

MATLAB® Release Notes

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Summary by Version

This table provides quick access to what's new in each version. For clarification, see "About Release Notes" on page 2.

Version (Release)	New Features and Changes	Version Compatibility Considerations	Fixed Bugs and Known Problems	Related Documentation at Web Site
Latest Version V7.5 (R2007b)	Yes Details	Yes Summary	Bug Reports Includes fixes	Printable Release Notes: PDF Current product documentation
V7.4 (R2007a)	Yes Details	Yes Summary	Bug Reports Includes fixes	No
V7.3 (R2006b)	Yes Details	Yes Summary	Bug Reports Includes fixes	No
V7.2 (R2006a)	Yes Details	Yes Summary	Bug Reports Includes fixes	No
V7.1 (R14SP3)	Yes Details	Yes Summary	Bug Reports Includes fixes	No
V7.0.4 (R14SP2)	Yes Details	Yes Summary	Bug Reports Includes fixes	No
V7.0.1 (R14SP1)	Yes Details	Yes Summary	Fixed bugs	No
V7 (R14)	Yes Details	Yes Summary	Fixed bugs	No

About Release Notes

Use release notes when upgrading to a newer version to learn about new features and changes, and the potential impact on your existing files and practices. Release notes are also beneficial if you use or support multiple versions.

If you are not upgrading from the most recent previous version, review release notes for all interim versions, not just for the version you are installing. For example, when upgrading from V1.0 to V1.2, review the New Features and Changes, Version Compatibility Considerations, and Bug Reports for V1.1 and V1.2.

New Features and Changes

These include

- New functionality
- Changes to existing functionality
- Changes to system requirements (complete system requirements for the current version are at the MathWorks Web site)
- Any version compatibility considerations associated with each new feature or change

Version Compatibility Considerations

When a new feature or change introduces a reported incompatibility between versions, its description includes a **Compatibility Considerations** subsection that details the impact. For a list of all new features and changes that have reported compatibility impact, see Chapter 9, “Compatibility Summary for MATLAB”.

Compatibility issues that are reported after the product has been released are added to Bug Reports at the MathWorks Web site. Because bug fixes can sometimes result in incompatibilities, also review fixed bugs in Bug Reports for any compatibility impact.

Fixed Bugs and Known Problems

MathWorks Bug Reports is a user-searchable database of known problems, workarounds, and fixes. The MathWorks updates the Bug Reports database as new problems and resolutions become known, so check it as needed for the latest information.

Access Bug Reports at the MathWorks Web site using your MathWorks Account. If you are not logged in to your MathWorks Account when you link to Bug Reports, you are prompted to log in or create an account. You then can view bug fixes and known problems for R14SP2 and more recent releases.

The Bug Reports database was introduced for R14SP2 and does not include information for prior releases. You can access a list of bug fixes made in prior versions via the links in the summary table.

Related Documentation at Web Site

Printable Release Notes (PDF)

You can print release notes from the PDF version, located at the MathWorks Web site. The PDF version does not support links to other documents or to the Web site, such as to Bug Reports. Use the browser-based version of release notes for access to all information.

Product Documentation

At the MathWorks Web site, you can access complete product documentation for the current version and some previous versions, as noted in the summary table.

Version 7.5 (R2007b)

MATLAB

This table summarizes what's new in Version 7.5 (R2007b):

New Features and Changes	Version Compatibility Considerations	Fixed Bugs and Known Problems	Related Documentation at Web Site
Yes Details below	Yes — Details labeled as Compatibility Considerations in descriptions of new features and changes. See also Summary.	Bug Reports Includes fixes	Printable Release Notes: PDF Current product documentation

New features and changes introduced in this version are organized by these areas:

- “Desktop Tools and Development Environment, MATLAB Version 7.5 (R2007b)” on page 7
- “Mathematics, MATLAB Version 7.5 (R2007b)” on page 27
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- “Creating Graphical User Interfaces (GUIs), MATLAB Version 7.5 (R2007b)” on page 46
- “External Interfaces/API, MATLAB Version 7.5 (R2007b)” on page 50

Desktop Tools and Development Environment, MATLAB Version 7.5 (R2007b)

New features and changes introduced in this version are organized by these topics:

- “Startup and Shutdown” on page 7
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Startup and Shutdown

Windows Startup Changes

You can now change the startup directory for MATLAB on Windows platforms using the standard shortcut **Start in** field. The My Documents\MATLAB subfolder (or Documents\MATLAB on Vista) is the default startup directory. Upon startup, MATLAB automatically creates a My Documents\MATLAB subfolder (or Documents\MATLAB on Vista) if it does not exist, and adds it to the top of the MATLAB search path. To change the startup directory:

- 1 Right-click the MATLAB shortcut icon and select **Properties** from the context menu. The Properties dialog box for MATLAB opens to the **Shortcut** pane.
- 2 In the **Start in** field, specify the directory in which you want MATLAB to start, for example, C:\My MATLAB Place.

You can specify the directory via a UNC path (that is, the path can begin with \\).

The **Target** field specifies the full path to the file to start MATLAB, `matlab.exe`, located in the bin folder (for example, C:\Program Files\MATLAB\R2007b\bin\matlab.exe). Use the `bin\matlab.exe` to

start MATLAB instead of `matlab.bat` or `matlab.exe` located in a platform directory such as `bin\win32`. The `bin\matlab.exe` detects the Windows platform and ensures required runtime files are installed.

Compatibility Considerations. The **Target** field no longer contains the `-sd $documents` startup option. In MATLAB Version 7.4 (R2007a), the startup directory was specified via the `-sd` startup option in the **Target** field. You had to specify the directory via a mapped drive. Any value in the **Start in** field was ignored.

The file to start MATLAB, as specified in the **Target** field, was `matlab.bat`.

Change any scripts you use to start MATLAB to specify the full path to `bin\matlab.exe`. If you use `matlab.bat` in R2007b, MATLAB issues a warning message instructing you to use `matlab.exe` instead.

If scripts include the `-sd` startup option to specify the startup directory, that will be the startup directory, even if a directory is specified in the **Start in** field.

Desktop

New features and changes introduced in Version 7.5 (R2007b) are:

- “Minimizing Tools in the Desktop Now Supported on Macintosh Platforms” on page 9
- “Double-Click to Maximize or Restore Minimized Tools in Desktop” on page 9
- “New Desktop Layout — All but Command Minimized” on page 9
- “Start Button Now Includes New Category for Links and Targets” on page 10
- “Start Button — View Source Files Renamed” on page 11
- “Changes to Look of Buttons in Desktop and Other Tools” on page 11
- “Antialiasing Option No Longer Necessary on Windows and Mac” on page 11

Minimizing Tools in the Desktop Now Supported on Macintosh Platforms

You can now minimize tools in the desktop on Macintosh platforms. It was introduced for other platforms in a previous version.

Double-Click to Maximize or Restore Minimized Tools in Desktop

After you minimize a tool within the desktop, you can now:

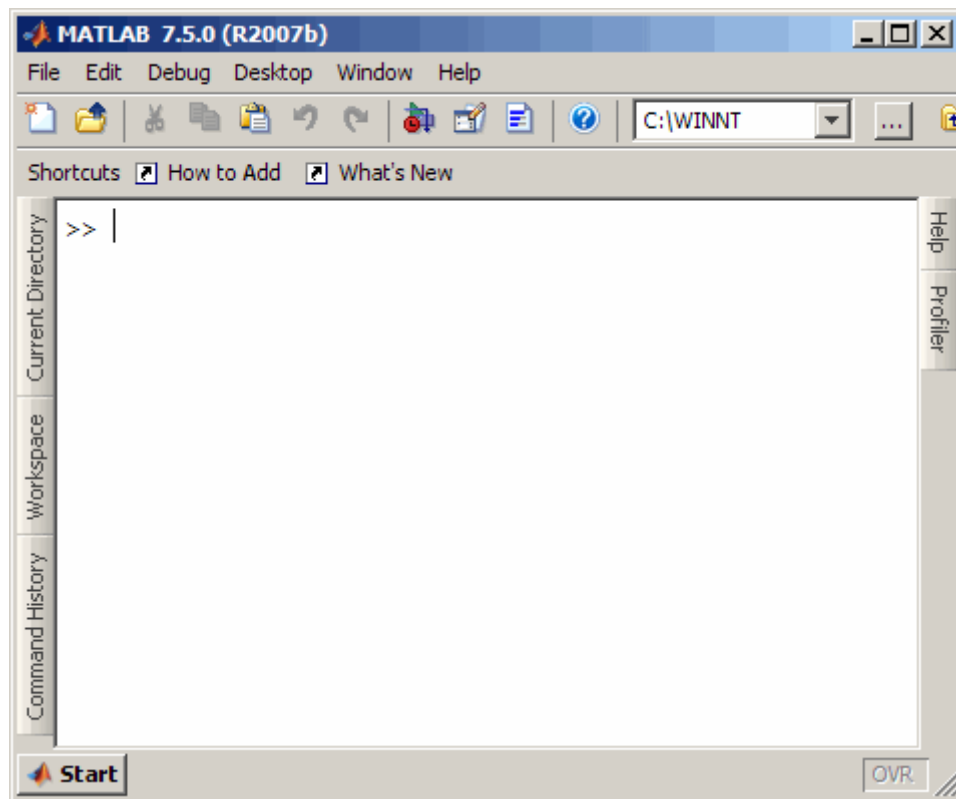
- Restore the tool to its former position by double-clicking the button.
- Drag a button to move its position—drag it to another edge of the desktop or to a new position within the edge where it's currently located.
- Restore the tool by dragging the button to a location within the desktop, or outside the desktop to undock the tool.

Similarly, you can double-click a tool's title bar to maximize the tool in the desktop; then double-click the title bar again to restore it to its former position. (The capability was introduced in R2007a, MATLAB 7.4).

For more information, see “Opening and Arranging Tools” and “Minimized Tools in Desktop Example”.

New Desktop Layout – All but Command Minimized

Select **Desktop > Desktop Layout > All but Command Minimized** to arrange the desktop as shown here. The Command Window is open in the desktop, and all other desktop tools are open, but minimized.



Start Button Now Includes New Category for Links and Targets

In the Start button, there is a new category for Link and Target products. Select **Start > Links and Targets**, and then select one of the products. In previous versions, you accessed these products from the Toolboxes or Simulink® categories.

You also use this new category when running demos, or accessing **Demos** or **Contents** in the Help browser. For more information, see “Demos and Help Browser Contents Now Include New Category for Links and Targets” on page 12.

Start Button – View Source Files Renamed

To add your own toolboxes to the **Start** button, select **Start > Desktop Tools > View Start Button Configuration Files**. In previous versions, this menu item was **View Source Files**. There has been no change in functionality or features.

Changes to Look of Buttons in Desktop and Other Tools

Some icons on toolbar buttons have changed slightly. In addition, standard desktop icon image files are no longer provided in the `matlabroot/toolbox/matlab/icons` directory.

Compatibility Considerations. If your code relied on icon files in the `matlabroot/toolbox/matlab/icons` directory (for example, for adding your entries to the **Start** button or the Help browser), you might need to use other image files.

Antialiasing Option No Longer Necessary on Windows and Mac

MATLAB now follows the operating system's font settings on Windows and Mac. This provides smooth fonts without the need for antialiasing within MATLAB.

Running Functions – Command Window and History

New features and changes introduced in Version 7.5 (R2007b) are:

- “Command History — Find Entry by Letter Now Looks in Collapsed Sessions” on page 11
- “Pop-Up Help for a Function in the Command Window” on page 12

Command History – Find Entry by Letter Now Looks in Collapsed Sessions

When you type letters in the Command History, it finds and selects the next entry that begins with the letters you typed. Now, if the entry is in a session that was collapsed, MATLAB automatically expands the session and selects the matching entry in it. In previous versions, MATLAB did not find matching entries in collapsed sessions.

If you do *not* want to find entries in collapsed sessions (the previous behavior), you can instead select **Edit > Find**, which finds text in the Command History, but not in collapsed sessions. For more information, see “Finding Next Entry By Letter”.

Pop-Up Help for a Function in the Command Window

For more information, see “Help on Selection Enhanced in Command Window and Editor” on page 15.

Help

New features and changes introduced in Version 7.5 (R2007b) are:

- “Minor Visual Changes to Help Browser” on page 12
- “Demos and Help Browser Contents Now Include New Category for Links and Targets” on page 12
- “Help on Selection Enhanced in Command Window and Editor” on page 15

Minor Visual Changes to Help Browser

- To open the Help browser from a tool’s **Help** menu, select **Product Help**. In previous versions you selected **Full Product Family Help**.
- When the Help browser first opens, it displays help for MATLAB. In previous versions, it displayed a Begin Here page. The information previously available on the Begin Here page has been incorporated into the MATLAB roadmap page.
- When you close and reopen the Help browser, it maintains the list of pages you previously viewed, but does not open to the page you last viewed. In previous versions, upon reopening, the Help browser displayed the page you last viewed.


Demos and Help Browser Contents Now Include New Category for Links and Targets


When you run the demo function or access **Demos** or **Contents** in the Help browser, there is a new category for Link and Target products.

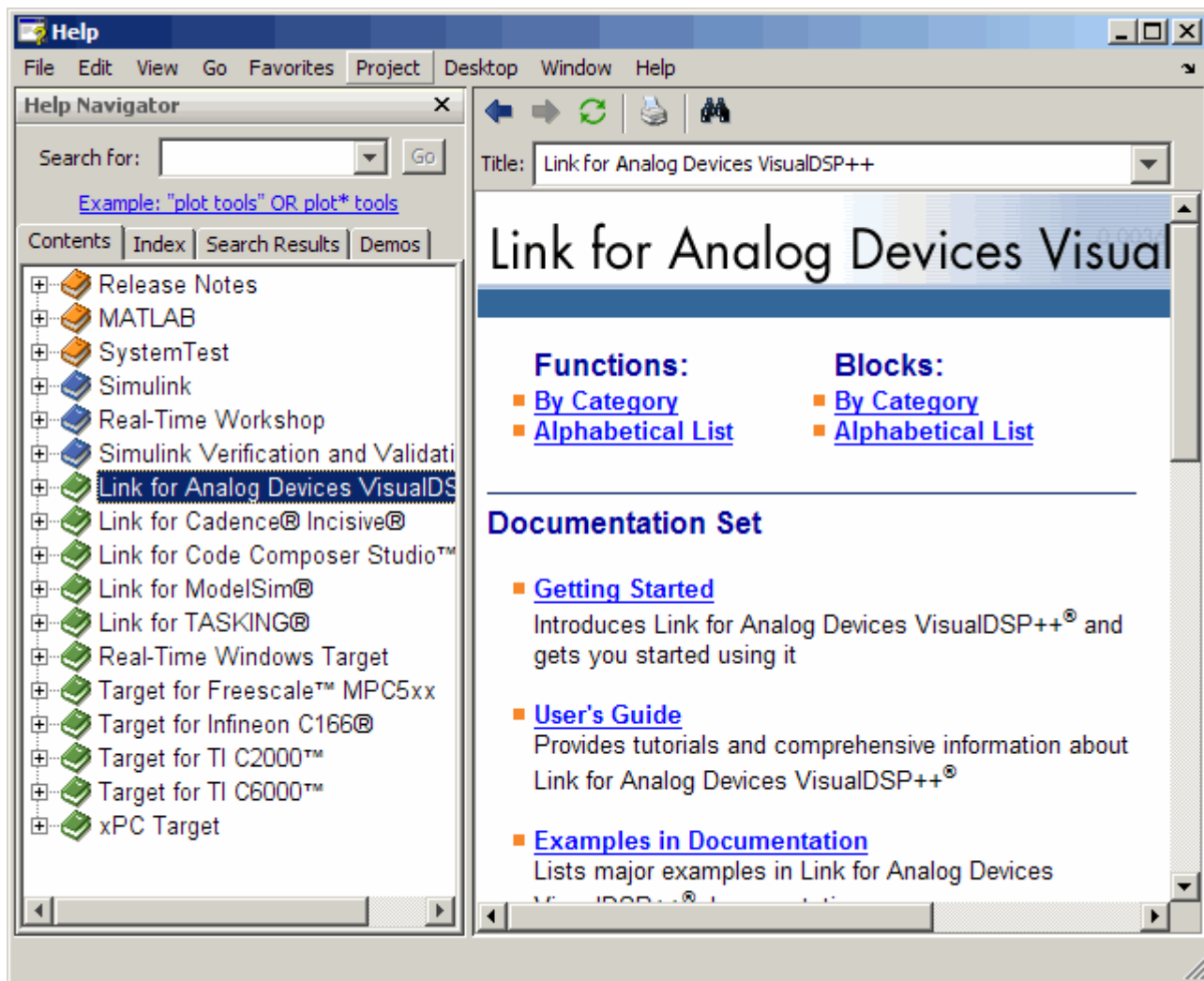
To use the `demo` function to access a demo that is now in the Links and Targets category, you specify the new subtopic 'links and targets', followed by the category. For example

```
demo('links and targets', 'link for modelsim')
```

displays the **Demos** pane, and expands the Link for ModelSim® demos listing.

In the Help **Demos**, Link and Target products appear together in their own category, and are identifiable by the new Links and Targets icon, .

In the Help **Contents**, Link and Target products appear together after any installed Simulink and Blockset products, and are identifiable by the new Links and Targets green book icon, .



This new category is also used in the **Start** button in the MATLAB desktop—for more information, see “Start Button Now Includes New Category for Links and Targets” on page 10.

If you add help or demos to the Help browser for your own toolbox or list your own toolbox in the **Start** button and you want to take advantage of the

new Links and Targets category, use the new type, `links_targets`, in the `info.xml` file for your toolbox.

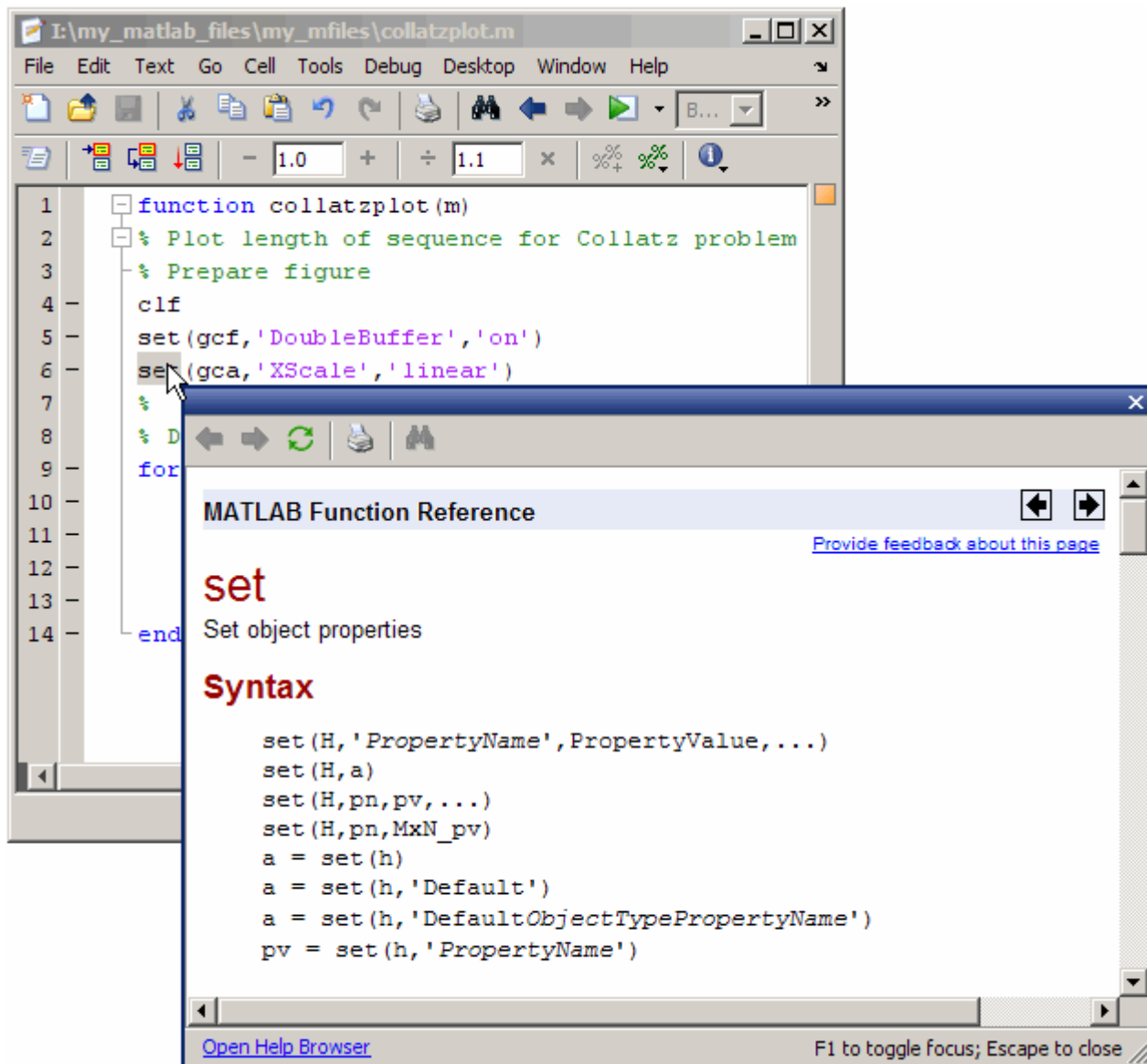
Compatibility Considerations. In previous versions, when you used the `demo` function to access a demo that is now in the Links and Targets category, you specified a different subtopic and category. If you have any code that relies on the `demo` function for accessing Links and Targets demos, you will need to replace the subtopic and category in the code.

In previous versions, you accessed the products in the Help browser **Demos** from the Toolbox or Simulink categories.

In previous versions, you accessed the products in the Help browser **Contents** from within the list of toolbox products (orange book icon) or Simulink products (blue book icon).

Help on Selection Enhanced in Command Window and Editor

To get help for a function in the Command Window or the Editor, click the pointer in the function name and press **F1**. The reference page for that function appears in a small, temporary (pop-up) window. To close the window, press **Escape**. You can also access the feature by choosing **Help on Selection** from the context menu. For details, see “Getting Pop-Up Help for Functions”.



Compatibility Considerations. In the previous version, you could select the function name, right-click, and select **Help on Selection**. The documentation appeared in the Help browser. Now if you want to see the documentation for the function in the Help browser, first access the pop-up help and then click the **Open Help Browser** link.


Editing and Debugging M-Files

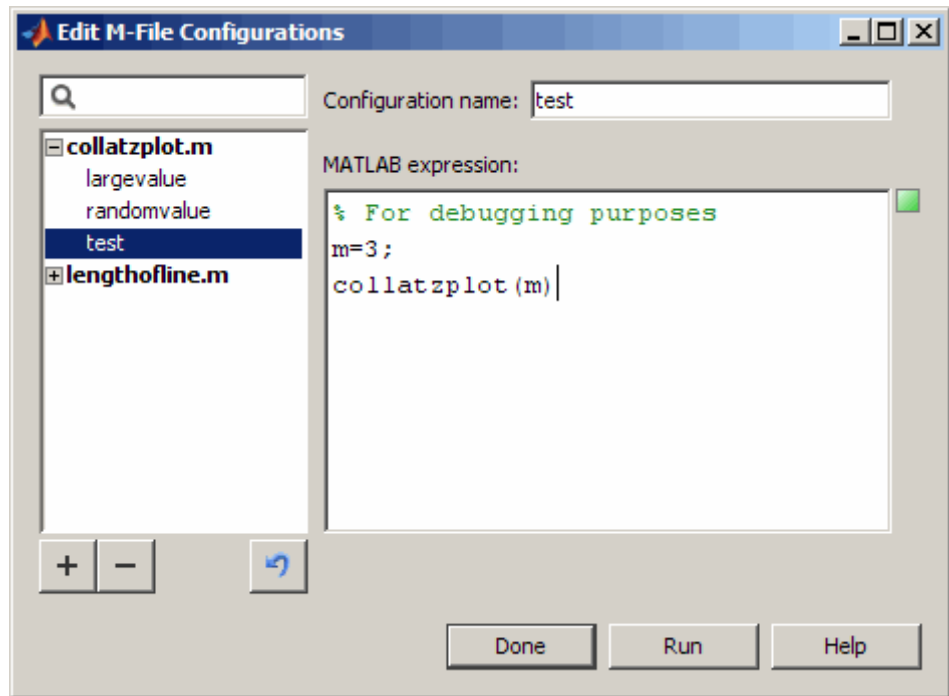
New features and changes introduced in Version 7.5 (R2007b) are:

- “Run Your Function M-Files in the Editor/Debugger Using Configurations” on page 17
- “Run/Continue Button Changes” on page 18
- “Code Folding Feature for Collapsing and Expanding Code” on page 19
- “Pop-Up Help for a Function in the Editor” on page 21
- “Line Endings Removed for Files Provided with MATLAB for Windows; Impacts Viewing in Notepad” on page 21
- “Stand-Alone Editor Will Not Be Included in Next Version” on page 24
- “Determine the McCabe (Cyclomatic) Complexity of an M-File” on page 25

Run Your Function M-Files in the Editor/Debugger Using Configurations

In the Editor/Debugger, you can provide values for a function’s input arguments using a configuration, and then run that configuration to use the assigned values. Use a configuration as an alternative to running the function in the Command Window. You can associate multiple configurations with an M-file, each for different input values. MATLAB saves the configurations between sessions.

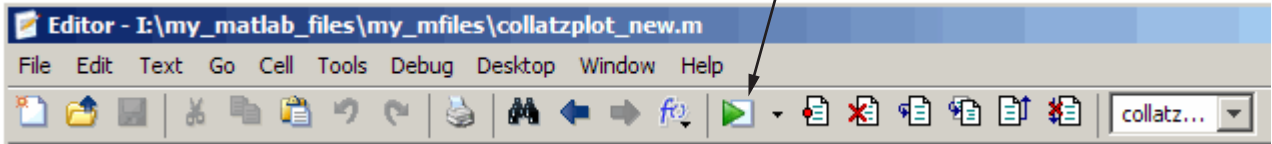
To create a configuration, first open an M-file in the Editor/Debugger. Then, from the down arrow on the Run button in the toolbar  select **Edit Configurations for *filename***. In the resulting Edit M-File Configurations dialog box, add statements and name the configuration. For more information, see “Using Configurations — Running M-Files with Input Arguments in the Editor/Debugger”.



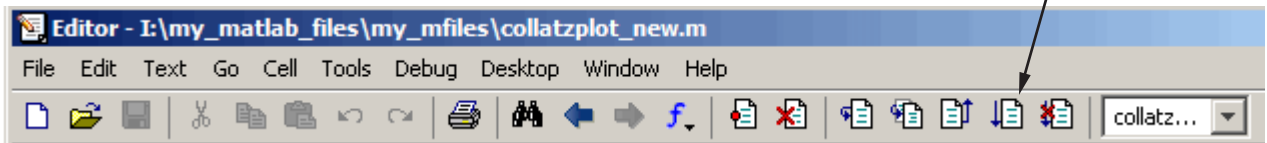
Run/Continue Button Changes

The Run/Continue button has a new look and new location on the Editor/Debugger toolbar.

New look and position of Run/Continue button



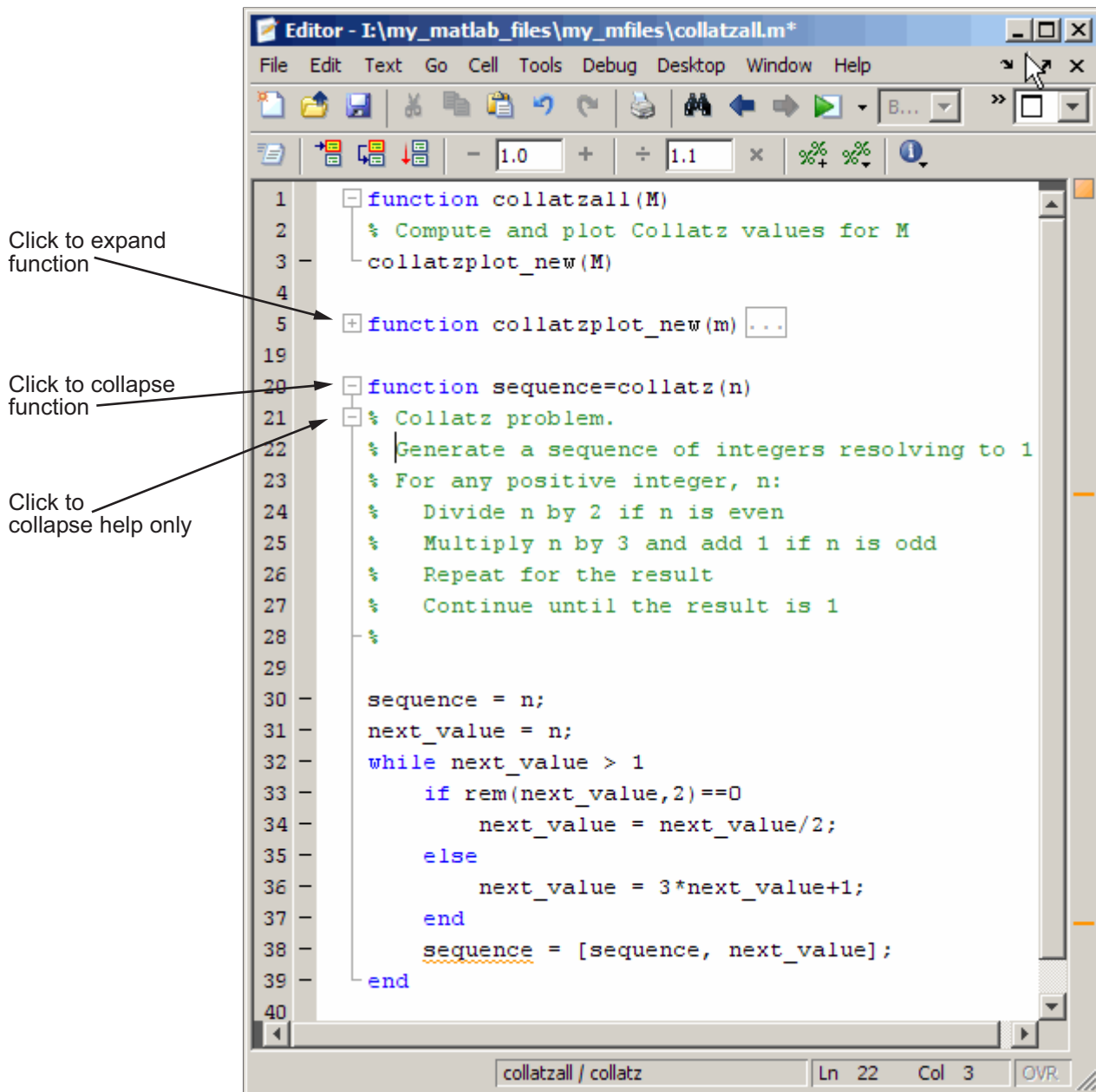
Run/Continue button in previous versions



Compatibility Considerations. The button performs the same as it did in previous versions, but you need to access it in the new position.

Code Folding Feature for Collapsing and Expanding Code

To improve the readability of files containing several subfunctions, the Editor includes a code folding feature, which is enabled by default. Using this feature you can collapse and expand subfunctions and their associated help. The following figure shows the `collatzplot_new` function collapsed, such that only the function definition is displayed. The figure shows the `collatz` function expanded, revealing both the help code and the function code. If you collapse just the help code, only the H1 help line displays.



- To expand code that is collapsed, click the plus sign (+) to the left of the code you want to expand.
- To collapse code that is expanded, click the minus sign (-) to the left of the code you want to collapse.
- To expand or collapse all of the code in an M-file, place your cursor anywhere within the M-file, right-click, and then select **Code Folding > Expand All** or **Code Folding > Collapse All** from the context menu.

For more information, see Code Folding—Expanding and Collapsing M-File Constructs

Pop-Up Help for a Function in the Editor

For more information, see “Help on Selection Enhanced in Command Window and Editor” on page 15.

Line Endings Removed for Files Provided with MATLAB for Windows; Impacts Viewing in Notepad

In previous versions, text files provided with MATLAB for Windows platforms included a carriage return and line feed at the end of each line. Starting in R2007b, the text files MATLAB provides do not include a carriage return and line feed at the end of each line.

File types affected are:

- .asc
- .bat
- .c
- .cc
- .cdr
- .cpp
- .def
- .for
- gs.rights

- .h
- .ini
- .m
- .mdl
- .pl
- readme
- .tlc
- .tmf
- .txt

There is no impact if you view the files in MATLAB and other common text editors, with the known exception of Windows Notepad.

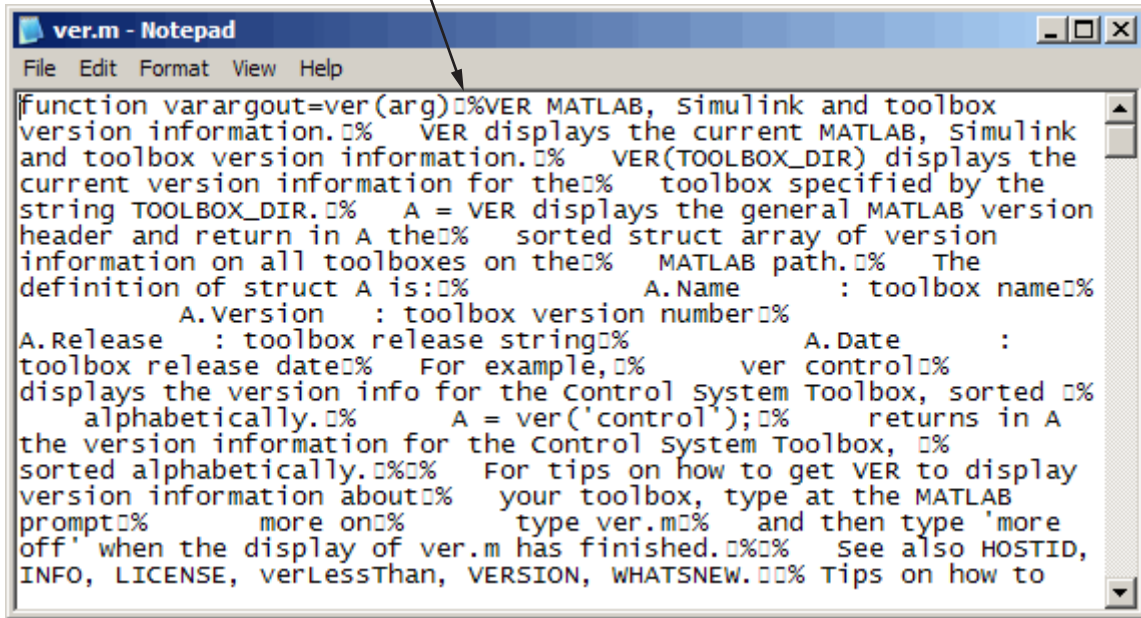
Compatibility Considerations. If you use Windows Notepad to view files provided with MATLAB, you see carriage return and line feed symbols `␣%` instead of line endings. This makes the files less readable in Notepad. Other text editors might display the symbols instead of line endings, but of the common text editors tested, none have been found that do so.

As an alternative to Notepad, use Microsoft WordPad, provided with Windows, or another text editor to view the files.

If your Windows file associations are set to associate any of the listed file types with Notepad, change the associations to use WordPad or another text editor.

The following illustration shows how the `ver` M-file included with MATLAB Version 7.5 looks when opened in Notepad.

M-file from MATLAB Version 7.5 when opened in Notepad shows symbols instead of line endings.



The screenshot shows a Notepad window titled 'ver.m - Notepad'. The text inside is the source code for the 'ver' function, but the line endings are represented by symbols (like '[]') instead of standard carriage returns. An arrow points from the text above to the first line of code in the Notepad window.

```
function varargout=ver(arg)%VER MATLAB, Simulink and toolbox
version information.[] VER displays the current MATLAB, Simulink
and toolbox version information.[] VER(TOOLBOX_DIR) displays the
current version information for the[] toolbox specified by the
string TOOLBOX_DIR.[] A = VER displays the general MATLAB version
header and return in A the[] sorted struct array of version
information on all toolboxes on the[] MATLAB path.[] The
definition of struct A is:[] A.Name : toolbox name[]
A.Version : toolbox version number[]
A.Release : toolbox release string[] A.Date :
toolbox release date[] For example,[] ver control[]
displays the version info for the Control System Toolbox, sorted []
alphabetically.[] A = ver('control');[] returns in A
the version information for the Control System Toolbox, []
sorted alphabetically.[][] For tips on how to get VER to display
version information about[] your toolbox, type at the MATLAB
prompt[] more on[] type ver.m[] and then type 'more
off' when the display of ver.m has finished.[][] See also HOSTID,
INFO, LICENSE, verLessThan, VERSION, WHATSNEW.[][] Tips on how to
```

The following illustration shows how the ver M-file included with MATLAB Version 7.5 looks when opened in WordPad.

M-file from MATLAB Version 7.5 when opened in WordPad shows line endings.

The screenshot shows a WordPad window titled 'ver.m - WordPad'. The menu bar includes File, Edit, View, Insert, Format, and Help. The toolbar contains icons for file operations and editing. The text area displays the following code with visible line endings (carriage returns):

```
function varargout=ver(arg)
%VER MATLAB, Simulink and toolbox version information.
%   VER displays the current MATLAB, Simulink and toolbox version information.
%   VER(TOOLBOX_DIR) displays the current version information for the
%   toolbox specified by the string TOOLBOX_DIR.
%   A = VER displays the general MATLAB version header and returns a
%   sorted struct array of version information on all toolboxes on the
%   MATLAB path.
%   The definition of struct A is:
%       A.Name       : toolbox name
%       A.Version    : toolbox version number
%       A.Release    : toolbox release string
%       A.Date       : toolbox release date
```

At the bottom of the window, it says 'For Help, press F1' and there is a 'NUM' button.

There are no problems with files you create or edit in Notepad, and then view or edit in MATLAB. The files have line endings in the MATLAB Editor, and continue to have line endings when you open them in Notebook.

(Microsoft product screen shot(s) reprinted with permission from Microsoft Corporation.)

Stand-Alone Editor Will Not Be Included in Next Version

The MATLAB stand-alone Editor (`meditor.exe`) will no longer be provided, starting in the next version of MATLAB. Instead of the stand-alone Editor, you can use the MATLAB Editor/Debugger. It provides all the features of the stand-alone Editor, plus the following:

- Tab completion

- Debugging M-files
- Evaluating selections
- Accessing source control features
- Docking the tool in the MATLAB desktop
- Using cell features for rapid code iteration or publishing

Compatibility Considerations. Some users have preferred the stand-alone Editor to the MATLAB Editor/Debugger because of slightly better startup performance and because it does not require a MATLAB license. For those situations, you can use any text editor you have, such as UltraEdit or Emacs.

Determine the McCabe (Cyclomatic) Complexity of an M-File

The `cyc` option to the `mlint` function enables you to determine the McCabe complexity (also referred to as the cyclomatic complexity) of an M-file. Higher McCabe complexity values indicate higher complexity, and there is some evidence to suggest that programs with higher complexity values are more likely to contain errors. Frequently, you can lower the complexity of a function by dividing it into smaller, simpler functions. In general, smaller complexity values indicate programs that are easier to understand and modify. Some people advocate splitting up programs that have a complexity rating over 10. See `mlint` for syntax and an example.

Publishing Results

New features and changes introduced in Version 7.5 (R2007b) are:

- “Notebook and Word for Office 2007” on page 25
- “Text Markup in Cells for Publishing” on page 26
- “Preference to Restrict Lines of Output” on page 26

Notebook and Word for Office 2007

Notebook now supports Word for Office 2007. For details, see Notebook for Publishing to Word

Text Markup in Cells for Publishing

The following Editor/Debugger menu items are added to assist you in marking up cells in the Editor/Debugger for publishing. Access the menu items presented in the following list from **Cell > Insert Text Markup**. When you select the menu item, the Editor inserts code to assist you in adding the text markup for the specified item.

- **Document Title and Introduction**
- **Section Title with Cell Break**
- **Hyperlinked Text**
- **Image**
- **Numbered List**
- **HTML Markup**
- **LaTeX Markup**

The first two list items are provided instead of the **Cell Title** and **Descriptive Text** menu items that were offered in Version 7.4 (R2007a).

As an alternative to using the Cell menu items, you can manually insert code to mark up cells in your M-file for publishing. For details on the Cell menu items and the resulting code see *Marking Up Text in Cells for Publishing*

Preference to Restrict Lines of Output

You can now specify options to restrict the number of lines included in the output of a published M-file. To access this option from the Editor/Debugger, follow these steps:

- 1** Select **File > Preferences > Editor/Debugger > Publishing**
- 2** In the Editor/Debugger Publishing Preferences pane, select the **Evaluate code** and **Restrict output to** options.
- 3** Specify the maximum number of lines that you want to include in the output.

Mathematics, MATLAB Version 7.5 (R2007b)

New features and changes introduced in this version are:

- “New Functions” on page 27
- “finite Function Deprecated” on page 27
- “dmperm Function Gives Coarse Decomposition” on page 28
- “ldl Function Supports Real Sparse Symmetric Matrices” on page 28
- “Upgrade to LAPACK Library” on page 28
- “Upgrade to BLAS Libraries” on page 28
- “Library for LAPACK and BLAS Symbols Separated” on page 28
- “Colon Operations on Characters Return Character Type Data” on page 29
- “Matrix Generating Functions No Longer Accept Complex Inputs” on page 29

New Functions

Function	Description
quadgk	Numerically evaluates the integral, adaptive Gauss-Kronrod quadrature
bvp5c	Solves boundary value problems for ordinary differential equations, notably useful for small error tolerances
maxNumCompThreads	Gets and sets the maximum number of computational threads

finite Function Deprecated

In this release, the `finite` function displays a warning message that the function is now deprecated. Support for `finite` will be removed in a future release of MATLAB.

Compatibility Considerations

It is recommended that you replace all calls to `finite` with the `isfinite` function.

dmperm Function Gives Coarse Decomposition

The `dmperm` function now provides two additional output arguments for the indices of the Dulmage-Mendelsohn coarse decomposition.

ldl Function Supports Real Sparse Symmetric Matrices

The `ldl` function now provides factorization and solving for an additional output argument, the scaling matrix, when the input matrix is real sparse and symmetric.

Upgrade to LAPACK Library

MATLAB now uses Version 3.1 of the Linear Algebra Package (LAPACK) library.

Upgrade to BLAS Libraries

For AMD processors, MATLAB now uses Version 3.6 of the AMD Core Math Library (ACML) for the Basic Linear Algebra Subroutine (BLAS) libraries.

Library for LAPACK and BLAS Symbols Separated

The binder library, `libmwlapack.lib`, containing both LAPACK and BLAS symbols is now two separate library files: `libmwlapack.lib` for LAPACK symbols and `libmwblas.lib` for BLAS symbols. For more information and syntax, see “Using LAPACK and BLAS Functions”.

Compatibility Considerations

If you previously linked to the `libmwlapack.lib` library to use the BLAS symbols, you will need to update your code to link to the `libmwblas.lib` library.

Colon Operations on Characters Return Character Type Data

Using a colon with characters to iterate a for-loop now returns data of type character. For example,

```
for x='a':'b',x,end
```

results in

```
x =
  a
x =
  b
```

Compatibility Considerations

Previously, colon operations with characters iterating a for-loop returned data of type double. In previous releases the above example returned:

```
for x='a':'b',x,end

x =
  97
x =
  98
```

Existing program code that relies on the colon operations of character arrays returning a double, needs to be updated to expect a character data type.

Matrix Generating Functions No Longer Accept Complex Inputs

Calling matrix generating functions, such as ones, zeros, rand, randn, true, and false, with a complex number as dimensions input now returns the error:

```
true([1 i])
??? Error using ==> true
Size vector must be a row vector with real elements.
```

Compatibility Considerations

In previous releases, if you supplied a complex number as a dimension input, MATLAB returned:

```
true([1 i])  
Warning: Size vector should be a row vector with integer elements.  
        Complex inputs will cause an error in a future release.  
  
ans =  
  
Empty matrix: 1-by-0
```

Existing program code that relies on entering complex numbers as dimension input to a matrix generating function should be modified.

Data Analysis, MATLAB Version 7.5 (R2007b)

There were no new features or changes in this version.

Programming, MATLAB Version 7.5 (R2007b)

New features and changes introduced in this version are

- “Increased Size for Large Arrays” on page 32
- “Documentation for Multiprocessing in MATLAB” on page 32
- “Setting Number of Threads Programmatically” on page 33
- “New Internal Format for P-code” on page 33
- “New Split String Functionality in regexp” on page 33
- “Changes Related to Error Handling” on page 34
- “Results From tempname Are More Unique” on page 36
- “iptcheckstrs and iptcheckinput Functionality Now Available with MATLAB” on page 37
- “Windows Current Working Directory Corrected” on page 37
- “New Multimedia Functionality” on page 38
- “Compressed AVI Video Files in Windows Vista and Windows XP x64” on page 39
- “mmfileinfo Reads Files on MATLAB Path” on page 39
- “Changes to imread Support of TIFF Format” on page 39
- “Removal of freeserial Function” on page 40

Increased Size for Large Arrays

On 64-bit platforms, MATLAB arrays are no longer limited to 2^{31} elements. The limit in MATLAB 7.5 is $2^{48}-1$. For example, given sufficient memory, many numeric and low-level file I/O functions now support real double arrays greater than 16 GB.

Documentation for Multiprocessing in MATLAB

Documentation for “Multiprocessing in MATLAB” has moved from Desktop Tools and Development Environment to the “Improving Performance and Memory Usage” section of MATLAB Programming.

Setting Number of Threads Programmatically

In this release, MATLAB provides a way to set or retrieve the maximum number of computational threads from within an M-file program. With the `maxNumCompThreads` function, you can either set the maximum number of computational threads to a specific number, or indicate that you want the setting to be done automatically by MATLAB

New Internal Format for P-code

P-code files have a new internal format in MATLAB Version 7.5. The new P-code files are smaller and more secure than those built with MATLAB 7.4 and earlier, and provide a more robust solution to protect your intellectual property.

Any P-code files that were built using MATLAB 7.4 or earlier also work in 7.5. However, support for these older files will at some point be removed from MATLAB.

P-code files built with MATLAB 7.5 only work on 7.5 or later. They cannot be used with MATLAB 7.4 or earlier versions.

Compatibility Considerations

Rebuild any P-code files using MATLAB 7.5 that you expect to need in the future.

New Split String Functionality in regexp

Using the regular expressions function `regexp`, you can now split an input string into sections by specifying the new `'split'` option when calling `regexp`:

```
s1 = ['Use REGEXP to split ^this string into ' ...
      'several ^individual pieces'];

s2 = regexp(s1, '\^', 'split');

s2(:)
ans =
      'Use REGEXP to split '
      'this string into several '
```

'individual pieces'

The `split` option returns those parts of the input string that are delimited by those substrings returned when using the `regexp` 'match' option.

Changes Related to Error Handling

New Error Handling Mechanism

MATLAB extends its error-handling capabilities with the new `MException` class to provide you with a more secure and extensible system for throwing and responding to errors. Read about this new feature in the “Error Handling” section of the MATLAB Programming documentation and in related function reference pages such as `MException`.

This feature *extends* the error-handling capabilities available in earlier releases, but does not replace that functionality. Your M-file programs will continue to function the same when using Version 7.5.

New Syntax for `catch` Function

As part of new error-handling mechanism, the `catch` function has a new, optional syntax:

```
catch ME
```

`ME` is an object of the `MException` class. This command gives you access to the `MException` object that represents the error being caught.

Warning and Error Messages Now Wrap

In previous versions of MATLAB, warning and error messages that were longer than the width of your terminal screen extended beyond the visible portion of your screen. These messages now wrap onto succeeding lines so that the entire text of the warning or error is visible.

Change to Error Message from Anonymous Function

The error message and M-file line number that MATLAB displays when encountering an error in an anonymous function defined within a script

file or at the MATLAB Command Line has changed in this release. In MATLAB Version 7.4, the error message included the line number (set to 1 for anonymous functions), and the stack information returned by the `lasterror` function also showed the line number as 1. In MATLAB 7.5, the line number is not displayed in the error message and is set to 0 in the returned stack information.

For example, when you enter the following two lines at the command line, MATLAB generates an error from the anonymous function:

```
X = @() error('* Error *');
X()
```

This example shows the difference between MATLAB Versions 7.4 and 7.5:

```
e = lasterror;

e.message
ans =
Error using ==> @()error('Error') at 1      % V7.4 response
Error using ==> @()error('Error')          % V7.5 response
* Error *

e.stack
ans =
    file: ''
    name: '@()error('* Error *')'
    line: 1                                % V7.4 response
    line: 0                                % V7.5 response
```

Compatibility Considerations. If you have programs that rely on the line number returned in response to an error in an anonymous function, these programs may not work as expected. Remove dependencies on the returned error message and line number, or update your program code to use the new string and value.

New Message In Response to **Ctrl+C**

MATLAB now displays a more user-friendly message when you press **Ctrl+C**. The previous response to **Ctrl+C** was

```
Error in ==> testctrlc>waitawhile at 5  
pause(100);
```

```
Error in ==> testctrlc at 2  
waitawhile
```

In this and future releases, pressing **Ctrl+C** still halts program execution, but now displays the response

```
??? Operation terminated by user during ==> testctrlc>  
waitawhile at 5
```

```
In ==> testctrlc at 2  
waitawhile
```

Compatibility Considerations. You only need to be aware that the change in the text of this message is intentional and does not signify any error on your part.

hdfread Errors Instead of Warns on I/O Failures

In previous releases, `hdfread` issued a warning when a requested I/O operation failed. In addition, `hdfread` created an empty variable in the workspace. In this release, `hdfread` now errors when a requested I/O operation fails and does not create an empty variable in the workspace.

Compatibility Considerations. If you call `hdfread` in a script to perform an I/O operation and that operation fails, your script will now terminate. Previously, because `hdfread` only warned when an I/O operation failed, your script would continue processing.

Results From `tempname` Are More Unique

The `tempname` function now produces a string such as

```
C:\Temp\tpe51f2ba3_9ad3_490f_8142_58359c98f4a5
```

when Java is present, or a string like

```
C:\Temp\tp346976948758473
```


when `nojvm` is selected. Underscores are included in the name so you can use the filename portion of it as a valid M-function name. If a string row vector is passed in as an argument, that string is used instead of `tempdir` as the root.

Compatibility Considerations

Because the new string generated by `tempname` is generally longer than the string constructed in earlier versions, there is a possibility of exceeding length restrictions, especially if your program code passes a string to the `tempname` function. If you consider this to be a potential problem, verify that the strings you pass to `tempname` will not result in an overly long string being returned.

Windows Current Working Directory Corrected

On Windows, you can define a current working directory, `cwd`, for each drive letter. For example, entering the command `cd D:\work` at the DOS prompt defines your D current working directory as `D:\work`. All references to `D:` are then relative to this directory.

The term . . .	Represents the directory . . .
D:	D:\work
D:matlab	D:\work\matlab
D:\matlab	D:\matlab

(Note the difference between D:\ and D:, where the former is the drive D, and the latter is a user-defined working directory that may or may not be equal to D:\.)

Previous versions of MATLAB have been inconsistent in the way that volume-relative path specification is handled. For example, in MATLAB 7.4 and earlier, if D: were defined as the directory D:\work, the following commands on the left and right returned identical results:

```
dir D:                dir D:\
dir D:matlab         dir D:\work\matlab
fileparts('D:myfile.m') fileparts('D:\myfile.m')
```

This has been fixed in MATLAB 7.5 so that the following are now equivalent:

```
dir D:                dir D:\work
dir D:matlab         dir D:\work\matlab
fileparts('D:myfile.m') fileparts('D:\work\myfile.m')
```

Compatibility Considerations

Some MATLAB commands may fail or return unexpected results if you use Windows current working directories on MATLAB. You might have to update hard-coded paths if you have been relying on the incorrect behavior exhibited in earlier versions.

New Multimedia Functionality

A new `mmreader` video file reader object for Windows platforms supports formats such as AVI, MPEG, and WMV, and adds the ability to read additional video codecs that `aviread` does not support. For more information, see the `mmreader` and `read` reference pages.

Compressed AVI Video Files in Windows Vista and Windows XP x64

Because Windows Vista, Windows Vista 64-bit, and Windows XP x64 operating systems do not ship with the Indeo5 codec, which is the default codec used by MATLAB Audio-Video functions for file compression, the functions `movie2avi` and `avifile` now generate uncompressed AVI files on these platforms. Also, `aviread` on these platforms cannot read files that were compressed using the Indeo5 codec.

Compatibility Considerations

If you have upgraded your Windows operating system to Windows Vista, Windows Vista 64-bit, or Windows XP x64, you need to install the Indeo5 codec to read or create Indeo5 compressed AVI files with `aviread`, `avifile`, or `movie2avi`. You can learn more about downloading the Indeo5 codec from the Ligos Corporation Web site at <http://ligos.com/index.php/home/products/indeo/>

mmfileinfo Reads Files on MATLAB Path

The `mmfileinfo` function now reads files on the MATLAB path, not only those in the current directory. The `mmfileinfo` output struct contains a field called `Path`, which indicates the directory where the file exists.

Compatibility Considerations

The `Filename` field of the output struct from `mmfileinfo` now contains only the filename itself without any path information, while the path information is contained in the `Path` field. In previous releases, the `Filename` field contained both path and filename information.

Changes to `imread` Support of TIFF Format

The `imread` function includes several updates to its TIFF support:

- `imread` reads TIFF files that use JPEG, LZW, and Deflate compression.
- `imread` reads image data from TIFF files in any arbitrary samples-per-pixel and bits-per-sample combination.

- `imread` provides increased performance when reading large images, when used with the `'PixelRegion'` parameter.

Removal of `freeserial` Function

The `freeserial` function is now obsolete. Use `fclose` to release the serial port.

Compatibility Considerations

If your program code still makes use of the `freeserial` function, replace each instance with the `fclose` function instead.

Graphics and 3-D Visualization, MATLAB Version 7.5 (R2007b)

New features and changes introduced in this version are:

- “Datatips Are Now Saved to FIG-Files” on page 41
- “New Options for Displaying Groups of Lines in Legends” on page 41
- “Drawnow Update Option Now Updates Uicontrols Only” on page 42
- “Annotation Textboxes Can Automatically Resize to Fit their Contents” on page 42
- “Property Inspector Now Has Context-Sensitive Help” on page 44
- “The “v6” Option for Creating Plot Objects is Obsolete” on page 44

Datatips Are Now Saved to FIG-Files

When you save a figure, all datatips existing in it are saved along with other annotations. When you open the FIG-file, the datatips are displayed and can be manipulated or deleted in the same ways they could in the original figure.

Compatibility Considerations

If you open a FIG-file containing datatips while using a previous version of MATLAB (V7.4 or earlier), no error results, but the datatips do not display.

New Options for Displaying Groups of Lines in Legends

You can now customize how legends for figures display groups of lines, such as contours. Previously, legends displayed groups of lines such as contourgroups with a glyph that represented the entire group; now users have the flexibility to designate a single legend entry, a legend entry for each child of the group, or no legend entries for the group.

By default, a legend entry for an hggroup now consists of the `DisplayName` of its first child and a glyph representing it (previously, no glyph appeared, only the `DisplayName`). This is what you now see after clicking the legend tool icon in the figure’s toolbar. However, you can set the new `Annotation` property

of `hggroups` to control how the group is represented in a legend. For details and examples of its use in customizing legends, see “Controlling Legends” in the Graphics documentation.

Drawnow Update Option Now Updates Uicontrols Only

The `drawnow` command can now selectively update the display of UI components. The update option enables you to update only uicontrol objects without allowing callbacks to execute or processing other events in the queue.

Annotation Textboxes Can Automatically Resize to Fit their Contents

In previous releases, textboxes had fixed sizes that users needed to adjust to fit the size of their contents. Now, if you create a textbox annotation using a GUI or the annotation function, it can grow or shrink to just fit the text you type into it. This behavior is controlled by the Annotation Textbox object’s `FitBoxToText` property, which can be 'on' or 'off'. When you create a textbox with the Annotation toolbar (using the **T** tool), this property is set to 'on' if you create a textbox without dragging; however, if you drag to make the new textbox have a certain size, the property is initially 'off'. When you create a textbox with the annotation function, for example,

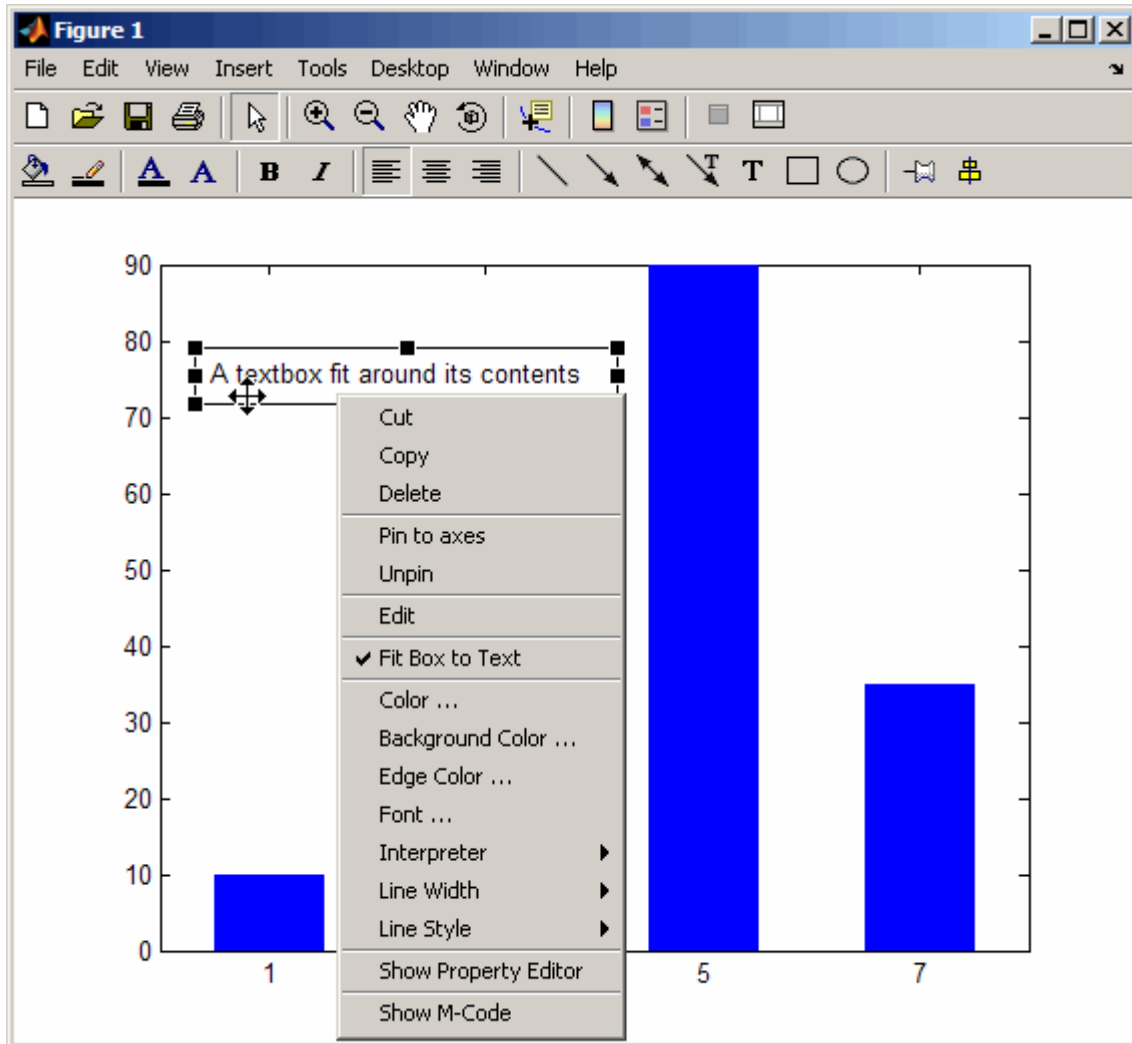
```
htb = annotation('textbox')
```

without specifying a position and size, the textbox is created with `FitBoxToText` set to 'on'. If you specify a position vector in the command, for example,

```
htb = annotation('textbox', [.1 .8 .4 .1])
```

the textbox is created with `FitBoxToText` set to 'off'.

Similarly, if you resize a textbox in plot edit mode or change the width or height of its position property directly, its `FitBoxToText` property is set to 'off'. You can toggle this property with `set`, with the Property Inspector, or more conveniently, via the object’s context menu, as the illustration below shows.



If you edit a textbox that has `FitBoxToText` set to 'on', the textbox resizes to accommodate the number of characters and lines in the text as you type. You can reposition the textbox without changing the `FitBoxToText` property, but as soon as you resize it, the property becomes (or remains) 'off'.

Property Inspector Now Has Context-Sensitive Help

When you use the Property Inspector (the `inspect` command), you can now ask for a description of any property it shows. The descriptions come from the property reference page for the type of object being inspected (e.g., axes, lineseries, annotations, uicontrols, etc.). To get a description of a property, right-click its name in the left-hand column of the Property Inspector and select **What's This?** from the context menu that appears. A mini-help window opens to show the property's description from the object's property reference page. If you need an overview of all properties pertaining to particular kinds of objects and how these objects relate, scroll through the entries in the mini-help window or open the Handle Graphics® Property Browser from the Help Browser.

The “v6” Option for Creating Plot Objects is Obsolete

Prior to Version 7 of MATLAB, handles returned by high-level plotting functions referenced graphic primitives, such as lines and patches. In Version 7, MATLAB began bundling the primitives into “series” objects, for example, lineseries, barseries, and contourgroups. At that time, the `v6` option was added to plotting functions to enable users of Version 7.x of MATLAB to create FIG-files that previous versions can open. The `v6` option is now obsolete. It will be removed in a future version of MATLAB. The following functions include the option in their syntax and now warn when it is used:

- `area`
- `bar`
- `barh`
- `colorbar`
- `contour`
- `contourf`
- `errorbar`
- `legend`
- `loglog`
- `mesh`
- `meshc`

- meshz
- plot
- quiver
- scatter
- scatter3
- semilogx
- semilogy
- stairs
- stem
- stem3
- subplot
- surf
- surfc

Compatibility Considerations

Specifying the `v6` flag to any plotting function now results in a warning that the option is being removed, but the option still functions. To generate a FIG-file for a plot created with the `v6` option, you still need to use the `-v6` option to the `hgsave` command in order to save it in a form that a previous version of MATLAB can read. Figures containing annotations (such as textboxes, arrows, ovals, and rectangles) that are saved this way open in previous versions, but the annotations do not display because different objects are used to contain them in Version 7 than before. That is, the annotation objects have never been backward compatible.

Creating Graphical User Interfaces (GUIs), MATLAB Version 7.5 (R2007b)

New features and changes introduced in this version are:

- “New Editors for Creating Custom Toolbars within GUIDE” on page 46
- “Coordinate Readouts in Layout Editor” on page 47
- “Documentation for Making GUIDE GUIs Interact” on page 47
- “Functions Being Removed” on page 48

New Editors for Creating Custom Toolbars within GUIDE

In previous releases, adding toolbars to a GUI had to be done programmatically, by writing code for the `uitoolbar`, `uipushtool` and `uitoggletool` functions. GUIDE now has a Toolbar Editor and an associated Icon Editor that allow you to lay out a toolbar for a GUI and populate it with standard predefined tools for printing, saving, panning, zooming, annotating, etc. or with custom tools that you design yourself. You can draw or modify an icon for any tool on your toolbar with the Icon Editor or import one from an image file.

The Toolbar Editor

When you run GUIDE to create a new GUI or edit an existing one, click the Toolbar Editor icon in the Layout Editor Toolbar or choose **Toolbar Editor** from the **Tools** menu to open the Toolbar Editor. To add tools to the toolbar of your GUI, you drag standard or custom tool icons to the toolbar layout area at the top. You can modify a tool’s properties using the Toolbar Editor and Property Inspector. You can also create and customize icons for tools using the new Icon Editor, described next. You control the behavior of a tool in your toolbar with its `ClickedCallback` (and for toggle tools, their `OnCallback` and `OffCallback`) in the GUI’s associated M-file. If you use an existing tool, such as Print or Save, you do not need to modify its callback; it is predefined as `%default`.

The Icon Editor

The Icon Editor lets you customize the icons for existing tools or create entirely new icons. Icons are stored as CData for each tool, and can also be read from and saved to .icn files. The Icon Editor also includes a Color Editor, a palette you can use for picking predefined colors and defining new ones.

Coordinate Readouts in Layout Editor

The GUIDE Layout Editor now has two fields in its lower left corner that continuously provide numeric feedback for:

- **Current Point** — The cursor location within the layout window
- **Position** — The Position property of the currently selected object(s) in the layout window

Both measurements are given in pixels, regardless of the current Units settings for GUI objects. When multiple objects are selected, any elements of their Position properties that are not identical are read out as MULTI. The readouts help you to precisely size and align GUI components.

Documentation for Making GUIDE GUIs Interact

A new documentation section, “Making Multiple GUIs Work Together”, has been added to illustrate how multiple GUIDE GUIs can work together by sharing data to create a more complicated GUI. It first summarizes the techniques that GUIDE GUIs can use to share data with one another. It then steps through two examples, accompanied by their M-files and FIG-files, to show how to use those techniques for specific tasks.

