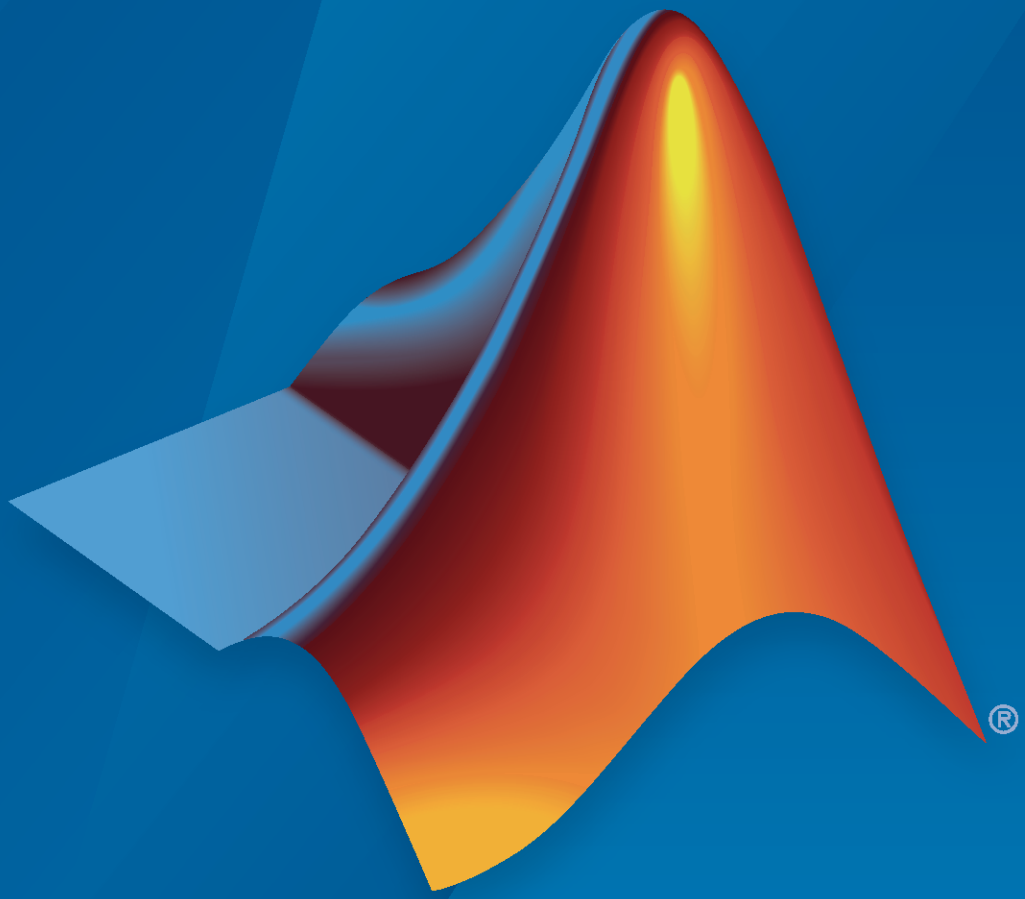
UAV Toolbox Support Package for PX4® Autopilots Release Notes



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UAV Toolbox Support Package for PX4® Autopilots Release Notes

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R2022a

R2021b

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R2020b

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R2022a

Version: 22.1.0

New Features

Support for hardware-in-the-loop simulation with Simulink Plant

The UAV Toolbox Support Package for PX4 Autopilots now supports onboard computer workflows with PX4 hardware-in-the-loop (HITL) simulation with PX4 Autopilot and the UAV Plant in Simulink®. The Simulink generated code integrated with the PX4 firmware is run on real flight controller hardware which communicates with the UAV dynamics in the Simulink plant model in the HITL simulation mode. The UAV plant in Simulink can generate UAV states from Actuator inputs and simulate IMU and GPS sensors.

