Building Cases for Use in MissionLab's CBR Wizard

Background

This document details the procedure that must be undertaken for creating new cases for use by MissionLab's Case Based Reasoning (CBR) wizard. MissionLab is a mission specification system in which users can create mission plans for multi-robot teams. MissionLab is comprised two primary components: CfgEdit and Mlab. CfgEdit is MissionLab's mission creation system. Mlab is MissionLab's mission simulation environment.

MissionLab also includes a case based reasoning system to simplify the process of mission development. This component stores missions as cases within its case library. Cases are initially created and stored by individuals with expertise in mission design. Once these cases have been stored, they can later be retrieved for execution or modification by a user.

Software Setup

It is assumed that the MissionLab toolkit has already been installed. If it has not, please refer to the installation documentation before continuing.

In order to create cases for use by MissionLab, two pieces of software are required: cbrserver and CfgEdit.

Steps:

1) Change to the desired working directory.
   Use: '*mlabhome*/demos/minos-demos' if unsure. '*mlabhome*' is the directory in which MissionLab was installed.
   Note: The working directory should contain the overlay appropriate for the mission area where the mission will take place. In addition, if using a previously created case library, the library should also be in the working directory
2) Start the case-based mission server 'cbrserver' by executing either:
   a) 'cbrserver' to start a new case library
   b) or 'cbrserver –l mylibraryname.cbl' to use an existing case library
3) Start CfgEdit, the graphical mission editor, by executing
   a) 'cfgedit'

Case Creation Overview

The creation of a case is a three step process. The expert first assembles a mission using the CfgEdit software. The expert then tests the mission in simulation. Finally, if the mission is correct, the expert saves the mission as a case. If the mission is not correct, then the expert modifies the mission and retests it in simulation until he or she is satisfies. Figure 1 depicts this process in a diagram.

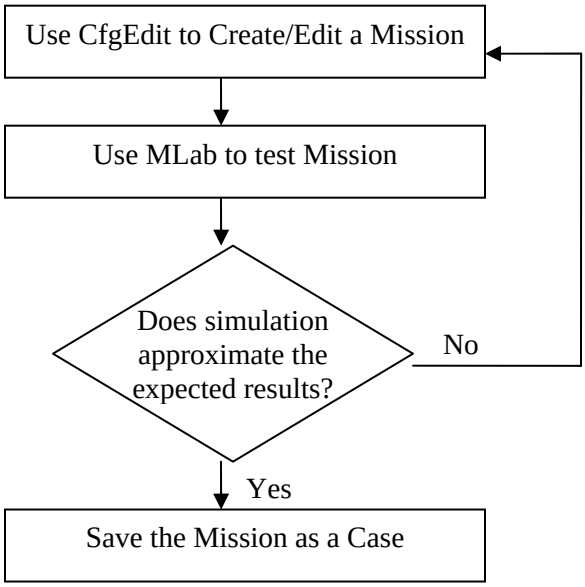
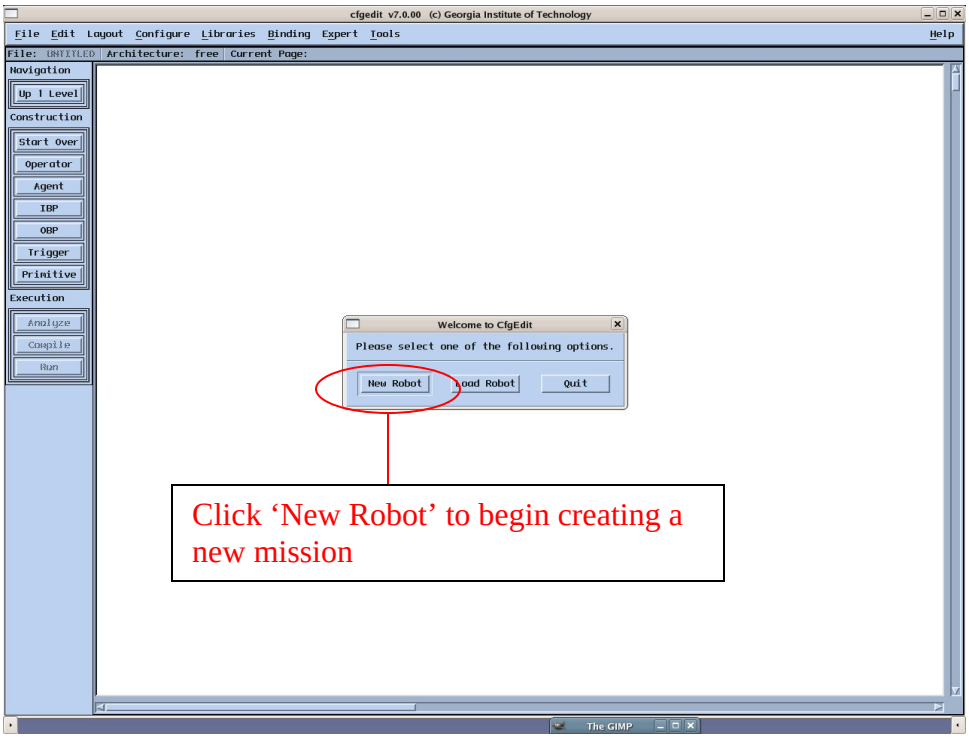


Figure 1. A top-level diagram of the case creating process.

