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**SOFTWARE DESIGN DOCUMENT
GT Real-Time Software Host CSCI (9B)**

Volume 2 of 2 Sections 2.12.20 - 3.2 and Appendices

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| 13. ABSTRACT (Maximum 200 words) A Simulation Network (SIMNET) project Software Design Document that describes the GT Real-Time Software Host Computer Software Configuration Item (CSCI number 9B) of the SIMNET hardware and software training system for vehicle crew training and operational training. | | | | |
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2.12.20 show_effect_msg.c

The show_effect_msg function adds new special effects to the active effects table in active area memory. This function is called whenever the Simulation Host sends a MSG_SHOW_EFFECT message. If the system contains two backends, show_effect_msg is called twice (each active area memory has its own active effects table).

The function call is show_effect_msg(msgp, pdbname, vme_offset), where:

- msgp is a pointer to the MSG_SHOW_EFFECT message
- pdbname is a pointer to the primary database block
- vme_offset is the VME address offset to AAM

show_effect_msg finds the load module in which the effect is to be placed, then adds the effect to the multiple-frame effects list.

Called By: msg_show_effect

Routines Called: FIND_LM

Parameters: MSG_SHOW_EFFECT *msgp
 DB_INFO *pdbname
 INT_4 vme_offset

Returns: none

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2.13 Real-Time Processing (/cig/libsrc/librtd)

The Real-Time Processing CSC is responsible for setting up and running the simulation using messages sent from the Simulation Host. The primary tasks performed by the functions in this CSC are the following:

System configuration

- Parses the command line entered by the user to initialize the system.
- Configures Ballistics.
- Opens the terrain database and Dynamic Elements Database (DED) files.
- Configures the color table.
- Configures the database.
- Downloads trajectory tables to Ballistics.
- Downloads textures data to the ESIFA.
- Initiates viewport configuration and 2-D overlay generation.

Simulation processing

- Processes all runtime messages sent by Simulation Host.
- Performs matrix concatenations to adjust the viewport displays as the simulated vehicle moves and rotates.
- Performs model control on other vehicles in the simulation environment.

Ballistics interface

- Notifies Ballistics of state changes and changes to simulation parameters (e.g., addition of static vehicles).
- Forwards requests from the Simulation Host to process rounds and trajectories, obtain terrain feedback data, and enable AGL processing.
- Processes messages returned from Ballistics.

Database management

- Loads the correct portion of the terrain database into active area memory.
- Loads new rows or columns as necessary during the simulation, to keep the simulated vehicle in the center of active area memory.

Database feedback

- Provides information to the Simulation Host on the terrain surrounding the simulated vehicle.

Hardware tests (not currently implemented)

- Runs hardware tests requested by the Simulation Host.

File control

- Transfers files to and from the CIG based on Simulation Host requests.

Miscellaneous

- Provides functions for interfacing to the Force board.
- Provides functions for interfacing with the EVC (Ethernet VME Controller).
- Allows the Gossip user to display calibration images.
- Provides a mechanism for recording message packets to a file.
- Manages cloud models.
- Builds M1 and M2 gun overlays for viewports connected to T backends.

At startup, various functions are called to initialize active area memory, verify that the communications interface to the Simulation Host is functional, and start Ballistics. The upstart function then processes the messages sent by the Simulation Host to place the CIG in a specified state. The CIG states that can be set are:

| | |
|-----------------------|---|
| Database setup | Prepares the CIG to run a simulation. If this state is requested, upstart passes control to db_mcc_setup. |
| File control | Used to transfer files to and from the CIG. If this state is requested, upstart passes control to file_control. |
| Test mode | Used to run hardware tests. If this state is requested, upstart passes control to hw_test. |
| MCC setup | Prepares the CIG to act as an MCC station. This mode is not currently used. |

If database setup is specified, db_mcc_setup processes messages from the Simulation Host to configure the viewports (by initiating the Viewport Configuration CSC) and the 2-D overlays (by initiating the 2-D Overlay Compiler CSC). db_mcc_setup also loads the terrain database and the dynamic elements database (DED) into active area memory, and processes requests to download trajectory table data. Upon another state change request from the Simulation Host, db_mcc_setup calls simulation to start the simulation.

During the simulation, the process_a_msg function (called by simulation) processes all runtime messages. These messages may ask to move or rotate dynamic vehicles, change gun overlays, pass process round and round fired messages to Ballistics, or change other simulation parameters. process_a_msg also processes the hit and miss messages returned by Ballistics.