Functions Being Removed

Function Name	What Happens When You Run the Function?	Use This Function Instead	Compatibility Considerations
axlimdlg	Errors	None	No replacement
cbedit	Errors	guide	Use the guide command instead
clruprop	Errors	rmappdata	Replace existing instances of clruprop with rmappdata
ctlpanel	Errors	guide	Use the guide command instead
edtext	Errors	Set the editing property on the text object	No replacement
extent	Errors	Get the extent property of the text object	No replacement
getuprop	Errors	getappdata	Replace existing instances of getuprop with getappdata
hthelp	Errors	web	Replace existing instances of hthelp with web
layout	Errors	None	No replacement
matq2ws	Errors	None	No replacement
matqdlg	Errors	None	No replacement
matqparse	Errors	None	No replacement

Function Name	What Happens When You Run the Function?	Use This Function Instead	Compatibility Considerations
matqueue	Errors	None	No replacement
menubar	Errors	Set the menubar property of the figure to none	No differences
menuedit	Errors	guide	Use the guide command instead
pagedlg	Errors	pagesetupdlg	Replace existing instances of pagedlg with pagesetupdlg
setupprop	Errors	setappdata	Replace existing instances of setupprop with setappdata
umtoggle	Errors	Set the Checked property of uimenu objects	No differences
wizard	Errors	guide	Use the guide command instead
ws2matq	Errors	None	No replacement

External Interfaces/API, MATLAB Version 7.5 (R2007b)

- “Support for 64-bit mxArray” on page 50
- “Fortran MEX-Files Will Require mwSize and mwIndex” on page 51
- “Changes to the MATLAB Locale Setting” on page 51
- “Changes to MEX Error-Handling Functions mexErrMsgTxt and mexErrMsgIdAndTxt” on page 52
- “Rebuild MEX-Files Created with MATLAB Versions Earlier Than V7 (R14)” on page 52
- “Changes to Compiler Support” on page 52
- “Changes to Applications Built with Borland 5.5 or 5.6 C Compilers” on page 54
- “Environment Variable Required for mex with Microsoft Platform SDK Compiler” on page 54
- “Environment Variables Required for mex with Intel Visual Fortran 9.0” on page 54
- “Changes to Handling ActiveX Methods” on page 55
- “Changes to Dynamic Data Exchange (DDE) Documentation” on page 55

Support for 64-bit mxArray

MATLAB Version 7.5 (R2007b) supports 64-bit mxArray. This change allows C/C++ and Fortran files built on 64-bit platforms to handle large data arrays.

In earlier versions of MATLAB, mxArray are limited to $2^{31}-1$ elements. In Version 7.5 (R2007b) your mxArray can have up to $2^{48}-1$ elements.

The mex command option, `-largeArrayDims`, uses the large-array-handling mxArray API. Use `mwSize` to represents size values, such as array dimensions and number of elements. Use `mwIndex` to represent index values, such as indices into arrays.

Compatibility Considerations

MEX-files that built properly in previous versions of MATLAB continue to build in Version 7.5 (R2007b).

The default option for `mex` is `-compatibleArrayDims`. If you use this option, `mex` builds the files using the 32-bit array-handling API.

To work with 64-bit `mxArrays`, your C, C++ and Fortran source code must comply with the 64-bit array-handling API. To use the API to create C/C++ MEX-files, see “Handling Large `mxArrays`” . To use the API to create Fortran MEX-files, see “Handling Large `mxArrays`” .

Fortran MEX-Files Will Require `mwSize` and `mwIndex`

In a future version of MATLAB, the default `mex` command option will change to `-largeArrayDims`. Fortran MEX-files will be required to use the `mwSize` and `mwIndex` preprocessor macros

Compatibility Considerations

To make your Fortran MEX-file compatible with the `-largeArrayDims` option, and to create platform-independent code, you need to include the `fintrf.h` header file in your Fortran source files, and you need to name your source files with an uppercase `.F` file extension. For information on creating MEX-files, see the “Gateway Routine” in the Fortran MEX-Files topic.

Changes to the MATLAB Locale Setting

Retrieving and using the proper locale setting is a mandatory operation in creating and using applications for international audiences. In R2007b, MATLAB Version 7.5 standardizes the way it initializes the locale setting across platforms. As a result, on Windows platforms, MEX-files that use C/C++ locale-dependent standard library functions should note that MATLAB now sets the locale using the `setlocale` function.

Because of changes to Microsoft Visual Studio, MEX-Files created on Windows with Microsoft Visual Studio 2003 will not have the same locale setting as MATLAB Version 7.5 (R2007b).

Note C/C++ users must not change the locale setting using the `setlocale` function. This is true for all versions of MATLAB on all platforms.

Changes to MEX Error-Handling Functions `mexErrMsgTxt` and `mexErrMsgIdAndTxt`

In MATLAB Version 7.5 (R2007b), the `mexErrMsgTxt` and `mexErrMsgIdAndTxt` functions determine where the error occurred, and display the function name. In previous versions, these functions only display the error message.

For example, if an error occurs in the function `foo`, `mexErrMsgTxt` and `mexErrMsgIdAndTxt` display the following information before the error message:

```
??? Error using ==> foo
```

Rebuild MEX-Files Created with MATLAB Versions Earlier Than V7 (R14)

To work with MATLAB V7.5 (R2007b), MEX-files compiled on any platform with MATLAB versions earlier than V7 (R14) no longer load correctly and must be rebuilt.

Changes to Compiler Support

The set of compilers that MATLAB supports has changed in MATLAB Version 7.5 (R2007b). For an up-to-date list of supported compilers, see Technical Note 1601: <http://www.mathworks.com/support/tech-notes/1600/1601.html>.

- “New Compiler Support” on page 52
- “Discontinued Compiler Support” on page 53
- “Compiler Support to Be Phased Out” on page 53

New Compiler Support

MATLAB V7.5 (R2007b) supports new compilers for building MEX-files.

Windows platforms.

- Microsoft Visual Studio 2005 SP1

Solaris SPARC (64-bit) platform.

- gcc / g++ Version 4.1.2

Discontinued Compiler Support

The following compilers are no longer supported.

Windows platforms.

- Microsoft Visual Studio 2005 without SP1

Solaris SPARC (64-bit) platform.

- gcc / g++ Version 3.2.3

Compatibility Considerations. To ensure continued support for building your C/C++ programs, consider upgrading to another supported compiler. For an up-to-date list of supported compilers, see Technical Note 1601: <http://www.mathworks.com/support/tech-notes/1600/1601.html>.

Compiler Support to Be Phased Out

The following compilers are supported in Version 7.5 (R2007b), but will not be supported in a future version of MATLAB.

Windows (32-bit) platform.

- Intel Visual Fortran Version 9.0
- Borland C++ Builder 6 Version 5.6
- Compaq Visual Fortran Version 6.6
- Intel C++ Version 7.1
- Borland C++ Builder 5 Version 5.5
- Borland C++ Compiler Version 5.5

- Compaq Visual Fortran Version 6.1

Changes to Applications Built with Borland 5.5 or 5.6 C Compilers

MATLAB applications built with Borland Version 5.5 or 5.6 C compilers have changed in MATLAB Version 7.5 (R2007b). MATLAB applications that run under Windows are now implemented as console applications, not Windows applications.

Compatibility Considerations

If you have customized the build process based on one of the `bcc*engmatopts.bat` options files, you must edit this file making changes to the appropriate `LINKFLAGS` statement, as described in the `.bat` file comments.

Environment Variable Required for mex with Microsoft Platform SDK Compiler

When you build a MEX-file, an engine application, or a MAT application on a Windows 64-bit platform using the Microsoft Platform SDK compiler, MATLAB requires that you define the environment variable `MSSdk`. The value of this environment variable is the path to the installation directory for Microsoft Platform SDK. The Microsoft Platform SDK installation program does not commonly define this environment variable. For example, you might set the environment variable as follows:

```
C:\Program Files\Microsoft Platform SDK
```

Environment Variables Required for mex with Intel Visual Fortran 9.0

When you build a MEX-file, an engine application, or a MAT application using Intel Visual Fortran 9.0, MATLAB requires that you define an environment variable for the Windows platform you are using.

Windows (32-bit) platform

Define the environment variable `VS71COMNTOOLS`. The value of this environment variable is the path to the `Common7\Tools` directory of the Visual Studio .NET 2002 or 2003 installation directory. (Intel Visual Fortran requires

Visual Studio .NET 2002 or 2003 on 32-bit Windows platforms.) The Visual Studio .NET 2003 installation program commonly defines this environment variable. For example, you might set the environment variable as follows:

```
C:\Program Files\Microsoft Visual Studio .NET 2003\Common7\Tools
```

Windows x64 platform

Define the environment variable MSSdk. The value of this environment variable is the path to the installation directory for Microsoft Platform SDK for Windows Server 2003. (Intel Visual Fortran requires Microsoft Platform SDK for Windows Server 2003 on Windows x64 platforms.) The Microsoft Platform SDK installation program does not commonly define this environment variable. For example, the environment variable might have the value

```
C:\Program Files\Microsoft Platform SDK
```

Changes to Handling ActiveX Methods

In MATLAB Version 7.4 (R2007a), a change was made to ActiveX methods which was not documented in the release notes. This change is described in “Changes to Handling ActiveX Methods” on page 107 in the MATLAB Release Notes, Version 7.4 (R2007a).

Changes to Dynamic Data Exchange (DDE) Documentation

In MATLAB V5.1, all development work for the Dynamic Data Exchange (DDE) server and client was stopped. This functionality is no longer documented in V7.5 (R2007b). The MathWorks provides, instead, a MATLAB interface to COM technology that is documented in COM Support in MATLAB (Windows Only).

Obsolete Functionality No Longer Documented

Documentation for Dynamic Data Exchange (DDE) is no longer included in External Interfaces.

Compatibility Considerations. If you must support this obsolete functionality, we suggest you print a copy of the External Interfaces chapter “COM and DDE Support (Windows Only)” from MATLAB V7.4 (R2007a) or earlier.

Documentation for Obsolete Functions To Be Phased Out

Documentation for the following functions is included in the MATLAB Function Reference documentation for MATLAB V7.5 (R2007b), but will not be included in a future version of MATLAB.

Obsolete Functions
ddeadv
ddeexec
ddeinit
ddepoke
ddereq
ddeterm
ddeunadv

The following syntax for `enableservice`, included in the MATLAB Function Reference documentation for MATLAB V7.5 (R2007b), will be removed from the documentation.

```
enableservice('DDEServer',enable)
```

Compatibility Considerations. If you must support this obsolete functionality, we suggest you print and keep a copy of the relevant MATLAB function reference pages from V7.5 (R2007b) or earlier.

Version 7.4 (R2007a)

MATLAB

This table summarizes what's new in Version 7.4 (R2007a):

New Features and Changes	Version Compatibility Considerations	Fixed Bugs and Known Problems	Related Documentation at Web Site
Yes Details below	Yes — Details labeled as Compatibility Considerations in descriptions of new features and changes. See also Summary.	Bug Reports Includes fixes	No

New features and changes introduced in this version are organized by these areas:

- “Desktop Tools and Development Environment, MATLAB Version 7.4 (R2007a)” on page 59
- “Mathematics, MATLAB Version 7.4 (R2007a)” on page 81
- “Data Analysis, MATLAB Version 7.4 (R2007a)” on page 85
- “Programming, MATLAB Version 7.4 (R2007a)” on page 86
- “Graphics and 3-D Visualization, MATLAB Version 7.4 (R2007a)” on page 94

- “Creating Graphical User Interfaces (GUIs), MATLAB Version 7.4 (R2007a)” on page 98
- “External Interfaces/API, MATLAB Version 7.4 (R2007a)” on page 101

Desktop Tools and Development Environment, MATLAB Version 7.4 (R2007a)

New features and changes introduced in this version are organized by these topics:

- “Startup and Shutdown” on page 59
- “Desktop” on page 64
- “Running Functions—Command Window and History” on page 72
- “Help” on page 73
- “Workspace, Search Path, and File Operations” on page 75
- “Editing and Debugging M-Files” on page 76
- “Tuning and Managing M-Files” on page 79
- “Publishing Results” on page 79

Startup and Shutdown

New features and changes introduced in Version 7.4 (R2007a) are

- “Double-Clicking Associated File Type in Windows Explorer Now Opens File in Existing MATLAB Session” on page 59
- “Changes to Startup Directory (Folder) and Startup Options for MATLAB on Windows” on page 60
- “JVM for Windows Updated” on page 63
- “New Version of Java Access Bridge” on page 64
- “Confirm Exit Preference to be Enabled by Default in Future Version” on page 64

Double-Clicking Associated File Type in Windows Explorer Now Opens File in Existing MATLAB Session

When you open a file from Windows Explorer whose type is associated with MATLAB®, the file opens in the appropriate tool in the existing MATLAB session if MATLAB is already running, or starts MATLAB. This assumes

you associated the file types with MATLAB by accepting the defaults during MATLAB installation, or by changing the associations. For example, in Windows Explorer, double-click an M-file to open the file in the MATLAB Editor/Debugger, or a MAT-file to open the Import Wizard and load the data into the MATLAB workspace. For details, including how to change file associations, see “Starting MATLAB from an M-File or Other File Type in Windows”.

Compatibility Considerations. In previous versions, when you double-clicked a file in Windows Explorer whose type was associated with MATLAB, the file opened in a new MATLAB session. The change made in MATLAB Version 7.4 (R2007a) to open the file in an existing session was based on many user requests.

In previous versions, double-clicking a MAT-file associated with MATLAB in Windows Explorer opened a new MATLAB session and loaded the data into the workspace. In the Macintosh Finder, it loaded the data into the existing MATLAB session. Now on Windows and Macintosh platforms, the Import Wizard opens in the existing MATLAB session, with which you can load the data into the workspace.

By default, in previous versions, double-clicking an M-file in Windows Explorer opened it in the MATLAB stand-alone Editor. For more information about that change, see “Stand-Alone Editor No Longer Opens By Default; To Be Removed in a Future Version” on page 76.

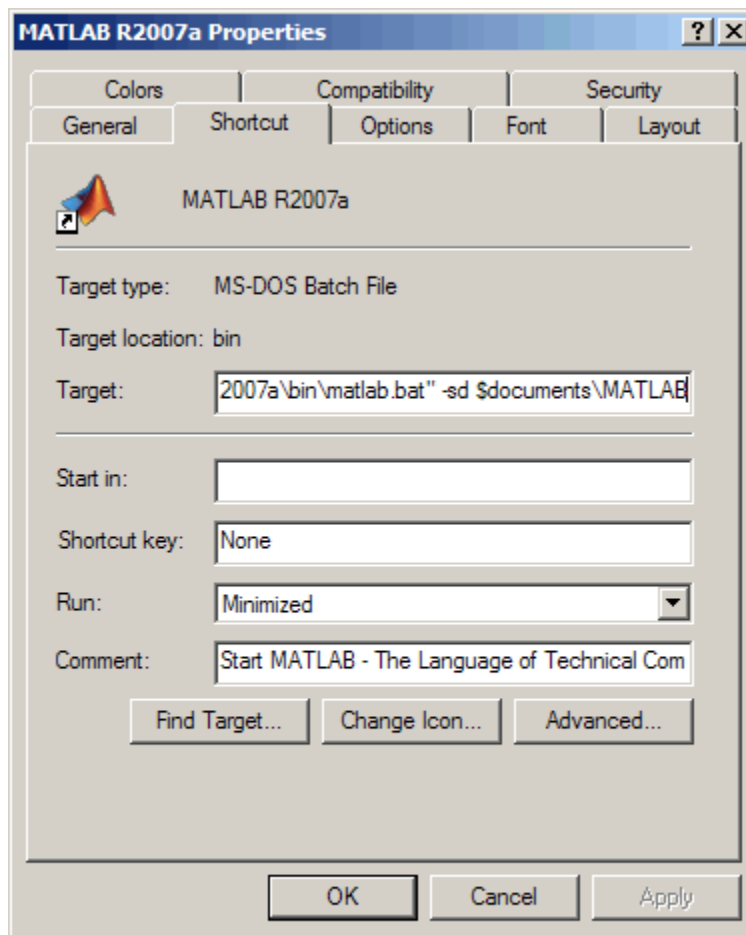
Changes to Startup Directory (Folder) and Startup Options for MATLAB on Windows

The default MATLAB startup directory on Windows platforms is now My Documents\MATLAB, or Documents\MATLAB on Vista. Upon startup, MATLAB automatically locates this MATLAB folder (creating it if it does not exist), and adds it to the top of the search path. This utilizes Windows and Vista standard folders to provide a unique startup directory for each user. As such, the folder is part of the user’s profile in Windows (or Vista), and will be accessible when the user runs MATLAB from other machines, when the profile is set up to roam.

By default, the **Target** field for the MATLAB shortcut icon Properties dialog box includes a new startup option -sd (for startup *d*irectory), followed by

\$documents\MATLAB, where MATLAB interprets \$documents as the My Documents folder for the current user (or Documents for Vista). If the path for \$documents is specified by Windows via a UNC pathname, MATLAB automatically assigns it a mapped drive, creating one if necessary. The -sd startup option overrides anything in the **Start in** field, which is now empty by default.

For more information, see “Changing the Startup Directory”.



Compatibility Considerations. In previous releases, the default startup directory was `\Work`, located in the directory in which MATLAB was installed. For example, in R2006b, if you installed MATLAB in `C:\Program Files`, the default startup directory was `C:\Program Files\MATLAB\R2006b\Work`.

Vista User Account Control (UAC) security features restrict access to Program Files. To accommodate this enhanced security model, the MATLAB default startup directory has been moved outside of Program Files.

These are the differences between the startup directory for R2007a and previous releases:

- In previous releases, upon installation, the default startup directory was specified in the **Start in** field of the MATLAB shortcut icon Properties dialog box. You could change the startup directory by replacing the pathname in that field. In R2007a, if you want to specify the startup directory using the **Start in** field, you must also remove from the **Target** field the -sd startup option and the pathname that follows it.
- The default startup directory is no longer specific to a release. When you upgrade from R2007a to a future release, files you created and saved in My Documents\MATLAB (or Documents\MATLAB on Vista) will automatically be in the startup directory for the new release. Previously, you had to move files you created and saved in the Work folder for a release, for example, R2006a\Work, to the default startup directory for the new release, for example, R2006b\Work.
- In previous releases, the default startup directory, Work, was shared by all users running that MATLAB executable. The default startup directory in R2007a, My Documents\MATLAB (or Documents\MATLAB on Vista), provides each user with a unique startup directory.
- In previous releases, MATLAB added the default startup directory, Work, to the bottom of the search path. In R2007a, MATLAB adds the default startup directory, My Documents\MATLAB (or Documents\MATLAB on Vista), to the top of the search path. In R2007a, for consistency with previous releases, MATLAB adds . . . \MATLAB\R2007a\Work to the bottom of the search path. However, we encourage you to stop using the Work folder because support for it might be removed in a future release.

JVM for Windows Updated

MATLAB is now using Java (JVM) 1.5.0_07 on Windows platforms. Java is supplied with MATLAB for Windows platforms, so this change requires no action on your part.

Compatibility Considerations. If you use a specific version of Java with MATLAB on Windows platforms, this change might impact you.

New Version of Java Access Bridge

MATLAB now installs Java Access Bridge Version 2.0, which is used by JAWS for accessibility support.

Confirm Exit Preference to be Enabled by Default in Future Version

When you exit from MATLAB, MATLAB terminates without displaying a confirmation dialog box that asks if you are sure you want to quit. This is the default behavior but you can set a preference to display a confirmation dialog box. In a future version, the confirmation dialog box will appear by default when you quit MATLAB.

Compatibility Considerations. When the confirmation dialog appears by default, you will be able to disable it using preferences. If you have files that include exit statements, you might need to ensure the preference for the confirmation dialog box is disabled.

Desktop

New features and changes introduced in Version 7.4 (R2007a) are

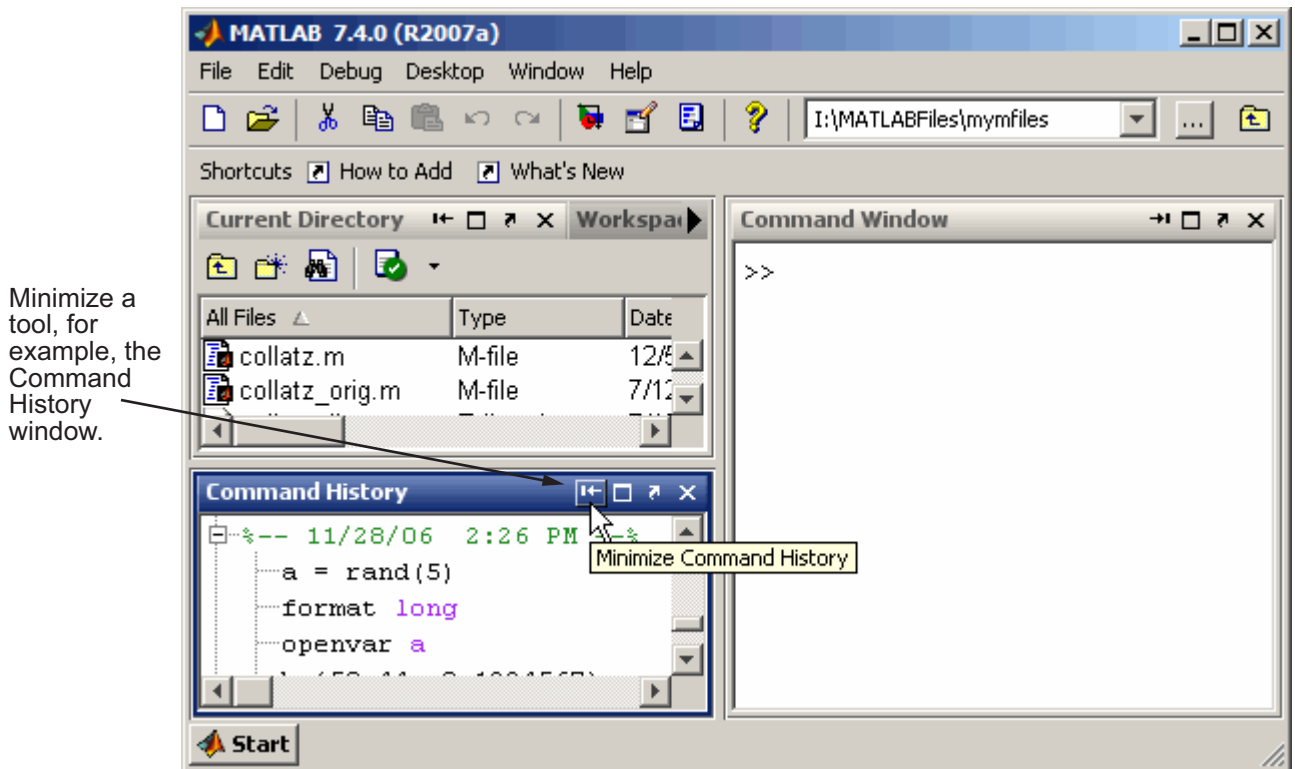
- “Minimize, Temporarily Display, and Restore Tools in the Desktop” on page 64
- “Maximize Tools in the Desktop” on page 68
- “Tabs for Tools Replaced by Title Bars” on page 70
- “Multithreaded Computation Support Added; Enable Via New Preference” on page 72

Minimize, Temporarily Display, and Restore Tools in the Desktop

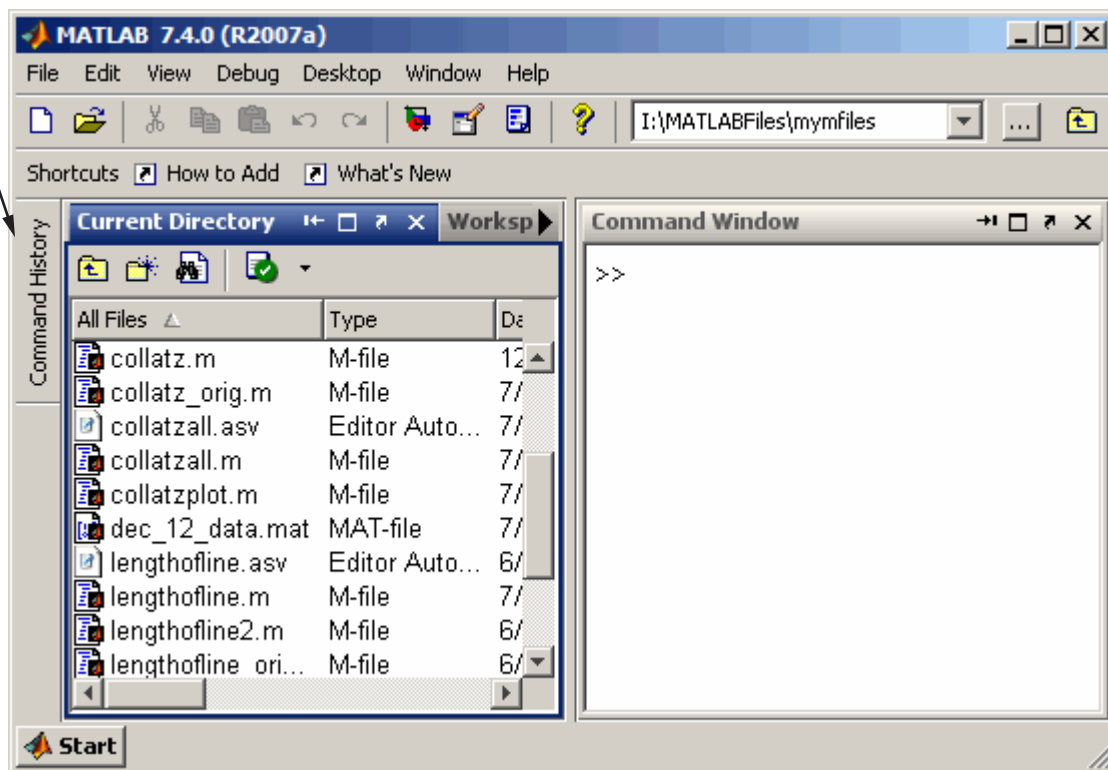
On Windows and UNIX platforms, you can minimize any tool in the desktop. Minimizing a tool creates a button for it along the specified edge. When you want to view the tool, hover over or click the button to temporarily show

it in the desktop. Right-click the button and select **Restore *toolname*** to return the tool to the desktop. Perform these tasks for the selected tool using items in the **Desktop** menu, equivalent mnemonics (for example **Alt+D, N** to minimize), or buttons on the tool's titlebar.

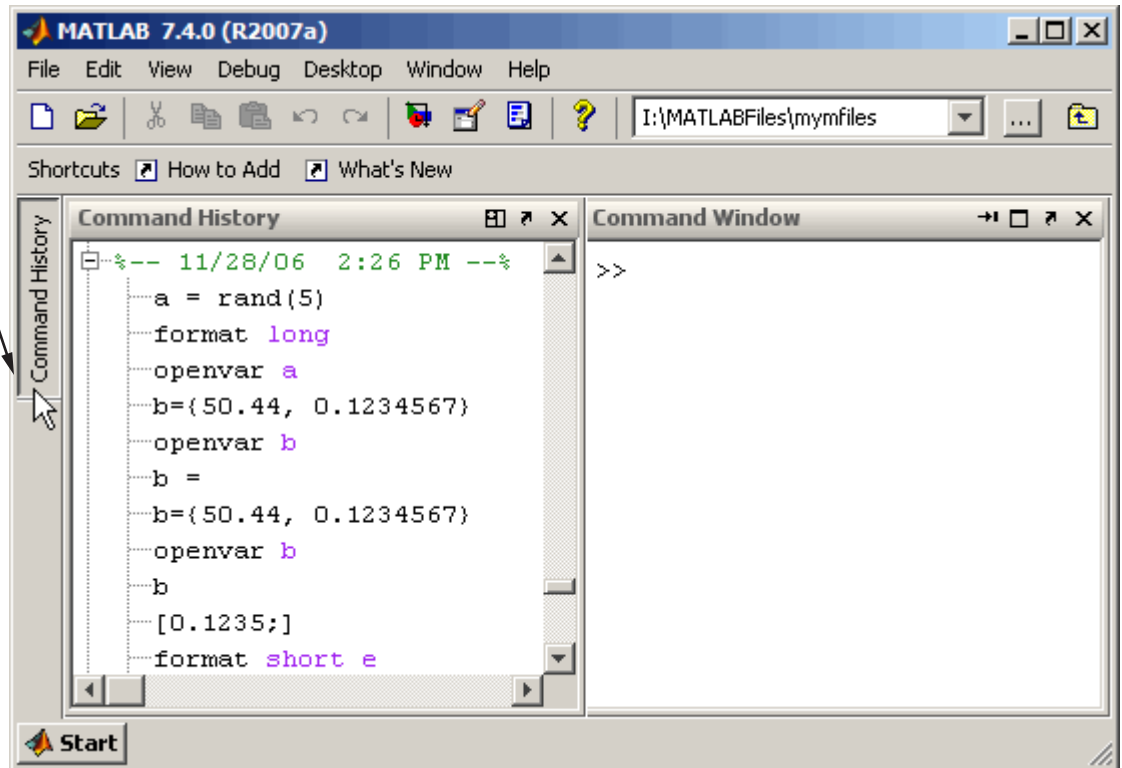
The following illustrations show how to use these features, using the example of the Command History window in the default desktop layout.



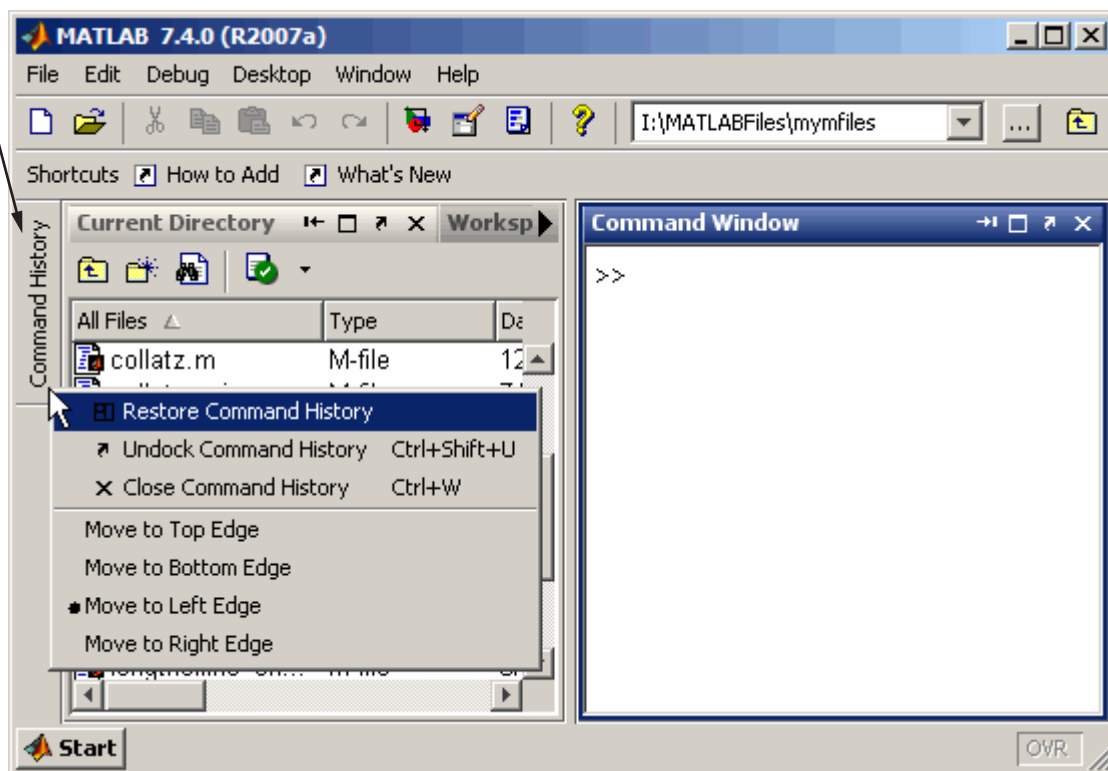
When minimized, a tool, such as the Command Window in this example, is represented by a button on the desktop border.



Hover over or click the button for a minimized tool to temporarily view the tool. The tool is temporarily displayed until you select another tool. Then the tool becomes minimized again.



On the button for a minimized tool, right-click, and from the context menu, select **Restore**. The tool resumes the size and position it had in the desktop before it was minimized.

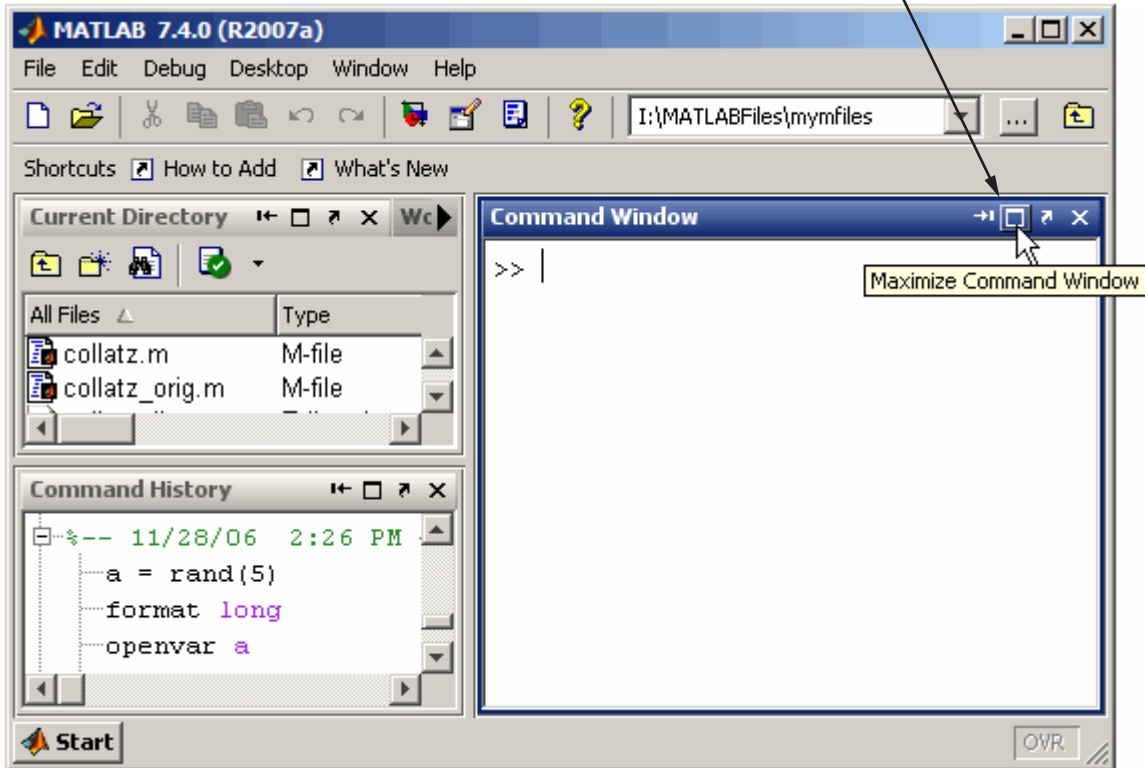


For more information, see “Opening and Arranging Tools” and “Minimized Tools in Desktop Example”.

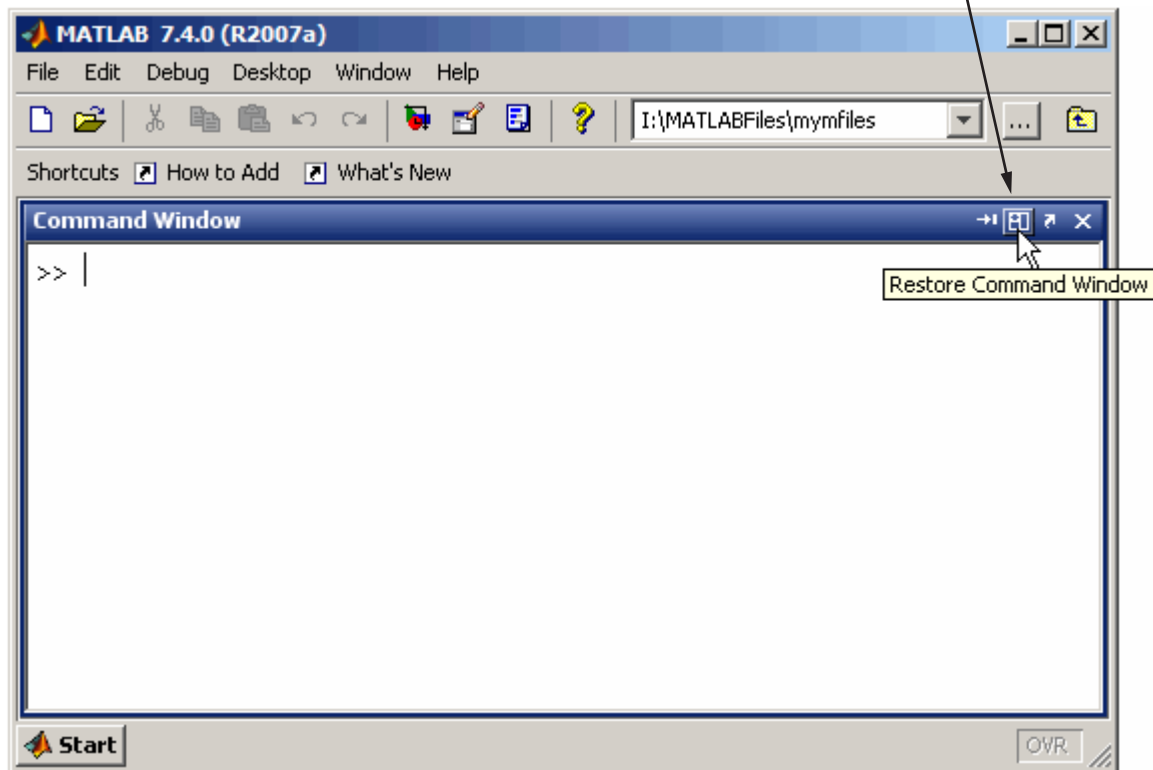
Maximize Tools in the Desktop

On Windows and UNIX platforms, you can maximize a tool so it occupies the entire MATLAB desktop tool area, then restore it to return it to its previous location. Perform these tasks for the selected tool using items in the **Desktop** menu, equivalent mnemonics (for example **Alt+D, X** to maximize), or buttons on the tool’s titlebar.

Default desktop layout.
Maximize a tool, for example, the Command Window
so it occupies the full MATLAB desktop area.



Maximized, the Command Window now occupies the full desktop area. Restoring the Command Window returns it to its original size and location in the desktop.



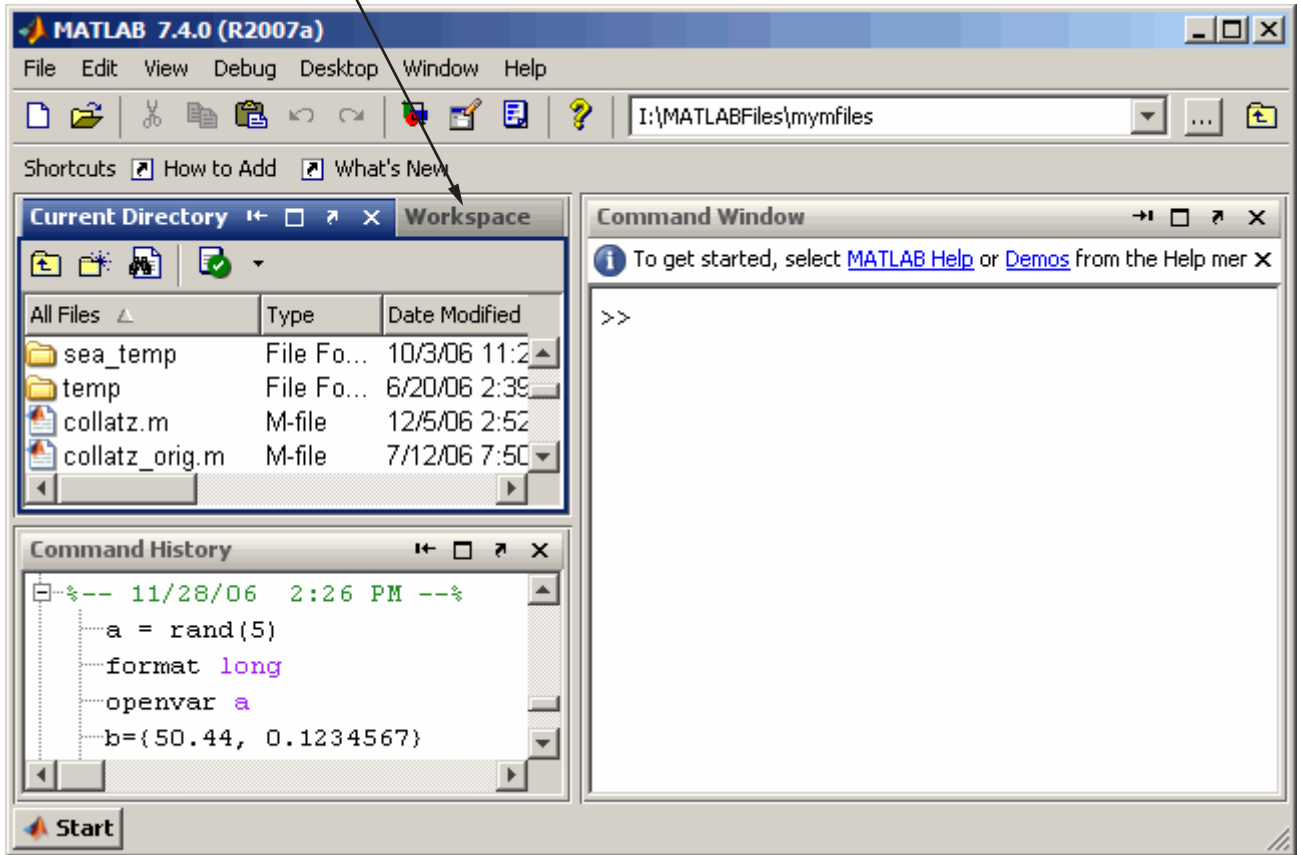
For more information, see “Opening and Arranging Tools” and “Maximized Tool in Desktop Example”.

Tabs for Tools Replaced by Title Bars

In the desktop, when you tab tools together, that is, arrange them so they occupy the same position, the tools’ title bars share the title bar area. To make a tool active, select its name in the title bar.

The Current Directory browser and Workspace browser are "tabbed together".

The name of the tool in the title bar serves as the tab. To make a tool active, click its name in the title bar. For example, click Workspace in the title bar to make the Workspace browser active.



For more information, see and “Tool Outside of Desktop and Other Tools Grouped Inside Desktop Example” and “Grouping Tools Together”.

Compatibility Considerations. In previous versions, tools tabbed together each had a tab at the bottom of the area they occupied. The tabs have been removed in favor of tools sharing the titlebar area.

Multithreaded Computation Support Added; Enable Via New Preference

If you run MATLAB on a multiple-CPU system (multiprocessor or multicore), use a new preference to enable multithreaded computation. This can increase MATLAB performance for element-wise and BLAS library computations.

By default the preference is not set, so you must set it to enable multithreaded computation. With the preference enabled, MATLAB automatically specifies the recommended number of computational threads, although you can change that value. On AMD-based Linux platforms, MATLAB supports multithreaded computation, but requires an extra step to change the default BLAS.

If you are using a multiple-CPU system, you can run a demo to see the performance impact—see *Multithreaded Computation* in the Help browser. For more information, see “Multithreading Preferences”.

Running Functions—Command Window and History

New features and changes introduced in Version 7.4 (R2007a) are

- “Startup Message Bar Replaces Startup Message in Command Window” on page 72
- “Command History Searching Enhanced” on page 73
- “Macintosh—Some Key Bindings in Command Window Changed” on page 73

Startup Message Bar Replaces Startup Message in Command Window

When you start MATLAB, a getting started message bar appears at the top of the Command Window, that provides links to information that is helpful for new users. You can dismiss the message bar by using the close box in it. Use Command Window preferences to specify whether or not the message bar should appear.

Command History Searching Enhanced

You can now find entries in the Command History window by typing the first few letters of an entry; the previous entry that begins with those letters is selected. Then use up and down arrow keys to extend the find to the next and previous instances. Use the **Ctrl** key with an arrow key to select the current as well as next or previous instances. Use **Ctrl+A** to find and highlight all instances at once. The search does not look at entries in sessions that are collapsed. For more information about this search feature, see “Finding Next Entry By Letter”.

Macintosh – Some Key Bindings in Command Window Changed

On Macintosh platforms, some key bindings were changed to make them more consistent with Macintosh standard behaviors.

Compatibility Considerations. Because key bindings you have been used to in the Command Window might have changed, peruse the list of all Macintosh key bindings, documented at “Keyboard Shortcuts in the Command Window”

Help

New features and changes introduced in Version 7.4 (R2007a) are

- “Demos Now Included in Search Results and Product Filtering” on page 73
- “Get URL of Displayed Page for Viewing on Web” on page 74
- “Include Search Database for Your Own Help Files” on page 74
- “Video Tutorials Now Accessed Via Web Site” on page 74

Demos Now Included in Search Results and Product Filtering

When you perform a search in the Help browser, the results now include code and text found in **Demos**. Also, the **Demos** listing in the Help Navigator pane now synchronizes with the demo currently open when you have the synchronization preference for the Help browser selected. For more information, see “Search Documentation and Demos with the Help Browser”.

When you select **File > Preferences > Help** and enable the Product Filter, only demos for selected products are shown in the **Demos** pane, and searched via the **Search for** field.

Get URL of Displayed Page for Viewing on Web

When viewing a page in the Help browser, select **View > Page Locations**. A window appears providing the location of the current Help page you are viewing. The window provides the page location on both your local system and the MathWorks Web site. Use this feature to

- Send the URL to someone else who wants to view that information and might not have MATLAB or the same version of MATLAB, for example, a colleague or technical support.
- More easily see if this same documentation page has been updated for the latest product version.

Include Search Database for Your Own Help Files

If you create your own HTML Help files for use with the MATLAB Help browser, the Help browser can now search the content of your files. First create a search database for your help files using the new `builddocsearchdb` function. The function creates a `helpsearch` directory that contains the search database files. For information on this process, see “Creating a Searchable Database”.

Compatibility Considerations. In previous versions of MATLAB, some users created help search databases for their own help files via assistance from MathWorks Technical Support. If you created a help search database for use with R2006b, it might work in R2007a, but it is recommended that you recreate it for R2007a, even if no content has changed. If you created a help search database prior to R2006b, you must recreate it for R2007a.

Help search databases in prior releases were built from a help jar file rather than html files. The `builddocsearchdb` function only supports html files. However, it is expected to support jar files in a future release. If you used a jar file for a prior version and want to use a jar file in R2007a, build your R2007a help search database using the same technique you used in R2006b.

Video Tutorials Now Accessed Via Web Site

Previously video tutorials were installed when you installed MATLAB. Now the tutorials are on the MathWorks Web site.

Compatibility Considerations. You can still link to and play video tutorials from within the Help browser Demos listings or other links to them in the product and documentation, however this now requires an active Internet connection.

Workspace, Search Path, and File Operations

New features and changes introduced in Version 7.4 (R2007a) are described here.

Current Directory Browser Enhancements

- When you double-click a Windows shortcut in the Current Directory browser, it runs the shortcut.
- When you double-click a prj file in the Current Directory browser, it opens in the Deployment Tool.
- You can now find entries in the Current Directory browser by typing the first few letters of an entry; the entry that begins with those letters is selected. For more information, see “Searching in the Current Directory Browser”

Workspace Browser

When you double-click an object, it opens in the Property Inspector.

Array Editor Enhancements

You can now undo and redo the last operation you performed in the Array Editor. This applies to cut, paste, insert, delete, and clear contents features.

Search Path Changes

On Windows platforms, MATLAB now adds the default startup directory, My Documents\MATLAB (or Documents\MATLAB on Vista), to the top of the search path upon startup.

Compatibility Considerations. In previous releases, MATLAB added the default startup directory, `Work`, to the bottom of the search path on Windows platforms. For example, in R2006b, it added `... \MATLAB\R2006b\Work` to the bottom of the search path. In R2007a, for consistency with previous releases, MATLAB adds `... \MATLAB\R2007a\Work` to the bottom of the search path. However, we encourage you to stop using the `Work` folder because support for it might be removed in a future release. For more information, see “Changes to Startup Directory (Folder) and Startup Options for MATLAB on Windows” on page 60.

Editing and Debugging M-Files

New features and changes introduced in Version 7.4 (R2007a) are

- “Stand-Alone Editor No Longer Opens By Default; To Be Removed in a Future Version” on page 76
- “Delimiter Matching Extended to Include Language Keyword Pairs” on page 77
- “M-Lint Automatic Correction Feature” on page 77
- “M-Lint Detection of Missing End-of-Line Semicolons Enhanced” on page 78
- “Macintosh—Some Key Bindings in Editor/Debugger Changed” on page 79
- “Other Changes in the Editor/Debugger” on page 79

Stand-Alone Editor No Longer Opens By Default; To Be Removed in a Future Version

Starting in this release, by default, double-clicking an M-file in Windows Explorer opens the file in the MATLAB Editor/Debugger rather than in the MATLAB stand-alone Editor. In a future version, the stand-alone Editor will not be provided with MATLAB.

Compatibility Considerations. The change to open M-files in the MATLAB Editor/Debugger rather than the stand-alone Editor was made based on many user requests. You can still use the MATLAB stand-alone Editor in this release by starting the application located at: `matlabroot\bin\win##\meditor.exe`.

Starting MATLAB by double-clicking an M-file requires a MATLAB license, while starting the stand-alone Editor does not require a MATLAB license.

If you want to associate M-files so that when you double-click them they open in the MATLAB stand-alone Editor rather than in the MATLAB Editor/Debugger, follow the instructions in “Changing File Associations for MATLAB from Windows”; rather than specifying the MATLAB executable, `matlab.exe`, specify `meditor.exe`, which is in the same folder.

Instead of the stand-alone Editor, you can use the MATLAB Editor/Debugger. It provides all the features of the stand-alone Editor plus some not found in the stand-alone Editor, such as debugging and tab completion; for a full list, see “Stand-Alone Editor Will Not Be Included in Next Version” on page 24.

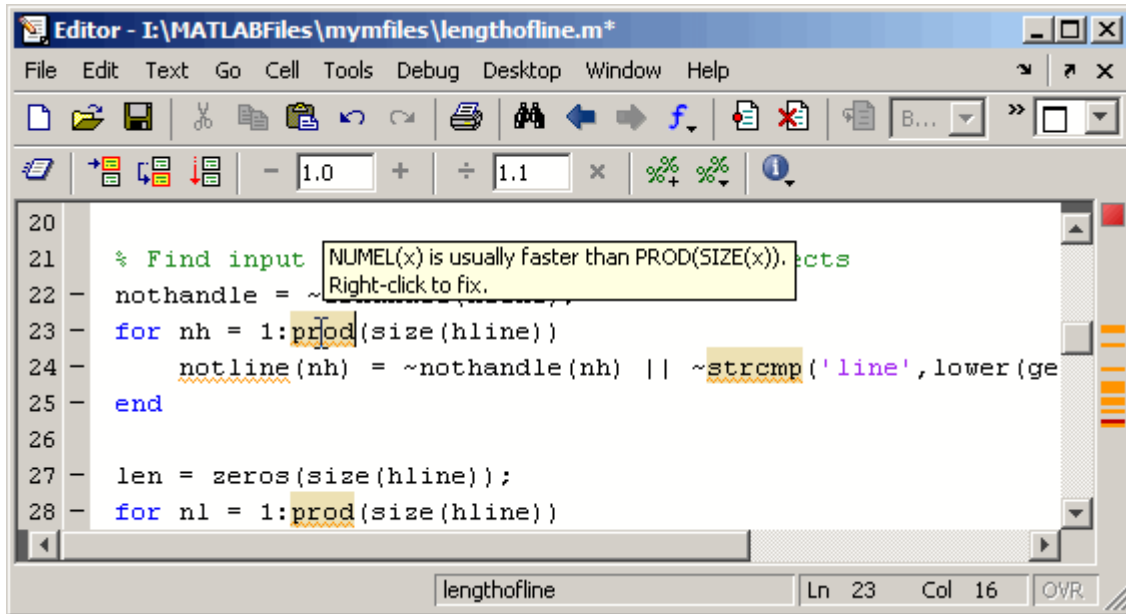
Some users have preferred the stand-alone Editor to the MATLAB Editor/Debugger because of slightly better startup performance and because it does not require a MATLAB license. For those situations, you can use any text editor you have, such as UltraEdit or Emacs. If you have concerns about the pending removal of the stand-alone Editor, please contact us at editor-feedback@mathworks.com, so we can plan to minimize transition issues.

Delimiter Matching Extended to Include Language Keyword Pairs

You can now see the match to language keyword pairs using delimiter matching features that previously existed for parentheses and brackets. For example, when you type `end`, the Editor/Debugger highlights the matching `if`. To set delimiter matching preferences, select **File > Preferences > Keyboard > Delimiter Matching**; click **Help** for more information.

M-Lint Automatic Correction Feature

For some types of warnings or errors, M-Lint can apply an automatic fix to the code. Code that can be automatically corrected appears with a different background color. To perform the fix, right-click the code that is highlighted (for a single single-button mouse, use **Ctrl+click**); from the resulting context menu, select the auto-fix action.



For more information, see step 7 in the example at “M-Lint Automatic Code Analyzer in the Editor/Debugger”.

M-Lint Detection of Missing End-of-Line Semicolons Enhanced

In previous versions, there was a single output message generated by a line with a missing terminating semicolon:

```
Terminate statement with semicolon to suppress output.
```

However, M-Lint suppressed displaying the message for files with three or more cells (a cell being indicated by a line with an initial %). This was done based on the assumption that such files were demo programs, and therefore display of the output was intentional.

In MATLAB Version 7.4 (R2007a), M-Lint no longer makes a distinction for files with three or more cells. Instead, M-Lint displays one message for scripts and a different message for functions:

```
Terminate statement with semicolon to suppress output (in functions).
Terminate statement with semicolon to suppress output (in scripts).
```

The corresponding M-Lint tags to suppress display of such messages within a line are `%#ok<NOPRT>` for functions, and `%#ok<NOPTS>` for scripts.

By default, both of the messages are initially selected in Preferences.

Compatibility Considerations. In MATLAB Version 7.3 (R2006b), `%#ok<NOPRT>` was the only tag used to suppress the missing terminating semicolon. The tag will remain valid for function files, but will not be valid for script files. If you added any `%#ok<NOPRT>` tags in script files in R2006b, change those tags to the new tag `%#ok<NOPTS>`.

Macintosh—Some Key Bindings in Editor/Debugger Changed

On Macintosh platforms, some key bindings were changed to make them more consistent with Macintosh standard behaviors.

Compatibility Considerations. Because key bindings you have been used to in the Editor/Debugger might have changed, peruse the list of all Macintosh key bindings documented at “Keyboard Shortcuts in the Editor/Debugger”.

Other Changes in the Editor/Debugger

- There is a new confirmation preference for displaying a warning about exiting debug mode in order to save a file.

Tuning and Managing M-Files

There was a minor change in M-Lint behavior—for details, see “M-Lint Detection of Missing End-of-Line Semicolons Enhanced” on page 78.

Compatibility Considerations

See the compatibility considerations associated with “M-Lint Detection of Missing End-of-Line Semicolons Enhanced” on page 78.

Publishing Results

New features and changes introduced in Version 7.4 (R2007a) are

- “Publishing Function M-Files Now Supported” on page 80

- “Specify Maximum Number of Output Lines in Published File” on page 80
- “New Publishing Options” on page 80

Publishing Function M-Files Now Supported

You can now publish an M-file function. When publishing an M-file function, you cannot evaluate the code. This feature effectively allows you to save M-file functions to output formats such as HTML or Microsoft Word documents, with formatting. To publish an M-file function, first clear the **Evaluate code** preference in **Editor/Debugger Publishing Preferences**, or run the publish function with the `evalCode` option set to `false`.

Specify Maximum Number of Output Lines in Published File

Using the `publish` function, you can specify the maximum number of lines in a published file. Set the new `maxOutputLines` field to a nonnegative value. The default value is `Inf`.

New Publishing Options

New publishing options provide increased flexibility and control over the appearance of the published document. The added options are for adding inline links, inline links with link text, graphics, and HTML markup. See “Marking Up Text in Cells for Publishing” for more information.

Mathematics, MATLAB Version 7.4 (R2007a)

New features and changes introduced in this version are:

- “New Functions” on page 81
- “More Efficient Matrix Multiplication for Sparse Matrices” on page 81
- “rand Function Uses the Mersenne Twister Algorithm as Default” on page 81
- “Upgrade to BLAS Libraries” on page 83
- “Divide By Zero and Log Of Zero Warnings Off By Default” on page 83
- “mode of Empty Array Now Returns NaN” on page 83
- “Change to Syntax for Setting BLAS Library Version on Linux” on page 84

New Functions

Function	Description
bsxfun	Applies an element-by-element binary operation to two full arrays with singleton expansion enabled
ilu	Performs the sparse incomplete LU factorization

More Efficient Matrix Multiplication for Sparse Matrices

Matrix multiplication for $A' * b$ now handles sparse matrices more efficiently.

rand Function Uses the Mersenne Twister Algorithm as Default

The rand function now uses the Mersenne Twister algorithm as default generator algorithm. This method generates double precision values in the closed interval $[2^{-53}, 1-2^{-53}]$, with a period of $(2^{19937}-1)/2$. Prior to this release, MATLAB used an algorithm known as the Subtract-with-Borrow (SWB) algorithm.

The `rand` function now produces different results than in previous releases. However, the results returned are still pseudorandom values drawn from a standard uniform distribution. Because the values returned by `rand` are intended to be random, this change should not affect your code.

Compatibility Considerations

There are several things to keep in mind regarding this change:

- If your code requires the exact values returned by `rand` in previous releases, you should use the statement

```
rand('state',0);
```

to reset `rand` to use the SWB algorithm. The new default algorithm's internal state at startup is equivalent to using the statement

```
rand('twister',5489);
```

Note that the `'state'` keyword corresponds specifically to the SWB algorithm; it cannot be used generally to refer to the internal state of the currently active algorithm.

- Existing code that uses the `'state'` keyword to reinitialize `rand` in a statement such as

```
rand('state',sum(100*clock))
```

causes `rand` to switch to using the SWB algorithm. You may want to use the `'twister'` keyword, which resets `rand` but does not switch algorithms.

- Existing code that uses the `'state'` keyword to save and restore the internal state of `rand` in statements such as

```
savedState = rand('state');  
... % code that uses rand  
rand('state',savedState);
```

may no longer work as intended. Specifically, the first line of code saves the state of the SWB generator algorithm (see the `rand` documentation for details). If the default Mersenne Twister algorithm was the active one at that time, then using the saved state in the last line does not restore the

rand internal state to its original conditions. Instead, it switches the rand algorithm to SWB. To save and restore the internal state of the Mersenne Twister algorithm, use the 'twister' keyword.

Upgrade to BLAS Libraries

MATLAB now uses new versions of the Basic Linear Algebra Subroutine (BLAS) libraries. For Windows, Intel Mac, and Intel processors on Linux platforms, MATLAB supports the Intel Math Kernel Library (MKL) version 9.0. For AMD processors on Linux platforms, MATLAB uses the AMD Core Math Library (ACML) version 3.5. For the Solaris platform, MATLAB uses the Sun Performance Library from Sun Studio 11.

Divide By Zero and Log Of Zero Warnings Off By Default

MATLAB no longer displays Divide by zero and Log of zero warnings unless you explicitly enable them with the following commands:

```
warning on MATLAB:divideByZero  
warning on MATLAB:log:LogOfZero
```

This only affects the display of the warning message on the screen; the warning status is still updated as usual.

Compatibility Considerations

This change should not cause any incompatibility with your existing code in this release. In future releases, in which internal MATLAB code will not necessarily disable these warning messages, you may see messages displayed that are currently suppressed.

mode of Empty Array Now Returns NaN

The mode function, when operating on an empty array (`[]`), returns a 1-by-0 array in previous releases, while related functions mean, median, std, and var return NaN when given the same input. In this release, mode returns NaN for an empty array input.

Compatibility Considerations

Existing program code that relies on mode of an empty array to return an empty array should be modified.

Change to Syntax for Setting BLAS Library Version on Linux

If you change the BLAS library used by MATLAB on Linux platforms, MATLAB now loads libraries in the left-to-right order specified in the syntax. For example, to load the Intel MKL BLAS, from a system prompt, run

```
setenv BLAS_VERSION mk1.so:mk1compat.so
```

MATLAB loads `mk1.so` first, and then loads `mk1compat.so`.

This also applies if you edit `bin\$(ARCH)\blas.spec` directly.

Compatibility Considerations

This syntax differs from that used for Linux platforms in prior versions.

Data Analysis, MATLAB Version 7.4 (R2007a)

There were no new features or changes in this version.

Programming, MATLAB Version 7.4 (R2007a)

New features and changes introduced in this version are:

- “New Functions” on page 86
- “Multithreading with MATLAB” on page 87
- “Parse Inputs with Consistently Implemented Mechanism” on page 87
- “textscan Returns Like Values in Same Cell Array” on page 87
- “Numbered Arguments for Formatted String Functions” on page 88
- “The dir Function Returns Additional datenum Field” on page 89
- “Using whos -file on Objects with Overloaded size or class Methods” on page 89
- “mat2str Returns Correct Output for Strings” on page 90
- “Warning Generated by try-catch” on page 90
- “save -regexp Saves to Correct Filename” on page 92
- “Functions Not Callable If in Directory Under Class Directory” on page 92
- “Improved Performance on Certain Platforms and Operations” on page 92
- “Technique to Conserve Memory on Windows Vista” on page 93
- “ispuma Function Deprecated” on page 93

New Functions

New Functions in this release are

Function	Description
assert	Generates an error when a specified condition is violated. Displays either the default error message or one that you have written.

Function	Description
<code>ismac</code>	Returns <code>true</code> if you are currently running one of the Mac OS X versions of MATLAB.
<code>verLessThan</code>	Compares the specified version number and toolbox name with the version of that same toolbox that is currently running. Use <code>verLessThan</code> in your functions when you want to write code that can run across multiple versions of MATLAB.

Multithreading with MATLAB

You can improve the performance of MATLAB on multicore or multiprocessor systems by taking advantage of the multithreaded computational capabilities available in MATLAB in this release. See the following release note under Desktop Tools and Development Environment for more information: “Multithreaded Computation Support Added; Enable Via New Preference” on page 72

Parse Inputs with Consistently Implemented Mechanism

The new `inputParser` class provides a consistent mechanism for parsing and validating input arguments in the M-file functions you write. Using `inputParser` methods in the body of your function, you build a schema that represents each valid input argument to the function. In the schema, you can specify whether arguments are required or optional, and if they are to be passed as single values or as parameter-value pairs. The schema also provides a means of validating each incoming argument. The properties of the `inputParser` class give you additional information about arguments that are passed to the function.

For more information, see “Parsing Inputs with `inputParser`” in the MATLAB Programming documentation.

`textscan` Returns Like Values in Same Cell Array

In previous versions of MATLAB, the `textscan` function always returned each output value in a separate cell array, even if those values were of the same

data type. In this release, if you call `textscan` with the new `CollectOutput` switch, MATLAB returns all consecutive data that is of the same type in the same cell array. This can save you the extra task of sorting through the output and merging like data types together in your own code.

For more information, see the `textscan` function reference page.

Numbered Arguments for Formatted String Functions

Using numbered argument specification with MATLAB functions that employ format specifiers such as `%d` or `%s` (e.g., `sprintf`, `error`), you can pass the numeric and character string values that correspond to these format specifiers in a varying order. This can be useful when translating format strings in a different sentence structure.

In addition to identifying the values, you can also use numbered arguments to specify the field width and precision of the format specifiers. In the following example, the first format specifier in the `sprintf` command is `%1$*4$f` (quite different from the usual `%f` specifier). The `1$` tells MATLAB that the value that is to replace this format specifier is in the first argument following the format string; that is, `123.45678`. The `*4$` indicates that the field width for this specifier is being passed in the fourth argument following the format string: `15`.

In the second and third arguments (`%2$. *5$f` and `%3$*6$. *7$f`), the symbols `2$` and `3$` represent the values, `*5$` and `*7$` represent precisions, and `*6$` represents field width:

```
sprintf('%1$*4$f  %2$. *5$f  %3$*6$. *7$f', ...  
123.45678, 16.42837, pi, 15, 3, 6, 4)  
  
ans =  
123.456780  16.428  3.1416
```

For more information, see “Formatting Strings” in the MATLAB Programming documentation.

The dir Function Returns Additional datenum Field

The `dir` function now returns the date the file or directory was last modified in two formats: string and numeric. The numeric date value is not specific to any particular locale, and thus is compatible for international use:

```
fileinfo = dir('myfile.txt')

fileinfo =
    name: 'myfile.txt'
    date: '16-Mar-2006 13:34:01'
    bytes: 251
    isdir: 0
    datenum: 7.3275e+005
```

This new output is also returned when running `dir` on an FTP server.