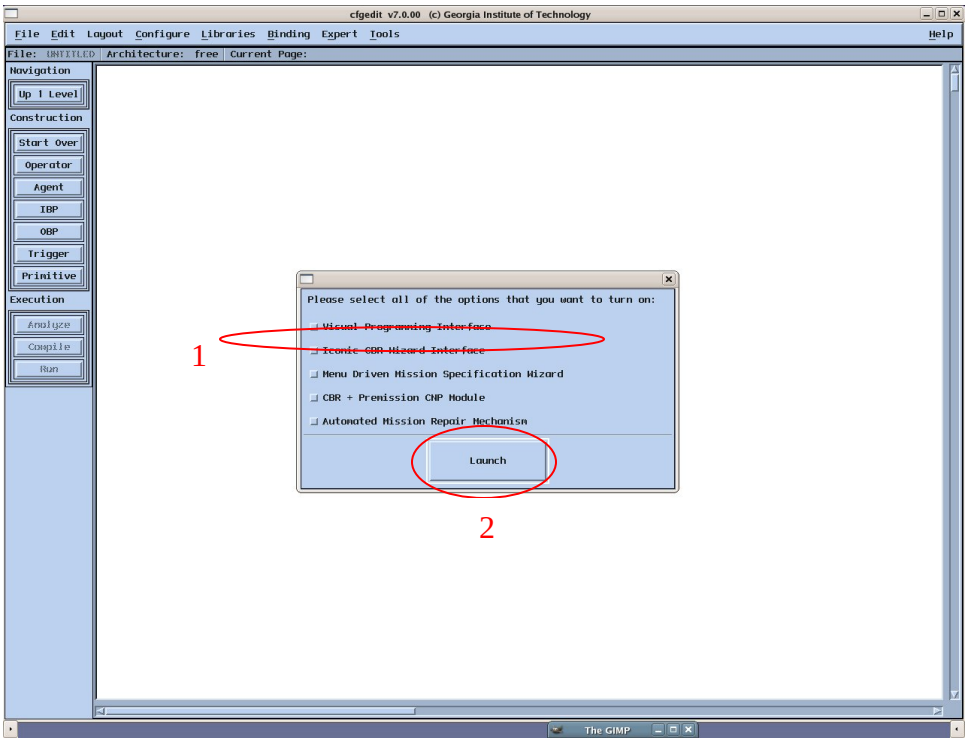
Case Creation

Starting the system:

1. If not already started, run the cfgedit program by executing ‘cfgedit’. The start screen should appear.

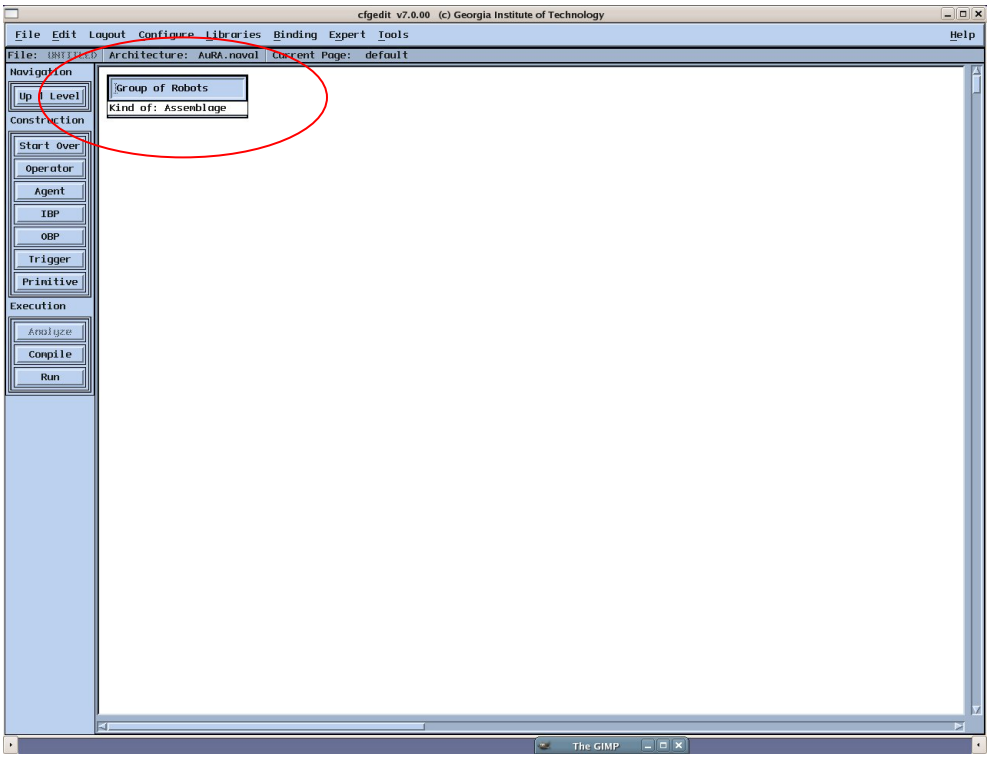


2. In the dialog box titled "Welcome to CfgEdit" left click on the 'New Robot' button.



3. Launch the visual programming interface by selecting the 'Visual Programming Interface' check box (1) and then clicking on the 'Launch' button (2).

