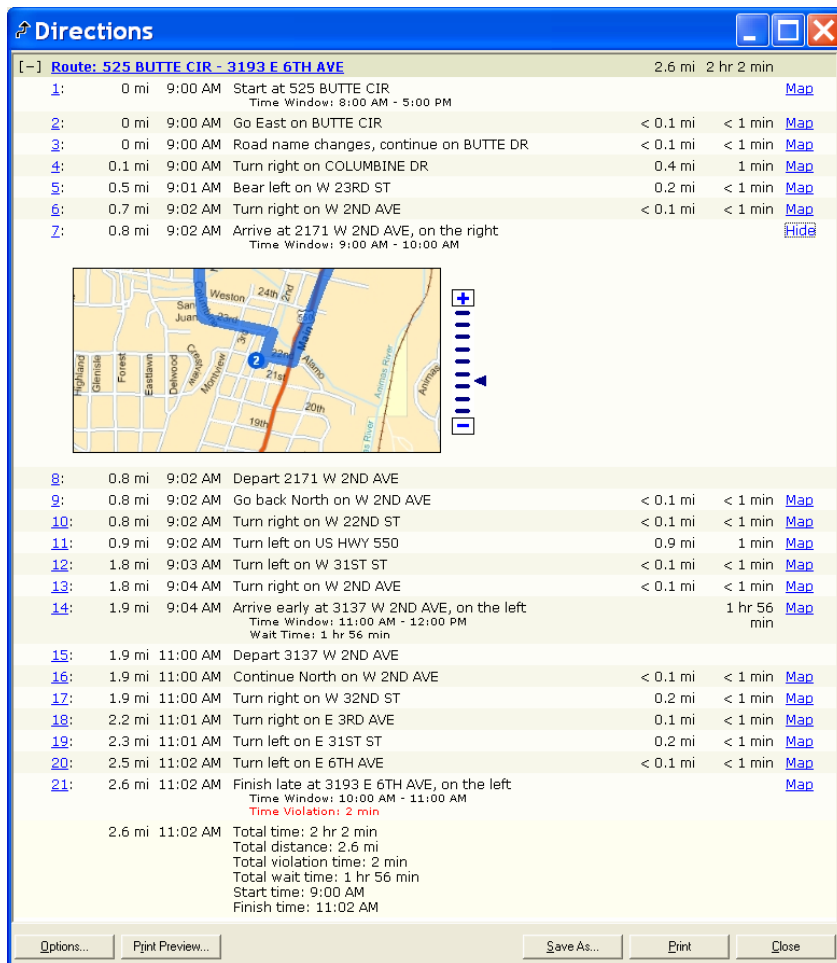
■ You can now solve a problem containing multiple routes. With each stop, you can now specify the route name that the stop belongs to. When the solver is executed, it generates routes between stops with the same route name for each unique route name. The Network Analyst Window has also been enhanced to display the stops per route name:
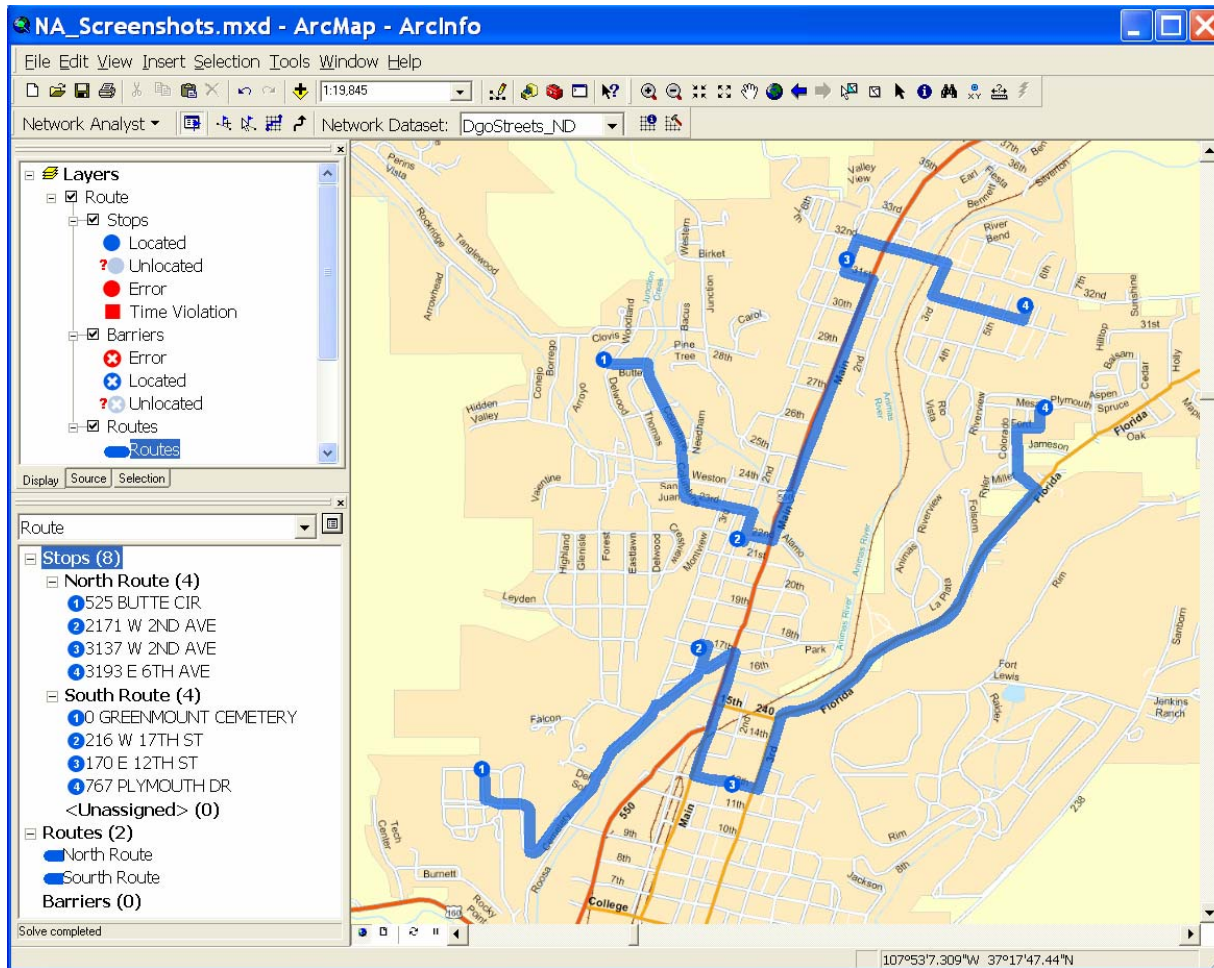
■ You can now create network datasets referencing signpost tables to improve the quality of directions. This is specified in the network dataset directions property pages. Signpost tables enable the generation of user-friendly directions such as "Take exit 123 on I-15 north towards Las Vegas".

■ The Directions window has been improved in several ways.

- The cumulative distance and time (based on the Route's start time)
- Time window support, including wait time and time violations
- The ability to turn off columns within the window
- Adjustable inset maps and ability to change the default scale
- A print option to print exactly what is shown within the window.

Directions

[−] Route: 525 BUTTE CIR - 3193 E 6TH AVE   2.6 mi 2 hr 2 min

1:	0 mi	9:00 AM	Start at 525 BUTTE CIR Time Window: 8:00 AM - 5:00 PM			Map
2:	0 mi	9:00 AM	Go East on BUTTE CIR	< 0.1 mi	< 1 min	Map
3:	0 mi	9:00 AM	Road name changes, continue on BUTTE DR	< 0.1 mi	< 1 min	Map
4:	0.1 mi	9:00 AM	Turn right on COLUMBINE DR	0.4 mi	1 min	Map
5:	0.5 mi	9:01 AM	Bear left on W 23RD ST	0.2 mi	< 1 min	Map
6:	0.7 mi	9:02 AM	Turn right on W 2ND AVE	< 0.1 mi	< 1 min	Map
7:	0.8 mi	9:02 AM	Arrive at 2171 W 2ND AVE, on the right Time Window: 9:00 AM - 10:00 AM			Hide

8:	0.8 mi	9:02 AM	Depart 2171 W 2ND AVE			
9:	0.8 mi	9:02 AM	Go back North on W 2ND AVE	< 0.1 mi	< 1 min	Map
10:	0.8 mi	9:02 AM	Turn right on W 22ND ST	< 0.1 mi	< 1 min	Map
11:	0.9 mi	9:02 AM	Turn left on US HWY 550	0.9 mi	1 min	Map
12:	1.8 mi	9:03 AM	Turn left on W 31ST ST	< 0.1 mi	< 1 min	Map
13:	1.8 mi	9:04 AM	Turn right on W 2ND AVE	< 0.1 mi	< 1 min	Map
14:	1.9 mi	9:04 AM	Arrive early at 3137 W 2ND AVE, on the left Time Window: 11:00 AM - 12:00 PM Wait Time: 1 hr 56 min		1 hr 56 min	Map
15:	1.9 mi	11:00 AM	Depart 3137 W 2ND AVE			
16:	1.9 mi	11:00 AM	Continue North on W 2ND AVE	< 0.1 mi	< 1 min	Map
17:	1.9 mi	11:00 AM	Turn right on W 32ND ST	0.2 mi	< 1 min	Map
18:	2.2 mi	11:01 AM	Turn right on E 3RD AVE	0.1 mi	< 1 min	Map
19:	2.3 mi	11:01 AM	Turn left on E 31ST ST	0.2 mi	< 1 min	Map
20:	2.5 mi	11:02 AM	Turn left on E 6TH AVE	< 0.1 mi	< 1 min	Map
21:	2.6 mi	11:02 AM	Finish late at 3193 E 6TH AVE, on the left Time Window: 10:00 AM - 11:00 AM Time Violation: 2 min			Map
	2.6 mi	11:02 AM	Total time: 2 hr 2 min Total distance: 2.6 mi Total violation time: 2 min Total wait time: 1 hr 56 min Start time: 9:00 AM Finish time: 11:02 AM			

Options...   Print Preview...   Save As...   Print   Close

■ The renderer property page for the route layer's Stops has been enhanced to look like other renderer property pages. As part of being more consistent with the other renderers, it allows you to turn on/off symbols, reorder the symbols, and change their label in the table of contents.

