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Autonomous Unmanned Vehicle Workbench (AUVW) Student Guide

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Intro

The role of the workbench is to design and rehearse missions for unmanned air, ground, surface, or underwater vehicles and then run the virtual missions. By doing this the operator hopes to gain information about how to run the mission in the real world with more success.

Background

This installer guide will be written with assumption that the user is using a Windows operating system, Linux or Mac OS. For users with different operating systems the guide will still apply but the user should note that some of the instructions may be different. The role of the workbench is to design and rehearse missions for unmanned air, ground, surface, or underwater vehicles and then run the virtual missions.

By testing a mission on AUV Workbench, one can discover and fix potential flaws in a vehicle's design before disaster strikes - such as the vehicle crashing into the ground because the motors were not straight. Additionally, if an operator is willing to ignore the tether on a Remotely Operated Vehicle (ROV), the AUV Workbench can be adapted to testing ROV missions.

This guide will show how one can test any ROV. As a demonstration a user can use the Beetle built by the Monterey High School ROV Club, and the Ojo Del Mar (Eye Of The Sea) built by the Hartnell College Rockets and Robotics Club as examples. These ROVs were used in the Marine Advanced Technology Education Center (MATE) ROV competition.

Installing AUV Workbench

Installing the AUV Workbench software is surprisingly easy. It can be either downloaded from the internet or from a CD-ROM. You will need user permission to install software on your computer. On Windows, this means you should be logged into an Administrator account. A prerequisite program for the AUV Workbench is the Java Developers Kit (JDK) and can be downloaded for free at http://www.oracle.com.

From the web:

1. Go to https://savage.nps.edu/AuvWorkbench on your web browser
2. Click on Auto-install software
3. pen the installer (the default program it opens with is Java(TM) Platform SE binary)
4. After the installing software has been downloaded, follow the instructions that appear on screen to download AUV Workbench

Note: Some Times AUV Workbench does not install the 3D Scene View. You might have to install it manually from the website. http://www.web3d.org/x3d/content/help.html
https://savage.nps.edu/Savage/X3dExamplesSavageAuvWorkbenchExcerpt.zip
https://savage.nps.edu/X3dExmaplesSavage.zip

From the CD-ROM:

1. Make a directory for AUV Workbench
2. Copy files into directory

AUV Workbench Linux Install Instructions for Ubuntu

1. Download installer jar from CD or Online
2. Open command line (from Ubuntu, Applications → Accessories → Terminal)
3. Go to the directory were AUV Workbench Installer was saved using the command: (and pressing enter)
    - cd [PATH_TO_FOLDER_WHERE_INSTALLER_IS]
    - Example: if Installer is in [/home/user/Download/AuvWorkbenchinstaller.jar]type cd/home/user/Downloads. If there are spaces, quote the path example :cd "/home/user one/Download"
4. Type: java -jar AuvWorkbenchInstaller.jar
5. Follow the instructions in popup to install
6. Once installed, to run AUV Workbench go to the directory where AUV Workbench was installed in Terminal (similarly as in steps 3) and type ./run.sh and press enter

For more detail explanation visit how to install AUV Workbench https://savage.nps.edu/AuvWorkbench

Uninstalling AUV Workbench

If the version of AUV Workbench installed on your computer is outdated it may have problems updating. If this is the case you may need to uninstall the software from your computer and then reinstall it (see above directions). Because of security settings on your computer, be sure that you are logged into an Administrator account before attempting to delete programs.

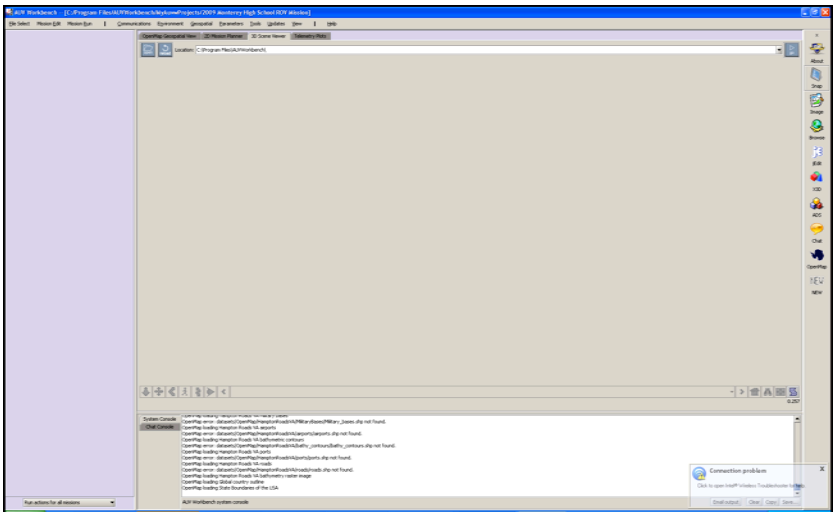
1. Select the My Computer or Control Panel icon from the desktop or Start menu
2. Select Add or Remove Programs
3. Select the program entitled AUV Workbench and click Remove.