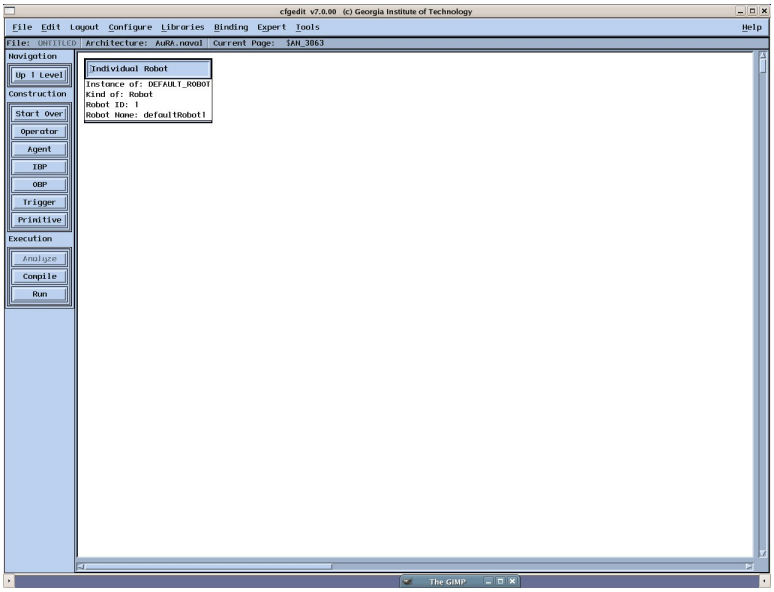
4. In the white workspace area, note the box titled “Group of Robots”. Using the middle mouse button, click the area titled “Kind of: Assemblage.”



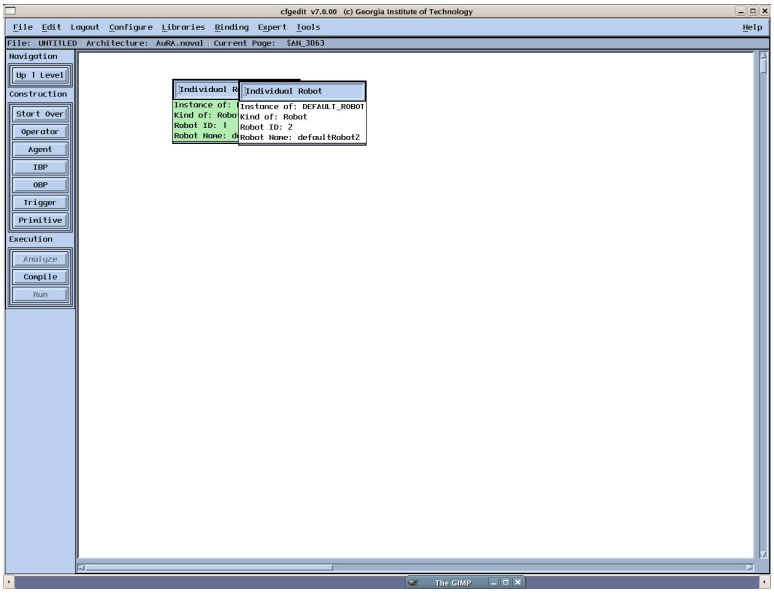
5. A screen listing all the robots in the mission will be shown. Missions default to one robot. If additional robots are desired for the mission, they can be added here.

Adding Additional Robots

6. To add additional robots highlight a robot dialog by left clicking on it and then select Duplicate from the edit menu. (Or press Control-D).
7. NOTE: The new robot will often appear under the existing robot and can be seen by moving the robot dialogs within the workspace.



