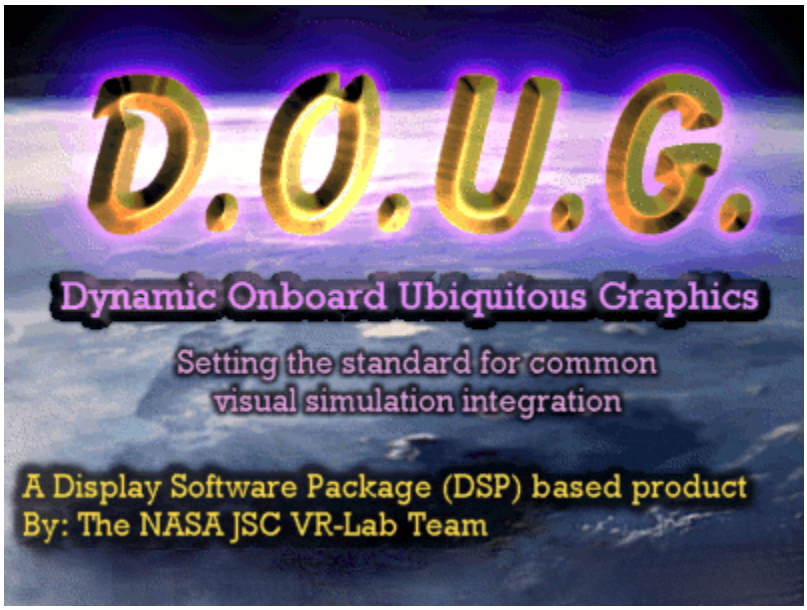
Dynamic Onboard Ubiquitous Graphics (DOUG)

http:**vrlab.jsc.nasa.gov**

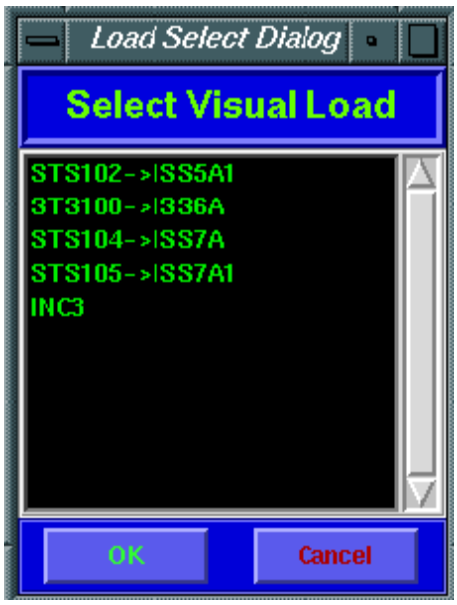


DOUG is a 3D viewing tool used for RMS/SSRMS and EVA planning and review and for situational awareness during RMS/SSRMS operations. DOUG receives RMS data from the Robotics Situational Awareness Display (RSAD) on the orbiter and from the ISP Server via PCSDAS on the Station. Using this information DOUG is capable of displaying the current RMS/SSRMS position as well as RMS/SSRMS target positions (if selected). DOUG also provides visuals for SAFER and SSRMS Onboard training.

DOUG is a product of the Virtual Reality Laboratory at the Johnson Space Center. It uses the graphics engine and mission scene configuration databases that are common with the major simulations at JSC, including the Shuttle Mission Simulation (SMS), the Systems Engineering Simulation (SES), the Virtual Reality Laboratory (VRL), the desktop Dynamic Skills Trainers (DST) and the Space Station Training Facility (SSTF). Use of this software on-board assures a commonality of scene configuration and user interface throughout the ground and on-board systems. DOUG runs under Microsoft Windows (98, 2000, ME, XP, NT, etc.), SGI IRIX and Linux operating systems.

DOUG Startup Menu

Load Select Dialog



- **List of flights**
    - For **Station**: display all flights and increments.
    - For **Shuttle**: defaults to a specific flight.

DOUG Main Menu

File Menu

- **Load State...**
  - Opens the Load State Dialog used to load a state file.

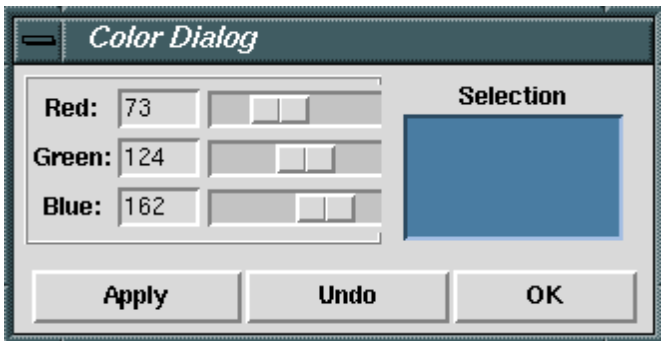
- **Save State...**
  - Opens the Save State Dialog used to save a state file. Once the scene has been configured to a desired state, this state may be saved.

- **Email... (Only on DST mode)**
    - Opens the Email Dialog, which allows the user to send JPEG images of views from the main window. A list of email addresses is saved in your local directory. You can add and delete addresses from the dialog.

- **Exit...**
    - Opens a Quit Dialog to exit the program.

Display Menu

- **Background...**



    - Opens the Color Dialog that changes the background color of DOUG's Main Window.

- **Resize Right-Half**
    - Resizes DOUG Main Window to the Right Half of the current screen.

- **Resize Left-Half**
    - Resizes DOUG Main Window to the Left Half of the current screen.

- **Ideal Lighting**
    - Toggles between a fake ideal lighting (a light source that is coming from the direction of the camera) and the present default lighting (a light source from a

specific location). When using the ideal lighting every component in the scene is lit and the light settings cannot be manipulated.