Layer Properties

General | Selection | Display | Symbology | Fields | Definition Query | Labels | Joins & Relates

Show:
Features
Network Analyst Stop
  Stops
Categories
Quantities
Charts
Multiple Attributes

NetworkAnalyst Stops Renderer   Import...

Stop Text Symbol
O Arial ▼   8 ▼
□▼ B I U   Text Symbol...

Stop Marker Symbols

| Symbol | Status | Label |
✔ 99	Located	Located
✔ ?99	Unlocated	Unlocated
✔ 99	Error	Error
✔ 99	Time Violation	Time Violation

OK   Cancel   Apply

■ At 9.2, you can now have a network dataset attributes with parameters defined on them. This is useful because the evaluators assigned to these attributes can use the parameters to determine the attributes value. This makes it possible to have a tunnel height restriction that will return restricted only if the vehicle height is more than the tunnel height.

To specify these you use ArcCatalog's network dataset creating wizard to add a parameter to an existing attribute. For example, a parameter called Vehicle Height could be added to a Height restriction attribute.
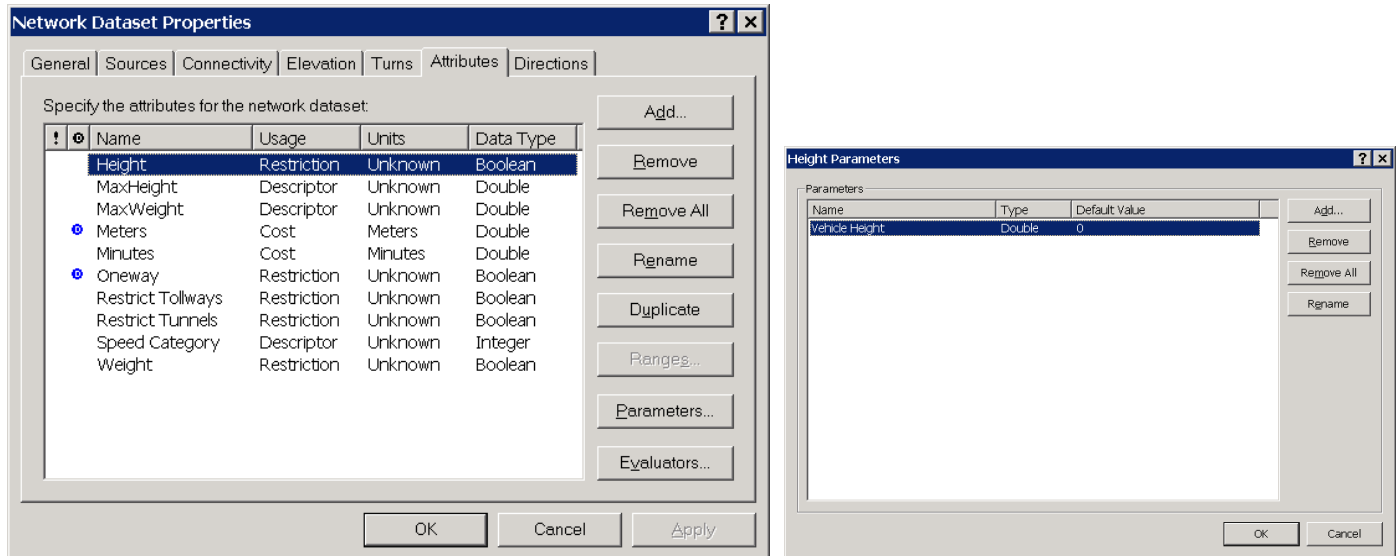
To use these parameterized attributes, create a network analysis layer in ArcMap and bring up its properties and use the Analysis Settings tab to specify their use. For example, to use the height restriction, check it on in the properties page and then use the Attributes Parameter to specify the value for the current vehicle height. The evaluator for the Height restriction can then use this parameter value to return the restriction status. The value of the Vehicle Height parameter can be changed any time during analysis by bringing up the properties of the network analysis layer or using a geoprocessing tool.
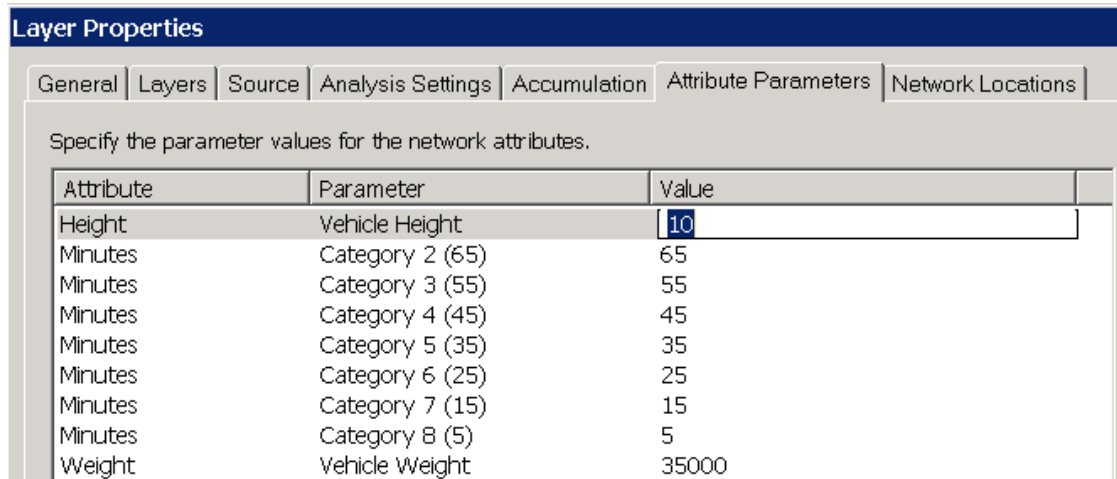
Service area analysis enhancements

■ You can now trim the outer service area polygon by a specified distance. This is useful in rural locations where there may be large areas with roads that you don't want to be included in the service area polygon.

Here is an example of the outer service areas being trimmed within 100 meters of the corresponding streets.
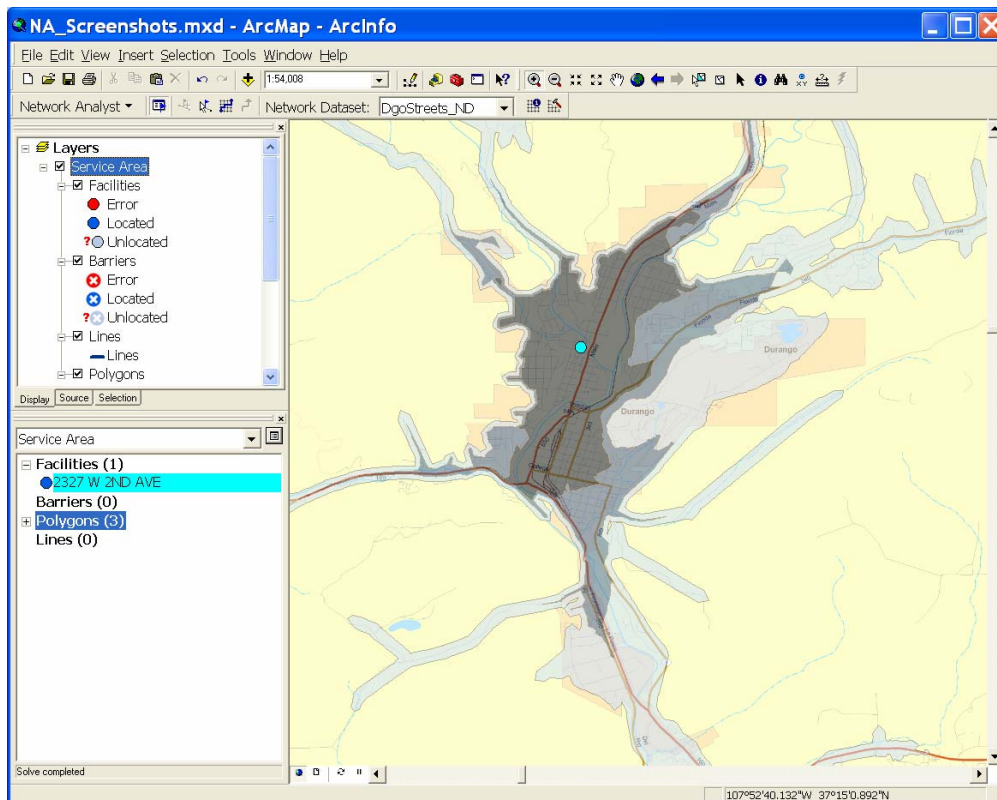