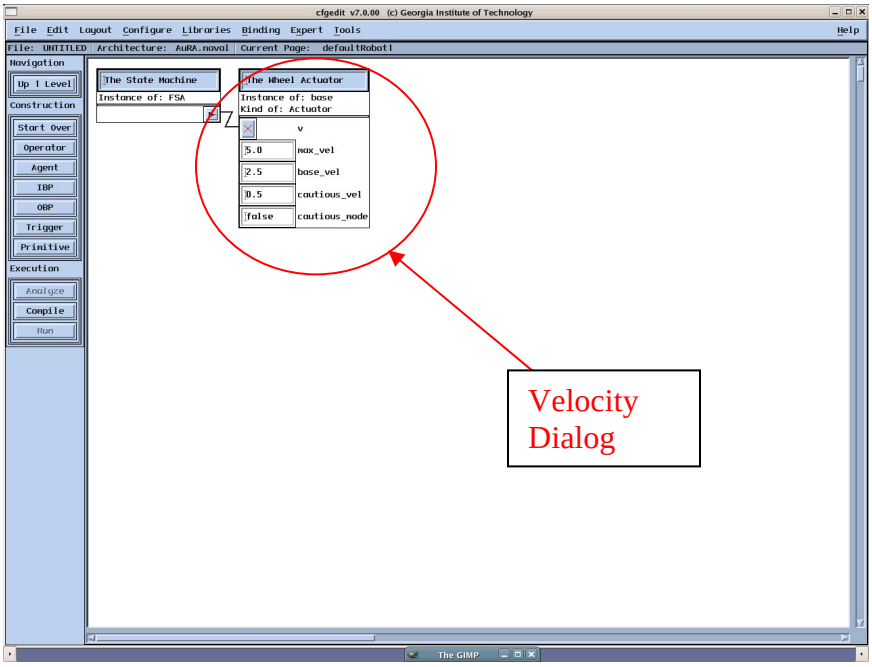
Single Robot



Two Robots

Building a mission for a robot

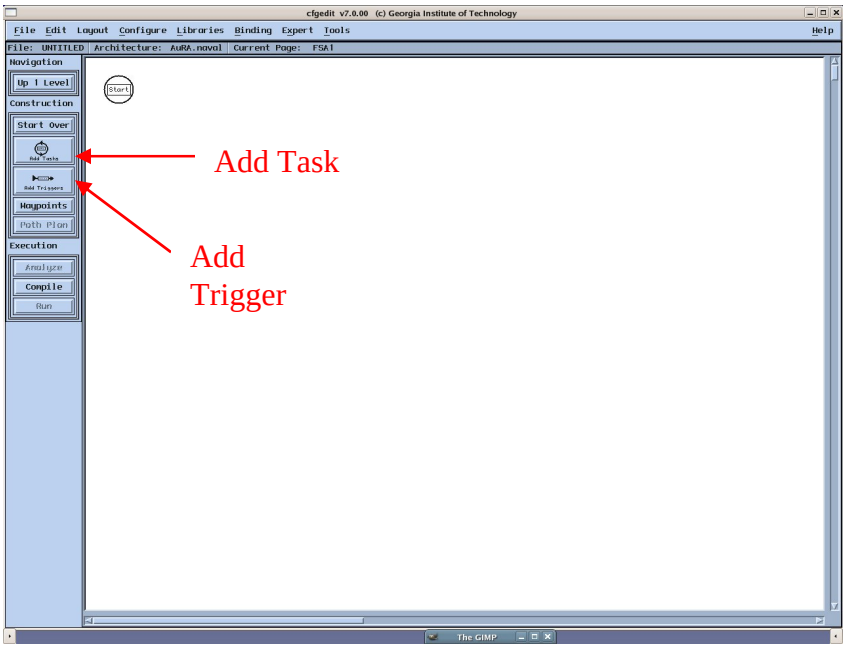
8. Left click the robot that you want to begin the mission creation process with. It should again turn green
9. Center click the highlighted robot. You should now see two boxes connected by a black line. The left most box is titled “The state machine” and the rightmost is titled “The wheel actuator”



Adjusting robot velocities

10. The speed of the robot can set using the wheel actuator dialog. To set the speed, type in the maximum speed in the max_vel entry and press enter. Type in the normal operating speed in the base_vel entry and press enter. NOTE: The velocity of the vehicles will not be changed if enter is not pressed after modification.

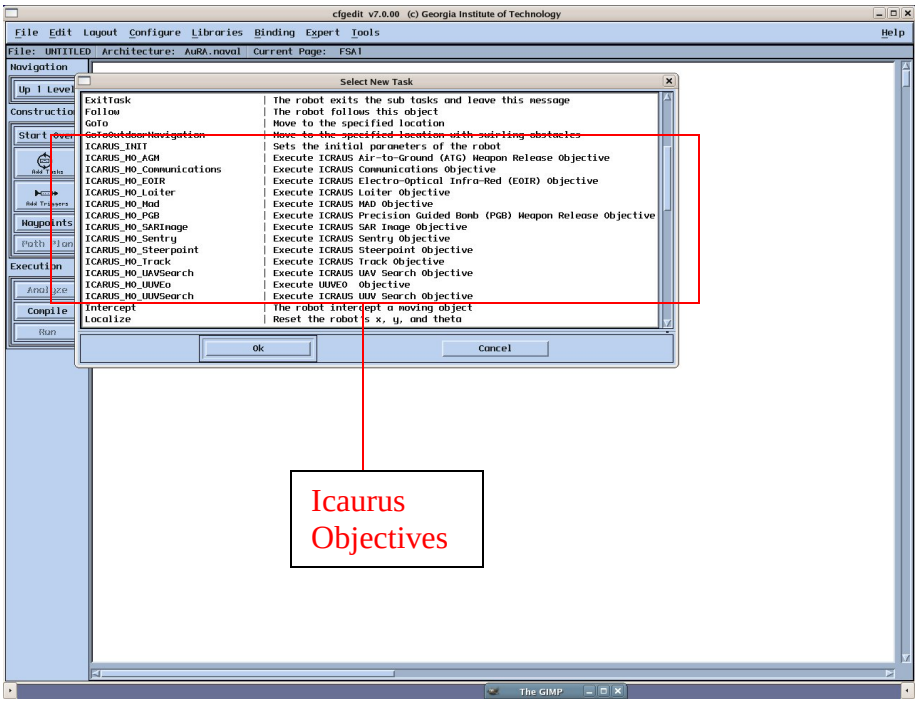
11. To begin the mission specification for this robot, center click the box titled “The state machine.” A new screen should appear with a single circle in the top left area with the word “start” at its center. This circle and other circles represent objectives. In other words these circles are the actions the robot will take as it performs its mission. The start objective does not do anything other than denoting the entry point into the mission plan.