- **One View**
    - Displays DOUG Main Window showing 'JimboCam' as the default camera. Activate the camera by moving the mouse pointer over the window. Using the right mouse button on the window will display a popup menu described in the Popup Menu document. Using the Hot Keys (see Key Cue Card in the help menu) over the window will select and manipulate the specific camera.
- **Two Views**
    - Divides DOUG Main Window into two windows. The Left Window shows 'CAMERA D' as the default and the Right Window shows 'CAMERA A' as the default. Activate the camera by moving the mouse pointer over the desired window. Using the Right mouse button on a window will display the Popup Menu described in this document. Using the Hot Keys (see Key Cue Card in the help menu) over the window will select and manipulate its camera.
- **Three Views**
    - Divides DOUG Main Window into three windows. The Upper Left Window shows 'CAMERA D' as the default, the Upper Right Window shows 'CAMERA A' as the default and the Lower Window shows the `JimboCam' as the default. Activate the camera by moving the mouse pointer over the desired window. Using the right mouse button on a window will display a popup menu described in the Popup Menu document. Using the Hot Keys (see Key Cue Card in the help menu) over a window will select and manipulate its camera.

- **Show RMS (SSRMS) Targets** (only in RMS and SSRMS mode)

  - Using **RMS** configuration: displays a shaded 'ghost' RMS target model. When used in conjunction with RSAD, DOUG will receive RMS joint angle information from RSAD. This information is also displayed at the bottom of DOUG's main window.

  - Using **SSRMS** configuration: Displays a shaded 'ghost' SSRMS target model. When used in conjunction with PCSDAS, DOUG will receive SSRMS joint angle information. This information is also displayed at the bottom of DOUG's main window.

- **Enable TAB monitoring** (only in RMS mode)

  - Displays a warning plot. The TAB (Topographical Augmentation Boundary) plot is a warning display that appears when the RMS approaches the shoulder yaw singularity warning zone and is triggered before the onboard system would be triggered. The red zone (or circle) is the region that represents where the Orbiter's onboard alarm would be set.

- **Puddle Plot Shoulder /Wrist** (only in SSRMS mode)

  - Displays SSRMS Shoulder/Wrist Collision Chart.

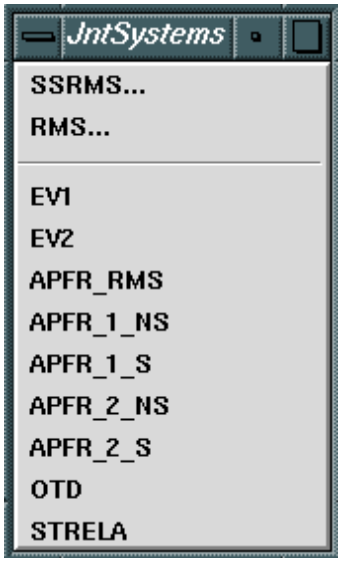
- **Puddle Plot Cluster Collision** (only in SSRMS mode)

  - Displays SSRMS Cross-Cluster Collision Chart.

Edit Menu

- **EVs**
    - EV 1... Opens the Edit System Dialog used to manipulate EV 1.
    - EV 2... Opens the Edit System Dialog used to manipulate EV 2.
- **Nodes...**
    - Opens the Edit Node dialog that displays all the components available in the scene. Double clicking on any of the items in the list will open the Edit Dialog to manipulate that component. Use this dialog with extreme caution. Modifying any of the values in this dialog could alter the scene's original configuration.
- **Edit Cameras**
    - Displays a list of specific cameras. Selecting a camera will display a Camera Dialog that will allow you to change its pan, tilt, hfov and zoom values.

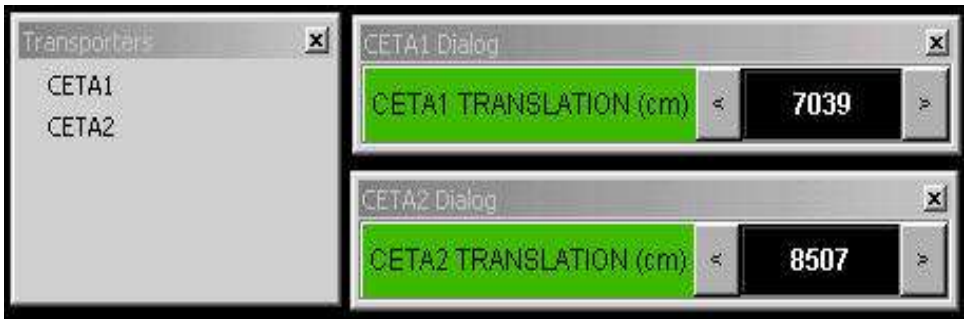
JntSystems Menu



- **RMS...**
    - Opens the RMS Dialog used to manipulate RMS (Shuttle ARM) joints. When used in conjunction with RSAD, DOUG will receive RMS joint angles information from RSAD. This information is also displayed at the bottom of DOUG's main screen.

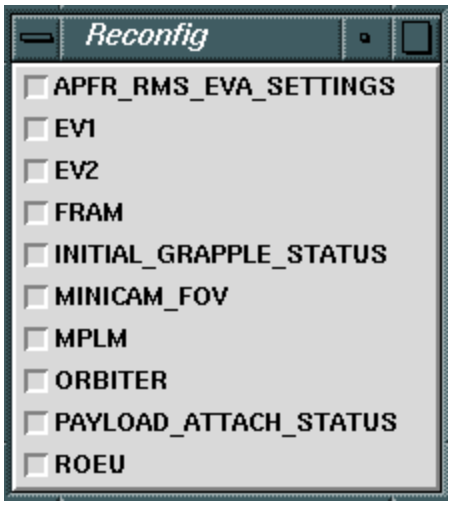
- **SSRMS...** (Mission specific)
    - Opens the SSRMS Dialog used to manipulate the SSRMS (Station ARM) joints. When used in conjunction with PCSDAS, DOUG will receive SSRMS joint angle information. This information is also displayed at the bottom of DOUG's main screen.
- **List of JointSystems...** (APFR_RMS, EV1, etc.) (mission specific)
    - Opens a specific ' Joint System' Dialog used to manipulate its joint angles. These joint systems are configured by the VR Lab and are flight specific.

