Universal RMS
user manual

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Disclaimer

This software is provided as it is without any warranty of any kind.

The project has been developed to be used as an add-on for Orbiter Space Flight Simulator by Martin Schweiger (www.orbitersim.com). Designed for Orbiter 2006 Edition, patch 1 (build 060929).

Introduction

Universal Remote Manipulator System is a special ship representing the space manipulator (like Space Shuttle RMS). You can attach the manipulator to any other vessel in Orbiter. URMS accurately translates to the core ship the changing of mass and the moments from cargo's engines.

URMS can be fixed motionlessly or can be established on a platform which can move along a rail way. It gives additional abilities for example in case of modular space stations building.

URMS is completely adjustable via Orbiter Scenario Editor.

Requirements and limits

Be sure that *ScnEditor* module is activated at *Modules* tab in Orbiter *Launch pad* dialog. The Scenario Editor is required for configuring Universal RMS.

Scenarios

The *Scenarios\Universal RMS* subdirectory contains the following scenarios:

1. ISS with URMS.scn
   Universal manipulator on main truss of ISS. No special requirements and addons.

2. Mir-2 (pr.93) with URMS.scn
   This is a manipulator in application to Mir-2 orbital station designed by RKK Energia in 1993.

   Requirements:
   Mir-2 (pr. 1993) addon by Nikolay (NickD) Dimitrov (http://nickd.freehostia.com/OrbiterVault)
   Can be downloaded from http://www.orbithangar.com/searchid.php?ID=3085

3. URMS on another Mir-2 station.scn

   Requirements:
   Space Tugs (http://www.orbithangar.com/searchid.php?ID=1292)
   or *ENERGY project* (http://www.orbithangar.com/searchid.php?ID=1036)

new !

4. URMS on Atlantis with Carina satellite.scn
   In this scenario Atlantis has two manipulators! Do not forget to close cargo bay doors before launch.

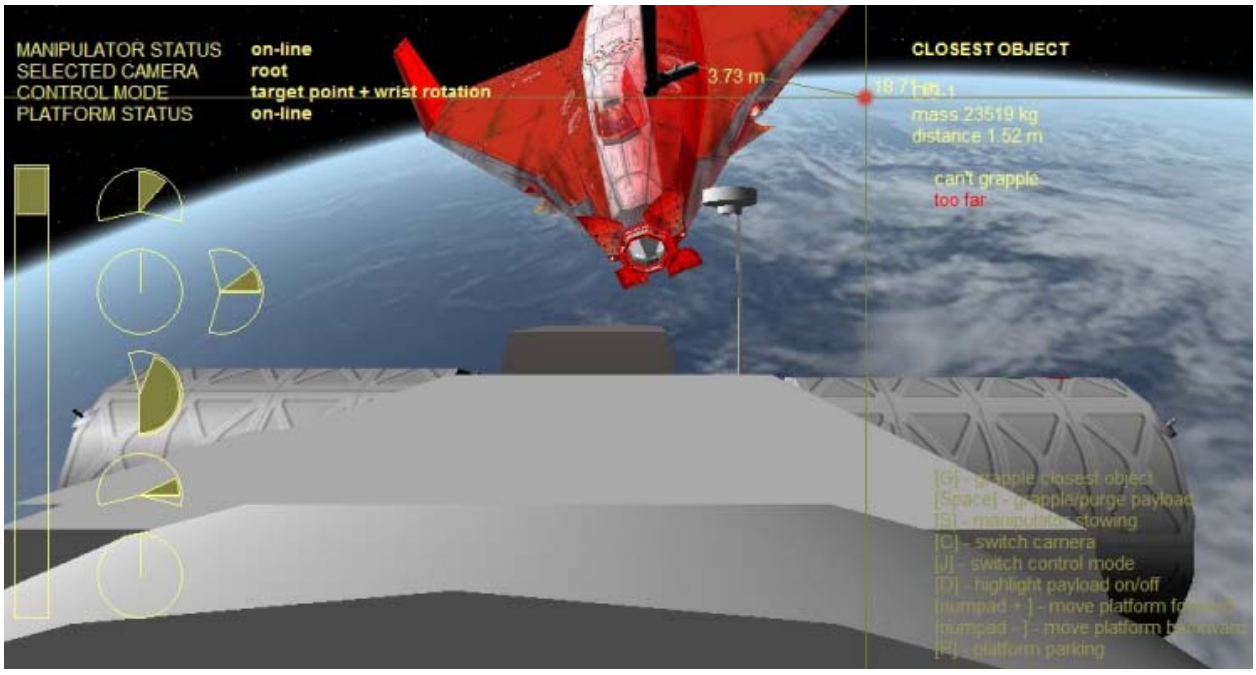
5. URMS with CargoDeck on Shuttle-A and DG.scn
   This is an example demonstrating of using Universal RMS with Universal Cargo Deck. You can use the manipulator for unloading the ship.