You can find the new trimming option in the Network Analysis Layer Properties dialog Polygon Generation tab:
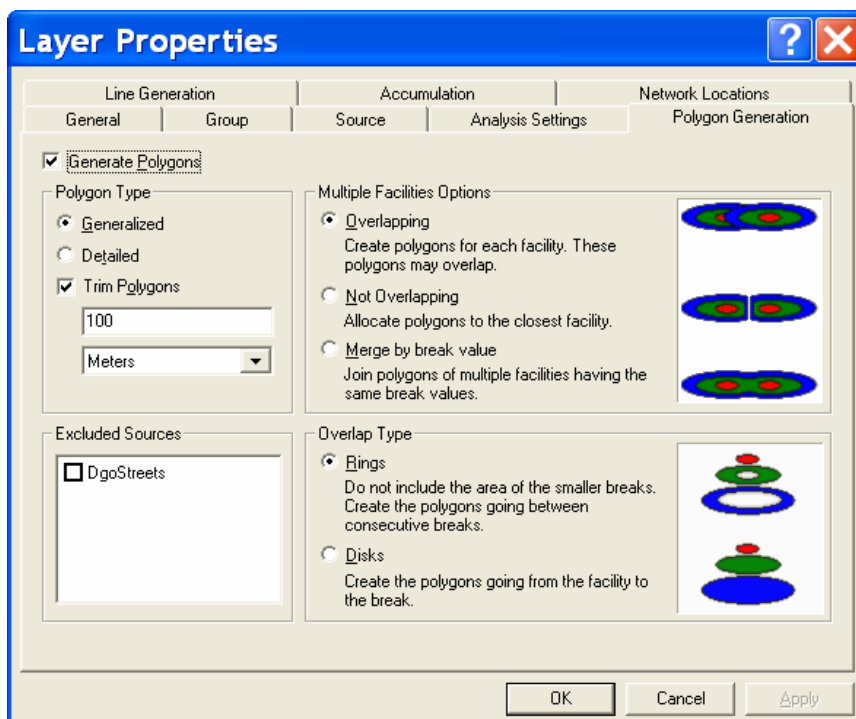
■ There is now an option to create service area polygons that do not overlap. This is useful in cases where there are multiple facilities and you need the area of each polygon to be generated based on the "closest" facility.

This option is also specified in the Network Analysis Layer Properties dialog Polygon Generation tab (see above)

Here is an example of non-overlapping service areas based on 3 facilities:
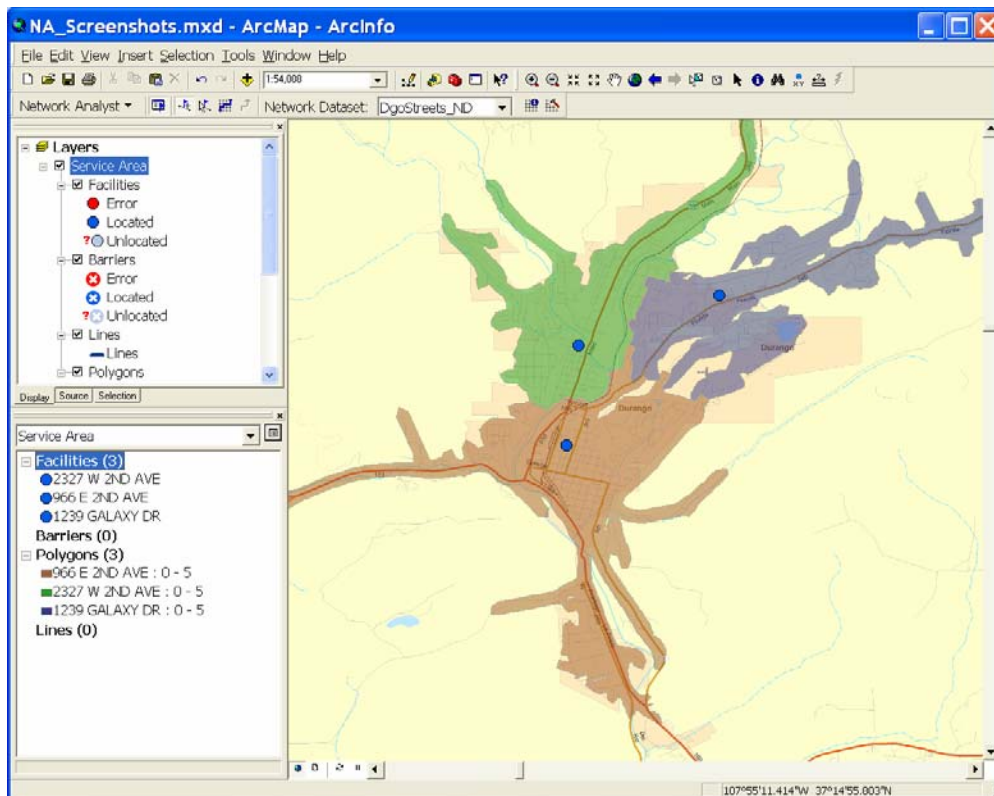
Better control over how network analysis layers are drawn

■ You can now change the order in which the individual layers (e.g. Stops, Barriers) inside a network analysis layer are drawn using a new tab called Layers that has been added into the Network Analysis Layer Properties dialog.

You can also use this tab to access the properties of the layers in an analysis layer directly to specify symbology, etc without having to close the Network Analysis Layer Properties dialog. Tip: double-click on a layer in the list to access its properties:
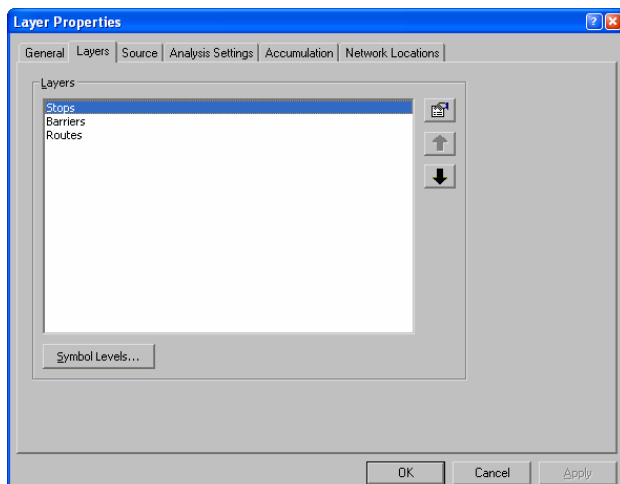
■ Network analysis layers now provide full support for the symbol levels, enabling you to specify the precise drawing order and join/merge behaviour of the symbols used in the layer, the same as you can for a group layer containing a set of feature layers. (In 9.1 you could specify symbol levels for the individual layers inside an analysis layer, but you weren't able to specify symbol level behaviour encompassing all the layers inside an analysis layer. You access the Symbol Levels dialog for a network analysis layer via a button on the new Layers tab (see above).

■ A new Reset Symbology dialog lets you change the symbology of all the sublayers in a network analysis layer at once instead of visiting them each individually. You can reset the symbology to the default based on the specified color (for example if you want the default symbology in pink) or you can chose another analysis layer to import the symbology from. Right-click an analysis layer in the Table Of Contents to access the Reset Symbology command that launches this dialog:
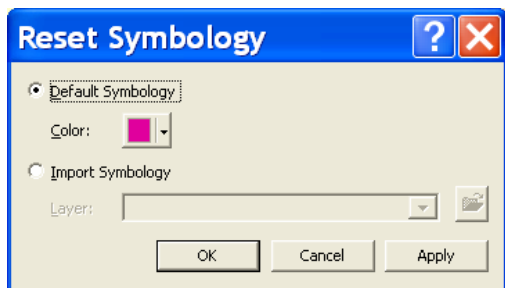

Adding network locations to a map

■ The search tolerance now starts small and expands up until the maximum search tolerance is reached. Therefore, you can specify a large search tolerance for cases where a network location may be far away from a source feature, but if the majority of your locations are close to a source feature, performance locating those features will be good.