Transporters Menu



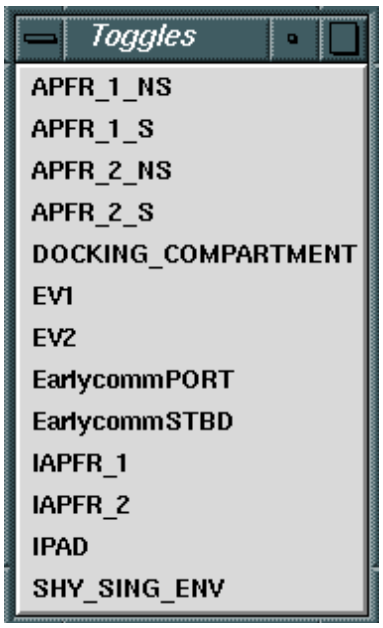
- **List of Transporters Items** (mission specific);
    - List of pre-configured transporter items. Selecting a transporter will display a dialog that will allow you to translate selected CETA cart along the truss. The display represents the position of the CETA cart along the CETA rail as defined by the labels on Face 1 of the ISS truss.

Reconfig Menu



- **List of Reconfig Items** (mission specific):
    - List of pre-configured items divided by type. Selecting a type will open a list of possible actions to apply to the scene. These items are configured by the VR Lab and are flight specific.

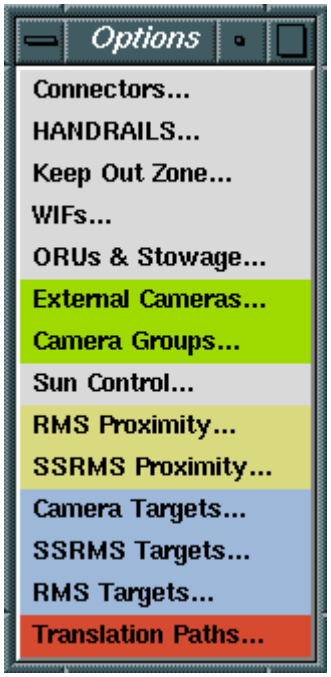
Toggles Menu



- **List of Toggle Items...** (Mission specific)

- Selecting an item in the list will turn a component (or components) either ON or OFF (toggle). These items are configured by the VR Lab and are flight specific.

Options Menu



- **Connectors...** (Mission specific)
  - Opens a Connectors Dialog used to FLASH specific connectors. These items are configured by the VR Lab and are flight specific.
- **HANDRAILS...** (Mission specific)
  - Opens a Handles Dialog used to FLASH specific handrails. These items are configured by the VR Lab and are flight specific.
- **Keep Out Zone...** (Mission specific)
  - Opens a Keep Out Zone Dialog used to turn ON/OFF specific keep out zone areas. These are areas around most of the antennas (on Station and Shuttle) in which the EMF generated by the antenna when

operating could possibly endanger the EVA personnel. These items are configured by the VR Lab and are flight specific.

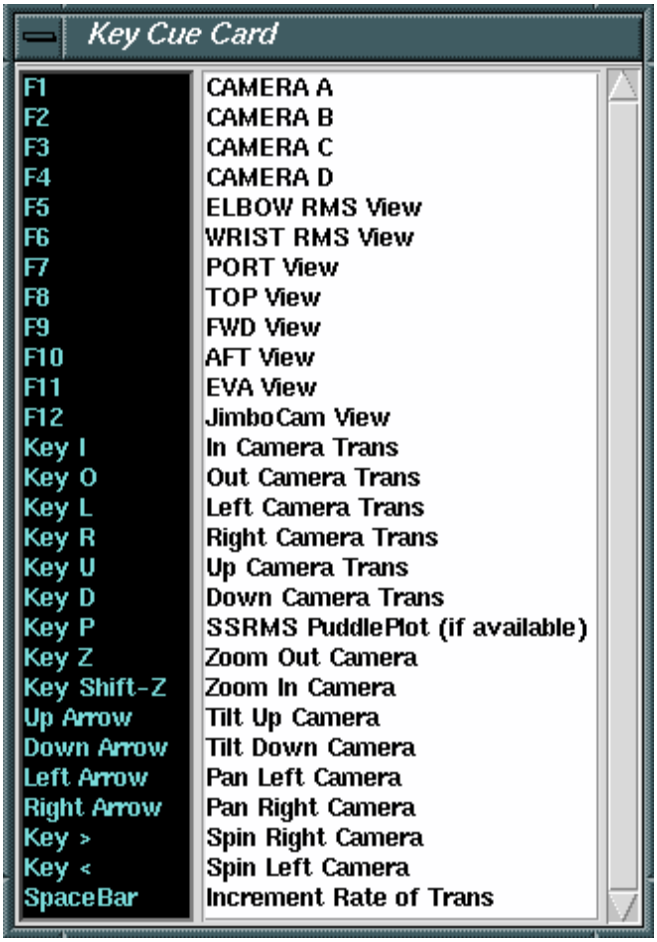
- **WIFs...** (Mission specific)
    - Opens a Wifs Dialog used to FLASH and link a predefined joint system to a specific WIF. These WIFs and joints are configured by the VR Lab and are flight specific.
- **ORUs & Stowage...** (Mission specific)
    - Opens an ORUs & Stowage Dialog with a list of the available ORU and stowage devices. Used to FLASH a specific device. These devices are configured by the VR Lab and are flight specific.
- **Camera Groups...** (Mission specific)
    - Opens a Camera Group Dialog that lists specific Camera Groups (ISS, EVA or ORBITER, etc) available in the DOUG scene. You can select a camera and apply it to any view. These cameras are configured by the VR Lab and are flight specific.
- **External Cameras...**
    - No longer used.
- **RMS Proximity...**
    - Opens a RMS Proxy Dialog used to set alarms to monitor the RMS when moving close to structure. Distances are user definable in the dialog.
- **SSRMS Proximity...**
    - Opens a SSRMS Proxy Dialog used to set alarms to monitor the SSRMS when moving close to structure. Distances are user definable in the dialog.