Adding and changing objectives

12. Locate the button on the left hand side titled “Add Task.” It is located below the “Start Over” button. Left click this button.
13. Your cursor has now become a rectangle. Left click somewhere in the white space. A behavior titled “Stop” should appear.

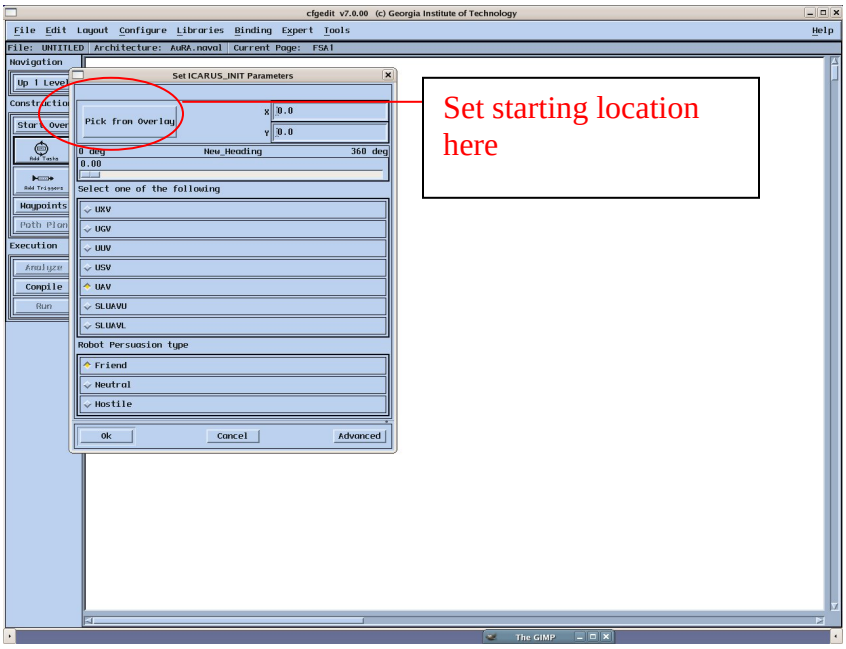
14. Right click the stop behavior. A dialog titled “Select new task” should appear.



15. Scroll down until all of the objectives prefixed ICARUS_* are in view. The ICARUS_MO type of behaviors represent objectives capable of being sent to the ICARUS/GIG system. These objectives are the only ones that will be used in the cases to be created.

Setting Initial Robot Parameters

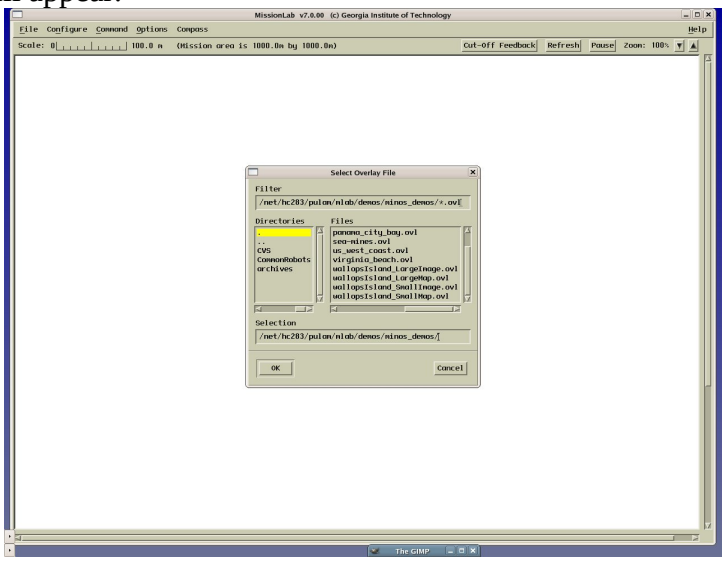
16. The first objective should always be ICARUS_Init. Select ICARUS_Init from the 'Select New Task' window.