Using whos -file on Objects with Overloaded size or class Methods

MATLAB is unable to determine the true size of an object stored in a MAT-file if the class of this object overloads the MATLAB `size` function. Likewise, MATLAB cannot determine the true class name of an object if it overloads the MATLAB `class` function. For these reasons, in previous versions of MATLAB, the command `whos -file` does not return or display object size and class accurately if the class of that object overloads these methods, but instead always returns `1x1` for the size and a default name for the class.

In this release, `whos -file` returns the empty matrix (`[]`) or displays a hyphen (`-`) for objects that overload `size`, and returns and displays unknown for objects that overload `class`.

Compatibility Considerations

If you use `whos -file` on objects in any of your programs, and if any of these objects overloads the `size` function, then you need to be aware that MATLAB now returns `[]` instead of a 2–element vector of ones in the `size` field of the output structure.

mat2str Returns Correct Output for Strings

The documentation for the `mat2str` function states that the `str` output of this function “is suitable for input to the `eval` function such that `eval(str)` produces the original matrix to within 15 digits of precision.” The behavior of `mat2str` when given a character array as input, however, did not abide by this rule. This inconsistency has been fixed in this release.

In MATLAB Version 7.3, the `eval` command below generated an error.

```
s = mat2str('MATLAB')
s =
    'MATLAB'

eval(s)
ans =
    MATLAB
```

Compatibility Considerations

You might have to modify M-file programs that expect the previous behavior from `mat2str`.

Warning Generated by try-catch

To accommodate future changes in the MATLAB error-handling capabilities, there is a new restriction to the syntax of the `try-catch` block. When the first MATLAB statement that follows the `try` keyword consists of just a single term (e.g., `A` as opposed to `A+B`) occurring on the same line as the `try`, then that statement and the `try` keyword should be separated by a comma. For example, the line

```
try A
```

should be written as either

```
try, A
```

or on two lines as

```
try
    A
```

This affects only single-term statements. For example, the following statement continues to be valid:

```
try A+B
```

The same holds true for the `catch` keyword and a single-term statement following the keyword on the same line. A valid try-catch statement of this type should be composed as follows:

```
try, A, catch, B, end
```

If you omit the commas following `try` and/or `catch`, your code will continue to operate correctly. However, MATLAB will issue a warning:

```
try statements, catch statements, end
```

Warning: This try-catch syntax will continue to work in R2007a, but may be illegal or may mean something different in future releases of MATLAB.

As with previous releases, the recommended syntax for a try-catch block is as follows:

```
try
    try_statements
catch
    catch_statements
end
```

Note Due to a bug in the R2007a release, the warning for a catch followed immediately by a single term is thrown as an error, even though the text of the message says that it is a warning.

Compatibility Considerations

Your M-file programs may generate the warning shown above if the correct syntax for `try` and `catch` is not used.

save -regexp Saves to Correct Filename

In previous releases, the following command mistook the `-regexp` argument (`[ab]` in the case shown below) to be the name of the file to save to:

```
save -regexp [ab]
```

In this release, the filename is correctly understood to be the default save filename, `matlab.mat`, and any arguments that follow the `-regexp` flag and precede the next flag are interpreted as patterns to be matched.

Functions Not Callable If in Directory Under Class Directory

M-files placed in a directory that is one or more levels beneath a MATLAB class directory are not callable from that same directory. A MATLAB class directory contains methods of a class and has a filename that begins with the `@` character.

In the following example, function `myfun1` is not callable if the current working directory is set to `dir1`. The same holds true for `myfun2` if the current working directory is set to `dir2`.

```
\home\matlab\@myobj\dir1\myfun1.m  
\home\matlab\@myobj\dir1\dir2\myfun2.m
```

This behavior existed in the R2006b release, as well as in this release.

Compatibility Considerations

You will no longer be able to call a file that is one or more levels beneath a MATLAB class directory if your current working directory is set to that same directory.

Improved Performance on Certain Platforms and Operations

As of release R2006b, MATLAB offers improved performance in the following areas:

- Improved performance on 64-bit Windows XP and Linux platforms. This is independent of the size of data set in use.
- Faster scalar indexing into cell arrays.
- Faster assignment of cell array data to variables.

Technique to Conserve Memory on Windows Vista

To conserve memory on machines running Windows Vista, you can reduce the amount of virtual memory space reserved by the operating system by using the command:

```
BCDEdit /set increaseuserva 3072
```

More documentation on this option can be found at the following URL:

<http://msdn2.microsoft.com/en-us/library/aa906211.aspx>

ispuma Function Deprecated

Because MATLAB no longer supports OSX 10.1, the `ispuma` function always returns `false` in this release, and also displays a warning message that the function is now deprecated. Support for `ispuma` will be removed in a future release of MATLAB.

Compatibility Considerations

It is recommended that you remove calls to `ispuma` from your M-file functions.

Graphics and 3-D Visualization, MATLAB Version 7.4 (R2007a)

New features and changes introduced in this version are:

- “Nudging Annotations with Arrow Keys” on page 94
- “Movies No Longer Play During Loading” on page 94
- “Ghostscript Printing Software Upgraded” on page 95
- “Property Inspector Now Categorizes Graphic Object Properties” on page 95
- “Figure WindowScrollWheelFcn Property Programs Scrollwheel Events” on page 97
- “Figure KeyReleaseFcn Property Programs Key Release Events” on page 97

Nudging Annotations with Arrow Keys

In plot edit mode, annotations such as textboxes, lines, arrows, doublearrows, and text now respond to pressing directional arrow keys. Each keypress will move the selected annotation(s) one or more pixels in the indicated direction. If you select multiple objects, they all move together in response to arrow key strokes. Normally, selected objects move one pixel with each press of an arrow key. If you have selected **Snap to Layout Grid** from the **Tools** menu, each keypress makes objects move to the next grid position.

Movies No Longer Play During Loading

The `movie` function no longer plays each frame one extra time. Previously, it would show frames as they were loaded into memory to speed up display. This behavior is no longer required and has been eliminated.

Compatibility Considerations

If you have code that calls `movie` in a loop a certain number of times and want that number to remain the same, you need to add one iteration to the loop.

Ghostscript Printing Software Upgraded

The Ghostscript software used by some print devices has been upgraded from an older version to Version 8.54. Starting in this release, the MathWorks is no longer shipping a separate, standalone Ghostscript executable program.

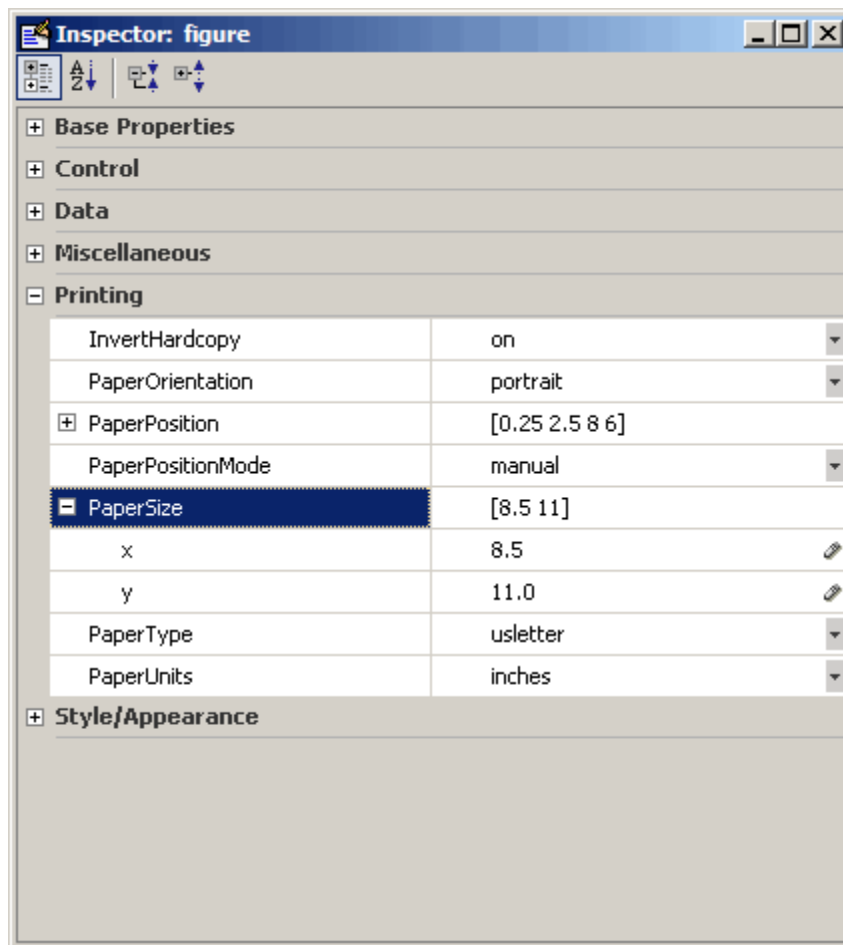
Compatibility Considerations

If you have written M-code based on undocumented functions that called the old version of Ghostscript, your code will no longer work.

As a consequence of this upgrade, support for printing on DEC LN03 printers (`print dln03`) has been removed from MATLAB.

Property Inspector Now Categorizes Graphic Object Properties

The Property Inspector (accessed via the Property Editor, GUIDE, and the `inspect` function) now provides tree views of groups of graphic object properties as well as an alphabetical list of all properties. You can switch between views via the two buttons at the top of the window, as shown in the following picture of the tree view of the Printing category:



In addition, the type of object currently being inspected is now shown in the title bar of the Property Inspector window. Formerly it was shown in the gray area below the title bar, which now contains the view manipulation buttons.

To change view, click a button without the blue background (the collapse and expand buttons at right are disabled in alphabetic list view). When you change views, the selected property stays the same. To inspect properties of graphic objects in the tree view, click the + icon next to a category of interest. Do the same to open properties within a category that have multiple elements.

Note that only Handle Graphics® objects have categories; annotation and most other MATLAB objects can be displayed only in alphabetic list view.

The functionality of the Property Inspector has not changed; only its GUI has. As previously, if you select a set or array of objects and inspect them, the Property Inspector only displays those properties that all the objects share.

For details on using the Property Inspector, see “Accessing Object Properties with the Property Inspector” in the MATLAB Graphics documentation and the inspect MATLAB reference page.

Compatibility Considerations

Text that you type or delete after clicking a text field that has a text widget icon (for example, `XTickLabel`), will not persist unless you press **Return** before clicking elsewhere. This mimics the behavior of clicking the text widget icon to open a text entry dialog box, typing into it, and accepting the result by clicking **OK**. This behavior differs from that which existed prior to R2006b (MATLAB 7.3).

Figure WindowScrollWheelFcn Property Programs Scrollwheel Events

The new figure property `WindowScrollWheelFcn` enables you to write a callback function that handles mouse wheel scrolling events while the figure has focus. See the documentation for the figure `WindowScrollWheelFcn` for more information.

Figure KeyReleaseFcn Property Programs Key Release Events

The new figure property `KeyReleaseFcn` enables you to write a callback function that handles key release events (analogous to `KeyPressFcn`). See the documentation for the figure `KeyReleaseFcn` for more information.

Creating Graphical User Interfaces (GUIs), MATLAB Version 7.4 (R2007a)

New features and changes introduced in this version are:

- “GUIDE No Longer Copies Callbacks When You Duplicate Components” on page 98
- “GUIDE M-File-Defined handles Structure Fields No Longer Become Permanent” on page 98
- “UNIX: File Dialog 'Location' Property Is Obsolete” on page 99
- “Functions Becoming Obsolete” on page 99

GUIDE No Longer Copies Callbacks When You Duplicate Components

In GUIDE, when you copy a component for which one or more of its callback properties are defined, the callback properties of the newly created component are now set to their default values, the ones you get when adding a component directly from the Component Palette. Previously, their values were copied from the corresponding callback properties of the original component. New callback subfunctions can be generated in the GUI M-file for the new component in the same way as for any component in the GUIDE layout.

Compatibility Considerations

If you have relied on the old behavior, in which the callbacks properties of the new component point to the callbacks of the original component, you will now have to explicitly change the callback properties, using the Property Inspector, to do that.

GUIDE M-File-Defined handles Structure Fields No Longer Become Permanent

The handles structure that is provided to every GUIDE generated callback subfunction in the GUI M-file is constructed at runtime every time the GUI runs. When the GUI is fully initialized, the handles structure contains only handles to all the components in the GUI and custom data added in

any `CreatedFcn` callbacks and/or the `OpeningFcn`. Previously, fields that the M-file had added to the `handles` structure could sometimes become a permanent part of the structure.

Compatibility Considerations

If your GUI runs well but displays error messages about missing fields in the `handles` structure when starting up, you may have to update the code in the GUI M-file where those fields are accessed. You may need to initialize those `handles` fields properly in a `CreateFcn` callback and/or in the `OpeningFcn`.

UNIX: File Dialog 'Location' Property Is Obsolete

For UNIX platforms, the `Location` property of `uigetfile` and `uiputfile` is obsolete. Previously, for UNIX platforms only, you could use the `Location` property to specify the screen location at which the dialog box would originally be displayed.

Compatibility Considerations

Since the UNIX `uigetfile` and `uiputfile` `Location` property is now obsolete, MATLAB ignores any occurrences in existing code of the `Location` property

```
uigetfile(...,'Location',[X Y])
```

or the older use of `X` and `Y` arguments to specify location

```
uigetfile(...,X,Y)
```

A warning is displayed for either syntax, on all platforms.

Functions Becoming Obsolete

The following functions are either obsolete or grandfathered in MATLAB 7.4 (R2007a): `cshelp`, `figflag`, `getstatus`, `menulabel`, `popupstr`, `setstatus`, `hidegui`, `uigettoolbar`.

Compatibility Considerations

The functions shown in the following table will continue to work but their use may generate a warning message. As soon as possible, replace any

occurrences you may have of these functions with the function(s) shown in the following table, if any, or with other suitable code.

Function	Replacement
<code>cshelp</code> , <code>figflag</code> , <code>getstatus</code> , <code>menulabel</code> , <code>popupstr</code> , <code>setstatus</code>	Grandfathered. There are no replacements. No enhancements will be made and only critical bugs will be fixed. No warnings will be displayed. These functions may become obsolete if replacements become available.
<code>hidegui</code>	Obsoleted. Now issues warnings. Set the figure <code>HandleVisibility</code> property instead.
<code>uigettoolbar</code>	Obsoleted. No warnings will be displayed until a replacement is available in a future release.

External Interfaces/API, MATLAB Version 7.4 (R2007a)

New features and changes introduced in this version are:

- “New File Extensions for MEX-Files” on page 101
- “MEX-Files Built in MATLAB R11 or Earlier Must Be Rebuilt” on page 102
- “Changes to Compiler Support” on page 102
- “New COM Features” on page 106
- “Changes to Handling ActiveX Methods” on page 107

New File Extensions for MEX-Files

MEX-Files in MATLAB for Intel-based Macintosh

With the introduction of MATLAB for Intel-based Macintosh, the MEX-files you build have the extension `.mexmaci`. The `mexext` command in MATLAB returns `mexmaci` for Macintosh (Intel).

Compatibility Considerations. MEX-files built using MATLAB for Macintosh PowerPC, which have `.mexmac` extensions, cannot be used in MATLAB for Intel-based Macintosh.

Note All MEX-files on Macintosh platforms need to be recompiled for R2007a.

MEX-Files in MATLAB for 64-bit Solaris SPARC

With the introduction of MATLAB for 64-bit Solaris SPARC, you can now build 64-bit MEX-files for the Solaris platform. These MEX-files have the extension `.mexs64`. The `mexext` command in MATLAB returns `mexs64` for Solaris SPARC.

Compatibility Considerations. MEX-files built using MATLAB for Solaris 32, which have `.mexsol` extensions, cannot be used in MATLAB for Solaris SPARC.

Note All MEX-files on Solaris 64 platforms need to be recompiled for R2007a.

MEX-Files Built in MATLAB R11 or Earlier Must Be Rebuilt

In order to work with MATLAB V7.4 (R2007a), MEX-files compiled on Windows (32-bit) platforms with MATLAB R11 or earlier will no longer load correctly and must be recompiled. These files can be compiled with MATLAB R12 or later.

Changes to Compiler Support

The set of compilers that MATLAB supports has changed in MATLAB Version 7.4 (R2007a). For an up-to-date list of supported compilers, see Technical Note 1601: <http://www.mathworks.com/support/tech-notes/1600/1601.html>.

- “New Compiler Support” on page 102
- “Fortran Compatibility Considerations” on page 104
- “Discontinued Compiler Support” on page 104
- “Compiler Support To Be Phased Out” on page 105
- “Additional Linker Support for Intel Fortran” on page 105

New Compiler Support

MATLAB V7.4 (R2007a) supports new compilers for building MEX-files.

Windows (64-bit) platform.

- Intel C++ version 9.1
- Intel Visual Fortran version 9.1

Windows (32-bit) platform.

- Intel C++ version 9.1
- Intel Visual Fortran version 9.1

- Microsoft Visual C++ 2005 version 8.0 Express Edition

Note If you use the `mex -f` `matlabroot/bin/$ARCH/mexopts/msvc80freeopts.bat` switch to build a MEX-file using Microsoft Visual C++ 2005 Express Edition, the environment variable `MSSdk` must be defined. The value of this environment variable is the path to the installation directory for Microsoft Platform SDK for Windows Server 2003. (Microsoft Visual C++ 2005 Express Edition requires Microsoft Platform SDK for Windows Server 2003.)

Macintosh PowerPC and Intel-based platforms.

- Apple Xcode 2.4.1 (gcc / g++ version 4.0.1)
- g95 version 0.90

Note All MEX-files on Macintosh platforms need to be recompiled for R2007a.

Linux (64-bit) platform.

- gcc / g++ version 4.1.1
- g95 version 0.90

Linux (32-bit) platform.

- gcc / g++ version 4.1.1
- g95 version 0.90

Note All Fortran MEX-files compiled on Linux platforms need to be recompiled for R2007a.

Solaris SPARC (64-bit) platform.

- cc / CC version 5.8
- gcc / g++ version 3.2.3
- f90 version 8.2

Fortran Compatibility Considerations

In R2007a we have added support for a new Fortran compiler g95 on the Linux and Macintosh platforms. This compiler implements the Fortran 95 language standard. It replaces previously supported Fortran compilers which implemented a previous language standard.

This may cause incompatibilities in your Fortran source code for MEX-files. Refer to the IBM XL Fortran V10.1 for Linux Language standards Web site <http://publib.boulder.ibm.com/infocenter/lnxpcmp/v8v101/index.jsp?topic=/com.ibm.xlf1011.doc/xlf1r/languagestandards.htm> for information about incompatibilities between language standards.

Discontinued Compiler Support

The following compilers are no longer supported.

Linux (64-bit) platform.

- gcc / g++ version 3.4.5
- g77 version 3.4.5

Linux (32-bit) platform.

- gcc / g++ version 3.4.5
- g77 version 3.4.5

Macintosh PowerPC platform.

- gcc / g++ version 3.3
- Absoft f77 / f90 version 8.2a

Compatibility Considerations. To ensure continued support for building your C/C++ programs, consider upgrading to another supported compiler. For an up-to-date list of supported compilers, see Technical Note 1601: <http://www.mathworks.com/support/tech-notes/1600/1601.html>.

Compiler Support To Be Phased Out

The following compilers are supported in Version 7.4 (R2007a) but will not be supported in a future version of MATLAB.

Windows (32-bit) platform.

- Intel C++ version 7.1
- Intel Visual Fortran 9.0
- Borland C++ Builder 6 version 5.6
- Borland C++ Builder 5 version 5.5
- Borland C++ Compiler version 5.5
- Compaq Visual Fortran version 6.6
- Compaq Visual Fortran version 6.1

Additional Linker Support for Intel Fortran

MATLAB V7.4 (R2007a) supports new linkers for building MEX-files with Intel Visual Fortran 9.0.

Windows (32-bit) platform.

- Microsoft Visual Studio .NET 2003
- Microsoft Visual Studio 2005

Windows (64-bit) platform.

- Microsoft Visual Studio 2005
- Microsoft Platform SDK for Windows Server 2003 (Build 1289 or later)

New COM Features

Programmatically Connect to Instances of a COM Automation Server

MATLAB can now programmatically connect to an instance of a COM Automation server using the new `actxGetRunningServer` function.

Improve the Custom Interface API

Changes to the `actxserver` function allow you to create a COM Automation server using a custom interface.

New COM Data Type Support

Additional COM data type support has been added. See “Handling COM Data in MATLAB” for a description of supported data types.

Enhanced Support for COM Interface Events

MATLAB users can take full advantage of event interfaces provided by COM Automation servers. This change is implemented in the `events`, `eventlisteners`, `isevent`, `registerevent`, `unregisterevent`, and `unregisterallevts` functions.

For an example of this feature, see “Responding to Interface Events from an Automation Server”.

Get the Status of a MATLAB Automation Server

Using the `enableservice` function you can learn the current state of a MATLAB Automation server. The function returns a logical value, where logical 1 (`true`) means MATLAB is an Automation server and logical 0 (`false`) means MATLAB is not an Automation server.

For example, if you type

```
enableservice('AutomationServer')
```

and MATLAB displays

```
ans =
```

```
1
```

then MATLAB is currently an Automation server.

Changes to MATLAB Version-Specific ProgID

A programmatic identifier, or ProgID, is used to create a COM component. MATLAB's version-specific ProgID `Matlab.Application.N.M` now lets you specify both a major and minor version number.

For example, to specify MATLAB version 7.4, use the ProgID `Matlab.Application.7.4`.

Changes to Handling ActiveX Methods

Beginning in MATLAB Version 7.4 (R2007a), an ActiveX method with the same name as a class is treated as a constructor and cannot be called in the same way as an ordinary method.

In the following example:

```
Excel = actxserver('Excel.Application');
op = invoke(Excel.Workbooks, 'open', 'MyFile.xls');
Sheets = Excel.ActiveWorkBook.Sheets;
target_sheet = get(Sheets, 'item', 'Sheet1');
invoke(target_sheet, 'Activate');
Activesheet = Excel.Activesheet;
cellname = 'B2';
Range = Activesheet.cells.Range(cellname, cellname);
```

the term `Range` is both a function on the MATLAB path and a constructor of the class `Range`. MATLAB tries to execute the function `range`, which generates the error:

```
??? Error using ==> range
Too many input arguments.
```

```
Error in ==> MyScript at 8
Range = Activesheet.cells.Range(cellname, cellname);
```

To get the property value, use the get function.

For example:

```
Range = get(Activsheet.cells, 'Range', cellname, cellname);
```


Version 7.3 (R2006b)

MATLAB

This table summarizes what's new in Version 7.3 (R2006b):

New Features and Changes	Version Compatibility Considerations	Fixed Bugs and Known Problems	Related Documentation at Web Site
Yes Details below	Yes — Details labeled as Compatibility Considerations in descriptions of new features and changes. See also Summary.	Bug Reports Includes fixes	No

New features and changes introduced in this version are organized by these areas:

- “Desktop Tools and Development Environment, MATLAB Version 7.3 (R2006b)” on page 111
- “Mathematics, MATLAB Version 7.3 (R2006b)” on page 124
- “Data Analysis, MATLAB Version 7.3 (R2006b)” on page 130
- “Programming, MATLAB Version 7.3 (R2006b)” on page 131
- “Graphics and 3-D Visualization, MATLAB Version 7.3 (R2006b)” on page 140

- “Creating Graphical User Interfaces (GUIs), MATLAB Version 7.3 (R2006b)” on page 144
- “External Interfaces/API, MATLAB Version 7.3 (R2006b)” on page 146

Desktop Tools and Development Environment, MATLAB Version 7.3 (R2006b)

New features and changes introduced in this version are organized by these topics:

- “Startup and Shutdown” on page 111
- “Desktop” on page 112
- “Help” on page 115
- “Workspace, Search Path, and File Operations” on page 116
- “Editing and Debugging M-Files” on page 117
- “Tuning and Managing M-Files” on page 121
- “Publishing Results” on page 123

Startup and Shutdown

New features and changes introduced in Version 7.3 (R2006b) are described here.

Associate MATLAB Files with Windows Using New Utility

You can run a utility from the Help browser to associate `.m`, `.mat`, `.fig`, `.p`, and `.mdl` files with MATLAB® in Windows. After running the utility, you will be able to start MATLAB by double-clicking any of those file types in Windows Explorer. You can still use Windows Explorer Folder Options to perform these file associations, but the utility makes the task more convenient. For details, see “Starting MATLAB from an M-File or Other File Type in Windows”.

Redirect Output on UNIX Now Sends Errors to Shell

When you start MATLAB on UNIX platforms using the `-nodesktop` startup option and redirect output, for example to a file, MATLAB now sends any errors to the shell, while normal output goes to the redirect target. This change was made so that MATLAB redirection follows standard UNIX behavior.

For example:

```
matlab -nodesktop -"r magic(3), magi(5)" > test.txt
```

starts MATLAB in nodesktop mode, runs the statement `magic(3)` and writes the output to `test.txt`. When MATLAB runs `magi(5)`, execution fails and MATLAB displays the error message in the shell.

Compatibility Considerations. In previous versions, MATLAB redirected both output and error messages, so in the above example, MATLAB wrote the output of `magic(3)` as well as the error message from `magi(5)` to `test.txt`.

If you have shell scripts that use `>` to redirect output, and you rely on errors appearing in the output target, you need to modify the `matlab` startup statements in those scripts.

To achieve the former behavior, that is, to redirect both output and errors to the specified target, use that specific redirect syntax for your shell. For example, in `tsh`, use `>&`, as in

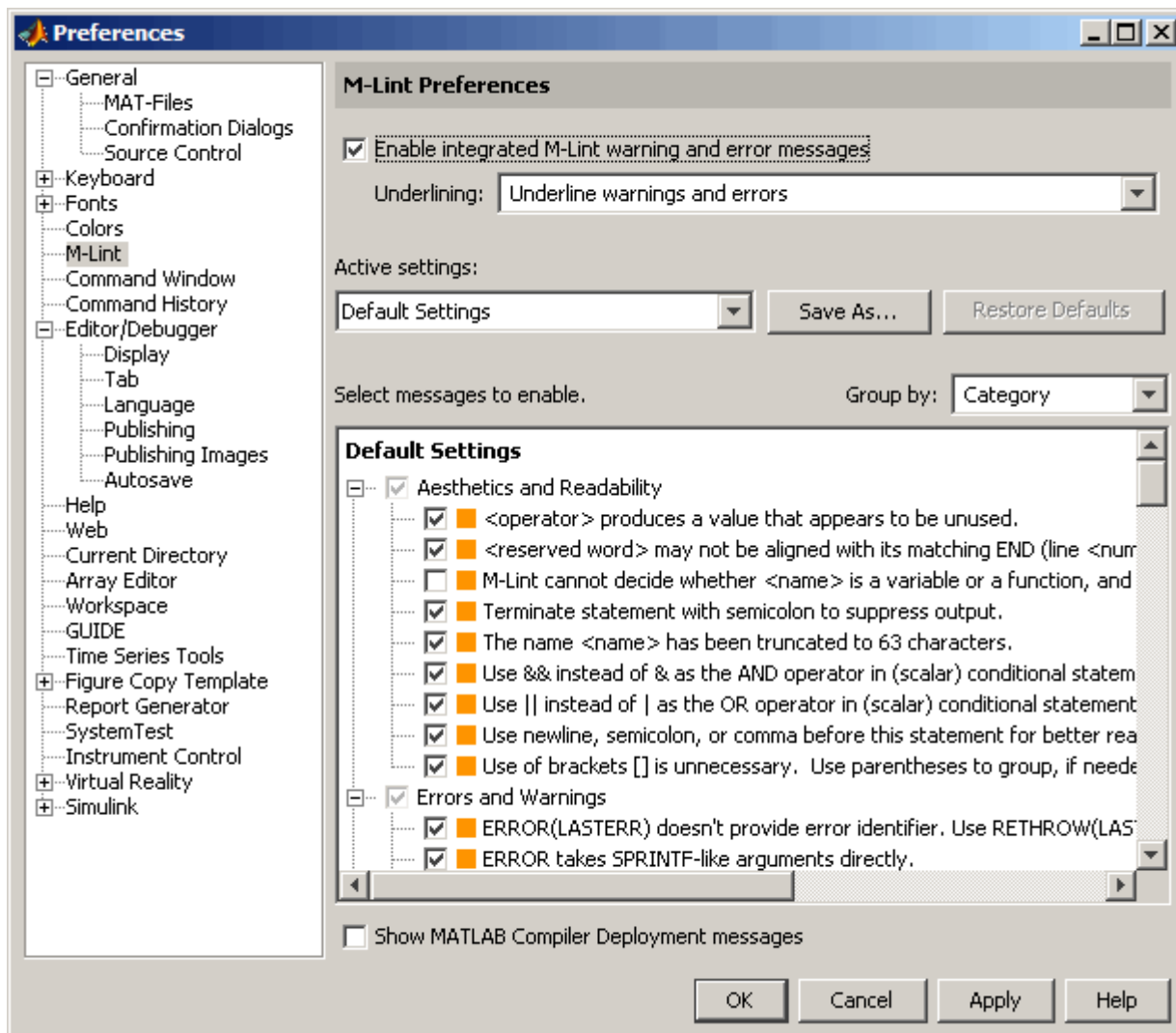
```
matlab -nodesktop -"r magic(3), magi(5)" >& test.txt
```

Desktop

New features and changes introduced in Version 7.3 (R2006b) are described here.

M-Lint Preferences Added and Now Appear on M-Lint Panel

M-Lint preferences now appear on a new M-Lint panel. There are new M-Lint preferences to disable specific messages or categories of messages, as well as to save the settings for use in a later session. In addition, you can choose to show or hide MATLAB® Compiler messages if the MATLAB Compiler is installed. These new M-Lint preferences apply to the M-Lint code analyzer operating automatically in the Editor/Debugger as well as to the M-Lint Code Check Report you run via the Current Directory browser Directory Reports or **Tools > M-Lint > Show M-Lint Report**.



Compatibility Considerations. M-Lint preferences were previously accessed via the Editor/Debugger Language settings for M.

Close All Documents and Close Selected Documents Feature Added

When you have multiple documents open within a tool, such as M-files in the Editor/Debugger, select **File > Close** to readily close selected files in that tool. Alternatively, right-click the document bar to close all open documents or all open documents except the selected document in that tool.

Accessibility Documentation Included

Accessibility features and assistive technologies are now part of the Desktop documentation. In prior versions, they were documented in the general Release Notes.

New Look and Feel on Linux and Solaris Platforms

MATLAB has a new look and feel on Linux and Solaris platforms affecting windows, decorations, color schemes, and responsiveness of the MATLAB interface.

Compatibility Considerations. All of the changes are cosmetic, except for file dialog boxes, like Open file. The new file dialog boxes are more conventional and easier to use than in previous versions, and there is no loss in functionality.

Invalid info.xml File on Path Now Generates an Error

When MATLAB finds an `info.xml` file on the search path or in the current directory, it assumes the file is intended to add information to the **Start** button or the Help browser, and automatically validates the file against the supported schema. If there is an invalid construct in the `info.xml` file, MATLAB displays an error in the Command Window. The error is typically of the form

```
XML-file failed validation against schema located in
...
XML-file name: full path to...\info.xml
```

and might appear when you start MATLAB, press the **Start** button, or in other situations. For more information about the error and how to eliminate it, see “Adding Your Own Toolboxes to the Start Button”.

Compatibility Considerations. In previous versions, MATLAB displayed a warning when it encountered an invalid `info.xml` file.

Help

New features and changes introduced in Version 7.3 (R2006b) are described here.

Exact Phrase and Wildcard Searching Added; Change to Search Database

These improvements were made to the Help browser search feature. Note that they are not supported on Japanese systems.

- **Search Field Always Shown** — The **Search for** field is now always in view when the Help browser is open. The list of pages found appears in the **Search Results** tab.
- **Exact Phrase Searches for More Relevant Results** — Find an exact phrase by typing quotation marks around the search term. For example, "plot tools" finds only pages that include plot tools together, but does not find pages that include plot in one part of the page and tools in another part of the page. You can specify more than one exact phrase in a search term, such as "plot tools" "figure palette".
- **Wildcards (*) in Search Terms for Variations of a Word (Partial Word Search)** — Use the wildcard character (*) in place of letters or digits in your search terms. For example, plot* finds various forms of the word plot, such as plot, plots, and plotting, while p*t find those variations as well as variations of print and part, among others. You can use multiple wildcards in a word or search term.
- **Boolean Operator Evaluation Order Changed** — Boolean NOT operators in search terms are now evaluated first, followed by ORs, and then ANDs. In prior versions, Boolean operators were evaluated in left to right order.

Compatibility Considerations. The search enhancements were facilitated by changing to a new type of database. As a result, any existing Help search databases for non-Mathworks products will not work in R2006b and beyond. The documentation still displays in the Help browser, but it is not included in searches.

If you use Help browser documentation for non-MathWorks products with a pre-R2006b search database, a message will display in the Help browser to notify you that the documentation will not be included in searches. If you want search to work for that documentation, contact the product provider to request an R2006b-compatible search database.

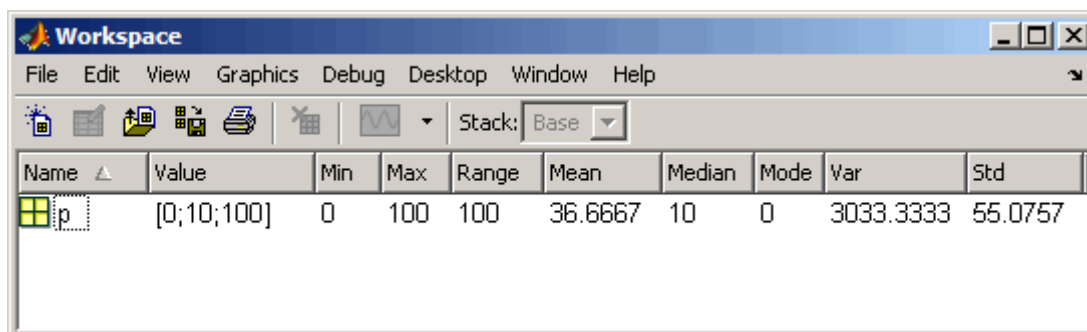
If you provide documentation for the Help browser and want the documentation to be included in the searches, you need to update the `helpsearch.db` entry in the `info.xml` file to the `helpsearch` directory, and prepare an R2006b-compatible help search database. This process is much easier than in the past. For instructions, contact Technical Support.

Workspace, Search Path, and File Operations

New features and changes introduced in Version 7.3 (R2006b) are described here.

Statistical Results in Workspace Browser

The Workspace browser includes new columns that automatically display results of common statistical calculations: Minimum, Maximum, Range, Mean, Median, Mode, Variance, and Standard Deviation. Use **View > Choose Columns** to specify the columns to show.



See also **File > Preferences > Workspace** for associated preferences.

Open Larger Arrays in Array Editor

You can open larger arrays in the Array Editor. In previous versions, large arrays would fail to open in the Array Editor.

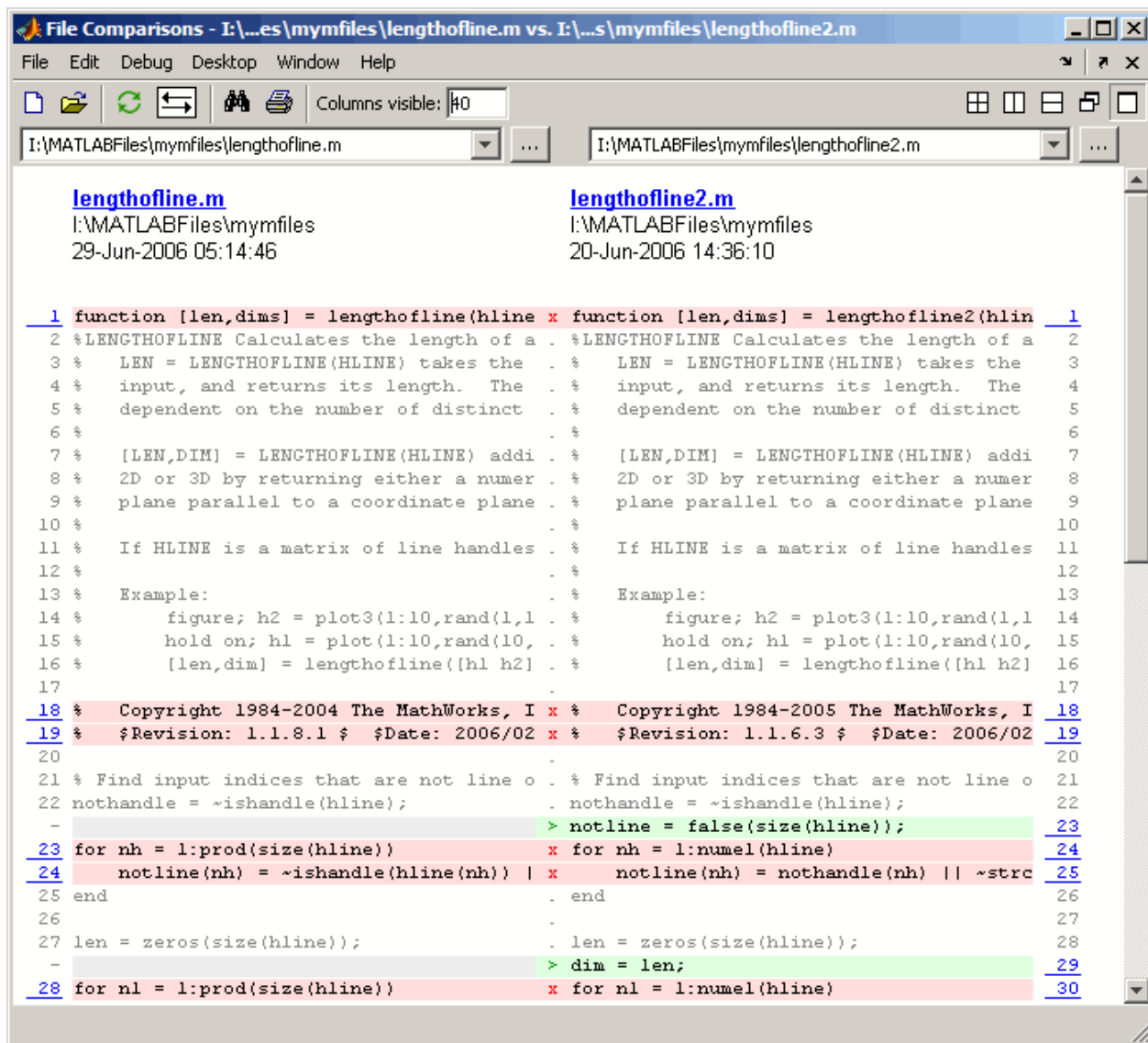
Editing and Debugging M-Files

New features and changes introduced in Version 7.3 (R2006b) are

- “File Comparisons Tool Added” on page 117
- “M-Lint Enhancements for Suppressing Messages, and Showing MATLAB Compiler Messages” on page 119
- “Restore Breakpoints Using New dbstop Feature” on page 120
- “End Debugging Completely Using New dbquit('all') Option” on page 120

File Comparisons Tool Added

Use the new File Comparisons tool to highlight the differences between two files. Open a file, select **Tools > Compare Against**, and then browse to select the second file or drag it into the tool from the Current Directory browser or Windows Explorer. The two files appear aligned in a window with highlights and indicators for any lines that differ, as shown in this example. For more information, see “Comparing Files”.



Use elements in the toolbar to exchange the left-right positions of the two files and to specify the number of columns shown.

You can also run the File Comparisons tool from the desktop by selecting **Desktop > File Comparisons**. Drag a file from the Current Directory browser or Windows Explorer into the tool. Then drag the second file into the tool.

M-Lint Enhancements for Suppressing Messages, and Showing MATLAB Compiler Messages

These are the new features and changes to M-Lint:

- “General Enhancements—Japanese Messages, and Line Number in Indicator Bar” on page 119
- “Suppressing M-Lint Messages” on page 119
- “Deployment Messages in M-Lint” on page 120
- “Compatibility Considerations” on page 120

General Enhancements—Japanese Messages, and Line Number in Indicator Bar.

- On Japanese systems, messages now appear in Japanese.
- The messages that appear at the indicator bar now includes the line number.

Suppressing M-Lint Messages. The M-Lint automatic code analyzer in the Editor/Debugger now provides a few ways for you to suppress specific messages and categories of messages:

- Ignore Specific Instance — Right-click at the underline for an M-Lint message, and from the context menu, suppress just that instance. M-Lint adds `%#ok` and a new message ID tag to the end of the line, which is the MATLAB syntax for suppressing an M-Lint message.
- Disable All Instances — Right-click at the underline for an M-Lint message, and from the context menu, disable all instances of that message in all files. This changes the preference setting for that message.
- Use Preferences to Disable All Instances — Select **File > Preferences > M-Lint**, and disable specific messages or categories of messages, which applies to all instances in all files. You can save the

settings to an M-Lint preference file. From the Editor/Debugger, you can select the M-Lint preference file from the **Tools > M-Lint** menu.

The M-Lint Code Check report also uses the preferences and suppresses the display of specific messages and categories of messages, per the preference settings.

Deployment Messages in M-Lint. M-Lint now displays MATLAB Compiler deployment messages, such as MCC does not permit the CD function, which appear if the MATLAB Compiler is installed and you select the M-Lint preference to **Show MATLAB Compiler deployment messages**. You can also disable or enable all deployment messages via the Editor/Debugger **Tools > M-Lint** menu. You can suppress specific messages using the same methods as for other M-Lint messages.

Compatibility Considerations. M-Lint preferences were previously accessed via the Editor/Debugger Language settings for M. See also “mlint Message IDs Changed and %#ok Syntax Enhanced” on page 121

Restore Breakpoints Using New dbstop Feature

You can save the status of breakpoints to a MAT-file using `s=dbstatus` and restore the breakpoint status at a later time by loading the MAT-file using the new `dbstop(s)` option. For example, set breakpoints in `collatz`. Run `s=dbstatus` to assign the breakpoint status to `s`; use the '**completenames**' option to save absolute pathnames and breakpoint function nesting sequence. Save `s` to a MAT-file by running, for example, `save mydebugsession s`. At a later time, run `load mydebugsession` to restore `s`, and then run `dbstop(s)` to restore the breakpoints.

End Debugging Completely Using New dbquit('all') Option

If you debug multiple files at once, you can exit debug mode for all files by running `dbquit('all')`. If you debug `file1` and step into `file2`, running `dbquit` terminates debugging for both files. However, if you debug `file3` and also debug `file4`, running `dbquit` terminates debugging for `file4`, but `file3` remains in debug mode until you run `dbquit` again. The new `dbquit('all')` option ends debugging for both `file3` and `file4`, and as `dbquit` does, ends debugging for `file1` and `file2`.

Tuning and Managing M-Files

New features and changes introduced in Version 7.3 (R2006b) are described here.

File Comparison Directory Report Removed; Replaced by File Comparison Tool

The File Comparison Report, one of the directory reports available in the Current Directory browser, was removed.

Compatibility Considerations. The new File Comparisons tool replaces the File Comparison Report. The tool provides the same functionality as the report did, and adds new features. For details, see “File Comparisons Tool Added” on page 117.

M-Lint Code Check Report Enhancements and Changes

You can indicate specific messages or categories of messages you want M-Lint to report. For details, see “M-Lint Enhancements for Suppressing Messages, and Showing MATLAB Compiler Messages” on page 119.

Compatibility Considerations. In previous versions, the M-Lint Code Check report showed all messages except those suppressed via a `%#ok` at the end of a line. Now, the M-Lint Code Check report will show only the messages that are enabled via M-Lint preferences.

mlint Message IDs Changed and %#ok Syntax Enhanced

The `mlint` function with the `-id` option returns message IDs using a new form. For example, when you run

```
mlint('filename.m', '-id')
```

MATLAB Version 7.2 (R2006a) returns

```
L 22 (C 1-9) 2:AssignmentNotUsed : The value ...
```

whereas MATLAB Version 7.3 (R2006b) returns

```
L 22 (C 1-9): NASGU: The value ...
```

The `%#ok` syntax used in M-files to suppress the display of M-Lint messages for a line has been enhanced to support multiple messages per line. For example, given this line in an M-file,

```
data{nd} = getfield(flds,fdata{nd});
```

two M-Lint messages result:

```
34: 'data' might be growing inside a loop; ...  
    consider preallocating for speed.
```

```
34: Use dynamic fieldnames with structures instead of GETFIELD...  
    Type 'doc struct' for more information.
```

In MATLAB Version 7.2 (R2006a), M-Lint messages could only be suppressed for the entire line:

```
data{nd} = getfield(flds,fdata{nd}); %#ok
```

In MATLAB Version 7.3 (R2006b), you can still use `%#ok` to suppress all messages for the line, or you can add an ID tag to indicate the exact messages to suppress. For example, this suppresses only the first message about data growing inside a loop:

```
data{nd} = getfield(flds,fdata{nd}); %#ok<GFLD>
```

To suppress more than one message per line, separate the ID tags with a comma. For example, this suppresses both messages:

```
data{nd} = getfield(flds,fdata{nd}); %#ok<GFLD,AGROW>
```

Compatibility Considerations. In previous versions, the message IDs returned from `mlint` with the `-id` option, were of a form that included a numeric identifier, followed by the category. If you rely on the exact ID values, you will need to make modifications to use the new form.

If you use M-Lint in MATLAB Version 7.3 (R2006b) and then run those files a previous version, M-Lint in the previous version ignores the tag and IDs that follow the `%#ok`, and therefore suppresses all messages for that line, which is the expected behavior for the previous version.

mlintrpt Option Added to Use Preference Settings File

The `mlintrpt` function now accepts a new option that applies the preferences saved to an M-Lint settings file. It works with the `file` or `dir` syntax:


```
mlintrpt('fullpath_to_file', 'file', 'fullpath_to_configfile.txt')
mlintrpt('fullpath_to_dir', 'dir', 'fullpath_to_configfile.txt')
```

For example, create the file `NoSemiSetting.txt` by saving settings in **File > Preferences > M-Lint**. Later, use the settings via preferences or M-Lint in the Editor/Debugger, or via `mlintrpt` as in this example:

```
mlintrpt('lengthofline.m', 'file', 'I:\MATLABFiles\NoSemiSettings.txt')
```

which displays an M-Lint report in the MATLAB Web browser for the `lengthofline` file in the current directory using the M-Lint settings in `I:\MATLABFiles\NoSemiSettings.txt`.

Toolbar Refresh Button Removed

The Profiler included a refresh button  on the toolbar. This button has been removed. It performed an action similar to the **Refresh** button that appears in many of the Profiler reports, so use that button instead.

Publishing Results

notebook Setup Arguments Removed

In MATLAB 7.1 (R14SP3), the notebook function was enhanced to automatically detect the version of Microsoft Word and other required information. This feature changed the notebook `-setup` syntax—arguments to specify the version of Microsoft Word (`wordversion`, `wordlocation`, `templatelocation`) were no longer supported. If you used those arguments, MATLAB ignored them and issued a warning. Now in MATLAB 7.3 (R2006b), if you use those arguments, MATLAB errors.

Compatibility Considerations. If you use notebook with the `wordversion`, `wordlocation`, and `templatelocation` arguments in any of your files (for example, `startup.m`), remove them to prevent errors.

Mathematics, MATLAB Version 7.3 (R2006b)

New features and changes introduced in this version are:

- “New Functions” on page 124
- “max and min Now Use Magnitudes and Phase Angle for Complex Input” on page 125
- “Additional Output from lu” on page 125
- “Upper and Lower Factors for chol and ldl” on page 125
- “Permutation Vectors with lu, luinc, ldl” on page 125
- “Two-Element Threshold for lu, spparms” on page 125
- “Lower Triangular Factors from symbfact” on page 126
- “Support for New Versions of AMD, COLAMD, CHOLMOD, UMFPACK” on page 126
- “Sparse Arrays on 64-Bit Systems” on page 126
- “FFTW Upgraded to Version 3.1.1 in MATLAB” on page 127
- “Future Obsolete Functions” on page 128
- “Obsolete Functions” on page 128
- “max and min No Longer Return Warning Messages for Inputs with Different Data Types” on page 129

New Functions

Function	Description
amd	Interface to the amd algorithm. This interface is similar to that used in symamd, but is typically faster than symamd.
bvpxtend	Forms a guess structure for extending the boundary value problem solution
ld1	Full ld1 factorization and solving for Hermitian matrices

max and min Now Use Magnitudes and Phase Angle for Complex Input

For complex input, `min` and `max` are computed using the magnitude, `min(abs(x))` and `max(abs(x))` respectively. In the case of equal magnitude elements, the phase angle, `min(angle(x))` and `max(angle(x))`, is now used.

Compatibility Considerations

In previous versions, `min` and `max` were computed using the magnitude, and in the case of equal magnitude elements, the first element was used. This behavior was indeterministic and not consistent with the `sort` function.

Code in previous releases that relied on the output of this functionality for the case described above should be updated.

Additional Output from lu

The `lu` function returns an additional output that helps improve numerical stability of sparse `lu` factorization.

Upper and Lower Factors for chol and ldl

Upper and lower triangular factors for `chol` and `ldl` improve performance for sparse `chol`. Referencing the lower triangle and returning the lower triangular factor is more memory efficient in the case of sparse `chol`.

Permutation Vectors with lu, luinc, ldl

Permutation vectors for `lu`, `luinc`, and `ldl` provide memory savings and, for large data, a noticeable performance improvement. You can now store permutation information in a single 1-by-N vector instead of an n-by-n matrix,

Two-Element Threshold for lu, spparms

A new two-element threshold for `lu` and `spparms` gives you more control over sparse `lu` and `sparse \` behavior.

Lower Triangular Factors from `symbfact`

Extra arguments exported for `symbfact` allow the return of the lower triangular symbolic factor.

Support for New Versions of `AMD`, `COLAMD`, `CHOLMOD`, `UMFPACK`

MATLAB 7.3 supports new versions of the following libraries:

Library Name	Version Supported in MATLAB 7.3
AMD	2.0
COLAMD	2.5
CHOLMOD	1.1
UMFPACK	5.0

Sparse Arrays on 64-Bit Systems

The internal storage of sparse arrays on 64-bit systems has changed in the R2006b release. This change should be invisible to most MATLAB users. However, MEX-file programs that run on a 64-bit system and access sparse arrays must be modified and recompiled in order to run on MATLAB Version 7.3. This applies to existing MEX-files and to any new MEX-files that you write.

If you are affected by this change, you will need to take the following steps to make your code compatible with the new sparse array format:

- Modify all sparse array declaration statements in MEX-files that are to run on a 64-bit system so that they now use the `mwSize` and `mwIndex` types instead of more specific type declarations such as `int` or `INTEGER*4`.
- Change any MEX code that assigns a negative value to a variable used to hold a sparse array index or size. An example of this would be code that temporarily uses an array index as a flag, assigning a `-1` to it to mark the index as unset. Do not try to cast negative `int` values to `mwSize` or `mwIndex`. Instead, change your code to avoid using negative values.
- Recompile these MEX-files using the `-largeArrayDims` option

For a full description of what you will need to do, please read the section “Sparse Arrays on 64-bit Systems” on page 147 in the MATLAB External Interfaces release notes.

Compatibility Considerations

Existing MEX-files that run on 64-bit systems and access sparse arrays in MATLAB will not operate correctly in MATLAB 7.3 unless the required changes outlined above are made and the files are recompiled with the `-largeArrayDims` option. New MEX-files that you create must also adhere to these guidelines.

FFTW Upgraded to Version 3.1.1 in MATLAB

The version of FFTW used in MATLAB has been upgraded from 3.0.2 to 3.1.1. Please read the “Compatibility Considerations” on page 128 section, below.

Other changes in MATLAB FFTW support are:

- The default planner method is now `estimate`. Previously, `hybrid` was the default.
- There are new syntaxes for importing from and exporting to the library's internal single- and double-precision wisdom databases. These are as follows and are documented in the reference page for the MATLAB `fftw` function:
 - `str = fftw('dwisdom')`
 - `str = fftw('swisdom')`
 - `fftw('dwisdom', str)`
 - `fftw('swisdom', str)`

Compatibility Considerations

FFTW version 3.1.1 does not support wisdom produced by previous versions of the FFTW library. For this reason, FFTW wisdom that has been exported from a previous version of MATLAB cannot be imported successfully in MATLAB R2006b. Trying to import “old” wisdom results in a warning.

Future Obsolete Functions

The `betacore` function generates a warning message in R2006b but completes successfully. This function will be made obsolete in a future release.

Compatibility Considerations

You should remove all instances of the `betacore` function from your M-file program code. This function will not be supported in a future release of MATLAB.

Obsolete Functions

The following uses of MATLAB functions are obsolete as of this release. Attempts to use this functionality in the R2006a release generate a warning message but complete successfully. In R2006b, these operations fail and generate an error message.

- The following functions in their entirety: `bvpval`, `quad8`, `table1`, `table8`, `bessela`

- The `sort` function, when used with complex integer inputs
- The `gt`, `ge`, `lt`, and `le` functions, when used with complex integer inputs
- The `beta` function, when used with 3 inputs
- The `gamma` function, when used with 2 inputs
- The `opts.cheb` and `opts.stagtol` fields in the options structure of `eigs`

Compatibility Considerations

You will need to remove all instances that reference these functions at this time. These functions are no longer supported in MATLAB.

max and min No Longer Return Warning Messages for Inputs with Different Data Types

In MATLAB version 7.0 (Release 14), the functions `max` and `min` were changed to return results of a different data type than in previous releases. This behavior is described in “`max` and `min` Now Have Restrictions on Inputs of Different Data Types” on page 321. This change in behavior produced warning messages to assist you with diagnosing any resulting issues. In R2006b, these warning messages no longer exist.

Compatibility Considerations

The warning messages for mixed-type inputs to the functions `max` and `min` are no longer produced. Turning warning messages on will no longer display messages for this behavior, and you will no longer be able to depend on the messages for the diagnosis of problems.

Data Analysis, MATLAB Version 7.3 (R2006b)

New features and changes introduced in this version are:

- “Generate M-File Now Supports Basic Fitting and Data Statistics” on page 130
- “New Options for Working with Time Series Objects” on page 130

Generate M-File Now Supports Basic Fitting and Data Statistics

The **Generate M-File** option on the **File** menu of MATLAB figure windows now generates code that reproduces plot objects created with the Basic Fitting Tool or the Data Statistics Tool. The generated M-file function accepts new data as input and creates plot objects with the same graphics properties as those in the generating figure. In addition, the M-file recomputes fits and statistics for the new data. The code shows you how to program what you do interactively with the Basic Fitting Tool or the Data Statistics Tool.

New Options for Working with Time Series Objects

- Time Series Tools are now easier to find. From the MATLAB **Start** button, select **MATLAB > Time Series Tools**.
- Time series objects are now fully supported by the Array Editor. When you open a `timeseries` object (using `open` or the Workspace browser), the editor from Time Series Tools appears in the Array Editor.
- Time series objects can now be opened directly in Time Series Tools. Select a `timeseries` object in the Workspace browser, right click, and choose **Open in Time Series Tools** from the context menu.
- In Time Series Tools, you can now change subplot indices interactively. Click on a plotted line in a time series view and drag and drop it from one subplot to another. To create a new subplot, drag and drop the plotted line below the bottom axes.

Programming, MATLAB Version 7.3 (R2006b)

New features and changes introduced in this version are:

- “Saving to MAT-Files Larger than 2 GB” on page 131
- “Import Wizard Generates Import M-Code” on page 133
- “New Dynamic Regular Expression Syntax” on page 133
- “New Reserved MATLAB Keywords” on page 133
- “Enhancements to Display Generated by whos” on page 133
- “unique Function Returns First and Last Indices” on page 134
- “save Compression and Unicode Options Removed” on page 135
- “Warning Generated by try-catch” on page 136
- “Case-Sensitivity Warning Removed” on page 137
- “fprintf(0,...) Now Throws an Error” on page 137
- “Assigning Nonscalar Structure Array Fields to a Single Variable” on page 138
- “Comma Separators Not Required in Function Declaration” on page 139
- “Improved Performance on Certain Platforms and Operations” on page 139

Saving to MAT-Files Larger than 2 GB

With MATLAB R2006b, you can save data that is over 2 gigabytes in size. This capability is implemented in MATLAB using a new HDF5-based format for MAT-files.

To save to a MAT-file in this format, specify the new `-v7.3` option with the `save` function:

```
save -v7.3 myfile v1 v2
```

Note MATLAB Version 7.3 does not write MAT-files in HDF5 format by default in this release; you must explicitly specify the `-v7.3` switch.

In this release,

- The default MAT-file format employed by `save` is the standard MAT-file format used in the R14, R14SP, and R2006a releases. You can explicitly specify this format with the command `save -v7`.
- To write an HDF5-based MAT-file, you must use `save -v7.3`.

In a future release,

- The default MAT-file format will be the HDF5-based format. You can explicitly specify the HDF5-based format with the command `save -v7.3`.
- To write the standard MAT-file format, you must use `save -v7`.

Here is a summary of the version options that you can use with `save`:

save Option	Description	Available In	Is the Default In
<code>save -v4</code>	Save to a MAT-file you can open in MATLAB version 4	V5 and later	V4, V5
<code>save -v6</code>	Save to a MAT-file you can open in MATLAB versions 5 or 6	V7 and later	V6
<code>save -v7</code>	Save to a MAT-file you can open in MATLAB version 7	V7.3 and later	V7.3
<code>save -v7.3</code>	Save to a MAT-file that supports data items ≥ 2 GB	V7.3 and later	post V7.3

Compatibility Considerations

If you are running MATLAB on a 64-bit computer system and you attempt to save a variable that is too large for a version 7 (or earlier) MAT-file, that is, you save without using the `-v7.3` option, MATLAB skips that variable during the save operation and issues a warning message to that effect.

If you are running MATLAB on a 32-bit computer system and attempt to load a variable from a `-v7.3` MAT-file that is too large to fit in 32-bit address space, MATLAB skips that variable and issues a warning message to that effect.

Import Wizard Generates Import M-Code

The Import Wizard now includes an automated M-code generation option. Click the Generate M-code button located in the lower right of the Import Wizard window and MATLAB generates an M-file that you can use to import additional files that are similar in type to the file you are currently importing. This simplifies the process of importing multiple files into MATLAB.

New Dynamic Regular Expression Syntax

The new (?@cmd) operator specifies a MATLAB command that regexp or regexpi is to run while parsing the overall match expression. Unlike the other dynamic expressions in MATLAB, this operator does not alter the contents of the expression it is used in. Instead, you can use this functionality to get MATLAB to report just what steps it's taking as it parses the contents of one of your regular expressions. This can be helpful in debugging regular expressions, for example.

New Reserved MATLAB Keywords

Two new reserved keywords have been added to the MATLAB language in this release:

- parfor – designates a for loop in the Distributing Computing Toolbox
- classdef – signals the beginning of an MCOS class definition

The iskeyword function returns true for each of these functions, thus identifying them as reserved keywords in MATLAB:

Compatibility Considerations

MATLAB keywords are reserved for use internal to MATLAB, and should not be used in your own program code as identifiers or function names. If your code uses either of these two new keywords in this manner, you should modify your code and use words that are not reserved.

Enhancements to Display Generated by whos

The visual output of the information returned by whos looks slightly different in R2006b than in previous releases. Changes are as follows:

- There is a new column in the output called `Attributes` that identifies values that are sparse, complex, global, or persistent.
- The words “array” and “object” have been dropped from items under the `Class` heading. Items formerly listed as `double array` or `timer object`, for example, are now displayed as `double`, and `timer`.
- MATLAB no longer includes summary information showing the “Grand total” of elements and bytes at the bottom of the `whos` output display.
- There is an additional field in the structure returned by `whos`. This new field is `'persistent'` and is set to logical 1 for those variables that are persistent, or logical 0 otherwise.

Here is an example of the information displayed by `whos` in MATLAB 7.3:

```
whos
  Name          Size          Bytes  Class          Attributes
-----
vCell          5x7             2380  cell
vComplex       6x2             192   double         complex
vDouble        6x5x9          2160  double
vFuncHdl       1x1             16    function_handle
vGlobal        0x0             0     double         global
vObject        1x1            248   timer
vPersist       0x0             0     double         persistent
vSparse        15x15          244   double         sparse
vStruct        1x3            804   struct
```

Compatibility Considerations

If any of your programs depend on the displayed output of `whos`, specifically in relation to the changes listed above, you might have to modify your program code. Also, if your code relies on a specific number of fields for the output structure, you should be aware that this release adds a new field: `persistent`.

unique Function Returns First and Last Indices

Using the new `first` option with the `unique` function returns a vector with elements that represent the *lowest* indices of unique elements in the input vector.

Given the following vector A

```
A = [16 7 5 41 2 16 8 2 6 3 16 6 2 5 2 5];
```

Get a sorted vector of the unique elements of A:

```
v = unique(A)
v =
     2     3     5     6     7     8    16    41
```

Use the first and last options to get indices of the first and last elements in A that make up the sorted vector v:

```
[v, m1] = unique(A, 'first');
m1
m1 =
     5    10     3     9     2     7     1     4

[v, m2] = unique(A, 'last');
m2
m2 =
    15    10    16    12     2     7    11     4
```

save Compression and Unicode Options Removed

In MATLAB Versions 7.0 through 7.2, you could use the switches `compress`, `nocompress`, `unicode`, and `nounicode` with the `save` function to enable or disable compression and Unicode character encoding in the MAT-file being generated. In MATLAB Version 7.3, the `save` function no longer supports these switches. Instead, `save` now creates a MAT-file with compression and Unicode character encoding by default, or with the following command:

```
save -v7 filename
```

You can still save to a MAT-file without using compression or Unicode encoding. In fact, you will have to do this in order to create MAT-files that you can load into a MATLAB Version 6 or earlier. To save to a MAT-file without compression or Unicode encoding, type

```
save -v6 filename
```

To disable compression and Unicode encoding for all save operations in a MATLAB session, open the MATLAB **Preferences** dialog, select **General** and then **MAT-Files**, and then click the button labelled **Ensure backward compatibility (-v6)**.

Compatibility Considerations

If you have code that uses any of these option switches with the save function, you will need to modify that code to use the `v6` option instead.

Warning Generated by try-catch

To accommodate future changes in the MATLAB error handling capabilities, MathWorks has added a new restriction to the single-line syntax of the try-catch block. In this release, the following syntax operates as it did in previous releases, but now it also generates the following warning message:

```
try try_statements, catch catch_statements, end
```

Warning: This try-catch syntax will continue to work in R2006b, but may be illegal or may mean something different in future releases of MATLAB.

To make this single-line try-catch work without warning in R2006b, you must insert a separator character (comma, semicolon, or newline) immediately after the word `catch`

```
try try_statements, catch, catch_statements, end
```

As with previous releases, the recommended syntax for a try-catch block is as follows:

```
try
    try_statements
catch
    catch_statements
end
```

Compatibility Considerations

Your M-file programs may generate this warning if correct syntax for `try` and `catch` is not used.

Case-Sensitivity Warning Removed

The following warning has been removed from MATLAB in release R2006b:

```
"Function call foo invokes /somewhere/on/the/path/foo.m,
however, function /somewhere/ahead/on/the/path/F00.m that
differs only in case precedes it on the path."
```

In previous versions of MATLAB, this warning message was triggered when you called a function such as `foo`, and all of the following were true:

- There was more than one MATLAB file of this name on the MATLAB path
- The names of these files differed only in letter case, and
- A MATLAB file of this name but with different case (e.g., `F00.m`) preceded a file of matching case (e.g., `foo.m`) on the path

Earlier versions of MATLAB displayed this warning for the purpose of helping users cope with newly-introduced case sensitive dispatching changes. The warning is being removed at this time under the assumption that users are now sufficiently well-acquainted with the way MATLAB handles case sensitivity in function calls.

Compatibility Considerations

The dispatching behavior regarding to the case sensitivity is NOT changed with the removal of this warning message. If both an exact match and inexact match are present on the path, the exact match is always the one to be invoked.

fprintf(0,...) Now Throws an Error

Commands such as `fprintf(0, ...)` and `fwrite(0, ...)`, in which the file identifier is zero (the same as `stdin`) now result in an error being thrown. In previous releases, MATLAB did not throw an error in response to these

commands, even though printing or writing to `stdin` is clearly not a valid option.

Compatibility Considerations

If any of your programs use lower-level MATLAB file I/O functions that send output to `stdin`, because these functions no longer ignore this type of operation, your code will now generate an error. You should modify your program code to use a file identifier other than zero.

Assigning Nonscalar Structure Array Fields to a Single Variable

In the R14 and R14 service pack releases of MATLAB, assigning a nonscalar structure array field to a single variable incorrectly resulted in an error. For example, in the following code, you should be able to assign `S.A` to one, two, three, or four output variables. However, if you assign to just a single variable, MATLAB throws an error:

```
% Create a 1-by-4 structure array S with field A.
S(1).A = 1;   S(2).A = 2;   S(3).A = 3;   S(4).A = 4;

% Assigning S(1).A and S(2).A works as expected.
[x y] = S.A
x =
    1
y =
    2

% Assigning only S(1).A should work, but does not.
x = S.A;
??? Illegal right hand side in assignment. Too many elements.
```

This has been fixed in MATLAB 7.3.