- **SSRMS Targets...**
    - Opens a SSRMS Targets Dialog used to show and define SSRMS targets.
- **SRMS Targets...**
    - Opens a SRMS Targets Dialog used to show and define SRMS targets.
- **Camera Targets...**
    - Opens a Camera Target Dialog used to create new camera targets.
- **Translation Paths...**
    - Opens a Trans Path Dialog that lists available translation paths by name. These paths are configured by the VR Lab and are flight specific.

Note: Other selections will be added as they are defined.

Help Menu

- **Key Cue Card...**



  - Opens a Key Cue Card Dialog that displays a list of the Hot Keys used to manipulate viewpoints.

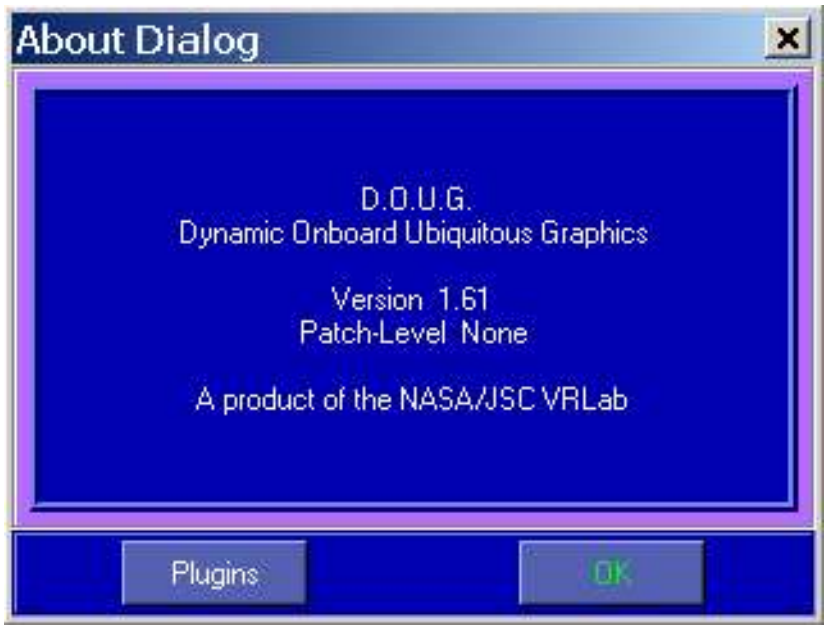
- **Help Index...**

  - Opens this dialog.

- **DOUG Web Site...**

  - Displays the http address of DOUG's Official Web Site.

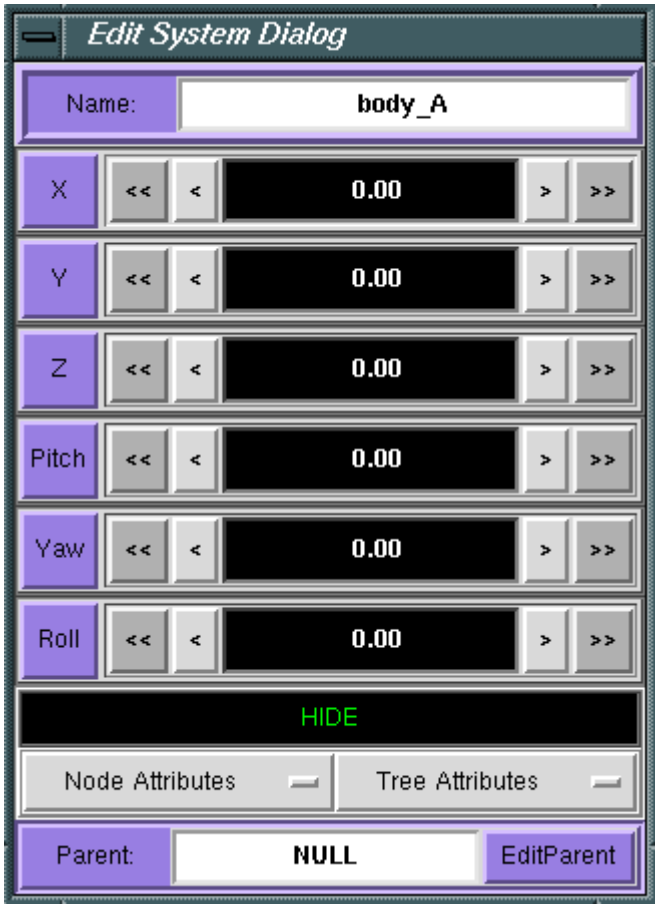
- **About...**



Opens an About Dialog used to display information about DOUG and its version.

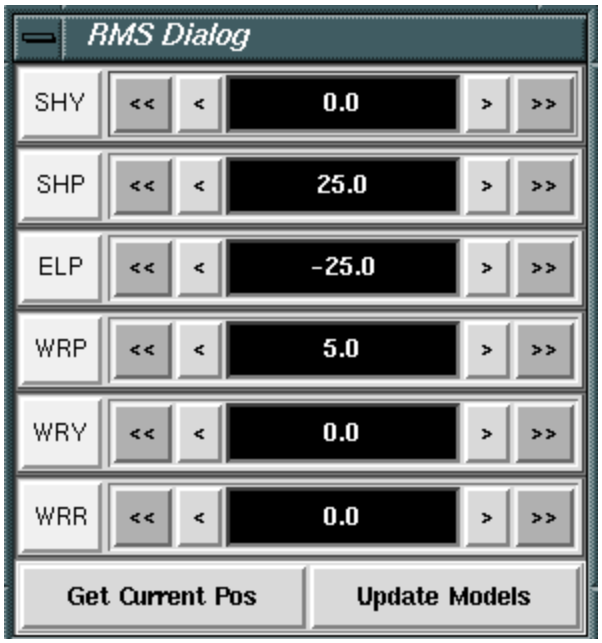
Definitions of Dialogs:

Edit System Dialog



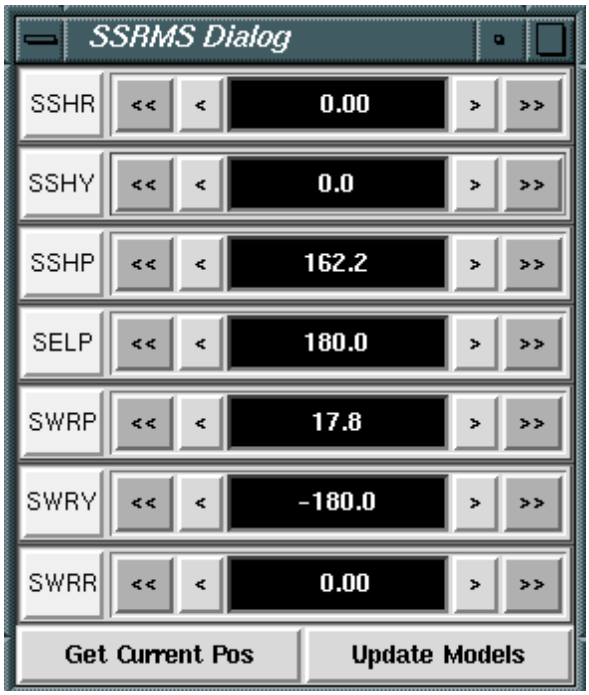
- **< Or >**: decrement or increment by 1 unit.
- **<< Or >>**: decrement or increment by 10 units.
- **Node Attributes**: selects ON or OFF to turn ON/OFF, flashing or highlighting of a specific component.
- **Tree Attribute:** selects ON or OFF to turn ON/OFF, flashing or highlighting a tree of components.
- **Parent:** Links the component to the parent.
- **EditParent:** Opens the Edit System or Edit Model Dialog of the parent.

RMS Dialog



- **< Or >**: decrement or increment by 1 unit.
- **<< Or >>:** decrement or increment by 10 units
- **Get Current Pos**: updates the joint values in the dialog from the current values of the scene. (Ex. when using Reconfig commands make sure to hit 'Get Current Pos' to get the current joint values)
- **Update Models**: updates the simulation scene with the current joint values from the dialog. Enter a new set of values in the text fields and tab or hit enter between fields to apply the value.

SSRMS Dialog

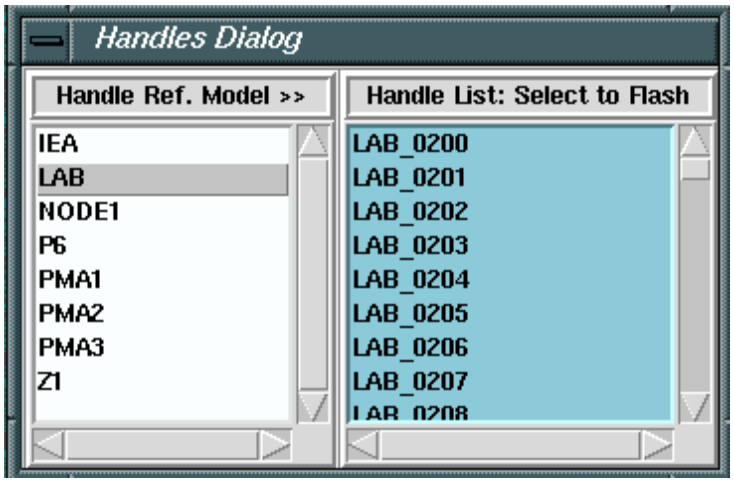


- **< Or >:** decrement or increment by 1 unit.
- **<< Or >>**: decrement or increment by 10 unit
- **Get Current Pos**: updates the joint values in the dialog from the current values of the scene. (Ex. when using Reconfig commands make sure to hit 'Get Current Pos' to get the current joint values)
- **Update Models**: updates the simulation scene with the current joint values from the dialog. Enter a new set of values in the text fields and tab or hit enter between fields to apply the value.

JointSystems Dialog

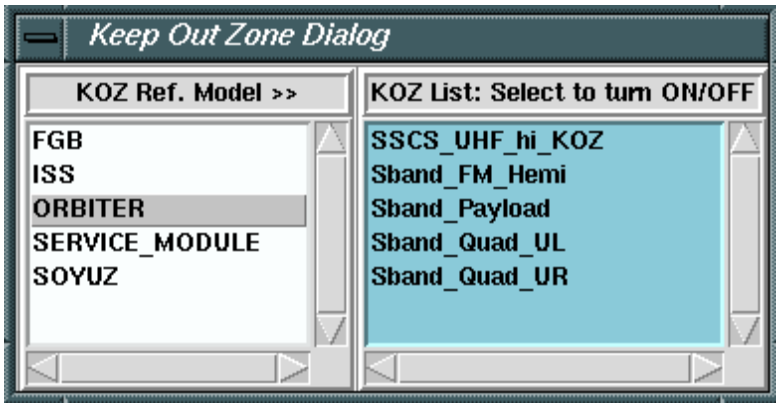
- **< Or >**: decrement or increment by a pre-defined unit. Every joint system has its own set of values.