Requirements:
Universal Cargo Deck (http://www.orbithangar.com/searchid.php?ID=3262)

This scenario requires last version of Universal Cargo Deck (release number 4 or above).

HUD

URMS is equipped with a special HUD, see the picture:

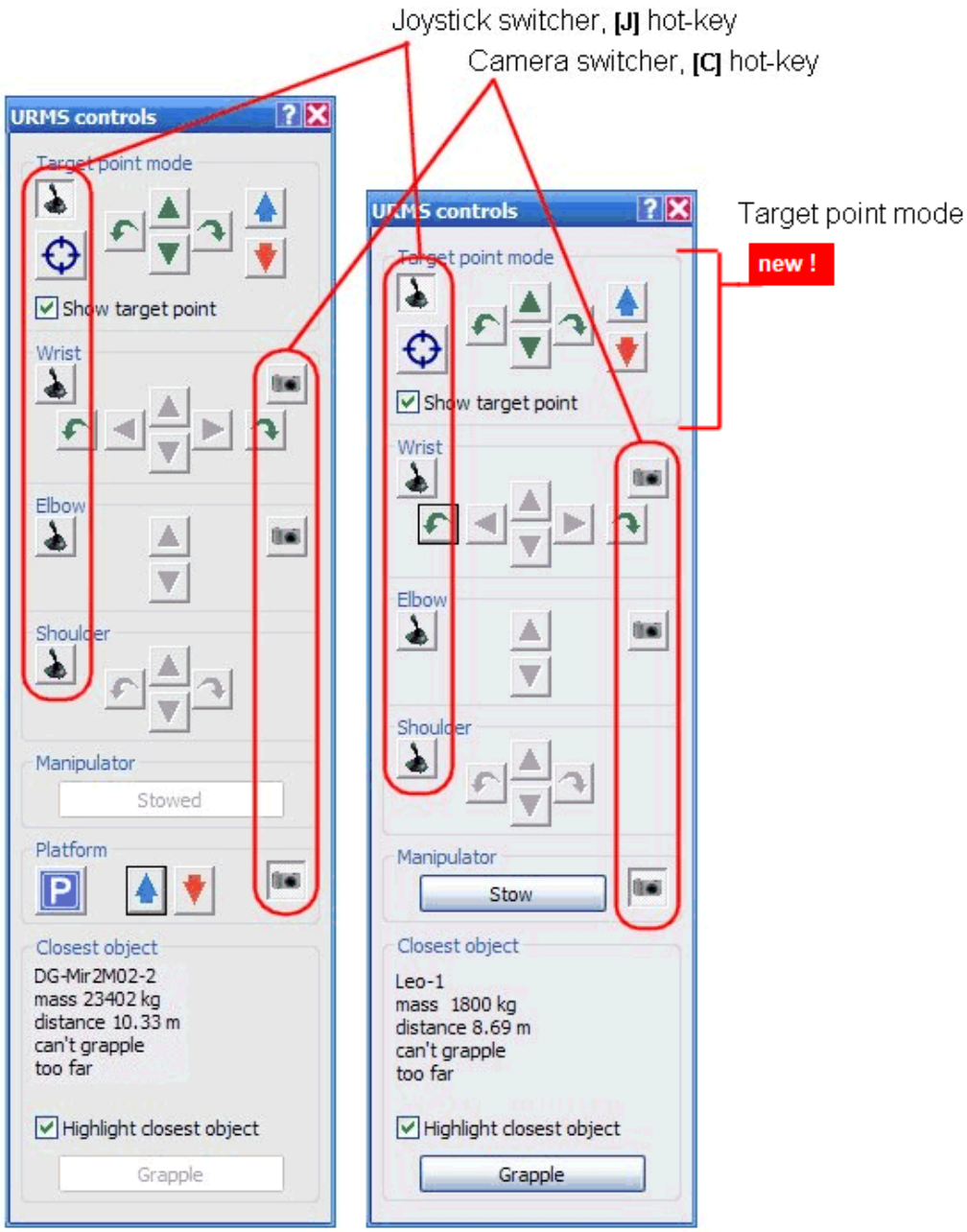


Here you can see the state of manipulator and platform, information about closest object and the help about hot keys.

MANIPULATOR STATUS	- current manipulator state (*on-line*, *stowed* or *stowing*);
SELECTED CAMERA	- current state of cockpit camera switcher;
CONTROL MODE	- current state of joystick switcher (the section of manipulator which is under joystick or keyboard control);
PLATFORM STATUS	- current platform state (*on-line*, *parked* or *parking*).

Control dialog

To open control dialog press Ctrl+space keys. Be sure that the control focus is on URMS vessel.



Control dialog allows you to fully operate the manipulator. You can change the cockpit view using camera switcher (or C key). You can operate the manipulator by keyboard or joystick. To select of manipulator's section for joystick control use the joystick switcher (or J key).

Grapple conditions

You do not need to define the special attachment points on cargo for grapple. The URMS can take the cargo in any point on it's mesh.

The URMS can grapple the vessel if (for manipulator with scale factor 1):

1. The distance from manipulator's wrist to mesh of cargo less than 0.5 meters.
2. The cargo mass less than 125 tons.
3. The linear speed of cargo vessel less than 2 m/s relative to manipulator.
4. Rotation speed of cargo vessel less than 0.5 radians/s.