■ Reverse geocoding is now supported when you are adding network locations. With this option, network locations you add by clicking on the map are named by their street address rather than "Graphic Pick X" or "Location X". These street addresses are obtained by reverse geocoding using an address locator specified in the new Location Names tab in the Network Analyst > Options dialog launched from the Network Analyst toolbar:
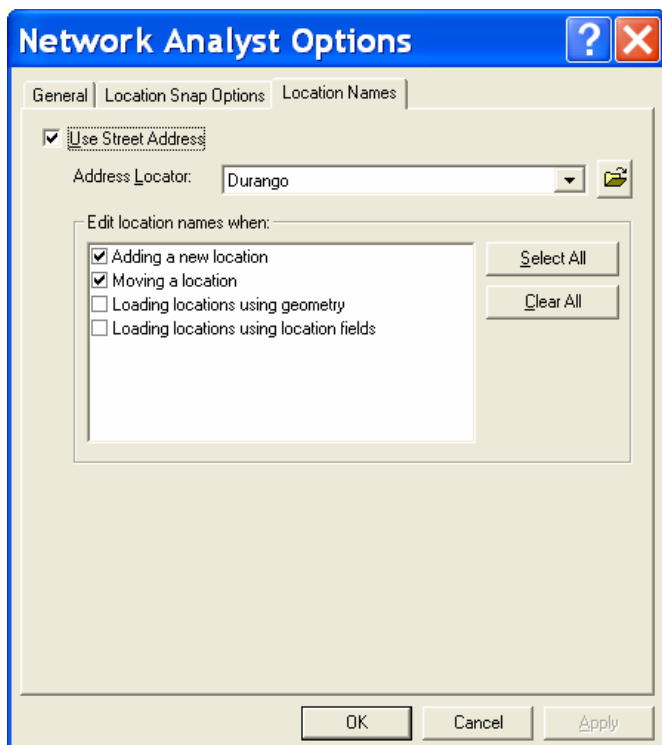
■ You can specify that network locations should be snapped to a network source. You can also snap them a specified distance from the source if you need an offset to model the side of street for curb approach. This is useful if you want your network locations a uniform distance from the actual feature it's referencing. These options can be configured in the new Location Snap Options tab in Network Analyst > Options dialog:
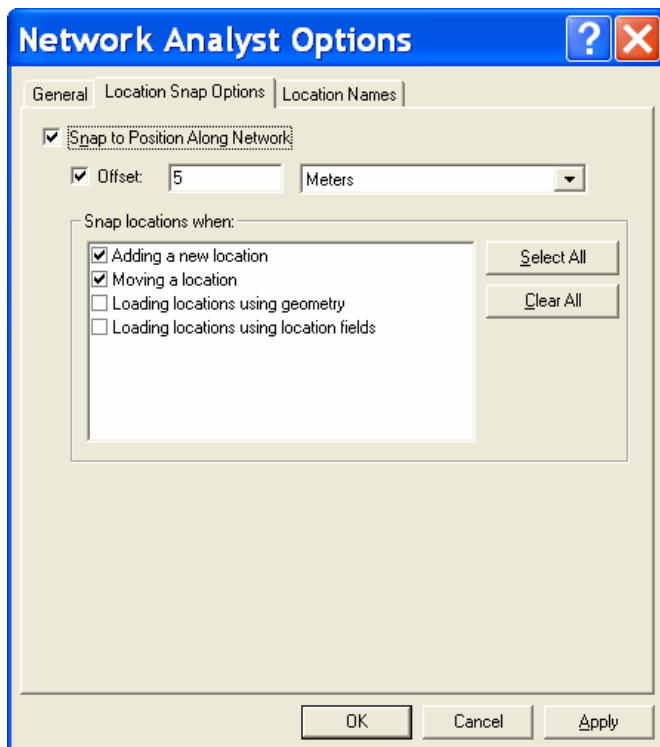
Geoprocessing

■ Derived output parameters have been added to more network analyst geoprocessing functions so you can string processes together more effectively.

■ A new geoprocessing tool:

🛠 Network Analyst Tools > Analysis > **Update Analysis Layer Attribute Parameter**

is provided to set or update the network attribute parameter value for a network analysis layer. This tool is useful for those network attributes that have parameters defined on them. This tool can be used to repeatedly change the value of a parameter before solving a network analysis layer.

ArcGIS Server support

ArcGIS Server now exposes network analysis web services. You are able to publish map documents that contain network analysis layers.

This allows you to create server applications which perform route, closest facility, and service area network analysis via a web service:
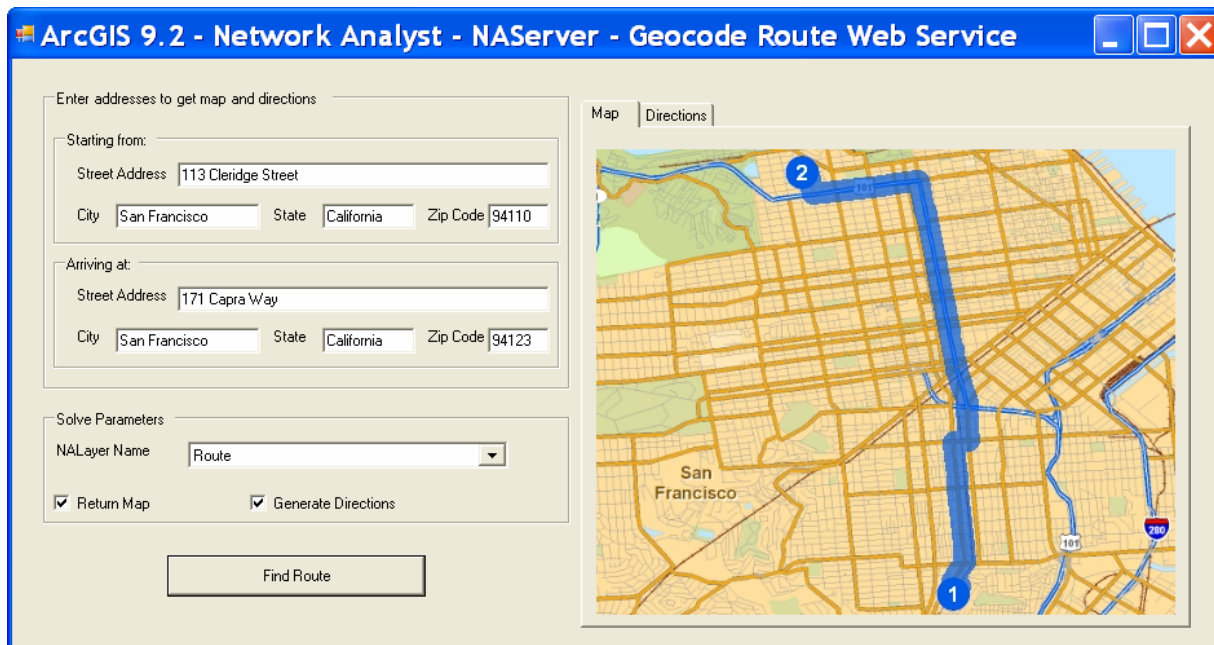
You could perform network analysis with ArcGIS Server at 9.1, but it required a lot of custom code.

ArcGIS Engine Developer Kit components

ArcGIS Engine now includes developer controls similar to those in ArcMap that allow users to easily create applications that perform network analysis. This includes the buttons on the Network Analyst Toolbar as well as the Network Analyst Window and the Directions Window:
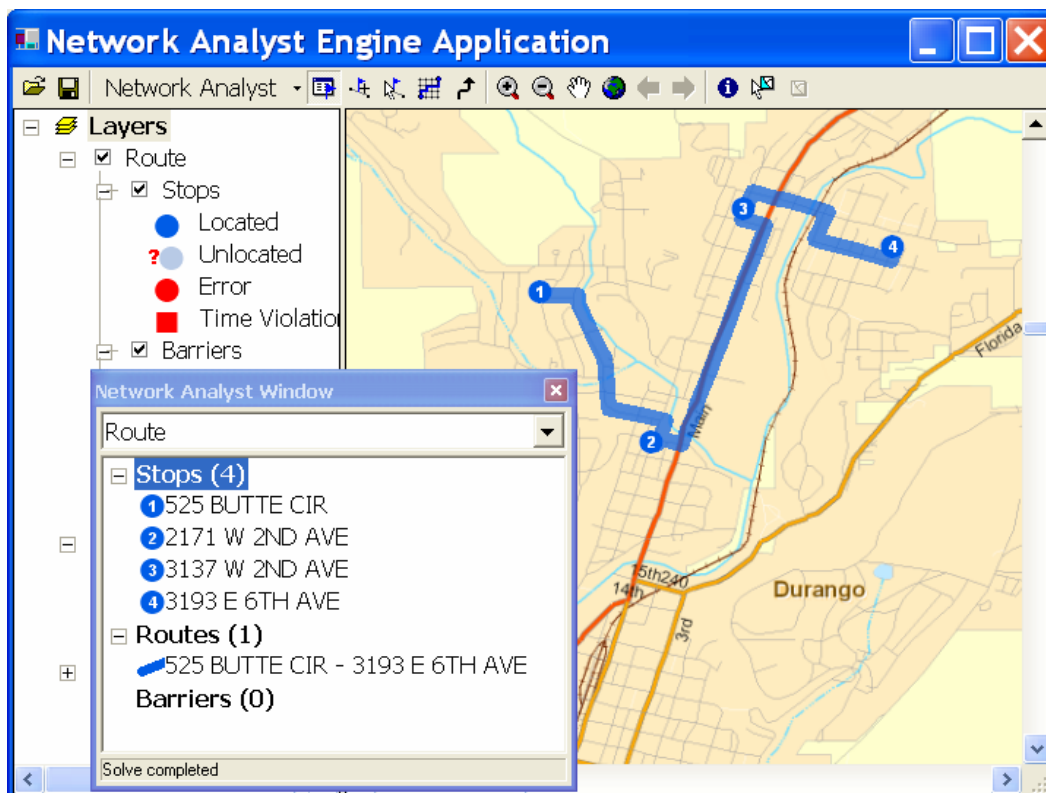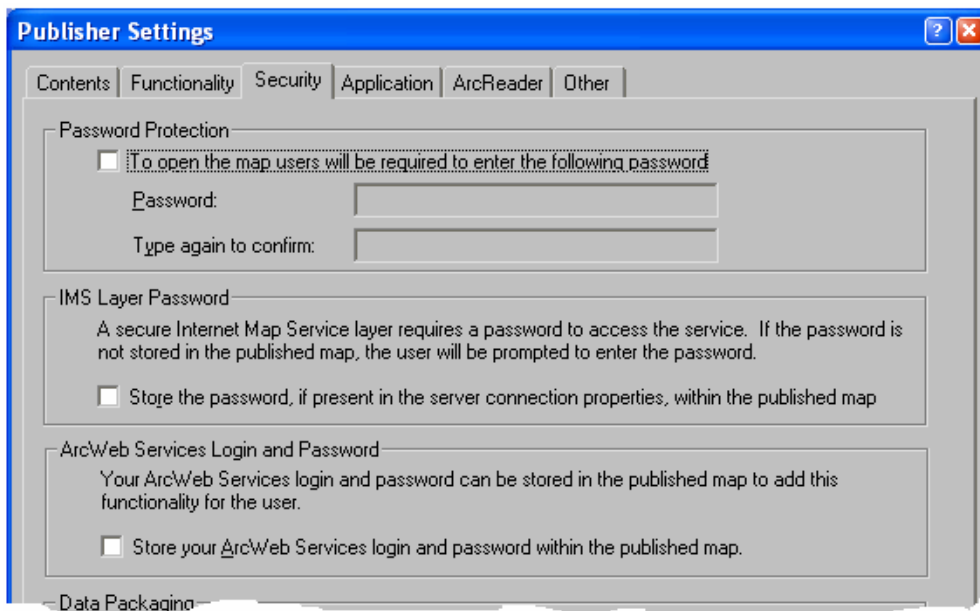
Publisher and ArcReader

Publisher

■ The data packager supports packaging data into a file geodatabase. This fixes several issues with the data packager because the capacity of file geodatabases is greater than that of personal geodatabases. Compression has been changed to use the file geodatabase compression that is part of 9.2.

