Phased Array System Toolbox™ Release Notes

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Phased Array System Toolbox™ Release Notes

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Summary by Version

This table provides quick access to what's new in each version. For clarification, see "Using Release Notes" on page 1.

Version (Release)	New Features and Changes	Version Compatibility Considerations	Fixed Bugs and Known Problems
Latest Version 1.1 (R2011b)	Yes Details	Yes Summary	Bug Reports
V1.0 (R2011a)	Yes Details	No	Bug Reports

Using Release Notes

Use release notes when upgrading to a newer version to learn about:

- New features

- Changes

- Potential impact on your existing files and practices

Review the release notes for other MathWorks® products required for this product (for example, MATLAB® or Simulink®). Determine if enhancements, bugs, or compatibility considerations in other products impact you.

If you are upgrading from a software version other than the most recent one, review the current release notes and all interim versions. For example, when you upgrade from V1.0 to V1.2, review the release notes for V1.1 and V1.2.

What Is in the Release Notes

New Features and Changes

- New functionality

- Changes to existing functionality

Version Compatibility Considerations

When a new feature or change introduces a reported incompatibility between versions, the **Compatibility Considerations** subsection explains the impact.

Compatibility issues reported after the product release appear under Bug Reports at the MathWorks Web site. Bug fixes can sometimes result in incompatibilities, so review the fixed bugs in Bug Reports for any compatibility impact.

Fixed Bugs and Known Problems

MathWorks offers a user-searchable Bug Reports database so you can view Bug Reports. The development team updates this database at release time and as more information becomes available. Bug Reports include provisions for any known workarounds or file replacements. Information is available for bugs existing in or fixed in Release 14SP2 or later. Information is not available for all bugs in earlier releases.

Access Bug Reports using your MathWorks Account.

Documentation on the MathWorks Web Site

Related documentation is available on `mathworks.com` for the latest release and for previous releases:

- Latest product documentation
- Archived documentation

Version 1.1 (R2011b) Phased Array System Toolbox Software

This table summarizes what's new in Version 1.1 (R2011b):

New Features and Changes	Version Compatibility Considerations	Fixed Bugs and Known Problems
Yes Details below	Yes Summary	Bug Reports

New features and changes introduced in this version are

- "Constant Gamma Clutter Modeling" on page 3
- "Clutter Modeling Utilities" on page 4
- "Phase-Coded Waveforms" on page 4
- "Spectrum Weighting Options in Matched Filter" on page 5
- "Expanded Lattice Options in Uniform Rectangular Array" on page 6
- "Enhanced Plots Show Multiple Frequency Responses" on page 6
- "Custom Antenna Removes Restriction on Radiation Pattern" on page 7
- "Storing States When Saving or Cloning Objects" on page 7
- "Custom System Objects" on page 7
- "Conversion of Error and Warning Message Identifiers" on page 8

Constant Gamma Clutter Modeling

The new `phased.ConstantGammaClutter` System object helps you model surface clutter using the constant gamma model. You can use this object when simulating a radar system or estimating its performance statistically.

For more information, see these resources:

- "Clutter Modeling"
- `phased.ConstantGammaClutter`

- Ground Clutter Mitigation with Moving Target Indication (MTI) Radar

Clutter Modeling Utilities

These new utility functions can help you implement custom clutter models:

- `billingsleyicm`
- `depressionang`
- `effearthradius`
- `grazingang`
- `horizonrange`
- `surfclutterrcs`
- `surfacegamma`

Phase-Coded Waveforms

The new `phased.PhaseCodedWaveform` System object generates samples of a phase-coded pulse waveform. This object supports these code types:

- Barker
- Frank
- P1
- P2
- P3
- P4
- Px
- Zadoff-Chu

For more information, see "Phase-Coded Waveforms" and `phased.PhaseCodedWaveform`.

Spectrum Weighting Options in Matched Filter

The `phased.MatchedFilter` System object supports spectrum weighting using these window types:

- Hamming
- Chebyshev
- Hann
- Kaiser
- Taylor

You can also specify a custom window. To do so, write a function that takes the window length as an input argument and returns window coefficients in an output argument.

For more information, see "Matched Filtering" or `phased.MatchedFilter`.

Compatibility Considerations

If you save a `phased.MatchedFilter` object in a MAT-file in V1.1 (R2011b) and then load the MAT-file in V1.0 (R2011a), the object does not perform spectrum weighting. The Command Window shows this warning:

```
Warning: While loading an object of class 'phased.MatchedFilter':
No public field SpectrumWindow exists for class phased.MatchedFilter.
```

If you write code in V1.1 (R2011b) that sets or reads any of the following properties of `phased.MatchedFilter` object, the code produces an error message in V1.0 (R2011a).

- `SpectrumWindow`
- `CustomSpectrumWindow`
- `SpectrumRange`
- `SampleRate`
- `SidelobeAttenuation`
- `Beta`

- Nbar

Expanded Lattice Options in Uniform Rectangular Array

The `phased.URA` System object supports both triangular lattices and rectangular lattices. You use the `Lattice` property to select the lattice type.

In V1.0 (R2011a), `phased.URA` supports only rectangular lattices and does not have a `Lattice` property.

Compatibility Considerations

If you save a `phased.URA` object in a MAT-file in V1.1 (R2011b) and then load the MAT-file in V1.0 (R2011a), the object uses a rectangular lattice. The Command Window shows this warning:

```
Warning: While loading an object of class 'phased.URA':
No public field Lattice exists for class phased.URA.
```

If you write code in V1.1 (R2011b) that sets or reads the `Lattice` property of a `phased.URA` object, the code produces an error message in V1.0 (R2011a).