As the simulated vehicle moves about in active area memory, the database management functions read new load modules in from the terrain database as necessary. The database feedback functions prepare messages describing the terrain around the simulated vehicle and return them to the Simulation Host at specified intervals.

When the Simulation Host sends a message ending the simulation, control is passed back to db_mcc_setup. db_mcc_setup then initializes the configuration tree and returns control to upstart.

The CSUs in the Real-Time Processing CSC are identified in Figure 2-17 and are described in this section.

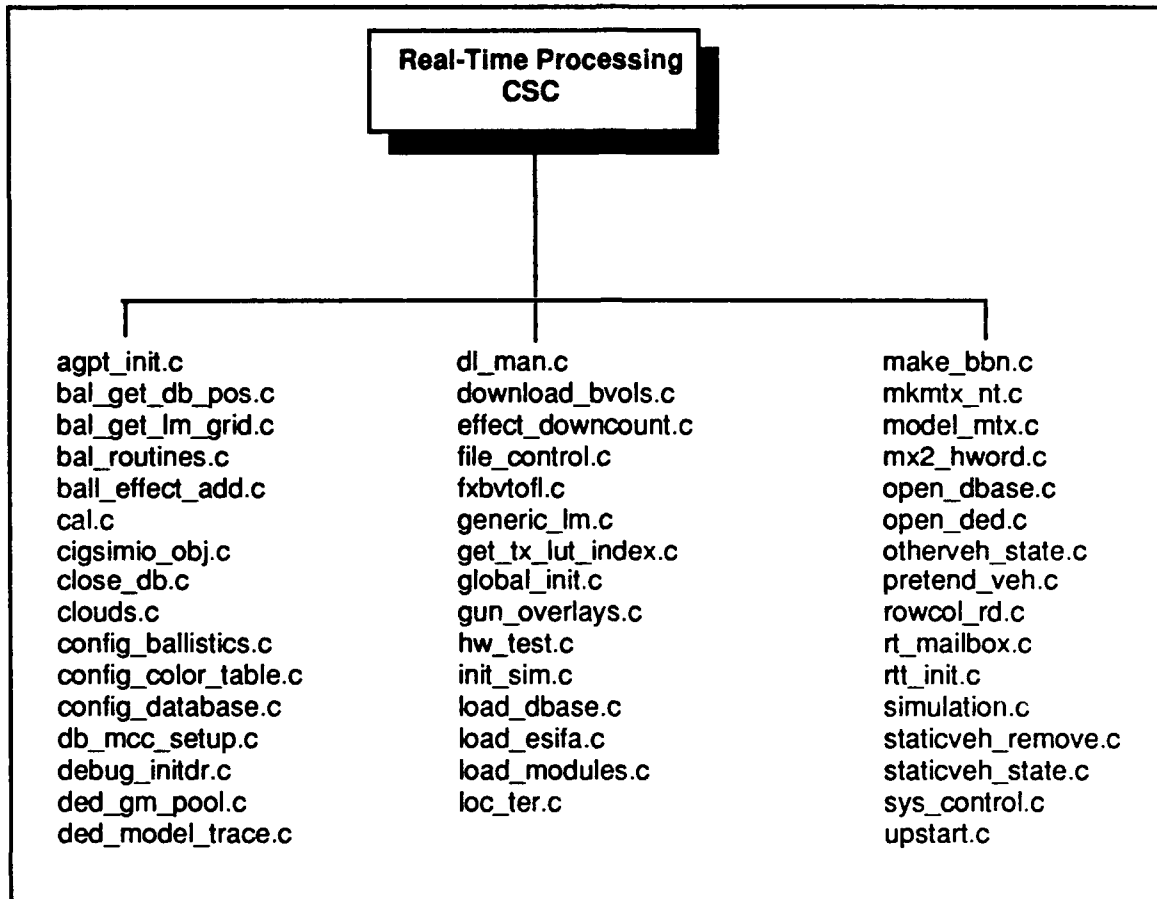


Figure 2-17. Real-Time Processing CSUs

2.13.1 agpt_init.c

The agpt_init function is not used in the standard GT100 system.

2.13.2 bal_get_db_pos.c

The bal_get_db_pos function finds the load module number and grid number of a given chord point. This function is used to determine the load module and grid of the simulated vehicle's current position.