■ When a map is published, you can now specify a title for the map using a new command called Publisher Map Title you can find in the Publisher pulldown menu in the Publisher toolbar. This title can be modified in ArcReader by the end-user of the published map. The ArcReader user will only be able to modify the Publisher map title if the Publisher has enabled that functionality. Additionally, the ArcReader user can only change the text of the publisher map title, all the other settings such as placement, text size, and font, are determined by the publisher of the map.

■ Specific PMFs can now be customized because template settings are embedded. Currently you have to create a customized ArcReader template file (.art) and then load that file into the embedded settings dialog, but in the future you will be able to edit the settings directly from the embedded settings dialog.

■ The Maplex extension is now supported by the ArcGIS Publisher extension. Maps containing layers with Maplex labeling properties can now be published via the Publisher extension and viewed using ArcReader.

■ If the map or globe document you are publishing contains layers based on ArcWeb Services, a new setting in the Publisher > Settings dialog lets you control whether users of the resulting PMF will require their own ArcWeb Services login, or will use the username and password stored with the layer in the document:


This check box is only enabled if you are currently signed in to ArcWeb Services via the Tools > Online Services > Sign In To ArcWeb Services command at the time you publish your document

ArcReader

■ New full-screen mode button. You can use this button or press **F11** to maximize the viewing area. Full screen mode eliminates the application title bar, the table of contents, and the Windows taskbar, if applicable.

Full Screen Mode button
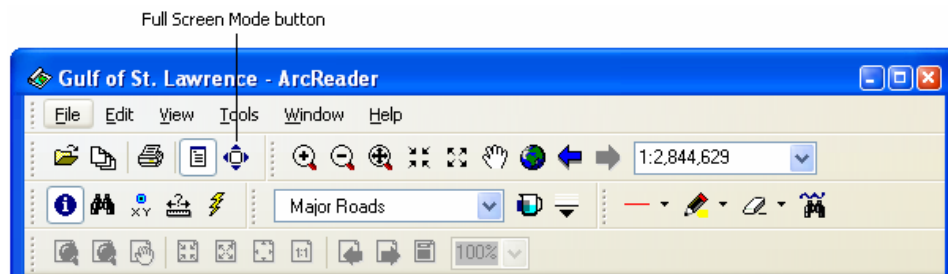
■ Additional 3D navigational tools. The new tools are Look Around, Fixed Line of Sight, and Return To North.

New 3D navigation tools
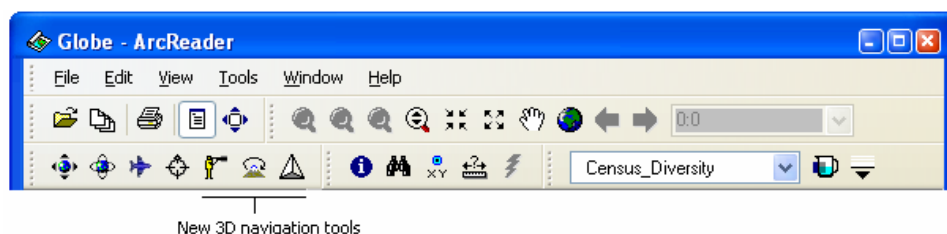
In addition to new tools, others have been revamped to provide additional functionality – such as the zoom/pan to tool. These new tools provide the ability to set the observer at a specific location, and rotate the rest of the scene/globe around them, or rotate them to have a 360 degree view of the area.

■ You can now edit the map title shown on the page layout prior to printing a map (if the publisher has enabled this).

■ New Go To XY command. (Same one that has been added to ArcMap at 9.2). ArcReader users can now navigate to coordinate locations they type in.

■ Improved Measure tool. (Same one that has been added to ArcMap at 9.2). Allows for 1-button click to measure features, areas, snap to features while measuring, and keep a sum of all measurements taken. Measurement units can now be changed through this new dialog. Additionally, the measurements remain in the small dialog and can be copied out to a text file.

■ The same improvements to ArcMap's Find dialog have been made in ArcReader too. This includes the ability to find addresses in the USA, Canada and more than 15 European countries using new web services that are built into the dialog. All you need to use these is an internet connection. This is the first time that ArcReader has supported the ability to find addresses. ArcReader users can navigate to addresses they find, annotate their map with them, and add them into the new Tools > My Places dialog for future access. In addition the ArcWeb Place Finder tab in the Find dialog has been renamed to be just the Places tab and it uses a new place finding service with improved performance.

■ The same new ⬦ Find Route dialog that has been added into ArcMap has also been added into ArcReader, enabling all ArcReader users to perform routing and generate driving directions out-of-the-box for the US, Canada and Western Europe. In ArcReader, look for the new Tools > Online Services > Find Route command. ► *See the 'Geocoding and routing' chapter in this document.*

■ Markup functionality has been added to ArcReader so that you can work with PMF-based maps in the field make notes and annotation. This includes pen, highlighter and eraser tool, all of varying widths, to use for markup. The markup gets saved automatically upon closing the PMF file to a .pmfink file in the same directory as the map.

■ ArcReader now supports the following map navigation shortcuts when working on a published map:

Roll wheel forward   = **Zoom out**
Roll wheel forward + CTRL   = Zoom out at finer increment

Hold down wheel & drag mouse   = **Pan**
Hold down wheel & drag mouse + CTRL = Zoom in on area you define

Click mouse wheel   = **Center**
Click mouse wheel + CTRL   = Center & zoom in

Roll wheel back   = **Zoom in**
Roll wheel back + CTRL   = Zoom in at finer increment

Note: Due to a technical issue, in ArcReader you have to right-click the map before you can roll the mouse wheel to zoom in or out.

■ All toolbars in ArcReader are now on by default.

■ The Transparency command has been removed from the right-click menu for layers in the TOC and moved into a new Layer Effects toolbar.

■ The scale control in ArcReader supports the same enhancements to how scale is input that have been added into ArcMap's scale control at 9.2. You can now type or paste in scale values using almost any format, including relative formats (such as "1 mile = 2.5 inches"). When you specify a scale in a relative format, it is automatically converted to absolute format (such as 1:25,344). A variety of formatting is supported to make it easy to copy and paste scales into the scale control without modification. ► *See the 'ArcMap' chapter of this document for more information.*

■ ESRI ArcWeb Services are now supported inside ArcReader. If you are an ArcWeb Services subscriber, you sign into ArcWeb Services from the new Online Services pullright in the Tools pulldown menu. Once you are signed in, you'll see additional premium services in the Find dialog Places tab, the Find dialog Addresses tab, the new Tools > Online Services > Find Route dialog and the new Tools > Online Services > Find Nearby Places dialog. This matches the way that ArcWeb Services are exposed in ArcMap and ArcGlobe at 9.2. If you open a PMF containing layers referencing ArcWeb Services, you'll be prompted to enter your ArcWeb Services user name and password in order to access these services, unless the publisher of the PMF chose to include their own ArcWeb Services user name and password in the document at the time they published it. ► *See the 'Data & services from ESRI' chapter in this document.*

Schematics

Builder

■ Schematics 9.2 provides a new schematic builder named Network Dataset Builder that works with network datasets provided by the Network Analyst extension. The builder allows the generation of schematic diagrams from any network layer containing a network analysis result such as a route, a service area or a closest facility.

Rules

■ At ArcGIS Schematics 9.1, a set of predefined rules were provided and were used to simplify or add new elements (for example, containers) during the generation process of your schematic diagrams. In 9.2, the Node Reduction By Priority and the Node Reduction By Flow rules are enhanced to filter elements based on a specified SQL filter from the schematic element class to be reduced. This rule allows for a node reduction by feature attribute. The new version of the Node Reduction By Priority can also be based on an extended criteria that determines which nodes will be reduced or not. This extended criteria is implemented by a custom component.

■ ArcGIS Schematics 9.2 provides two new rules: Spatial Query rule and Route Node Reduction rule.

The new **Spatial Query rule** allows the addition of new schematic elements of one or more schematic element types. Behind the scene, this rule is using the Selection by Location query and is based on the spatial positioning of elements relative to another schematic element type.

The new **Route Node Reduction rule** has been specifically developed to reduce nodes contained in schematic diagrams generated from a network layer containing a resulting route. The rule can be applied on any type of schematic diagram. It works with degree two nodes (a node with only 2 connected links) along a route and allows you to generate schematic diagrams after all nodes or some particular nodes related to a given schematic element type have been removed along the route while preserving the topology.

Schematic Layout Algorithms

■ The new Reduce Vertices schematic layout algorithm is now available. It removes vertices displayed along schematic links according to the angle that separates the segments incident to the vertices and the length of the segments that compose the links regarding to the longest segment. If neither the condition based on the segments length nor that based on the angle formed by the incident segments is verified, vertices are kept.