Depending on where the program was placed during installation, AUV Workbench may not be in this menu. If this is the case, the program can be deleted in a different way.

1. From the My Computer menu, select the Local Disk (C:) Hard Disk Drive
2. Click on the folder entitled Program Files
3. Select the folder entitled AUV Workbench
4. Select Delete this Folder from the File and Folder Tasks window

Beginning Your AUV Workbench project

Open up the AUV Workbench program and you should see this screen.



To begin go to File Select (top left corner of the menu bar), select New project, then Empty Project Directory. Entitle your new mission, example Monterey Peninsula College Pool ROV Mission Directory. The AUV Workbench will give you the option of adding missions to your project directory; however, since the point of the guide is to show you how to build your own mission you should disregard this click Cancel. Since you have started a new project your screen should look like this

Building An Agenda Mission

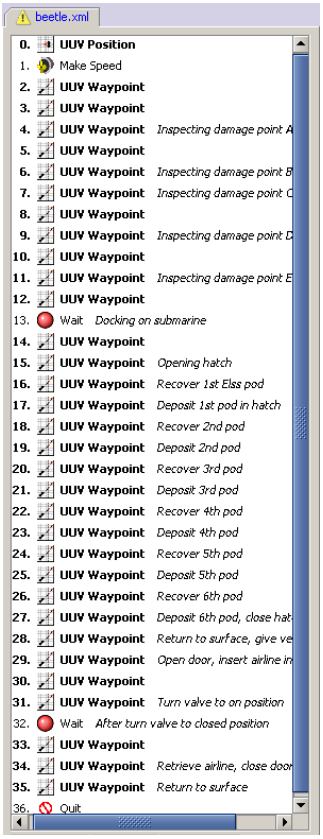
In addition to dictating where your vehicle should go during the mission, the AUV Workbench also gives the option of giving your vehicle a goal to accomplish, such as illuminating or searching an area. These are called agenda missions and can be started by choosing Agenda Missions from New Mission File. You can move the launch and recovery points by selecting X and Y coordinates (you are not allowed to drag points when building agenda missions) and add goal or avoid areas. Avoid areas are areas where your vehicle is prohibited from entering; these can be added to the mission by right-clicking on the Selected Mission window and selecting Add Avoid Area. This will bring up the Avoid Area window that will allow you to change the size and shape of the area. You may also select Add Goal which will bring up the Agenda Goal window. This will allow you to select the goal you want the vehicle to accomplish, the timeframe for attempting the goal, the goal area size and shape, and the order of which the goals are to by attempted. When you start running the mission the vehicle will try to create the best route that will allow the vehicle to accomplish all goals.