The function call is `bal_get_db_pos(pcrd, lm_width, lm_per_side)`, where:

pcrd is a pointer to the chord data

lm_width is the width of a load module

lm_per_side is the number of load modules in a row or column of AAM

bal_get_db_pos uses the FIND_LM macro (described in Appendix B) to determine the load module for the x and y coordinates specified in the chord data. It then calculates which grid the vehicle occupies within the load module. The load module and grid number are placed in the chord data structure.

Called By: local_terrain

Routines Called: FIND_LM

Parameters: CHORD_DATA *pcrd
 INT_4 lm_width
 INT_4 lm_per_side

Returns: none

2.13.3 bal_get_lm_grid.c

The `bal_get_lm_grid` function finds the load modules and grids in the database that are intersected by a chord. This function is used to determine which four grids lie around the simulated vehicle.

The function call is `bal_get_lm_grid(pcrd, lm_per_side, lm_size, lm_base_addr, bal_search, dvl_search, lm_width)`, where:

pcrd is a pointer to the chord data
lm_per_side is the number of load modules in a row or column of AAM
lm_size is the size in bytes of a load module
lm_base_addr is the load module's base address
bal_search is the array in which to store load module offsets and grid words
dvl_search is the array in which to store dynamic module path data
lm_width is the width of a load module

The function returns TRUE if it is successful. It returns FALSE if an illegal chord (one longer than 125 meters) is detected.

Called By: local_terrain

Routines Called: none

Parameters: CHORD_DATA pcrd[]
 INT_4 lm_per_side
 INT_4 lm_size
 INT_4 lm_base_addr
 SEARCH_LIST bal_search[]
 INT_4 dvl_search[]
 INT_4 lm_width

Returns: 1 (TRUE)
 0 (FALSE)

2.13.4 bal_routines.c

The functions in the bal_routines.c CSU handle the interface between the real-time software and the Ballistics Processing CSC. Many of these routines process messages passed to and from Ballistics. These functions are:

- sim_bal_init
- sim_bal_start
- sim_bal_frame_rate
- sim_bal_req_pt_info
- sim_bal_agl_wanted
- sim_bal_process_msg
- sim_bal_process_tracer
- sim_bal_traj_chord
- sim_bal_round_fired
- sim_bal_static_add
- sim_bal_static_rem
- sim_bal_reset
- sim_bal_tf_veh_update

2.13.4.1 sim_bal_init

The sim_bal_init function initializes variables used in Ballistics messages. This function is called at the start of a simulation.

The function call is **sim_bal_init()**. sim_bal_init initializes the following:

- Variables used when processing rounds (estimated impact time and range).
- Parameters used in the Ballistics "new frame" message.
- The database index.
- Variables used when processing chords.

Called By: init_simulation

Routines Called: none

Parameters: none

Returns: none

2.13.4.2 sim_bal_start

The sim_bal_start function puts Ballistics into the run state and tells it where active area memory is. This function is called at the start of a simulation.

The function call is `sim_bal_start(pdbase)`, where *pdbase* is a pointer to the primary database control block. `sim_bal_start` does the following:

- Sets the Ballistics state to `BX_RUN`.
- Pushes a `MSG_B0_STATE_CONTROL` message onto the Ballistics message queue.
- Calculates the coordinates of the southwest corner of active area memory by subtracting half of the AAM width from the simulated vehicle's coordinates.
- Pushes a `MSG_B0_AAM_SW_CORNER` message onto the Ballistics message queue.

Called By: `init_simulation`

Routines Called: `GLOB`
`mx_push`
`printf`

Parameters: `DB_INFO` `*pdbase`

Returns: `none`

2.13.4.3 `sim_bal_frame_rate`

The `sim_bal_frame_rate` function tells Ballistics the current CIG frame rate by pushing a `MSG_B0_CIG_FRAME_RATE` message onto the Ballistics message queue. This function is called when a simulation is started.

The function call is `sim_bal_frame_rate()`.

Called By: `init_simulation`

Routines Called: `GLOB`
`mx_push`

Parameters: `none`

Returns: `none`

2.13.4.4 `sim_bal_req_pt_info`

The `sim_bal_req_pt_info` function processes the `MSG_REQUEST_POINT_INFO` message. This message is sent by the Simulation Host to obtain the terrain characteristics at a specified point.