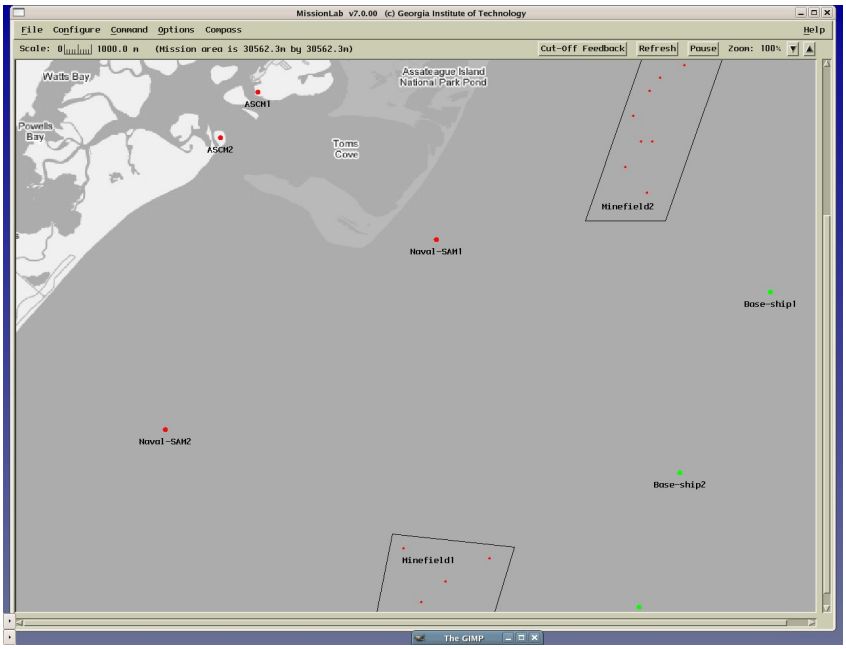
17. Often it is necessary to alter an objective's parameters. To do this, middle click the objective. A dialog title "Set ICARUS_Init Parameters" should appear.
18. Using this dialog, various parameters can be set for the robot. These include the robot type, and starting location.

Selecting objective locations using an overlay

19. To set the starting location, left click on select from overlay. An overlay selection dialog will appear.



20. Select the appropriate overlay from the dialog and left click ok.

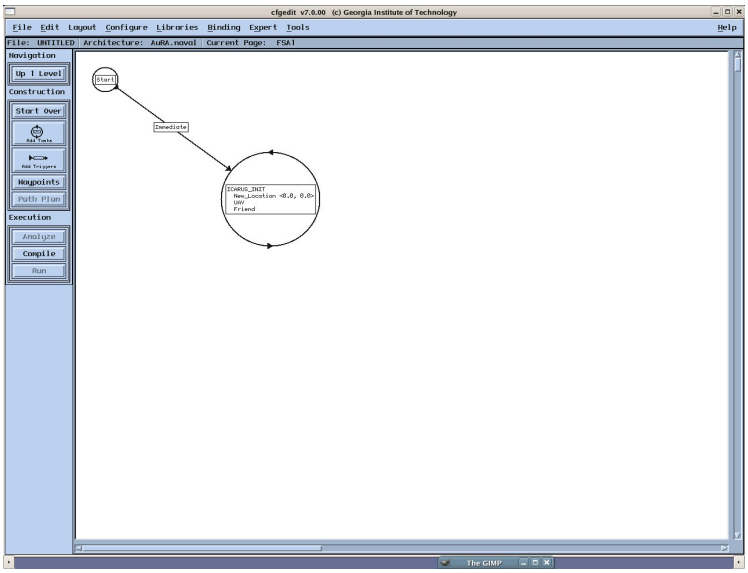


21. To select a location simply left click on the desired location on the map.
22. Once this is done, the display will return back to the parameter modification screen.

23. Click ‘OK’ once parameter modification is complete.

Connecting Objectives

24. Connect the ICARUS_INIT behavior with the start behavior by clicking on ‘New Trigger’ button on the left side of the screen and then clicking and dragging between the start and ICARUS_Init objective. This arrow should be labeled immediate which means control follows this arrow immediately when the originating objective is reached.



Adding Additional Objectives

25. To add an additional objective left click on the new task button and then left click any location in the workspace. Change the objective by right clicking on the newly placed objective.
26. For example, select the ICARUS_MO_STEERPOINT from the Select New Task window and click ok.

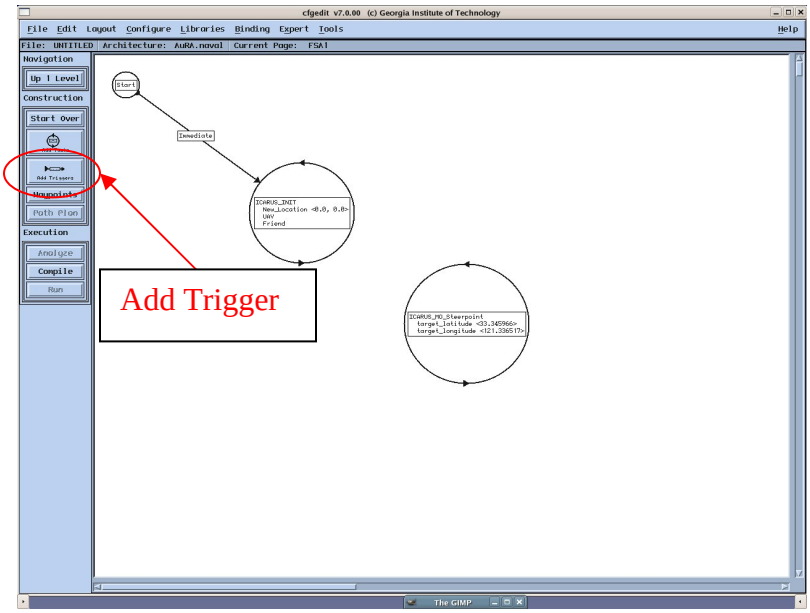
Altering an objective’s parameters:

27. Often it is necessary to alter an objective’s parameters. To do this, center click the objective. A dialog title “Set ICARUS_MO_STEERPOINT Parameters” should appear.
28. To view all of the objective’s parameters click advanced. All of the parameters should appear.
29. The location of the objective can be entered manually or by selecting ‘Select from Overlay’ as described previously in the section labeled:. **Selecting objective locations using an overlay**.