Handles Dialog



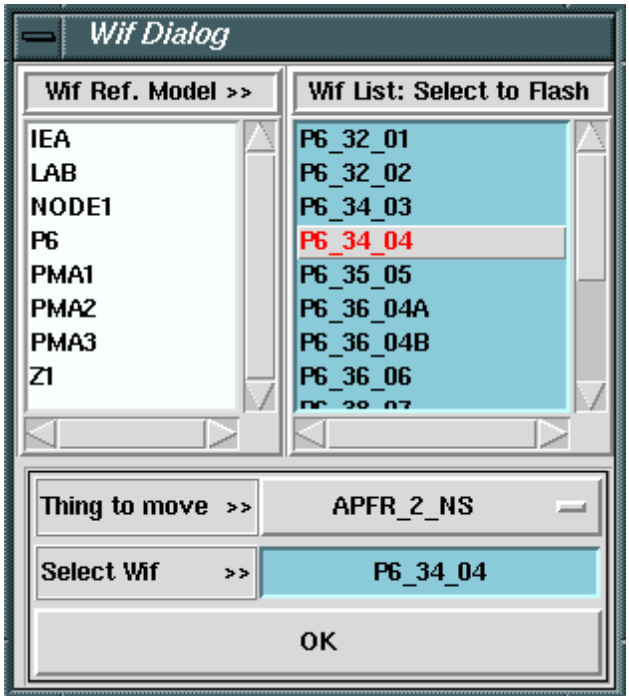
- **Left list**: list of components with handrails.
- **Right list**: list of all handlrails available by component. Select an item in the list of handles to Flash.

Keep Out Zone Dialog



- **Left list**: list of components with KOZs.
- **Right list**: list of all keep out zones available by component. Select an item in the KOZ List to turn ON/OFF.

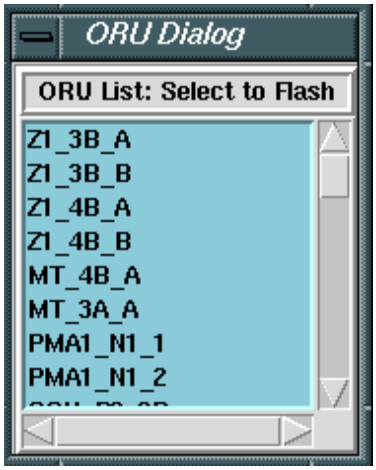
Wifs Dialog



- **Left list**: list of components with WIFs.
- **Right list**: list of all WIFs available by component. Select an item in the list of WIFs to Flash.

- **Thing to move**: list of pre-defined joint systems. Select the one to move to the WIF.
- **Select WIF**: selects a WIF from the "WIF List" to work with.
- **Ok**: links the joint to the WIF.

ORUs & Stowage Dialog

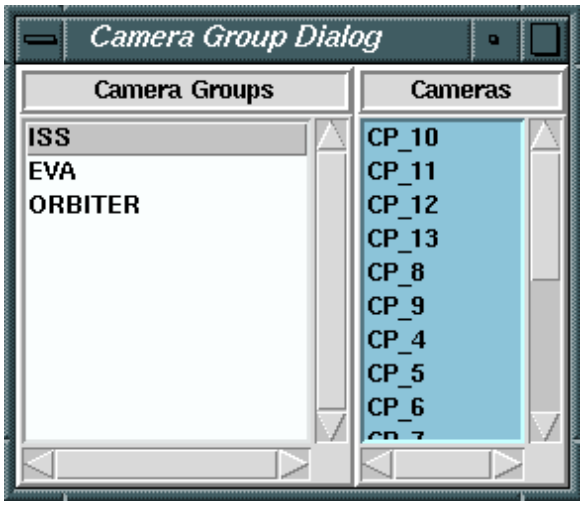


- **List:** list of ORUs and Stowage devices. Selected item will be highlighted.

External Cameras Dialog

No longer used.

Camera Groups Dialog



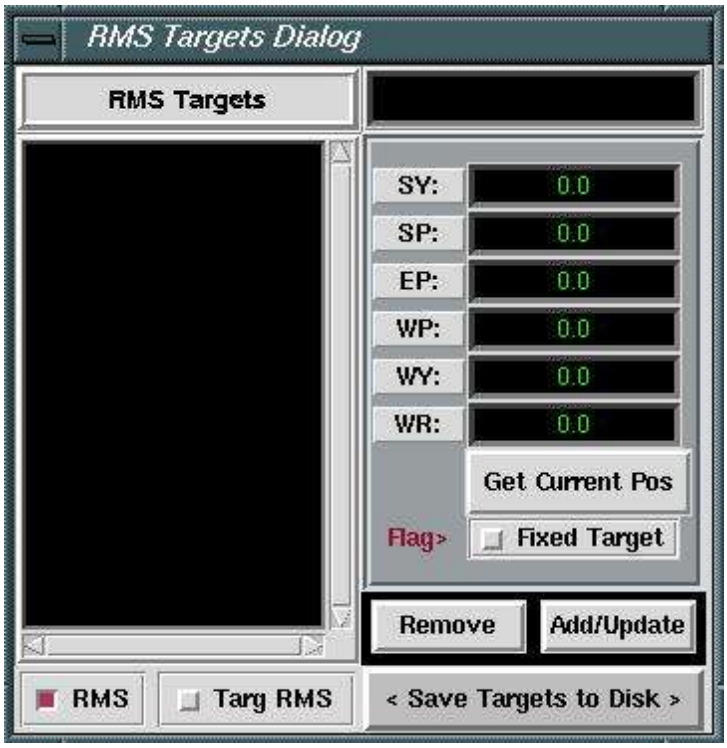
- **Left list:** list of Camera Groups (ex: ISS, EVA, ORBITER)
- **Right list:** list of Cameras by group. Select a camera and apply it to a specific view.

SSRMS Targets Dialog

- **Left list:** list of the SSRMS targets by title.
- **SSRMS:** applies angles to the real SSRMS.
- **Targ SSRMS:** applies angles to the **target** SSRMS.
- **Top text:** name of SSRMS target selected. User can input new title name.
- **Right Panel:** target angle values. User can input new values.
- **Get Current Pos:** access actual SSRMS angle values.
- **Fixed Target:** allows targets to be modified. If ON the target cannot be changed.
- **Remove:** Remove selected item in the target list.
- **Add/Update:** Add (to the next) item selected from the target list and also update values from item selected if exists.