The function call is `sim_bal_req_pt_info(p_msg)`, where `p_msg` is a pointer to the `MSG_REQUEST_POINT_INFO` message. The function does the following:

- Builds the chord data required by Ballistics. The chord's starting x and y coordinates are taken from the message from the Simulation Host. The function sets the starting and ending z coordinates to 20000 and -1, respectively. The type and id are set to `GETZ_CHORD`.
- Pushes a `MSG_B0_TRAJ_CHORD` message onto the Ballistics message queue.

Called By: `process_a_msg`

Routines Called: `GLOB`
 `mx_push`

Parameters: `MSG_REQUEST_POINT_INFO` `*p_msg`

Returns: `none`

2.13.4.5 `sim_bal_agl_wanted`

The `sim_bal_agl_wanted` function sends a `MSG_B0_TRAJ_CHORD` message to Ballistics to (1) calculate the simulated vehicle's altitude above ground level (AGL), and (2) calculate the collision chord for the simulated vehicle, based on how far and in which direction it has moved since the last frame. This function also sends new frame information (frame count and the current state of all dynamic models) to Ballistics. This function is called at the end of every frame.

The function call is `sim_bal_agl_wanted(pdynl)`, where `pdynl` is a pointer to the structure containing the current state of all dynamic models. The function does the following:

- If AGL processing is enabled and the frame count is greater than 4:
 - Sets the trajectory chord id and type to `AGL_CHORD`.
 - Sets the chord's beginning and ending x and y coordinates to the simulated vehicle's current x and y coordinates.
 - Sets the chord's beginning z coordinate to the simulated vehicle's current z coordinate.
 - Sets the chord's ending z coordinate to -1.0.
 - Pushes a `MSG_B0_TRAJ_CHORD` message onto the Ballistics message queue.
 - Sets the trajectory chord id and type to `COL_CHORD`.
 - Sets the chord's beginning x, y, and z coordinates to the simulated vehicle's current coordinates.
 - Sets the chord's ending x, y, and z coordinates to 2 times the simulated vehicle's current coordinate minus its previous position. (This is the location the vehicle will occupy in the next frame if it moves in the same direction and the same distance it moved in the last frame.)
 - Pushes a `MSG_B0_TRAJ_CHORD` message onto the Ballistics message queue.

- Sets the simulated vehicle's previous position to its new current position.
- Passes the new frame count and the state of all dynamic models to Ballistics by pushing a MSG_B0_NEW_FRAME message onto the Ballistics message queue.

Called By: msg_end

Routines Called: GLOB
mx_push

Parameters: INT_4 *pdynl

Returns: none

2.13.4.6 sim_bal_process_msg

The `sim_bal_process_msg` function is responsible for processing the messages that are returned to the real-time software from Ballistics. This function is called at the end of every frame, to generate the messages to be returned to the Simulation Host in the next exchange packet.

The function call is `sim_bal_process_msg()`. The function does the following:

- Resets the count of terrain feedback points to zero.
- Previews and processes the top message in the Ballistics message queue.
- Deletes that message from the queue and previews the next.

The following table identifies the messages processed by `sim_bal_process_msg`, and summarizes the processing performed for each one. The `SEND_TF_INFO` macro referenced in the table is described in Appendix B.

| Message | Processing by <code>sim_bal_process_msg</code> |
|--|---|
| MSG_B1_HIT_RETURN AGL_CHORD COL_CHORD GETZ_CHORD default | <i>Reports an intersection.</i> Sets the vehicle's altitude to its z coordinate. Sets the vehicle's altitude to -9999. Builds a MSG_RETURN_PT_INFO message with the intersection point data provided by Ballistics. Builds a MSG_HIT_RETURN message with the data provided by Ballistics. |
| MSG_B1_MISS AGL_CHORD COL_CHORD GETZ_CHORD default | <i>Reports a miss.</i> Sets the vehicle's altitude to minus its z coordinate. No action. No action. Builds a MSG_MISS message with the data provided by Ballistics. |
| MSG_B1_SHOT_REPORT | <i>Reports on rounds designated for specific targets.</i> Builds a MSG_SHOT_REPORT message. |
| MSG_B1_TF_HDR | <i>Terrain feedback header message.</i> Uses the SEND_TF_INFO macro to build a MSG_TF_HDR message. |
| MSG_B1_TF_PT | <i>Reports terrain feedback for a specified point.</i> Uses the SEND_TF_INFO macro to build one MSG_TF_PT message for each feedback point specified in the header message. |

Called By: `msg_end`

Routines Called: `CLOB`
 `mx_peek`
 `mx_skip`
 `printf`
 `SEND_TF_INFO`

Parameters: none

Returns: none

2.13.4.7 `sim_bal_process_tracer`

The `sim_bal_process_tracer` function processes tracer (round position) messages returned by Ballistics. This function is called at the end of every frame.