Compatibility Considerations

If any of your programs rely on this error being thrown, you will need to modify those programs.

Comma Separators Not Required in Function Declaration

As of Release 14, the function definition line in a function M-file no longer requires commas separating output variables. This now makes the function definition syntax the same as the syntax used when calling an M-file function:

```
function [A B C] = myfun(x, y)
```

Compatibility Considerations

This new syntax is not valid in MATLAB versions earlier than Release 14. When writing an M-file that you expect to run on versions both earlier and later than R14, be sure to separate any output variables in the function definition line with commas:

```
function [A, B, C] = myfun(x, y)
```

Improved Performance on Certain Platforms and Operations

In this release, MATLAB offers improved performance in the following areas:

- Improved performance on 64-bit Windows XP and Linux platforms. This is independent of the size of data set in use.
- Faster scalar indexing into cell arrays.
- Faster assignment of cell array data to variables.

Graphics and 3-D Visualization, MATLAB Version 7.3 (R2006b)

New features and changes introduced in this version are:

- “Plotting Tools Are Now Modular Desktop Components” on page 140
- “Version 6 Property Editor Has Been Removed” on page 140
- “New Desktop Printing GUI” on page 141
- “Zoom Mode Now Supports Mouse Scroll Wheel” on page 141
- “Data Cursor Text Can Now Be Programmatically Modified” on page 142
- “Customizing Zoom, Pan, and Rotate3D Data Explore Modes” on page 142
- “Improvements to MATLAB Graphics Documentation” on page 143

Plotting Tools Are Now Modular Desktop Components

The three MATLAB plotting tools (Figure Palette, Property Editor, and Plot Browser) now function as desktop components like the Workspace Browser and the Array Editor. They dock, however, not to the MATLAB desktop but to a Figures window. Figures windows contain one or more figures, each of which is accessible by a tab. Turning on any plotting tool changes your figure group into a mini-desktop. You can undock, rearrange, tab, and resize the plot tools within the mini-desktop, and their state will persist across MATLAB invocations. There are just one set of plot tools for all your figures, but they only operate on figures contained in the group; undocked figures are free of the plotting tools until you redock them.

For more information see Plotting Tools – Interactive Plotting in the MATLAB Graphics documentation.

Version 6 Property Editor Has Been Removed

The Version 6 Property Editor, one of the Plotting Tools, is no longer available in MATLAB. this means that the 'v6' switch for the `propedit` function now produces an error instead of starting the version 6 property editor. The error message is

```
??? Error using ==> propedit
```


The Version 6 property editor is no longer available. Sorry!

Compatibility Considerations

If you have code that calls the version 6 property editor, you will need to modify it to use the modular plotting tools described above in “Plotting Tools Are Now Modular Desktop Components” on page 140. The `propedit` function remain otherwise the same.

New Desktop Printing GUI

Printing MATLAB figures has become easier as a result of combining the **Page Setup**, **Print Setup**, and **Print Preview** dialogs into one tabbed **Print Preview** dialog. You can now specify paper size, plot size and layout, color and line weight, header text, rendering, and other printing characteristics in this new dialog. The **Page Setup** and **Print Setup** dialogs still exist, and the **Print** dialog that you call from **File** → **Print** remains the same. The **Page Setup** dialog is available on all platforms.

For more information, see Using Print Preview in the MATLAB Graphics documentation and `printpreview` in the MATLAB function reference documentation.

Compatibility Considerations

The **Page Setup** dialog no longer is available from the figure window **File** menu. However, it does continue to exist; you can raise it using the `pagesetupdlg` command. The old **Print Preview** dialog has been removed, however. The old **Print Setup** dialog can be raised using the command

```
print -dsetup
```

When you dismiss the **Print Setup** dialog with **OK**, the settings you made with it are saved, but nothing is printed at that time.

Zoom Mode Now Supports Mouse Scroll Wheel

If your mouse has a center scroll wheel, you can use it to zoom in and out of axes, as well as by clicking and/or dragging.

You can zoom in by positioning the mouse cursor where you want the center of the plot to be and either press the mouse button or rotate the mouse scroll wheel away from you (upward). Zoom out by positioning the mouse cursor where you want the center of the plot to be and either simultaneously press **Shift** and the mouse button, or rotate the mouse scroll wheel toward you (downward). Each mouse click or scroll wheel click zooms in or out by a factor of 2.

Data Cursor Text Can Now Be Programmatically Modified

You can now easily customize the text of datatips. The `datacursormode` function lets you specify the contents and formatting of text displayed by the data cursor tool. When the data cursor tool is active, you can use its context (right-click) menu to edit or specify the text update function that MATLAB executes to display datatips. For more information, see [Data Cursor — Displaying Data Values Interactively in the MATLAB Graphics documentation](#) and `datacursormode` in the MATLAB Function Reference documentation.

Customizing Zoom, Pan, and Rotate3D Data Explore Modes

You can now customize the behavior of data explore modes by modifying the `zoom`, `pan` and `rotate3d` objects that are dereferenced as follows:

```
h = pan(figure_handle)
h = rotate3d(figure_handle)
h = zoom(figure_handle)
```

These syntaxes create *mode objects* that you can use to control the behaviors of the explore tools. Among the effects you can achieve using these explore mode objects are

- Allow, change, or inhibit a mode for a specified axes
- Create callbacks for pre- and post-buttonDown events
- Change callbacks dynamically

See `pan`, `rotate3d`, and `zoom` in the MATLAB Function Reference documentation for details and examples.

Compatibility Consideration

Using mode objects can cause a forward incompatibility. In prior releases, `explore` modes did not return an argument. Therefore, code such as the above examples that you write to take advantage of the new API will not run in versions of MATLAB previous to R2006b. `zoom`, `pan`, and `rotate3d` code written for previous versions of MATLAB, however, will run as before (there is no backward incompatibility).

Improvements to MATLAB Graphics Documentation

A new section in the Graphics User Guide, “Types of Plots Available in MATLAB”, now includes a gallery of graphs that catalogs the kinds of plots that you can create using MATLAB graphics functions. There are two tables containing labeled icons, one for “Two-Dimensional Plotting Functions”, and one for “Three-Dimensional Plotting Functions”, classified by plot type. Clicking the function name above any thumbnail plot in the gallery opens the reference documentation for that function.

Reference pages for functions that create, edit, annotate, and save plots have been enhanced in several ways:

- Thumbnail figures at the top of plotting functions and related GUI reference pages illustrate what you see when you invoke these functions.
- *GUI Alternatives* sections above syntax descriptions describe how to invoke a function (or similar capability) from a GUI, and provide links to relevant topics in the Graphics and Desktop Tools User Guides.
- Revised printing documentation in user guides and reference pages (see “New Desktop Printing GUI” on page 141, above)
- Numerous corrections and clarifications of details in user guides and reference pages

Creating Graphical User Interfaces (GUIs), MATLAB Version 7.3 (R2006b)

New features and changes introduced in this version are:

- “Functions Are Now Obsolete” on page 144
- “Colored Buttons on Windows XP” on page 144
- “Documentation Enhancement” on page 145

Functions Are Now Obsolete

The following functions are obsolete in MATLAB 7.3 (R2006b): `axlimdlg`, `edtext`, `menubar`, `pagedlg`, `umtoggle`.

Compatibility Considerations

The functions shown in the following table will continue to work but their use will generate a warning message. As soon as possible, replace any occurrences you may have of these functions with the function(s) shown in the following table, if any, or with other suitable code.

Function	Replacement
<code>axlimdlg</code>	None
<code>edtext</code>	Set the Editing property of the text object.
<code>menubar</code>	Set the MenuBar property of the figure to none.
<code>pagedlg</code>	<code>pagesetupdlg</code>
<code>umtoggle</code>	Set the Checked property of the uimenu object.

Colored Buttons on Windows XP

Setting the background color of user interface control (`uicontrol`) push buttons and toggle buttons on Windows XP now results in flat, colored buttons.

Compatibility Considerations

Prior to this release, if you set the background color of a push button or toggle button to any color other than the factory color on Windows XP, the color

displayed only as a border around the button. With this release, any such buttons will display as flat, colored buttons with a simple border.

Documentation Enhancement

The Creating GUIs Programmatically section of the documentation now contains information commensurate with information in the Creating GUIs with GUIDE section. It adds, in workflow order, information and many basic examples about:

- Adding components, menus, and toolbars to your GUI. Placing and aligning components.
- Designing for cross-platform compatibility.
- Initializing the GUI and creating callbacks.
- Callback examples for the different components.

External Interfaces/API, MATLAB Version 7.3 (R2006b)

New features and changes introduced in this version are:

- “New Types for Declaring Size and Index Values” on page 146
- “Sparse Arrays on 64-bit Systems” on page 147
- “New MAT-File Format Based on HDF5” on page 148
- “-V5 Option to MEX to Be Removed” on page 149
- “Location of mex.bat File Changed” on page 149
- “Changes to Compiler Support” on page 149
- “Actxcontrol Command Now Validates ProgID” on page 149

New Types for Declaring Size and Index Values

Version 7.3 (R2006b) defines two new types for API arguments and return values. These are

- `mwSize` — represents size values, such as array dimensions and number of elements.
- `mwIndex` — represents index values, such as indices into arrays.

Using these types in array declarations replaces more specific type declarations such as `int` or `INTEGER*4`. In general, using these types consistently in your C or Fortran source files can insulate your code from changes in the API implementation that might take place between different versions of MATLAB.

The `mwSize` and `mwIndex` types are required when working with functions that access sparse arrays on a 64-bit system. This is described in the release note on “Sparse Arrays on 64-bit Systems” on page 147, below.

Note In Fortran, `mwSize` and `mwIndex` are implemented as preprocessor macros. To use these types in Fortran code, add the declaration `#include "fintrf.h"` in your source file and build your MEX-files using the Fortran preprocessor.

Sparse Arrays on 64-bit Systems

The internal storage of sparse arrays on 64-bit systems has changed in the R2006b release. Due to this change, you will need to

- Change declaration statements in your source code so that you use the new types `mwSize` and `mwIndex` in place of specific type declarations such as `int` or `INTEGER*4`. This is described in the section “New Types for Declaring Size and Index Values” on page 146, above.
- Recompile all MEX-files that interact with sparse arrays using the new `-largeArrayDims` switch. For more information about the `-largeArrayDims` switch, see the section “New MEX Switch” on page 147, below.

See the section on “Compatibility Considerations” on page 148 to find out if you will need to make any modifications to your existing MEX code to accommodate these changes.

Sparse API Functions Affected By This Change

You will need to recompile any MEX-files that use the following sparse functions on a 64-bit system:

- `mxGetIr`
- `mxGetJc`
- `mxSetIr`
- `mxSetJc`

New MEX Switch

In order to build MEX-files that use any of the sparse array functions listed above, you need to compile these files with the `-largeArrayDims` switch, as shown here:

```
mex -largeArrayDims filename
```

Also, any existing MEX-files that interact with sparse arrays in MATLAB Version 7.3 must be recompiled using the `-largeArrayDims` switch.

Note The `-largeArrayDims` option is likely to become the default in a future version of MATLAB.

Compatibility Considerations

If you are using any of the functions listed above, then you should be aware of the following potential compatibility issues if your MEX code uses sparse arrays on a 64-bit system:

- In release R2006b, you must rebuild all MEX-files that use sparse arrays using the new `-largeArrayDims` switch.
- Before building your MEX-files, change your C or Fortran sources to use the `mwSize` or `mwIndex` types introduced in this release. See the `mxAarray` reference pages for the types to use for each function.
- MEX-files that compiled properly in Version 7.2 (R2006a) and do not use sparse arrays should build and execute correctly in Version 7.3 (R2006b) without changes.
- For more information on how the sparse API is affected, see the Sparse Arrays on 64-Bit Systems section in the MATLAB Mathematics release notes.

New MAT-File Format Based on HDF5

In Version 7.3 (R2006b), you can save MAT-files in a format based on HDF5. Unlike earlier MAT-file formats, the HDF5-based format is capable of saving variables that occupy more than 2 GB of storage, including large arrays created on 64-bit systems.

To save a MAT-file in the HDF5-based format, use the `-v7.3` option to the MATLAB save function or the `"w7.3"` mode argument to the C or Fortran `matOpen` function. The default MAT-file format is the same as that in Version 7.2 (R2006a).

Compatibility Considerations

Earlier versions of MATLAB cannot read MAT-files written in the HDF5-based format.

MAT-files written with MATLAB Version 7.3 (R2006b) on a 64-bit system can be read back into MATLAB 7.3 on a 32-bit system, provided that none of the values stored in the MAT-file require more than 32 bits to store.

-V5 Option to MEX to Be Removed

The -V5 option to mex is not supported in this and future versions of MATLAB.

Compatibility Considerations

You will no longer be able to build a MEX-file that is compatible with MATLAB Version 5.

Location of mex.bat File Changed

In MATLAB Version 7.3, the Windows script mex.bat is located in the directory \$MATLAB\bin.

Compatibility Considerations

You may need to change any scripts or environment variables that relied on the previous location of mex.bat.

Changes to Compiler Support

Compaq Visual Fortran version 6.1 is supported in Version 7.3 (R2006b) but will not be supported in a future version of MATLAB.

Compatibility Considerations

To ensure continued support for building your Fortran programs, consider upgrading to another supported compiler. For an up-to-date list of supported compilers, see Technical Note 1601: <http://www.mathworks.com/support/tech-notes/1600/1601.html>.

Actxcontrol Command Now Validates ProgID

Attempting to insert a COM server into a MATLAB figure can result in unpredictable behaviors. To prevent this condition, the actxcontrol command now checks the ProgID by looking at the registry's HKR/CLSID/Control

keyword and throws an error if the ProgID does not belong to an ActiveX control.

Compatibility Considerations

Before the validation check was added, some server ProgIDs worked with `actxcontrol`, probably because there are cases where Microsoft points the server GUID to a control GUID underneath. An example of a ProgID that might not work with `actxcontrol` is the MediaPlayer server ProgID `MediaPlayer.mediaplayer.1`. Therefore, depending on how Microsoft registers the control, the following command might now return an error:

```
h = actxcontrol('MediaPlayer.mediaplayer.1'); % Returns an error
```

The correct ProgID to use for MediaPlayer is the ActiveX control ProgID:

```
h = actxcontrol('WMPlayer.OCX.7'); % Use control ProgID
```

Note that methods and properties to open and play files are different when using the control ProgID.

You can disable the validation check with the following command:

```
feature('COM_ActxProgIdCheck',0)
```

Or reenable it with:

```
feature('COM_ActxProgIdCheck',1)
```

By default, ProgID checking is on.

Version 7.2 (R2006a)

MATLAB

This table summarizes what's new in Version 7.2 (R2006a):

New Features and Changes	Version Compatibility Considerations	Fixed Bugs and Known Problems	Related Documentation at Web Site
Yes Details below	Yes — Details labeled as Compatibility Considerations in descriptions of new features and changes. See also Summary.	Bug Reports at Web site	No

New features and changes introduced in this version are organized by these areas:

- “Desktop Tools and Development Environment, MATLAB Version 7.2 (R2006a)” on page 153
- “Mathematics, MATLAB Version 7.2 (R2006a)” on page 167
- “Data Analysis, MATLAB Version 7.2 (R2006a)” on page 169
- “Programming, MATLAB Version 7.2 (R2006a)” on page 170
- “Graphics and 3-D Visualization, MATLAB Version 7.2 (R2006a)” on page 177

- “Creating Graphical User Interfaces (GUIs), MATLAB Version 7.2 (R2006a)” on page 179
- “External Interfaces/API, MATLAB Version 7.2 (R2006a)” on page 181

Desktop Tools and Development Environment, MATLAB Version 7.2 (R2006a)

New features and changes introduced in this version are organized by these topics:

- “Startup and Shutdown” on page 153
- “Desktop” on page 154
- “Running Functions — Command Window and Command History” on page 155
- “Help” on page 156
- “Workspace, Search Path, and File Operations” on page 156
- “Editing and Debugging M-Files” on page 157
- “Tuning and Managing M-Files” on page 164
- “Publishing Results” on page 166
- “Source Control Interface” on page 166

Startup and Shutdown

New features and changes introduced in Version 7.2 (R2006a) are described here.

Installation Directory Structure on Windows

The installation directory structure on Windows platforms is slightly different than in previous versions. By default, the structure now includes a general MATLAB top level directory, with a subdirectory for R2006a. The MATLAB® root directory, as returned by the `matlabroot` function, is now of the form in this example:

```
D:\Applications\MATLAB\R2006a
```

In previous versions, the top-level directory included the version number, so the MATLAB root directory, as returned by the `matlabroot` function, was of the form in this example:

```
D:\Applications\MATLAB 7.1
```

Compatibility Considerations. If you relied on the explicit MATLAB root directory structure in your code, change it to reflect the new structure including the top-level MATLAB directory. The `matlabroot` function might be useful.

Error Log Reporting

If MATLAB experiences a segmentation violation, it generates an error log. Upon the next startup, MATLAB prompts you to e-mail the error log to The MathWorks. The MathWorks uses the log to work on resolving the problem. When you send a log, you receive a confirmation e-mail and will only receive further e-mails if The MathWorks develops a fix or workaround for the problem.

There are some situations where the Error Log Reporter does not open, for example, when you start MATLAB with a `-r` option or run in deployed mode. If you experience segmentation violations but do not see the Error Log Reporter on subsequent startups, you can instead e-mail logs by following the instructions at the end of the segmentation violation message in the Command Window.

JVM Updated for 64-Bit Linux Platforms

The Java Virtual Machine (JVM) version for 64-bit Linux platforms that MATLAB uses is now Sun 1.5.0_04.

Desktop

New features and changes introduced in Version 7.2 (R2006a) are described here.

Preferences Reorganized and New Keyboard Pane Added to Support Command Window and Editor/Debugger

Preferences includes a new pane, **Keyboard**, for setting key bindings, tab completion, and delimiter-matching preferences for the Command Window and Editor/Debugger. Most of these preferences were previously located in the preference panes for the Command Window or Editor/Debugger.

Compatibility Considerations. You no longer access keyboard and indenting preferences for the Command Window and Editor/Debugger from the component preferences, but rather from the new **Keyboard** preferences. In addition, some preferences that were set separately for these components are now shared. For details about the changes, see “Keyboard and Indenting Command Window Preferences Reorganized” on page 155, and “Keyboard and Indenting Editor/Debugger Preferences Reorganized” on page 159.

Open All Desktop Tools from Desktop Menu

You can now open (and close) all desktop tools from the **Desktop** menu. In previous versions, you could not access document-based tools from the **Desktop** menu. The document-based desktop tools are: Editor/Debugger, Figures, Array Editor, and Web Browser.

Access Login Renamed to MathWorks Account

Use **Help > Web Resources > MathWorks Account** menu items to go to your MathWorks Account if you are registered, or to register online. MathWorks Account was previously called Access Login.

Running Functions – Command Window and Command History

New features and changes introduced in Version 7.2 (R2006a) are described here.

Keyboard and Indenting Command Window Preferences Reorganized

The Command Window Keyboard and Indenting preferences pane was removed. The tab size preference is now on the Command Window preferences pane. The tab completion, keybinding, and parentheses matching preferences were moved to the new Keyboard preferences pane. The parentheses-matching preferences are now called delimiter-matching preferences and are shared with the Editor/Debugger.

Help

New features and changes introduced in Version 7.2 (R2006a) are described here.

help for Model Files

You can now use the help function to get the complete description for MDL-files. For example, run

```
help f14_dap.mdl
```

MATLAB displays the description of the Simulink® F-14 Digital Autopilot High Angle of Attack Mode model, as defined in its **Model Properties** > **Description**:

```
Multirate digital pitch loop control for F-14 control design demonstration.
```

Workspace, Search Path, and File Operations

New features and changes introduced in Version 7.2 (R2006a) are described here.

toolboxdir function added

The toolboxdir function returns the absolute pathname to the specified toolbox. It is particularly useful with MATLAB Compiler because the toolbox root directory is different than in MATLAB.

Visual Directory View Removed

The Visual Directory view was removed from the Current Directory browser. Most of the features it provided are accessible from the Current Directory browser standard view.

Editing and Debugging M-Files

New features and changes introduced in Version 7.2 (R2006a) are

- “Tab Completion — Tab Now Completes Function and Variable Names” on page 157
- “Go Menu Added; Bookmark and Go To Items Moved from Edit Menu to Go Menu” on page 158
- “Navigate Back and Forward in Files” on page 159
- “Keyboard and Indenting Editor/Debugger Preferences Reorganized” on page 159
- “M-Lint Automatic Code Analyzer Checks for Problems and Suggests Improvements” on page 159
- “Debugging Changes” on page 160
- “Cell Mode On by Default — Shows Cell Toolbar and Possibly Horizontal Lines and Yellow Highlighting; Cell Information Bar and Button Added” on page 161
- “Lines Between Cells” on page 163
- “Cell Titles in Bold Preference Removed” on page 163

Tab Completion — Tab Now Completes Function and Variable Names

You can now use tab completion in the Editor/Debugger to complete function names and variable names that are in the current workspace. When you type the first few characters of a function or variable name and press the **Tab** key, the Editor/Debugger displays a list of all function and variable names that begin with those letters, from which you choose one.

It operates essentially the same way as the existing tab completion feature in the Command Window, with the exception that Editor/Debugger tab completion does not support completion of file and path names.

To enable tab completion in the Editor/Debugger, select **File > Preferences > Keyboard**, and then under **Tab completion**, select **Tab key narrows completions**. By default, the preference is selected.

With tab completion enabled in the Editor/Debugger, you can still include tab spacing, for example, to include a comment at the end of a line. To add tab spacing, include a space after the last character you type and then press **Tab**. Instead of showing possible completions, the Editor/Debugger moves the cursor to the right where you can continue typing.

Compatibility Considerations. If you press the **Tab** key to add spacing within your statements, you might instead get a completion for a function or see a list of possible completions. For example, if the preference for tab completion is on and you want to create this statement

```
if a=mate    %test input value
```

where you press **Tab** after `mate` to achieve the spacing, the following happens instead

```
if a=material
```

This is because the tab completion preference completes `mate`, automatically supplying the `material` function.

To achieve the spacing with **Tab** (as in previous versions), either add a space after `mate` and then press **Tab**, or turn off the preference **Tab key narrows completions** in **Keyboard Preferences**.

Go Menu Added; Bookmark and Go To Items Moved from Edit Menu to Go Menu

- To set, clear, and navigate to bookmarks, use the menu items in the new **Go** menu, which were previously located in the **Edit** menu.
- The **Go To** feature for navigating to line numbers, functions in M-files, and cells has moved to the new **Go** menu. It was previously located in the **Edit** menu.

Compatibility Considerations. Use the new **Go** menu items instead of **Edit > Bookmark** features and **Edit > Go To**.

Navigate Back and Forward in Files

Use **Go > Back** (and **Go > Forward**) to go to lines you previously edited or navigated to in a file, in the sequence you accessed them. The main benefit of this feature is going directly to lines of interest. As an alternative to the menu items, use the Back and Forward buttons on the toolbar.

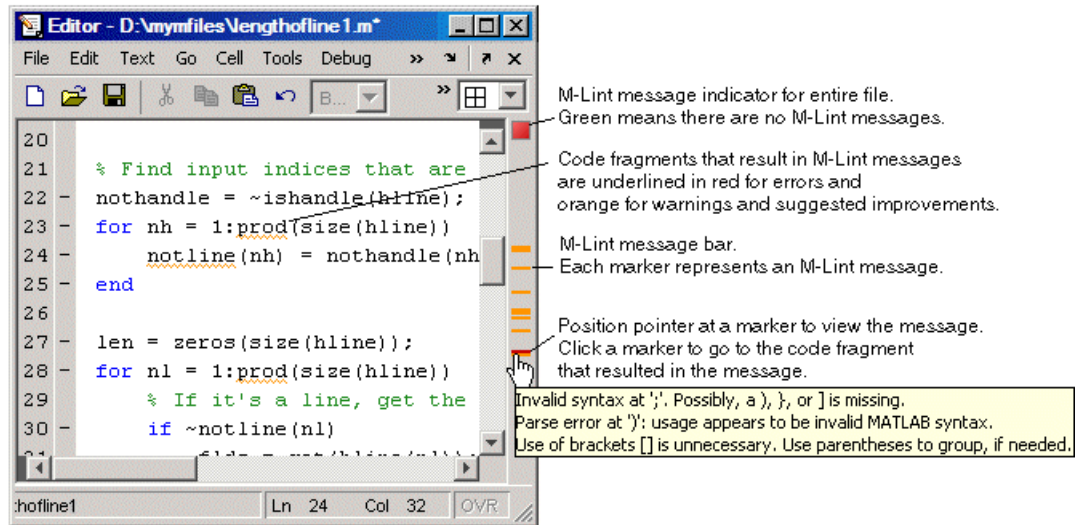
Keyboard and Indenting Editor/Debugger Preferences Reorganized

The Editor/Debugger **Keyboard and Indenting** preferences pane was renamed to **Tab** preferences, and keybinding and parentheses-matching preferences were moved to the new **Keyboard** preferences pane. The parentheses-matching preferences are now called delimiter-matching preferences and are shared with the Command Window.

M-Lint Automatic Code Analyzer Checks for Problems and Suggests Improvements

The M-Lint code analyzer, now built into the Editor/Debugger, continuously checks your code for problems and recommends modifications to maximize performance and maintainability. It performs the same analysis as the existing M-Lint Code Check report, but also provides these features:

- Indicates the problem lines and associated M-Lint messages directly in the M-file rather than in a separate report.
- Identifies (underlines) code fragments within a line that result in M-Lint messages.
- Distinguishes messages that report errors (red) from warnings and suggestions (orange).
- Continually analyzes and updates messages as your work so you can see the effect of your changes without having to save the M-file or rerun an M-Lint report.




To use or turn off M-Lint in the Editor/Debugger, select **File > Preferences > Editor/Debugger > Language**, and for **Language**, select **M**. Under **Syntax**, select **Enable M-Lint messages**, or clear the check box to turn it off. Use the associated drop-down list to specify the types of code fragments that you want M-Lint to underline, for example, **Underline warnings and errors**.

Debugging Changes

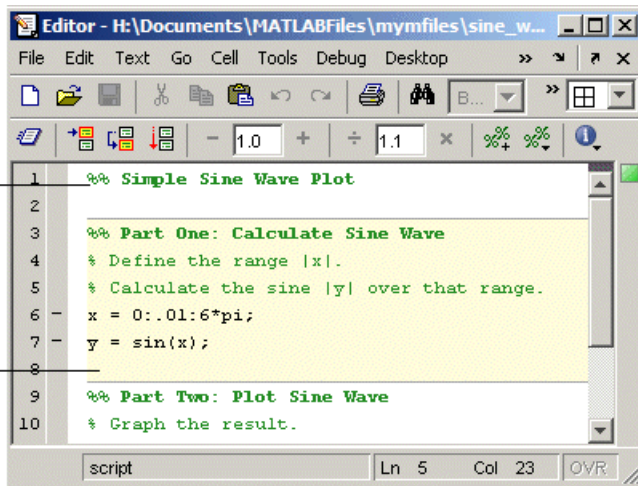
- The `dbstop` function now allows you to stop at, (not in), a non M-file, allowing you to view code and variables near it in your M-file. For example, if you want to stop at the point in your M-file `myfile.m` where the built-in `clear` function is called, run `dbstop in clear; myfile`. Use this feature with caution because the debugger stops in M-files it uses for running and debugging if they contain the non M-file, and then some debugging features do not operate as expected, such as typing `help functionname` at the `K>>` prompt.

Cell Mode On by Default – Shows Cell Toolbar and Possibly Horizontal Lines and Yellow Highlighting; Cell Information Bar and Button Added

Cell mode, a useful feature in the Editor/Debugger for publishing results and rapid code iteration, is now enabled by default. An M-file cell is denoted by a %% at the start of a line. Any M-file that contains %% at the start of a line is interpreted as including cells. The Editor/Debugger reflects the cell toolbar state and the cell display preferences, such as yellow highlighting of the current cell and gray horizontal lines between cells.

For quick access to information about using cells in M-files, use the new information  button on the cell toolbar.

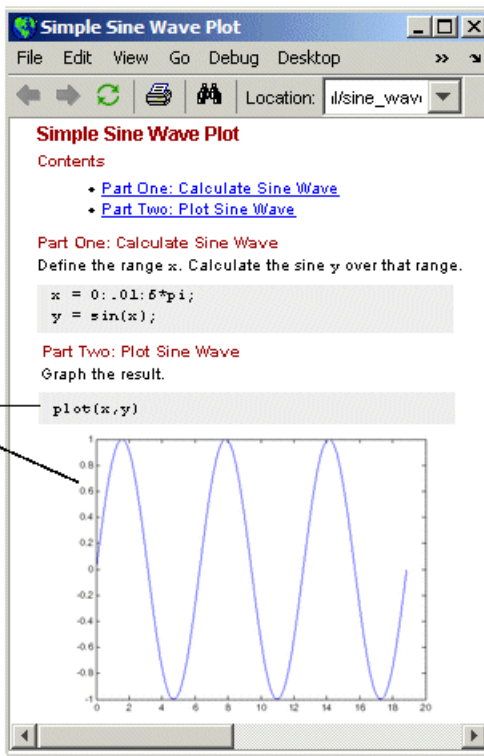
%% at the start of a line denotes a cell, used for publishing or rapid code iteration. The current cell is highlighted in yellow.



Example of M-file with cells published to HTML.

Includes source code and output.

Supported formats are: HTML, Word, PowerPoint, LaTeX, and XML.



If you do not want cell mode enabled, select **Cell > Disable Cell Mode**.

MATLAB remembers the cell mode between sessions. If cell mode is disabled when you quit MATLAB, it will be disabled the next time you start MATLAB, and the converse is true.

In MATLAB Version 7.2, the first time you open an M-file in the Editor/Debugger, the cell toolbar appears. If the M-file contains a line beginning with `%`, an information bar appears below the cell toolbar, providing links for details about cell mode. To dismiss the information bar, click the close box on the right side of the bar. To hide the cell toolbar, right-click the toolbar and select **Cell Toolbar** from the context menu.

Compatibility Considerations. In previous versions, cell mode was off by default. The cell toolbar and yellow highlighting or horizontal rules in M-files that contain `%%` at the start of a line might be unexpected. If you used the `%%` symbols at the start of a line in M-files for a purpose other than denoting M-file cells, consider replacing the `%%` symbols with a different indicator, or keep cell mode disabled.

Lines Between Cells

You can set an Editor/Debugger display preference, **Show lines between cells**, to add a faint gray rule above each cell in an M-file. The line does not print or appear in the published M-file.

Cell Titles in Bold Preference Removed

Previous versions included an Editor/Debugger display preference to **Show bold cell titles**. When cleared, cell titles appeared in plain text, rather than bold text. This is no longer a preference you can set — all cell titles now appear in bold text.

Tuning and Managing M-Files

New features and changes introduced in Version 7.2 (R2006a) are

- “M-Lint and mlint Enhancements and Changes” on page 164
- “Profiling Enhancements” on page 165
- “Visual Directory View Removed from Current Directory Browser” on page 165

M-Lint and mlint Enhancements and Changes

The M-Lint code analyzer is now built into the Editor/Debugger where it continuously checks your code for problems and recommends modifications to maximize performance and maintainability. For details, see “M-Lint Automatic Code Analyzer Checks for Problems and Suggests Improvements” on page 159.

Compatibility Considerations. The `mlint` function has changed slightly to support its use in the Editor/Debugger. Specifically, the results returned from `mlint` with the `-id` option are of a different form than for previous versions. If you rely on the exact values, you need to make modifications.

For example, this is the form of a message returned in R2006a: `L 22 (C 1-9) 2:AssignmentNotUsed : The value assigned here to variable 'nothandle' might never be used.`

This is the form of the message from R14SP3: `22 (C 1-9) InefficientUsage:AssignmentNotUsed : The value assigned here to variable 'nothandle' might never be used.`

There is now a numeric identifier, followed by the category, for example:
`2:AssignmentNotUsed`

If you do rely on the exact values, note that there have been very few changes to the message text itself. For example, both R14SP3 and R2006a use the same text: `The value assigned here to variable 'nothandle' might never be used.`

Because of improvements being made to `mlint`, the values returned using the `-id` option are expected to change in the next version as well, particularly

the numeric identifier and category form. Do not rely on the exact values returned using `mlint` with the `-id` option or you will probably need to make modifications.

Profiling Enhancements

nohistory Option Added to profile Function. Use the new `profile -nohistory` option after having previously set the `-history` option to disable further recording of history (exact sequence of function calls). All other profiling statistics continue to accumulate.

Accuracy Improved. The Profiler provides more accurate accounting. The total time you see with the Profiler GUI now matches total wall clock time from when you started profiling until you stopped profiling. Overhead associated with the Profiler itself is now applied evenly.

Statistics for Recursive Functions. The `profile` function now gathers and reports time for recursive functions in the `FunctionTable`'s `TotalTime` for the function. In previous versions, `profile` attempted to break out `TotalRecursiveTime`, which was not always accounted for accurately. The value for `TotalRecursiveTime` in `FunctionTable` is no longer used.

This change is also reflected in the Profiler GUI reports.

PartialData Reported in Results, AcceleratorMessages Removed. The `FunctionTable` now includes the `PartialData` value. A value of 1 indicates the function was modified during profiling, for example, by being edited or cleared, so data was only collected up until the point it was modified.

In previous versions, `FunctionTable` included `AcceleratorMessages` although it was not used. `AcceleratorMessages` is no longer included.

Visual Directory View Removed from Current Directory Browser

The Visual Directory view was removed from the Current Directory browser.

Compatibility Considerations. Most of the features it provided are accessible from the Current Directory browser standard view.

Publishing Results

New features and changes introduced in Version 7.2 (R2006a) are described here.

Insert Italic Text Markup

You can now make designated text comments in cells appear italicized in the published output. Use **Cell > Insert Text Markup > Italic Text**, or use the equivalent markup symbols, underscores, as in `_SAMPLE ITALIC TEXT_`.

publish Function has New catchError Option

The `publish` function has a new `catchError` option that allows you to continue or stop publishing if the M-file contains an error.

Source Control Interface

New features and changes introduced in Version 7.2 (R2006a) are described here.

PVCS Source Control System Name Change

The PVCS source control system (from Merant) now has a new name, ChangeMan (from Serena), and the MATLAB source control interface on UNIX platforms reflects this change.

If you use ChangeMan on UNIX platforms, the `cmopts` value returned for it is `pvcs`. If you use PVCS, select ChangeMan in the Source Control Preferences pane.

Compatibility Considerations. PVCS users on UNIX platforms formerly selected PVCS in the Source Control Preferences pane. Now, PVCS users select ChangeMan instead.

Mathematics, MATLAB Version 7.2 (R2006a)

New features and changes introduced in this version are

- “New Library CHOLMOD for Sparse Cholesky Factorization” on page 167
- “New Solver for State-Dependent DDEs” on page 167
- “Upgrade to BLAS Libraries” on page 167
- “New Function for Integer Division” on page 168
- “New Input to gallery Function” on page 168
- “Improved Algorithm for expm” on page 168
- “More Efficient condst for Sparse Matrices” on page 168
- “accumarray Accepts Cell Vector Input” on page 168

New Library CHOLMOD for Sparse Cholesky Factorization

For sparse matrices, MATLAB now uses CHOLMOD version 1.0 to compute the Cholesky factor. CHOLMOD is a set of routines offering improved performance in factorizing sparse symmetric positive definite matrices. See the function reference pages for `chol`, `spparms`, and `mldivide` for more information on how CHOLMOD is used by MATLAB.

New Solver for State-Dependent DDEs

In this release, MATLAB provides a second solver function, `ddesd`, in addition to the existing `dde23` function, for delay differential equations (DDEs). This new solver is for use on equations that have *general* delays. You supply a function in the input argument list that returns the vector of delays to be used by the solver. See the function reference page for `ddesd`, and “Initial Value Problems for DDEs” in the MATLAB Mathematics documentation for more information.

Upgrade to BLAS Libraries

MATLAB now uses new versions of the Basic Linear Algebra Subroutine (BLAS) libraries. For Intel processors on Windows and Linux platforms,

MATLAB supports the Math Kernel Library (MKL) version 8.0.1. For AMD processors on Linux platforms, MATLAB uses the AMD Core Math Library (ACML) version 2.7.

New Function for Integer Division

The new `idivide` function provides division similar to `A./B` on integers except that fractional quotients are rounded to integers according to a specified rounding mode.

New Input to gallery Function

The `gallery` function has a new, optional input argument called `classname`. The `classname` input is a quoted string that must be either `'single'` or `'double'`. When you specify a `classname` argument in the call to `gallery`, MATLAB produces a matrix of that class.

Improved Algorithm for expm

The `expm` function now uses an improved algorithm to compute a matrix exponential. This algorithm often requires fewer matrix multiplications.

More Efficient condst for Sparse Matrices

The `condst` function handles sparse matrices more efficiently when estimating a 1-norm condition number.

accumarray Accepts Cell Vector Input

The `accumarray` function now accepts a cell vector as the `subs` input. This vector can have one or more elements, each element a vector of positive integers. All the vectors must have the same length. In this case, `subs` is treated as if the vectors formed columns of an index matrix.

Data Analysis, MATLAB Version 7.2 (R2006a)

New features and changes introduced in this version are

- “Data Analysis Collection Revised and Expanded” on page 169
- “Reference Pages for timeseries and tscollection Objects” on page 169
- “Text Files Can Be Imported In Time Series Tools” on page 169
- “Linux 64 Platform Fully Enabled for Time Series Tools” on page 169

Data Analysis Collection Revised and Expanded

In this release, the *MATLAB Data Analysis* collection has been thoroughly revised to improve content organization and flow. In addition, most examples have been updated and streamlined.

Reference Pages for timeseries and tscollection Objects

Detailed reference pages are now available for `timeseries` and `tscollection` objects, properties, and methods. You can access these reference pages in the Help contents, under MATLAB Functions — By Category.

Text Files Can Be Imported In Time Series Tools

In Time Series Tools, you can now use the Import Wizard to import data from text files, such as `.csv`, `.dat`, and `.txt`.

Linux 64 Platform Fully Enabled for Time Series Tools

Time Series Tools is now fully enabled on the Linux 64 platform.

Compatibility Considerations

On the Linux 64 platform, you no longer need to manually enable the Time Series Tools feature before starting Time Series Tools (as in MATLAB 7.1).

Programming, MATLAB Version 7.2 (R2006a)

New features and changes introduced in this version are

- “Larger Data Sets with 64-Bit Windows XP” on page 170
- “Using avifile and movie2avi on Windows XP 64” on page 170
- “Regular Expressions” on page 171
- “Setting Environment Variables” on page 172
- “issorted Support for Cell Arrays” on page 172
- “XLS Functions Support More Formats” on page 172
- “Archiving Functions Accept Files on Path and ~/” on page 172
- “sendmail No Longer Requires ASCII Messages” on page 173
- “MATLAB Warns on Invalid Input to str2func” on page 173
- “Changes to Character Encoding in File I/O” on page 173

Larger Data Sets with 64-Bit Windows XP

MATLAB support for Windows XP 64-bit edition enables you to handle much larger data sets. There remains a 2 GB limit on each variable, but you can store many more such variables in memory at one time.

Using avifile and movie2avi on Windows XP 64

Note You must change the compression setting if you use the `avifile` or `movie2avi` function on Windows XP 64.

MATLAB currently defaults to using Indeo codecs to compress video frames when using `avifile/addframe` or `movie2avi`. If you attempt to use `avifile` and `addframe`, or `movie2avi` on a Windows XP 64-bit platform without specifying the compression type, an error message appears indicating the codec was not found. Nondefault settings must be explicitly passed in when using these functions on Windows XP 64 because Microsoft does not provide Indeo codecs on this platform.

This issue does not affect 32-bit Windows XP installations.

Compatibility Considerations

To work around this issue, do the following:

- 1 Explicitly specify no compression when creating the `avifile` object or when calling `movie2avi`. Two examples of this are

```
aviobj = avifile('myvideo.avi', 'compression', 'none');  
movie2avi(mov, 'myvideo.avi', 'compression', 'none');
```

- 2 Specify a codec for a compression that is installed. The ones that are included with Windows XP 64 are

- IYUV — Intel YUV codec (c:\winnt\system32\iyuv_32.dll)
- MRLE — Microsoft RLE codec (c:\winnt\system32\msrle32.dll)
- MSVC — Microsoft Video 1 codec (c:\winnt\system32\msvidc32.dll)

For example, to use the Intel YUV codec, use the four-CC code:

```
aviobj = avifile('myvideo.avi', 'compression', 'IYUV');
```

Other codecs can be found at <http://fourcc.org>.

Note there are restrictions with some codecs. For example, some codecs can only be used with grayscale images.

Regular Expressions

MATLAB 7.2 introduces the following new features for regular expressions in MATLAB. For more information on these features, see “Regular Expressions” in the MATLAB Programming documentation.

New Features

- Dynamic regular expressions — You can now insert MATLAB expressions or commands into regular expressions or replacement strings. The dynamic part of the expression is then evaluated at runtime.

- **Generating literals in expressions** — Use the new `regexpttranslate` function when you want any of the MATLAB regular expression functions to interpret a string containing metacharacters or wildcard characters literally.
- **New parsing modes** — Four matching modes (case-sensitive, single-line, multiline, and freespacing) extend the parsing capabilities of the MATLAB regular expression functions.
- **Warnings display** — Use the new 'warnings' option with the regular expression functions to enable the display of warnings that are otherwise hidden.

Compatibility Considerations

Calling `regexp` or `regexp` with the 'tokenExtents' and 'once' options specified now returns a double array instead of a cell array. You may need to change your code to accommodate the new return type.

Setting Environment Variables

Use the new `setenv` function to set the value of an environment variable belonging to the underlying operating system.

issorted Support for Cell Arrays

You can now use the `issorted` function on a cell array of strings.

XLS Functions Support More Formats

`xlsread` now supports Excel files having formats other than XLS (e.g., HTML) as long as the COM server is available. Also, `xlsfinfo` now returns this file format information.

Archiving Functions Accept Files on Path and ~/

Files specified as arguments to `gzip`, `gunzip`, `tar`, and `zip` can now be specified as partial path names. On UNIX machines, directories can start with `~/` or `~username/`, which expands to the current user's home directory or the specified user's home directory, respectively. The wildcard character `*`

can be used when specifying files or directories, except when relying on the MATLAB path to resolve a filename or partial pathname.

sendmail No Longer Requires ASCII Messages

E-mail messages that you send using `sendmail` are no longer restricted to ASCII character encoding schemes.

MATLAB Warns on Invalid Input to `str2func`

Due to a bug introduced in MATLAB R14, the `str2func` function failed to issue a warning or error when called with an invalid function name or a function name that includes a path specification. In the R2006a release, `str2func` now generates a warning under these conditions. In a future version of MATLAB, `str2func` will generate an error under these conditions.

Compatibility Considerations

Any existing code that calls `str2func` with an invalid function name or a function name that includes the path now generates a warning message from MATLAB. In a future version, this will cause an error. You should note any such warnings when using R2006a, and fix the input strings to `str2func` so that they specify a valid function name.

Changes to Character Encoding in File I/O

The `fopen` function has a new optional argument, a string that specifies a name or alias for the character encoding scheme associated with the file. If this argument is omitted or is the empty string (`''`), the MATLAB default encoding scheme is used. Given a file identifier as the only argument, `fopen` now returns an additional output value, a string that identifies the character encoding scheme associated with the file.

Low-level file I/O functions that read data from files, including `fread`, `fscanf`, `fgetl`, and `fgets`, read characters using the encoding scheme associated with the file during the call to `fopen`. Low-level file I/O functions that write data, including `fwrite` and `fprintf`, write characters using the encoding scheme associated with the file during the call to `fopen`.

Support for character encoding schemes has these limitations:

- Surrogate pairs are not supported. Each surrogate pair is read as a replacement character, the equivalent of char(26).
- Stateful character encoding schemes are not supported.
- Byte order marks are not interpreted in any special way. Your code must skip them if necessary.
- Scanning numbers, using fscanff, is supported only for character encoding schemes that are supersets of ASCII. (Most popular character encoding schemes, with the exception of UTF-16, are such supersets.)

Compatibility Considerations

In V7.1 (R14SP3), low-level file I/O functions that read and write data treated characters as unsigned bytes. Programs using such functions as fread may have called native2unicode to convert input to MATLAB characters using a particular encoding scheme. Programs using such functions as fwrite may have called unicode2native to convert output from MATLAB characters using a particular encoding scheme.

For example, on a Japanese Windows platform, where the default character encoding scheme is Shift-JIS, a program may have used native2unicode and unicode2native to read and write Japanese text in this way:

```
fid = fopen(file);
data = fread(fid, '*char');
fclose(fid);
dataU = native2unicode(data);
% operate on data
outData = unicode2native(dataU);
fid = fopen(file, 'w');
fwrite(fid, outData, 'char');
fclose(fid);
```

Such a program would produce different and possibly incorrect results in V7.2 (R2006a). The calls to native2unicode and unicode2native are no longer necessary, because the fread and fwrite functions now convert data to and from MATLAB characters using the character encoding scheme specified in the calls to fopen. In V7.2 (R2006a), the example code can be simplified to produce correct results:

```

fid = fopen(file);
dataU = fread(fid, '*char')';
fclose(fid);
% operate on data
fid = fopen(file, 'w');
fwrite(fid, dataU, 'char');
fclose(fid);

```

Changes to code using fread, fgets, fgetl, and fscanff. If your code calls `native2unicode` to convert input to MATLAB characters using a specified (or default) encoding scheme, you can, but do not have to, remove the calls to `native2unicode`.

This applies to reading from an encoded file using any of the following:

- `fread` with precision set to `'*char'` or `'char=>char'`
- `fgets` or `fgetl`
- `fscanf` with the format specifier set to either `'%s'` or `'%c'`

When you remove a call to `native2unicode`, be sure that the call to `fopen` supplies the same encoding argument (if any) as the call to `native2unicode`.

You may have used code like these examples in V7.1 (R14SP3):

```

indata = native2unicode(fread(fid, '*char')');
indata = native2unicode(fread(fid, 'char=>char')');
indata = native2unicode(fgets(fid));
indata = native2unicode(fgetl(fid));
indata = native2unicode(fscanf(fid, '%s'));
indata = native2unicode(fscanf(fid, '%c'));

```

You can, but do not have to, remove the calls to `native2unicode` in V7.2 (R2006a):

```

indata = fread(fid, '*char')';
indata = fread(fid, 'char=>char')';
indata = fgets(fid);
indata = fgetl(fid);
indata = fscanf(fid, '%s');
indata = fscanf(fid, '%c');

```

Changes to code using `fwrite`. If your code calls `unicode2native` to convert output from MATLAB characters using a specified (or default) encoding scheme, in most cases you must remove the calls to `unicode2native`. This is especially important if the encoding represents multibyte characters.

This applies to writing an encoded file using `fwrite` with precision set to either `'char'` or `'char*1'`.

When you remove a call to `unicode2native`, be sure that the call to `fopen` supplies the same encoding argument (if any) as the call to `unicode2native`.

You may have used code like these examples in V7.1 (R14SP3):

```
fwrite(fid, unicode2native(outbuff), 'char');  
fwrite(fid, unicode2native(outbuff), 'char*1');
```

You must remove the calls to `unicode2native` in V7.2 (R2006a):

```
fwrite(fid, outbuff, 'char');  
fwrite(fid, outbuff, 'char*1');
```

Graphics and 3-D Visualization, MATLAB Version 7.2 (R2006a)

Two changes have been introduced in this version:

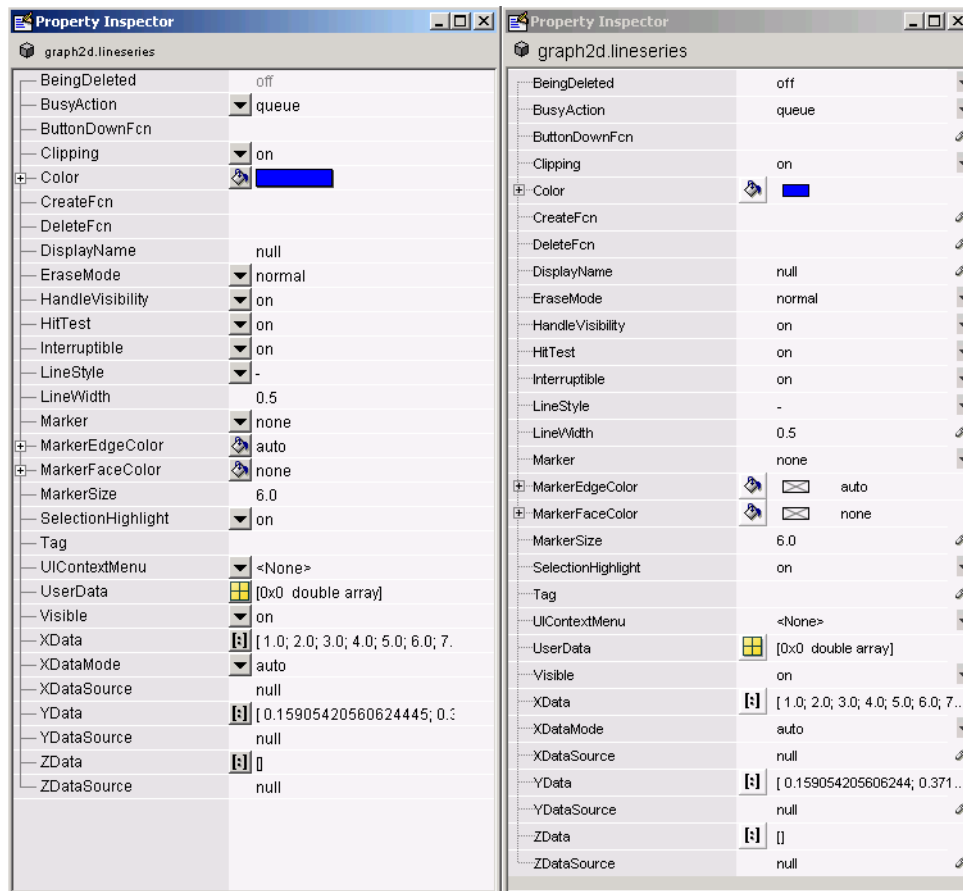
Pasting Cut or Copied Graphic Objects Can Create an Axes

The way in which MATLAB handles copying (or cutting) and pasting children of axes such as lineseries, barseries, or contourgroup objects has changed slightly. In previous releases, if no destination axes was selected prior to pasting one or more such objects, MATLAB would paste them into the current axes (returned by the `gca` function). MATLAB no longer makes this assumption; if no axes is currently selected when you paste graphic objects, a new axes is created in the destination figure to contain them.

To avoid creating a new axes where you do not want to do so, you should be in plot edit mode and have selected a destination axes before using **Edit** -> **Paste** or typing **CTRL-V**. You can use the Plot Browser to conveniently select objects to copy and to paste into.

Inspector Has New Look

The Property Inspector (the GUI summoned by the MATLAB `inspect` command) has a new look, but no changed functionality. The inspector enables you to view and change the most commonly used object properties. The figure below compares the previous version (7.1, left) of the Property Inspector with the new version (7.2, right):



Note that in addition to having a smaller font and wider line spacing, the new inspector locates pop-up menus at the right margin instead of between the two columns. Also, some icons have been redesigned.

Creating Graphical User Interfaces (GUIs), MATLAB Version 7.2 (R2006a)

New features and changes introduced in this version are:

- “Treatment of & in Menu Label Is Changed” on page 179
- “Major Documentation Revision” on page 179

Treatment of & in Menu Label Is Changed

The use of '&' (ampersand) in the `uimenu` 'Label' property string is changed for cases that use the constructs 'A& B' and 'A&&B'. The changes bring these constructs in line with the way '&' is used in other 'Label' constructs. See “Compatibility Considerations” below for specific information.

Compatibility Considerations

Interpretation of 'Label' property strings that use the following constructs is changed:

- The string 'A& B' now produces the menu label **A& B** with no underlined mnemonic. Previously, 'A& B' produced the label **A_B**, in which the space is a mnemonic.
- The string 'A&&B' now produces the menu label **A & B** with no underlined mnemonic. Previously, 'A&&B' produced the label **A&B** with no mnemonic.

If you use either construct, 'A& B' or 'A&&B', in your menu labels, verify that the new resulting label is acceptable or change the 'Label' property to a new string.

Major Documentation Revision

The MATLAB document *Creating Graphical User Interfaces* is reorganized and rewritten. It now consists of three sections:

- **Getting Started**—Leads you through the steps needed to create a simple GUI, both programmatically and using GUIDE.

- **Creating GUIs with GUIDE**—Contains the information, previously included in *Creating Graphical User Interfaces*, that you need to create a GUI using GUIDE. This section is organized in workflow order with many small examples of the various steps. A final chapter provides advanced examples.
- **Creating GUIs Programmatically**—For now, this section contains a summary of the available functions and complete code examples for three GUIs.

One GUI uses a variety of user interface controls to enable a user to calculate the mass of an object after specifying the object's density and volume.

Two other GUIs work together as an icon editor. One GUI, a color palette, is embedded in the other GUI, an icon editor. The color palette passes data to the icon editor whenever the GUI user selects a new color.

Note Following the release of MATLAB version 7.2, *Creating Graphical User Interfaces* will be further updated and expanded. The PDF and HTML versions of this document will be updated on The MathWorks Web site some time after the release. Check the top page of the HTML document and the title page of the PDF to determine if they have been updated.

External Interfaces/API, MATLAB Version 7.2 (R2006a)

New features and changes introduced in this version are:

- “MEX-Files Built with gcc on Linux Must Be Rebuilt” on page 181
- “MEX-Files in MATLAB for Windows x64” on page 182
- “New Microsoft and Intel Compilers Supported” on page 182
- “MWPOINTER Macro for Platform-Independent Fortran Code” on page 183
- “Compaq Visual Fortran Engine and MAT Options File Renamed” on page 183
- “Options Files Removed for Unsupported Compilers” on page 183
- “Obsolete Functions No Longer Documented” on page 184
- “Support for Licensed ActiveX Controls” on page 188
- “Support for VT_Date Type” on page 189
- “Dynamic Linking of External Libraries” on page 189

MEX-Files Built with gcc on Linux Must Be Rebuilt

In MATLAB V7.2 (R2006a) on Linux and Linux x86-64 platforms, MEX-files built with gcc must be recompiled and relinked using gcc version 3.4 or later. Rebuilding is required because MATLAB V7.2 (R2006a) on Linux and Linux x86-64 platforms is built with gcc version 3.4.

Compatibility Considerations

Changes in gcc version 3.4 have caused incompatibilities between MATLAB V7.2 (R2006a) and MEX-files built with gcc versions earlier than 3.4.

On Linux and Linux x86-64 platforms, MEX-files built with gcc versions earlier than 3.4 cannot be used in MATLAB V7.2 (R2006a).

On Linux and Linux x86-64 platforms, MEX-files built with gcc version 3.4 or later cannot be used in versions of MATLAB earlier than V7.2 (R2006a).

MEX-Files in MATLAB for Windows x64

With the introduction of MATLAB for Windows x64, you can now build 64-bit MEX-files. These MEX-files have the extension `.mexw64`. The `mexext` command returns `mexw64` in MATLAB for Windows x64.

Compatibility Considerations

MEX-files built using MATLAB for Windows (32-bit), which have `.mexw32` extensions by default, cannot be used in MATLAB for Windows x64.

By default, when MATLAB for Windows x64 is installed, the `mex.pl` and `mex.bat` scripts build MEX-files for a Windows x64 platform (with `.mexw64` extensions).

New Microsoft and Intel Compilers Supported

MATLAB V7.2 (R2006a) supports new compilers for building MEX-files on Windows and Windows x64 platforms:

- Microsoft Visual C++ 2005, also informally called Visual C++ 8.0, part of Visual Studio 2005
- Intel Visual Fortran 9.0

Environment Variables Needed for Intel Visual Fortran

When you build a MEX-file or an Engine or MAT application using Intel Visual Fortran 9.0, MATLAB requires an environment variable to be defined, depending on whether you are building in MATLAB for Windows (32-bit) or MATLAB for Windows x64:

- MATLAB for Windows (32-bit): The environment variable `VS71COMNTOOLS` must be defined. The value of this environment variable is the path to the `Common7\Tools` directory of the Visual Studio .NET 2002 or 2003 installation directory. (Intel Visual Fortran requires Visual Studio .NET 2002 or 2003 on 32-bit Windows platforms.) This environment variable is commonly defined by the Visual Studio .NET 2003 installation program.
- MATLAB for Windows x64: The environment variable `MSSdk` must be defined. The value of this environment variable is the path to the installation directory for Microsoft Platform SDK for Windows Server

2003. (Intel Visual Fortran requires Microsoft Platform SDK for Windows Server 2003 on Windows x64 platforms.) This environment variable is *not* commonly defined by the Microsoft Platform SDK installation program.

MWPOINTER Macro for Platform-Independent Fortran Code

MATLAB provides a preprocessor macro, `mwPointer`, that declares the appropriate Fortran type representing a pointer to an `mxArray` or to other data that is not of a native Fortran type, such as memory allocated by `mxMalloc`. On 32-bit platforms, the Fortran type that represents a pointer is `INTEGER*4`; on 64-bit platforms, it is `INTEGER*8`. The Fortran preprocessor translates `MWPOINTER` to the Fortran declaration that is appropriate for the platform on which you compile your file.

Compaq Visual Fortran Engine and MAT Options File Renamed

MATLAB V7.1 (R14SP3) included a Windows Engine and MAT options file named `df66engmatopts.bat`. This file contained options for Compaq Visual Fortran version 6.6 for use in building Fortran engine or MAT stand-alone programs. The file name `df66engmatopts.bat` originated with an earlier version of the Fortran compiler, named Digital Fortran.

In V7.2 (R2006a), this file has been renamed `cvf66engmatopts.bat` to match the Compaq Visual Fortran product name.

Compatibility Considerations

You may need to change any scripts that depend on the earlier name for the options file.

Options Files Removed for Unsupported Compilers

MATLAB V7.1 (R14SP3) included MEX, Engine, and MAT options files for a number of Windows C and Fortran compilers that were untested. These options files are not included in V7.2 (R2006a). The unsupported compilers, and the supported compilers that replace them, are:

Unsupported Compiler	Supported Replacement
Borland 5.0, 5.2, 5.3, 5.4	Borland 5.5, Borland 5.5 Free, Borland 5.6
Digital Visual Fortran 5.0, 6.0	Compaq Visual Fortran 6.1, Compaq Visual Fortran 6.6, Intel Visual Fortran 9.0
Microsoft Visual C++ 5.0, Visual C++ .NET 2002 (7.0)	Microsoft Visual C++ 6.0, Visual C++ .NET 2003 (7.1), Visual C++ 2005 (8.0)
Watcom 10.6, 11	Open Watcom 1.3

Compatibility Considerations

If you were using an untested compiler with a previous version of MATLAB, replace it with a supported compiler. You may need to recompile your MEX-files or applications.

Obsolete Functions No Longer Documented

In V7.1 (R14SP3), many MAT-file access, MX array manipulation, MEX-files, and MATLAB engine functions were declared obsolete in the External Interfaces Reference documentation. These functions are no longer documented in V7.2 (R2006a).

This section lists the obsolete functions removed from the documentation, along with replacement functions, if any.

Obsolete Functions: MAT-File Access

Obsolete Function	Replacement
<code>matDeleteArray</code> (C and Fortran)	<code>matDeleteVariable</code>
<code>matDeleteMatrix</code> (C and Fortran)	<code>matDeleteVariable</code>

Obsolete Function	Replacement
matGetArray (C and Fortran)	matGetVariable
matGetArrayHeader (C and Fortran)	matGetVariableInfo
matGetFull (C and Fortran)	matGetVariable followed by mxGetM, mxGetN, mxGetPr, mxGetPi
matGetMatrix (C and Fortran)	matGetVariable
matGetNextArray (C and Fortran)	matGetNextVariable
matGetNextArrayHeader (C and Fortran)	matGetNextVariableInfo
matGetNextMatrix (C and Fortran)	matGetNextVariable
matGetString (C and Fortran)	matGetVariable followed by mxGetString
matPutArray (C and Fortran)	matPutVariable
matPutArrayAsGlobal (C and Fortran)	matPutVariableAsGlobal
matPutFull (C and Fortran)	mxCreateDoubleMatrix followed by mxSetPr, mxSetPi, matPutVariable
matPutMatrix (C and Fortran)	matPutVariable
matPutString (C and Fortran)	mxCreateString followed by matPutVariable

Obsolete Functions: MX Array Manipulation

Obsolete Function	Replacement
mxClearLogical (C and Fortran)	None
mxCreateFull (C and Fortran)	mxCreateDoubleMatrix
mxCreateScalarDouble (C and Fortran)	mxCreateDoubleScalar
mxFreeMatrix (C and Fortran)	mxDestroyArray
mxGetName (C and Fortran)	matGetVariable, mexGetVariable, or engGetVariable
mxIsFull (C and Fortran)	mxIsSparse
mxIsString (C and Fortran)	mxIsChar
mxSetLogical (C and Fortran)	None
mxSetName (C and Fortran)	matPutVariable, mexPutVariable, or engPutVariable

Obsolete Functions: MEX-Files

Obsolete Function	Replacement
mexAddFlops (C)	None
mexGetArray (C and Fortran)	mexGetVariable
mexGetArrayPtr (C and Fortran)	mexGetVariablePtr
mexGetEps (C and Fortran)	mxGetEps

Obsolete Function	Replacement
mexGetFull (C and Fortran)	mexGetVariable followed by mxGetM, mxGetN, mxGetPr, mxGetPi
mexGetGlobal (C and Fortran)	mexGetVariablePtr
mexGetInf (C and Fortran)	mxGetInf
mexGetMatrix (C and Fortran)	mexGetVariable
mexGetMatrixPtr (C and Fortran)	mexGetVariablePtr
mexGetNaN (C and Fortran)	mxGetNaN
mexIsFinite (C and Fortran)	mxIsFinite
mexIsInf (C and Fortran)	mxIsInf
mexIsNaN (C and Fortran)	mxIsNaN
mexPutArray (C and Fortran)	mexPutVariable
mexPutFull (C and Fortran)	mxCreateDoubleMatrix followed by mxSetPr, mxSetPi, mexPutVariable
mexPutMatrix (C and Fortran)	mexPutVariable

Obsolete Functions: MATLAB Engine

Obsolete Function	Replacement
engGetArray (C and Fortran)	engGetVariable

Obsolete Function	Replacement
engGetFull (C and Fortran)	engGetVariable followed by mxGetM, mxGetN, mxGetPr, mxGetPi
engGetMatrix (C and Fortran)	engGetVariable
engPutArray (C and Fortran)	engPutVariable
engPutFull (C and Fortran)	mxCreateDoubleMatrix followed by mxSetPr, mxSetPi, engPutVariable
engPutMatrix (C and Fortran)	engPutVariable
engSetEvalCallback (C)	None
engSetEvalTimeout (C)	None
engWinInit (C)	None

Compatibility Considerations

Most of the functions listed as obsolete in this section are unsupported in V6.5 (R13) and later versions. Some obsolete functions are unsupported in earlier versions.

If this section lists a replacement for an obsolete function, change any code that refers to the obsolete function to use the replacement instead.

If you must use an obsolete function in a MEX-file or application, use the `-V5` option to `mex` when you build the file.

Support for Licensed ActiveX Controls

MATLAB supports the use of ActiveX controls that require licensing at both design time and runtime.

See the `actxcontrol` function for information on how to specify a design-time license key.

See “Deploying ActiveX Controls Requiring Run-Time Licenses” for information on how to use ActiveX Controls that require runtime licenses in your MATLAB application.

Support for VT_Date Type

MATLAB defines a data type to be used with controls requiring input defined as type VT_DATE. See “Date Data Type” for more information.

Dynamic Linking of External Libraries

MATLAB supports dynamic linking of external libraries only on 32-bit MS-Windows systems and 32-bit Linux systems. See “MATLAB Interface to Generic DLLs” for more information.

Version 7.1 (R14SP3)

MATLAB

This table summarizes what's new in Version 7.1 (R14SP3):

New Features and Changes	Version Compatibility Considerations	Fixed Bugs and Known Problems	Related Documentation at Web Site
Yes Details below	Yes — Details labeled as Compatibility Considerations in descriptions of new features and changes. See also Summary.	Bug Reports at Web site	No

New features and changes introduced in this version are organized by these areas:

- “Desktop Tools and Development Environment, MATLAB Version 7.1 (R14SP3)” on page 193
- “Mathematics, MATLAB Version 7.1 (R14SP3)” on page 207
- “Data Analysis, MATLAB Version 7.1 (R14SP3)” on page 211
- “Programming, MATLAB Version 7.1 (R14SP3)” on page 213
- “Graphics and 3-D Visualization, MATLAB Version 7.1 (R14SP3)” on page 220

- “Creating Graphical User Interfaces (GUIs), MATLAB Version 7.1 (R14SP3)” on page 221
- “External Interfaces/API, MATLAB Version 7.1 (R14SP3)” on page 223

Desktop Tools and Development Environment, MATLAB Version 7.1 (R14SP3)

New features and changes introduced in this version are organized by these topics:

- “Startup and Shutdown” on page 193
- “Desktop” on page 194
- “Running Functions — Command Window and Command History” on page 197
- “Help” on page 198
- “Workspace, Search Path, and File Operations” on page 200
- “Editing and Debugging M-Files” on page 201
- “Tuning and Managing M-Files” on page 204
- “Publishing Results” on page 205

Startup and Shutdown

New features and changes introduced in this version are described here.