Support for onboard computer workflows with PX4 hardware-in-the-loop simulation with Simulink Plant

The UAV Toolbox Support Package for PX4 Autopilots now supports onboard computer workflows with PX4 hardware-in-the-loop target and Simulink Plant. This feature allows you to model onboard algorithms in Simulink and deploy them to a NVIDIA® Jetson® computer. The support package also supports flight simulation with 3D Scene and streaming simulation sensor data to a Jetson computer.

R2021b

Version: 21.2.0

New Features

Support for Hardware-in-the-Loop Simulation with jMAVSim Plant

The UAV Toolbox Support Package for PX4 Autopilots now supports enabling Hardware-in-the-loop (HITL) simulation mode in which the Simulink generated code integrated with PX4 firmware is run on real flight controller hardware. This feature helps you in testing most of the actual flight code on the real hardware. For more information.

PX4 Read Position Setpoint Block

Starting R2021b, use the PX4 Read Position Setpoint block in your Simulink model to read the position setpoints in Simulink for a mission that has been created in QGroundControl and uploaded to the Pixhawk board. The drone follows the desired mission when the read position is fed to the controller algorithm.

R2021a

Version: 21.1.0

New Features

Monitor signals and tune parameters using XCP on Serial

The UAV Toolbox Support Package for PX4 Autopilots now supports Universal Measurement and Calibration Protocol (XCP)-based External mode simulation. By setting `XCP on Serial` as the communication interface for External mode on supported Pixhawk boards and `XCP on TCP/IP` on PX4 Host Target, you can include Simulink Dashboard blocks for tuning parameters in the model and monitor the signals using the Simulation Data Inspector (SDI).

Use Connected I/O to communicate with Pixhawk Board

The UAV Toolbox Support Package for PX4 Autopilots is enhanced to support Connected I/O simulation with Pixhawk boards. When you simulate a model in Connected I/O, the model communicates with the Pixhawk board, enabling you to read and write data to the Pixhawk board from Simulink.

R2020b

Version: 20.2.0

New Features

Version History

Embedded Coder Support Package for PX4 Autopilots moved to UAV Toolbox

The Embedded Coder® Support Package for PX4 Autopilots is now in the UAV Toolbox and is renamed UAV Toolbox Support Package for PX4 Autopilots. You can perform Connected I/O simulation for the PX4 Host Target with the UAV Toolbox. You can generate and deploy code for your Simulink model with the Embedded Coder license.

Use Connected I/O to Communicate with PX4 Host Target

The UAV Toolbox Support Package for PX4 Autopilots supports Connected I/O simulation with the PX4 Host Target. When you simulate a model in Connected I/O, the model communicates with the PX4 Host Target, enabling you to read and write data to the PX4 Host Target from Simulink.

These blocks support Connected I/O:

- PX4 uORB Read
- PX4 uORB Write
- Accelerometer
- Battery
- GPS
- Gyroscope
- Magnetometer
- Radio Control Transmitter
- Vehicle Attitude
- PX4 Analog Input

For more information on Connected I/O, see “Getting Started with Connected I/O for PX4 Host Target”.

New Blocks Added to UAV Toolbox Support Package for PX4 Autopilots

This table lists the new blocks available in the UAV Toolbox Support Package for PX4 Autopilots.

Block	Usage
I2C Master Write	Write data to I2C slave device or I2C slave device register.
I2C Master Read	Read data from I2C slave device or I2C slave device register.

Support for PX4 Autopilot Firmware v1.10.2

The UAV Toolbox Support Package for PX4 Autopilots now supports PX4 Autopilot Firmware v1.10.2 for both Ubuntu 18.04 and Windows platforms. The support package supported v1.8.0 until R2020a.

Simulink-Based Plant Model to Simulate Controller Model in PX4 Host Target with Lockstep Simulation

Use the UAV Toolbox Support Package for PX4 Autopilots to create a lockstep simulation environment to test the controller model using a Simulink-based plant model. The controller model uses PX4 uORB Read blocks and the PX4 Host Target executable. The plant model uses the MAVLink blocks from the UAV Toolbox. For more details, see “Integrate Simulator Plant Model Containing MAVLink Blocks with Flight Controller Running on PX4 Host Target”.