The function call is `sim_bal_process_tracer(db, pdbname)`, where:

db is the current double-buffer pointer

pdbname is a pointer to the primary database control block

`sim_bal_process_tracer` does the following:

- Previews the top message in the Ballistics message queue.
- If the message is a MSG_B1_ROUND_POSITION message:
 - Verifies there is room for the tracer data.
 - Calls ball_effect_add to store the effects data in memory for incorporating in the scene with other effects.
 - If separate updating is enabled for AAM2, calls ball_effect_add to store the effects data in memory for that AAM.
- Deletes this message from the queue and previews the next one.

Called By: msg_end

Routines Called: ball_effect_add
GLOB
mx_peek
mx_skip
printf

Parameters: INT_4 db
DB_INFO *pdbase

Returns: none

2.13.4.8 sim_bal_traj_chord

The sim_bal_traj_chord function sends the MSG_B0_TRAJ_CHORD message to Ballistics to compute the intersection of a specified trajectory chord. This function is called when the Simulation Host sends a MSG_TRAJ_CHORD message.

The function call is sim_bal_traj_chord(db, pdbase), where:

db is the current double-buffer pointer
pdbase is a pointer to the primary database control block

sim_bal_traj_chord does the following:

- Pushes a MSG_B0_TRAJ_CHORD message onto the Ballistics message queue.
- If the message requests tracer effects and there is room for the effects data, calls ball_effect_add to store the effects data in memory for incorporating in the scene with other effects.
- If separate updating is enabled for AAM2, calls ball_effect_add to store the effects data in memory for that AAM.

Called By: process_a_msg

Routines Called: ball_effect_add
GLOB
mx_push

Parameters: INT_4 db
DB_INFO *pdbase

Returns: none

2.13.4.9 sim_bal_round_fired

The `sim_bal_round_fired` function pushes a `MSG_B0_ROUND_FIRED` message onto the Ballistics message queue.

The function call is `sim_bal_round_fired(msg_P)`, where `msg_P` is a pointer to the `MSG_B0_ROUND_FIRED` message.

This function is not currently used. When it receives a `MSG_ROUND_FIRED` message from the Simulation Host, `process_a_msg` pushes the message onto the Ballistics queue itself.

Called By: none

Routines Called: GLOB
mx_push

Parameters: MSG_ROUND_FIRED *msg_P

Returns: none

2.13.4.10 sim_bal_static_add

The `sim_bal_static_add` function notifies Ballistics when the Simulation Host adds a static vehicle to active area memory via a `MSG_STATICVEH_STATE` message.

The function call is `sim_bal_static_add(to, from, type, rcnt, veh_is_tank)`, where:

to is a pointer to the static vehicle's entry in the database
from is a pointer to the `MSG_STATICVEH_STATE` message
type is the type of vehicle (taken from the message)
rcnt is a register counter used to store the vehicle's load module
veh_is_tank indicates whether the vehicle is a tank (taken from the message)

`sim_bal_static_add` builds a `MSG_B0_ADD_STATIC_VEHICLE` message, then pushes it onto the Ballistics message queue.

Called By: staticveh_state

| | | |
|------------------|--|---|
| Routines Called: | GLOB mx_error mx_push printf | |
| Parameters: | INT_4 INT_4 INT_2 INT_2 BYTE | *to *from type rcnt veh_is_tank |
| Returns: | none | |

2.13.4.11 sim_bal_static_rem

The `sim_bal_static_rem` function notifies Ballistics when the Simulation Host deletes a static vehicle from active area memory via a `MSG_STATICVEH_REM` message.