Windows -nodesktop No Longer has Menu Bar and Toolbar; Use Function Equivalents Instead

The behavior of MATLAB when started on a Windows platform with the `-nodesktop` option has changed. The MATLAB Command Window no longer displays a menu bar or toolbar. This change resolves a number of problems that occurred in previous versions when running MATLAB in `-nodesktop` mode on Windows.

Compatibility Considerations. Use equivalent functions instead of the menu and toolbar.

Instead of using the **File > Preferences** menu to modify the font or colors used in the Command Window, run `preferences -nodesktop`. For more information, see “preferences Function Now Supports `-nodesktop` Option” on page 196.

Desktop

New features and changes introduced in this version are organized by these topics:

- “Arranging Windows and Documents” on page 194
- “Preferences Directory Added for R14SP3; Supplements R14 Directory” on page 195
- “Preferences Changes for Fonts, Hyperlinks, and -nodesktop” on page 196
- “info.xml File Automatic Validation; Shows Warnings for Invalid Constructs” on page 197
- “Other Desktop Changes” on page 197

Arranging Windows and Documents

Figure Windows Now Dockable on Macintosh. On Macintosh platforms, figure windows are now dockable.

Resize Multiple Tools at Once. You can now position the pointer at the intersection of three or four tools or documents to resize all of them at once.

Resize and Move Desktop Tools Using the Keyboard. There are now menu items you can select to move and resize the active tool in the desktop. Use the menu item mnemonics to perform those action with the keyboard. For example, if the Command Window is in the desktop along with other tools, press **Ctrl+0** (or click in it) to make the Command Window the active tool. Then press **Alt+D, V**, which is the mnemonic equivalent for selecting **Desktop > Move Command Window**. The pointer becomes an arrow. Use the arrow keys to move an outline of the Command Window to a new dockable location. Press **Enter** to dock it there, or press **Esc** to return the Command Window to its original position.

Resize Names in the Document Bar. You can now adjust the width of a name in the document bar when the bar is at the top or bottom of the window.

Positioning Document Bar Menu Item Name Changed. In previous versions, selecting **Desktop > Document Bar** displayed only menu items for positioning the document bar. Now, there are additional menu items. The same change was made to the context menu for the document bar. To access the menu items for positioning the document bar, select **Desktop > Document Bar > Bar Position**.

Keyboard Access Added for Document Bar Options. The **Desktop > Document Bar** now includes these items: **Alphabetize**, **Width**, and **Move documentname On Bar**. With their inclusion in the menu, you can use the keyboard to access these features via mnemonics. For example, on Windows, press **Alt+D, M, A** as a shortcut to for **Desktop > Document Bar > Alphabetize**.

Left/Right and Top/Bottom Split for Document Arrangements Name Changed. When arranging documents in desktop tools, you can choose **Window > Left/Right Split** or **Window > Top/Bottom Split** to show two documents at once in the tool. Those menu items are now called **Left/Right Tile** and **Top/Bottom Tile**. This change was made to avoid any confusion with the Editor/Debugger's new split screen feature.

Preferences Directory Added for R14SP3; Supplements R14 Directory

There is a new preferences directory, R14SP3. This is the directory name returned when you run the `prefdir` function. When you install R14SP3, MATLAB migrates files from your existing preference directory, R14, to the new directory, R14SP3. Changes made to files in the directory when you run R14SP3 are not used when you run previous R14 releases.

This represents a change in the preference directory MATLAB uses for a minor release, and was done to prevent serious backwards compatibility problems. It is primarily relevant if you use R14SP3 and previous R14 releases. If you only run R14SP3, or run R14SP3 with R13 or R12 releases, you will not be affected by this change.

In the past, minor releases and the associated major release used the same preferences directory. For example, R13 and R13SP1 shared the R13 preferences directory. That continues to be true for all previous releases, but is not true for R14SP3 and beyond. The R14 preferences directory will be

shared by the R14 through R14SP2 releases, but the new R14SP3 preferences directory is only used by R14SP3. This means that changes made to files in the directory while running R14SP3 are not used when you run a previous R14 release, and the reverse is true. For example, statements added to the Command History when you run R14SP3 are not in the Command History when you run R14SP2.

For more information, see the reference page for `prefdir`.

Compatibility Considerations. This change was made to prevent major backwards compatibility problems. Use the R14SP3 preferences directory instead of the R14 directory. If you use the `prefdir` function and have code that relies on the result being R14, you will need to modify that code.

Preferences Changes for Fonts, Hyperlinks, and -nodesktop

Font Antialiasing Preference Added. In **Preferences > Fonts**, select the new antialiasing preference to provide a smoother appearance to desktop fonts.

Hyperlink Color Preference Changed. There is a new **Colors** preference for specifying the color of hyperlinks in the Command Window and the Help browser **Index** pane. In previous releases, this preference only applied to the Command Window hyperlinks and was accessed via Command Window preferences.

preferences Function Now Supports -nodesktop Option. Run `preferences -nodesktop` after starting MATLAB on Windows with the `-nodesktop` option to change Command Window font and colors via a special **Preferences** dialog box.

To set other available preferences for the Command Window after starting MATLAB with the `-nodesktop` option, run `preferences` and use the resulting **Preferences** dialog box for all tools and products. Note that changes you make to font and color preferences in this dialog box do not apply to the Command Window.

info.xml File Automatic Validation; Shows Warnings for Invalid Constructs

If you add your own toolbox to the **Start** button, you can use the schema file for its `info.xml` file, `matlabroot/sys/namespace/info/v1/info.xsd`. MATLAB now automatically validates your `info.xml` file against this schema when you click the **Start** button after updating and refreshing your `info.xml` file.

Compatibility Considerations. If your `info.xml` contains invalid constructs, you will see warnings in the Command Window until you correct the problems.

Other Desktop Changes

Paste Special Menu Item Renamed. In the **Edit** menu, the name of the **Paste Special** item has been replaced by **Paste to Workspace**, but the functionality remains the same. It opens the Import Wizard so you can paste the clipboard contents to the MATLAB workspace.

Rename Shortcut Categories. You can now rename shortcut categories.

Running Functions – Command Window and Command History

New features and changes introduced in this version are

- “Tab Completion Preference Added” on page 197
- “Tab Completion No Longer Shows Entries Twice” on page 198
- “Incremental Search Now Supports Removing Characters” on page 198
- “Hyperlink Color Preference Moved” on page 198

Tab Completion Preference Added

There is a new Command Window preference, **Tab key narrows completion**. When selected, with a list of possible completions in view, type another character and press **Tab** to further narrow the list shown. Repeat to continue narrowing the list. This behavior is similar to tab completion behavior in releases prior to R14.

Tab Completion No Longer Shows Entries Twice

In previous versions, when completing filenames or function names, a name sometimes appeared twice in the completion list, once with the file extension and once without. Now the entry appears only once.

Incremental Search Now Supports Removing Characters

In incremental search, use **Ctrl+G** to remove characters back to the previous successful string of characters found. For example, when searching for the term `plode`, the text is not found and `Failing` appears in the incremental search field. **Ctrl+G** automatically removes the `de` from the search term because `plo` does exist in the file.

Hyperlink Color Preference Moved

The preference for specifying the hyperlink color has moved from the Command Windows preferences pane to the **Colors** preferences pane. The hyperlink color now also applies to links in the Help browser **Index** pane.

Compatibility Considerations. Use the **Colors** preference pane to specify the hyperlink color, and be aware that it also impacts the Help browser Index pane color.

Help

New features and changes introduced in this version are

- “Hyperlink Color in the Index Pane Preference Added” on page 199
- “New Look for Demos, Including Thumbnails and Categories” on page 199
- “Demos Run in Command Window as Scripts and Their Variables Now Created in Base Workspace” on page 199
- “echodemo Function Added to Replace playshow function” on page 200
- “Add Demos to Favorites” on page 200
- “Adding Your Own Demos Type Tag Now Supported” on page 200
- “Bug Reporting System Introduced” on page 200

Hyperlink Color in the Index Pane Preference Added

You can now specify the color for links in the Help browser **Index** pane using the **Colors** preferences pane. The hyperlink color also applies to links in the Command Window, so changes you make to the preference apply to both tools.

New Look for Demos, Including Thumbnails and Categories

Stylistic changes were made to the Demos interface in the Help browser. On the summary page for a product, each demo appears with a thumbnail image that provides an indication of the type of output it creates, as well as an icon representing the type of demo (M-file, M-GUI, model, or video).

Demos Run in Command Window as Scripts and Their Variables Now Created in Base Workspace

In this release, all M-file demos include the **Run in the Command Window** link, which executes the demo via `echodemo`.

In previous releases, some M-file demos provided a **Run** hyperlink in the display pane. When you clicked **Run**, the M-file demo executed in a GUI via the `playshow` function. An example of this type of demo is the MATLAB Mathematics Basic Matrix Operations demo, `intro.m`. In this release, the **Run** hyperlink for these M-file demos has been replaced by **Run in the Command Window**. It executes the demo step by step in the Command Window via the `echodemo` function. Double-clicking this type of M-file demo in the Navigator pane no longer runs the M-file demo, but opens the M-file in the Editor/Debugger where you can run it step by step using **Cell > Evaluate Current Cell and Advance**.

Compatibility Considerations. The new **Run in Command Window** hyperlink represent a change in the way demos run.

The `echodemo` function MATLAB uses to run M-file demos in the Command Window runs the demos as scripts. The `playshow` function MATLAB used to run M-file demos in previous releases ran the demos as a function. This means that now the demo's variables are created in the base workspace. If you have variables in the base workspace when you run an M-file demo, and the demo uses an identical variable name, there could be problems with variable name conflicts. For example, your variable could be overwritten. The demo's variables remain in the base workspace after the demo finishes running until

you clear them or quit MATLAB. Another change is that figures are not automatically closed when you end the demo.

echodemo Function Added to Replace playshow function

There is a new echodemo function that replaces playshow. The Demos browser uses echodemo to execute M-file demos when you click the **Run in the Command Window** link.

Compatibility Considerations. The playshow function is deprecated in favor of the echodemo function. In a future release, the playshow function will be removed. In practice, both echodemo and playshow are helper functions for running demos. It is unlikely you would ever call either playshow or echodemo directly, and especially not in M-files.

Add Demos to Favorites

You now can add published M-file demos to favorites.

Adding Your Own Demos Type Tag Now Supported

If you add demos for your own toolbox, you can use the new <type> tag for a <demoitem> to identify the type of demo in your toolbox's demos.xml file.

Bug Reporting System Introduced

You now can view bugs fixed with this release, as well as any known bugs using the Bug Reports database in the Support section of the MathWorks Web site. The MathWorks continuously updates the database to add any newly found bugs and compatibility issues, as well as any new workarounds and solutions. The system includes bugs found and fixed in R14SP2 and later releases.

Workspace, Search Path, and File Operations


New features and changes introduced in this version are described here.

Find Files Offers Additional Filtering

The Find Files tool has been enhanced. It now allows you to search all file types except those specified. It also lets you ignore files larger than a specified

size. Along with enhancements to the Find Files tool, some minor feature changes were made, including the removal of the **Restore Defaults** button.

Visual Directory View to be Removed

In the next release, the Current Directory browser will no longer support the Visual Directory view (accessed using the  toolbar button).

Compatibility Considerations. Some features currently available using the Visual Directory view will not be available in the next release when the feature is removed.

Editing and Debugging M-Files

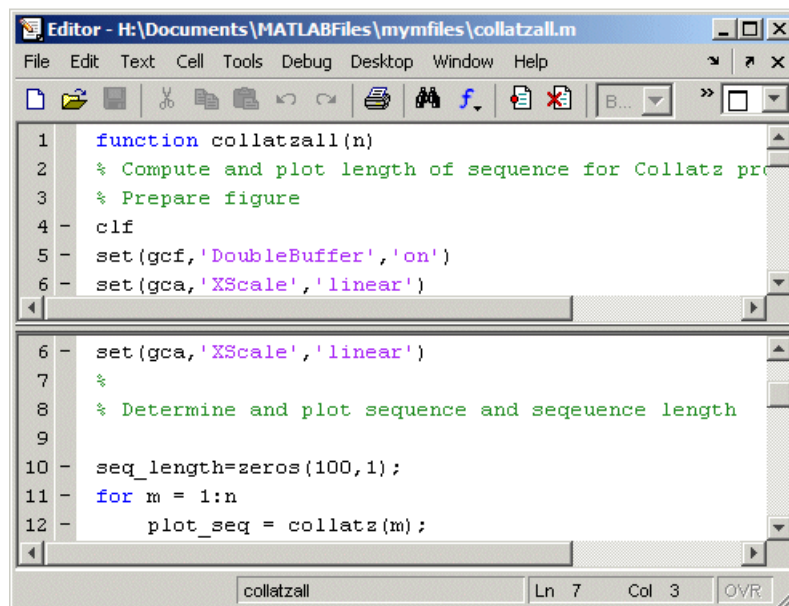
New features and changes introduced in this version are

- “Split Screen Display Added” on page 201
- “Highlight Current Line Added” on page 202
- “Comment Lines in Java and C/C++ Files Now Supported” on page 203
- “HTML File Indenting Feature Added as the Default” on page 203
- “Incremental Search Now Supports Removing Characters” on page 204
- “Emacs Key Binding for Select All” on page 204
- “Change Case Added to Menu” on page 204
- “Nested Function Name No Longer in Status Bar” on page 204

Split Screen Display Added

The Editor/Debugger now supports a horizontal or vertical split screen for displaying two different parts of the same document at once. To split the screen, select **Window > Split Screen** and the splitting action you want, for example, **Top/Bottom**. Alternatively, drag the splitter bar that appears above the vertical scroll bar or to the left of the horizontal scroll bar. To remove the splitter, drag it to an edge of the window.

Document with top/bottom split.

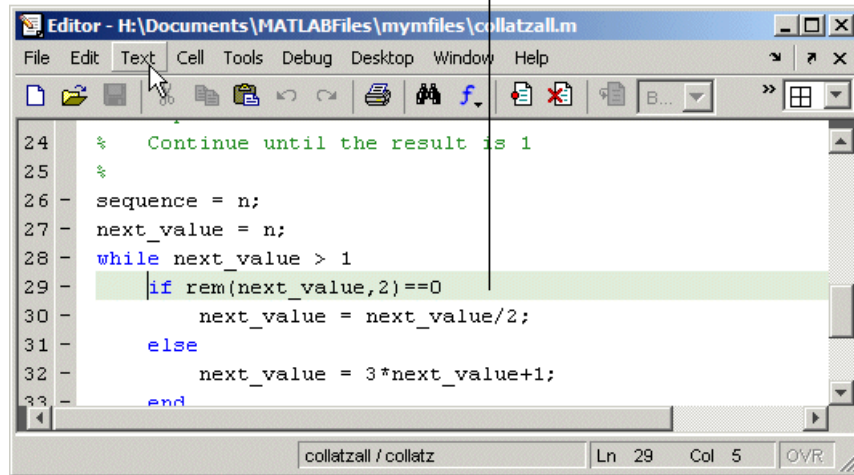


```
1 function collatzall(n)
2 % Compute and plot length of sequence for Collatz pro
3 % Prepare figure
4 clf
5 set(gcf,'DoubleBuffer','on')
6 set(gca,'XScale','linear')
6 set(gca,'XScale','linear')
7 %
8 % Determine and plot sequence and sequence length
9
10 seq_length=zeros(100,1);
11 for m = 1:n
12     plot_seq = collatz(m);
```

Highlight Current Line Added

You can set a preference to highlight the current line, that is, the line with the caret (also called the blinking cursor). This is useful, for example, to help you see where copied text will be inserted when you paste. To highlight the current line, select **Preferences > Editor/Debugger > Display** and under **General Display Options**, select the check box for **Show caret row highlighting**. You can also specify the color used to highlight the line.

Current line (line with the caret/blinking cursor) is highlighted.



Comment Lines in Java and C/C++ Files Now Supported

You can now use the **Text > Comment** feature to comment selected lines in Java and C/C++ files. This adds the // symbols at the front of the selected lines. Similarly, **Text > Uncomment** removes the // symbols from the front of selected lines in Java and C/C++ files.

HTML File Indenting Feature Added as the Default

There is a new Editor/Debugger language preference for HTML files to specify block indenting. By default, the preference is selected so block indenting applies when typing text in HTML files.

In addition, you now can select **Text > Smart Indent** to apply smart indenting to selected text in HTML files.

Compatibility Considerations. When typing text in HTML files, you will automatically see block indenting because the preference is selected by default.

Incremental Search Now Supports Removing Characters

In incremental search, use **Ctrl+G** to remove characters back to the previous successful string of characters found. For example, when searching for the term `plode`, the text is not found and `Failing` appears in the incremental search field. **Ctrl+G** automatically removes the `de` from the search term because `plo` does exist in the file.

Emacs Key Binding for Select All

With the Emacs key bindings preference selected, use **Ctrl+X, H** to select all.

Change Case Added to Menu

Use new items in the **Text** menu to change the case of selected text. You can also use the keyboard equivalents for changing case that existed in previous versions—these are shown in the menu next to each item.

Nested Function Name No Longer in Status Bar

The Editor/Debugger no longer displays the current nested function name in the status bar. Look in the M-file to view the current nested function name.

Tuning and Managing M-Files

New features and changes introduced in this version are described here.

Directory Reports Uses New Run Buttons

With Directory Reports displayed in the Web browser, you can use these two new buttons:

- **Rerun This Report** — This updates the currently displayed report after you have made changes to the report options or to any files in the current directory.
- **Run Report on Current Directory** — Use this after changing the current directory to run the same type of report for the new current directory.

These new buttons replace the **Refresh** button.

Override %#ok with the New `mlint -notok` Option

There is a new option for the `mlint` function, `'-notok'` you can use to override any statements that include `%#ok` (the symbol you add to the end of a line instructing `mlint` to ignore the line). That is, `mlint` will run for all lines in the file and will not ignore any statements.

Hyperlink Now Part of Messages Displayed by `mlint`

When you run the `mlint` function, the line number in the messages displayed is a hyperlink that when clicked, opens the file in the Editor/Debugger scrolled to that line number.

Profiler Button Added to Toolbar

There is now a button  on the MATLAB desktop toolbar to open the Profiler.

Publishing Results

New features and changes introduced in this version are described here.

Notebook Setup Changes; Some Arguments Removed

The notebook function setup behavior and syntax have changed.

When you run `notebook(' -setup')`, MATLAB automatically obtains all the Word information from the Windows system registry and you are no longer prompted to supply the information.

In previous versions, when you configured Notebook, you ran

```
notebook (' -setup')
```

Notebook then prompted you to specify the version of Microsoft Word you were using, and if needed, the location of Word and its template directory. You could supply the information using optional arguments to the notebook function:

```
notebook(' -setup', wordversion, wordlocation, templatelocation)
```

Now, when you run `notebook(' -setup')`, MATLAB automatically obtains all the Word information from the Windows system registry.

Compatibility Considerations. If you use notebook with the `wordversion`, `wordlocation`, and `templatelocation` arguments in any of your files (for example, `startup.m`), remove those arguments in your files. If you specify the optional arguments, the notebook function runs and issues a warning, but ignores the values. In a future release, MATLAB will issue an error when it encounters notebook with these arguments.

Word Versions Supported by Notebook; Word 97 No Longer Supported

MATLAB Notebook supports Word versions 2000, and supports Word 2002 and 2003, both for XP.

Compatibility Considerations. As of MATLAB 7.1 (R14SP3), Notebook no longer supports Microsoft Word 97.

Mathematics, MATLAB Version 7.1 (R14SP3)

New features and changes introduced in this version are organized by these topics:

- “New Functions” on page 207
- “Modified Functions” on page 208
- “Changes to accumarray” on page 208
- “Imposing Nonnegativity Constraints on Computed ODE Solution” on page 209
- “Mersenne Twister Support in rand” on page 209
- “svd Returns Economy Decomposition” on page 209
- “New Location for LAPACK Libraries” on page 210
- “Documentation on Data Analysis” on page 210

New Functions

The following functions are new in R14SP3:

Function	Description
hypot	Square root of sum of squares
mode	Finds most frequent values in sample

Compatibility Considerations

A new function name can potentially introduce a backward incompatibility since it can, under certain circumstances, override a variable with the same name as the new function. This is especially true for names that are commonly used as variable names in program code.

An example of such a function name is the `mode` function, introduced in this release. If you have M-file programs that use `mode` as a variable name, it is possible under certain conditions for MATLAB to interpret these variable names as function names by mistake. Read the section “Potential Conflict with Function Names” in the MATLAB Programming documentation to find out how to avoid having these variables misinterpreted.

If your program code uses a user-written function named `mode`, you may find that MATLAB calls the new MATLAB `mode` function instead of your own `mode` function. To correct this, modify your MATLAB path by placing the location of your own `mode` function closer to the beginning of the path string than the location of the MATLAB `mode.m` file. The help for the `addpath` and `rmpath` functions explains how to modify your MATLAB path.

Modified Functions

The following functions have been modified in MATLAB 7.1:

Function	Modified Behavior
<code>accumarray</code>	Allows more flexibility for input/output classes and functions to be called
<code>odeset</code>	New <code>NonNegative</code> integration property to impose nonnegativity constraints on an ODE solution
<code>rand</code>	Supports the Mersenne Twister algorithm in generating random numbers
<code>svd</code>	Returns economy decomposition

Changes to `accumarray`

MATLAB Version 7.1 adds the following new features to the `accumarray` function:

- The data type for the `val` input can be any numeric type, or logical, or character.
- The data type for the `subs` input can be any numeric type.
- You can use a cell array of separate index vectors for the `subs` input.
- When you specify a function input argument, the value returned by `accumarray` is given the same class as the values returned by that function.
- You can control the sparsity of the value returned by `accumarray` by specifying the new input argument `issparse`.

Imposing Nonnegativity Constraints on Computed ODE Solution

There is a new integration property called `NonNegative` that you can use when applying ODE initial value problem solvers. If you need to solve a problem in which certain components of the solution must be nonnegative, use the `NonNegative` property to impose nonnegativity constraints on the computed solutions.

See “Example: Computing Nonnegative Solutions” under “Differential Equations” in the MATLAB Mathematics documentation for more information on this feature.

Mersenne Twister Support in `rand`

The `rand` function now supports a method of random number generation called the Mersenne Twister. The algorithm used by this method, developed by Nishimura and Matsumoto, generates double precision values in the closed interval $[2^{-(53)}, 1-2^{-(53)}]$, with a period of $(2^{19937}-1)/2$.

For a full description of the Mersenne twister algorithm, see <http://www.math.sci.hiroshima-u.ac.jp/~m-mat/MT/emt.html>.

`svd` Returns Economy Decomposition

The following feature was released in MATLAB 7.0, but was undocumented until this release.

The command `svd(A, 'econ')` returns economy decomposition on matrices having few rows and many columns as well as those with many rows and few columns. `svd(A,0)` continues to behave as it always has, namely to only return economy-sized decomposition on matrices having many rows and few columns.

Note that this does not carry over to the `qr` function as there is no valid way of cutting out any of the information returned by `qr` to make an economy-sized decomposition of matrices having few rows and many columns.

New Location for LAPACK Libraries

The location of the LAPACK libraries has been changed. These libraries are now located in

```
extern/lib/win32/microsoft/libdflapack.lib  
extern/lib/win32/microsoft/libmwapack.lib
```

This change impacts you only if you build MEX-files that call LAPACK and BLAS functions.

Documentation on Data Analysis

The section of the MATLAB Mathematics documentation on “Data Analysis and Statistics” has been moved to a new *MATLAB Data Analysis* book.

This book documents MATLAB functions and tools that support basic data analysis, including plotting, descriptive statistics, correlation, interpolation, filtering, and Fourier analysis. It also documents the new object-oriented command-line API for analyzing time-series data.

Data Analysis, MATLAB Version 7.1 (R14SP3)

New features and changes introduced in this version are described in this section:

Data Analysis Documentation

The MATLAB 7.1 documentation includes a new Data Analysis book that describes how to use MATLAB functions and tools for common data-analysis tasks:

- Plotting
- Filtering
- Interpolation
- Descriptive statistics
- Correlation
- Data fitting using linear regression
- Fourier analysis
- Time-series analysis

Some of the content in Data Analysis is incorporated from the Mathematics and Graphics books, such as data plotting, descriptive statistics, data fitting, and Fourier analysis. All information about time-series analysis is new.

Time-Series Analysis

You can analyze time-series data using the new `timeseries` and `tscollection` objects and methods, as well as the Time Series Tools graphical user interface. This new functionality supports the following:

- Representation for univariate or multivariate time series from MATLAB and Simulink® logged-signals data
- Built-in management of time units
- Removal or interpolation of missing data
- Resampling of data

- Arithmetic operations for `timeseries` objects
- Synchronization of time series

Note Due to reported instabilities on the Linux 64 platform, you must manually enable the Time Series Tools feature before starting Time Series Tools.

To manually enable Time Series Tools on the Linux 64 platform, type the following at the MATLAB prompt:

```
rehash toolboxcache
feature('TimeSeriesTools',1)
```


Programming, MATLAB Version 7.1 (R14SP3)

New features and changes are organized by these topics:

- “New Functions” on page 213
- “Modified Functions” on page 214
- “Evaluation Functions for Arrays, Structures, Cells” on page 215
- “Using who and whos with Nested Functions” on page 215
- “Date and Time Functions Support Milliseconds” on page 215
- “Stack Trace Provided for lasterror” on page 215
- “isfield Function Supports Cell Arrays; Results Might Differ from Previous Version” on page 215
- “Support for Reading EXIF Data from Image Files” on page 216
- “Performance Improvements to the MATLAB JIT/Accelerator on Macintosh” on page 217
- “Specifying fread Precision as Number of Bits” on page 217
- “Seconds Field Now Truncated; Results Might Differ” on page 218
- “Built-in Functions No Longer Use .bi; Impacts Output of which Function” on page 218
- “New Warning About Potential Naming Conflict” on page 219

New Functions

This version introduces the following new functions:

Function	Description
arrayfun	Applies a given function to each element of an array. This is especially useful for arrays of structures.
exifread	Reads EXIF information from JPEG and TIFF image files
structfun	Applies a given function to each field of a structure

Function	Description
swapbytes	Swaps byte ordering
typecast	Converts data types without changing underlying data

Compatibility Considerations

A new function name can potentially introduce a backward incompatibility since it can, under certain circumstances, override a variable with the same name as the new function. This is especially true for names that are commonly used as variable names in program code. Read the section “Potential Conflict with Function Names” in the MATLAB Programming documentation to find out how to avoid having these variables misinterpreted.

Modified Functions

The following functions were modified in this version:

Function	Modified Behavior
cellfun	Applies a given function to each cell of a cell array
datestr	Seconds field truncates instead of rounding
error	Saves stack information that you can retrieve using <code>lasterror</code>
isfield	Supports cell array input
lasterror	Returns stack information on last error
rethrow	Accepts stack information as input
who, whos	Displays information separately for nested functions

Compatibility Considerations

The following functions might, under certain circumstances, return a different value than what was returned in MATLAB 7.0.4 (R14SP2):

- `datestr`: Output might differ by 1 second from what was returned in a previous version.

- `isfield`: Output might differ if you used this feature in a release in which it was not officially supported.

Evaluation Functions for Arrays, Structures, Cells

MATLAB offers the capability to apply a given function to each element of an array, each field of a structure, or each cell of a cell array. See the help on `arrayfun`, `structfun`, and `cellfun` for more information.

Using `who` and `whos` with Nested Functions

When you use `who` or `whos` inside of a nested function, MATLAB returns or displays all variables in the workspace of that function, and in the workspaces of all functions in which that function is nested. This applies whether you include calls to `who` or `whos` in your M-file code or if you call `who` or `whos` from the MATLAB debugger. See the `thewho` reference page for more information.

Date and Time Functions Support Milliseconds

The `datestr`, `datenum`, and `datevec` functions now support time specification in milliseconds. Use the symbol `.FFF` to represent milliseconds in any of these three functions. See the table labeled Free-Form Date Format Specifiers on the `datestr` reference page for more information.

Stack Trace Provided for `lasterror`

The `lasterror` function now returns an additional field in the structure that it returns. The new `stack` field contains information from the stack on the M-file, function, and line in which the error occurred.

You can use this stack information to track down the source of an error, or as an input to the `rethrow` function. When used with `rethrow`, MATLAB sets the stack of the rethrown error to the value contained in the stack input.

`isfield` Function Supports Cell Arrays; Results Might Differ from Previous Version

The `isfield` function now supports cell array input as shown in this example. Check structure `S` for any of four possible field names. In this case, only the first is found, so the first element of the return value is set to true:

```
S = struct('one', 1, 'two', 2);

fields = isfield(S, {'two', 'pi', 'One', 3.14})
fields =
     1     0     0     0
```

Compatibility Considerations

There might be backward compatibility issues associated with this change if you used `isfield` with cell array input in a previous release. In previous releases, although `isfield` might have worked with this type of input in certain cases, it was not officially a supported feature. If you used this previously unsupported syntax in previous releases, you may see a change in the content and/or size of the return values in this release.

For example, create a structure `s` with three fields `a`, `b`, and `c` created in that order. In MATLAB 7.0.4, `isfield` called with a cell array input returns true if any of the elements of the cell array matches a field name, and if that element is in the same position in the cell array as the field is in the structure. This is true for `'c'`:

```
isfield(s, {'b'; 'a'; 'c'})
ans =
     1
```

In MATLAB 7.1, `isfield` returns true for each element in the cell array that matches a field name, regardless of where the string is positioned in the cell array. This is true for `'a'`, `'b'`, and `'c'`:

```
isfield(s, {'b'; 'a'; 'c'})
ans =
     1
     1
     1
```

Support for Reading EXIF Data from Image Files

You can now read EXIF (Exchangeable Image File Format) data from JPEG and TIFF graphics files using the new `exifread` function. EXIF is a standard used by digital camera manufacturers to store information in the image file,

such as the make and model of a camera, the time the picture was taken and digitized, the resolution of the image, exposure time, and focal length.

Performance Improvements to the MATLAB JIT/Accelerator on Macintosh

The JIT/Accelerator for MATLAB, introduced in MATLAB Version 6.5 for Windows and UNIX, is now also supported on Macintosh systems. The JIT/Accelerator affects the performance of MATLAB and can give you a substantial performance increase over earlier MATLAB versions for many MATLAB applications.

Specifying fread Precision as Number of Bits

The following information on the `fread` function applies to MATLAB 7.1 and also to earlier versions.

MATLAB provides the following method of specifying a precision argument in a call to `fread`:

```
input_format=>output_format
```

For example, to read 50 8-bit unsigned integers from a file and convert them to characters, you can use

```
c = fread(fid, 50, 'uint8=>char')
```

If the input format and output format are the same, you can abbreviate the precision specifier by using

```
*input_format
```

For example, you can replace

```
c = fread(fid, 50, 'uint8=>uint8')
```

with

```
c = fread(fid, 50, '*uint8')
```

You can also use this notation with an input stream that is specified as a number of bits (e.g., `bit4` or `ubit18`). MATLAB translates this into an

output type that is a signed or unsigned integer (depending on the input type), and which is large enough to hold all of the bits in the source format. For example, `*ubit18` does not translate to `ubit18=>ubit18`, but instead to `ubit18=>uint32`.

Seconds Field Now Truncated; Results Might Differ

When handling time data, MATLAB now truncates the seconds field instead of rounding it. This is consistent with the way that MATLAB handles hours and minutes.

For example, using MATLAB 7.0.4 (R14SP2), `datestr` returns

```
t = datestr('11:30:01.666')
t =
    01-Jan-2005 11:30:02
```

while MATLAB 7.1 (R14SP3) returns

```
t = datestr('11:30:01.666')
t =
    01-Jan-2005 11:30:01
```

Compatibility Considerations

If your M-files relied on the previous behavior, you might get different results.

Built-in Functions No Longer Use .bi; Impacts Output of which Function

In previous releases, MATLAB function dispatching located built-in functions by means of special files having a `.bi` file extension. MATLAB no longer uses this mechanism to locate built-in functions. All `.bi` files have been removed in MATLAB 7.1.

Compatibility Considerations

If you have M-files that relied on built-in files having a `.bi` extension, your files need to accommodate this change.

There are changes in how MATLAB displays built-in functions using `which`:

In MATLAB 7.0.4 (R14SP2),

```
which -all int32
\\matlab\toolbox\symbolic\@sym\int32.m           % sym method
\\matlab\toolbox\matlab\datatypes\int32.bi      % Shadowed
\\matlab\toolbox\matlab\datatypes\int32.m      % Shadowed
```

In MATLAB 7.1 (R14SP3),

```
which -all int32
built-in (\\matlab\toolbox\matlab\datatypes\int32)
\\matlab\toolbox\symbolic\@sym\int32.m         % sym method
```

New Warning About Potential Naming Conflict

If you change directories (`cd`) or add a new directory to your current MATLAB path, and the new directory contains an M-file having the same name as a MATLAB built-in function, MATLAB now displays a warning alerting you to the potential naming conflict. For example,

```
Warning: Function D:\test\matlab\disp.m has the same name as a
MATLAB builtin. We suggest you rename the function to avoid a
potential name conflict.
```

In general, any file system event that leads to path refreshing in MATLAB can trigger this warning if the directory involved in this event has such a user function under it.

Compatibility Considerations

MATLAB might generate warnings about naming conflicts that did not appear in previous versions. To avoid this warning, renaming your M-files that have name conflicts with built-in functions.

Graphics and 3-D Visualization, MATLAB Version 7.1 (R14SP3)

This version introduces the new features and changes described below.

Plot Tools Now Available on Mac Platform

As a consequence of enabling Java figures on Macintosh, the Plot Tools user interface is now available to Mac users, enabling them to interactively add data to plots, change plot symbology, and otherwise customize their data plots.

Documentation for Data Analysis Reorganized

Documentation explaining techniques for analyzing graphical data has been shifted from the Graphics book of the MATLAB documentation to a new book called Data Analysis.

Creating Graphical User Interfaces (GUIs), MATLAB Version 7.1 (R14SP3)

Plans for Obsolete Functions

The table below indicates functions that were designated as obsolete prior to R14SP3 and that will be removed in a future version.

Compatibility Considerations

If you use these functions, you should use replacement functions instead.

Obsolete Function	Removed from Version	Replacement
clruprop	Future version	rmappdata
ctlpanel	Future version	guide
extent	Future version	get(txtobj, 'extent')
figflag	Future version	findobj to determine if figure exists. figure(figurehandle) to bring figure to front and give it focus.
getuprop	Future version	getappdata
hthelp	Future version	web
layout	Future version	None provided
matq2ws	Future version	None provided
matqdlg	Future version	None provided
matqparse	Future version	None provided
matqueue	Future version	None provided
menuedit	Future version	guide
menulabel	Future version	Use '&' to specify mnemonics and 'Accelerator' property to define accelerator keys.

Obsolete Function	Removed from Version	Replacement
setupprop	Future version	setappdata
wizard	Future version	None provided
ws2matq	Future version	None provided

External Interfaces/API, MATLAB Version 7.1 (R14SP3)

New features and changes introduced in this version are:

- “mex Switches Now Supported on Windows” on page 223
- “New COM Programmatic Identifier” on page 224
- “New File Extension for MEX-Files on Windows” on page 224
- “New Preferences Directory and MEX Options” on page 226
- “Compiler Support” on page 227
- “Import Libraries Moved” on page 227
- “MEX Perl Script Moved” on page 228
- “Linking to System Libraries” on page 228
- “COM Automation Server Now Displays Figure” on page 228

mex Switches Now Supported on Windows

MATLAB now supports the `-l` and `-L` options to the `mex` command on Windows. In previous releases of MATLAB, these options were supported only on UNIX.

Switch	Description
<code>-l</code>	<p>Specifies additional libraries to link against.</p> <hr/> <p>Note On Windows, the <code>-l</code> option can specify libraries of two forms. For example, specifying <code>-l name</code> matches either <code>name.lib</code> or <code>libname.lib</code>, whereas on UNIX it matches only <code>libname.lib</code>.</p> <hr/>
<code>-L</code>	<p>Specifies a path to use when MATLAB searches for library files specified with the <code>-l</code> option. The <code>-L</code> option must precede the <code>-l</code> option.</p>

For the switches you can use with the `mex` command, see the “MEX Script Switches” table in the “Custom Building MEX-Files” section of “Calling C

and Fortran Programs from MATLAB” in the MATLAB External Interfaces documentation.

New COM Programmatic Identifier

There is now a ProgID that enables you to use the full desktop version of MATLAB as an automation server.

`Matlab.Desktop.Application` starts an automation server using the most recent version of MATLAB that is installed on your system.

New File Extension for MEX-Files on Windows

MATLAB now uses the extension `.mexw32` for MEX-files on 32-bit versions of Windows. In previous versions, MATLAB used the extension `.dll`.

The MathWorks recommends that you recompile all MEX-files after installing MATLAB 7.1. MEX-files compiled in MATLAB 7.0.4 with `.dll` extensions should still work in MATLAB 7.1.

There may be two MEX-files with the same name, except that one has a `.mexw32` extension and the other has a `.dll` extension. When these files are both on the MATLAB search path:

- If the two files are in the same directory, MATLAB uses the `.mexw32` file.
- If the two files are in different directories, MATLAB uses the file in the directory that is higher on the search path.

If you want one of these two files to take precedence over the other, ensure that the directory that contains the file you want MATLAB to use is higher on the search path than the directory that contains the file you do not want MATLAB to use.

Compatibility Considerations

Previous versions of MATLAB do not recognize MEX-files compiled in MATLAB 7.1 with `.mexw32` extensions. However, you can use the `mex -output` option in MATLAB 7.1 to build a MEX-file with a `.dll` extension that earlier versions of MATLAB can recognize.

You may need to update any M-files or makefiles that explicitly expect `.dll` extensions for compiled MEX-files. You can use the `mexext` function in MATLAB to obtain the extension for the platform and version you are working on. A new `mexext` script obtains the appropriate extension when executed from outside MATLAB, as in a makefile.

On Windows, MATLAB issues warnings at MEX setup time, compile time, and run-time to notify you of possible incompatibilities resulting from the change in MEX-file extension from `.dll` to `.mexw32`.

New mex-output Behavior for Compatibility

The `-output` option to `mex` specifies the filename of the compiled MEX-file. In general, `mex` ignores any filename extension supplied in the `-output` argument and uses the extension for the compiled file that is appropriate for the architecture. However, on Windows, if the `-output` argument specifies a `.dll` extension, the compiled file has this extension instead of `.mexw32`. Previous versions of MATLAB can recognize the resulting compiled file.

Conflicting MEX-Files Renamed Automatically

If two files with the same name but with `.mexw32` and `.dll` extensions exist in the same directory, MATLAB uses the `.mexw32` file. To avoid unintended shadowing, MATLAB automatically renames compiled MEX-files under the following circumstances:

- When you build a MEX-file with a `.mexw32` extension and the directory contains an existing file with the same name, but with a `.dll` extension, the extension of the `.dll` file is changed to `.dll.old`.
- When you build a MEX-file with a `.dll` extension (using the `mex -output` option) and the directory contains an existing file with the same name, but with a `.mexw32` extension, the extension of the `.mexw32` file is changed to `.mexw32.old`.

New Return Value for mexext on Windows

On 32-bit Windows platforms, the `mexext` function now returns `mexw32`. In MATLAB 7.0.4 it returned `dll`.

New mexext Script to Obtain MEX-File Extension in Makefiles

A new script displays the MEX-file extension in the current version of MATLAB that corresponds to the platform on which the script is executed. It is intended to be used outside MATLAB, in makefiles or scripts, to obtain the appropriate filename extension for compiled MEX-files. Use this script instead of explicitly specifying the MEX-file extension in a makefile.

The script is named `mexext.bat` on Windows and `mexext.sh` on UNIX. It is located in the directory `$matlab/bin`, where `$matlab` represents the string returned from the `matlabroot` command.

The script displays the MEX-file extension without a leading period. For example, on 32-bit Windows platforms, it returns `mexw32`.

Following is a fragment of a GNU makefile that uses the `mexext` script to obtain the MEX-file extension:

```
ext = $(shell mexext)

yprime.$(ext) : yprime.c
    mex yprime.c
```

New Preferences Directory and MEX Options

The MATLAB preferences directory has changed. In MATLAB 7.1, the preferences directory is named `R14SP3`. In previous R14 releases, the preferences directory was named `R14`. For more information, see the documentation for `prefdir`, which returns the preferences directory.

Compatibility Considerations

When you install MATLAB 7.1, MATLAB migrates some files from any existing `R14` preferences directory to the new `R14SP3` directory. However, MATLAB does not migrate the MEX options file, `mexopts.bat`. If you want to preserve any MEX options that you have customized in an earlier R14 release, you need to migrate your options to the new `R14SP3` preferences directory.

You can migrate your MEX options in either of two ways:

- If you have customized only a few options: Invoke `mex` with the `-setup` option to create a new `mexopts.bat` file in the R14SP3 preferences directory. Edit the new `mexopts.bat` file to customize the MEX options there.
- If you have customized many options: Copy your customized `mexopts.bat` file from the old R14 preferences directory to the new R14SP3 directory. Edit at least the settings of the `LIBLOC` and `NAME_OUTPUT` linker parameters in the `mexopts.bat` file. These lines should look as follows on Windows when Microsoft is the compiler vendor:

```
set LIBLOC=%MATLAB%\extern\lib\win32\microsoft
set NAME_OUTPUT=/out:"%OUTDIR%MEX_NAME%MEX_EXT%
```

The `LIBLOC` parameter has changed because import libraries have moved; see “Import Libraries Moved” on page 227. The value of this parameter depends on the platform you are running MATLAB on and the vendor of the compiler you are using.

The `NAME_OUTPUT` parameter has changed because the extension for compiled MEX-Files has changed on Windows; see “New File Extension for MEX-Files on Windows” on page 224.

Compiler Support

The set of compilers that MATLAB supports has changed in MATLAB 7.1. For a complete, up-to-date list of supported compilers, see the following location on the Web:

<http://www.mathworks.com/support/tech-notes/1600/1601.shtml>

Compatibility Considerations

You may need to recompile code compiled with an earlier compiler that is no longer supported.

Import Libraries Moved

The import libraries (`.lib` files) for the MATLAB `dll` files have been moved up a directory level and are no longer specific to the compiler version. The new location for these files is

```
$matlab/extern/lib/$arch/$vendor
```

where the terms `$matlab`, `$arch`, and `$vendor` respectively represent the string returned from the `matlabroot` command, the platform you are running MATLAB on, and the vendor of the compiler you are using.

Compatibility Considerations

You may need to change any code that depends on the previous library locations.

MEX Perl Script Moved

The MEX Perl script used in building MEX-files is now located in `$matlab/bin`, rather than `$matlab/bin/win32`. (The term `$matlab` represents the string returned by the `matlabroot` function.) You should not notice any difference, however, as a batch file located in `$matlab/bin/win32` provides backward compatibility.

Linking to System Libraries

MATLAB now links with the system libraries by default. You no longer need to specify them explicitly.

COM Automation Server Now Displays Figure

When using MATLAB as an Automation server, executing MATLAB commands that create figures now displays the figure window.

Previous releases of MATLAB created the figure in the background. To duplicate the old behavior, create a figure with its `Visible` property set to `off`, then set the property to `on` when you want the figure to be visible:

```
h = actxserver('matlab.application');  
h.Execute('figure visible off');  
h.Execute('plot(1:10)');  
h.Execute('set(gcf, 'visible', 'on')');
```


Version 7.0.4 (R14SP2)

MATLAB

This table summarizes what's new in Version 7.0.4 (R14SP2):

New Features and Changes	Version Compatibility Considerations	Fixed Bugs and Known Problems	Related Documentation at Web Site
Yes Details below	Yes — Details labeled as Compatibility Considerations in descriptions of new features and changes. See also Summary.	Bug Reports at Web site	No

New features and changes introduced in this version are organized by these areas:

- “Desktop Tools and Development Environment, MATLAB Version 7.0.4 (R14SP2)” on page 231
- “Mathematics, MATLAB Version 7.0.4 (R14SP2)” on page 238
- “Programming, MATLAB Version 7.0.4 (R14SP2)” on page 239
- “Graphics and 3-D Visualization, MATLAB Version 7.0.4 (R14SP2)” on page 245
- “Creating Graphical User Interfaces (GUIs), MATLAB Version 7.0.4 (R14SP2)” on page 246

- “External Interfaces/API, MATLAB Version 7.0.4 (R14SP2)” on page 247

Desktop Tools and Development Environment, MATLAB Version 7.0.4 (R14SP2)

New features and changes are organized by these topics:

- “Installation Folder with Spaces” on page 231
- “Startup and Shutdown” on page 232
- “Desktop” on page 232
- “Running Functions — Command Window and History” on page 233
- “Help” on page 233
- “Workspace, Search Path, and File Operations” on page 234
- “Editing and Debugging M-Files” on page 235
- “Source Control Interface” on page 236
- “Publishing Results” on page 236

Installation Folder with Spaces

In MATLAB 7.0.4 (R14SP2) the following two changes have been made to the MathWorks Installer on Windows systems:

- The Installer now allows a folder name with spaces in the installation path.
- The Installer honors the Windows default installation folder, which on most machines is Program Files.

These changes were made in response to many customer requests and the desire to conform to a widely established industry practice for the PC platform.

Note MathWorks products are used and integrated into many software environments. If you use MathWorks products in conjunction with other third party applications (compilers, other numerical analysis packages, etc.) you might want to continue installing into a folder that does not have spaces in the path until you have tested that those applications work with MathWorks products.

Startup and Shutdown

Confirmation Dialog Box for Quitting Added

When quitting MATLAB, a confirmation dialog box appears if you set a new preference for that purpose. By default, the confirm quitting preference is not set, so the dialog box will not appear. To change the preference, see the instructions for “Confirmation Dialogs Preferences” in the desktop documentation.

JVM Updated

MATLAB is now using Java (JVM) 1.5 on Windows, Linux (32-bit), and Solaris platforms. Java is supplied with MATLAB, so this change requires no action on your part.

Compatibility Considerations

If you use a specific version of Java with MATLAB on Windows, Linux 32-bit, or Solaris platforms, this change might affect you.

Desktop

Confirmation Dialog Boxes Preference Introduced

There are new preferences for displaying or not displaying confirmation dialog boxes for desktop tools. In previous versions, some of these preferences existed but were located with other preferences for the associated desktop tool. They are now organized in one preference panel for all desktop tools. Access them by selecting **File > Preferences > General > Confirmation Dialogs**. These preferences work in conjunction with the **Do not show this prompt again** check boxes that appears on various desktop confirmation dialog boxes. For more information, see “Confirmation Dialogs Preferences” in the desktop documentation.

Running Functions – Command Window and History

Overwrite Mode Now Supported

The Command Window now supports overwrite mode. Press the **Insert** key to enter text in overwrite mode. Press the **Insert** key again to return to entering text in insert mode. View the current state at the far right end of the status bar of the Command Window when it is undocked, or in the desktop when the Command Window is docked and has focus. In insert mode, **OVR** in the status bar is gray and the cursor has a wide block shape.

Hyperlink Color Preference Added

Set the color of hyperlinks that display in the Command Window. Select **File > Preferences > Command Window**, and under **Display**, select **Hyperlink color**.

Help

Subfunction Help Syntax Changed

To get help for a subfunction, use

```
help functionname>subfunctionname
```

Compatibility Considerations

In previous versions, the syntax was `help functionname/subfunctionname`. This change was introduced in R14 (MATLAB 7.0) but was not documented.

Bug Fixes and Known Problems Now on Web; No Longer Found Via Help Search

The Release Notes sections “Major Bug Fixes” and “Known Software and Documentation Problems” no longer include the content in the installed help files. Instead, the sections provide links to these lists on the MathWorks Web site. The lists on the Web site can be updated after the release date to reflect the latest information.

Compatibility Considerations

As a result of this change, the Help browser **Search** feature will not find search terms that are in the content of those reports. Use the MathWorks Web site search features to look for search terms in those reports.

Workspace, Search Path, and File Operations

Formatting Decimal Separator when Copying From the Array Editor

You can now specify how you want decimal numbers to be formatted when you cut or copy cells from the Array Editor and paste them into text files or other applications. You can specify a separator for this purpose in the Array Editor panel of the **Preferences** dialog. The **Decimal separator to use when copying** edit field is by default "." (period). If you are working in or providing data to a locale that uses a different character to delimit decimals, type that character in this edit field and click **OK** or **Apply**.

Workspace Browser Preference Panel Removed

The Workspace browser preferences panel was removed. The entry on that panel was for confirming deletion of variables. That preference is now part of **General > Confirmation Dialogs** preferences.

Compatibility Considerations

Use **File > Preferences > General > Confirmation Dialogs** instead of **File > Preferences > Workspace Browser**.

Current Directory Browser Preferences Added

There are new Current Directory browser preferences you can access by selecting **File > Preferences > Current Directory Browser, Browser display options**:

- View the file size by selecting the **Show file sizes** check box. (This is selected by default.)
- View brief Simulink model descriptions in the **Description** column when **Show M and MDL file descriptions** is selected.

- View the complete Simulink model description in the lower pane when the preference for **Show M, MDL and MAT file contents** is selected. This allows you to view information about a model without running Simulink.

Editing and Debugging M-Files

Go To Subfunction or Nested Function

Go directly to a subfunction or nested function within an M-file using the enhanced **Go To** dialog box. Access the dialog box by selected **Edit > Go To**. Click the **Name** column header to arrange the list of functions alphabetically, or click the **Line** column header to arrange the list by the position of the functions in the file.

Help Browser Now Accessible from MATLAB Stand-Alone Editor

You can now access the MATLAB Help browser from the MATLAB stand-alone Editor. This provides you with documentation for MATLAB, including using Editor features and MATLAB functions.

Preference for Editor/Debugger Dialog Moved

The **Show dialog prompt** preference has been moved to **Preferences > General > Confirmation Dialogs**. For more information, see “Confirmation Dialogs Preferences” in the desktop documentation.

Compatibility Considerations

Use **File > Preferences > General > Confirmation Dialogs** instead of **File > Preferences > Editor/Debugger** to set this preference.

Dragging Text Maintains Font and Highlighting

Now, when you drag text from the Editor/Debugger to another application, it maintains the syntax highlighting and font characteristics.

Source Control Interface

Register Project Feature Added; Add to Source Control Behavior Changed

There is a new source control interface feature for Windows platforms, **Register Project with MATLAB**. Use this to associate all files in a directory with a source control project. You perform this for any file in a directory, which registers the directory and all files in that directory. You only perform this once in a directory, and must perform it before you perform any other source control actions for files in that directory.

Access the feature in the Current Directory browser by right-clicking a file and selecting **Source Control > Register Your Source Control System Project with MATLAB** from the context menu. You can also access it from the Editor/Debugger **File** menu. To access the feature for Simulink or Stateflow® files, use the Current Directory browser.

For a summary of the process, see the topic “Source Control Interface on Windows” in the desktop documentation.

Compatibility Considerations

In previous releases, this feature was part of the **Add to Source Control** feature. You still need to add each file to source control, but you do this after first registering the directory that contains the file.

Project Name Exact Match No Longer Required

The name of the project in the source control system is no longer required to exactly match the name of the directory on disk containing the files.

Publishing Results

Cell Publishing: File Extension Changes

The files created when publishing using cells now have more natural extensions. JPEG files now have a `.jpg` instead of a `.jpeg` extension, and EPSC2 files now have an `.eps` instead of an `.epsc2` extension.

Compatibility Consideration

If you relied on the formerly used file extensions, you need to accommodate the changes.

Cell Publishing: LaTeX Image File Type Changes

Publishing to LaTeX now respects the image file type you specify in preferences rather than always using EPSC2 files.

Cell Publishing: Image Options More Restrictive

The **Publish image options** in Editor/Debugger preferences for **Publishing Images** have changed slightly. The changes prevent you from choosing invalid formats.

Notebook Support for Word 97 to be Discontinued

Notebook will no longer support Microsoft Word 97 starting in the next release of MATLAB.

Compatibility Considerations

If you use Word 97 with Notebook, you will need to migrate to a more recent version.

Mathematics, MATLAB Version 7.0.4 (R14SP2)

This version introduces the following new features and changes:

- “New Vendor BLAS Used for Linear Algebra in MATLAB” on page 238
- “max and min on Complex Integers Not Supported” on page 238

New Vendor BLAS Used for Linear Algebra in MATLAB

MATLAB uses Basic Linear Algebra Subprograms (BLAS) for its vector inner product, matrix-vector product, matrix-matrix product, and triangular solvers in `\`. MATLAB also uses BLAS behind its core numerical linear algebra routines from Linear Algebra Package (LAPACK), which are used in functions like `chol`, `lu`, `qr`, and within the linear system solver `\`.

Starting in this release

- On Macintosh, MATLAB now uses the Accelerate framework.
- On 64-bit Linux, MATLAB uses Intel® Math Kernel Library (MKL) 7.0.1 on Intel chips, and AMD Core Math Library (ACML) 2.0 on AMD chips.

max and min on Complex Integers Not Supported

Using the `max` and `min` functions on complex integer inputs (as shown in the example below) is no longer supported. This operation had been supported from release R11 through R14SP1, but now returns an error.

```
max(int8([3-4i 3+4i]))
```

Compatibility Considerations

Any code that calls `max` or `min` on complex integers should be removed from your program files.

Programming, MATLAB Version 7.0.4 (R14SP2)

This version introduces the following new features and changes:

- “Memory-Mapping” on page 239
- “textscan Enhancements” on page 240
- “xlsread Enhancements” on page 240
- “xlsread Imported Date Format Changes” on page 240
- “format Options Added” on page 240
- “Nonscalar Arrays of Function Handles to Become Invalid” on page 241
- “Assigning Nonstructure Variables As Structures Displays Warning” on page 241
- “Function Declaration Compatibility with Pre-R14 M-Files” on page 243

Memory-Mapping

Memory-mapping is a mechanism that maps a portion of a file, or an entire file, on disk to a range of addresses within an application’s address space. The application can then access files on disk in the same way it accesses dynamic memory. This makes file reads and writes faster in comparison with using functions such as `fread` and `fwrite`.

Another advantage of using memory-mapping in MATLAB is that it enables you to access file data using standard MATLAB indexing operations. Once you have mapped a file to memory, you can read the contents of that file using the same type of MATLAB statements used to read variables from the MATLAB workspace. The contents of the mapped file appear as if they were an array in the currently active workspace. You simply index into this array to read or write the desired data from the file.

Memory-mapped files also provide a mechanism for sharing data between applications. This is achieved by having each application map sections of the same file. This feature can be used to transfer large data sets between MATLAB and other applications.

textscan Enhancements

The `textscan` function originally read data only from files. As of this release, you can use `textscan` to read from strings as well.

xlsread Enhancements

In this release, you can write a function and pass a handle to this function to `xlsread`. When `xlsread` executes, it reads from the spreadsheet, executes your function on the data read from the spreadsheet, and returns the final results to you.

You can use either of the following syntaxes:

```
num = xlsread('filename', ..., functionhandle)
[num, txt, raw, X] = xlsread('filename', ..., functionhandle)
```

See Example 5 — Passing a Function Handle on the `xlsread` reference page.

xlsread Imported Date Format Changes

In MATLAB versions prior to R14, date values read into MATLAB from an Excel spreadsheet using `xlsread` were always imported as numeric date values. The R14 and later releases of MATLAB import dates in the format in which they were stored in the Excel file. Dates stored in string or date format are now imported as strings by `xlsread`. Dates stored in numeric format are imported as numeric date values.

Compatibility Considerations

Because of a difference in the way Excel and MATLAB compute numeric date values, any numeric dates imported from Excel into MATLAB must be converted to the MATLAB format before being used in the MATLAB application. See [Handling Excel Date Values](#) on the `xlsread` function reference for information on how to do this.

format Options Added

You can display MATLAB output using two new formats: `short eng` and `long eng`. See the [format](#) reference page for more information.

- `short eng` — Displays output in an engineering format that has at least 5 digits and a power that is a multiple of three.
- `long eng` — Displays output in an engineering format that has exactly 16 significant digits and a power that is a multiple of three.

```
format short eng
pi
ans =
    3.1416e+000
```

```
format long eng
pi
ans =
    3.14159265358979e+000
```

Nonscalar Arrays of Function Handles to Become Invalid

Creation of nonscalar arrays of function handles by `str2func` may be invalid or may return different results in future versions of MATLAB, but will continue to work in R14.

Compatibility Considerations

To avoid this warning and prepare for this change, convert the cell array of strings to a cell array of function handles.

For more information, type `help function_handle` and see the section entitled Note on Backward Compatibility.

Assigning Nonstructure Variables As Structures Displays Warning

Assigning to a nonstructure variable as if it were a structure is not recommended in MATLAB. For example, if variable `x` holds a double (as shown below), then attempting to add a fieldname to it, thus converting `x` to a structure, is not good programming practice and should generate an error.

```
x = 10;
x.name = magic(3);
```

Note that if `x` were empty (i.e., `x == []`), then assigning a field to it as if it were already a structure is acceptable.

Behavior Prior to Release R14

Because of a bug in releases of MATLAB prior to R14, you can assign a field to a nonempty, nonstructure variable in those releases without MATLAB generating a warning message or error. The result is that MATLAB quietly converts the variable to a structure:

```
x = 10;
class(x)
ans =
    double

x.name = magic(3);      % Invalid expression completes
                        %   without warning or error.

class(x)
ans =
    struct
```

Behavior In R14 and Later

In the MATLAB R14 and R14 service pack releases, you can still perform this type of operation, but MATLAB now displays a warning message:

```
x = 10;
x.name = magic(3);

Warning: Struct field assignment overwrites a value with class
"double".
```

In a future release of MATLAB, attempting this type of operation will throw an error instead of just displaying a warning message.

Compatibility Considerations

You are encouraged to modify any code that generates this warning. The section “Making a Valid Assignment” on page 243 gives instructions on how to do this.

Another Case – Extending the Depth of a Structure

The same rules apply when extending the depth of a structure by adding additional, lower-level fields. The first line of the example shown below creates a structure named `handle` and assigns to it a field of type `double` named `output`. The line after that treats this `double` as if it were a structure by attempting to assign a field named `time` to it. The second line is an invalid expression:

```
handle.output = 5;  
handle.output.time = 13;
```

As in the case discussed earlier, this assignment does not generate a warning or error in MATLAB releases prior to R14. In the R14 and R14 service pack releases of MATLAB, you get the warning shown in the previous example. Beginning in a future release of MATLAB, this assignment will throw an error.

Making a Valid Assignment

To avoid this warning and future errors, first make `x` an empty structure or empty array as shown here. Once a variable is established as a structure or empty array, you can assign fields to it without getting an error:

```
x = struct;      or      x = [];  
x.name = magic(3);
```

In the case of extending the depth of an existing structure, you can perform this type of assignment without generating a warning or error using the `struct` function as shown here:

```
handle.output = struct('time', 13);
```

Function Declaration Compatibility with Pre-R14 M-Files

As of Release 14, the function definition line in a function M-file no longer requires commas separating output variables. However, because this syntax is not compatible with earlier releases, you should always include the comma separators when writing an M-file function that you intend to run on releases both earlier and later than Release 14.

Compatibility Considerations

See “Comma Separators Not Required in Function Declaration” on page 352 in the Release 14 release notes.

Graphics and 3-D Visualization, MATLAB Version 7.0.4 (R14SP2)

This version introduces the following new feature:

imwrite Now Supports GIF Export

The `imwrite` function now supports exporting image data in Graphics Interchange Format (GIF).

Compatibility Considerations

The MATLAB 7.0.4 graphics features have the following platform limitations:

Cannot Dock Figures on Macintosh

You cannot dock figures in the Desktop, because MATLAB uses native figure windows on the Macintosh platform.

Plotting Tools Not Working on Macintosh

The plotting tools are not supported on the Macintosh platform. This means the Figure Palette, Plot Browser, and Property Editor do not work these platforms. To use the MATLAB 6 Property Editor, see the `propedit` command.

Not All Macintosh System Fonts Are Available

MATLAB figures do not support the same fonts as native Macintosh applications. Use the `uifont` functions to see which fonts are available in MATLAB.

XDisplay Property Setable on Motif-Based Systems

You can specify the value of the figure `XDisplay` property only on systems using Motif-Based figure windows.

Creating Graphical User Interfaces (GUIs), MATLAB Version 7.0.4 (R14SP2)

New Callbacks Chapter

The Creating Graphical User Interfaces documentation offers a new chapter, in draft form, that attempts to bring information regarding callbacks into one place. It introduces the concepts and mechanisms with which you work, and explains some basic techniques for programming your GUI's behavior. This chapter is not yet complete, but you may find it useful, even in its current state, particularly if you are new to creating GUIs.

Temporarily, this new chapter appears as Appendix A, "Working with Callbacks (Draft)." It contains some new information, but also duplicates information that can be found in various places throughout the rest of the book. In cases where information has not yet been included in the new chapter, links take you to the main part of the book.

External Interfaces/API, MATLAB Version 7.0.4 (R14SP2)

New features and changes introduced in this version are described here.

New File Archiving Functions and Functionality

In addition to being able to zip and unzip compressed file archives, MATLAB now supports the following archiving functions:

- `gzip/gunzip` — Compress/uncompress files in gzip format.
`gunzip` reads archives from both file systems and URLs.
- `tar/untar` — Compress/extract files in a tar-file.
`untar` reads archives from both file systems and URLs.
- The `unzip` function can now also open a zip archive from a URL.

Version 7.0.1 (R14SP1)

MATLAB

This table summarizes what's new in Version 7.0.1 (R14SP1):

New Features and Changes	Version Compatibility Considerations	Fixed Bugs and Known Problems	Related Documentation at Web Site
Yes Details below	Yes — Details labeled as Compatibility Considerations in descriptions of new features and changes. See also Summary.	Fixed bugs	No

New features and changes introduced in this version are organized by these areas:

- “Desktop Tools and Development Environment, MATLAB Version 7.0.1 (R14SP1)” on page 251
- “Mathematics, MATLAB Version 7.0.1 (R14SP1)” on page 257
- “Programming, MATLAB Version 7.0.1 (R14SP1)” on page 261
- “Graphics, MATLAB Version 7.0.1 (R14SP1)” on page 267
- “Creating Graphical User Interfaces (GUIs), MATLAB Version 7.0.1 (R14SP1)” on page 268

- “External Interfaces/API, MATLAB Version 7.0.1 (R14SP1)” on page 271

Desktop Tools and Development Environment, MATLAB Version 7.0.1 (R14SP1)

New features and changes are organized by these topics:

- “Startup and Shutdown” on page 251
- “Desktop” on page 251
- “Running Functions — Command Window and Command History” on page 252
- “Help” on page 253
- “Workspace, Search Path, and File Operations” on page 253
- “Editing and Debugging M-Files” on page 254
- “Source Control Interface” on page 255
- “Publishing Results” on page 255

Startup and Shutdown

Constructing Java Classpath Now Uses `librarypath`

When MATLAB starts, it now uses `librarypath.txt` as well as `classpath.txt` to construct the Java classpath.

Compatibility Considerations. If you call Java from MATLAB, refer to “Locating Native Method Libraries” in the MATLAB External Interfaces documentation for details. This change was part of MATLAB 7.0.

Desktop

System Web Browser Used for Large Files

The MATLAB Web browser displays files up to 1.5 MB. When the Web browser tries to open a file greater than 1.5 MB, MATLAB instead automatically displays the file in the system default browser.

Keyboard Access Added for More Desktop Tools

Additional desktop tools provide keyboard access to toolbar buttons and fields via mnemonics. For example, **Alt+K** moves the cursor to the **Stack** field in the Editor/Debugger toolbar. In the Profiler, the **R** in the **Run this code** toolbar field is underlined, indicating that **Alt+R** moves the cursor to this field. You might need to hold down the **Alt** key while the tool is selected in order to see the mnemonics on the menus and buttons.

Macintosh Menus

On the Macintosh, the location of MATLAB menus has changed. In this version, MATLAB menus are not located at the top of the screen with other Macintosh screen menus. Instead, MATLAB menus appear within the MATLAB desktop and MATLAB tools. This change was made because of a problem with screen menus that caused MATLAB on the Macintosh to crash.

Running Functions – Command Window and Command History

Preferences for Parentheses Matching Added

There are now Command Window preferences you can set to perform parenthesis matching. Select **File > Preferences > Command Window > Keyboard and Indenting** to set them. With the preference **Match parentheses while typing** selected, when you type a parenthesis or another delimiter, MATLAB highlights the matched parenthesis or other delimiter in the pair. With the preference **Match parentheses on arrow key or mouse movement** selected, when you move over a parenthesis or another delimiter, MATLAB highlights the matched parenthesis or other delimiter in the pair. MATLAB also alerts you to mismatches. These preferences also allow you to specify how MATLAB notifies you of matches and mismatches.

Clear Command Window Now Available from Context Menu

You can now select **Clear Command Window** from the context menu in the Command Window. A confirmation dialog box does not appear and the Command Window clears immediately. If you want a confirmation dialog box to appear before the Command Window clears, use **Edit > Clear Command Window** instead.