30. Once completed, click ok to set the objective's new parameters.

Organizing Objectives

31. Objectives can be rearranged by clicking on them and holding the left mouse button down.
32. Then dragging the objective to a new location.



Adding Additional Triggers:

33. Triggers are perceptual information that allows a robot to transition from one objective to the next. Triggers must connect each objective to the next. Locate the button on the left hand side titled "Add Triggers." It is located below the "Start Over" button. Left click this button.
34. Your cursor has now become an arrow. Hold the left mouse button down and drag the cursor from the ICARUS_Init objective to the ICARUS_MO_Steerpoint objective. An arrow titled "Immediate" should connect the two Steerpoint objectives.
35. Right click the "Immediate" part of the arrow. A dialog titled "Select new trigger" should appear.
36. The ICARUS_Objective_Completed trigger is located towards the bottom of the dialog. This trigger will be used to connect all objectives to other objectives.
37. Left click ICARUS_Objective_Completed. The line containing this objective should turn yellow.
38. Click ok. Notice that the Immediate trigger has become a ICARUS_Objective_Completed trigger. Additional triggers are added to the mission by repeating steps 12 thru 17. Add a trigger connecting the start behavior to the first Steerpoint objective. This trigger should remain as Immediate.

39. The robot can transition to a previously executed objective (for continuous patrol of two steerpoints for example) by placing a trigger from one objective to a previous objective.

40. The steps described above for adding objectives and connecting them can be repeated until the desired mission plan for that robot is completed.

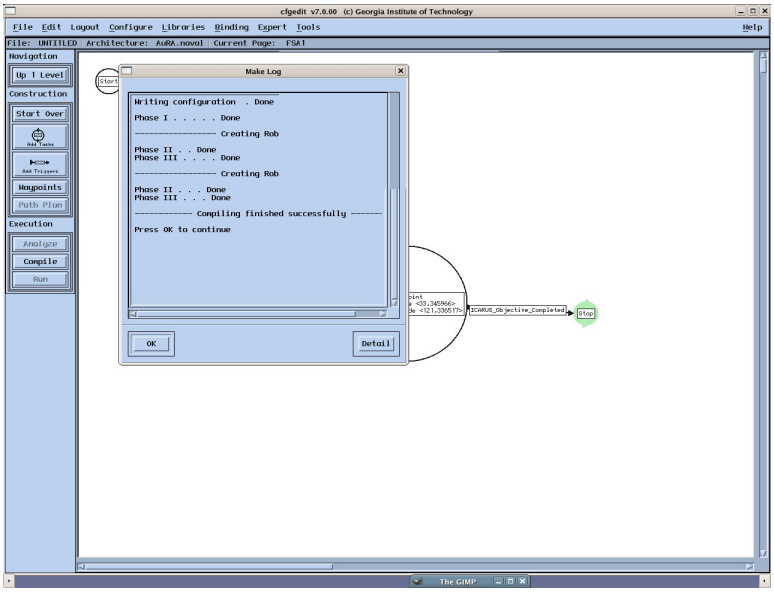
Creating the mission for additional robots

41. Once the mission for the first robot has been completed, the mission for additional robots can be specified by left clicking ‘Up 1 Level’ in the top left corner of the window twice. This will return you to the robot selection window where you can then edit the mission plan for another robot.

Testing a Mission

Compiling the Mission:

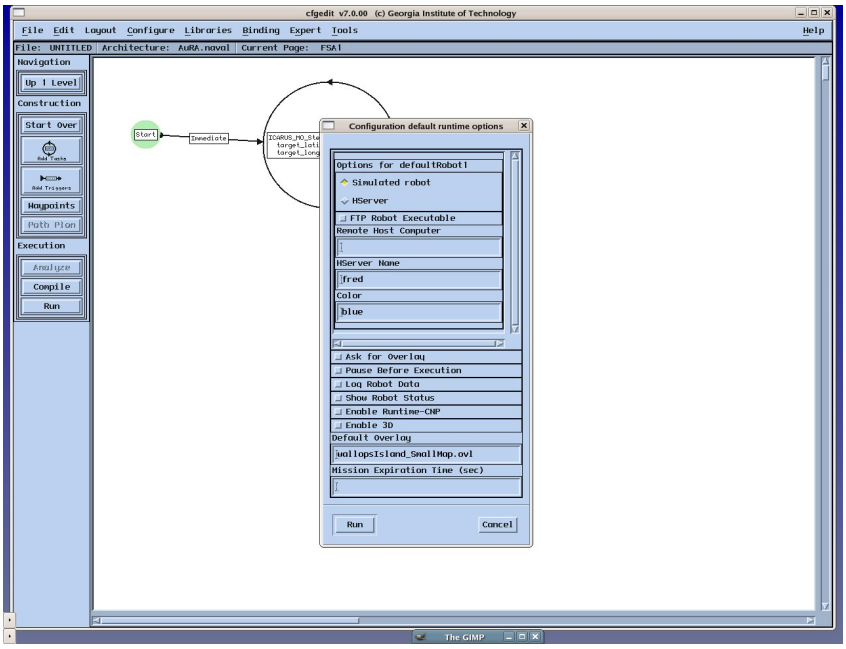
42. Once a mission has been created it must be compiled to be run in the mlab simulator. Click the compile button in the left hand side menu. A progress window should appear.
43. If the progress window reports errors, then these errors must be corrected before the mission can be tested. If everything is ok, then click ok.