■ Until now, if you wanted to pre-define the parameter values to be used for the schematic layout algorithms, you needed to implement a custom component that set these parameter values and initialize that component when the schematic project opens. With Schematics 9.2, schematic layout algorithm property values can be set per diagram type. You can decide which schematic algorithms will be available, set the default parameter values and decide whether or not to lock the user's ability to change the algorithms' parameters. You can also reorder the list of the schematic layout algorithms in the Layout Task dropdown list per diagram type.

All these specifications can be done within Schematics Designer from the new Layout Task tab that is now available when a diagram type entry is selected in the Designer tree.

■ When a schematic layout algorithm property page is editable for a diagram type, even if default parameter values are specified in the Schematics Designer application, users can override the default parameter values in a map document (MXD) that contains diagrams of this type. The new parameter values for the schematic layout algorithm are saved within the MXD.

Working with schematics in ArcMap

■ In 9.2 Service Pack 2, the viewer windows introduced in 9.2 have been enhanced so that you can use them to work with the contents of inactive data frames side-by-side on-screen with the active data frame shown in the main ArcMap window. This enables you to work with a schematic side-by-side with the geography it represents without having to work in Layout view. In the example below, two schematics have been created to represent the features in the data frame called Geography shown in the main ArcMap window. Each schematic is in its own separate data frame displayed inside a viewer window:
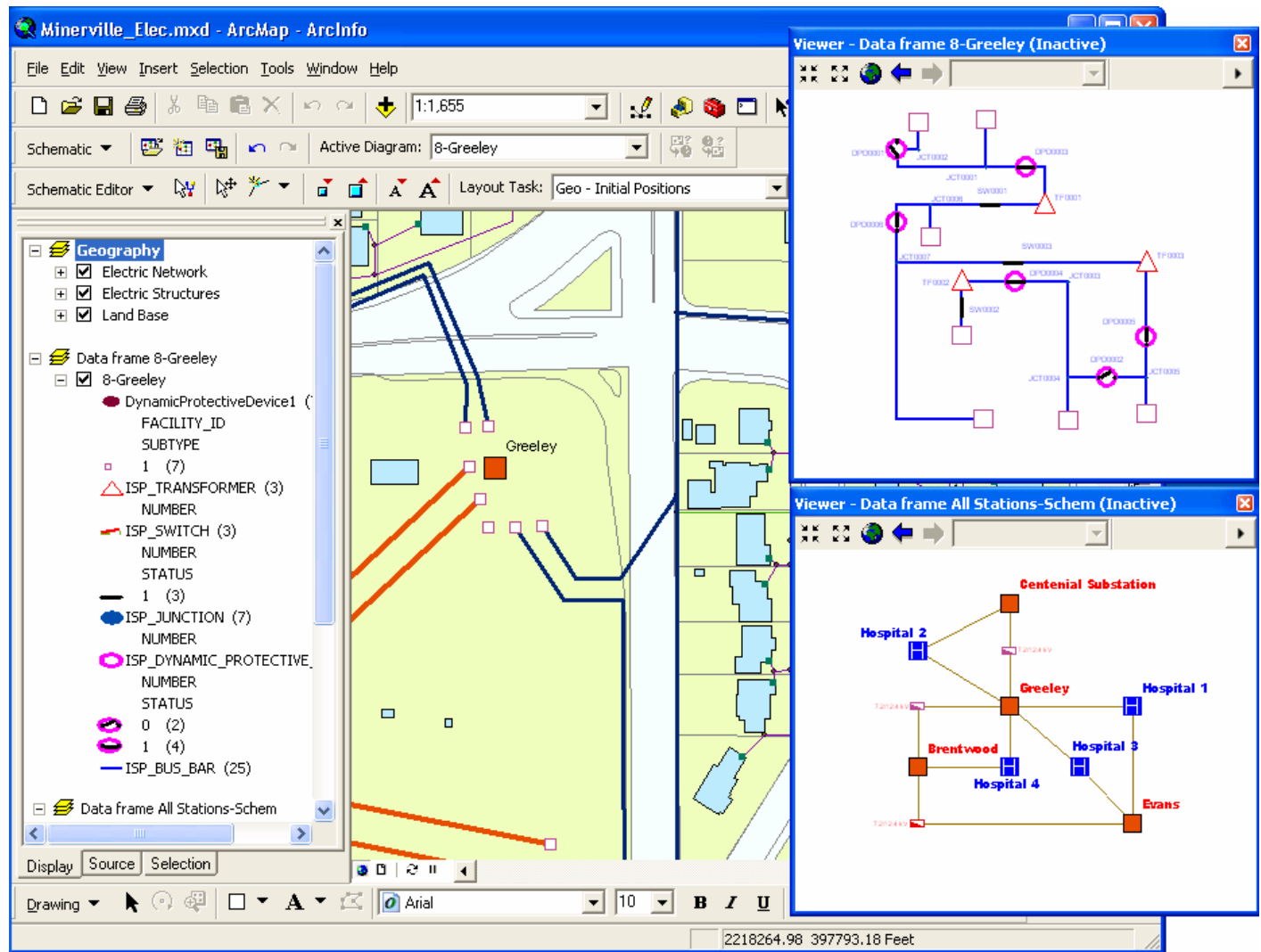
The Schematics commands and tools have been updated in Service Pack 2 so that you can use them to perform operations on schematics displayed inside inactive data frames in viewer windows.

To work with geography and a schematic side-by-side, first activate the data frame containing the data you want to see in a viewer window. Now choose the Viewer command from the Window pulldown menu to open a viewer window. Finally, activate the data frame you want to work with in the main ArcMap window. The viewer window you opened will remain on-screen, allowing you to work with both data frames. (► *See the 'ArcMap' chapter in this document for more).*

Tip: There are two shortcuts that make it easy to work with multiple data frames:

CTRL + TAB switches between the data frames making each one active in turn. (If you want to be able to do the same thing by pressing a button on-screen, add the Activate Next Data Frame command into any toolbar from the View category in the Tools > Customize dialog).

ALT + click on the name of a data frame in the Table Of Contents activates that data frame.

■ A new command called Mark Crossing is available in ArcMap from the Schematic Editor pulldown menu. Clicking this menu lets you turn on or off the display of crossing marks where two schematic links cross each other. When turning on the crossing marks display, an algorithm detects the horizontal and vertical links that cross each other at a right angle in the active schematic diagram. The algorithm then marks the detected intersections with a bridge symbol placed on the horizontal links.

■ A new command called Copy Layout is available in ArcMap that enables you to copy the layout of one diagram to another diagram. To use the command, in the Schematic toolbar, first set the Active Diagram to the target diagram. Then in the Table Of Contents, right-click the source diagram layer and choose Copy Layout from the context menu. This will copy the layout of the elements and labels from the source to the target.

■ A new command called 🔍 Zoom To Make Visible has been added to the context menu you get if you right-click a schematic layer in ArcMap. The command is enabled if the layer has a scale visibility range and is currently not being drawn because of the map's scale. Choosing the command zooms the map in or out to a scale at which the layer will become visible. ArcMap chooses the nearest scale to the map's current scale at which the layer will become visible. (This same command has been added for most layer types at 9.2).

Working with schematics in ArcCatalog

■ Right-clicking a schematic dataset from the Catalog tree displays the Export menu. Selecting To Geodatabase allows you to export the selected schematic dataset to another geodatabase. You can choose to export only the schematic project definition or to also include the schematic diagrams contained in the input schematic dataset.

■ Schematic diagrams can also be exported to shapefiles or to features classes in a geodatabase. This operation can easily be done from the ArcCatalog tree by right-clicking the schematic diagram you want to export, selecting the Export function, then select To Shapefiles for exporting it to shapefiles or To Geodatabase for exporting it to a geodatabase.

Schematics Designer

■ At 9.2 there is a new Diagram Type Assistant that guides you in creating new diagram types.

■ Forgetting to associate a newly created element type with a diagram type, forgetting to specify the origin and extremity node for a link element type are very common oversights while you are customizing your schematic project parameters. Schematics Designer 9.2 integrates a process that checks your parameters when you save the schematic project. A dialog containing a list of warnings ordered by critical levels opens and invites you to check and modify the parameters specified.

■ Schematic layout algorithm parameters management impacts Schematics Designer GUI: the new Layout Task tab is now available when a diagram type is selected in the Designer tree. This tab lets you specify the parameters and the algorithm availability for each diagram type.

Schematics Dataset

■ With Schematics 9.1, schematic datasets only resided in a Geodatabase (SDE or Personal). Schematic datasets can now be created and stored in a File Geodatabase.

Schematics Engine

■ The Schematics 9.1 extension only existed in its full version. With ArcGIS 9.2, you can limit the install to Schematics Engine which is the Schematics core without the Schematics UI part. This will allow developers to use Schematics as a part of their ArcGIS Engine applications.
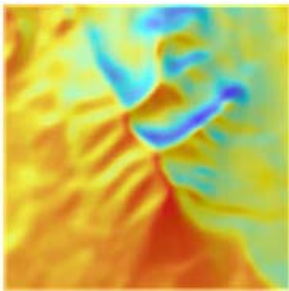
Spatial Analyst

New geoprocessing tools for spatial analysis

■ New Solar Radiation geoprocessing toolset containing these tools:

🔨 Spatial Analyst Tools > Solar Radiation > **Area Solar Radiation**

🔨 Spatial Analyst Tools > Solar Radiation > **Points Solar Radiation**

🔨 Spatial Analyst Tools > Solar Radiation > **Solar Radiation Graphics**

These tools let you calculate direct, diffuse, and global solar radiation at point locations or across a landscape. The basic inputs are a DEM and the time configuration, such as a start and end time/date, and interval for calculation such as hourly, daily or weekly.