Log PX4 Flight Data to SD Card and Retrieve Data Using MATLAB Functions

Use the UAV Toolbox Support Package for PX4 Autopilots to log Simulink signals to an SD Card in the MAT-file format. The two new functions, `getMATFilesFromPixhawk` and `px4MATFilestitcher`, help you retrieve the MAT-files from the SD card inserted on the Pixhawk hardware board and combine them for further analysis. For more details on the complete workflow on integrating MAT-file logging in your Simulink model, see “Log Signals on an SD Card”.

R2020a

Version: 20.1.1

New Features

Bug Fixes

Deployment and Verification of Flight Controller Algorithms

Embedded Coder Support Package for PX4 Autopilots now supports PX4 SITL (Software in the Loop) simulation of flight controller algorithms developed in Simulink, before you deploy the model to the supported hardware boards. To achieve this capability, the support package provides a new customized hardware target called **PX4 Host Target**, which you can select in the Configuration Parameters dialog box. When you deploy the Simulink model to this target, a jMAVSim simulator is launched, which you can use to visualize the simulation of the quadcopter.

For more details, see “Deployment and Verification Using PX4 Host Target and jMAVSim”.

PIL Capability for PX4 Autopilots Support Package

Embedded Coder Support Package for PX4 Autopilots now supports the Simulink capability of PIL (Processor-in-the-loop). This helps you to perform code verification and validation of the algorithms that you design for the supported hardware boards. You can utilize all the PIL-related capabilities like code optimization and execution profiling to ensure that the behavior of the deployment code matches the design.

For more details, see “Code Verification and Validation with Processor-in-the-Loop (PIL) Simulation”.

Quadcopter Controller Examples Using jMAVSim

Embedded Coder Support Package for PX4 Autopilots now provides three new examples that demonstrate the design of flight controller algorithms for an X-configuration quadcopter. These example models use the supported Simulink blocks and include attitude control and position control subsystems. You can also verify the logic using the jMAVSim simulator by specifying the Hardware board as `PX4 Host Target`.

The new examples are:

- “Attitude Control for X-Configuration Quadcopter Using External Input”
- “Position Tracking for X-Configuration Quadcopter”
- “Position Tracking for X-Configuration Quadcopter Using Rate Controller”

GPS block to Read Data from GPS

The Simulink Library Browser now includes a new block, GPS, under the Embedded Coder Support Package for PX4 Autopilots > PX4 Sensor Blocks category. You can use this block to read data from GPS devices connected to the supported hardware boards and use the data in the control algorithms developed using the support package. For more details, see GPS.

Addition of Support Package Capability Topics (April 2020, Version 20.1.1)

A new set of topics is added under “Setup and Configuration” to explain the key capabilities of Embedded Coder Support Package for PX4 Autopilots.

R2019b

Version: 19.2.1

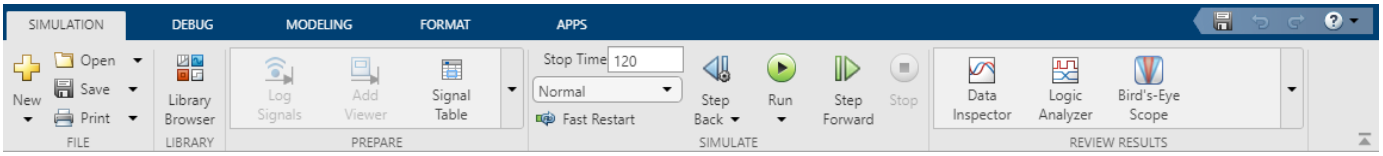
New Features

Official Support for Windows Cygwin Toolchain

Embedded Coder Support Package for PX4 Autopilots now provides the official support to build PX4 firmware using the Windows Cygwin toolchain, directly from the Hardware Setup screens.