- **< Save targets to Disk >:** Save targets permanently to disk. If you don't save the changes they will be available only for this run

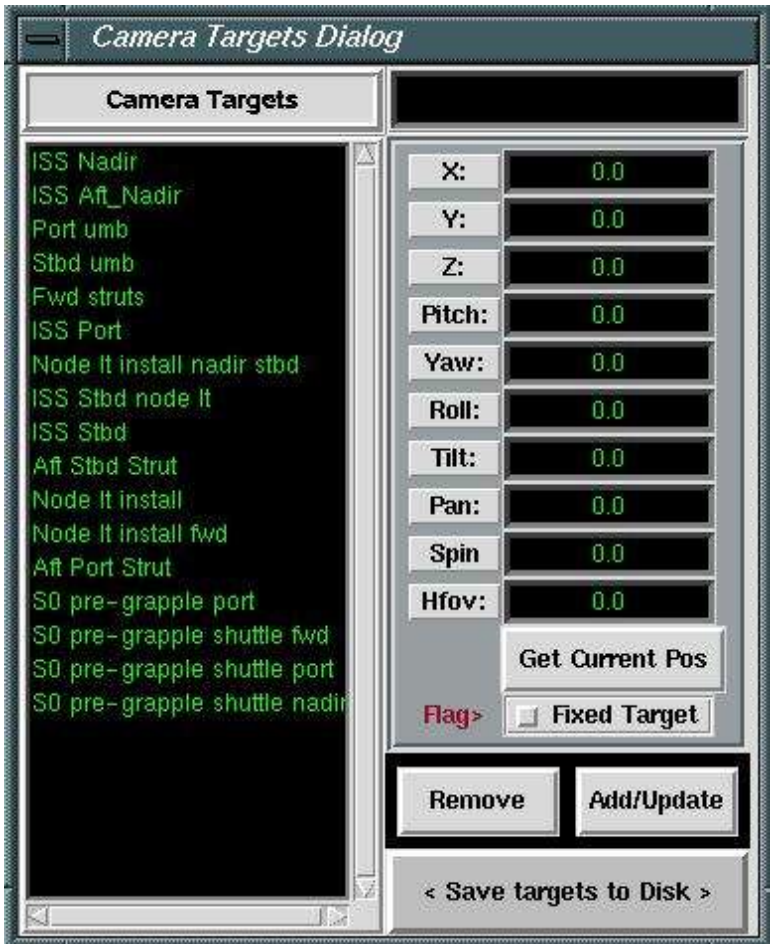
SRMS Targets Dialog



- **Left list:** list of the SRMS targets by title.
- **RMS:** applies angles to the real SRMS.
- **Targ RMS:** applies angles to the **target** SRMS.
- **Top text:** name of SRMS target selected. User can input new title name.
- **Right Panel:** target angle values. User can input new values.
- **Get Current Pos:** access actual SRMS angle values.
- **Fixed Target:** allows targets to be modified. If ON the target cannot be changed.
- **Remove:** Remove selected item in the target list.
- **Add/Update:** Add (to the next) item selected from the target list and also update values from item selected if exists.

- **< Save targets to Disk >:** Save targets permanently to disk. If you don't save the changes they will be available only for this run.

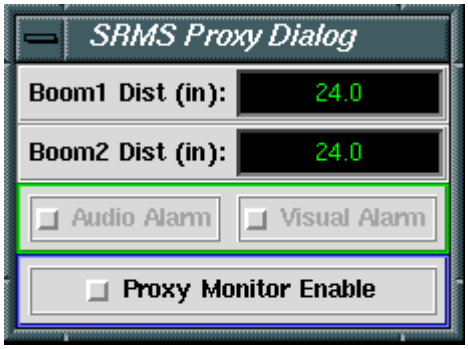
Camera Targets Dialog



- **Left list:** list of the camera targets by title.
- **Top text:** name of camera target selected. User can input new title name.
- **Right Panel:** camera values. User can input new values.
- **Get Current Pos:** access current camera position.
- **Fixed Target:** allows targets to be modified. If ON the target cannot be change.
- **Remove:** Remove selected item in the target list.
- **Add/Update:** Add (to the next) item selected from the target list and also update values from item selected if exists.

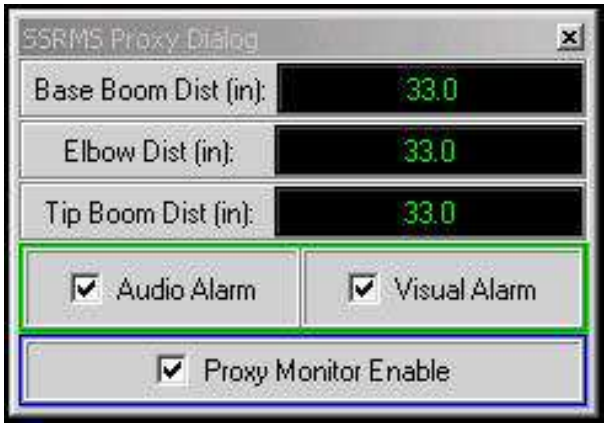
- **< Save targets to Disk >:** Save targets permanently to disk. If you don't save the changes they will be available only for this run.