The graphic below displays the output from the Area Solar Radiation tool showing the amount of incoming global radiation (direct+diffuse, WH/m2) for a given time period (red are high values, blue are low).

■ New math geoprocessing tools:

🔨 Spatial Analyst Tools > Math > **Diff**

Compares two rasters on a cell by cell basis, returning a value of 0 where they are the same, and the value of the first input when they are not.

🔨 Spatial Analyst Tools > Math > **InList**

Determines on a cell by cell basis which values from the first input are contained in a list of other inputs.

🔨 Spatial Analyst Tools > Math > **Over**

Compares two rasters on a cell by cell basis, returning the value of the first input where it is non-zero, and the value of the second input where it is zero

■ New overlay geoprocessing tool:

🔨 Spatial Analyst Tools > Overlay > **Weighted Sum**

Overlays several rasters multiplying each by their given weight and summing them together. The inputs to Weighted Sum can be floating point, in contrast to the existing Weighted Overlay tool, which only works with integer values.

Improvements to existing tools

■ These existing geoprocessing tools have been improved:

🔨 Spatial Analyst Tools > Zonal > **Tabulate Area**

This tool now supports feature class data as inputs for zone and class data. It also fully supports the use of string fields for the zone and class data.

🔨 Spatial Analyst Tools > Local > **Combine**

The way that this tool creates output field names has been enhanced. In some cases, temporary rasters needed to be created and these names were carried over such as "Z_Z_Zc41, Z_Z_Zc42...". The output now reflects the names of the input rasters used and handles cases of different raster formats and duplicate names.

■ The Histogram tool 📊 in the Spatial Analyst toolbar now uses the new graphing functionality added at 9.2. Histograms created with this tool will now match the colors being used to display the layer. ▶ *See the separate section on graphing in this document.*
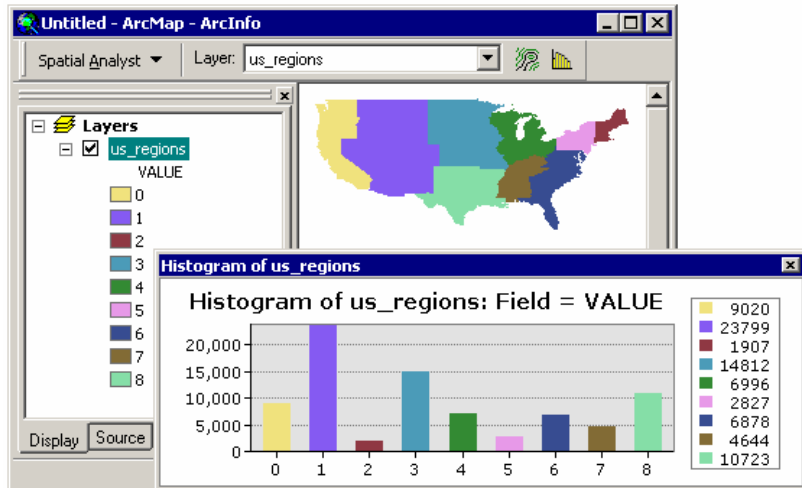
Serve your Spatial Analyst geoprocessing models to the web with ArcGIS Server

■ You can now publish your spatial analysis workflows and models over the web as geoprocessing services that can be accessed by users in web mapping applications, ArcGIS Explorer, and ArcGIS Desktop. This provides you with a completely new way to deliver spatial analysis functionality both inside and beyond your organization. You'll need ArcGIS Server Advanced edition and the Spatial Analyst extension on your server. ▶ *See the 'ArcGIS Server' and 'Geoprocessing' chapters of this document.*

Other 9.2 enhancements of particular interest to Spatial Analyst extension users

■ Full support for ESRI GRID Value Attribute Tables (VATs) and new Raster Attribute Tables (RATs) supported for all single band integer raster datasets. ▶ *See the 'Rasters' chapter of this document.*

■ Three new vector to raster conversion tools have been added at 9.2 to give you more control over how values are assigned to cells in the output raster when there is more than one vector feature falling into the cell. ▶ *See the 'Geoprocessing' chapter of this document.*

■ Two random data generation tools have been added for use in sensitivity analysis and simulation. ▶ *See the 'Geoprocessing' chapter of this document.*

■ ModelBuilder now supports list and series processing, iteration (looping) and batch processing. ▶ *See the 'Geoprocessing' chapter of this document.*

Tracking Analyst

■ Improved performance for very large historical datasets.

■ A new Tracking Analyst Tools toolbox is available containing the following tools.
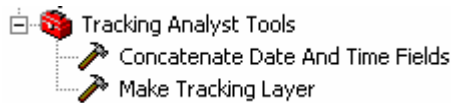

You can add this toolbox into ArcToolbox from the System Tools folder. The first tool allows you to work with temporal data where the date and time is stored in separate fields. The second one allows you to create tracking layers, so that this process can be integrated into scripts, models, and batch processes.

■ New Settings command in Tracking Analyst pulldown menu launches a Global Settings dialog.

■ New Step Through Tracks tool in the Tracking Analyst toolbar allow you to step forwards or backwards through a series of events in a track displaying information for each event:

You can also display up to six attributes for an event graphically on the map. As you step through events the information on the map will change based on the event selected:
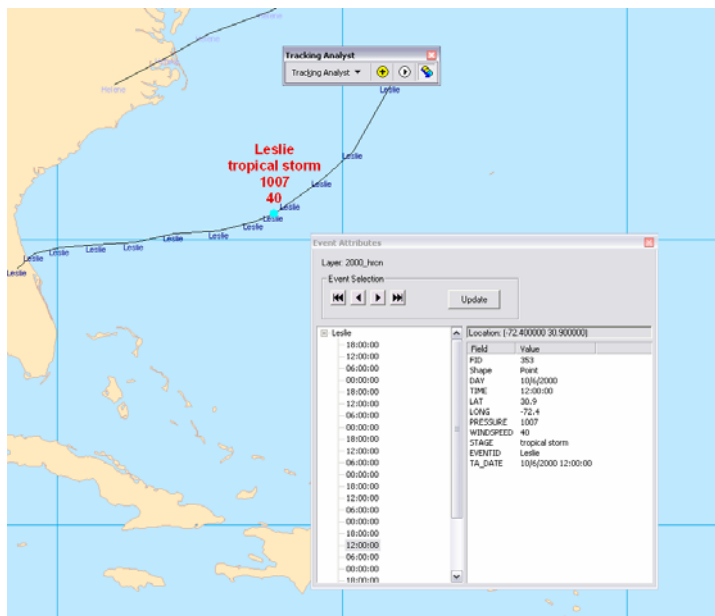
■ Adds the ability to use tables when building custom actions

■ Events can now be labeled:
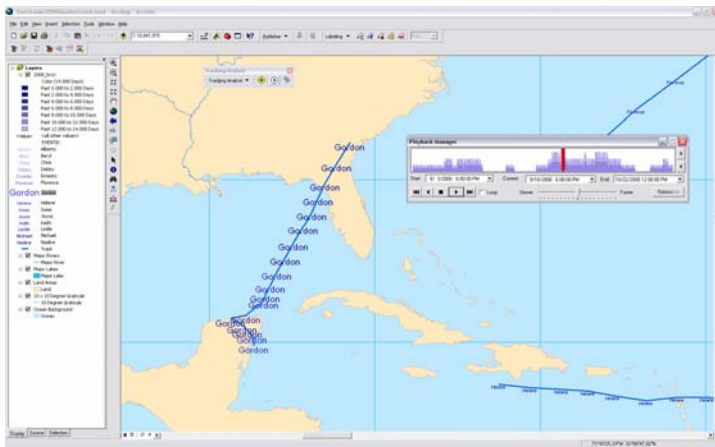
■ The most current event for a track can have unique symbology so that it stands out from the rest of the events:
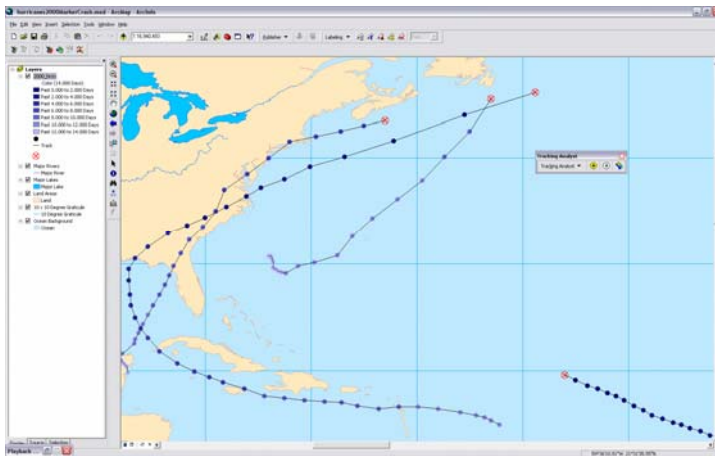
■ Tracking Analyst now supports directional vectors. Based on the current speed and heading you can display an arrow showing the projected direction and time the next event may occur:
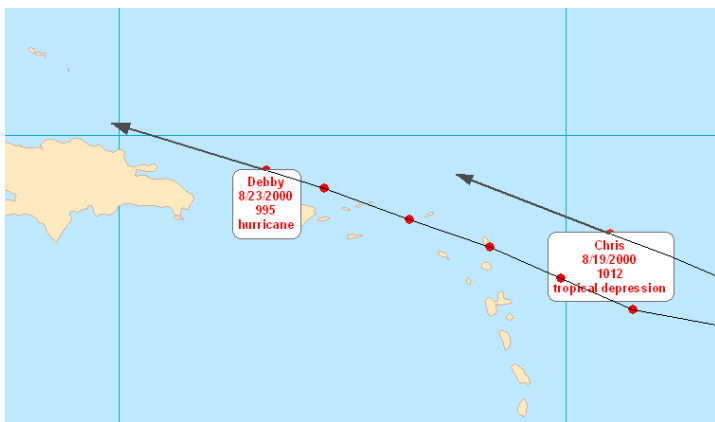
■ Smooth tracks – New line algorithm can be used to smooth the track path eliminating spikes at sharp turns:
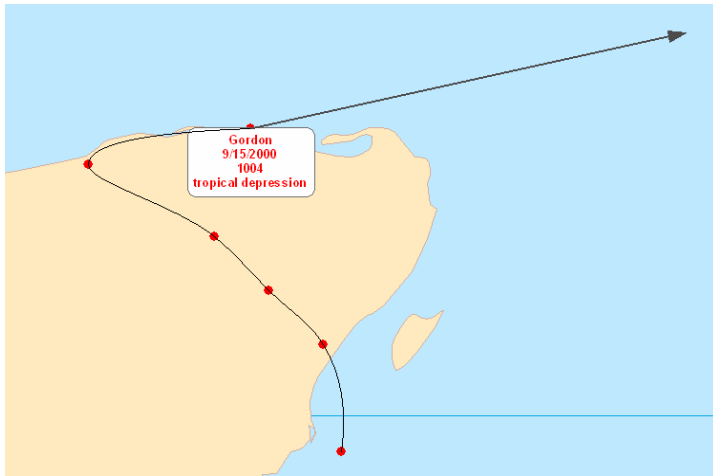
■ Now supports local GPS connection.