5. The cargo vessel is not docked to another vessel.

If highlighting of closest object is switched on you will see the current situation with grapple conditions. If grapple is possible the cargo vessel is flashing green otherwise – red.

The control dialog and cockpit HUD show you the information about current grapple conditions.

Keyboard interface

Space	Grapple/purge payload
new ! G	Start "Grapple closest target" sequence
S	Manipulator stowing
P	Platform parking
C	Switch camera in cockpit view between platform, elbow and wrist
J	Switch RCS control between shoulder, elbow, wrist and target point mode
D	Highlight closest object on/off
Numpad +	Move platform forward
Numpad -	Move platform backward
Ctrl+space	Open Control dialog.

Joystick interface

You can use the joystick or numpad keyboard to control the manipulator just like the RCS (Reaction Control System) in other vessels.

The manipulator section currently under control is defined by joystick switcher (*CONTROL MODE* indicator in cockpit view).

new ! Target point mode

It is an alternative way to operate movement of the manipulator. You simply need to specify a point in space, and the manipulator automatically reaches this point. This method uses technology of inverse kinematics.

Movement of a target point in space is also controlled via joystick or keyboard. You can see the target point if the checkbox *Show target point* in control dialog is switched on.

The useful application of *Target point mode* is "Grapple closest object" option. Just click on the *Target* button in control dialog (or hit G key on keyboard) and manipulator will automatically grab the closest vessel.