Enhanced Plots Show Multiple Frequency Responses

The `plotResponse` method can plot multiple frequency responses along an azimuth cut or elevation cut. This method is available for the System objects for array design, antenna elements, and microphone elements. To create a plot of multiple frequency responses, use a `plotResponse` syntax in which:

- `FREQ` is a row vector.
- `RespCut` either does not appear explicitly, or has the value `'Az'` or `'El`.

The affected System objects are:

- phased.ConformalArray
- phased.CosineAntennaElement
- phased.CustomAntennaElement
- phased.CustomMicrophoneElement

- `phased.IsotropicAntennaElement`

- `phased.OmnidirectionalMicrophoneElement`

- `phased.ULA`

- `phased.URA`

In V1.0 (R2011a), `FREQ` must be a scalar. The resulting plot shows one frequency response.

Custom Antenna Removes Restriction on Radiation Pattern

The `phased.CustomAntennaElement` System object now permits more general radiation patterns. The main beam of the pattern is no longer required to point to 0 degrees azimuth and 0 degrees elevation.

Storing States When Saving or Cloning Objects

The `save` and `clone` operations now store all states of the System objects in the `phased` package. As a result, calling the `step` method on a loaded or cloned object resumes processing from the state where the original object left off. In V1.0 (R2011a), the loaded or cloned object is unlocked and uninitialized.

Compatibility Considerations

If your legacy code exploits the unlocked, uninitialized state of a loaded or cloned object, you should update the code in V1.1 (R2011b). You can use the `release` method to unlock objects.

Custom System Objects

You can now create custom System objects in MATLAB. This capability allows you to define your own System objects for time-based and data-driven algorithms, I/O, and visualizations. The System object API provides a set of implementation and service methods that you incorporate into your code to implement your algorithm. See "Custom System Objects" in the DSP System Toolbox™ documentation for more information.

Conversion of Error and Warning Message Identifiers

For version 1.1 (R2011b), some error and warning message identifiers have changed in Phased Array System Toolbox™ software.

Compatibility Considerations

If you have scripts or functions that use message identifiers that changed, you must update the code to use the new identifiers. Typically, message identifiers are used to turn off specific warning messages, or in code that uses a try/catch statement and performs an action based on a specific error identifier.

For example, the `'phased:phased:RootWSFEstimator:ZeroSourceNumber'` identifier and the `'phased:phased:RootMUSICEstimator:ZeroSourceNumber'` identifier have both changed to `'phased:phased:doa:ZeroSourceNumber'`. If your code checks for one of the earlier values, you must update it to check for `'phased:phased:doa:ZeroSourceNumber'` instead.

To determine the identifier for a warning, run the following command just after you see the warning:

```
[MSG,MSGID] = lastwarn;
```

This command saves the message identifier to the variable `MSGID`.

To determine the identifier for an error, run the following command just after you see the error:

```
exception = MException.last;
MSGID = exception.identifier;
```

Note Warning messages indicate a potential issue with your code. While you can turn off a warning, a suggested alternative is to change your code so it runs warning-free.

Version 1.0 (R2011a) Phased Array System Toolbox Software

This table summarizes what's new in Version 1.0 (R2011a):

New Features and Changes	Version Compatibility Considerations	Fixed Bugs and Known Problems
Yes Details below	No	Bug Reports

- "Introducing the Phased Array System Toolbox" on page 9
- "Features" on page 9

Introducing the Phased Array System Toolbox

Phased Array System Toolbox provides algorithms and tools for the design, simulation, and analysis of phased array signal processing systems. These capabilities are provided as MATLAB functions and MATLAB System objects. The system toolbox includes algorithms for waveform generation, beamforming, direction of arrival estimation, target detection, and space-time adaptive processing. The system toolbox lets you build monostatic, bistatic, and multistatic architectures for a variety of array geometries. You can model these architectures on stationary or moving platforms. Array analysis and visualization tools help you evaluate spatial, spectral, and temporal performance. The system toolbox lets you model an end-to-end phased array system or use individual algorithms to process acquired data.

Features

Key features of Phased Array System Toolbox Version 1.0 include:

- Algorithms available as MATLAB functions and MATLAB System objects

- Monostatic, bistatic, and multistatic phased array system modeling

- Array analysis and 3D visualization; physical array modeling for uniform linear arrays, uniform rectangular arrays, and arbitrary conformal arrays on platforms with motion

- Broadband and narrowband digital beamforming functions, including MVDR/Capon, LCMV, time delay, Frost, time delay LCMV, and subband phase shift

- Space-time adaptive processing algorithms, including displaced phase center array (DPCA), adaptive DPCA, sample matrix inversion (SMI) beamforming, and angle-Doppler response visualization

- Direction of arrival algorithms, including MVDR, ESPRIT, Beamscan, Root MUSIC, and monopulse tracking

- Waveform synthesis functions for pulsed CW, linear FM, stepped FM, and staggered PRF signals, and waveform visualization tools for ambiguity function and matched filter response

- Algorithms for TVG, pulse compression, coherent and non-coherent integration, CFAR processing, plotting ROC curves, and estimating range and Doppler

Compatibility Summary for Phased Array System Toolbox

This table summarizes 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 in the description of the new feature or change.

Version (Release)	New Features and Changes with Version Compatibility Impact
Latest Version V1.1 (R2011b)	• "Spectrum Weighting Options in Matched Filter" on page 5 • "Expanded Lattice Options in Uniform Rectangular Array" on page 6 • "Storing States When Saving or Cloning Objects" on page 7 • "Conversion of Error and Warning Message Identifiers" on page 8
V1.0 (R2011a)	None