End Key Behavior Changes

With the **Display** preference for **Wrap lines** selected, pressing **End** moves the cursor to the end of the current statement. When the **Command line key bindings** preference is set to **Emacs (MATLAB standard)**, you can also do this using **Ctrl+E**. In the previous version, **End** (and **Ctrl+E**) moved the cursor to the end of the current line.

Help

Own Help Files Now Allow Special Icons

When you supply your own help files, you can now specify the type of icon that appears in the Help browser **Contents** pane via the `<help_contents_icon>` tag in the `info.xml` file. For details, see “Adding Help Files”.

Workspace, Search Path, and File Operations

Array Editor: F2 Keyboard Shortcut Added to Edit Current Element

A keyboard shortcut to use instead of double-clicking a cell is **F2** (or **Ctrl+U** on Macintosh), which allows you to edit the current element, positioning the cursor at the end of the element.

Array Editor: Single Quotation Marks Now Supplied for Strings During Paste from Excel

When you copy data from Microsoft Excel and paste it into a cell array in the Array Editor using the menu item **Edit > Paste Excel Data**, MATLAB assumes the values are strings and automatically supplies the single quotation marks if they cannot be interpreted as numeric values.

Current Directory Browser Comments Now Include First Line

When you select the Current Directory preference **Show M-file comments and MAT-file contents**, the help shown now includes the first comment line (also called the H1 line).

Current Directory Browser Auto-Refresh Rate Now Specifiable

The Current Directory browser preference for auto-refresh now allows you to specify the update time. By default, every 2 seconds the Current Directory browser checks for and reflects any changes you made to files and directories in the current directory using other applications.

In some cases when the current directory is on a network and the Current Directory browser is open, MATLAB becomes slow because of the auto-refresh feature. If you experience general slowness in MATLAB and have the Current Directory browser open, increase the default update time to improve responsiveness. If increases do not alleviate the slowness enough, clear the check box in preferences to turn auto-refresh off. Then you can manually refresh the display selecting **Refresh** from the context menu in the Current Directory browser.

Find Files Field Now Uses Selected Text

You can now select text in the Command Window or Editor and the **Find Files** dialog box enters that text in its **Find files containing text** field.

Editing and Debugging M-Files

Breakpoints Supported in Anonymous Functions

The Editor/Debugger supports breakpoints in anonymous functions. Lines containing anonymous functions can have more than one breakpoint in a line: one for the start of the line and one for each anonymous function in the line. A line that contains multiple breakpoints has a blue breakpoint icon.

dbstatus Supports Anonymous and Nested Functions

The `dbstatus` function now supports anonymous and nested functions, including a new `'-completenames'` argument. Running `dbstatus('-completenames')` displays, for each breakpoint, the absolute filename and the sequence of functions that nest the function containing the breakpoint.

Colors Now Maintained when Copying From Editor

When you paste a selection from the Editor into another application, such as Word, the Editor now maintains the syntax highlighting colors in the file in the other application. MATLAB pastes the selection to the clipboard in RTF format, which many Windows and Macintosh applications support.

Open Selection Now Works for Current Cursor Position

In an M-file, position the cursor within a subfunction, function, file, variable, or Simulink model, and press **Ctrl+D** (or right-click and select **Open Selection**). The item opens in the appropriate tool. In the previous version of MATLAB, you had to select the complete name in the M-file to use this feature. See “Opening a Selection in an M-File” for more information.

Source Control Interface

verctrl Function Does Not Support Handle

The `verctrl` function, available for Windows platforms only, was documented incorrectly. The documentation stated that you could create a handle, and showed the handle argument in the function syntax. You cannot create a handle, but must instead use a value of 0 for that field.

Publishing Results

Notebook Causes MATLAB to Become Automation Server

If you run Notebook from MATLAB and MATLAB is not an automation server, MATLAB will become an automation server. This is a change from Release 14, where MATLAB spawned a second instance that was an automation server.

Notebook Now Supports Office 2003

Notebook now supports Office 2003 (for XP); it is one of the `notebook -setup` options.

Notebook Support for Word 97 to Be Discontinued

Word 97 is supported in this release, but will not be supported in future releases.

Compatibility Considerations. If you use Word 97 with Notebook, move to a newer version of Word before moving to the next version of MATLAB.

Mathematics, MATLAB Version 7.0.1 (R14SP1)

This version introduces the following new features and changes:

- “New Function — `ordeig`” on page 257
- “More Functions Accept Single-Precision Data Inputs” on page 257
- “New Vendor BLAS Used for Linear Algebra in MATLAB” on page 258
- “Overriding the Default BLAS Library on Sun/Solaris Systems” on page 258
- “FDLIBM Version Upgraded” on page 259
- “Different Results When Solving Singular Linear Systems on Intel Systems; Inconsistent NaN Propagation” on page 259
- “`funm` Returns Status Information; New Output Might Result In Error” on page 260

New Function — `ordeig`

The new function `ordeig` takes a quasitriangular matrix `T` or matrix pair `(A,B)` and returns the vector of eigenvalues in the same order that they appear down the diagonal of `T` or `(A,B)`. You can use `ordeig` with the functions `ordschur` and `ordqz`, which reorder the eigenvalues of a Schur factorization or a `QZ` factorization, respectively.

More Functions Accept Single-Precision Data Inputs

More MATLAB functions now accept single-precision data inputs in addition to the usual double-precision inputs. To determine whether a function works on single precision inputs, look for the `Class support` line in the M-file help for the function. For example, to determine whether the function `mean` accepts single-precision inputs, type

```
help mean
```

The `Class support` line is

```
float: double, single
```

which tells you that `mean` does accept single-precision inputs.

New Vendor BLAS Used for Linear Algebra in MATLAB

MATLAB uses Basic Linear Algebra Subprograms (BLAS) for its vector inner product, matrix-vector product, matrix-matrix product, and triangular solvers in `\`. MATLAB also uses BLAS behind its core numerical linear algebra routines from Linear Algebra Package (LAPACK), which are used in functions like `chol`, `lu`, `qr`, and within the linear system solver `\`.

On some platforms, MATLAB continues to use ATLAS BLAS.

Starting in Release 14, MATLAB 7.0 uses vendor BLAS from the `vecLib` library on the Mac.

Starting in Release 14 with Service Pack 1, MATLAB 7.0.1 uses vendor BLAS from

- The Intel® Math Kernel Library (MKL) Version 7.0 on Intel chips running both Windows and Linux. See the MATLAB 7.0 Release Notes for how to use the multi-threaded capabilities of MKL.
- The AMD Core Math Library (ACML) Version 2.0 library on AMD chips, native 64 bit application

Overriding the Default BLAS Library on Sun/Solaris Systems

MATLAB uses the Basic Linear Algebra Subroutines (BLAS) libraries to speed up matrix multiplication and LAPACK-based functions like `eig`, `svd`, and `\(mldivide)`. At start-up, MATLAB selects the BLAS library to use.

For Release 14 with Service Pack 1, MATLAB still uses the ATLAS BLAS libraries on the Sun Microsystems Solaris Operating System. However, you can switch the BLAS library that MATLAB uses to the Sun Performance Library (Sunperf) BLAS, provided by Sun Microsystems.

If you want to take advantage of the potential performance enhancements provided by the Sun BLAS, you can set the value of the environment variable `BLAS_VERSION` to the name of the Sun Performance Library, `libsunperf.so.4`. MATLAB uses the BLAS specified by this environment variable, if it exists.

To set the `BLAS_VERSION` environment variable, enter the following command at the at the UNIX prompt.

```
% setenv BLAS_VERSION libsunperf.so.4
```

Then start MATLAB as usual.

To get visual feedback that the BLAS version has changed, also type at the UNIX prompt

```
% setenv LAPACK_VERBOSITY 1
```

before starting MATLAB. This will display diagnostic information while MATLAB is starting up, for example:

```
cpu_id: sun4u
libmwlpack: loading libsunperf.so.4
libmwlpack: loading lapack.so
```

FDLIBM Version Upgraded

In Release 14, MATLAB used FDLIBM Version 5.2. In R14SP1, MATLAB has been upgraded to use FDLIBM Version 5.3.

Different Results When Solving Singular Linear Systems on Intel Systems; Inconsistent NaN Propagation

In previous releases, when you solved n -by- n linear systems $Ax=b$ using `x = A\b`, where A is singular or contains NaN, the computed result x often contained NaN. In Version 7.0.1, the same command might return 0 in x , due to the way the Intel® Math Kernel Library (MKL) implementation of the BLAS handles this operation.

Compatibility Considerations

Code that relies on the result containing NaN should check for the following warnings instead:

- For singular A , an existing warning is issued.

```
x = [1 2; 0 0]\[1; 0]
```

```
Warning: Matrix is singular to working precision.
```

```
x =  
    1  
    0
```

- For A that contains NaN, a new warning message is issued.

```
x = [1 2; 0 NaN]\[1; 0]  
Warning: Matrix is singular, close to singular or badly scaled.  
Results may be inaccurate. RCOND = NaN.  
x =  
    1  
    0
```

funm Returns Status Information; New Output Might Result In Error

Prior to Release 14, the second output of the function `funm` was an error estimate that was sometimes inaccurate. In Release 14, Version 7.0, the second output was replaced by an exit flag that indicates whether the computation was successful.

Compatibility Considerations

Code that was created prior to Release 14 and that uses the second output of `funm`, might not work correctly in Version 7.0 or later.

Programming, MATLAB Version 7.0.1 (R14SP1)

This version introduces the following new features and changes:

- “Character Set Conversion Functions Added” on page 261
- “datevec Support of Empty String Argument” on page 262
- “depfun Function Supports New Options” on page 262
- “ftell Returning Invalid Position in Rare Cases” on page 262
- “fwrite Saves uint64 and int64 Types” on page 263
- “mat2str Enhanced to Work with Non-double Types” on page 263
- “nargin, nargout Operate on Function Handles” on page 263
- “regexprep Now Supports Character Representations in Replacement String” on page 264
- “Logical OR Operator | in regexp Expressions Might Yield Different Results from Previous Version” on page 264
- “Multiple Declarations of Persistent Variables No Longer Supported” on page 265
- “Function Declaration Compatibility with Pre-R14 M-Files” on page 266

Character Set Conversion Functions Added

Unicode is becoming the preferred internal presentation of characters in MATLAB. For example, MATLAB functions such as `disp` require an input string in Unicode to display properly. To facilitate the use of different character sets, MATLAB provides two new functions to convert characters from a native character set to Unicode and back.

The `native2unicode` function converts from either a default, or user specified, native character set to Unicode. The `unicode2native` function does the opposite, converting from Unicode to either a default, or user specified, native character set. Note that any MATLAB string containing only US-ASCII characters does not require any conversion.

Type `doc native2unicode` or `doc unicode2native` for more information on these functions.

datevec Support of Empty String Argument

For the purpose of backwards compatibility, invoking the command `datevec('')` now returns an empty vector.

Compatibility Considerations

This behavior was not intentional in previous versions of MATLAB, and it is subject to change in future releases.

depfun Function Supports New Options

The `depfun` function now supports these options:

Option	Description
'-all'	Computes all possible left-side arguments and displays the results in the report(s). Only the specified arguments are returned.
'-calltree'	Returns a call list in place of a called_from list. This is derived from the called_from list as an extra step.
'-expand'	Includes both indices and full paths in the call or called_from list.
'-print', 'file'	Prints a full report to file.
'-quiet'	Displays only error and warning messages, and not a summary report.
'-toponly'	Examines <i>only</i> the files listed explicitly as input arguments. It does not examine the files on which they depend.
'-verbose'	Outputs additional internal messages.

ftell Returning Invalid Position in Rare Cases

The `ftell` function is likely to return an invalid position when *all* of the following are true. This is due to the way in which the Microsoft Windows C library currently handles its `ftell` and `fgetpos` commands:

- The file you are currently operating on is an ASCII text file.
- The file was written on a UNIX-based system, or uses the UNIX-style line terminator: a line feed (with no carriage return) at the end of each line of text. (This is the default output format for MATLAB functions `dlmwrite` and `csvwrite`.)
- You are reading the file on a Windows system.
- You opened the file with the `fopen` function with mode set to `'rt'`.
- The `ftell` command is directly preceded by an `fgets` command.

Note that this does not affect the ability to accurately read from and write to this type of file from MATLAB.

Compatibility Considerations

This represents a change in behavior.

fwrite Saves uint64 and int64 Types

The `fwrite` function can now save `uint64` and `int64` values. Previously `fwrite` supported these data types only on DEC Alpha systems. Now, it works on all supported MATLAB platforms.

mat2str Enhanced to Work with Non-double Types

In MATLAB 7.0.1, you can use the `mat2str` function to convert nondouble data types to a string that represents the input value. Type `doc mat2str` for more information.

nargin, nargout Operate on Function Handles

The `nargin` and `nargout` functions now accept either a function name or function handle as an input argument. When called with a function handle, `nargin` and `nargout` return the number of input or output arguments you can pass to or receive from the function that the handle maps to.

regexprep Now Supports Character Representations in Replacement String

The `regexprep` function now supports the use of character representations (e.g., `'\t'` for tab, `'\n'` for newline) in replacement strings. For example, the following `regexprep` command replaces the `|` character with two horizontal tabs:

```
str = 'Field 1 | Field 2 | Field 3';
regexprep(str, '\|', '\t\t')
ans =
    Field 1     Field 2     Field 3
```

In Version 6, the same command yielded the string

```
Field 1 \t\t Field 2 \t\t Field 3
```

Logical OR Operator | in regexp Expressions Might Yield Different Results from Previous Version

Be careful about using the logical OR (`|`) operator within square brackets (e.g., `[A|B]`) in regular expressions in MATLAB. The recommended way to match “the letter A or the letter B” in a MATLAB regexp expression is to use `'[AB]'`.

Compatibility Considerations

If you have used `'[A|B]'` for this purpose in earlier versions of MATLAB, you may get unexpected results when you run your code in version 7.0.

MATLAB versions 6.0 and 6.5 treat `|` as an ordinary character when it is used between square brackets. For example, these versions interpret the expression `'[A|B]'` as “match 'A', or match '|', or match 'B'.” MATLAB 7.0 correctly gives precedence to the logical OR functionality of the `|` operator. Because of this change, MATLAB now interprets `'[A|B]'` as “match '[A', or match 'B]'.”

You can avoid the effects of this bug fix altogether by using the recommended syntax `'[AB]'` for this type of operation. This syntax returns the correct results in all MATLAB versions.

The following example attempts to find the word Jill or Bill in the string 'My name is Bill'. The syntax used in the expression is incorrect, but `regexp` in

MATLAB 6.5 finds a match anyway because of the software bug. This syntax does not work in version 7.0 or 7.0.1 because MATLAB now interprets the expression as the logical OR of the two statements, '[J' and 'B]ill':

<pre> MATLAB 6.5 str = 'My name is Bill'; expr = '[J B]ill'; [s e] = regexp(str, expr); str(s:e) ans = Bill </pre>	<pre> MATLAB 7.0.1 str = 'My name is Bill'; expr = '[J B]ill'; [s e] = regexp(str, expr); str(s:e) ans = Empty string: 1-by-0 </pre>
--	--

Using the recommended syntax returns the correct results in all MATLAB versions:

```

str = 'My name is Bill';
expr = '[JB]ill';
[s e] = regexp(str, expr);
str(s:e)
ans =
    Bill

```

If you want to use | in an expression as an ordinary character, precede it with a backslash:

```

str = 'The | operator performs a logical OR';
expr = 'The [\$ \\ \#] operator';
[s e] = regexp(str, expr);
str(s:e)
ans =
    The | operator

```

Multiple Declarations of Persistent Variables No Longer Supported

You can no longer declare a variable as persistent more than once within a function.

Compatibility Considerations

If you do this, you will need to modify your code.

Function Declaration Compatibility with Pre-R14 M-Files

As of Release 14, the function definition line in a function M-file no longer requires commas separating output variables. However, because this syntax is not compatible with earlier releases, you should always include the comma separators when writing an M-file function that you intend to run on releases both earlier and later than Release 14.

Compatibility Considerations

See “Comma Separators Not Required in Function Declaration” on page 352 in the Release 14 release notes.

Graphics, MATLAB Version 7.0.1 (R14SP1)

This version introduces the following new feature:

OpenGL Trouble Shooting

The `opengl` command now enables you to switch from hardware to software-based OpenGL rendering. It also enables you to select various known bug workarounds. See the `opengl` reference page for more information.

Compatibility Considerations

Cannot Dock Figures on Macintosh

You cannot dock figures in the Desktop, because MATLAB uses native figure windows on the Macintosh platform.

Plotting Tools Not Working on Macintosh

The plotting tools are not supported on the Macintosh platform. This means the Figure Palette, Plot Browser, and Property Editor do not work these platforms. To use the MATLAB 6 Property Editor, see the `propedit` command.

Not All Macintosh System Fonts Are Available

MATLAB figures do not support the same fonts as native Macintosh applications. Use the `uifont` functions to see which fonts are available in MATLAB.

Preview Java Figures on the Macintosh

You can preview the use of Java Figure on the Macintosh by starting MATLAB with the `-useJavaFigures` option.

Creating Graphical User Interfaces (GUIs), MATLAB Version 7.0.1 (R14SP1)

This version introduces the following new features and changes:

- “FIG-File Format Change” on page 268
- “Panels, Button Groups, and ActiveX Components” on page 268
- “Comments Now Optional for Newly Generated Callback Functions” on page 269
- “Windows XP Display of Push and Toggle Buttons” on page 269

FIG-File Format Change

GUI FIG-files that are created or modified with MATLAB 7.0 or a later MATLAB version are not automatically compatible with Version 6.5 and earlier versions.

- GUIs Saved from GUIDE or from the Command Line: You can check the **Ensure backward compatibility (-v6)** preference in the **Preferences** dialog box under **General > MAT-Files**. When this preference is checked, all MAT-files are saved so as to be backward compatible with Version 6.5 and earlier versions.
- Alternative for GUIs Saved from the Command Line: If you do not want to check the **MAT-Files** preference described above, but want to make individual GUI FIG-files backward compatible, use the 'v6' argument when you save the GUI with the `hgsave` function.

Compatibility Considerations

To make FIG-files, which are a kind of MAT-file, backward compatible, you must explicitly specify that you want the backwards compatibility.

Panels, Button Groups, and ActiveX Components

Panels, button groups, and ActiveX components were introduced in MATLAB 7.0. These components are not compatible with versions earlier than 7.0.

Compatibility Considerations

You should not use these components in GUIs that you expect to run in earlier MATLAB versions.

You can export a GUI that contains a panel, button group, or ActiveX component from GUIDE to a single M-file that does not require a FIG-file. However, you will not be able to run that M-file in MATLAB versions earlier than 7.0.

Comments Now Optional for Newly Generated Callback Functions

In prior releases, GUIDE automatically generated comment lines for each callback that you added to an existing GUI M-file. For example:

```
% --- Executes during object deletion, before destroying properties.
function figure1_DeleteFcn(hObject, eventdata, handles)
% hObject    handle to figure1 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)
```

Comment lines are now optional for most callbacks. If you want the comments to be generated automatically when you add a callback, check the new preference **Add comments for newly generated callback functions** on the **GUIDE** panel of the **Preferences** dialog box. The factory default is checked.

If this preference is unchecked, GUIDE includes the comment lines only for callbacks that are automatically included for the GUIDE template you chose. No comments are included for any other callbacks that are added to the M-file.

Windows XP Display of Push and Toggle Buttons

Push buttons and toggle buttons with background colors other than the default display differently in Windows XP.

Compatibility Considerations

For Windows XP, GUI push buttons are displayed with a white background. If you have specified a background color other than the default, that color

appears as a border around the push button. Unselected toggle buttons are displayed with the specified background color, but selected toggle buttons are displayed with a white background bordered by the background color.

External Interfaces/API, MATLAB Version 7.0.1 (R14SP1)

New features and changes introduced in this version are described here.

Function Handles in COM Event Callbacks

MATLAB now supports function handles as callbacks for ActiveX objects. This example passes a function handle that maps to `sampev` to `registerevent`:

```
cd $matlabroot\toolbox\matlab\winfun
h = actxcontrol('mwsamp.mwsampctrl1.2', [0 0 200 200]);
registerevent(h, @sampev);           % Click the control.
```

Registering Events for COM Servers and Controls

With MATLAB 7.0.1, you can register events for COM servers as well as for COM controls.

Expanded Support for Web Services (SOAP and WSDL)

This version expands MATLAB support for Web services, that is, Simple Object Access Protocol (SOAP) and Web Services Description Language (WSDL). These are some of the key enhancements:

- MATLAB now supports document style messages, in addition to the Remote Procedure Call (RPC) style supported in version 7.0.
- MATLAB preserves the case in method, class, and object names.
- Web services functions now decode results that use Base64 encoding.
- The `createClassFromWsd1` function now supports WSDL files that define multiple services.

Specifying the Search Path for Java Native Method DLLs

The mechanism that MATLAB uses to locate native method libraries that are required by Java has changed. MATLAB no longer uses system environment variables to define the paths to these libraries.

Compatibility Considerations

If you presently rely on the PATH (for Windows) or LD_LIBRARY_PATH (for UNIX) environment variables for this purpose, you will need to use the file `librarypath.txt`, as described below, in its place.

Specifying the Java Library Path

Java classes can dynamically load native methods using the Java method `java.lang.System.loadLibrary("LibFile")`. In order for the JVM to locate the specified library file, the directory containing it must be on the Java Library Path. This path is established when MATLAB launches the JVM at startup, and is based on the contents of the file

```
$matlab/toolbox/local/librarypath.txt
```

(where `$matlab` is the MATLAB root directory represented by the MATLAB keyword `matlabroot`).

You can augment the search path for native method libraries by editing the `librarypath.txt` file. Follow these guidelines when editing this file:

- Specify each new directory on a line by itself.
- Specify only the directory names, not the names of the DLL files. The `LoadLibrary` call does this for you.
- To simplify the specification of directories in cross-platform environments, you can use any of these macros: `$matlabroot`, `$arch`, and `$jre_home`.

MATLAB DDE Server Is Now Disabled By Default

To enable the DDE server start MATLAB with the `/Automation` option.

The outgoing MATLAB DDE commands (`ddeinit`, `ddeterm`, `ddeexec`, `ddereq`, `ddeadv`, `ddeunadv`, `ddepoke`) function normally without the MATLAB DDE server. See <http://www.mathworks.com/support/solutions/data/1-Q4728.html?solution=1-Q4728> for more information.

Clearing MEX-Functions

The command `clear mex` now clears MEX-functions, but not M- and MEX-functions. Entering `clear mex` does not clear locked functions or functions that are currently in use. It does however clear breakpoints and persistent variables.

Version 7 (R14) MATLAB

This table summarizes what's new in Version 7 (R14):

New Features and Changes	Version Compatibility Considerations	Fixed Bugs and Known Problems	Related Documentation at Web Site
Yes Details below	Yes — Details labeled as Compatibility Considerations in descriptions of new features and changes. See also Summary.	Fixed bugs	No

New features and changes introduced in this version are organized by these areas:

- “Desktop Tools and Development Environment, MATLAB Version 7 (R14)” on page 276
- “Mathematics, MATLAB Version 7 (R14)” on page 307
- “Programming, MATLAB Version 7 (R14)” on page 332
- “Graphics and 3-D Visualization, MATLAB Version 7 (R14)” on page 371
- “Creating Graphical User Interfaces (GUIs), MATLAB Version 7 (R14)” on page 380
- “External Interfaces/API, MATLAB Version 7 (R14)” on page 386

Desktop Tools and Development Environment, MATLAB Version 7 (R14)

New features and changes introduced in this version are organized by these topics:

- “Startup and Shutdown” on page 276
- “Desktop” on page 277
- “Running Functions — Command Window and Command History” on page 282
- “Help” on page 286
- “Workspace, Search Path, and File Operations” on page 289
- “Editing and Debugging M-Files” on page 295
- “Tuning and Managing M-Files” on page 301
- “Source Control Changes” on page 305
- “Publishing Results” on page 305

Startup and Shutdown

JVM Version Updated

MATLAB is now using Java (JVM) 1.4.2.

Desktop

New features and changes introduced in this version are

- “Demo of MATLAB Desktop Added” on page 277
- “Arranging Documents Supports New Options” on page 277
- “Finding Files and Content in Files with New Tools” on page 278
- “MATLAB Shortcuts to Easily Run Group of Statements” on page 278
- “MATLAB Web Browser Added” on page 279
- “Menu Changes” on page 279
- “Keyboard Shortcuts Added to Go to Tools and Documents” on page 279
- “Drag and Drop Supported Between Desktop Tools” on page 280
- “Arranging Columns in Tools” on page 280
- “Font and Color Preferences for Tools” on page 280
- “terminal Function Removed” on page 281
- “license Function Results Modified Slightly” on page 281

Demo of MATLAB Desktop Added

If you are using the Help browser, watch the new Desktop and Command Window video demo for an overview of the major functionality.


Arranging Documents Supports New Options

The MATLAB desktop now provides you with new options for arranging the following types of documents:

- M-files and other files in the Editor/Debugger
- Arrays in the Array Editor
- Figure windows
- HTML documents in the MATLAB Web browser

You can dock these types of documents in the desktop, undock them from the desktop so each is in its own separate window, or group undocked documents

together in their tool. You can now position the documents using these features: tile, left/right split, top/bottom split, floating, or maximized. Use the **Window** menu or toolbar icons to position documents.

Docking Tools and Documents. There are now dock buttons  in the menu bars of undocked tools and documents. Click a dock button to move the tool into the desktop, or to move the document into its tool.

Document Bar. There is now a Document Bar in tools that support documents that you use to go to open documents. It appears when there is more than one maximized document open in a tool. You can hide or move the Document Bar by selecting **Desktop > Document Bar** menu options.

Saving Layouts. You can save desktop layouts. Select **Desktop > Save Layout** and provide a name. To restore a saved layout, select **Desktop > Desktop Layout > name**.

Launch Pad Removed. The Launch Pad tool was removed. Use the **Start** button instead.

Adding Your Own Toolbox to Start Button. Add your own toolbox to the **Start** button. Select **Start > Desktop Tools > View Source Files**. Click **Help** in the resulting dialog box for details.

Finding Files and Content in Files with New Tools

Search for files and directories, as well as for content within files by selecting **Edit > Find Files** from any desktop tool. For details, see “Finding Files and Content Within Files” in the online documentation.

MATLAB Shortcuts to Easily Run Group of Statements

You can create and run MATLAB shortcuts, where a shortcut is an easy way to run a group of MATLAB statements. A shortcut is like an M-file script, but unlike an M-file, a shortcut does not have to be on the MATLAB search path or in the current directory when you run it.

Create a shortcut by selecting **Start > Shortcuts > New Shortcut** and completing the dialog box. Run the shortcut from the **Start** button.

You can also create a shortcut by dragging selected statements to the shortcut toolbar. This adds the shortcut to the toolbar, from where you can then run it. For details, see “Shortcuts for MATLAB — Easily Run a Group of Statements” in the online documentation.

MATLAB Web Browser Added

MATLAB now displays HTML documents it produces in a new desktop tool, the MATLAB Web browser. You can display HTML documents in this Web browser using the `web` function.

The `web` function now opens the MATLAB Web browser by default, instead of opening the MATLAB Help browser. Use the `web` function’s `-helpbrowser` option to display files in the Help browser.

Menu Changes

Debug Menu Added. You can now access debugging features from the **Debug** menu of most desktop tools.

View, Window, and Desktop Menus. There is no longer a desktop **View** menu, although some tools still have a **View** menu. The **Window** menu in the desktop has changed. Use the new **Desktop** menu to select a layout, and to open and close tools. Use the **Window** menu to access open tools and documents, as well as to position documents. The menus and the menu items in the desktop change, depending on the current tool selected.

Web Menu Items Moved. The **Web** menu was removed. Access the items it contained from **Help > Web Resources**.

Keyboard Shortcuts Added to Go to Tools and Documents

There is now a keyboard shortcut you can use to go to each tool and to each open document. For example, use **Ctrl+0** to go to the Command Window, and **Ctrl+Shift+0** to go to the most recently used Editor document. See the **Window** menu for the shortcuts to go to currently open tools and documents.

There have been some changes to the keyboard shortcuts you use with desktop tools. For example, **Ctrl+Tab** now moves you to the next open tool or group of tools tabbed together. In previous releases, **Ctrl+Tab** moved you to the

next open document or tool. In MATLAB 7, use **Ctrl+Page Down** to move to the next open document or tool in a tabbed group. For the complete list, see “Keyboard Shortcuts (Accelerators or Hot Keys) and Mnemonics” in the online documentation.

Drag and Drop Supported Between Desktop Tools

You can drag selected text or files between desktop tools. For example, you can

- Select text in the Editor and drag it to the Command Window, which cuts and pastes it into the Command Window. You can use **Ctrl** while dragging to copy selected text instead of just moving it.
- Select a file in the Current Directory browser and drag it to the Editor, which opens the file in the Editor.

You can also drag selected text or files between desktop tools and external tools and applications. For example, you can

- Select a MAT-file from the Microsoft Windows Explorer and drag it to the Command Window, which loads the data into the MATLAB workspace.
- Select text from a page displayed in a Netscape browser and drag it to a file in the Editor, which pastes the text into the file in the Editor.

Arranging Columns in Tools

In desktop tools that contain columns, you can drag a column to a new position. For example, this includes the Current Directory browser, and the Help browser **Index** and **Search** panes. Click a column head to sort by that column. For some tools, you can click again to reverse the sort order.

When a column is too narrow to show all the information in it, position the cursor over a long item in that column, and a tooltip displays showing the complete content of the item.

Font and Color Preferences for Tools

Access font and color preferences for all desktop tools in the **Fonts** and **Colors** preference panes. Select **File > Preferences > Fonts** or **File > Preferences > Colors**. For more information, click the **Help** button

in the preferences dialog box, or see “Fonts Preferences for Desktop Tools” and “Colors Preferences for Desktop Tools” in the online documentation.

terminal Function Removed

The `terminal` function was removed.

Compatibility Considerations. If your code refers to the terminal function, you need to change it.

license Function Results Modified Slightly

The data returned by the `license` command is now sorted in alphabetical order and uses only lowercase characters.

Compatibility Considerations. If you rely on the data returned by `license`, be sure your code works properly with these changes.

Running Functions – Command Window and Command History

New features and changes introduced in this version are

- “Demo of Command Window Features” on page 282
- “Tab Completion Graphical Interface Added; Removed Preference to Limit Completions” on page 282
- “Navigate in Command Window Using Arrow Keys Via New Preference” on page 283
- “Incremental Search Indicates Search Direction and is Now Case Sensitive” on page 283
- “commandwindow Function Added to Open or Select the Command Window” on page 283
- “Macintosh: Command +. Now Stops Execution” on page 283
- “Comment After Ellipsis Now Properly Highlighted” on page 283
- “Evaluate Selection from Context Menus No Longer Appends” on page 284
- “Syntax Highlighting Default Colors Modified” on page 284
- “Ctrl+C to Stop Execution is Now More Consistent” on page 284
- “Parentheses Matching Support Removed” on page 284
- “Command History Features” on page 285

Demo of Command Window Features

If you are using the Help browser, watch the new Desktop and Command Window video demo for an overview of the major functionality.

Tab Completion Graphical Interface Added; Removed Preference to Limit Completions

Tab completion now has a graphical interface. For example, type `cos` and press the **Tab** key. A list of functions that begin with `cos` appears. Double-click the function you want and MATLAB completes the name in the Command Window. Alternatively, when the list of names appears, you can type the next unique letter in the name, and the first name in the list that

matches it is selected. Continue typing unique letters to select the name you want, and press **Enter**. Press **Esc** to clear the list without selecting a name.

With the new interface, there is no longer a preference allowing you to limit the number of tab completions that display. MATLAB always displays all possible completion.

Compatibility Considerations. If you relied on the preference to limit the number of tab completions MATLAB displays, type more characters before pressing **Tab** so fewer possible completions display.

Navigate in Command Window Using Arrow Keys Via New Preference

There is a new preference that allows you to use arrow keys to navigate in the Command Window instead of recalling history.

Incremental Search Indicates Search Direction and is Now Case Sensitive

The incremental search interface now indicates the search direction. It is also case sensitive when you enter uppercase letters in the search field.

commandwindow Function Added to Open or Select the Command Window

Use the new `commandwindow` function to open the Command Window when it is closed. For example, use this function in an M-file. Or if the Command Window is already open, use the function to select the Command Window, making it the active window.

Macintosh: Command +. Now Stops Execution

On Macintosh platforms, you can now use **Command+.** (**Command** key and period key) to stop execution of a running program.

Comment After Ellipsis Now Properly Highlighted

When you include an ellipsis in a statement so that you can continue the statement on the next line, any text you type after the `...` on the same line is considered to be a MATLAB comment and now is syntax highlighted as a

comment. In previous releases, the syntax highlighting did not indicate the text after the . . . as a comment.

Evaluate Selection from Context Menus No Longer Appends

Evaluate selection, available from context menus for various tools, no longer appends the selection to the statement at the prompt, but instead runs the selection. Make a selection and press **Enter** or **Return** to append the selection to the statement at the prompt and execute it.

Syntax Highlighting Default Colors Modified

The default colors for syntax highlighting have been modified. Unterminated strings are now maroon, while terminated strings are now purple. This is the opposite of previous versions. Maroon is considered to be more of an “alerting” color, resembling the default of red for errors, which is the reason for the change. If you prefer the colors used in previous versions, change them using preferences — see “Syntax Highlighting Colors” in the online documentation.

In addition, arguments in statements entered using command syntax rather than function syntax are highlighted as strings, emphasizing that variables in command syntax are passed as literal strings rather than as their values.

Ctrl+C to Stop Execution is Now More Consistent

Stopping execution using **Ctrl+C** (^C) has changed. Windows and UNIX platforms now respond similarly to **Ctrl+C**, and in general, stop execution without the need for pause or drawnow statements in your M-files. For M-files that run for a long time, or that call built-ins or MEX-files that take a long time, **Ctrl+C** does not always effectively stop execution. In that event, include a drawnow command in your M-file, for example, within a large loop. **Ctrl+C** might be less responsive if you started MATLAB with the -nodesktop option.

Parentheses Matching Support Removed

Matching parentheses in the Command Window is not supported in this version.

Compatibility Considerations. This feature was available in the Command Window in previous versions but you cannot use it in this version.

Command History Features

Demo of Command History Features. If you are using the Help browser, watch the new Command History video demo for an overview of the major functionality.

Syntax Highlighting in Command History. Entries in the Command History tool now appear with syntax highlighting.

Tree View in Command History. Entries in the Command History now appear in a tree view so you can minimize the length of the visible history. The top-level nodes of the tree are the dates/times for each session, and beneath that is the history for that session. Click the - to the left of a date/time to hide the history entries for that session. Click the + to the left of a date/time entry to show history entries for that session.

commandhistory Function Added to Go to Tool. Use the new commandhistory function to open the Command History when it is closed, and to select it when it is open.

Save Frequency Higher by Default. The default for saving the history has changed. Now, by default, MATLAB saves the history file after five statements have been added to the history. You can modify the frequency using Command History preferences.

Help

New features and changes introduced in this version are

- “Demo of New Help Browser Features” on page 286
- “Documentation Now Automatically Installed; Not Accessible from CD-ROMs and docroot Not Supported” on page 286
- “Index Pane Adds Alphabetical Links” on page 287
- “Search Type Removed” on page 287
- “Favorites in Help Browser” on page 287
- “Display Pane Find in Page Icon” on page 287
- “Title Field No Longer Supports Web Browsing” on page 287
- “docsearch Function Added to Execute Help Browser Search” on page 288
- “help Function Provides Help for Methods and Classes” on page 288
- “web Function Now Opens MATLAB Web Browser By Default” on page 288
- “HTML Documentation Not Viewable with -nojvm Startup Option” on page 288

Demo of New Help Browser Features

If you are using the Help browser, watch the new Help and Documentation video demo for an overview of the major functionality.

Documentation Now Automatically Installed; Not Accessible from CD-ROMs and docroot Not Supported

Documentation is automatically installed for all the products you install. Documentation is no longer accessible from CD-ROMs. To access the documentation for products not installed on your system, use The MathWorks Web site, <http://www.mathworks.com/access/helpdesk/help/helpdesk.shtml>.

Compatibility Considerations. Because of this change, the docroot function is no longer needed and will not be supported.

Index Pane Adds Alphabetical Links

The **Index** pane now has an alphabetical quick index, so you can choose a letter to see entries starting with that letter. You can still type any index term in the text box to go directly to that term. Index entries are now shown as links. Entries that are merely headings do not go to a specific page and do not appear as links. As is true for all desktop tools, you can now drag columns in the **Index** pane to reorder them, or click a column head to sort by that column.

Search Type Removed

In the **Search** pane, you no longer select the type of search. Results are ordered so reference pages appear first, followed by headings that include the search terms. After performing a search, click the link at the bottom of the **Search** pane to look for the same term in the technical support database on The MathWorks Web site. As is true for all desktop tools, you can now drag columns in the **Search** pane to reorder them, or click a column head to sort by that column.

Favorites in Help Browser

Add pages in the Help browser to favorites (also known as bookmarking pages) by selecting **Favorites > Add to Favorites**. The **Favorites Editor** dialog box opens. Accept the default entries or modify the **Label** and click **Save**. Access favorites from the **Favorites** menu or from the **Start** menu **Shortcuts** item.

Display Pane Find in Page Icon

Click the binoculars icon on the display pane toolbar to search within the page.

Title Field No Longer Supports Web Browsing

The Help browser is now used only for MathWorks documentation installed with your products.

You can no longer enter a URL in the **Title** field of the display pane. Instead run the web function to enter a URL in the **Location** field. Links from the documentation to Web pages display the Web pages in the MATLAB Web browser, not in the Help browser.

docsearch Function Added to Execute Help Browser Search

The new docsearch function allows you to execute a full text search of the Help browser documentation from the Command Window.

help Function Provides Help for Methods and Classes

The help function now allows you to get help for methods and classes. For details, see specific instructions in the release notes about using help and doc for each product, or type help help.

web Function Now Opens MATLAB Web Browser By Default

The web function no longer opens the specified URL in the Help browser by default, but instead opens the page in the MATLAB Web browser.

Compatibility Considerations. If you want web to open pages in the Help browser, use the -helpbrowser option.

HTML Documentation Not Viewable with -nojvm Startup Option

If you start MATLAB using the -nojvm option, you cannot view the HTML documentation files from within MATLAB. The docopt function no longer supports that option.

Compatibility Considerations. This represents a change from previous versions. You can view the HTML documentation files at the MathWorks Web site.

Workspace, Search Path, and File Operations

New features and changes introduced in this version are organized by these topics:


- “Workspace Browser Enhancements and Changes” on page 289
- “Array Editor Enhancements and Changes” on page 290
- “Built-In Functions Now Treated Like Other M-Files on Search Path” on page 291
- “savepath Function Added to Replace path2rc” on page 291
- “Search Path Functions — Other Enhancements and Changes” on page 291
- “File Operations” on page 292
- “Current Directory Browser Changes and Enhancements” on page 293
- “Visual Directory and Directory Reports in Current Directory Browser” on page 294

Workspace Browser Enhancements and Changes

Demo of New Workspace Browser Features. If you are using the Help browser, watch the new Workspace Browser video demo for an overview of the major functionality.

Value Column Added to Workspace Browser. The Workspace browser now includes a **Value** column where you can see the content of the variable, or a description of the content. Click the value in the **Value** column to edit the content.

Rename or Duplicate Variable in Workspace Browser. Click a variable name (in the **Name** column) to rename the variable. To create a copy of a variable, right-click and select **Duplicate** from the context menu.

Plotting Selected Variables from Workspace Browser. Click the **plot** icon  in the Workspace browser toolbar to plot the selected variable. Choose from other applicable plots by clicking the arrow next to the plot button. The function used to create the plot appears in the Command Window so you can use it again later.

Print from Workspace Browser. Click the Print button in the Workspace browser toolbar to print a view of the current workspace.

MAT-Files Compressed by Default. MAT-files are now compressed by default. For details on compressing MAT-files, see the “Compressed Data Support in MAT-Files” on page 338 in the Programming release notes.


genvarname Function Added to Construct MATLAB Variable Name. Use the new function `genvarname` to construct a valid MATLAB variable name from a given candidate, where the candidate can be a string or a cell array of strings. For details, type `help genvarname`.

datatipinfo Function Added to Display Information About Variable. The new function `datatipinfo(x)` displays information about the variable, `x`.

Array Editor Enhancements and Changes

Demo of New Array Editor Features. If you are using the Help browser, watch the new Array Editor video demo for an overview of the major functionality.

Cell Arrays and Structures Now Supported. You can now view and edit the content of cell arrays and structures in the Array Editor. For example, double-click a structure in the Workspace browser to open it in the Array Editor. In the Array Editor, double-click an element of the structure to open it as its own Array Editor document. You can then view and edit the contents.

Plotting Multiple Elements. You can select contiguous elements in an array, and then click the **plot** button  on the Array Editor toolbar to plot only the selected elements. Click the arrow next to the plot button in the toolbar to select from other applicable plots.

Print from Array Editor. You can print an array from the Array Editor. Select **File > Print** to create a print of the current variable.

Larger Arrays Supported. You can open arrays having up to 2^{19} (524288) elements, which is eight times more than the previous limit, 2^{16} (65536).

Save to MAT-File. You can save a variable to a MAT-file from the Array Editor. Select **File > Save** and complete the resulting **Save** dialog box.

Built-In Functions Now Treated Like Other M-Files on Search Path

MATLAB now considers built-in files to be the same as other M-files on the search path.

Compatibility Considerations. MATLAB no longer considers built-in functions differently from any other M-files on the search path. MATLAB now looks for a given name first as a variable, then as an M-file in the current directory, and finally as an M-file on the search path. Previously MATLAB looked for a given name as a built-in function after looking for it as a variable.

If you have a function name that is the same as a MATLAB built-in function, your function might run instead of the built-in function, whereas in previous releases the built-in function would have run. For the built-in function to run, remove or rename your function, or change the directory order in the search path.

savepath Function Added to Replace path2rc

There is a new function, `savepath`, that saves the current search path to a file, `pathdef.m`, so that you can use the same search path in future sessions. Note that this function replaces `path2rc`.

Compatibility Considerations. The `path2rc` function has been replaced by a new function, `savepath`. If you use `path2rc`, it will run `savepath` instead. The new function, `savepath`, performs the same actions as `path2rc` did, but uses a more intuitive name. In addition, `savepath` is case sensitive on PC platforms, whereas `path2rc` was not. Use `savepath` instead of `path2rc`, and replace existing instances of `path2rc` with `savepath`.

Search Path Functions – Other Enhancements and Changes

restoredefaultpath Function Added for Recover from Problems. There is a new function, `restoredefaultpath`, that helps redefine the search path file, `pathdef.m`, to include only files installed with MathWorks products. Use this function to recover from problems with the path. If that fails, run

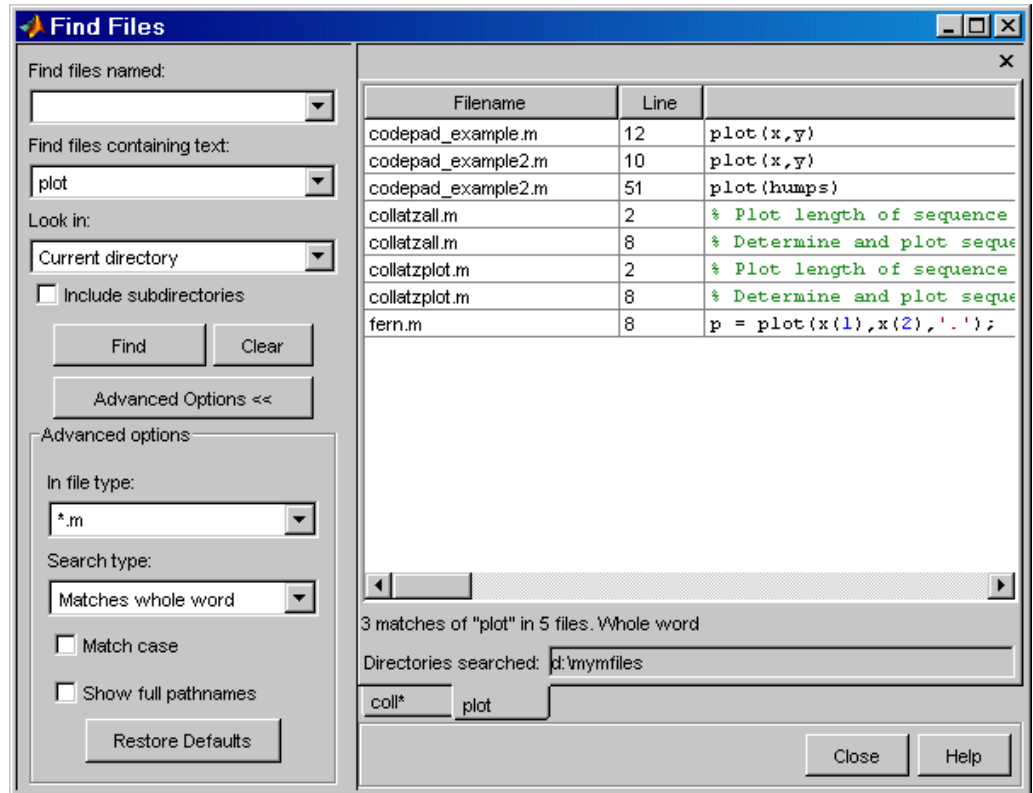
```
restoredefaultpath; matlabrc
```

genpath Function Now Includes Empty Directories. The `genpath` function now includes empty directories in the generated path string.

which Function Now Shows Built-In Functions. The `which` function now displays the pathname for built-in functions, as well as for overloaded functions when only the overloaded functions are available

File Operations

Finding Files and Content Within Files. From any desktop tool, select **Edit > Find Files**. Complete the resulting dialog box to find specified files or files containing specified text in the directories you choose. Double-click a file in the results listing to open it. For details, see “Finding Files and Content Within Files” in the online documentation.



Preventing Accidental File Deletion. Use the new recycle function or the **General** preference for the delete function to send files you remove using the delete function to the Recycle Bin on Windows, to the Trash Can on Macintosh, or to a /tmp/MATLAB_Files_timestamp directory on UNIX systems. You can then recover any accidentally deleted files from these locations.

Current Directory Browser Changes and Enhancements

Demo of New Current Directory Browser Features. If you are using the Help browser, watch the new Current Directory Browser video demo for an overview of the major functionality.

Source Control Interface Features Accessible from Current Directory

Browser. You can access source control system features from the Current Directory browser. Right-click a file or directory, and from the context menu, select **Source Control** and then select the source control function you want to use.

Open File Using External Application. To open a file using an external application, select **Open Outside MATLAB** from the context menu. For example, if you select `myfile.doc`, **Open Outside MATLAB** opens `myfile.doc` in Microsoft Word, assuming you have the `.doc` file association configured to launch Word.

Copy and Paste Directories. Using the Current Directory browser, you can now copy and paste directories, including the entries' contents.

Drag to Reorder Columns. As is true for all desktop tools, you can drag columns in the Current Directory browser to reorder them, or click a column head to sort by that column. For an item that does not fit in its column, you can hover over it to see the full name of the item.

Current Directory Text Field Does Not Display When Current Directory

Browser is Docked. The current directory field appears in the Current Directory browser only when the Current Directory browser is undocked from the MATLAB desktop. When the Current Directory browser is docked in the MATLAB desktop, use the current directory text field in the desktop toolbar.

Visual Directory and Directory Reports in Current Directory Browser

There are new tools accessible from the Current Directory browser for tuning and managing M-files. For details, see “Visual Directory Tool in the Current Directory Browser” on page 301 and “Directory Reports in the Current Directory Browser” on page 302.

Editing and Debugging M-Files

New features and changes introduced in this version are

- “Demo of New Editor Features” on page 295
- “Opening, Arranging, and Closing Documents” on page 295
- “Visual Changes” on page 296
- “Entering Statements” on page 297
- “Create Block Comments Using %{ and %}” on page 297
- “Finding and Replacing Text” on page 298
- “Printing M-Files” on page 298
- “Breakpoints and Debugging” on page 298
- “Debugging Functions Enhanced” on page 299
- “dbstack Function Supports Nested Functions” on page 299
- “dbstatus Function Supports Conditional Breakpoints” on page 300
- “Access Tools from Editor/Debugger” on page 300
- “Rapid Code Iteration Using Cells” on page 300
- “Preferences for the Editor/Debugger” on page 301

Demo of New Editor Features

If you are using the Help browser, view the Editor new features video demo to see highlights of the major new features.

Opening, Arranging, and Closing Documents

Drag File into Editor. You can drag a file onto the Editor to open it. For example, drag a text file from Windows Explorer onto the Editor.

Automatically Remove Autosave Files – Preference Added.

There is now an Editor/Debugger preference you can set to automatically remove autosave files when you close the source file. Select **Preferences > Editor/Debugger > Autosave**, and under **Close options**, select the **Automatically delete autosave files** check box.

Toggle Between Command Window and Editor/Debugger. To move from an Editor document to the Command Window, press **Ctrl+0**. To move back to the Editor document, press **Ctrl+Shift+0**.

Editor Remains Open with No Files Open. When you close the last open document in the Editor, the Editor remains open.

Automatic Reloading of Files When Changes Made Outside of MATLAB. When a file is open in the Editor and you open that same file outside of MATLAB and make changes to it, the Editor automatically updates the file to include the changes you made outside the Editor. This only applies if you did not make any changes to the file in the Editor. If you want to be prompted before the Editor updates the file, clear the Editor/Debugger preference for automatically reloading files.

Open Files While Debugging Preference Moved to Debug Menu. In the previous version, you used a preference to automatically open files when debugging. Now, instead of using a preference, you select **Open M-Files When Debugging** from the **Debug** menu in any desktop tool.

With this item selected, when you run an M-file containing breakpoints, the file opens in the Editor/Debugger when MATLAB encounters a breakpoint.

Visual Changes

Syntax Highlighting for Other Languages. The Editor now supports syntax highlighting for other languages, specifically C/C++, Java, and HTML. Use Editor language preferences to change the colors for the syntax highlighting.

Datatips Now Off By Default in Edit Mode. In edit mode, datatips are now off by default. Select the preference to display them in edit mode. Datatips display until you move the cursor. Datatips are always on in debug mode.

Vertical Line in Files. There is now a faint line at column 75, which serves as a useful reminder of where text would be cut off when printing the document. Remove the line or change the column at which the line appears using Editor/Debugger Display preferences.

Balance Delimiters Removed. The feature **Text > Balance Delimiters** has been removed.

Syntax Highlighting Default Colors Modified. The default colors for syntax highlighting M-files have been modified. Unterminated strings are now maroon, while terminated strings are now purple. This is the opposite of previous versions. Maroon is considered to be more of an "alerting" color, resembling the default of red for errors, which is the reason for the change. If you prefer the colors used in previous versions, change them using preferences — see “Syntax Highlighting Colors” in the online documentation.

In addition, arguments in statements entered using command syntax rather than function syntax are highlighted as strings, emphasizing that variables in command syntax are passed as literal strings rather than as their values.

Entering Statements

Change Case of Selected Text. To change the case of selected text, select the text and then press

- **Alt+U, U** to change all text to upper case
- Press **Alt+U, L** to change all text to lower case
- Press **Alt+U, R** to change the case of each letter

Nested Function Indenting Supported. MATLAB now supports nested functions and the Editor provides preferences regarding how to indent them.

Overwrite Mode Supported. When you press the **Insert** key, text entry is done in overwrite mode and the cursor assumes a block shape. Press the **Insert** key again to return to insert mode.

Create Block Comments Using %{ and %}

You can create a block comment in an M-file using any text editor, that is, you can comment out contiguous lines of code. Type `%{` on the line before the first line of the comment and `%}` following the last line of the comment. The lines in between are considered to be comments. Do not include any code on the lines with the block comment symbols. You can also nest block comments. See “Commenting in M-File Using Any Text Editor” for details.

Compatibility Considerations. Because of the new block comment symbols, if you have any files with lines that consist only of `%{` and `%}`, they might be misinterpreted as block comment start and end symbols, and might cause errors in your file.

Finding and Replacing Text

Find Files and Content Within Files. You can find directories, files, and content within multiple files. Select **Edit > Find Files**. For details, see “Finding Files and Content Within Files” in the online documentation.

Incremental Search Now Indicates Direction and is Case Sensitive. The incremental search interface has been updated. It now indicates the search direction. It is also case sensitive when you enter uppercase letters in the search field.

Printing M-Files

Page setup options differ slightly from previous versions.

Breakpoints and Debugging

Conditional Breakpoints Supported. You can specify conditional breakpoints in an M-file. MATLAB only stops at the line with the breakpoint if the condition is met. Conditional breakpoints have a yellow breakpoint icon, which you can copy and paste to other lines.

Disable (Ignore) Breakpoints. You can disable standard and conditional breakpoints. MATLAB ignores a disabled breakpoint until you enable it again. A disabled breakpoint icon has an X through it.

Error Breakpoints Supported. Set error breakpoints for all files by selecting **Debug > Stop If Errors/Warnings**, and then completing the resulting dialog box. You can specify a message identifier for an error or warning breakpoint so that MATLAB stops only if it encounters the specified error or warning message.

Debugging Functions Enhanced

Error Support Added to `dbstop` and `dbclear`. Enhancements to debugging functions include `dbstop` if caught error, `dbclear` if caught error, and `dbclear` if all error. The `dbstop` if all error option has been grandfathered and will not be supported in future versions. To specify a message identifier, use `dbstop` if error ID, `dbstop` if caught error ID, `dbstop` if warning ID, and the corresponding `dbclear` options. The `dbstatus` function has been updated to reflect the changes to `dbstop` and `dbclear`.

`dbstop` Function Supports Nested and Anonymous Functions. The `dbstop` function has been updated to support nested and anonymous functions. See the `dbstop` reference page for details. You cannot use the Editor/Debugger GUI to set breakpoints in anonymous functions, but must use the `dbstop` function instead. Note that when you save a file in the Editor/Debugger that contains breakpoints in anonymous functions, those breakpoints are cleared. They are also cleared when you run an unsaved file from the Editor/Debugger GUI, because running first saves the file.

Notation for Reporting Path Modified. MATLAB now uses a new notation for reporting the path of functions, subfunctions, and nested functions. As an example, `A/B>C/D` means directory A, file B, (sub)function C within the file B, and nested function D within C.

`dbstack` Function Supports Nested Functions

The `dbstack` function has been updated to supported nested functions. See the `dbstack` function reference page for more information.

Compatibility Considerations. If you use `dbstack` in M-files, you might need to update your files because of this change. When you run `dbstack` and return results to a structure, there are now three fields, whereas in previous versions, there were only two fields. The fields are

- `file`, the file in which the function appears
- `name`, the function name within the file
- `line`, the line number in the function

The `file` field does not contain a complete pathname, as the `name` field did in previous versions. To get the complete pathname, use `dbstack('-completenames')`.

dbstatus Function Supports Conditional Breakpoints

The `dbstatus` function has been updated to support conditional breakpoints. See the `dbstatus` function reference page for more information.

Compatibility Considerations. As a result there have been changes to some of the fields in the structure returned with `s = dbstatus(...)`. If you use `dbstatus` in M-files, you might need to update your files because of this change. For details on the new format, see the `dbstatus` reference page.

Access Tools from Editor/Debugger

You can access useful tools for M-files from the Editor/Debugger. From the **Tools** menu, select **Check Code with M-Lint**, **Show Dependency Report**, or **Open Profiler**. For details about these tools, see “Tuning and Managing M-Files” on page 301.

Rapid Code Iteration Using Cells

In the Editor, cell features allow you to easily make changes to values in a section of an M-file to readily see the impact of the changes. First, you define cells in a file, then evaluate a cell or cells, iterate values in the cell, and then reevaluate the cell(s). Cells also allow you to publish M-file code and results to popular formats, such as HTML and Microsoft Word. For details, see “Using Cells for Rapid Code Iteration and Publishing Results” in the online documentation.

Demo of New Rapid Code Iteration Features. If you are using the Help browser, watch the new Rapid Code Iteration Using Cells video demo for an overview of the major functionality.

Compatibility Considerations. Because of the new symbols for cell publishing, if you have any files with lines that consist only of `%%`, those lines might be misinterpreted as the start of a cell. Your files will still run without problems, but if you publish the M-files, you might need to modify those lines.

Preferences for the Editor/Debugger

Add New Line to End of File Upon Save. There is now a preference that allows you to add a new line to the end of a file upon saving.

Open M-Files When Debugging Preference Moved. The feature that instructs M-files to open automatically when debugging is no longer in preferences but is now accessible from the **Debug** menu in all desktop tools.

Tuning and Managing M-Files

Use these tools to fine-tune and manage your M-files, and to prepare them for distribution to other users. New features introduced in this version are organized by these topics:



- “Demo of New Directory Reports Features” on page 301
- “Visual Directory Tool in the Current Directory Browser” on page 301
- “Directory Reports in the Current Directory Browser” on page 302
- “Profiler for Measuring Performance” on page 304

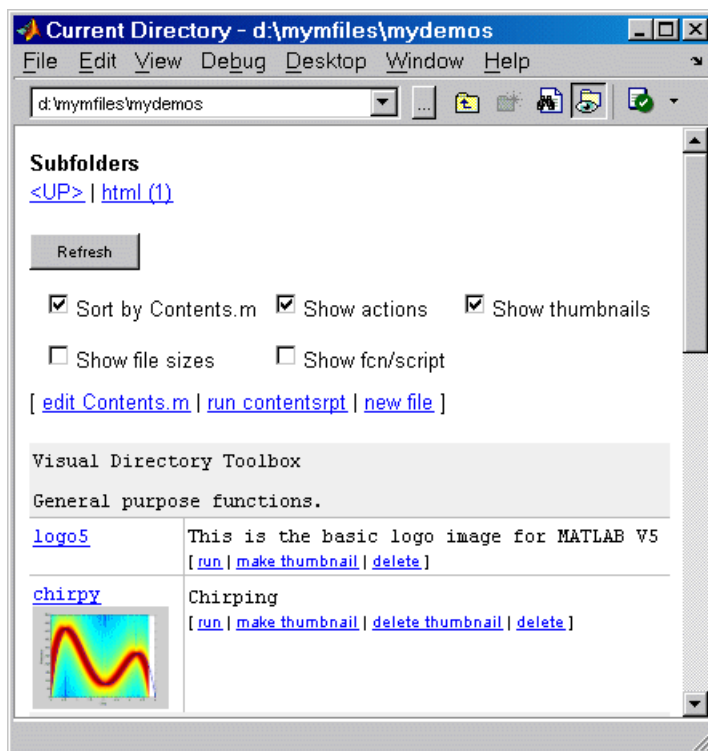
Demo of New Directory Reports Features

If you are using the Help browser, watch the new Directory Reports video demo for an overview of the major functionality.

Visual Directory Tool in the Current Directory Browser

The Visual Directory view of the Current Directory provides useful information about the M-files in a directory. It can help you polish M-files before providing them to others to use.

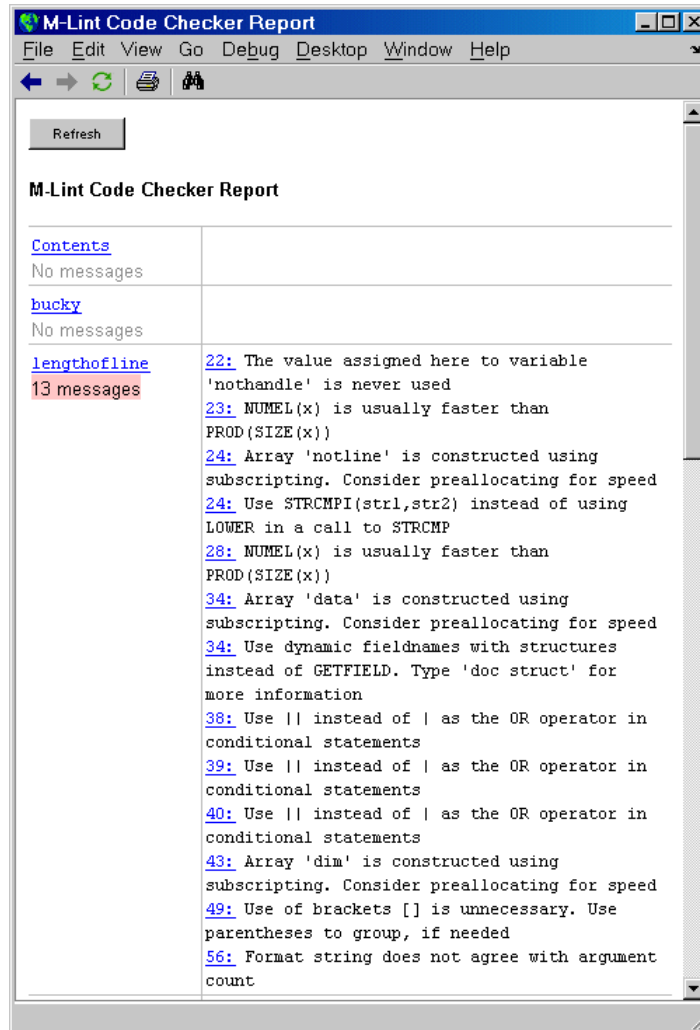
Click the **Show Visual Directory** button  on the Current Directory browser toolbar. The view changes — see the following figure for an example. To return to the Classic view of the Current Directory browser, click the button  again.



Directory Reports in the Current Directory Browser

In the Current Directory browser, select **View > Directory Reports** and select the type of report to run. The report appears as an HTML document in the MATLAB Web browser. A summary of the reports follows. For more information, see “Directory Reports in Current Directory Browser” in the online documentation.

M-Lint Code Check Report. The M-Lint report displays potential errors and problems, as well as opportunities for improvement in your code. For example, one common message is that a variable is defined but never used. You can also produce an M-Lint report for specified files using the `mlint` function, or run the M-Lint report from the Editor/Debugger or Profiler.



TODO/FIXME Report. The TODO/FIXME report shows M-files that contain text strings you included as notes to yourself, such as TODO.

Help Report. The Help report presents a summary view of the help component of your M-files. Use this information to help you identify files of interest or to help you identify files that lack help information.

Contents Report. The Contents report displays information about the integrity of the Contents.m file for the directory. A Contents.m file is a file you create that provides a brief description for relevant M-files in the directory. When you type help followed by the directory name, such as help mydemos, MATLAB displays the information in the Contents.m file. Use the Contents report to help you clean up and maintain your Contents.m file. If there is no Contents.m file, use the Contents report to create one.

Dependency Report. The Dependency report shows all M-files called by each M-file, or in other words, shows all children of each M-file. Use this report to determine all files you need to provide to someone who wants to run an M-file.

File Comparison Report. The File Comparison report identifies the differences between two files in the current directory. For example, you can easily compare an autosaved version of a file to the latest version of the file.

Coverage Report. Run the Coverage report after you run the Profile report to identify what percentage of the file was executed when it was profiled.

Profiler for Measuring Performance

Access Profiler from Desktop or Editor/Debugger. Access the Profiler from the **Desktop** menu or the Editor/Debugger **Tools** menu.

Profiler Summary Report. In the Profiler summary report, click a column name to sort the report by that column.

Profiler Detail Report. In the Profiler detail report, specify options to show busy lines (lines where the most time was spent) and to show the file listing (the M-file code). Other options allow you to run the M-Lint Code Check report, which provides messages for improving the file, and the Coverage report, which indicates how much of the file was exercised during profiling. For more information about these reports, see “Directory Reports in Current Directory Browser” in the online documentation. After selecting an option in the detail report, click **Refresh** to update the report. The performance acceleration information in the detail report has been removed.

Compatibility Considerations. The profile report previously supported in MATLAB is no longer available. This was the report you generated by running `profile report` or `profreport`. There is a new function, `profsave` that replaces `profreport`. The `profsave` function saves a static version of the HTML profile report.

Source Control Changes

In MATLAB 6.5 (R13) and MATLAB 7.0 (R14), only source control systems that comply with the Microsoft Common Source Control standard are supported. If there is a compliant source control system installed on your machine, it will be listed in the Source Control options in the MATLAB Preferences dialog.

There are several vendors who provide and interface into Revision Control Systems (RCS), Concurrent Versions System (CVS), and other such tools using Microsoft Source Code Control API. ComponentSoftware provides one such interface layer.

Compatibility Considerations

This represents a change to how MATLAB interfaced with source control systems in prior versions.

Publishing Results

Publishing to HTML, XML, LaTeX, Word, and PowerPoint

You can publish M-files to HTML, XML, LaTeX, Word, and PowerPoint documents. The published documents can include code, formatted comments, and results, such as graphs in Figure windows. Use cells and cell publishing features in the Editor/Debugger. For details, see “Publishing to HTML, XML, LaTeX, Word, and PowerPoint Using Cells” in the online documentation.

Demo of New Publishing Features. If you are using the Help browser, watch the new Publishing M Code from the Editor video demo for an overview of the major functionality.

Notebook

If you currently use Notebook, consider using cell publishing from the Editor instead, which provides more features and flexibility for most applications.