The function call is `sim_bal_static_rem(from, rcnt)`, where:

from is a pointer to the `MSG_STATICVEH_REM` message
rcnt is a register counter used to store the vehicle's load module

`sim_bal_static_rem` builds a `MSG_B0_DELETE_STATIC_VEHICLE` message, then pushes it onto the Ballistics message queue.

| | | |
|------------------|---------------------------------------|---------------|
| Called By: | staticveh_remove | |
| Routines Called: | GLOB mx_error mx_push printf | |
| Parameters: | INT_4 INT_2 | *from rcnt |
| Returns: | none | |

2.13.4.12 sim_bal_reset

The `sim_bal_reset` function tells Ballistics to reinitialize itself by pushing a `MSG_B0_STATE_CONTROL` message onto the Ballistics message queue with the new state set to `BX_RESET`. This function is called when the Simulation Host sends a `MSG_CIG_CTL - C_STOP` message to stop the simulation.

The function call is `sim_bal_reset()`.

Called By: `msg_cig_ctl`

Routines Called: `GLOB`
 `mx_push`

Parameters: `none`

Returns: `none`

2.13.4.13 `sim_bal_tf_veh_update`

The `sim_bal_tf_veh_update` function notifies Ballistics of the new position of the simulated vehicle, for the purposes of terrain feedback reporting. This function is called whenever the simulated vehicle's current position is updated.

This function is called only if the terrain feedback vehicle is the simulated vehicle. The Simulation Host may send `MSG_TF_VEHICLE_POS` messages to update the positions of other vehicles for which Ballistics is collecting terrain feedback data. Such messages are pushed onto the Ballistics message queue by `process_a_msg`.

The function call is `sim_bal_tf_veh_update(time_stamp, pos, matrix)`, where:

time_stamp is the time stamped in the `MSG_TF_VEHICLE_POS` message
pos is the simulated vehicle's new position
matrix is the simulated vehicle's new rotation matrix

`sim_bal_tf_veh_update` does the following:

- Determines whether Ballistics needs to process terrain feedback for this vehicle during this frame.
- Builds a `MSG_B0_TF_VEHICLE_POS` message with the data from the message.
- Pushes the message onto the Ballistics message queue.

The function always returns 0.

Called By: `process_vppos`

Routines Called: `GLOB`
 `mx_push`

Parameters: `UNS_2` `time_stamp`
 `R4P3D` `*pos`
 `RTS4x3_MTX` `*matrix`

Returns: 0

2.13.5 ball_effect_add.c

The `ball_effect_add` function adds single-frame special effects to the current effects list. This function is called by the routines responsible for processing `MSG_ROUND_POSITION` and `MSG_TRAJ_CHORD` messages.

The function call is `ball_effect_add(db, type, x, y, z, pdbname, vme_offset)`, where:

db is the double buffer to be updated
type is the type of special effect
x, y, and z are the world coordinates at which the effect is to be shown
pdbname is a pointer to the primary database control block
vme_offset is the VME address offset to active area memory

`ball_effect_add` does the following:

- Uses the `FIND_LM` macro (described in Appendix B) to find the load module on which to place the Ballistics tracer.
- Puts the data in the register used to store effects. This data includes the effect's coordinates, number of stamps, number of frames, and load module number.

Called By: `sim_bal_process_tracer`
`sim_bal_traj_chord`

Routines Called: `FIND_LM`

| | | |
|-------------|----------------------|-------------------------|
| Parameters: | <code>INT_4</code> | <code>db</code> |
| | <code>INT_2</code> | <code>type</code> |
| | <code>REAL_4</code> | <code>x</code> |
| | <code>REAL_4</code> | <code>y</code> |
| | <code>REAL_4</code> | <code>z</code> |
| | <code>DB_INFO</code> | <code>*pdbname</code> |
| | <code>INT_4</code> | <code>vme_offset</code> |

Returns: none

2.13.6 cal.c

The `cal` (calibration menu) function exercises the video monitors by placing a known pattern on all channels. This function is called when the Gossip user selects the 1 ("calibration menu") option from the Gossip main menu. `cal` presents a menu that lets the user turn the calibration image or gunner pixel overlay on or off. The user is then able to verify the accuracy of the image and take appropriate measures.

The function call is `cal()`. `cal` displays the "Calibration menu -->" prompt and uses `unbf_getchar` to get the user's entry.