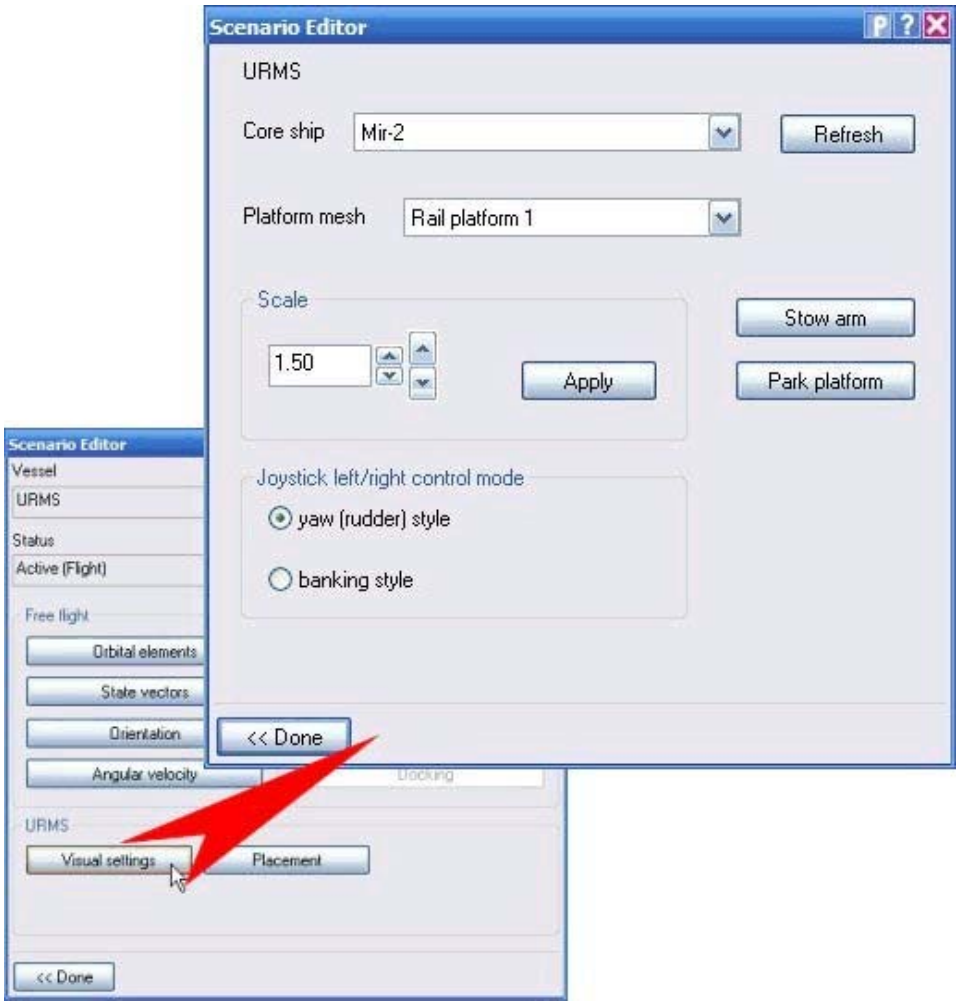
Configuring

Universal RMS is compatible with Orbiter Scenario Editor (read more about Scenario Editor in *Doc\ScenarioEditor.pdf* manual).

Open Scenario Editor and select the *URMS* vessel. Click the *Edit...* button.

Visual settings

Click the *Visual setting* button to open this dialog, see the picture:



To change the core ship select the vessel in the *Core ship* list. Use *Refresh* button to update vessels list.

The mass of manipulator does not automatically increase the mass of core ship.
So the core vessel should be developed in view of mass of the manipulator as a component of whole construction.

To change the platform mesh select mesh from *Platform mesh* list. You can disable platform mesh by selecting *no platform* position.

In *Scale* section you can set the scaling of manipulator. Minimum scale is 0.1, maximum scale is 1000.

Grapple conditions will be changed according to scale.

You can define 3 additional meshes of platform. Just replace the *platform_custom_N.msh* files in *\Meshes\URMS* directory with your meshes.