Compiling

Running a mission:

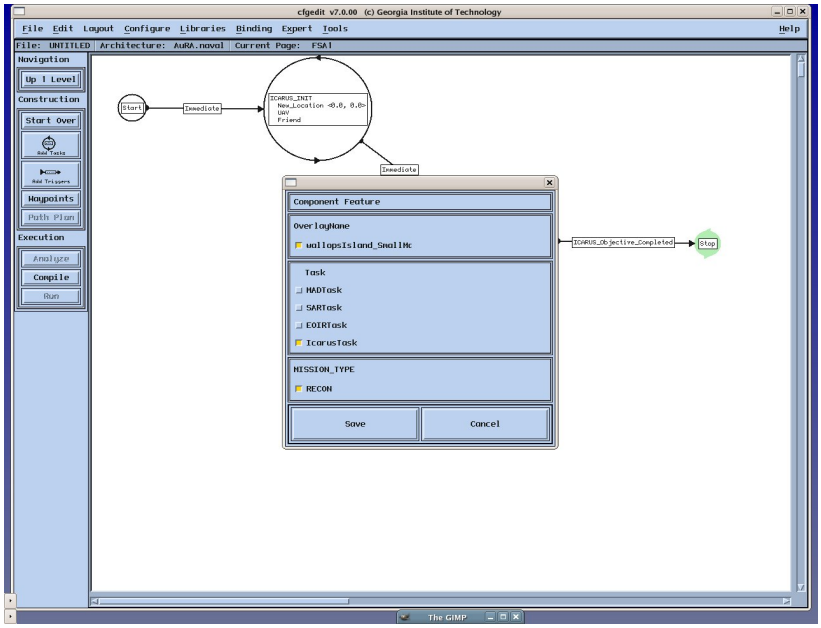
44. Click the run button in the left hand side menu. A dialog titled “Configuration default runtime options” should appear. Do not change any of the default options in this dialog.



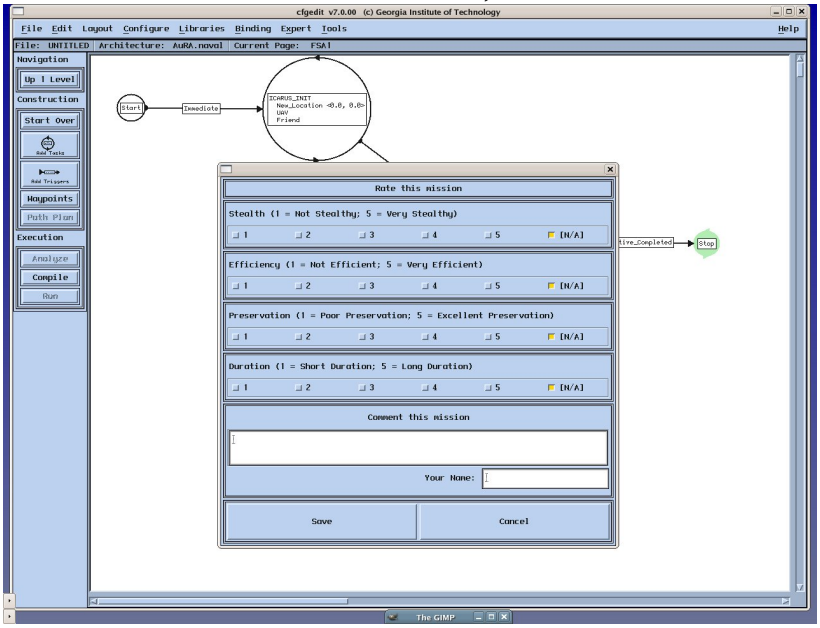
45. Click run. The Mlab console should appear. Be patient, it may take as long as 30 seconds for the system to startup. The simulation should depict the overlay selected for the mission. Friendly units will be colored cyan, enemy units colored red, and neutral units green
46. Examine the behavior of the cyan vehicles to determine whether or not the mission is performing as intended.
47. When you are done let click the file menu and select quit. The Mlab console should shut down retuning you to the CfgEdit interface.
48. If the mission requires modification, it can be done now.
49. If you wish to save the mission, the save dialog can be accessed from the file menu in the top left.

Saving the mission as a case

50. To store the mission as a new case, left click the Expert menu on the top menu bar.
51. Select menu item titled “Add This Mission to CBR Library.”
52. A dialog box should appear asking “CNP?” Select No.
53. Another dialog box should appear describing component features. Make sure that IcarusTask is selected in the task section and then left click on save.



54. Another dialog will now appear with which the expert can enter descriptions of the case. Once the case has been described, left click on save.



55. Finally, save the mission using the save dialog accessed through the file menu.
56. To create another mission, exit CfgEdit by selecting ‘Quit’ from the file menu then restart CfgEdit