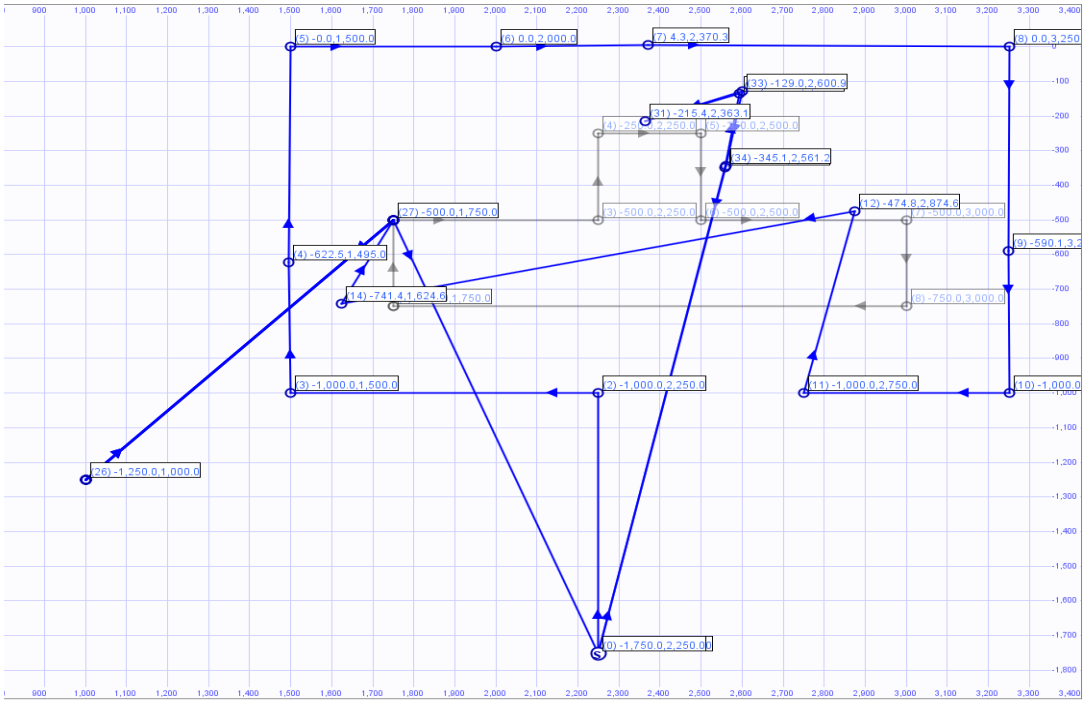
Building Your Mission

To open up a new, or the first, mission file go back to File Select and down to New Mission File. The Workbench gives you the choice of a variety of mission types (air, ground, surface, underwater, agenda, and munition) but since our example mission is an ROV mission you should select an the underwater mission (UUV Script Mission). Name your mission and remember to put .xml afterwards or the mission will not open or save properly. For this example the mission will be entitled beetle.xml. To start planning your ROV mission click on the tab (found underneath the menu bar) entitled 2D Mission Planner. The start point for your mission will be located at the Workbench Geographic Origin (at 0, 0) but you can move your start location- just click on the circle with an S inside and drag it to wherever you want on the grid. For this example the mission start point will be at the center bottom of the page where, in the real would, the pool deck would be. In the Project Directory (the window on the left hand side) there will be three commands listed: UUV Position, Make Speed, and Quit. Right-click on Make Speed, select Edit Selected Command and choose how fast you want your vehicle to travel. After you choose a speed, right-click on Make Speed again and select Insert New Command After Selection. In order to make your vehicle move, click on Closed-loop Commands and then Waypoint UUV. In the window that appears select the X and Y coordinates you want your vehicle to travel to. You may also leave the default coordinates (0, 0), click Select, and then drag the point to the desired location. Continue with this process until you have built a complete mission. When you have it should look something like this.

The mission highlighted in blue is the ROV mission. The gray shape in the middle represents the submarine the ROV is supposed to by rescuing. It is not necessary to have the submarine there but this example is pretty much pointless without it.

The Selected Mission window on the left hand side of the screen will also display information about your ROV mission.





Rehearsing The Mission

After you have created your ROV Mission, click Start at the very bottom of the Selected Mission window. Doing so will result in a circle with an X through it to appear on your screen. That circle represents your ROV and you can watch it complete the mission.

Examples of ROV

https://savage.nps.edu/Savage/Robots/RemotelyOperatedVehicles/index.html

Examples of Pool Missions

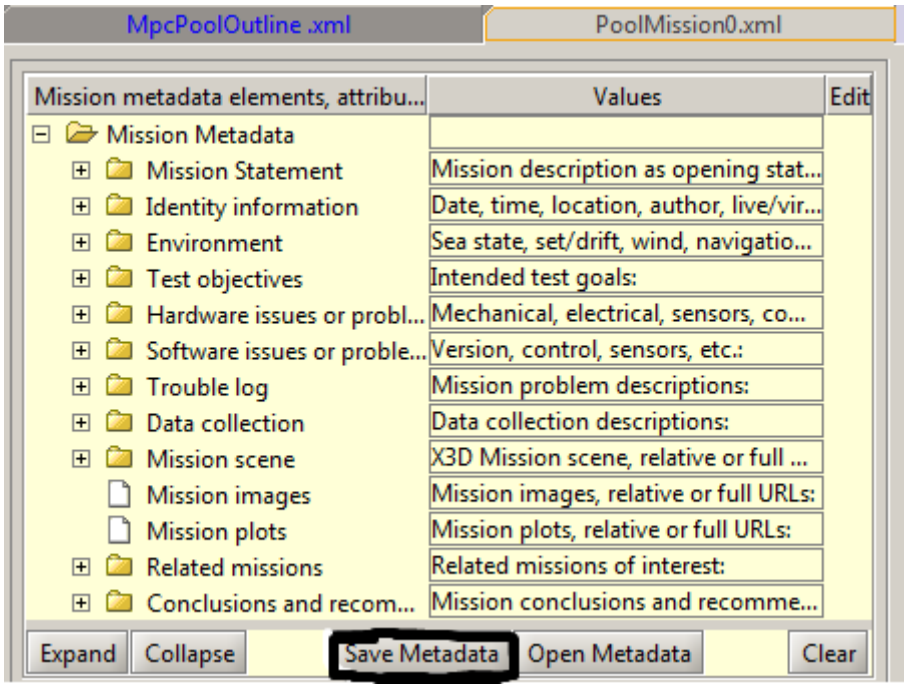
How to add a location pool to AUV Workbench