■ You can copy events to the clipboard to be pasted into other applications. Choose from three formats: text, XML and GML.

■ The ArcObjects interface has been improved to allow developers to build real-time connections (outside of Tracking Server).

■ The extension now supports ArcGIS Engine providing new ways to deploy tracking layers.

Summary of map navigation shortcuts in ArcMap

Panning	
Click mouse wheel:	Center map at location you clicked
Hold down mouse wheel:	Pan map
Hold down C	Temporarily switch to Pan tool. Single click centers. Drag pans
Home / Page Up / End / Page Down	Page map left / right / up / down
↑ ← ↓ →	Scroll map left / right / up / down
Single-click with any pan tool:	Center map at location you clicked

| Zooming	
Roll mouse wheel:	Zoom in / out. Direction can be customized in Tools>Options dialog.
CTRL + roll mouse wheel:	Zoom in / out at finer rate
CTRL + click mouse wheel:	Center map and zoom in at location you clicked
CTRL + drag mouse wheel:	Zoom in on box you define
Hold down Z *or* X	Temporarily switch to Zoom In or Zoom Out tool
Hold down B	Temporarily switch to Continuous Zoom / Pan tool. Drag up / down with left mouse button to zoom in / out. Right mouse button pans
- / +	Zoom out / in

Other	
Right-click map in Data View:	Access new context menu of shortcuts to commands
Hold down SHIFT while in Layout view:	Apply map navigation with mouse wheel, Z X C B keys, or Continuous Zoom/Pan tool to data frame instead of layout page
Esc	Put keyboard focus onto map from Table Of Contents
F3	Put keyboard focus onto Table Of Contents from map
F5	Refresh map
F6	Toggle between Zoom In, Zoom Out, & Pan tools when one is active
F9	Toggle Pause Drawing mode
F11	Activate selected data frame in Table Of Contents
Insert	Full extent
< / >	Previous extent / next extent
CTRL + TAB:	Switches between data frames when there is more than one
CTRL + click check box next to layer in Table Of Contents:	Turn all layers on and off. CTRL + SPACE does the same when layer is selected in Table Of Contents
ALT + click data frame in TOC:	Activate this data frame
ALT + click layer in TOC:	Zoom to this layer's extent

Summary of tables shortcuts

Opening and closing tables

CTRL + double-click layer or table	Open table window for the layer or table you clicked in Table Of Contents.
CTRL + **T** or **CTRL** + **ENTER**	Open table window for currently selected layer/table(s) in Table Of Contents.
CTRL + **T** in table window	Minimizes the window.
CTRL + **SHIFT** + **T**	Toggle all tables between displayed and minimized state (show/hide all)
CTRL + **SHIFT** + **TAB**	Toggles between the tables you currently have open.
CTRL + **SHIFT** + **F4**	Close all currently open tables.

Working with fields

Right-click field name	Get context menu of field commands.
Choose Properties in context menu	See field's data type and specify alias and numeric format.
Double-click field name	Sort on this field.
CTRL + Double-click field name	Turn field off. Same as unchecking it in the Layer Properties Fields tab.
CTRL + **SHIFT** + Double-click	Hide this field (same as dragging its column so it has no width).
Double-click column divider	Reveals hidden field if the divider is next to a hidden field.

Navigating around a map from a table

Right-click grey cell	Get context menu of navigation and other commands.
Double-click grey cell	Zoom to this feature and select it exclusively.
CTRL + Double-click grey cell	Pan to this feature and select it exclusively.
CTRL + **8**	Flash current feature.
CTRL + **=**	Zoom to current feature.
CTRL + **P**	Pan to current feature.
CTRL + **I**	Identify the current record.
CTRL + **SHIFT** + **=**	Zoom to selected features.

Navigating around inside a table

← →	Go left or right. Wrap back to start of same record at end of row.
↓ or **ENTER**	Go to the cell below.
↑ or **SHIFT** + **ENTER**	Go to the cell above.
HOME or **END**	Go to the first or last cell in the current row
CTRL + ← or →	Go to the first or last cell in the current row.
TAB	Go to the cell to the right. Wraps around to next record below at end of row.
SHIFT + **TAB**	Go to the cell to the left. Wraps around to next record above at start of row.
CTRL + ↑ or ↓	Go to the first or last cell in the current column.
CTRL + **HOME** or **END**	Go to first cell in first row or last row in last row.
CTRL + **F**	Launch Find dialog.
CTRL + **G**	Go to a record number.
Application key 📑	Open the row context menu.
CTRL + **Application key** 📑	Open the Options menu.
Right-click bottom part of table	Open the Options menu.

Copying data from a table

CTRL + **C** or **CTRL** + **INSERT**	Copy the value in the current cell to clipboard.
CTRL + **SHIFT** + **C**	Copy selected records to clipboard.

Selecting and unselecting records

CTRL + click on a record	Add it to the selected set (or remove it if it is already selected).
SHIFT + click on a record	Extend the selection from currently selected record(s) to the record you click.
SHIFT + **SPACEBAR** or ⬇ or ⬆	Make block selection.
CTRL + **TAB**	Switch between Show All Records and Show Selected Records mode.
SPACEBAR	Select or unselect the current record (highlights or unhighlights if in Show Selected Records Mode). In editing mode shortcut is **CTRL** + **SPACEBAR**.
BACKSPACE	Remove the current record from the selection in Show All or Show Selected Records Mode. Not available if you are editing the table.
CTRL + **ENTER**	Go to next record and select it. Unselects the one you began on if it was selected. Lets you work sequentially through a table selecting each record.
SHIFT + **CTRL** + **ENTER**	Go the previous record and select it.
Click top left corner of table	Clear the selected set (highlighted set in Show Selected Records).
SHIFT + click top left corner	Select all records.
CTRL + click top left corner	Switch selection.
CTRL + **BACKSPACE**	Clear the selected set.
CTRL + **A**	Select all records.
CTRL + **SHIFT** + **A**	Clear the selected set.
CTRL + **U**	Switch selection.

Editing the data in a table

CTRL + **SHIFT** + **E**	Start or stop editing .
F2	Edit contents of current cell. Press again to finish editing cell.
ESC	Cancels editing the current cell and restores the original value.
ENTER	Finish editing cell and go down to the next cell below in same field.
TAB	Finish editing cell and go across to next cell to the right in same record. Wraps around to next record below when you get to the end of the row.
CTRL + **ENTER**	Same as ENTER but selects the next record too so you can see it on map.
CTRL + **V** or **SHIFT** + **INSERT**	Paste the contents of the clipboard into the current cell.
CTRL + **Z** and **CTRL** + **Y**	Undo/Redo edits to a record.
DELETE	Delete currently selected record(s).
CTRL + **D**	In Show All Records mode, deletes currently selected records(s). In Show Selected Records mode, deletes the currently highlighted (yellow) records in your selection.
SHIFT + **ENTER**	Inserts a line feed into a text string when you are editing it (for example, to use as stacked text for labeling or annotation).

Some extra Desktop tips

- Click inside the Table Of Contents window or the table window and press **F1** to get a popup help topic listing all the shortcuts available in that window.

- Get context sensitive help on any command in any menu: highlight the command and press **SHIFT + F1**. Get context sensitive help on any toolbar button by clicking on it with the What's This ? tool in the Standard toolbar. Context help will tell you what it does, why it becomes disabled, and what shortcuts are available for it.

- Measure tool (except for globes): Hold down **CTRL** to snap to any part of a line instead of only to vertices when are measuring in 'snap to features mode'. To get geodesic measurements when you measure lines, hold down **SHIFT**.

- Drawing tools in ArcMap's Draw toolbar: To type in coordinates for vertices, press **SHIFT + F6**. Press **E** to type in the last vertex in a rectangle, line or polygon. To type in the radius or area when you use the Circle tool, press **R** or **A**.