Simulink Toolstrip

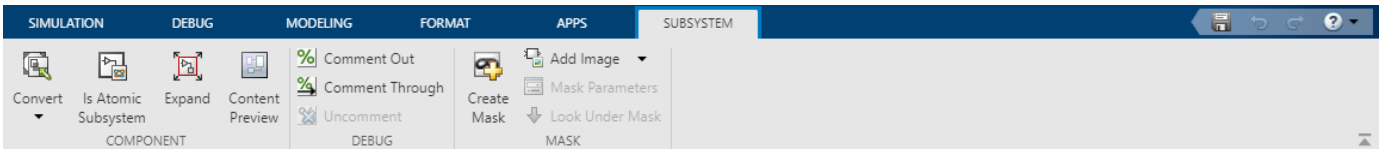
The new Simulink Toolstrip contains components that were previously available in menus and toolbars. To support common user workflow tasks, new tabs called **Simulation**, **Debug**, **Modeling**, **Format**, **Hardware** and **Apps** provide functionality corresponding to each task.



The **Apps** tab provides a gallery of applications from the Simulink family of products. Apps may open a new contextual tab, a separate window, or they may be a shortcut to the configuration parameters.

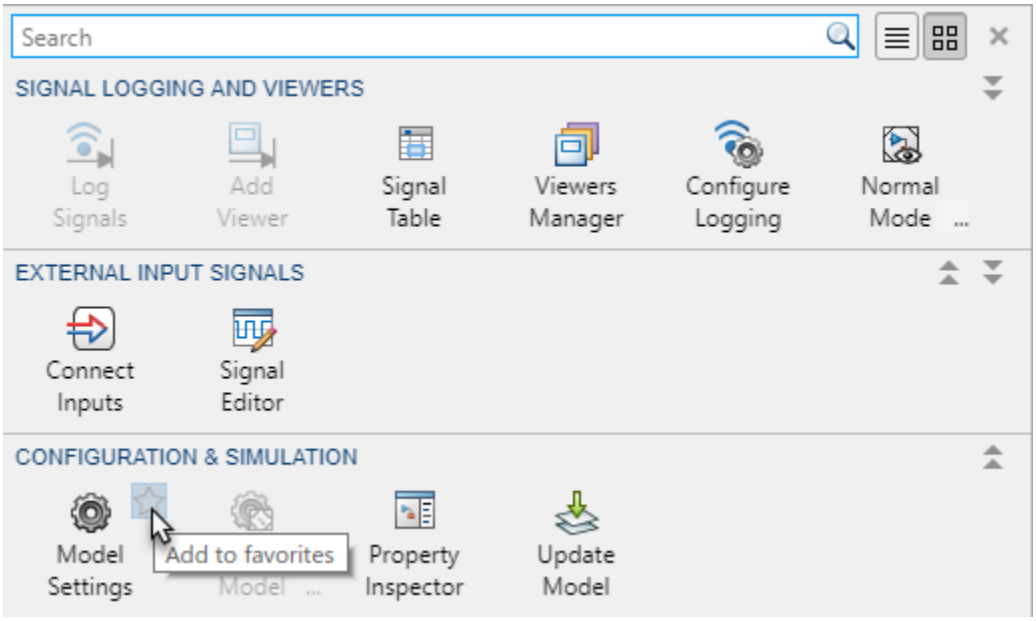
The **Hardware** tab will appear to the left of the **Apps** tab for all models configured to run on hardware.

When you select a model component, a contextual tab activates, displaying the tools to assist you in a step in your workflow. For example, when you select a subsystem block, the **Subsystem** tab appears. If you select a Stateflow® chart, the **State Chart** tab appears. When the block or chart is no longer selected, the contextual tabs disappear.



The quick access toolbar contains frequently used options such as save, undo, and redo.

After opening a gallery, you can mark buttons as favorites. Buttons that are favorites appear at the top of the gallery for quicker access.



You can customize your toolstrip options by adding commands and submenus to a menu bar and context menus for the Simulink® Editor and Stateflow® Editor. See “Add Items to Model Editor Menus”.

Simulink Editor Changes

Mapping from Simulink Editor to the Simulink Toolstrip

The following tables list few of the new Simulink Toolstrip items that are different from the Simulink Editor menu bar items.

Note For details about mapping all the Simulink Editor changes to the new Simulink Toolstrip, see the Simulink Release Notes.

