

ArduPilot Mission Planner Simulation Notes

ArduPilot Link <https://ardupilot.org/ardupilot/>

ArduPilot Mission Planner Home Page Link <https://ardupilot.org/planner/index.html>

Down Load Link <https://firmware.ardupilot.org/Tools/MissionPlanner/MissionPlanner-latest.msi>

Installation Link <https://ardupilot.org/planner/docs/mission-planner-installation.html>

Success with ArduPilot requires that the 'First Time Setup' and 'First Flight/Drive and Tuning' sections of the vehicle's documentation be read and followed!

Mission Planner Menu Tabs

DATA, PLAN, SETUP, CONFIG, SIMULATION, HELP

ArduPilot Mission Planner Simulation Instructions Video Tutorial (24 minutes Mike Holden)

The Autonomous Sailboat Simulation uses Mission Planner and SITL to simulate a ArduPilot sailboat.

<https://www.youtube.com/watch?v=kzGciG7cCBc>

Mission Planner Instructional Guide

Open ArduPilot and wait for drivers and other files to load.

Menu Tab = **SIMULATION**

Sim Speed (Drop Down List) = As Required

Model (Drop Down List) = *Sailboat*

Click on *Rover* - Select *Stable*

Menu Tab = **PLAN**

1. Set (Drag & Drop) Home Location as required by dragging **H** icon
MVMYC Latitude 39.70, Longitude 84.26, Elevation 720 feet / 220 meters

2. Add Way Points (Drag & Drop) or see Table below and manually add a Way Point.
Close Loop & Set Repeat Functions

Close Loop by Selecting DO_JUMP = Way Point # = **1**
Set Repeat Cycles Delay = **-1**

	Command	P1	P2	P3	P4	Lat	Lon
▷ 1	WAYPOINT	0	0	0	0	39.6964186	-84.2594383
2	WAYPOINT	0	0	0	0	39.6964124	-84.2607231
3	WAYPOINT	0	0	0	0	39.6960016	-84.2604201
4	WAYPOINT	0	0	0	0	39.6961771	-84.2600727
5	WAYPOINT	0	0	0	0	39.6960254	-84.2594625
6	WAYPOINT	0	0	0	0	39.6963195	-84.2591903
7	WAYPOINT	0	0	0	0	39.6963639	-84.2595644
8	WAYPOINT	0	0	0	0	39.6965342	-84.2595296
9	DO_JUMP	1	-1	0	0	39.6964609	-84.2592868

Right Hand Side Buttons

Load File or Save File (as appropriate)

Read or Write Parameters to Boat (as appropriate)

Menu Tab = **CONFIG**

1. Set Distance Units (feet) Speed Units, Altitude Units.

Note: As best as I can discern, only Wind, Ground & Air Speed are expressible in fps or mph.
All other distance/velocity units are in meters only !!!!! - Need to Verify

Metric Approximations

1 mph = 1.5 fps = 0.45 mps
10 mph = 14.7 fps = 4.5 mps
1 mps = 3.3 fps = 2.2 mph
4 mps = 13.1 fps = 9.0 mph

2. Set Wind Direction and Speed

Use Search Box on Right **Sim_Wind_Dir** & **Sim_Wnd_Spd**
270 @ 5 mps (5 mps = 11 mph = 16 fps)

Change Speed & Direction to see how upwind tacking is affected.

3. Set Cross Track Error = 5 (minimum value)

Use Search Box on Right **Sail_XTrack_Max**

Minimum Value = 5 meters = 16 feet

Experiment with different values to see how upwind tacking is affected.

Note: Mission Planner creates two User Files in addition to the modified parameter file (.param)

(C:\Program Files (x86)\Mission Planner\MVMYC.waypoints)

(C:\Program Files (x86)\Mission Planner\poi.txt)

(C:\Program Files (x86)\Mission Planner\DMK_ArduParameters.param)

Menu Tab = **SIMULATION**

Choose Model = Sailboat

Select Firmware = **Rover**

Wait for EKF icon to turn green and "DISARMED" icon to appear. (**Data** Menu Tab)

Menu Tab = **PLAN**

Save File to directory (C:\Program Files (x86)\Mission Planner\MVMYC.waypoints)

Write File to boat

Menu Tab = **DATA**

Click Action Tab **ARMED**

Click Action Tab **AUTO** to start simulation

Notes:

ArduPilot Mission Planner Simulation incorporates Google Map and includes two user generated files:

Way Points

Launch Point Green Circle with "H"

Way Points Green Circle with Numbers

Way Points are ArduPilot way points NOT race course buoys.

1 mph = 1.5 fps

Note: On upwind leg, boat will tack when it reaches maximum Cross_Track_Error.

The minimum value for Cross_Track_Error is 5 meters (16 feet).

Simulation Traces

The purple trace is the boat track.

It automatically erases after a given length of time, hence the multiple screenshots.

Orientation Lines emanating from bow of the sailboat avatar:

Red = Current Heading

Orange = Direction to Way Point

Black = GPS Track

Green = Target Heading (not applicable)

Set Simulation & Boat Parameters (see video approximately 5:00 minutes)

Set Cross Track Error = 5 meters (video 12:30 minutes)

Set Wind Direction and Speed (video 14:30 minutes)

Modify Displays (video 16:00 minutes)

Fences Info (video 17:00 minutes)

Comments & Questions

How do we upload the ArduPilot Mission Plan data to the flight controller hardware?

How do we switch back and forth between manual joystick control and programmed "autonomous control"?

Regarding ArduPilot Mission Planner Rover Sailboat

1. It seems that in order to execute the simulation, a current version of the Rover firmware must be downloaded from the Internet and upload to the computer each time.
2. Can't find a method to stop and restart a simulation without closing and reopening Mission Planner. This seems to a common complaint. <https://discuss.ardupilot.org/t/how-to-stop-a-simulation/107581>
3. If *Full List Parameters* (Menu Tab **CONFIG**) is not visible
Menu Tab **CONFIG**
 - *Layout* Drop Down List
 - Select *Advanced*

See - <https://discuss.ardupilot.org/t/missing-full-parameter-list-running-auduplane-4-4-1-on-mavik405vtol/106393/2>