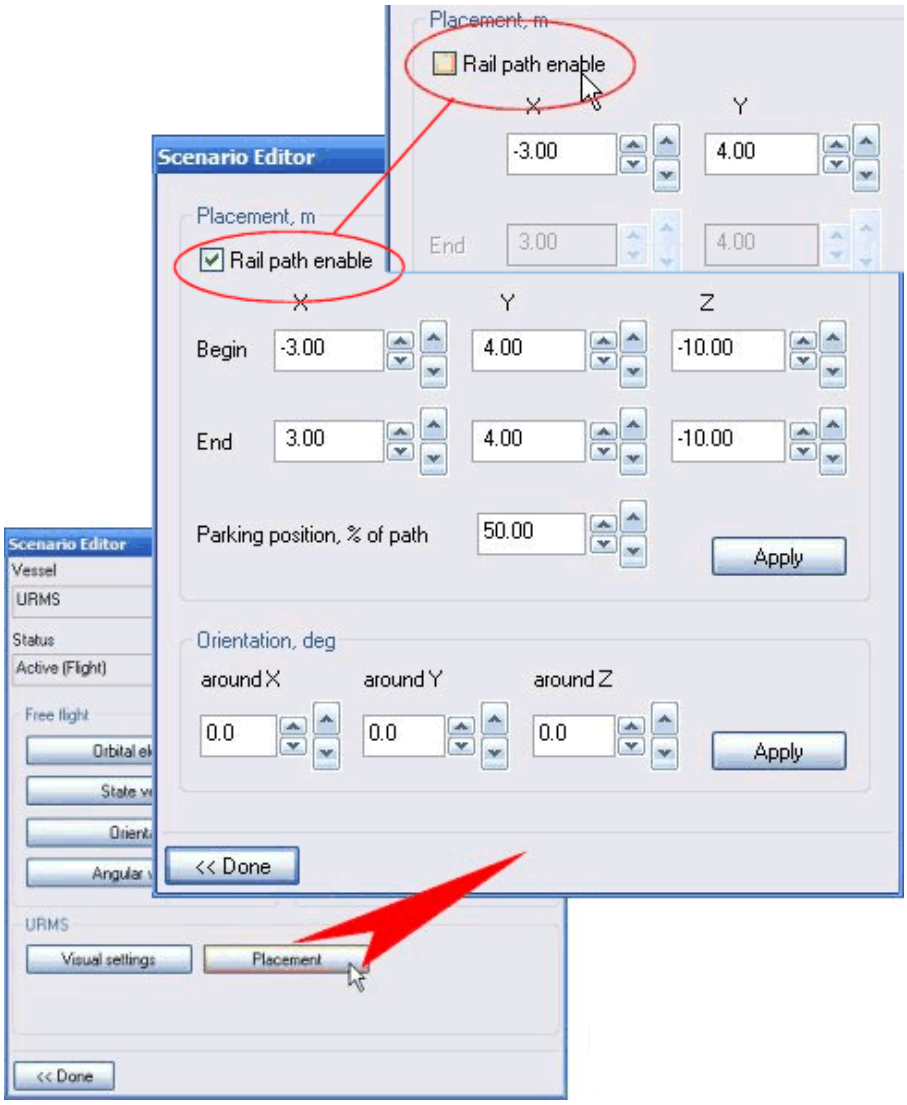
The custom platform meshes are limited. The maximum number of groups in one mesh is 500.

Joystick left/right control mode section defines the behaviour under joystick (or numpad) control.
The *yaw (rudder) style* (default) position means that left-right manipulator's movements are controlled by rudder axis (numpad keys 1 and 3).
The *banking style* position means that left-right manipulator's movements are controlled by bank axis (numpad keys 4 and 6).

To stow the manipulator click the *Stow arm* button. To move the platform in parking position use the *Park platform* button.

Placement

Click the *Placement* button to open next setup dialog, see the picture:



Placement section allows you to define the location of manipulator on core vessel.

Switch *Rail path enable* checkbox on if you want to enable linear movement of manipulator's platform. In this case you should specify the beginning and the end of a way.

The position of a platform parking is defined in percents of whole path.

In the *Orientation* section you can specify the orientation of manipulator relative to core vessel. The orientation is defined by angles of rotation around axis of core's coordinates system.

Use *Apply* buttons to set new values.

Repaint kit

Repaint kit (if installed) is located in *Textures**URMS**Repaint_kit* directory.

There are two files:

elbow.psd	– texture for elbow section of manipulator
shoulder.psd	– texture for shoulder section of manipulator

You can edit this files with Photoshop and save in DDS format. Take the *DDS Photoshop Plug-in* from here: http://developer.nvidia.com/object/photoshop_dds_plugins.html

Save the textures in *Textures**URMS* directory in *DXT1 RGB (No Alpha)* and use *Generate MIP MAP* option.