Notebook has been improved with regards to speed and stability, with a few minor changes in operation. The improvements were available via a Web-downloadable update to MATLAB version 6.5, and are now part of MATLAB version 7.

Mathematics, MATLAB Version 7 (R14)

This version introduces the following new features and changes:

New and Obsolete Functions

- “New Functions” on page 309
- “Obsolete Functions” on page 310

Nondouble Math

- “New Nondouble Mathematics Features” on page 310
- “Nondouble Arithmetic” on page 311
- “New Integer Functions — intmax and intmin” on page 312
- “New Warnings for Integer Arithmetic” on page 312
- “Warning on Concatenating Different Integer Classes” on page 313
- “Integer Data Type Functions Now Round Instead of Truncate” on page 314
- “Changes to Behavior of Concatenation” on page 315
- “Class Input for realmax and realmin” on page 315
- “Class Input for ones, zeros, and eye” on page 316
- “Class and Size Inputs for Inf and NaN” on page 317
- “New Class and Data Inputs for eps” on page 317
- “New Class Inputs for sum” on page 318
- “complex Now Accepts Inputs of Different Data Types” on page 319
- “Bit Functions Now Work on Unsigned Integers” on page 319

Matrices and Elementary Math

- “New Function accumarray for Constructing Arrays with Accumulation” on page 319
- “Enhanced sort Capabilities and Performance” on page 320

- “New Functions for Numerical Data Types” on page 321
- “max and min Now Have Restrictions on Inputs of Different Data Types” on page 321
- “Mathematic Operations on Logical Values” on page 322

Linear Algebra

- “New Function linsolve for Solving Systems of Linear Equations” on page 322
- “New Output for polyeig” on page 322
- “Enhancements to lscov” on page 323
- “New Form for Generalized Hessian” on page 323

Nonlinear Methods

- “New Function quadv Integrates Complex, Array-Valued Functions” on page 324

Trigonometry, Geometry

- “New Trigonometric Functions For Angles in Degrees” on page 324
- “Matrix, Trigonometric, and Other Math Functions No Longer Accept Inputs of Type char” on page 325
- “New Warnings for Complex Inputs to atan2, log2, and pow2” on page 325
- “Enhanced Functions for Computational Geometry” on page 326
- “New Support for Interpolation Functions” on page 326

Differential Equations

- “New and Enhanced Functions for Ordinary Differential Equations (ODEs)” on page 327

FFT

- “Enhancements to Discrete Fourier Transform Functions” on page 328
- “FFT Functions Applied to Integer Data Types are Becoming Obsolete” on page 328

Optimization

- “New Output Function for Optimization Functions” on page 329

Specialized Math

- “New Input Argument for Incomplete Gamma Function” on page 329

Other

- “Overriding the Default BLAS Library on Intel/Windows Systems” on page 330
- “New Names for Demos expm1, expm2, and expm3” on page 331

New Functions

This release introduces the following new functions:

Function	Description
accumarray	Construct array with accumulation
cast	Cast variable to different type
expm1	Compute $\exp(x) - 1$ accurately for small values of x
intmax	Largest value of specified integer type
intmin	Smallest value of specified integer type
intwarning	Control state of integer warnings
isfloat	Determine whether input is floating-point array
isinteger	Determine whether input is integer array
linsolve	Solve linear system of equations

Function	Description
log1p	Compute $\log(1+x)$ accurately for small values of x
nthroot	Real n th root of real numbers
ode15i	Solve fully implicit differential equations, variable order method
odextend	Extend solution of initial value problem for ordinary differential equation
quadv	Vectorized quadrature

Obsolete Functions

The functions listed in the left column of the following table are obsolete and will be removed from a future version of MATLAB.

Compatibility Considerations

Use the replacement functions listed in the right column instead.

Obsolete Function	Replacement Function
colmmd	colamd
quad8	quadl
symmmd	symamd

The following obsolete functions are no longer included in MATLAB:

fmin, fmins, icubic, interp4, interp5, interp6, meshdom, nnls, saxis

New Nondouble Mathematics Features

MATLAB Version 7.0 supports many arithmetic operations and mathematical functions on the following nondouble MATLAB data types:

- single
- int8 and uint8

- `int16` and `uint16`
- `int32` and `uint32`

Most of the built-in MATLAB functions that perform mathematical operations now support inputs of type `single`. In addition, the arithmetic operators and the functions `sum`, `diff`, `colon`, and some elementary functions now support integer data types.

Note In Version 7.0, MATLAB only supports mathematical operations on nondouble data types for built-in functions; it does *not* support these operations for M-file functions unless otherwise stated in the M-file help.

Nondouble Arithmetic

This section describes how MATLAB performs arithmetic on nondouble data types.

Single Arithmetic

You can now combine numbers of type `single` with numbers of type `double` or `single`. MATLAB performs arithmetic as if both inputs had type `single` and returns a result of type `single`. For more information, see “Single-Precision Floating Point” in the online MATLAB Programming documentation.

Integer Arithmetic

You can now combine numbers of an integer data type with numbers of the same integer data type or type `scalar double`. MATLAB performs arithmetic as if both inputs had type `double` and then converts the result to the same integer data type.

MATLAB computes operations on arrays of integer data type using *saturating* integer arithmetic. Saturating means that if the result is greater than the upper bound of the integer data type, MATLAB returns the upper bound. Similarly, if the result is less than the lower bound of the data type, MATLAB returns the lower bound. For more information, see “Integers” in the online MATLAB Programming documentation.

New Integer Functions – `intmax` and `intmin`

Two new functions, `intmax` and `intmin`, return the largest and smallest numbers, respectively, for integer data types. For example,

```
intmax('int8')
ans =
    127
```

returns the largest number of type `int8`. See “Largest and Smallest Values for Integer Data Types” in the online MATLAB documentation for more information.

New Warnings for Integer Arithmetic

This section describes four new warning messages for integer arithmetic in Version 7.0. While these warnings are turned off by default, you can turn them on as a diagnostic tool or to warn of behavior in integer arithmetic that might not be expected.

To turn all four warning messages on at once, enter

```
intwarning on
```

Integer Conversion of Noninteger Values

MATLAB can now return a warning when it rounds up a number in converting to an integer data type. For example,

```
int8(2.7)
Warning: Conversion rounded non-integer floating point value to
nearest int8 value.

ans =
     3
```

Integer Conversion of NaN

When MATLAB converts NaN (Not-a-Number) to an integer data type, the result is 0. MATLAB can now return a warning when this occurs. For example,

```
int16(NaN)
```

```
Warning: NaN converted to int16(0).
```

```
ans =
    0
```

Integer Conversion Overflow

MATLAB can now return a warning when you convert a number to an integer data type and the number is outside the range of the data type. For example,

```
int8(300)
Warning: Out of range value converted to intmin('int8') or
intmax('int8').
```

```
ans =
   127
```

Integer Arithmetic Overflow

MATLAB can now return a warning when the result of an operation on integer data types is either NaN or outside the range of that data type. For example,

```
int8(100) + int8(100)
Warning: Out of range value or NaN computed in integer arithmetic.
```

```
ans =
   127
```

To turn all of these warnings off at once, enter

```
intwarning off
```

Warning on Concatenating Different Integer Classes

If you concatenate integer arrays of different integer classes, MATLAB displays the warning

```
Concatenation with dominant (left-most) integer class may
overflow other operands on conversion to return class.
```

The class of the resulting array is the same as the dominant (or left-most) value in the concatenation:

```
a = int8([52 37 89; 23 16 47]);
b = int16([74 61 32; 98 73 25]);

% Combine int8 and int16 (int8 is dominant)
c = [a b];
class(c)
ans =
    int8

% Combine int16 and int8 (int16 is dominant)
c = [b a];
class(c)
ans =
    int16
```

Integer Data Type Functions Now Round Instead of Truncate

The following integer data functions now round noninteger inputs instead of truncating:

```
int8, uint8, int16, uint16, int32, uint32, int64, uint64
```

For example, in MATLAB 7.0,

```
int8(3.7)
```

returns

```
ans =
    4
```

Compatibility Considerations

In previous releases, the same command returned 3. If you have code that contains these functions, it might return different results in Version 7.0 than in previous releases, in particular, results that differ by 1 after converting floating-point inputs to an integer data type.

You can turn the following warning on to help diagnose these differences:

warning on MATLAB:intCovertNonIntVal

See “New Warnings for Integer Arithmetic” on page 312 for more information about this and other new warning messages.

Changes to Behavior of Concatenation

When you perform concatenation (`[a, b]`, `[a;b]`, and `cat(a,b,dim)`) on mixed integer and other numeric or logical inputs, the left-most integer type among the inputs is the type of the result. As a result, the other inputs might lose values when they are converted to the integer data type. In Version 7.0, MATLAB now returns a warning when you concatenate these mixed data types.

For example,

```
[int8(100) uint8(200)]
Warning: Concatenation with dominant (left-most) integer class
may overflow other operands on conversion to return class.
(Type "warning off MATLAB:concatenation:integerInteraction" to
suppress this warning.)

ans =
    100    127

class(ans)
ans =
    int8
```

Compatibility Considerations

Concatenating an input of any nondouble numeric data type (single and integer data type) with type char now returns a result of type char. In previous releases, the same operation returned a result of the same type as the numeric data type.

Class Input for `realmax` and `realmin`

You can now call the function `realmax` with the syntax

```
realmax('single')
```

```
ans =
```

```
3.4028e+038
```

which returns the largest single-precision number. Similarly,

```
realmin('single')
```

returns the smallest single-precision number.

The commands `realmax('double')` and `realmin('double')` return the same results as `realmax` and `realmin`, respectively. See “Largest and Smallest Values for Floating-Point Data Types” in the online MATLAB Programming documentation for more information.

Class Input for ones, zeros, and eye

You can now call `ones` or `zeros` with an input argument specifying the data type of the output. For example,

```
ones(m, n, p, ..., 'single')
```

or

```
ones([m, n, p, ...], 'single')
```

returns an `m`-by-`n`-by-`p`-by ... array of type `single` containing all ones. `zeros` uses the same syntax.

You can now call `eye` with this input argument for two-dimensional arrays. For example,

```
eye(m, 'single')
```

returns an `m`-by-`m` identity matrix of type `single`. The command

```
eye(m, n, 'int8')
```

returns an `m`-by-`n` array of type `int8`.

Class and Size Inputs for Inf and NaN

The functions `Inf` and `NaN` now accept inputs that enable you to create `Infs` or `NaNs` of specified sizes and floating-point data types. As examples,

- `Inf('single')` or `NaN('single')` create the single-precision representations of `Inf` and `NaN`, respectively.
- `Inf(m,n,p, ...)` or `NaN(m,n,p, ...)` create `m`-by-`n`-by-`p`-by-... arrays of `Infs` or `NaNs`, respectively.

See the reference pages for `Inf` and `NaN` for more information.

New Class and Data Inputs for `eps`

You can now call the function `eps` with the syntax

```
eps(x)
```

If `x` has type `double`, `eps(x)` returns the distance from `x` to the next largest double-precision floating point number. This is a measure of the accuracy of `x` as a double-precision number. `eps(1)` returns the same value as `eps` with no input argument.

You can now replace expressions of the form

```
if Y < eps * abs(X)
```

with

```
if Y < eps(X)
```

If `x` has type `single`, `eps(x)` returns the distance from `x` to the next largest single-precision floating point number. This is a measure of the accuracy of `x` as a single-precision number.

The command

```
eps('single')
ans =
    1.1921e-007
```

returns the same value as `eps(single(1))`. The value of `eps('single')` is the same as `single(2^-23)`. The command `eps('double')` returns the same result as `eps`.

See “Accuracy of Floating-Point Data” in the online MATLAB documentation for more information.

New Class Inputs for `sum`

The following new input arguments for `sum` control how the summation is performed on numeric inputs:

- `s = sum(x, 'native')` and `s = sum(x, dim, 'native')` accumulate in the native type of its input and the output `s` has the same data type as `x`. This is the default for `single` and `double`.
- `s = sum(x, 'double')` and `s = sum(x, dim, 'double')` accumulate in double-precision. This is the default for integer data types.

In Version 7.0, `sum` applied to a vector of type `single` performs `single` accumulation and returns a result of type `single`. In other words, `sum(x)` is the same as `sum(x, 'native')` if `x` has type `single`. This is a change in the behavior of `sum` from previous releases. To make `sum` accumulate in `double`, as in previous releases, use the input argument `'double'`.

Compatibility Considerations

In Version 7.0, `sum` applied to a vector of type `single` performs `single` accumulation and returns a result of type `single`. In previous releases, `sum` performed this operation in `double` accumulation.

To restore the previous behavior, call `sum` with the syntax

```
sum(X, 'double')
```

or

```
sum(X, dim, 'double')
```

complex Now Accepts Inputs of Different Data Types

The function `complex` now accepts inputs of different data types when you use the syntax

```
complex(a,b)
```

according to the following rules:

- If either of `a` or `b` has type `single`, `c` has type `single`.
- If either of `a` or `b` has an integer data type, the other must have the same integer data type or type `scalar double`, and `c` has the same integer data type.

Bit Functions Now Work on Unsigned Integers

The following functions now work on unsigned integer inputs:

```
bitand, bitcmp, bitget, bitor, bitset, bitshift, bitxor
```

Instead of using `flints` (integer values stored in floating point) to do your bit manipulations, consider using unsigned integers, as a more natural representation of bit strings. Instead of using `bitmax`, use the `intmax` function with the appropriate class name. For example, use `intmax('uint32')` if you are working with unsigned 32 bit integers.

In addition, the function `bitcmp` now accepts the following new syntax for inputs of type `uint8`, `uint16`, and `uint32`:

```
bitcmp(A)
```

`bitcmp` now uses the data type of `A` to determine how to take the bitwise complement.

New Function `accumarray` for Constructing Arrays with Accumulation

The new `accumarray` function enables you to construct an array with accumulation. The following example uses `accumarray` to construct a 5-by-5 matrix `A` from a vector `val`. The function `accumarray` adds the entries of `val` to `A` at the indices specified by the matrix `ind`, which has the same number of

rows as `val`. If an index in `ind` is repeated, the entries of `val` accumulate at the corresponding entry of `A`.

```
ind = [1 2 5 5;1 2 5 5]';
val = [10.1 10.2 10.3 10.4]';
A = accumarray(ind, val)
```

`A =`

```
10.1000         0         0         0         0
         0 10.2000         0         0         0
         0         0         0         0         0
         0         0         0         0         0
         0         0         0         0 20.7000
```

To get the (5,5) entry of `A`, `accumarray` adds the entries of `val` corresponding to repeated pair of indices (5,5).

$$A(5, 5) = 10.3 + 10.4$$

In general, if `ind` has `ndim` columns, `A` will be an `N`-dimensional array with `ndim` dimensions, whose size is `max(ind)`.

Enhanced sort Capabilities and Performance

Improved Performance

`sort` performance has been improved for numeric arrays of randomly ordered data. Although there is some performance improvement for all such numeric arrays, you should see the greatest improvement for integer arrays and multidimensional arrays.

Sort Direction

A new argument, `mode`, lets you specify whether `sort` returns the sorted array in ascending or descending order.

New Functions for Numerical Data Types

MATLAB 7.0 contains three new functions for detecting and converting data types:

- `cast` enables you to cast a variable to a different data type or class
- `isfloat` enables you to detect floating-point arrays. `isfloat(A)` returns 1 if `A` has type `double` or `single` and 0 otherwise. `isfloat(A)` is the same as `isa(A, 'float')`.
- `isinteger` enables you to detect integer arrays. `isinteger(A)` returns 1 if `A` has integer data type and 0 otherwise. `isinteger(A)` is the same as `isa(A, 'integer')`

max and min Now Have Restrictions on Inputs of Different Data Types

In MATLAB 7.0, the functions `max` and `min` now have the following restrictions on inputs of different data types:

- If any input has an integer data type, all other inputs must have the same integer data type or type `scalar double`.
- If any input is of type `single`, all other inputs must have type `double` or `single`.

Other combinations of inputs now return an error message. In previous releases, inputs to `max` or `min` could have any combination of data types.

For the allowed mixed-type combinations listed above, `max` and `min` now return results of a different data type than in previous releases:

- If one input has an integer data type, while another has type `double`, the result now has the same integer data type. In previous releases, the result had type `double`.
- If one input has type `single`, while another has type `double`, the result now has type `single`. In previous releases, the result had type `double`.

You can turn on the following warning messages to diagnose any issues that might result from this change in behavior:

- warning on MATLAB:max:mixedIntegersScalarDoubleInputs
- warning on MATLAB:max:mixedSingleDoubleInputs
- warning on MATLAB:min:mixedIntegersScalarDoubleInputs
- warning on MATLAB:min:mixedSingleDoubleInputs

Compatibility Considerations

Combinations of inputs other than those listed above now return an error message. Also, for these allowed mixed-type combinations, `max` and `min` now return results of a different data type than in previous releases:

Mathematic Operations on Logical Values

Most mathematic operations are not supported on logical values.

New Function `linsolve` for Solving Systems of Linear Equations

The new `linsolve` function enables you to solve systems of linear equations of the form $Ax = b$ more quickly when the matrix of coefficients A has a special form, such as upper triangular. When you specify one of these special types of systems, `linsolve` is faster than `mldivide` or `\` (backslash) because it does not check whether the matrix actually has the form you specify.

Note If the matrix A does not have the form you specify in `opts`, `linsolve` returns incorrect results because it does not perform error checking. If you are unsure of the form of A , use `mldivide`, or `\` instead.

New Output for `polyeig`

The function `polyeig` can now return a vector of condition numbers for the eigenvalues, when you call it with the syntax

```
[X,E,S] = polyeig(A0,A1,...,Ap)
```

At least one of A_0 and A_p must be nonsingular. Large condition numbers imply that the problem is close to one with multiple eigenvalues.

Enhancements to `lscov`

The command

$$\text{lscov}(A, b, V)$$

now accepts either a weight vector or a covariance matrix for V . If you enter `lscov(A, b)` without a third argument, `lscov` uses the identity matrix for V .

The command `lscov(A, b, V, alg)` now enables you to specify the algorithm used to compute the result when V is a matrix. You can specify `alg` to be one of the following:

- 'chol' uses the Cholesky decomposition of V
- 'orth' uses the orthogonal decomposition of V

The command

$$[x \text{ stdx } \text{mse}] = \text{lscov}(\dots)$$

now returns `mse`, the mean squared estimate (MSE).

The command

$$[x \text{ stdx } \text{mse } S] = \text{lscov}(\dots)$$

now returns `S`, the estimated covariance matrix of x .

In addition, `lscov` can now accept a design matrix A that is rank deficient and a covariance matrix, V , that is positive semidefinite.

New Form for Generalized Hessian

The function `hess` has a new syntax of the form

$$[AA, BB, Q, Z] = \text{hess}(A, B)$$

where A and B are square matrices, and returns an upper Hessenberg matrix AA , an upper triangular matrix BB , and unitary matrices Q and Z such that

$$Q^*A^*Z = AA$$

and

$$Q*B*Z = BB$$

New Function `quadv` Integrates Complex, Array-Valued Functions

The new function `quadv` integrates complex, array-valued functions.

New Trigonometric Functions For Angles in Degrees

The following new functions compute trigonometric functions of arguments in degrees.

Function	Purpose
<code>sind</code>	Compute the sine of an argument in degrees
<code>cosd</code>	Compute the cosine of an argument in degrees
<code>tand</code>	Compute the tangent of an argument in degrees
<code>cotd</code>	Compute the cotangent of an argument in degrees
<code>secd</code>	Compute the secant of an argument in degrees
<code>cscd</code>	Compute the cosecant of an argument in degrees

The following new functions compute the inverse trigonometric functions and return the answer in degrees:

Function	Purpose
<code>asind</code>	Compute the inverse sine of an argument and return answer in degrees
<code>acosd</code>	Compute the inverse cosine of an argument and return answer in degrees
<code>atand</code>	Compute the inverse tangent of an argument and return answer in degrees
<code>acotd</code>	Compute the inverse cotangent of an argument and return answer in degrees

Function	Purpose
asecd	Compute the inverse secant of an argument and return answer in degrees
acscd	Compute the inverse cosecant of an argument and return answer in degrees

Matrix, Trigonometric, and Other Math Functions No Longer Accept Inputs of Type char

Matrix functions, such as `chol`, `lu`, and `svd`, and trigonometric functions, such as `sin` and `cos`, no longer accept inputs of type `char`. In previous releases, these functions simply converted `char` inputs to `double` before performing operations on them.

Compatibility Considerations

To restore the previous behavior of these functions, create an M-file that converts its input to `double` before applying the function. For example, to restore the behavior of `sin`,

- 1 Create a directory called `@char` in a directory on the MATLAB path, for example, your work directory.
- 2 Create an M-file with the following commands:

```
function s = sin(x)
s = sin(double(x));
```

- 3 Save the file as `sin.m` in the directory `@char`.

New Warnings for Complex Inputs to `atan2`, `log2`, and `pow2`

The following functions now return a warning for inputs that are not real numbers:

- `atan2(y,x)`
- `[f,e] = log2(x)`

- `pow2(f,e)`

Enhanced Functions for Computational Geometry

The following functions, which perform geometric computations on a set of points in N-dimensional space, now provide many new options:

- `convhull` — Compute convex hulls
- `convhulln` — Compute N-dimensional convex hulls
- `delaunay` — Construct Delaunay triangulation
- `delaunay3` — Construct 3-dimensional Delaunay tessellations
- `delaunayn` — Construct N-dimensional Delaunay tessellations
- `griddata` — Data gridding and surface fitting
- `griddata3` — Data gridding and surface fitting for 3-dimensional data
- `griddatan` — Data gridding and hypersurface fitting (dimensions ≥ 2)
- `voronoi` — Construct Voronoi diagrams
- `voronoin` — Construct N-dimensional Voronoi diagrams

These functions now accept an input cell array options that gives you greater control over how they perform calculations. These functions use the software Qhull, created at the National Science and Technology Research Center for Computation and Visualization of Geometric Structures (the Geometry Center). For more information on the available options, see <http://www.qhull.org/>.

New Support for Interpolation Functions

The following interpolation functions now have enhanced features:

- `interp1` — The command `YI = interp1(X,Y,XI)` now accepts a multidimensional array `Y` and returns an array of the correct dimensions. If `Y` is an array of size $[n, m_1, m_2, \dots, m_k]$, `interp1` performs interpolation for each m_1 -by- m_2 -by- \dots - m_k value in `Y`. If `XI` is an array of size $[d_1, d_2, \dots, d_j]$, `YI` has size $[d_1, d_2, \dots, d_j, m_1, m_2, \dots, m_k]$.

The command `pp = interp1(X,Y,'method','pp')` uses the specified method to generate the piecewise polynomial form (ppform) of `Y`. See the reference page for `interp1` for information about the available methods.

- `interp2`, `interp3`, and `interpN` — You can now pass in a scalar argument, `ExtrapVal`, which these functions return for any values of `XI` and `YI` that lie outside the range of values spanned by `X` and `Y` defining the grid. For example,

```
ZI = interp2(X,Y,Z,XI,YI,'method',ExtrapVal)
```

returns the value of `ExtrapVal` for any values of `XI` or `YI` that are outside the range of values spanned by `X` and `Y`.

- `ppval` now accepts multidimensional arrays returned by the `spline` function using the syntax

```
YY = ppval(spline(X,Y), XX)
```

Each entry of `YY` is obtained by evaluating `spline(X,Y)` at the corresponding value of `XX`.

- `spline` — The command `YY = spline(X,Y,XX)` now accepts a multidimensional array `Y` and returns an array of the correct dimensions. Note that `YY = spline(X,Y,XX)` is the same as `YY = ppval(spline(X,Y), XX)`.

If `spline(X, Y)` is scalar-valued, then `YY` is of the same size as `XX`. If `spline(X, Y)` is $[D_1, \dots, D_r]$ -valued, and `XX` has size $[N_1, \dots, N_s]$, then `YY` has size $[D_1, \dots, D_r, N_1, \dots, N_s]$, where `YY(:, ..., :, J1, ..., Js)` is the value of `spline(X, Y)` at `XX(J1, ..., Js)`. There are two exceptions to this rule:

New and Enhanced Functions for Ordinary Differential Equations (ODEs)

MATLAB 7.0 provides two new functions for solving implicit ODEs and extending solutions to ODEs, along with several enhancements to existing ODE-related functions:

- `ode15i`, which is new in Version 7.0, provides the capability to solve fully implicit ODE and DAE problems of the form $f(t, y, y') = 0$ with consistent initial conditions, i.e., $f(t_0, y_0, y_0') = 0$. `ode15i` provides an interface that is

similar to that of the other MATLAB ODE solvers and is as easy to use. A supporting function `decic` helps you calculate consistent initial conditions. The existing functions `odeset` and `odeget` enable you to set integration properties that affect the problem solution. `deval` evaluates the numerical solution obtained with `ode15i`.

- `odextend`, which is new in Version 7.0, enables you to extend the solution to an ODE created by an ODE solver.
- `bvp4c` can now solve multipoint boundary value problems. To see an example of how to solve a three-point boundary value problem, enter `threebvp`. To see the code for the example, enter `edit threebvp`. Enter `help bvp4c` to learn more about `bvp4c`.
- `deval` can now evaluate the derivative of the solution to an ODE as well as the solution itself. The command

```
[psxint, spxint] = deval(sol,xint)
```

returns `spxint`, the value of the derivative to `sol`.

Enhancements to Discrete Fourier Transform Functions

The new function `fftw` enables you to optimize the speed of the discrete Fourier transform (DFT) functions `fft`, `ifft`, `fft2`, `ifft2`, `fftn`, and `ifftn`. You can use `fftw` to set options for a tuning algorithm that experimentally determines the fastest algorithm for computing a discrete Fourier transform of a particular size and dimension at run time.

The functions `ifft`, `ifft2`, and `ifftn` now accept the input argument `'symmetric'`, which causes these functions to treat the array `X` as conjugate symmetric. This option is useful when `X` is not exactly conjugate symmetric, merely because of round-off error.

FFT Functions Applied to Integer Data Types are Becoming Obsolete

In previous releases, the following fast Fourier transform (FFT) and related functions cast integer inputs of type `uint8` and `uint16` to `double`, used the `double` algorithm, and returned a `double` result:

- `fft`

- `fftn`
- `ifft`
- `ifftn`
- `conv2`

In Version 7.0, these operations return warning messages that recommend convert the inputs to double before applying the function, for example, by `fft(double(x))`.

New Output Function for Optimization Functions

In MATLAB 7.0, you can create an output function for several optimization functions in MATLAB. The optimization function calls the output function at each iteration of its algorithm. You can use the output function to obtain information about the data at each iteration or to stop the algorithm based on the current values of the data. You can use the output function with the following optimization functions:

- `fminbnd`
- `fminsearch`
- `fzero`

See “Output Functions” for an example of how to use the output function.

- `N1` is ignored if `XX` is a row vector, that is, if `N1` is 1 and `s` is 2.
- `spline` ignores any trailing singleton dimensions of `XX`.

New Input Argument for Incomplete Gamma Function

The incomplete gamma function, `gammainc`, now accepts the input argument `tail`, using the syntax

```
Y = gammainc(X,A,tail)
```

`tail` specifies the tail of the incomplete gamma function when X is non-negative. The choices are for `tail` are 'lower' (the default) and 'upper'. The upper incomplete gamma function is defined as

$$1 - \text{gammainc}(x, a)$$

Overriding the Default BLAS Library on Intel/Windows Systems

Note Intel has used aggressive optimization to compile MKL. This optimization causes NaNs to be treated as zeros in some situations. Calculations that do not involve NaNs are done correctly. In some calculations that do involve NaNs, the NaNs will not propagate.

MATLAB uses the Basic Linear Algebra Subroutines (BLAS) libraries to speed up matrix multiplication and LAPACK-based functions like `eig`, `svd`, and `\(mldivide)`. At start-up, MATLAB selects the BLAS library to use.

For R14, MATLAB still uses the ATLAS BLAS libraries, however, on Windows systems running on Intel processors, you can switch the BLAS library that MATLAB uses to the Math Kernel Library (MKL) BLAS, provided by Intel.

If you want to take advantage of the potential performance enhancements provided by the Intel BLAS, you can set the value of the environment variable `BLAS_VERSION` to the name of the MKL library, `mk1.dll`. MATLAB uses the BLAS specified by this environment variable, if it exists.

To set the `BLAS_VERSION` environment variable, follow this procedure:

- 1 Click the **Start** button, go to the **Settings** menu, and select **Control Panel**.
- 2 On the **Control Panel** menu, select **System**.
- 3 In the **System Properties** dialog box, click the **Advanced** tab.
- 4 On the **Advanced** panel, click the **Environment Variables** button.
- 5 In the **Environment Variables** dialog box, click the **New** button in the User variables section.

- 6 In the **New User Variable** dialog box, enter the name of the variable as `BLAS_VERSION` and set the value of the variable to the name of the MKL library: `mk1.dll`.

Multithreading Disabled in Intel Math Kernel Library (MKL) BLAS

The Intel Math Kernel Library (MKL) is multithreaded in several areas. By default, this threading capability is disabled. To enable threading in the MKL library, set the value of the `OMP_NUM_THREADS` environment variable. Intel recommends setting the value of the `OMP_NUM_THREADS` variable to the number of processors you want to use in your application.

To set the value of this environment variable, follow the instructions outlined in “Overriding the Default BLAS Library on Intel/Windows Systems” on page 330.

Before enabling multithreading, read the Intel Math Kernel Library 6.1 for Windows Technical User Notes that explains certain limitations of this capability.

New Names for Demos `expm1`, `expm2`, and `expm3`

The demos `expm1`, `expm2`, and `expm3` have been renamed `expdemo1`, `expdemo2`, and `expdemo3`, to avoid a name conflict with the new function `expm1`.

Compatibility Considerations

If you have code that relies on these function names, you will need to change the names in your code.

Programming, MATLAB Version 7 (R14)

Caution If you have saved data to a MAT-file using MATLAB Release 14 Beta 2, please read “MAT-Files Generated By Release 14 Beta2 Must Be Reformatted” on page 336.

This version introduces the following new features and changes:

Save and Load

- “MATLAB Stores Character Data As Unicode; Making Release 14 MAT-files Readable in Earlier Versions” on page 335
- “MAT-Files Generated By Release 14 Beta2 Must Be Reformatted” on page 336
- “Unicode-Based Character Classification” on page 337
- “Character Rendering on Linux” on page 337
- “Additional Bytes Reserved in MAT-File Header; Do Not Write To Reserved Space” on page 337
- “Compressed Data Support in MAT-Files” on page 338
- “Saving Structures with the save Function” on page 338

Function Dispatching

- “Case-Sensitivity in Function and Directory Names; Can Affect Which Function MATLAB Selects” on page 338
- “Differences Between Built-Ins and M-Functions Removed; Can Affect Which Function MATLAB Selects” on page 343
- “Warning on Naming Conflict” on page 345
- “Change to How evalin Evaluates Dispatch Context” on page 345

Functions and Scripts

- “Summary of New Functions” on page 346
- “New Function Type — Anonymous Functions” on page 347
- “New Function Type — Nested Functions” on page 349
- “Calling Private Functions From Scripts” on page 350
- “New Calling Syntax for Function Handles; Replace eval With New Syntax” on page 350
- “Arrays of Function Handles” on page 351
- “Calling nargin and narginout with Built-In Functions” on page 351
- “Comma Separators Not Required in Function Declaration” on page 352

Changes to Specific Functions

- “getfield and setfield Not To Be Deprecated” on page 352
- “isglobal Function To Be Discontinued” on page 352
- “Recycle to Protect Files from Unwanted Deletion” on page 353
- “bin2dec Ignores Space Characters” on page 353
- “dbstop crashes Are Now Resolved” on page 353
- “Bit Functions on Unsigned Integers” on page 354
- “inmem Returns Path Information” on page 354

Specific Data Types

- “New Features for Nondouble Data Types” on page 354
- “Mathematic Operations on Logical Values” on page 354
- “Accessing Cell and Structure Arrays Without deal” on page 354

Characters and Strings

- “New Features in Regular Expression Support” on page 355

- “Functions that Use Regular Expressions” on page 356
- “Regular Expressions Accept String Vector; No Longer Support Character Matrix Input” on page 357
- “Cell Array Support for String Functions” on page 357
- “Additional Class Output From mat2str” on page 357
- “String Properties” on page 358
- “Using strtok on Cell Arrays of Strings” on page 358
- “Colon Operator on char Now Returns a char” on page 358

Dates and Times

- “datestr Returns Date In Localized Format” on page 359
- “Form and Locale for weekday” on page 359
- “Freestyle Date String Format” on page 359
- “Reading Date Values with xlsread; Conversion No Longer Necessary” on page 359

File I/O

- “Comprehensive Function for Reading Text Files” on page 360
- “New Inputs and Outputs to xlsread” on page 361
- “New Inputs and Syntax for dlmwrite” on page 361
- “Change in Output from xlsinfo” on page 362
- “Importing Complex Arrays” on page 363
- “Using imread to Import Subsets of TIFF Images” on page 363
- “Getting Information about Multimedia Files” on page 364
- “All-Platform Audio Recording and Playback” on page 364
- “FTP File Operations” on page 365
- “Web Services (SOAP)” on page 365
- “64-Bit File Handling on MacIntosh” on page 365

Error Handling

- “Changes to Error Message Format” on page 365
- “nargchk Has a New Format for Error Messages” on page 368
- “Enabling and Disabling Warning Messages” on page 369
- “Catching Ctrl+C in try-catch Statements” on page 369

Other Topics

- “MATLAB Performance Acceleration” on page 370
- ““Using MATLAB” Documentation Is Now Three Books” on page 370

MATLAB Stores Character Data As Unicode; Making Release 14 MAT-files Readable in Earlier Versions

Prior releases of MATLAB represented character data in memory using a system default character encoding scheme that was padded out to 16-bits. This was the case both in memory and in MAT-files. If this data needed to be accessible to multiple users, each user’s system had to use the same character encoding scheme. For those users whose default encoding scheme differed, the exchange of character-oriented information was not possible.

In Release 14, this limitation is removed by adopting the Unicode character encoding scheme in `mxArrays` and their storage in MAT-files. For more information regarding Unicode, consult the Unicode Consortium web site at <http://www.unicode.org>.

For more information on saving character data using Unicode encoding, see “Writing Character Data” in the External Interfaces documentation. For information on the internal formatting of MAT-files, see the “MAT-File Format” document in the MATLAB documentation available in PDF format

Compatibility Considerations

Release 14 MATLAB writes character and figure data to MAT-files using Unicode character encoding by default. This is now the default encoding used by MATLAB when writing to MAT-files with the `save` and `hgsave` functions or with the MAT-file external interface functions.

Unicode encoded MAT-files are not readable by earlier versions of MATLAB. Thus, if you save data to a MAT-file using MATLAB Release 14, and you intend to load this MAT-file into an earlier release of MATLAB, you must override the default encoding during the save, as explained in this section.

You can override the default encoding by using the `-v6` switch with `save` and `hgsave`:

```
save filename -v6
hgsave filename -v6
```

or, when saving with MAT functions, by setting the mode to “wL” on the `matOpen` operation:

```
matOpen(filename, "wL");
```

MAT-Files Generated By Release 14 Beta2 Must Be Reformatted

Any MAT-files that you created with Release 14 Beta 2 were written using an internal format that is no longer supported by MATLAB.

Compatibility Considerations

If you need to import data from these files using any release besides Release 14 Beta 2, you must first regenerate the files as described in this section. You cannot read these files using other releases of MATLAB 7.0, and attempting to read them with MATLAB 6.5 or 6.5.1 will corrupt memory.

There are two ways in which you can regenerate your MAT-file:

- If you want to use the MAT-file with earlier versions of MATLAB, regenerate the file using the local character set for your system. To do this, run MATLAB R14 prerelease or MATLAB R14 Beta 2, load the MAT-file, and rewrite the file using the command

```
save filename -v6
```

- If you want to use the MAT-file with R14 LCS or later, regenerate the file using Unicode character encoding. To do this, run MATLAB R14 prerelease, load the MAT-file, and rewrite it using the following command that uses the `-unicode` default.

```
save filename
```

Caution The final R14 release of MATLAB does not allow you to import a MAT-file written with Release 14 Beta 2. You will get an error if you attempt to do this. To use a Beta 2 MAT-file with Release 14, you must first reformat the file with MATLAB R14 prerelease as described above.

If you no longer have access to Release 14 Beta2 or the R14 prerelease, then you must regenerate the data and save it again.

Unicode-Based Character Classification

Unicode-based character classification APIs are now provided in MATLAB. The new character classification functions work with any locale or language and resolve all locale-specific issues that existed in prior releases.

Character Rendering on Linux

Character data rendering has been improved for Linux operating systems that are configured with a UTF-8 default character set.

Additional Bytes Reserved in MAT-File Header; Do Not Write To Reserved Space

In previous releases of MATLAB, the last 4 bytes of the 128-byte MAT-file header were reserved for use by the MathWorks. In Release 14, the last 12 bytes of this header are reserved. See the PDF file “MAT-File Format” for more information.

Compatibility Considerations

If you have programs that write to any of the last 12 bytes of the MAT-file header, or if they rely on the state of the 8 additional header bytes that are reserved as of this release, you will probably need to change your code. These bytes are now used by MATLAB. If your code writes to these bytes, MATLAB is likely to overwrite this data. If your code reads these bytes, they might not be in the same state as they were in previous releases of MATLAB.

Compressed Data Support in MAT-Files

The `save` function compresses your workspace variables as they are saved to a MAT-file. When writing a MAT-file that you will need to load using an earlier version of MATLAB, be sure to use the `save -v6` command. When you use the `-v6` switch, MATLAB saves the data without compression and without Unicode character encoding. This makes the resulting file compatible with MATLAB Version 6 and earlier.

You can also compress data when using MAT-file interface library functions (`matPut*`) to write to a MAT-file by opening the file with the command `matOpen wz`. See the section “Data Compression” in the MATLAB Programming documentation for more information on this feature.

Saving Structures with the `save` Function

Two new syntaxes for the `save` function enable you to save individual fields of a structure to a file. See the function reference for `save` for more information.

To save all fields of the scalar structure `s` as individual variables within the file, `myfile.mat`, use

```
save('myfile', '-struct', 's')
```

To save as individual variables only those structure fields specified (`s.f1`, `s.f2`, ...), use

```
save('myfile', '-struct', 's', 'f1', 'f2', ...)
```

Case-Sensitivity in Function and Directory Names; Can Affect Which Function MATLAB Selects

Prior to this release, filenames for MATLAB functions and Simulink® models, (M, P, MEX, DLL, and MDL files) and also directory names were interpreted somewhat differently by MATLAB with regards to case sensitivity, depending upon which platform you were running on. Specifically, earlier versions of MATLAB handled these names with case sensitivity on UNIX, but without case sensitivity on Windows.

This release addresses the issue of case sensitivity in an effort to make MATLAB consistent across all supported platforms. By removing these

differences, we hope to make it easier for MATLAB users to write platform independent code.

Case Sensitivity in MATLAB 6 and Earlier

There are several rules regarding case sensitivity that were already consistent across all platforms in MATLAB 6, and remain in effect on all platforms in MATLAB 7. MATLAB interprets each of the following with case sensitivity on both Windows and UNIX:

- Function names that correspond to MATLAB built-ins
- M-file subfunction names
- The names of functions imported from another language environment, such as Java or COM

UNIX. On all UNIX platforms, including the new implementation on MacIntosh, all function, model, and directory names were case sensitive and required an exact match. This rule remains true for UNIX systems in MATLAB 7.

Windows. On Windows platforms, MATLAB 6 obeys the following rules. These rules are changing in MATLAB 7:

- Function and model names were not case sensitive.
- Directory names, including MATLAB class directory names (e.g., @MyClass) and private directory names (e.g., prIVAtE) were not case sensitive.

Case Sensitivity in MATLAB 7

MATLAB 7 removes the platform specific behaviors by adopting its UNIX case sensitivity rules on Windows systems. MATLAB running on Windows now gives preference to an exact (case sensitive) name match, but falls back to an inexact (case insensitive) match when no exact match can be found.

Compatibility Considerations

There are four main conditions under which MATLAB 7 interprets directory or function names differently in regards to case sensitivity:

- “Two Files of the Same Name” on page 340
- “Two Method Files of the Same Name” on page 341
- “One File with an Inexact Match” on page 341
- “Private Directory Names” on page 342

In any of these cases, each described below, there is a potential for MATLAB to select a file other than the one you had intended.

Whenever MATLAB 7 detects a potential naming conflict related to case sensitivity, it issues a warning. If you get one of these warnings when running a MATLAB program, you may want to modify the related code to eliminate the warning, or you may wish to simply disable the warning. To disable this type of warning, see “Turning Off Warnings Caused by Case Mismatch” on page 343.

Two Files of the Same Name. Consider the situation in which there are two or more directories on the MATLAB path that contain a function or model file of the same name. The names of these M-files differ only in letter case:

```
H:\released\myTestFun.m
K:\under_test\mytestfun.m
```

Of these two directories, H:\released is closer to the beginning of the MATLAB path and, thus, has priority over the other:

```
path = H:\released; K:\under_test; ...
```

On Windows Platforms —

- In MATLAB 6, executing the function mytestfun invokes H:\released\myTestFun.m.
- In MATLAB 7, executing the function mytestfun invokes K:\under_test\mytestfun.m and also displays the following warning:

```
Function call mytestfun invokes K:\under_test\mytestfun.m
however, function H:\released\myTestFun.m, that differs only in
case, precedes it on the path.
```


On UNIX Platforms —

MATLAB 7 does the same as on Windows, except that the warning message is disabled by default.

Two Method Files of the Same Name. In this case, there are two M-files of the same name that implement methods of a MATLAB base class and one of its subclasses:

```
@baseclass/my_method.m
@subclass/My_Method.m
```

On Windows Platforms —

- In MATLAB 6, the command `my_method(subclass)` invokes `@subclass/My_Method`.
- In MATLAB 7, the same command invokes `@baseclass/my_method` because it is an exact match.

On UNIX Platforms —

MATLAB 7 does the same as on Windows.

One File with an Inexact Match. Another situation that MATLAB now handles differently involves just one function or model file that matches the function being called:

```
H:\released\myTestFun.m
```

However, the name of this M-file does not match the called function (`mytestfun`) in letter case.

On Windows Platforms —

- In MATLAB 6, calling the function `mytestfun` invokes `H:\released\myTestFun.m`.
- In MATLAB 7, calling the function `mytestfun` invokes the same M-file but also displays the following warning:

```
Function call mytestfun invokes inexact match
```

H:\released\myTestFun.m.

On UNIX Platforms —

- In MATLAB 6, calling the function `mytestfun` results in an error.
- In MATLAB 7, calling `mytestfun` invokes `H:\released/myTestFun.m` and generates the following warning:

```
Function call mytestfun invokes inexact match
H:/released/myTestFun.m.
```

Private Directory Names. Private functions must reside in a directory named `private` that is one level down from the directory of any calling function. As of this release, the directory name `private` is case sensitive on Windows as it has always been on UNIX.

On Windows Platforms —

- In MATLAB 6, calling function `myprivfun` in an environment where only a subdirectory named `\PriVate` contains the M-file `myprivfun.m` invokes `\PriVate\myprivfun` without displaying a warning.
- MATLAB 7 does the same as MATLAB 6, except that it also displays the following warning:

```
Wrong case spelling of 'private' as a directory name in
\released\PriVate\myprivfun.m.
```

On UNIX Platforms —

- In MATLAB 6, calling function `myprivfun` in an environment where only a subdirectory named `\PriVate` contains the M-file `myprivfun.m` results in an error.
- In MATLAB 7, calling `myprivfun` in this same environment invokes `/Private/myprivfun` and also displays the following warning:

```
Wrong case spelling of 'private' as a directory name in
/released/PriVate/myprivfun.m.
```

Turning Off Warnings Caused by Case Mismatch

You can disable most warnings caused by case mismatch with the following command:

```
warning off MATLAB:dispatcher:InexactMatch
```

To disable this warning for all of your MATLAB sessions, add this command to your `startup.m` or `matlabrc.m` file.

If you continue to get case sensitivity warnings after entering this command, you can disable a wider range of warnings with the following command:

```
warning off ...  
MATLAB:dispatcher:CaseInsensitiveFunctionPrecedesExactMatch
```

Note This latter warning alerts you when, for case sensitivity reasons, MATLAB may have selected a different M-file from the one you had intended to run. It is recommended that you leave this warning enabled.

Differences Between Built-Ins and M-Functions Removed; Can Affect Which Function MATLAB Selects

MATLAB implements many of its core functions as built-ins. In previous releases of MATLAB, there have been several significant differences between the way MATLAB handles built-in and M-file functions. As of this release, MATLAB handles both types of functions the same. This change affects the following:

- “Function Dispatching” on page 343
- “Return Value from the functions Function” on page 344
- “Output from the which Function” on page 344

Function Dispatching

MATLAB now dispatches both built-in and M-file functions according to the same precedence rules, (see “Function Precedence Order” in the MATLAB Programming documentation). In previous releases, subfunctions, private functions, and class constructor functions took precedence over M-functions of

the same name, but not over built-ins. In this release, built-in functions follow the same rules given to M-functions, and thus are lower in precedence than the three function types named above.

This change addresses a potential problem in that changes to the internal implementation of MATLAB functions could potentially affect the operation of your own M-code. For example, if a new version of MATLAB were to change an internal function from being M-based to being built-in, the function in the new version would now be subject to different precedence rules. If one of your M-code modules had a subfunction with the same name as this function (now obeying the built-in rules), then this subfunction would never be called.

This release resolves this potential conflict by using the same precedence rules for both M-functions and built-ins.

Compatibility Considerations. If any of your programs have subfunctions, private functions, or class constructor functions that have the same name as a built-in function that has the same function scope, MATLAB now gives precedence to the subfunction, private function, or constructor rather than the built-in. If this is not corrected, you may find instances where your program calls a function other than the one you had intended. You can avoid such problems by renaming any functions that may conflict with a MATLAB built-in function.

Return Value from the functions Function

The MATLAB `functions` function returns information about a function handle such as the function name, type, and filename. In previous releases, functions returned the filename for a built-in function as the string

```
'MATLAB built-in function'
```

In this release, MATLAB associates each built-in function with a placeholder file that has a `.bi` extension (for example, `reshape.bi` for the built-in `reshape` function).

Output from the which Function

The `which` function now displays the pathname for built-in functions, as well as for overloaded functions when only the overloaded functions are available.

Warning on Naming Conflict

The following warning was added to identify the case when you first use a name as a function and later use it as a variable:

```
Warning: File: D:\Work\MATLAB_XL\theworks\my_yprime.m Line: 17
Column: 1 Variable 'getdata' has been previously used as a
function name.
(Type "warning off MATLAB:mir_warning_variable_used_as_function:
to suppress this warning.)
```

For example, this code generates such a warning:

```
X = i; % Calls the function i() to get sqrt(-1)
for i = 1:10 % uses i as a variable. This produces the warning.
... end
```

Change to How evalin Evaluates Dispatch Context

In Release 13 and earlier, the `evalin` function evaluated its input in the specified workspace, but not the workspace's corresponding dispatching context. Hence, running the following example used to succeed, calling the subfunction `MySubfun` but using the value of `x` from the base workspace:

```
function demo
evalin('base', 'MySubfun(x)')

function MySubfun(in)
disp(in)
```

When you call `evalin` in Release 14, MATLAB tries to find a function named `MySubfun` that is accessible in the base workspace, i.e. at the command prompt. Since `MySubfun` is a subfunction and therefore not in scope at the command prompt, MATLAB errors, reporting that `MySubfun` is undefined.

Compatibility Considerations

There are two ways to change your existing code to work with this new behavior. First, if your code only needs to get the value of the subfunction's inputs from the base workspace (as `demo.m` does above), and does not care what context `MySubfun` is run in, then you can change your code to use `evalin` only to get the values of the inputs from the base workspace, like this:

```
function demo_workaround1
MySubfun(evalin('base', 'x'))
```

```
function MySubfun(in)
disp(in)
```

If, however, it is important that the subfunction itself be run in the context of the base workspace, you can place a function handle to the subfunction in the base workspace and then evaluate that:

```
function demo_workaround2
assignin('base', 'MySubfunHandle', @MySubfun);
evalin('base', 'MySubfunHandle(x)')
```

```
function MySubfun(in)
disp(in)
```

You can also substitute 'caller' for 'base' in the workaround code if your original code uses `evalin('caller', ...)`.

Summary of New Functions

These functions are new in this release.

Function	Description
<code>addtodate</code>	Modify a particular field of a date number
<code>genvarname</code>	Construct valid variable name from string
<code>intmax</code>	Return largest possible integer value
<code>intmin</code>	Return smallest possible integer value
<code>intwarning</code>	Control state of integer warnings
<code>isfloat</code>	Detect floating-point arrays
<code>isinteger</code>	Detect whether an array has integer data type
<code>isscalar</code>	Determine if item is a scalar
<code>isstrprop</code>	Determine the content of each element of a string
<code>isvector</code>	Determine if item is a vector

Function	Description
<code>mmfileinfo</code>	Get information about multimedia file
<code>recycle</code>	Set option to move deleted files to recycle folder
<code>restoredefaultpath</code>	Restore default search path
<code>strtrim</code>	Remove leading and trailing whitespace from string
<code>textscan</code>	Read data from text file, convert and write to cell array
<code>xlswrite</code>	Write matrix to a Microsoft Excel spreadsheet

New Function Type – Anonymous Functions

Anonymous functions give you a quick means of creating simple functions without having to create M-files each time. You can construct an anonymous function either at the MATLAB command line or from within another function or script.

Refer to “Anonymous Functions” in the MATLAB Programming documentation for more complete coverage of this topic. For more information on anonymous functions, open the M-file `anondemo.m` in the MATLAB Editor by typing

```
edit anondemo
```

Syntax

The syntax for creating an anonymous function from an expression is

```
fhandle = @(arglist) expr
```

where `arglist` is a comma-separated list of input variables, and `expr` is any valid MATLAB expression. The constructor returns a function handle, `fhandle`, that is mapped to this new function. Creating a function handle for an anonymous function gives you a means of invoking the function. It is also useful when you want to pass your anonymous function in a call to some other function.

Note Function handles not only provide access to anonymous functions. You can create a function handle to any MATLAB function. The constructor uses a different syntax: `fhandle = @functionname` (e.g., `fhandle = @sin`). To find out more about function handles, see “Function Handles” in the MATLAB Programming documentation.

You can use the function handle for an anonymous function in the same way as any other MATLAB function handle.

A Simple Example

To create a simple function `sqr` to calculate the square of a number, use

```
sqr = @(x) x.^2;
```

To execute the function, type the name of the function handle, followed by any input arguments enclosed in parentheses:

```
a = sqr(5)
a =
    25
```

Since `sqr` is a function handle, you can pass it to other functions. The code shown here passes the function handle for anonymous function `sqr` to the MATLAB `quad` function to compute its integral from zero to one:

```
quad(sqr, 0, 1)
ans =
    0.3333
```

Arrays of Anonymous Functions

To store multiple anonymous functions in an array, use a cell array. See “Arrays of Anonymous Functions” in the MATLAB Programming documentation.

Examples

You can find more examples of how to use anonymous functions in MATLAB under “Examples of Anonymous Functions”.

New Function Type – Nested Functions

You can now define one or more functions within another function in MATLAB. These inner functions are said to be *nested* within the function that contains them. You can also nest functions within other nested functions.

Refer to “Nested Functions” in the MATLAB Programming documentation for more complete coverage of this topic. For more information on nested functions, open the M-file `nesteddemo.m` in the MATLAB Editor by typing

```
edit nesteddemo
```

Writing a Nested Function

To write a nested function, simply define one function within the body of another function in an M-file. Like any M-file function, a nested function contains any or all of the usual function components. In addition, you must always terminate a nested function with an `end` statement:

```
function x = A(p1, p2)
...
    function y = B(p3)
        ...
    end
...
end
```

Characteristics of Nested Functions

Two characteristics unique to nested functions are

- A nested function has access to the workspaces of all functions inside of which it is nested. A variable that has a value assigned to it by the primary function can be read or overwritten by a function nested at any level within the primary. Similarly, a variable that is assigned in a nested function can be read or overwritten by any of the functions containing that function.
- When you construct a function handle for a nested function, the handle not only stores the information needed to access the nested function; it also stores the values of all variables shared between the nested function and those functions that contain it. This means that these variables persist in memory between calls made by means of the function handle.

Examples

You can find examples of how to use nested functions in MATLAB under “Examples of Nested Functions”.

Calling Private Functions From Scripts

You can now invoke a private function from a script, provided that the script is called from another M-file function, and that the private function being called by the script is within the scope of this M-file function.

New Calling Syntax for Function Handles; Replace `eval` With New Syntax

You can now call functions by means of their related function handles using standard calling syntax rather than having to use `feval`. When calling a function using its handle, specify the function handle name followed by any input arguments enclosed in parentheses.

For example, if the handle to a function was stored in variable `h`, you would call the function as if the handle `h` were a function name:

```
h(arg1, arg2, ...)
```

For the parabola function shown here, construct a function handle `h` and call the parabola function by means of the handle:

```
function y = parabola(a, b, c, x)
y = a*x.^2 + b*x + c;

parabHandle = @parabola;

parabHandle(1.3, .2, 30, 25)
```

When calling functions that take no input arguments, you must use empty parentheses after the function handle:

```
parabHandle()
```

Compatibility Considerations

Using `feval` for the purpose of invoking functions via function handle is no longer necessary and is, in fact, slower. However, for purposes of backward compatibility, the use of `feval` to evaluate function handles is still supported in this release.

Parenthesis notation on a nonscalar function handle means subscripting, just as in Release 13, while the same notation on scalar function handles means function call, as described above. Incompatibility can arise only if you construct a scalar array of function handles and actually index it, necessarily with an index of 1.

Arrays of Function Handles

Previous releases of MATLAB supported arrays of function handles. You created such an array using the `[]` operator, and indexed into the array with the `()` operator:

```
x = [@sin @cos @tan];
plot(feval(x(2), -pi:.01:pi));
```

In Release 14, MATLAB supports arrays of functions handles using cell arrays. You create and index into a function handle array using the `{}` operator:

```
x = {@sin @cos @tan};
plot(x{2}(-pi:.01:pi));
```

Compatibility Considerations

For purposes of backward compatibility, standard arrays of function handles are still supported in this release.

Calling `nargin` and `nargout` with Built-In Functions

When you pass the name of a function to `nargin` or `nargout`, MATLAB returns the number of declared inputs or outputs for that function. For example, passing the function name `'normest'` to `nargin` returns 2, (the number of inputs declared in `normest.m`:

```
nargin('normest')           % normest is an M-function.
```

```
ans =  
    2
```

In this release, you can also use this feature with MATLAB built-in functions. The following use of `nargin` returned an error in previous versions of MATLAB because `norm` is implemented as a built-in function. In this release, `nargin` returns the number of inputs declared by the `norm` function:

```
nargin('norm')           % norm is a built-in function.  
ans =  
    2
```

The same applies to `nargout`.

Comma Separators Not Required in Function Declaration

As of Release 14, the function definition line in a function M-file no longer requires commas separating output variables. This now makes the function definition syntax the same as the syntax used when calling an M-file function:

```
function [A B C] = myfun(x, y)
```

Compatibility Considerations

This new syntax is not valid in MATLAB versions earlier than Release 14. When writing an M-file that you expect to run on versions both earlier and later than R14, be sure to separate any output variables in the function definition line with commas:

```
function [A, B, C] = myfun(x, y)
```

getfield and setfield Not To Be Deprecated

There are no plans to remove the `getfield` and `setfield` functions from the MATLAB language, as stated in the release notes for MATLAB Release 13.

isglobal Function To Be Discontinued

Support for the `isglobal` function will be removed in a future release of MATLAB. In Release 14, invoking `isglobal` generates the following warning:

Warning: `isglobal` is obsolete and will be discontinued.
Type "help `isglobal`" for more details.

Recycle to Protect Files from Unwanted Deletion

To protect yourself from unintentionally deleting any files that you want to keep, use the new `recycle` function to turn on file recycling. When file recycling is on, MATLAB moves all files that you delete with the `delete` function to either the recycle bin (on the PC or Macintosh) or a temporary folder (on UNIX). When file recycling is off, any files you delete are actually removed from the system.

You can turn recycling on for all of your MATLAB sessions using the **Preferences** dialog box. (Select **File > Preferences > General**.) Under the heading **Default behavior of the delete function**, select **Move files to the Recycle Bin**.

bin2dec Ignores Space Characters

The `bin2dec` function now ignores any space (' ') characters in the input string. Thus, the binary string '010 111' now yields the same result as the string '010111'.

In Release 13, `bin2dec` interpreted space characters as zeros:

```
bin2dec('010 111')
ans =
    39
```

In this release, `bin2dec` ignores all space characters:

```
bin2dec('010 111')
ans =
    23
```

dbstop crashes Are Now Resolved

In previous versions, a MATLAB session would terminate prematurely when attempting to execute certain P-code files if you had set a debugger breakpoint in the function represented by that file. For example, an attempt to run Guide would terminate your MATLAB session if you had used the `dbstop` function to set a breakpoint in the corresponding M-file:

```
dbstop in guide  
guide
```

This bug has been fixed in this release enabling you to debug these files successfully.

Bit Functions on Unsigned Integers

MATLAB bit functions now work on unsigned integers. Instead of using flints (integer values stored in floating point) to do your bit manipulations, consider using unsigned integers. See “Bit Functions Now Work on Unsigned Integers” on page 319 in the MATLAB Mathematics release notes.

inmem Returns Path Information

The `inmem` function now returns not only the names of the currently loaded M- and MEX-files, but the path and filename extension for each as well. Use the `-completenames` option to obtain this additional information:

```
inmem(' -completenames')
```

New Features for Nondouble Data Types

The section “New Nondouble Mathematics Features” on page 310 describes new features affecting the nondouble (single and integer) data types. These changes affect single and integer arithmetic operations, and also conversion of single and double data types to integers.

Mathematic Operations on Logical Values

Most mathematic operations are not supported on logical values.

Accessing Cell and Structure Arrays Without deal

In many instances, you can access the data in cell arrays and structure fields without using the `deal` function. Here is an example that reads each of the cells of a cell array into a separate output:

```
C = {rand(3) ones(3,1) eye(3) zeros(3,1)};
```

Use either of the following to access the cells in `C`:

```
[a,b,c,d] = deal(C{:})
[a,b,c,d] = C{:}
```

Here is an example that reads each of the fields of a structure array into a separate output:

```
A.name = 'Pat'; A.number = 176554;
A(2).name = 'Tony'; A(2).number = 901325;
```

Use either of the following to access the name field:

```
[name1,name2] = deal(A(:).name)
[name1,name2] = A(:).name
```

New Features in Regular Expression Support

This version of MATLAB introduces the following new features in regular expression support:

- **Multiple Input Strings** — You can use any of the MATLAB regular expression functions with cell arrays of strings as well as with single strings. Any or all of the input parameters (the string, expression, or replacement string) can be a cell array of strings.
- **Selective Outputs** — To select what type of data you want the `regexp` and `regexpi` to return (string indices or text, token indices or text, or token data by name) use one or more of the six qualifiers for these functions.
- **Lookaround Operators** — Lookahead and lookbehind operators enable you to match a pattern only if it is preceded, or followed, by another pattern.
- **New Logical Operators** — New operators for grouping, inserting comments, and finding alternative match patterns
- **New Quantifiers** — Lazy quantifiers match a minimum number of characters in a string. Possessive quantifiers do not reevaluate parts of the string that have already been evaluated
- **Element Grouping** — Group elements together using either `(...)` to group and capture, or `(?:...)` for grouping alone
- **Named Capture Grouping** — Capture characters in a token and assign a name to the token

- **Conditional Expressions** — Process a string in different ways depending on a stated condition
- **New Character Representations** — New symbolic representations such as `\e` for escape, or `\xN` for a character of hexadecimal value `N`, are available in this release.
- **Default Tokenizing** — The `regexpr` function now tokenizes by default. There is no longer a `'tokenize'` option

Refer to “Regular Expressions” on page 171 in the MATLAB Programming documentation.

Functions that Use Regular Expressions

The `who`, `whos`, `save`, `load`, and `clear` functions now accept regular expressions as input. This feature enables you to be more selective concerning which variables they operate on.

For example, this statement saves to a MAT-file only those variables with a name that either starts with the letters A or B, or contains ten or more characters:

```
save('mydata.mat', '-regexp', '^[AB].', '{10,}');
```

If the workspace contains the following four variables, two of the four meet the requirements of the regular expression:

```
whos
```

Name	Size	Bytes	Class
A_stats	10x5	400	double array
X23456789	1x1	12	char array
ab	3x1	536	struct array
longerVariableName	1x4	8	char array

When you perform the `save` operation and then check the contents of the MAT-file, you see that the variables with names that either start with A or have at least ten characters were saved:

```
save('mydata.mat', '-regexp', '^[AB].', '{10,}');
```



```
whos -file mydata.mat
Name                               Size          Bytes  Class

A_stats                            10x5          400    double array
longerVariableName                 1x4           8      char array
```

Refer to the reference pages for these functions for more information and examples.

Regular Expressions Accept String Vector; No Longer Support Character Matrix Input

You can now pass a vector of strings in a cell array to any of the MATLAB regular expression functions (`regexp`, `regexpi`, and `regexprep`).

Compatibility Considerations

Because this is the preferred method of passing a string vector, MATLAB no longer supports using character matrices for this purpose.

Cell Array Support for String Functions

You can now pass a cell array of strings to the `strfind` function. MATLAB searches each string in the cell array for occurrences of the pattern string, and returns the starting index of each such occurrence.

Additional Class Output From `mat2str`

The statement `str = mat2str(A, 'class')` creates a string with the name of the class of `A` included. This option ensures that the result of evaluating `str` will also contain the class information.

Change the 16-bit integer matrix to a string that includes `'int16'`. Next, evaluate this string and verify that you get the same matrix that you started with:

```
x1 = int16([-300 407 213 418 32 -125]);

A = mat2str(x1, 'class')
A =
```

```

int16([-300 407 213 418 32 -125])
x2 = eval(A);

isa(x2, 'int16') && all(x2 == x1)
ans =
    1

```

String Properties

Use the new `isstrprop` function to see what parts of a string or array of strings are alphabetic, alphanumeric, numeric digits, hexadecimal digits, lowercase, uppercase, white-space characters, punctuation characters, contain control characters, or contain graphic characters.

For example, to test for alphabetic characters in a two-dimensional cell array, use

```

A = isstrprop({'abc123def'; '456ghi789'}, 'alpha')
A =
    [1x9 logical]
    [1x9 logical]

A{:,:}
ans =
    1 1 1 0 0 0 1 1 1
    0 0 0 1 1 1 0 0 0

```

Using `strtok` on Cell Arrays of Strings

You can now use the `strtok` function on a cell array of strings. When used with a cell array of strings, `strtok` returns a token output that is also a cell array of strings, each containing a token for its corresponding input string.

See the `strtok` reference page to see an example of how this works.

Colon Operator on `char` Now Returns a `char`

Applying the colon operator to inputs of type `char` now returns a result of type `char`. For example,

```
'a':'g'
```

```
ans =  
  
abcdefg
```

Compatibility Considerations

In previous releases, the same operation returned a result of type `double`. You may need to change your code if it relies on type `double` being returned.

datestr Returns Date In Localized Format

The statement `str = datestr(..., 'local')` returns the date string in a localized format. See the `datestr` reference page for more information.

Form and Locale for weekday

The `weekday` function now takes two new inputs that control the output format. These arguments enable you to get a full or abbreviated day name, and a local or US English output.

Freestyle Date String Format

When converting between serial date numbers, date vectors, and date strings with the `datenum`, `datevec`, and `datestr` functions, you can specify a format for the date string from the “Free-Form Date Format Specifiers” table shown on the `datestr` reference page.

Reading Date Values with xlsread; Conversion No Longer Necessary

There are two changes that affect importing date information from Excel with the `xlsread` function:

- “Date Information Returned as Cell Array of Char” on page 359
- “Conversion of Date Values Is No Longer Necessary” on page 360

Date Information Returned as Cell Array of Char

Prior to this release, `xlsread` imported date information from an Excel file and returned the results as a `double`. In Release 14, `xlsread` returns this

information as a cell array containing data of class `char`. The reason for this is that MATLAB now imports Excel files using an Excel COM server. Excel returns dates as strings, and there is really no indication that what is returned is a date.

Compatibility Considerations. You will need to change your program code to accept a cell array of type `char` instead of an array of `double` when using `xlsread` to import date information from Excel.

Conversion of Date Values Is No Longer Necessary

When reading date fields from a Microsoft Excel file using earlier versions of MATLAB, it was necessary to convert the Excel date values into MATLAB date values. This was necessary because Excel and MATLAB calculated date values based on a different reference date. This is explained in the section, “Handling Excel Date Values” in the function reference for `xlsread`.

With MATLAB 7.0, you no longer have to do this conversion because `xlsread` now imports dates as strings rather than as numerical values.

Compatibility Considerations. If your existing code converts Excel date values to MATLAB values, you will need to remove this step so that you end up with the correct results.

Comprehensive Function for Reading Text Files

The new `textscan` function reads data from an open text file into a cell array. MATLAB parses the data into fields and converts it according to conversion specifiers passed to `textscan` in the argument list.