1. Open the mission file at MyAuvwProjects/MontereyPeninsulaCollegePoolRovMissions /missions/MpcPoolOutline (File Select → Open Mission File; **Note** You May have to go up a few directories to get to MyAuvwProjects)
    - Click yes when asked whether to copy file to project directory
2. Open mission(s) file in missions directory
3. Select MPC Pool as Geographic Origin (Geospatial → Select Geographic Origin → Monterey Peninsula College Pool, Monterey → select)

Working with AUV Workbench

Here are some handy tips to working with AUV Workbench .

- If you are trying to create a specific mission on AUV Workbench it is incredibly helpful to sketch it out on paper first.
- When the 2D Mission Planner is up, right-clicking on the grid will give you the ability to zoom in or out, change grid options, or change the grid colors.
- Clicking on the mission tab at the top of the Selected Mission window will change how the mission is displayed.
- You can change your mission on the OpenMap Geospatial View but it causes weird things to happen in the 2D Mission Planner. Avoid doing so if at all possible.
- Clicking the 3D Scene Viewer tab is somewhat pointless because the feature does not currently work.
- Clicking on the Telemetry Plots tab after running a mission will enable you to review you ROV's performance. Most of the plots require an understanding of physics or engineering to make sense.
- When adding a command the window that pops up allows you to add a description. The description will show on the Selected Mission window.
- Clicking on Snap on the right menu bar will enable you to take a snapshot of the AUV Workbench screen, clicking on jEdit will allow you to take notes on your project, clicking on Image will open Paint, and clicking on Browse will take you to the internet.
- Selecting Mission Run (on the top menu bar) and then Select UUV model will allow you to change what vehicle runs your mission.
- You can have multiple missions up in one project; just go to New or Open Mission File. Multiple missions may also be run simultaneously by selecting Run Actions For All Missions at the very bottom of the Selected Mission Window.
- Right-clicking on the Mission Selected window will open up the same window as clicking on Mission Edit on the top Menu bar.
- After mission is completed you can create a mission report. By going to Mission Run Tab, and selection Mission Report Generation Panel. Select the mission that you previously run, and you will get a mission report open into an internet browser.
- Note when editing mission meta data there are two different save buttons. The correct button is the one underneath the Metadata window.



TODO

Here is a list of things TO DO to make the workbench better.

- Get a better entry screen after initial installation to better prompt the user what to do next.
- Be able to move the 2D grid and OpenMap view around better.
- Show steps on how to introduce your mission agenda to the right Geospatial view coordinates.
- The vehicles do not follow the path directly and this makes sense because of currents and such, what is confusing is that different vehicles go of path in the same pattern. The physics models may need work.
- Be nice to be able to drag the entire mission, especially on the map.
- If there is a way to view two or more telemetry plots side by side it would be quite nice alternative to clicking between them.
- In the map if two points are overlaid the curser grabs both, when you grab a point on mission 1 a point (the start point) from mission 2 follows, clicking and dragging on the map brings points to it.
- What is the Geospatial offset option? It doesn't seem to offset the mission selected.

Agenda Missions

- Have the Agenda Goal windows make sense. When building a script mission the user can guess how to build the mission and be okay at it. The agenda missions are not really intuitive at all and hard to create if the user isn't sure about the procedure. It would be helpful if the window was explained in the Help section or if the little pop-up explanations would be added.
- Can't seem to rearrange or delete goals in the Selected Mission window.
- When goal is given a time value an error occurs.
- Some of the different goals do not work.
- Be nice to click and drag the goal and avoid areas.