RMS Proxy Dialog



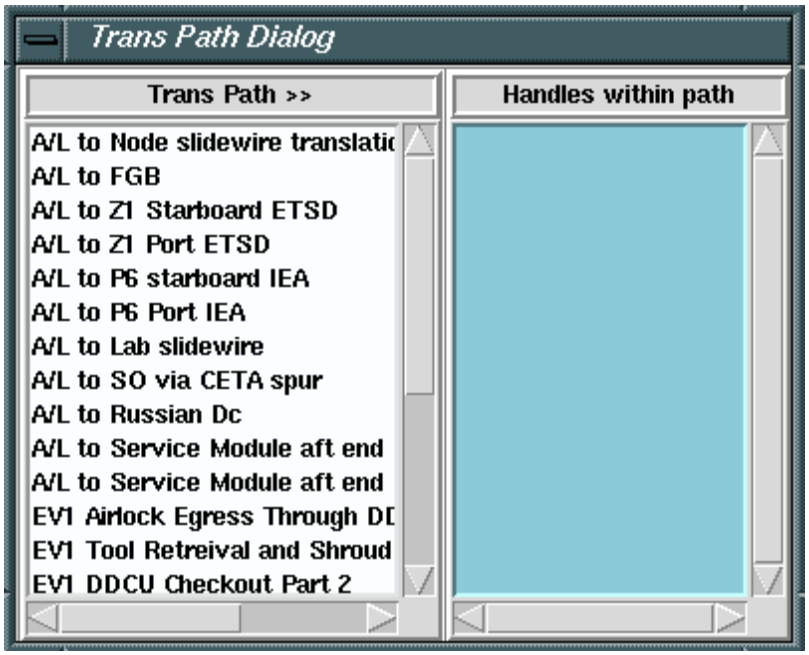
- **Boom1 Dist (in):** size of the envelope for RMS Boom1 (inches).
- **Boom2 Dist (in):** size of the envelope for RMS Boom2 (inches).
- **Audio Alarm:** turns on the audio alarm for the whole RMS when getting close to a structure.
- **Visual Alarm:** turns on the visual alarm (RMS turns yellow) for the whole RMS when getting close to a structure.
- **Proxy Monitor Enable:** enables the monitoring of individual booms depending on which one is close to structure. This enables the alarms.

SSRMS Proxy Dialog



- **Base Boom Dist (in):** size of the envelope for SSRMS Base Boom (inches).
- **Elbow Dist (in):** size of the envelope for SSRMS Elbow (inches).
- **Tip Boom Dist (in):** size of the envelope for SSRMS Tip Boom (inches).
- **Audio Alarm:** turns on the audio alarm for the whole SSRMS when getting closer to a structure.
- **Visual Alarm:** turns on the visual alarm (arm turns yellow) for the whole SSRMS when is close to structure.
- **Proxy Monitor Enable:** enables the monitoring of individual SSRMS components (listed in dialog box). Component will flash “blue” when the specified envelop is violated.

Translation Path Dialog



- **Left list:** list by name of Translation Paths. Select a path to highlight the translation path handrails. The affected components will change resolution.
- **Right list:** Displays all handles within the selected translation path.

DOUG Popup Menu (right mouse button)

Rulers (Only on DST mode)

Enables the rulers. There are 3 rulers: red, green and blue. You have to define them first by clicking on the "Define Red-Ruler" or "Define Green-Ruler" or "Define Blue-Ruler". Click the "left mouse button" to select the beginning point. Click the "left mouse button" again to select the end point on the screen. An "approximate" distance will be displayed. You can enable or disable the particular ruler by selecting the Red, Green or Blue Ruler Enabled selection on the menu.

Enable/Disable View (Only on DST mode)

Enables and disables the view.

Cross Hair

ON/OFF cross hair.

Save JPEG

Saves a JPEG image file. Opens a dialog to select where to save it.

Wire Toggle

Toggles the entire scene to wire and normal mode.

Pick Model to Toggle Detail

Changes mode to pick (the cursor will change to a pick hand). Select the component and toggle detail between high or low resolution.

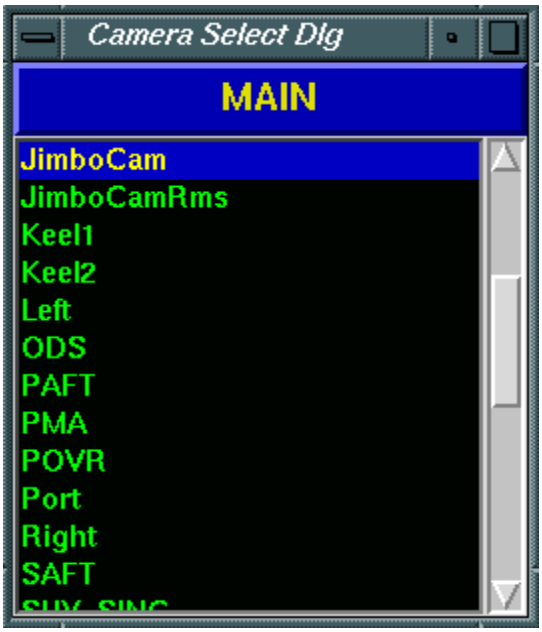
Pick Model to Edit

Opens the Edit Model Dialog for the selected model.

Scene Detail

- **High**
    - Renders entire scene in high-resolution mode (more detail).
- **Low**
    - Renders entire scene in low-resolution mode (less detail).

Assign Camera



Opens a dialog with a list of all available cameras to select for the specific window.

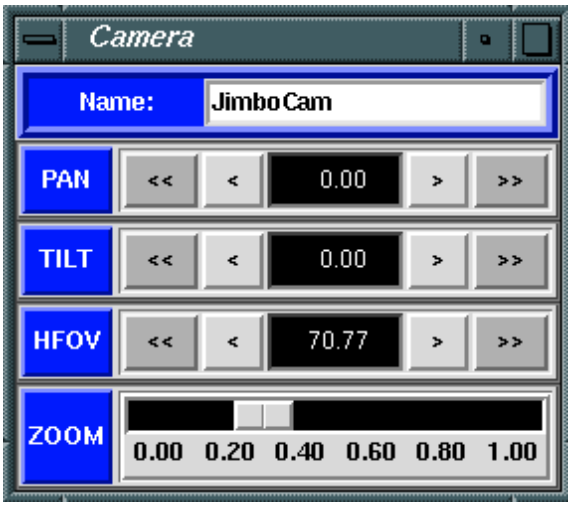
Assign Window View

Opens a dialog with a list of all pre-defined window views.

Overlays (Only on DST mode)

List a selection of joint angles to be displayed on the lower part of the main screen.

Edit Camera



Opens a Camera Dialog used to manipulate the camera selected from the **Assign Camera** list.

Exit

Opens the Quit Dialog to exit the program.