Diagram Menu

Menu Bar Item	Toolstrip Equivalent
Refresh Blocks	**Modeling > Update Model > Refresh Blocks** (Ctrl+K)
Subsystem & Model Reference > Create Subsystem from Selection	Select the blocks to create a subsystem. **Multiple > Create Gallery > Create Subsystem**

Menu Bar Item	Toolstrip Equivalent
Subsystem & Model Reference > Expand Subsystem	Select the subsystem. **Subsystem > Expand** 
Subsystem & Model Reference > Convert to > • **Referenced Model** • **Variant Subsystem**	Select the subsystem. **Subsystem > Convert >** • **Convert to Model Block** • **Convert to Variant**
Subsystem & Model Reference > Model Block Normal Mode Visibility	**Simulation > Prepare Gallery > Normal Mode Visibility**
Subsystem & Model Reference > Refresh Selected Model Block	Select the Model block. **Model Block > Refresh**
Subsystem & Model Reference > Create Protected Model for Selected Model Block	Select the Model block. **Model Block > Protect**
Signal & Ports > • **Signal & Scope Manager** • **Viewers**	**Simulation > Prepare Gallery** apps
Signals & Ports > • **Input Port Signal Properties** • **Output Port Signal Properties**	Right-click block. **Signals & Ports >** • **Input Port Signal Properties** • **Output Port Signal Properties**
Signal & Ports > Signal Hierarchy	Click signal. **Signal > Signal Hierarchy**

Simulation Menu

Menu Bar Item	Toolstrip Equivalent
Update Diagram	**Modeling > Update Model** (Ctrl+D)
Model Configuration Parameters	**Modeling > Model Settings**
Mode > • **Normal** • **Accelerator** • **Rapid Accelerator**	**Simulate >** • **Normal** • **Accelerator** • **Rapid Accelerator**
Mode > • **Software-in-the-Loop (SIL)** • **Processor-in-the-Loop (PIL)**	**Apps > SIL/PIL Manager > SIL/PIL** • SIL/PIL Mode > **Software-in-the-Loop (SIL)** • SIL/PIL Mode > **Processor-in-the-Loop (PIL)**

Menu Bar Item	Toolstrip Equivalent
Mode > External	**Hardware > Monitor & Tune**  The **Hardware** tab will appear to the left of the **Apps** tab for all models configured to run on hardware. To configure your system to be run on hardware, in the **Modeling** tab, click **Model Settings**. In the **Hardware Implementation** pane of the **Configuration Parameters**, choose your hardware board from the dropdown list. Once your hardware board is selected, open the **Target hardware resources** options and under **Groups** choose **External Mode**. In the **Hardware** tab, click **Monitor & Tune** to perform signal monitoring and parameter tuning (earlier referred as *Run in External mode* in the documentation).
Data Display > • **Remove All Value Labels** • **Show Value Label of Selected Port** • **Show Value Labels When Hovering** • **Toggle Value Labels When Clicked** • **Options**	**Debug > Output Values >** • **Remove Value Displays**  • **Show Output Value of selected signal**  • **Options > Show When Hovering** check box • **Toggle Value Displays** • **Options** 
Fast Restart	**Simulation > Fast Restart** 
Step Back	**Simulation > Step Back** 
Run	**Simulation > Run** 
Pacing Options	**Simulation > Run > Simulation Pacing** 
Step Forward	**Simulation > Step Forward** 
Stop	• **Simulation > Stop**  (to stop Normal simulation) • **Hardware > Stop**  (this icon replaces the  icon while the Monitor and Tune action is in progress)

Menu Bar Item	Toolstrip Equivalent
Output > • **Simulation Data Inspector** • **Logic Analyzer** • **Bird's-Eye Scope**	**Simulation > Review Results Gallery >** • **Data Inspector** • **Logic Analyzer** • **Bird's-Eye Scope**
Output > • **Log Selected Signals** • **Log Chart Signals** • **Configure Logging**	**Simulation > Prepare Gallery** • **Log Signals** • In R2019b, the Stateflow Signal Logging dialog box is no longer available. To log multiple signals from your Stateflow chart, see Stateflow documentation. • **Configure Logging**
Stepping Options >	**Simulation > Step Back > Configure simulation stepping** 
Debug > • **Add Conditional Breakpoint** • **Conditional Breakpoints List** • **Debug Model**	**Debug >** • **Add Breakpoint**  • **Breakpoints List**  • **Breakpoints List > Debug Model** 