The `textscan` function is similar to `textread` but differs from `textread` in the following ways:

- The `textscan` function offers better performance than `textread`, making it a better choice when reading large files.
- With `textscan`, you can start reading at any point in the file. Once the file is open, (`textscan` requires that you open the file first), you can seek to any position in the file and begin the `textscan` at that point. The `textread` function requires that you start reading from the beginning of the file.

- Subsequent textscan operations start reading the file at the point where the last textscan left off. The textread function always begins at the start of the file, regardless of any prior textread.
- textscan returns a single cell array regardless of how many fields you read. With textscan, you don't need to match the number of output arguments to the number of fields being read as you would with textread.
- textscan offers more choices in how the data being read is converted.
- textscan offers more user-configurable options.

New Inputs and Outputs to xlsread

The table below shows new input and output arguments to the xlsread function. See the function reference for xlsread for more information. With the exception of the **basic** input argument, these arguments are supported only on computer systems capable of starting Excel as a COM server from MATLAB.

New Input Arguments	Description
-1	Opens the Excel file in an Excel window, enabling you to interactively select the worksheet to be read and the range of data to import from the worksheet.
range	Reads data from the rectangular region of a worksheet specified by range.
basic	Imports data from the spreadsheet in basic import mode.

New Output Argument	Description
rawdata	Returns unprocessed cell content in a cell array. This includes both numeric and text data.

New Inputs and Syntax for dlmwrite

The dlmwrite function now has several new input arguments plus an optional attribute-value format in which to enter these arguments. You can now enter

input arguments to `dlmwrite` in an attribute-value format. This format enables you to specify just those arguments that you need and omit any others. This new syntax for `dlmwrite` is

```
dlmwrite('filename', M, attribute1, value1, ...
        attributeN, valueN)
```

The former syntax for `dlmwrite` is still supported for arguments that were available in earlier versions of MATLAB.

The table below shows new input arguments to the `dlmwrite` function. You must specify these new arguments using the attribute-value format. See the `dlmwrite` function reference for more information.

Attribute	Value
delimiter	Delimiter string to be used in separating matrix elements
newline	Character(s) to use in terminating each line
roffset	Offset, in rows, from the top of the destination file to where matrix data is to be written
coffset	Offset, in columns, from the left side of the destination file to where matrix data is to be written
precision	Numeric precision to use in writing data to the file

For example, to export matrix `M` to file `myfile.txt`, delimited by the tab character, and using a precision of six significant digits, type

```
dlmwrite('myfile.txt', M, 'delimiter', '\t', 'precision', 6)
```

Change in Output from `xlsinfo`

`xlsinfo` now returns the names of all worksheets in an Excel file instead of just the ones with numbers in them (as in Release 13).

Importing Complex Arrays

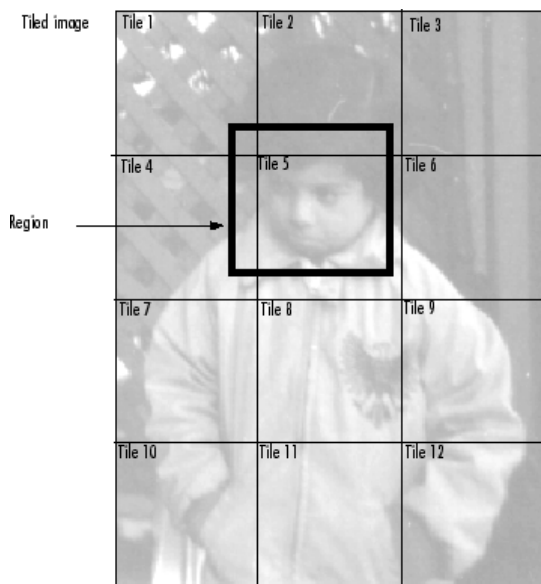
The `csvread`, `dlmread`, and `textscan` functions import any complex number as a whole into a complex numeric field, converting the real and imaginary parts to the specified numeric type. Valid forms for a complex number are

Form	Example
<code>-<real>-<imag>i j</code>	<code>5.7-3.1i</code>
<code>-<imag>i j</code>	<code>-7j</code>

Using `imread` to Import Subsets of TIFF Images

When using the `imread` function with the `'PixelRegion'` parameter, you can now read in portions of an image stored in TIFF format. Specify a cell array containing two vectors, `ROWS` and `COLS`, for the value of this parameter. Each vector can either be a two-element vector specifying the extent of the region, `[START STOP]`, or a three-element vector that enables downsampling, `[START INCREMENT STOP]`.

When used with tiled images, `'PixelRegion'` subsetting can improve memory usage and performance because it only reads in the tiles that encompass the region. For example, in the following figure, if you specify the region defined by the box, `imread` would only read in tiles 1, 2, 4, and 5.



Getting Information about Multimedia Files

MATLAB now includes a function, named `mmfileinfo`, that returns information about the contents of a multimedia file. The file can contain audio data, video data, or both.

This function is only available on Windows platforms.

All-Platform Audio Recording and Playback

The MATLAB `audiorecorder` and `audioplayer` functions can now be used on Windows and UNIX platforms. These functions were previously only available on Windows systems.

Note The `audiorecorder` and `audioplayer` objects are now implemented as MATLAB objects on all platforms. The methods supported by these objects are overloaded functions. You must use standard MATLAB function calling syntax to call methods of these objects; you cannot use dot notation.

FTP File Operations

From within MATLAB, you can connect to an FTP server to perform remote file operations. For more information, see the `ftp` reference page.

Web Services (SOAP)

MATLAB can now consume Simple Object Access Protocol-based (SOAP) Web services with the `createClassFromWSDL` function. For more information, see “Using Web Services in MATLAB” in the online documentation.

64-Bit File Handling on Macintosh

The release notes for MATLAB Release 13 should have included Macintosh in the list of those platforms that support 64-bit file handling. This support is available on the following platforms:

- Windows
- Solaris
- Linux 2.4.x
- HP-UX 11.0, 9000/785
- Macintosh

Changes to Error Message Format

The last two lines of MATLAB error messages have changed for Release 14. Error messages now

- Display functions and subfunctions differently than in R13.
- Display nested functions.
- Call out the error in a string that you can use as input to other functions, like `dbstop`.
- Have a hot link to the source of the error.

Each of these changes is discussed below. Examples show the errors generated by both the previous release (V6.5) and current release (7.0) of MATLAB for the purpose of comparison.

Display of Functions and Subfunctions

MATLAB now calls out the source of the error using a consistent format. One of the features of this format is that you can place the string of the message into other MATLAB commands. See “Using the Error Message String as Input to Other Functions” on page 367.

Errors Generated by the Primary Function. Errors generated by the primary function of an M-file are displayed as shown below. In version 7.0, the path is not shown in most cases (private functions are one exception). Filename extension is also not shown. The failing line number is shown on third line.

In MATLAB V6.5 —

```
??? Error using ==> strcmp
Too many input arguments.

Error in ==> B:\MATLAB_V70\work\errmsgtest.m
On line 11 ==> strcmp('aa','bb','cc');
```

In MATLAB V7.0 —

```
??? Error using ==> strcmp
Too many input arguments.

Error in ==> errmsgtest at 11
strcmp('aa','bb','cc');
```

Errors Generated by a Subfunction. Errors generated by a subfunction of an M-file are displayed in the previous release and current release of MATLAB as shown below. Comments for primary functions apply here as well. Also, the name of the failing subfunction follows the > character instead of being put in parentheses.

In MATLAB V6.5 —

```
??? Error using ==> strcmp
Too many input arguments.

Error in ==> B:\MATLAB_V70\work\errmsgtest.m (subFun1)
```

```
On line 17 ==> strcmp('aa','bb','cc');
```

In MATLAB V7.0 —

```
??? Error using ==> strcmp
Too many input arguments.
```

```
Error in ==> errmsgtest>subFun1 at 17
strcmp('aa','bb','cc');
```

Error Messages Display Nested Functions

This example shows an error that comes from a nested function (`nestFun2`) called by another nested function (`nestFun1`). It uses the following syntax, where the `>` character follows the name of the primary function and precedes the names of any nested functions.

```
fun>nestfun1/nestfun2/etc at lineno.
```

In MATLAB V6.5 —

Nested functions are not supported prior to version 7.0.

In MATLAB V7.0 —

```
??? Error using ==> strcmp
Too many input arguments.
```

```
Error in ==> errmsgtest>nestFun1/nestFun2 at 6
strcmp('aa','bb','cc');
```

Using the Error Message String as Input to Other Functions

You can copy the text of the line that calls out the source of an error and use this string as input to some of the MATLAB debugging functions. The example shown below uses the string in a call to the `dbstop` function.

Copy the text that begins after

```
Error in ==>
```

In MATLAB V6.5 —

This feature is not supported prior to version 7.0.

In MATLAB V7.0 —

```
??? Error using ==> strcmp
Too many input arguments.
```

```
Error in ==> errmsgtest>nestFun1/nestFun2 at 6
strcmp('aa','bb','cc');
```

Copy and paste text of this error message into the dbstop command:

```
dbstop errmsgtest>nestFun1/nestFun2 at 6
```

Hot Link to the Source of an Error

Error messages now contain a blue-underlined hot link to the failing line of the M-file being executed.

Compatibility Considerations

If any of your programs rely on specific text in the types of error messages described here, you may have to modify your program code.

nargchk Has a New Format for Error Messages

When the `nargchk` function detects an error condition, it returns information on the error in either a string or a MATLAB structure. Use one of these two command syntaxes to specify which format to return. If neither is specified, `nargchk` returns a string:

```
msgstring = nargchk(minargs, maxargs, numargs, 'string')
msgstruct = nargchk(minargs, maxargs, numargs, 'struct')
```

The return structure has two fields: the message string, and a message identifier . When too few inputs are supplied, these fields are

```
message: 'Not enough input arguments.'
identifier: 'MATLAB:nargchk:notEnoughInputs'
```

When too many inputs are supplied, the structure fields are

```
message: 'Too many input arguments.'
identifier: 'MATLAB:nargchk:tooManyInputs'
```

Enabling and Disabling Warning Messages

The following message, which MATLAB appended to all warning messages in the previous release, is no longer displayed.

(Type "warning off <msgid:msgstr>" to suppress this warning.)

Use the off and on options of the warning function to control the display of all or selected warnings. This example disables a selected warning, and then enables all warnings:

```
% All warnings are enabled by default.
A = 5/0;
Warning: Divide by zero.

% Disable the most recent warning
[msgstr msgid] = lastwarn;
warning('off', msgid);

% Try it again. This time there is no warning.
A = 5/0;

% Enable all warnings
warning('on', 'all')

% Verify that the warning is reenabled.
A = 5/0;
Warning: Divide by zero.
```

Catching Ctrl+C in try-catch Statements

In previous releases of MATLAB, typing **Ctrl+C** while executing the try part of a try-catch statement resulted in the program branching to the catch part of that statement. In this release, typing **Ctrl+C** is purposely not caught by try-catch statements.

The reason for this change is that, under certain circumstances, this behavior in try-catch statements was found to adversely affect internal MATLAB code. In these cases, this resulted in MATLAB code catching the **Ctrl+C** rather than responding appropriately to it by terminating the current operation.

MATLAB Performance Acceleration

Release 13 introduced a new performance acceleration feature built into MATLAB. Enhancing performance in MATLAB is an ongoing development project that continues to show significant improvements in the performance of MATLAB programs.

The Performance Acceleration documentation written for Release 13 included suggestions on specific techniques to make the most of this feature. In this release, many of those techniques are no longer necessary. This documentation has been replaced with more general suggestions on how to improve the performance of your programs.

“Using MATLAB” Documentation Is Now Three Books

Due to the increasing size of the printed “Using MATLAB” manual, we have divided it into three separate printed books in version 7.0 to make it more manageable. The titles for these books (and their corresponding headings in the MATLAB Help Browser) are

- Desktop Tools and Development Environment
- Mathematics
- Programming

The online structure of this documentation is very similar to what it has been in previous releases, although some topics are now covered more thoroughly. We hope that you find this new format easier to use.

Graphics and 3-D Visualization, MATLAB Version 7 (R14)

If you are using the Help browser, view the Graphics new features video demo to see highlights of the new features.

This version introduces the following new features and changes:

- “Plotting Tools” on page 371
- “Code Generation” on page 372
- “Data Exploration Tools” on page 372
- “Annotation Features” on page 372
- “Plot Objects” on page 373
- “Group Objects” on page 375
- “Linking Graphics Object Properties” on page 375
- “New Behavior for Hold Command” on page 375
- “Enhancements to findobj” on page 375
- “New Ancestor Function Returns Object’s Ancestry” on page 375
- “New Axes Properties” on page 376
- “New Figure Properties” on page 376
- “New Rootobject Property” on page 377

Plotting Tools

If you are using the Help browser, watch the new Plotting Tools video demo for an overview of the major functionality.

The following list links to new or redesigned plotting tool features.

- “Anatomy of a Graph” — figure toolbars that provide data exploration, plot editing, and annotation tools
- Interactive Plotting Tools — overview of plotting tools
 - Figure Palette
 - Plot Browser

- Property Editor

Related functions:

- `plottools`
- `figurepalette`
- `plotbrowser`
- `propertyeditor`

Code Generation

You can save a graph as an M-file that contains the code to regenerate the graph. See “Generating an M-File to Recreate a Graph” for more information.

Data Exploration Tools

The following list links to the documentation for the data exploration tools.

- Data Cursor — displaying data values interactively
- Zooming — 2-D and 3-D zoom tools
- Panning — repositioning you view of the graph
- Rotate 3D — interactive rotation of 3-D views
- Camera Toolbar — mouse-controlled 3-D view manipulation.

Annotation Features

The following list links to the documentation for annotation features and properties of the annotation objects.

- Overview of annotation features
- Rectangles and ellipses
 - Rectangle properties
 - Ellipse properties
- Textbox annotations
 - Textbox properties

- Lines and Arrows
 - Line properties
 - Arrow properties
 - Textarrow properties
 - Doublearrow properties
- Adding a Colorbar to a graph — new positioning options and colormap modification.
colorbar — new command options
- Adding a legend to a graph — new positioning and appearance options
legend — new command options
- Pinning — attaching annotation objects to a point in the figure
- Aligning and Distributing graphics objects

See the `annotation` function for information on programmatic access to annotation objects.

See “Annotation Objects” for an overview of this type of graphics object.

Plot Objects

Plot Objects are composite graphics objects that simplify the modification of graphs that employ them. The following list links to reference pages for modified graphing functions and to property descriptions of the new plot objects.

See “Plot Objects” for an overview of this type of graphics object.

Functions That Use Plot Objects

- area
- bar
- contour
- errorbar

- plot, plot3, loglog, semilogx, semilogy
- quiver, quiver3
- scatter, scatter3
- stairs
- stem, stem3
- surf, and mesh group

Note that all of the above functions have a 'v6' optional argument that causes each function to return the core graphics objects that were created in previous releases. See the reference pages for more information.

Plot Objects

- areaseries
- barseries
- contourgroup
- errorbarseries
- lineseries
- quivergroup
- scattergroup
- stairseries
- stemseries
- surfaceplot

Refreshing Data Source Properties

The refreshdata function enables you to take advantage of the XDataSource, YDataSource, and ZDataSource plot objects properties to update graph data when workspace variables change values.

See “Example — Specifying a Data Source” in the MATLAB Graphics documentation for more information.

Group Objects

Group objects enable you to treat a number of objects as one, with respect to certain properties.

See “Group Objects” on page 375 for an overview of this type of graphics object.

Group Object Functions

- `hgroup`
- `hgtransform`
- `makehgtform`

Linking Graphics Object Properties

You can link the corresponding properties of graphics objects so that changing any one object’s properties makes the same change to all the linked objects.

See `linkprop` and `linkaxes` for more information.

New Behavior for Hold Command

The `hold` command has a new option `all`. This option holds the plot and the current line color and line style so that subsequent graphing commands do not reset the `ColorOrder` or `LineStyleOrder` property values to the beginning to the list.

Enhancements to `findobj`

The `findobj` function now supports logical operators and regular expressions. See the `findobj` reference page for more information.

New Ancestor Function Returns Object’s Ancestry

The `ancestor` function enables you to determine an object’s direct parent, as well as its complete ancestry. This is particularly useful when you want to determine whether an object is contained in a `uipanel` or `hgroup`, for example, and need the handle of the container object or the top-level figure.

New Axes Properties

You can control the behavior of an axes within a resized figure using the following new axes properties.

- `OuterPosition` — The boundary of the axes including the axis labels, title, and a margin. For figures with only one axes, this is the interior of the figure.
- `ActivePositionProperty` — Specifies whether to use the `OuterPosition` or the `Position` property as the size to preserve when resizing the figure containing the axes.
- `TightInset` — The margins added to the width and height of the `Position` property to include text labels, title, and axis labels.

See “Automatic Axes Resize” for more information.

New Figure Properties

There are three new figure properties described below.

Figure `KeyPressFcn` Property

The figure `KeyPressFcn` property now supports an event structure that returns information about the key press event. See the `KeyPressFcn` description for more information.

`DockControls` and `WindowState` Properties

Figures now have a `DockControls` property that determines if the **Desktop** menu appears on the figure. Setting dockable to on causes the menu to be displayed, the default setting of off prevents the menu from being displayed. You can always dock and undock the figure by setting the figure `WindowState` property.

Note that, depending on your preference settings, the figure might first be grouped into a Document window, which can then be docked in the Desktop.

See “Docking Figures in the Desktop” for more information.

New Rootobject Property

The `MonitorPosition` property enables you to get the position (width, height, and location) of multiple monitors connected to your computer.

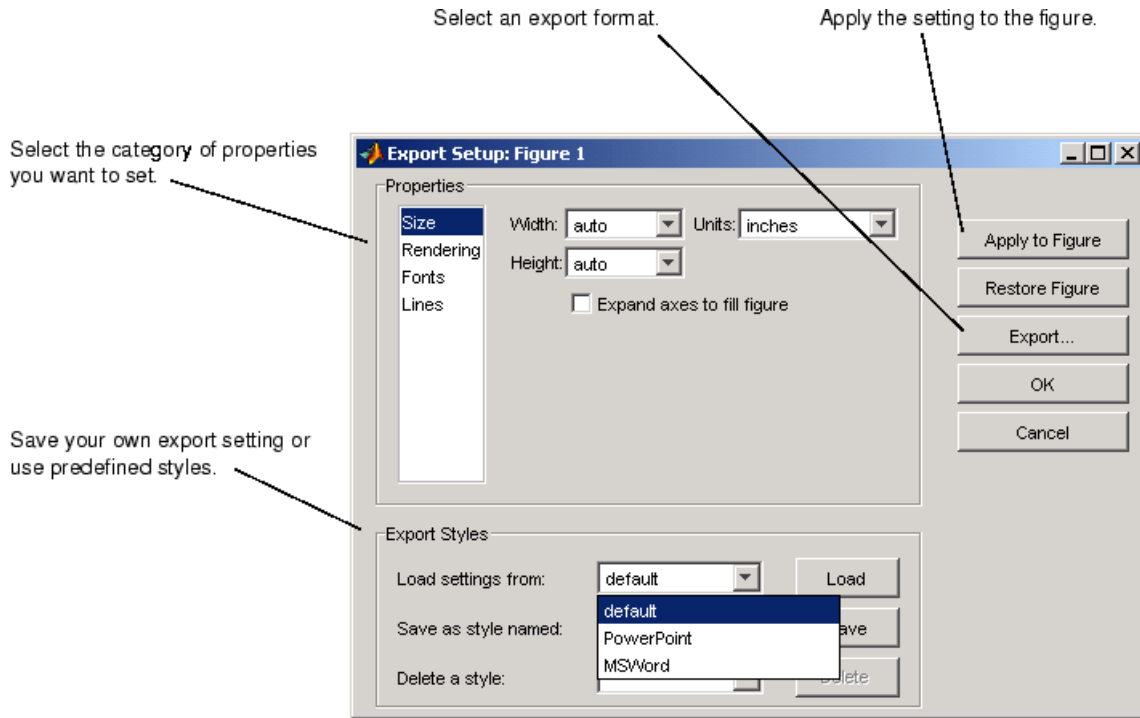
New Dialog for Exporting Figures

You can export MATLAB figures to a variety of standard file formats using the Export Setup dialog. To display the dialog, select **Export Setup** from the figure **File** menu.

Export Setup provides easy access to the graphics properties that affect exported figures. For example, it enables you to control the size of the figure, the font size and type, whether to use line styles or solid lines, and so on.

You can save your own export setting as an export style, or you can use predefined options optimized for PowerPoint and MSWord.

The following picture shows the major components of the Export Setup dialog.



Compatibility Considerations

Plotting Tools Not Working on Macintosh

The plotting tools not supported on the Macintosh platform. This means the Figure Palette, Plot Browser, and Property Editor do not work these platforms. To use the MATLAB 6 Property Editor, see the `propedit` command.

Using `-nojvm` Option Prevents Plotting Tools Use

If you use the `-nojvm` option when starting MATLAB, the plotting tools are not available.

MATLAB 6 Version Property Editor

The MATLAB 6 Property Editor is being replaced by a new Property Editor, which is available in this release. However, you can still access the MATLAB 6 Property Editor by issuing the following command.

```
propedit(object_handle, 'v6')
```

Without the `v6` argument, `propedit` displays the new Property Editor. See the `propedit` function for more information. Note that the Property Editor might not work with all objects.

Cannot Dock Figures on Macintosh

You cannot dock figures in the Desktop, because MATLAB uses native figure windows on the Macintosh platform.

Not All Macintosh System Fonts Are Available

MATLAB figures do not support the same fonts as native Macintosh applications. Use the `uifont` functions to see which fonts are available in MATLAB.

Creating Graphical User Interfaces (GUIs), MATLAB Version 7 (R14)

This version introduces the following new features and changes:

- “New Container Components” on page 380
- “ActiveX Controls” on page 381
- “New Toolbar Component” on page 381
- “Menu Editor Enhancements” on page 382
- “Layout Resize Behavior” on page 382
- “Key Press Detection” on page 383
- “Edit Text Box Scroll Bar” on page 383
- “Setting Uicontrol Focus” on page 383
- “Multiple Selection in uigetfile” on page 384
- “Program Suspension Time-Out” on page 384
- “Standard Dialog Box Push Buttons” on page 384
- “New Syntax for uigetfile and uiputfile” on page 384
- “Frames Not Available in GUIDE Layout Editor” on page 385

New Container Components

MATLAB 7.0 introduces two new container components,

- Panel — Groups components
- Button group — Groups components and manages exclusive selection behavior for radio buttons and toggle buttons.

These components are available in the GUIDE Layout Editor and via the functions `uipanel` and `uibuttongroup`.

A container component can be the child of a figure or another container. In general, containers can have as children the same components as figures, including other containers. However, they cannot have menu bars, toolbars,

or ActiveX controls as children. The `Position` property of the child of a panel or button group is interpreted relative to the panel or button group. If you move the panel or button group, the components it contains automatically move with it and maintain their positions.

Panel properties and button group properties enable you to control the color, size, border, and position of the panel or button group, assign a title, and specify a context menu. In general, panels and button groups have many of the same properties as `uicontrol` objects.

For information about working with panels and button groups in GUIDE, see the following topics in the Creating Graphical User Interfaces collection of the MATLAB documentation.

Compatibility Considerations

You can export a GUI that contains a panel or button group from GUIDE to a single M-file that does not require a FIG-file. However, you will not be able to run that M-file in MATLAB versions earlier than 7.0.

ActiveX Controls

GUIDE now enables you to insert an ActiveX control into your GUI if you are running MATLAB on Microsoft Windows. When you drag an ActiveX component from the component palette into the layout area, GUIDE displays a dialog in which you can select any registered ActiveX control on your system. When you select an ActiveX control and click **Create**, the control appears as a small box in the Layout Editor. You can then program the control to do what you want it to.

See “MATLAB COM Client Support” in the online MATLAB documentation and ActiveX Controls in the GUIDE documentation to learn more about ActiveX controls.

New Toolbar Component

A new function, `uitoolbar`, enables you to add a toolbar to a figure. You can add your own push tools and toggle tools to the toolbar with the `uipushtool` and `uitoggletool` functions.

Uipushtool properties enable you to provide a callback that responds to a mouse click. Uitoggletool properties enable you to provide callbacks that respond to the tool being set on, off, or toggled to either position. Properties for both uipushtools and uitoggletools provide for tooltip strings, separators, and truecolor images to display on the tools. In general, uitoolbar, uipushtool, and uitoggletool objects have many of the same properties as uicontrol objects.

Menu Editor Enhancements

The GUIDE Menu Editor now enables you to:

- Choose a keyboard accelerator for a menu item from a pop-up menu.
- Set an item's Enabled property on or off when the menu is first opened. If the property value is off, the item appears dimmed and the user cannot select it.
- Open the Property Inspector where you can change all uimenu properties.
- Display the callback subfunction in an editor. If the callback does not yet exist, GUIDE creates it before displaying it.

The Menu Editor is now better synchronized with other GUIDE tools:

- Property changes made in the Menu Editor or in the Property Inspector are immediately reflected in the other.
- uimenu objects in the Menu Editor now also appear in the Object Browser. If you select a uimenu object in either, it is automatically selected in the other.
- If a component is selected in the Layout Editor and you select a menu item in the Menu Editor, the component is deselected in the Layout Editor.

See Menu Editor in the MATLAB documentation for more information.

Layout Resize Behavior

In the GUIDE Layout Editor, components you have placed in the layout area now maintain their visual position relative to the upper left corner of their parent container (figure, panel, or button group) when you resize the container in the Layout Editor. However, the values of the Position property

are determined relative to the lower left corner, and these values will change accordingly when you increase or decrease the height of the container.

Key Press Detection

A new `uicontrol` callback property, `KeyPressFcn`, specifies a key press callback function with which you can detect a key press when the callback's `uicontrol` object has focus. If no `uicontrol` has focus, the figure's key press callback function, if any, is invoked. This property is available in the `uicontrol` function and in GUIDE.

If you specify the `KeyPressFcn` property as an M-file, the callback routine can query the figure's `CurrentCharacter` property to determine what particular key was pressed and, thereby, limit the callback execution to specific keys. If you specify the `KeyPressFcn` property as a function handle, the callback routine can retrieve information about the key that was pressed from its `eventdata` structure argument.

As an example, you can use this property to enable a user to press **Enter**, rather than the space bar, after giving focus to a `uicontrol` push button. Use the push button's key press callback function to determine if the user pressed the **Enter** key. If it was the **Enter** key, call the push button callback.

See the `Uicontrol Properties` for more information.

Edit Text Box Scroll Bar

For `uicontrol` editable text fields, i.e. the `Style` property is set to `'edit'`, if `Max-Min>1`, then multiple lines are allowed. For multi-line edit boxes, a vertical scroll bar enables you to scroll the text. You can also use the arrow keys to scroll.

Setting Uicontrol Focus

The `uicontrol` function now enables you to transfer focus programmatically to a specified `uicontrol` object. The syntax `uicontrol(uich)` transfers focus to the `uicontrol` object with handle `uich`.

Multiple Selection in uigetfile

The `uigetfile` function can now create a dialog that enables the user to select and retrieve multiple files using the **Shift** and **Ctrl** keys. You can turn this capability on or off using the new `'MultiSelect'` parameter. The default setting is off.

Program Suspension Time-Out

A new `uiwait` argument, `timeout`, enables you to specify the number of seconds after which program execution will resume, unless `uiresume` is called first or the specified figure is deleted. For example,

```
uiwait(h,5)
```

causes the suspended program to resume execution, if it has not already, after five seconds.

Standard Dialog Box Push Buttons

For standard dialog boxes with more than one `uicontrol` push button, you can now give focus to another button while retaining the default button. Focus is denoted by a border or a dotted border, respectively, in UNIX and Microsoft Windows. The default button has a shadow.

In such a case, if the user presses the space bar, the button with focus gets the key press and can choose to execute its own callback or the callback of the default button. If the user presses **Enter**, the default push button gets the key press and its callback executes. This code provides an example.

```
ButtonName=questdlg('What is your wish?', ...
    'Genie Question', ...
    'Food', 'Clothing', 'Money', 'Money')
```

New Syntax for uigetfile and uiputfile

The `uigetfile` and `uiputfile` syntax that enables you to position dialog boxes that are used to retrieve and save files is changed. The new syntaxes are `uigetfile('FilterSpec', 'DialogTitle', 'Location', [x y])` and `uiputfile('FilterSpec', 'DialogTitle', 'Location', [x y])`. Previously, the syntaxes were, `uigetfile('FilterSpec', 'DialogTitle', x, y)` and `uiputfile('FilterSpec', 'DialogTitle', x, y)`

Compatibility Considerations

You are encouraged to change to the new `uigetfile` and `uiputfile` syntax. The earlier syntaxes continue to be valid but may be removed in a later release.

Frames Not Available in GUIDE Layout Editor

The frame component no longer appears in the GUIDE Layout Editor component palette. It has been replaced by the panel and button group components. See “New Container Components” on page 380 for information about these new components.

Compatibility Considerations

GUIDE continues to support frames in those GUIs that contain them, but it is recommended that you replace them with panels or button groups.

External Interfaces/API, MATLAB Version 7 (R14)

New features and changes introduced in this version are organized by these topics:

- “Importing and Exporting” on page 386
- “ActiveX and COM” on page 387
- “MATLAB Interface to Java” on page 394
- “General Features” on page 395

Importing and Exporting

Saving Character Data with Unicode Encoding

The save function now saves character data to a MAT-file using Unicode character encoding by default. You can use your system’s default character encoding scheme instead by specifying the -v6 option with save.

Compatibility Considerations. MAT-files saved in MATLAB version 7.0 without using the new -v6 flag will not be readable in previous versions of MATLAB.

Saving Data in Compressed Format

The save function now saves data to a MAT-file in a compressed format by default.

Large File I/O for MEX-Files

MATLAB supports the use of 64-bit file I/O operations in your MEX-file programs. This enables you to read and write data to files that are up to and greater than 2 GB ($2^{31}-1$ bytes). Note that some operating systems or compilers may not support files larger than 2 GB.

See “Large File I/O” in the External Interfaces documentation for more information.

ActiveX and COM

Automatic Registration of Automation Server on Installation

When installing previous versions of MATLAB, system administrators also had to run MATLAB at least once on each machine to register the Automation server. In MATLAB 7.0, the MATLAB installation software does the Automation server installation for you.

Support for Multiple COM Type Libraries

MATLAB now fully supports importing additional type libraries from within an IDL file. Any COM object that depends on an imported type library is now handled correctly.

COM Interface Supports Custom Interfaces

MATLAB now supports custom interfaces to a server component in configurations where MATLAB is the client controlling an ActiveX control, or an in-process or out-of-process server. For those COM components that implement one or more custom interfaces, you can list the interfaces in MATLAB using the new `interfaces` function:

```
h = actxserver('ComponentA.CustomObject')
h =
    COM.componenta.customobject

customlist = interfaces(h)
customlist =
    ICustomObject1
    ICustomObject2
```

Once you select the custom interface that you want, use the `invoke` function to get a handle to it:

```
c1 = invoke(h, 'ICustomObject1')
c1 =
    Interface.componenta_Type_Library.ICustomObject1_Interface
```

You can now use this handle with most of the COM client functions to access the properties and methods of the object through this custom interface. For

example, to list the methods available through the `ICustomObject1` interface, use

```
invoke(c1)
Add = double Add(handle, double, double)
CustomMethod1 = HRESULT CustomMethod1(handle, int32)
CustomMethod2 = HRESULT CustomMethod2(handle, int32)
TripleAdd = [double, double] TripleAdd(handle, double, double)
method3 = [string, int32, string, string] method3(
    handle, int16, int32, double, string)
outin = [double, double, double, double] outin(
    handle, double, double)
strings = string strings(handle, string)
```

You can read more about this feature in the section, “Getting Interfaces to the Object” in the External Interfaces documentation.

COM Data Type Support for Scripting Languages

In previous versions of MATLAB, a COM client program written in VBScript could not retrieve numeric data from or write data to the workspace of a MATLAB client. This was because VBScript does not support the `SAFEARRAY` data type used by MATLAB to pass numeric data to and from the server workspace using the `GetFullMatrix` and `PutFullMatrix` functions.

Release 14 adds two new functions, `GetWorkspaceData` and `PutWorkspaceData`, that pass data using the variant data type, a type that is supported by VBScript. You can use these new functions to pass either numeric or string data to any workspace in the COM server running MATLAB.

Refer to “Exchanging Data with the Server” in the External Interfaces documentation.

Additional ProgIDs for Latest MATLAB Version

There are three additional COM programmatic identifiers (ProgIDs) in MATLAB 7.0:

```
MATLAB.Autoserver
MATLAB.Autoserver.Single
MATLAB.Autoserver.7
```


Using any of these identifiers with the `actxserver` function guarantees that the MATLAB server you create always runs the latest version of MATLAB (version 7.0).

Note These new ProgIDs do not replace the `MATLAB.Application` identifier used in previous versions of MATLAB. You can continue using this ProgID, but there is no guarantee that `actxserver` will create a server running MATLAB 7.0.

Connecting to an Existing MATLAB Server

Instead of having to create new instances of a MATLAB server, clients can connect to an existing MATLAB automation server using the `GetObject` command. This sample Visual Basic program connects to a running MATLAB automation server, returning a handle `h` to that server. It then executes a simple plot command in the server:

```
Dim h As Object

' Call GetObject (omit first argument).
Set h = GetObject(, "matlab.application")

' Handle h should be valid now. Test it by calling Execute
h.Execute ("plot([0 18], [7 23])")
```

Graphical Interface to Listing Available ActiveX Controls

The `actxcontrollist` function enables you to see what COM controls are currently installed on your system. Type

```
list = actxcontrollist;
```

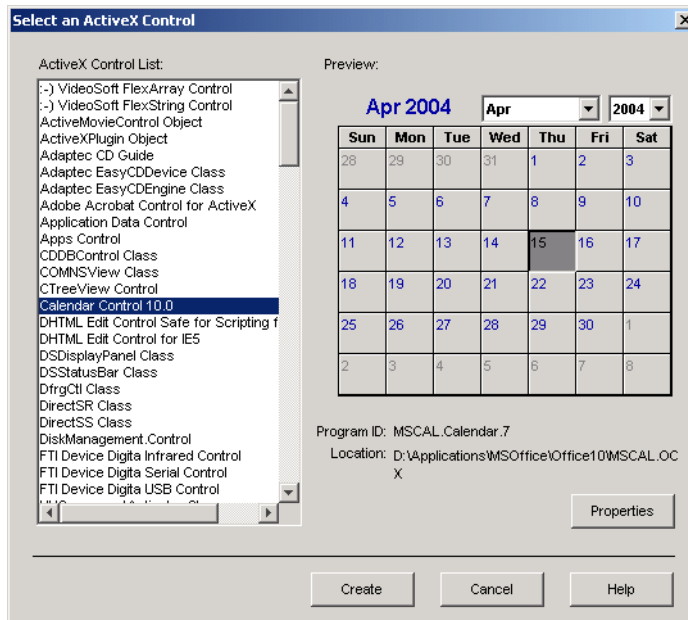
and MATLAB returns a list of each control, including its name, programmatic identifier (or ProgID), and filename, in the output cell array.

Refer to “Finding Out What Controls Are Installed” in the External Interfaces documentation.

Graphical Interface to Creating ActiveX Controls

The simplest way to create a control object is to use the `activexcontrolselect` function. This function displays a graphical interface that lists all controls installed on the system and creates the one that you select from the list.

The `activexcontrolselect` interface has a selection panel at the left of the window and a preview panel at the right. Click on one of the control names in the selection panel to see a preview of the control displayed. (If MATLAB cannot create the control, an error message is displayed in the preview panel.) Select an item from the list and click the **Create** button.



Refer to “Creating Control Objects Using a Graphical Interface” in the External Interfaces documentation.

New Functions for the MATLAB COM Interface

There are five new COM client functions.

Function	Description
<code>actxcontrollist</code>	List all currently installed ActiveX controls
<code>actxcontrolselect</code>	Display graphical interface for creating an ActiveX control
<code>interfaces</code>	List custom interfaces to a COM server
<code>iscom</code>	Determine if input is a COM or ActiveX object
<code>isinterface</code>	Determine if input is a COM interface

There are three new COM server functions. When invoked by a MATLAB or Visual Basic client, these functions execute in the server associated with the specified handle parameter.

Function	Description
<code>Feval</code>	Evaluate MATLAB function call in the server
<code>GetWorkspaceData</code>	Get data from server workspace
<code>PutWorkspaceData</code>	Store data in server workspace

See the function reference pages in the External Interfaces Reference documentation for more information.

COM Interface Supports Dot Syntax in Commands

You can now use a simpler form of syntax when invoking either MATLAB COM functions or methods belonging to COM objects. In this *dot syntax* (as it is referred to in the MATLAB documentation), you specify the object name, a dot (`.`), and then the name of the function or method you are calling. Enclose any input arguments in parentheses after the function name. Specify output arguments to the left of the equals sign:

```
outputvalue = object.function(arg1, arg2, ...)
```

For example, Release 13 syntax for invoking the `addproperty` function on a COM object with handle `h` was

```
invoke(h, 'addproperty', 'Position');
```

You can now perform the same operation using

```
h.addproperty('Position');
```

The get and set operations are even simpler:

```

** R13 SYNTAX **
x = get(h, 'Radius');
set(h, 'Radius', 50);

** R14 SYNTAX **
x = h.Radius;
h.Radius = 50;
```

Refer to “Invoking Commands on a COM Object” in the External Interfaces documentation.

Enumeration in COM Method Arguments

In addition to supporting enumeration for the properties of a COM object, MATLAB now supports enumeration for parameters passed to methods of a COM object. The only restriction is that the type library in use must report the parameter as ENUM, and only as ENUM.

Refer to “Specifying Enumerated Parameters” in the External Interfaces documentation.

Event Handling for COM Servers

In addition to handling events from ActiveX controls, MATLAB now handles events fired by Automation servers as well. Use the same event handling functions that you have been using for events from controls.

Function	Description
eventlisteners	Return a list of events attached to listeners
events	List all events, both registered and unregistered, a control or server can generate
isevent	Determine if an item is an event of a COM object
registerevent	Register an event handler with a control or server event

Function	Description
<code>unregisterallevents</code>	Unregister all events for a control or server
<code>unregisterevent</code>	Unregister an event handler with a control or server event

Refer to “Responding to Events from a COM Server” and in the External Interfaces documentation.

Callbacks to COM Event Handlers Written as Subfunctions

Instead of having to maintain a separate M-file for every event handler routine you write, you can consolidate some or all of these routines into a single M-file using M-file subfunctions.

Refer to “Writing Event Handlers Using M-File Subfunctions” in the External Interfaces documentation.

Event Handlers Can Be Function Handles

In this release, you can now implement ActiveX event handlers as function handles.

Optional Input Arguments to COM Methods

When calling a method that takes optional input arguments, you can skip any optional argument by specifying an empty array (`[]`) in its place. The syntax for `invoke` with the second argument (`arg2`) not specified is as follows:

```
invoke(handle, 'methodname', arg1, [], arg3);
```

See the section, “Optional Input Arguments” in the External Interfaces documentation for more information.

Display of Interface Handles

MATLAB has changed the way it displays a COM interface in this release. For example, the string used to represent an interface in MATLAB 6.5 was

```
[1x1 Interface.excel.application.Workbooks]
```

MATLAB 7.0 represents this same interface with the following string:

```
[1x1 Interface.Microsoft_Excel_9.0_Object_Library.Workbooks]
```

Compatibility Considerations. You may need to change any code that depends on the previous behavior.

MATLAB Interface to Java

Java Interface Adds Dynamic Java Class Path

MATLAB loads Java class definitions from files that are on the Java class path. The Java class path now consists of two segments: the *static path*, and a new segment called the *dynamic path*.

The static path is loaded from the file `classpath.txt` at the start of each MATLAB session and cannot be changed without restarting MATLAB. This was the only path available in previous versions of MATLAB. Thus, there was no way to change the Java path without restarting MATLAB.

The dynamic Java class path can be loaded at any time during a MATLAB session using the `javaclasspath` function. You can define the dynamic path (using `javaclasspath`), modify the path (using `javaaddpath` and `javarmppath`), and refresh the Java class definitions for all classes on the dynamic path (using `clear java`) without restarting MATLAB. See the function reference pages for more information on how to use these functions.

The `javaclasspath` function, when used with no arguments, displays both the static and dynamic segments of the Java class path:

```
javaclasspath

      STATIC JAVA PATH

      D:\Sys0\Java\util.jar
      D:\Sys0\Java\widgets.jar
      D:\Sys0\Java\beans.jar
      .
      .
```

DYNAMIC JAVA PATH

```
User4:\Work\Java\ClassFiles
User4:\Work\Java\mywidgets.jar
.
.
```

You can read more about this feature in the sections, “The Java Class Path” and “Making Java Classes Available to MATLAB” in the External Interfaces documentation.

Locating Java Native Method DLLs with File librarypath.txt

Previous versions of MATLAB required that you set a system environment variable to enable Java to locate the shared libraries supporting any native methods you need to use. This environment variable was PATH on Windows systems, and LD_LIBRARY_PATH on UNIX systems. This is no longer necessary.

Now you can enter the names of those directories that contain native method libraries in a new file called `librarypath.txt` using one line per directory. The `librarypath.txt` file resides adjacent to the similar file `classpath.txt` in the `$matlab/toolbox/local` directory.

General Features

New mx Functions

New functions `mxIsInt64` and `mxIsUint64` return true if an `mxArray` represents its data as signed or unsigned 64-bit integers respectively.

Identifying Dependencies When MEX-Files Do Not Load

If MEX-files don't load on the PC the error message is not informative. The dependency walker is a very useful tool distributed with MSVC. It is also freely available from <http://www.dependencywalker.com>.

Recompile MEX-Files on GLNX86 and Macintosh

In Release 14, MATLAB uses C++ exception handling. MEX-files built prior to R14 did not support C++ exceptions.

For example, write a C MEX-file that just calls `mexErrMsgTxt`. If you build this with a release prior to Release 14 and run it, the program aborts MATLAB. If you build this with Release 14 and run it, MATLAB will handle the exception correctly.

Compatibility Considerations. On GLNX86 and Macintosh systems, all MEX-files that can throw errors need to be recompiled for R14.

Shared Libraries Now In /bin/\$ARCH

Shared libraries previously residing in directory `$MATLAB/extern/lib/$ARCH` are now in `$MATLAB/bin/$ARCH`.

Compatibility Considerations. You may need to change any code that depends on the previous behavior.

Compatibility Summary for MATLAB

These tables summarize new features and changes that might cause incompatibilities when you upgrade from an earlier version, or when you use files on multiple versions. Details are provided with the description of the new feature or change.

- “Version 7.5 (R2007b) Compatibility Summary for MATLAB” on page 398
- “Version 7.4 (R2007a) Compatibility Summary for MATLAB” on page 401
- “Version 7.3 (R2006b) Compatibility Summary for MATLAB” on page 404
- “Version 7.2 (R2006a) Compatibility Summary for MATLAB” on page 407
- “Version 7.1 (R14SP3) Compatibility Summary for MATLAB” on page 409
- “Version 7.04 (R14SP2) Compatibility Summary for MATLAB” on page 411
- “Version 7.01 (R14SP1) Compatibility Summary for MATLAB” on page 413
- “Version 7 (R14) Compatibility Summary for MATLAB” on page 415

Version 7.5 (R2007b) Compatibility Summary for MATLAB

For other versions, see the “Compatibility Summary for MATLAB”.

Area	New Features and Changes with Version Compatibility Impact
Desktop Tools and Development Environment	<p>See the Compatibility Considerations subheading for each of these new features or changes:</p> <ul style="list-style-type: none"> • “Windows Startup Changes” on page 7 • “Changes to Look of Buttons in Desktop and Other Tools” on page 11 • “Demos and Help Browser Contents Now Include New Category for Links and Targets” on page 12 • “Help on Selection Enhanced in Command Window and Editor” on page 15 • “Run/Continue Button Changes” on page 18 • “Line Endings Removed for Files Provided with MATLAB for Windows; Impacts Viewing in Notepad” on page 21 • “Stand-Alone Editor Will Not Be Included in Next Version” on page 24
Math	<p>See the Compatibility Considerations subheading for each of these new features or changes:</p> <ul style="list-style-type: none"> • “finite Function Deprecated” on page 27 • “Library for LAPACK and BLAS Symbols Separated” on page 28 • “Colon Operations on Characters Return Character Type Data” on page 29 • “Matrix Generating Functions No Longer Accept Complex Inputs” on page 29
Data Analysis	None

Area	New Features and Changes with Version Compatibility Impact
Programming	<p>See the Compatibility Considerations subheading for each of these new features or changes:</p> <ul style="list-style-type: none"> • “New Internal Format for P-code” on page 33 • “Change to Error Message from Anonymous Function” on page 34 • “New Message In Response to Ctrl+C” on page 35 • “hdfread Errors Instead of Warns on I/O Failures” on page 36 • “Results From tempname Are More Unique” on page 36 • “iptcheckstrs and iptcheckinput Functionality Now Available with MATLAB” on page 37 • “Windows Current Working Directory Corrected” on page 37 • “Removal of freeserial Function” on page 40
Graphics and 3-D Visualization	<p>See the following release notes or their Compatibility Considerations subheading for each of these new features or changes:</p> <ul style="list-style-type: none"> • “Datatips Are Now Saved to FIG-Files” on page 41 • “The “v6” Option for Creating Plot Objects is Obsolete” on page 44

Area	New Features and Changes with Version Compatibility Impact
Creating GUIs	<p>See the Compatibility Considerations subheading for each of these new features or changes:</p> <ul style="list-style-type: none">• “Functions Being Removed” on page 48
External Interfaces	<p>See the Compatibility Considerations subheading for each of these new features or changes:</p> <ul style="list-style-type: none">• “Support for 64-bit mxArrayArrays” on page 50• “Fortran MEX-Files Will Require mwSize and mwIndex” on page 51• “Rebuild MEX-Files Created with MATLAB Versions Earlier Than V7 (R14)” on page 52• “Discontinued Compiler Support” on page 53• “Changes to Applications Built with Borland 5.5 or 5.6 C Compilers” on page 54• “Changes to Dynamic Data Exchange (DDE) Documentation” on page 55• “Documentation for Obsolete Functions To Be Phased Out” on page 56

Version 7.4 (R2007a) Compatibility Summary for MATLAB

For other versions, see the “Compatibility Summary for MATLAB”.

Area	New Features and Changes with Version Compatibility Impact
Desktop Tools and Development Environment	<p>See the Compatibility Considerations subheading for each of these new features or changes:</p> <ul style="list-style-type: none"> • “Double-Clicking Associated File Type in Windows Explorer Now Opens File in Existing MATLAB Session” on page 59 • “Changes to Startup Directory (Folder) and Startup Options for MATLAB on Windows” on page 60 • “JVM for Windows Updated” on page 63 • “Confirm Exit Preference to be Enabled by Default in Future Version” on page 64 • “Tabs for Tools Replaced by Title Bars” on page 70 • “Macintosh—Some Key Bindings in Command Window Changed” on page 73 • “Include Search Database for Your Own Help Files” on page 74 • “Video Tutorials Now Accessed Via Web Site” on page 74 • “Search Path Changes” on page 75 • “Stand-Alone Editor No Longer Opens By Default; To Be Removed in a Future Version” on page 76 • “M-Lint Detection of Missing End-of-Line Semicolons Enhanced” on page 78 • “Macintosh—Some Key Bindings in Editor/Debugger Changed” on page 79

Area	New Features and Changes with Version Compatibility Impact
Math	<p>See the Compatibility Considerations subheading for each of these new features or changes:</p> <ul style="list-style-type: none"> • “rand Function Uses the Mersenne Twister Algorithm as Default” on page 81 • “Divide By Zero and Log Of Zero Warnings Off By Default” on page 83 • “mode of Empty Array Now Returns NaN” on page 83 • “Change to Syntax for Setting BLAS Library Version on Linux” on page 84
Data Analysis	None
Programming	<p>See the Compatibility Considerations subheading for each of these new features or changes:</p> <ul style="list-style-type: none"> • “Using whos -file on Objects with Overloaded size or class Methods” on page 89 • “mat2str Returns Correct Output for Strings” on page 90 • “Warning Generated by try-catch” on page 90 • “Functions Not Callable If in Directory Under Class Directory” on page 92 • “ispuma Function Deprecated” on page 93
Graphics and 3-D Visualization	<p>See the Compatibility Considerations subheading for each of these new features or changes:</p> <ul style="list-style-type: none"> • “Movies No Longer Play During Loading” on page 94 • “Ghostscript Printing Software Upgraded” on page 95 • “Property Inspector Now Categorizes Graphic Object Properties” on page 95

Area	New Features and Changes with Version Compatibility Impact
Creating GUIs	<p>See the Compatibility Considerations subheading for each of these new features or changes:</p> <ul style="list-style-type: none"> • “GUIDE No Longer Copies Callbacks When You Duplicate Components” on page 98 • “GUIDE M-File-Defined handles Structure Fields No Longer Become Permanent” on page 98 • “UNIX: File Dialog 'Location' Property Is Obsolete” on page 99 • “Functions Becoming Obsolete” on page 99
External Interfaces	<p>See the Compatibility Considerations subheading for each of these new features or changes:</p> <ul style="list-style-type: none"> • “MEX-Files in MATLAB for Intel-based Macintosh ” on page 101 • “MEX-Files in MATLAB for 64-bit Solaris SPARC” on page 101 • “MEX-Files Built in MATLAB R11 or Earlier Must Be Rebuilt” on page 102 • “Fortran Compatibility Considerations” on page 104 • “Discontinued Compiler Support” on page 104

Version 7.3 (R2006b) Compatibility Summary for MATLAB

For other versions, see the “Compatibility Summary for MATLAB”.

Area	New Features and Changes with Version Compatibility Impact
Desktop Tools and Development Environment	<p>See the Compatibility Considerations subheading for each of these new features or changes:</p> <ul style="list-style-type: none"> • “Redirect Output on UNIX Now Sends Errors to Shell” on page 111 • “M-Lint Preferences Added and Now Appear on M-Lint Panel” on page 112 • “New Look and Feel on Linux and Solaris Platforms” on page 114 • “Invalid info.xml File on Path Now Generates an Error” on page 114 • “Exact Phrase and Wildcard Searching Added; Change to Search Database” on page 115 • “File Comparison Directory Report Removed; Replaced by File Comparison Tool” on page 121 • “M-Lint Code Check Report Enhancements and Changes” on page 121 • “mlint Message IDs Changed and %#ok Syntax Enhanced” on page 121

Area	New Features and Changes with Version Compatibility Impact
Mathematics	<p>See the Compatibility Considerations subheading for each of these new features or changes:</p> <ul style="list-style-type: none"> • “max and min Now Use Magnitudes and Phase Angle for Complex Input” on page 125 • “FFTW Upgraded to Version 3.1.1 in MATLAB” on page 127 • “Future Obsolete Functions” on page 128 • “Obsolete Functions” on page 128 • “notebook Setup Arguments Removed” on page 123 • “max and min No Longer Return Warning Messages for Inputs with Different Data Types” on page 129
Data Analysis	None
Programming	<p>See the Compatibility Considerations subheading for each of these new features or changes:</p> <ul style="list-style-type: none"> • “Saving to MAT-Files Larger than 2 GB” on page 131 • “New Reserved MATLAB Keywords” on page 133 • “Enhancements to Display Generated by whos” on page 133 • “save Compression and Unicode Options Removed” on page 135 • “Warning Generated by try-catch” on page 136 • “Case-Sensitivity Warning Removed” on page 137 • “fprintf(0,...) Now Throws an Error” on page 137 • “Assigning Nonscalar Structure Array Fields to a Single Variable” on page 138 • “Comma Separators Not Required in Function Declaration” on page 139

Area	New Features and Changes with Version Compatibility Impact
Graphics and 3-D Visualization	See the Compatibility Considerations subheading for each of these new features or changes: <ul style="list-style-type: none">• “Version 6 Property Editor Has Been Removed” on page 140• “New Desktop Printing GUI” on page 141• “Customizing Zoom, Pan, and Rotate3D Data Explore Modes” on page 142
Creating GUIs	See the Compatibility Considerations subheading for each of these new features or changes: <ul style="list-style-type: none">• “Functions Are Now Obsolete” on page 144• “Colored Buttons on Windows XP” on page 144
External Interfaces	See the Compatibility Considerations subheading for each of these new features or changes: <ul style="list-style-type: none">• “Sparse Arrays on 64-bit Systems” on page 147• “New MAT-File Format Based on HDF5” on page 148• “-V5 Option to MEX to Be Removed” on page 149• “Location of mex.bat File Changed” on page 149• “Changes to Compiler Support” on page 149• “Actxcontrol Command Now Validates ProgID” on page 149

Version 7.2 (R2006a) Compatibility Summary for MATLAB

For other versions, see the “Compatibility Summary for MATLAB”.

Area	New Features and Changes with Version Compatibility Impact
Desktop Tools and Development Environment	<p>See the Compatibility Considerations subheading for each of these new features or changes:</p> <ul style="list-style-type: none"> • “Installation Directory Structure on Windows” on page 153 • “Preferences Reorganized and New Keyboard Pane Added to Support Command Window and Editor/Debugger” on page 154 • “Tab Completion — Tab Now Completes Function and Variable Names” on page 157 • “Go Menu Added; Bookmark and Go To Items Moved from Edit Menu to Go Menu” on page 158 • “Cell Mode On by Default — Shows Cell Toolbar and Possibly Horizontal Lines and Yellow Highlighting; Cell Information Bar and Button Added” on page 161 • “M-Lint and mlint Enhancements and Changes” on page 164 • “Visual Directory View Removed from Current Directory Browser” on page 165 • “PVCS Source Control System Name Change” on page 166
Mathematics	None
Data Analysis	<p>See the Compatibility Considerations subheading for each of these new features or changes:</p> <ul style="list-style-type: none"> • “Linux 64 Platform Fully Enabled for Time Series Tools” on page 169

Area	New Features and Changes with Version Compatibility Impact
Programming	<p>See the Compatibility Considerations subheading for each of these new features or changes:</p> <ul style="list-style-type: none"> • “Using avifile and movie2avi on Windows XP 64” on page 170 • “Regular Expressions” on page 171 • “MATLAB Warns on Invalid Input to str2func” on page 173 • “Changes to Character Encoding in File I/O” on page 173
Graphics and 3-D Visualization	<ul style="list-style-type: none"> • “Pasting Cut or Copied Graphic Objects Can Create an Axes” on page 177
Creating GUIs	<p>See the Compatibility Considerations subheading for each of these new features or changes:</p> <ul style="list-style-type: none"> • “Treatment of & in Menu Label Is Changed” on page 179
External Interfaces	<p>See the Compatibility Considerations subheading for each of these new features or changes:</p> <ul style="list-style-type: none"> • “MEX-Files Built with gcc on Linux Must Be Rebuilt” on page 181 • “MEX-Files in MATLAB for Windows x64” on page 182 • “Compaq Visual Fortran Engine and MAT Options File Renamed” on page 183 • “Options Files Removed for Unsupported Compilers” on page 183 • “Obsolete Functions No Longer Documented” on page 184

Version 7.1 (R14SP3) Compatibility Summary for MATLAB

For other versions, see the “Compatibility Summary for MATLAB”.

Area	New Features and Changes with Version Compatibility Impact
Desktop Tools and Development Environment	<p>See the Compatibility Considerations subheading for each of these new features or changes:</p> <ul style="list-style-type: none"> • “Windows -nodesktop No Longer has Menu Bar and Toolbar; Use Function Equivalent Instead” on page 193 • “Preferences Directory Added for R14SP3; Supplements R14 Directory” on page 195 • “info.xml File Automatic Validation; Shows Warnings for Invalid Constructs” on page 197 • “Hyperlink Color Preference Moved” on page 198 • “Demos Run in Command Window as Scripts and Their Variables Now Created in Base Workspace” on page 199 • “echodemo Function Added to Replace playshow function” on page 200 • “Visual Directory View to be Removed” on page 201 • “HTML File Indenting Feature Added as the Default” on page 203 • “Notebook Setup Changes; Some Arguments Removed” on page 205 • “Word Versions Supported by Notebook; Word 97 No Longer Supported” on page 206
Mathematics	<p>See the Compatibility Considerations subheading for each of these new features or changes:</p> <ul style="list-style-type: none"> • “New Functions” on page 207
Data Analysis	None

Area	New Features and Changes with Version Compatibility Impact
Programming	See the Compatibility Considerations subheading for each of these new features or changes: <ul style="list-style-type: none">• “New Functions” on page 213• “Modified Functions” on page 214• “isfield Function Supports Cell Arrays; Results Might Differ from Previous Version” on page 215• “Seconds Field Now Truncated; Results Might Differ” on page 218, “Built-in Functions No Longer Use .bi; Impacts Output of which Function” on page 218, “New Warning About Potential Naming Conflict” on page 219
Graphics and 3-D Visualization	None
Creating GUIs	See the Compatibility Considerations subheading for each of these new features or changes: <ul style="list-style-type: none">• “Plans for Obsolete Functions” on page 221
External Interfaces	See the Compatibility Considerations subheading for each of these new features or changes: <ul style="list-style-type: none">• “New File Extension for MEX-Files on Windows” on page 224• “New Preferences Directory and MEX Options” on page 226• “Compiler Support” on page 227• “Import Libraries Moved” on page 227

Version 7.04 (R14SP2) Compatibility Summary for MATLAB

For other versions, see the “Compatibility Summary for MATLAB”.

Area	New Features and Changes with Version Compatibility Impact
Desktop Tools and Development Environment	<p>See the Compatibility Considerations subheading for each of these new features or changes:</p> <ul style="list-style-type: none"> • “JVM Updated” on page 232 • “Subfunction Help Syntax Changed” on page 233 • “Bug Fixes and Known Problems Now on Web; No Longer Found Via Help Search” on page 233 • “Workspace Browser Preference Panel Removed” on page 234 • “Preference for Editor/Debugger Dialog Moved” on page 235 • “Register Project Feature Added; Add to Source Control Behavior Changed” on page 236 • “Cell Publishing: File Extension Changes” on page 236 • “Notebook Support for Word 97 to be Discontinued” on page 237
Mathematics	<p>See the Compatibility Considerations subheading for each of these new features or changes:</p> <ul style="list-style-type: none"> • “max and min on Complex Integers Not Supported” on page 238
Programming	<p>See the Compatibility Considerations subheading for each of these new features or changes:</p> <ul style="list-style-type: none"> • “xlsread Imported Date Format Changes” on page 240 • “Nonscalar Arrays of Function Handles to Become Invalid” on page 241 • “Assigning Nonstructure Variables As Structures Displays Warning” on page 241

Area	New Features and Changes with Version Compatibility Impact
Graphics and 3-D Visualization	See the Compatibility Considerations subheading for each of these new features or changes: <ul style="list-style-type: none">• “Cannot Dock Figures on Macintosh” on page 245• “Plotting Tools Not Working on Macintosh” on page 245• “Not All Macintosh System Fonts Are Available” on page 245• “XDisplay Property Setable on Motif-Based Systems” on page 245
Creating GUIs	None
External Interfaces	None

Version 7.01 (R14SP1) Compatibility Summary for MATLAB

For other versions, see the “Compatibility Summary for MATLAB”.

Area	New Features and Changes with Version Compatibility Impact
Desktop Tools and Development Environment	<p>See the Compatibility Considerations subheading for each of these new features or changes:</p> <ul style="list-style-type: none"> • “Constructing Java Classpath Now Uses librarypath” on page 251 • “Notebook Support for Word 97 to Be Discontinued” on page 256
Mathematics	<p>See the Compatibility Considerations subheading for each of these new features or changes:</p> <ul style="list-style-type: none"> • “Different Results When Solving Singular Linear Systems on Intel Systems; Inconsistent NaN Propagation” on page 259 • “funm Returns Status Information; New Output Might Result In Error” on page 260
Programming	<p>See the Compatibility Considerations subheading for each of these new features or changes:</p> <ul style="list-style-type: none"> • “datevec Support of Empty String Argument” on page 262 • “ftell Returning Invalid Position in Rare Cases” on page 262 • “Logical OR Operator in regexp Expressions Might Yield Different Results from Previous Version” on page 264 • “Multiple Declarations of Persistent Variables No Longer Supported” on page 265

Area	New Features and Changes with Version Compatibility Impact
Graphics and 3-D Visualization	See the Compatibility Considerations subheading for each of these new features or changes: <ul style="list-style-type: none">• “Cannot Dock Figures on Macintosh” on page 267• “Plotting Tools Not Working on Macintosh” on page 267• “Not All Macintosh System Fonts Are Available” on page 267• “Preview Java Figures on the Macintosh” on page 267
Creating GUIs	See the Compatibility Considerations subheading for each of these new features or changes: <ul style="list-style-type: none">• “FIG-File Format Change” on page 268• “Panels, Button Groups, and ActiveX Components” on page 268• “Windows XP Display of Push and Toggle Buttons” on page 269
External Interfaces	See the Compatibility Considerations subheading for this new feature or change: <ul style="list-style-type: none">• “Specifying the Search Path for Java Native Method DLLs” on page 271

Version 7 (R14) Compatibility Summary for MATLAB

For other versions, see the “Compatibility Summary for MATLAB”.

Area	New Features and Changes with Version Compatibility Impact
Desktop Tools and Development Environment	<p>See the Compatibility Considerations subheading for each of these new features or changes:</p> <ul style="list-style-type: none"> • “terminal Function Removed” on page 281 • “license Function Results Modified Slightly” on page 281 • “Tab Completion Graphical Interface Added; Removed Preference to Limit Completions” on page 282 • “Parentheses Matching Support Removed” on page 284 • “Documentation Now Automatically Installed; Not Accessible from CD-ROMs and docroot Not Supported” on page 286 • “web Function Now Opens MATLAB Web Browser By Default” on page 288 • “HTML Documentation Not Viewable with -nojvm Startup Option” on page 288 • “Built-In Functions Now Treated Like Other M-Files on Search Path” on page 291 • “savepath Function Added to Replace path2rc” on page 291 • “Create Block Comments Using %{ and %}” on page 297 • “dbstack Function Supports Nested Functions” on page 299 • “dbstatus Function Supports Conditional Breakpoints” on page 300 • “Rapid Code Iteration Using Cells” on page 300 • “Profiler for Measuring Performance” on page 304 • “Source Control Changes” on page 305

Area	New Features and Changes with Version Compatibility Impact
Mathematics	<p>See the Compatibility Considerations subheading for each of these new features or changes:</p> <ul style="list-style-type: none">• “Obsolete Functions” on page 310• “Integer Data Type Functions Now Round Instead of Truncate” on page 314• “Changes to Behavior of Concatenation” on page 315• “New Class Inputs for sum” on page 318• “max and min Now Have Restrictions on Inputs of Different Data Types” on page 321• “Matrix, Trigonometric, and Other Math Functions No Longer Accept Inputs of Type char” on page 325• “New Names for Demos expm1, expm2, and expm3” on page 331

Area	New Features and Changes with Version Compatibility Impact
Programming	<p>See the Compatibility Considerations subheading for each of these new features or changes:</p> <ul style="list-style-type: none"> • “MATLAB Stores Character Data As Unicode; Making Release 14 MAT-files Readable in Earlier Versions” on page 335 • “MAT-Files Generated By Release 14 Beta2 Must Be Reformatted” on page 336 • “Additional Bytes Reserved in MAT-File Header; Do Not Write To Reserved Space” on page 337 • “Case-Sensitivity in Function and Directory Names; Can Affect Which Function MATLAB Selects” on page 338 • “Differences Between Built-Ins and M-Functions Removed; Can Affect Which Function MATLAB Selects” on page 343 • “Change to How evalin Evaluates Dispatch Context” on page 345 • “New Calling Syntax for Function Handles; Replace eval With New Syntax” on page 350 • “Arrays of Function Handles” on page 351 • “Regular Expressions Accept String Vector; No Longer Support Character Matrix Input” on page 357 • “Colon Operator on char Now Returns a char” on page 358 • “Reading Date Values with xlsread; Conversion No Longer Necessary” on page 359 • “Changes to Error Message Format” on page 365

Area	New Features and Changes with Version Compatibility Impact
3-D Graphics and Visualization	See the Compatibility Considerations subheading for each of these new features or changes: <ul style="list-style-type: none">• “Plotting Tools Not Working on Macintosh” on page 378• “Using -nojvm Option Prevents Plotting Tools Use” on page 378• “MATLAB 6 Version Property Editor” on page 379• “Cannot Dock Figures on Macintosh” on page 379• “Not All Macintosh System Fonts Are Available” on page 379
Creating GUIs	See the Compatibility Considerations subheading for each of these new features or changes: <ul style="list-style-type: none">• “New Container Components” on page 380• “New Syntax for uigetfile and uiputfile” on page 384• “Frames Not Available in GUIDE Layout Editor” on page 385
External Interfaces	See the Compatibility Considerations subheading for each of these new features or changes: <ul style="list-style-type: none">• “Saving Character Data with Unicode Encoding” on page 386• “Display of Interface Handles” on page 393• “Recompile MEX-Files on GLNX86 and Macintosh” on page 395• “Shared Libraries Now In /bin/\$ARCH” on page 396