Code Menu

Menu Bar Item	Toolstrip Equivalent
C/C++ Code > Code Generation Report > • **Open Model Report** • **Open Subsystem Report** • **Options**	These options can be found by using **Embedded Coder**, **Simulink Coder**, or the **AUTOSAR Component Designer**. The path is shown using **Embedded Coder**. For **Simulink Coder** or **AUTOSAR Component Designer**, select those apps from the **Apps** gallery. **Apps > Embedded Coder > C Code >** • **View Code**  • **Open Latest Report**  • **Open Latest Report > Report Options** 

Menu Bar Item	Toolstrip Equivalent
C/C++ Code > • **Embedded Coder Quick Start** • **Code Generation Advisor** • **Code Generation Options** • **Configure Model in Code Perspective** • **Embedded Coder Dictionary** • **Navigate to C/C++ Code**	These options can be found by using **Embedded Coder**, **Simulink Coder**, or the **AUTOSAR Component Designer**. The path is shown using **Embedded Coder**. For **Simulink Coder** or **AUTOSAR Component Designer**, select those apps from the **Apps** gallery. **Apps > Embedded Coder > C Code >** • **Quick Start** • **C/C++ Code Advisor**  • **Settings > Code Generation Settings** • **Settings > Code Perspective Help** check box • **Settings > Embedded Coder Dictionary**  (**Embedded Coder** only) • **View Code** 
C/C++ Code > Deploy to Hardware	**Hardware > Build, Deploy & Start** 
C/C++ Code > Build Selected Subsystem	Right-click the subsystem. **C/C++ Code > Build This Subsystem**
C/C++ Code > • **Export Functions** • **Generate S-Function**	Right-click the function or S-function. **C/C++ Code >** • **Export Functions** • **Generate S-Function**
External Mode Control Panel	**Hardware > Prepare Gallery > Control Panel**

Tools Menu

Menu Bar Item	Toolstrip Equivalent
Library Browser	**Simulation > Library Browser** 
Model Explorer	**Modeling > Design Gallery > Model Explorer**
Report Generator	**Apps > Report Generator**
Simulink Real-Time	**Apps > Simulink Real-Time**
Run on Target Hardware > • **Prepare to Run** • **Install/Update Support Package**	**Apps >** • **Run on Hardware Board** • **Get Hardware Support Packages**

Menu Bar Item	Toolstrip Equivalent
Help	Use the quick access toolbar 

R2019a

Version: 19.1.3

New Features

Embedded Coder Support Package for PX4 Autopilots: Generate, build, and deploy Simulink models on Pixhawk Series Controllers

The Embedded Coder Support Package for PX4 Autopilots is available from release R2019a onwards. You can use the support package to generate, build, and deploy Simulink models for PX4 Autopilots on Pixhawk® Series controllers.

Additional Topics that Describe PX4 Workflow and Troubleshooting (April 2019, Version 19.1.1)

The “Run on Target Hardware” category page is updated to include additional help topics that describe the workflow and troubleshooting steps when you work with Embedded Coder Support Package for PX4 Autopilots.

Cygwin Batch Script Update (May 2019, Version 19.1.2)

The workflow to build PX4 firmware using the Windows Cygwin toolchain errored. The batch script that helps build PX4 firmware has been updated to resolve the issue.

PX4 PWM Output Block Update (May 2019, Version 19.1.2)

If you used PX4 PWM Output block to send pulses to the AUX channels of the Pixhawk flight controller, the PWM ON-time values of the pulse waveform showed a sporadic behavior (particularly at higher frequencies). This issue is now resolved.

PX4 uORB Read Block Update (August 2019, Version 19.1.3)

If you set the Sample time of PX4 uORB Read block to `-1`, the block did not inherit the sample time properly during compilation. This issue is now resolved.