The following table identifies the options presented on the calibration menu, and summarizes the steps performed by `cal` to process each selection. The menu is displayed if the user enters an invalid character.

| Calibration Menu Option | Processing by cal |
|--------------------------------|---|
| 0 calibration images off | Sets <code>pcal_flag</code> to FALSE in both AAMs. |
| 1 offset calibration images on | Calls <code>make_cal_matrices</code> and <code>make_cal_patterns</code> to create and display the offset calibration overlay. If AAM2 is present, copies the overlay there. |
| 2 color calibration pixels on | Calls <code>make_cal_matrices</code> and <code>gos_polys</code> to create and display the color calibration pixels. If AAM2 is present, copies the overlay there. |
| 3 bbn logo on | Calls <code>make_cal_matrices</code> and <code>make_bbn_logo</code> to create and display the BBN logo overlay. If AAM2 is present, copies the overlay there. |
| 5 calibration pixels on | Calls <code>backend_get_object_addr</code> to get the address of each backend. For a T backend, sets the pixel state to TRUE and calls <code>msg_ppm_pixel_state</code> . |
| 6 calibration pixels off | Calls <code>backend_get_object_addr</code> to get the address of each backend. For a T backend, sets the pixel state to FALSE and calls <code>msg_ppm_pixel_state</code> . |
| x exit | Exits. |

Called By: `gossip_tick`

Routines Called: `backend_get_object_addr`
`bcopy`
`GLOB`
`gos_polys`
`make_bbn_logo`
`make_cal_matrices`
`make_cal_patterns`
`msg_ppm_pixel_state`
`printf`
`unbf_getchar`
`VME_TO_VMX`

Parameters: none

Returns: none

2.13.7 `cigsimio_obj.c`

The functions in the `cigsimio_obj.c` CSU accommodate writing CIG-to-SIM and SIM-to-CIG messages to a binary disk file (`cigsimio.000`) during runtime. This option, called recording, can be enabled using the `r` ("record i/f messages menu") option on the Gossip main menu. The user can open or close the record file, start or stop recording, and set the number of frames to be recorded. Messages can be recorded during any CIG state, including simulation.

If recording is enabled, the `cigsimio_obj` functions write *every* message each frame into a temporary buffer. Incoming messages are written to the buffer as they are received. Outgoing messages are written to the buffer when the packet is sent. At the same time, the contents of the buffer are written to a disk file (`cigsimio.000`).

The record file can be played back to repeat the recorded simulation exercise. This feature, called absolute script playback, is available through options on the Flea Script menu. Refer to section 2.7.19 for details.

In addition to (or instead of) writing messages to a disk file, messages can be sent to stdout each frame. This feature, called debug message display, is provided by the Host Interface debug routines. The Host Interface debug routines are dependent upon the `cigsimio_obj` functions, in that they display messages from the temporary buffer created by the `cigsimio_obj` functions. This interface works as follows:

- The recording and debug display features can be enabled through Gossip. The user can also select which message types are to be displayed.
- Each frame, the `cigsimio_write` function copies the messages to a temporary buffer. If message recording is enabled, `cigsimio_write` writes the buffer contents to disk also. If only debug display is enabled, the messages are written to the buffer only.
- At the end of each frame, the `host_if_debug` function waits for a mailbox message to be posted by `cigsimio_write`. It then gets a pointer to the `cigsimio` buffer and calls `host_if_debug_tick` to display the messages using the `print_msg_*` functions. Only those messages that have been enabled for debug display are displayed; other messages in the buffer are ignored.
- The `cigsimio` buffer is initialized at the beginning of every frame.

The `cigsimio_obj` functions use `ifx_write` to write the messages to the binary disk file. The `print_msg_*` functions that write the messages to stdout are tailored for each message type to provide formatted, readable displays.

For more information on debug message display, refer to the Host Interface Manager CSC. For more information on the specialized `print_msg_*` functions, refer to the Message Processing CSC.

The functions in the `cigsimio_obj.c` CSU are:

- `gos_cigsimio`
- `cigsimio_msg_in`
- `cigsimio_msg_out`

- cigsimio_write
- cigsimio_get_data
- cigsimio_buffer_init
- cigsimio_frame_end

2.13.7.1 gos_cigsimio

The `gos_cigsimio` function lets the Gossip user control the process of writing all messages to a disk file. This function is called if the user selects the `r` ("record i/f messages menu") option from the Gossip main menu.

The function call is `gos_cigsimio()`. `gos_cigsimio` displays a menu of options, and uses `unbf_getchar` to get the keystroke entered by the user. The following table identifies these options and lists the major steps performed by `gos_cigsimio` to process each selection.

| Record I/F Messages Menu Option | Processing by <code>gos_cigsimio</code> |
|---------------------------------|--|
| ? print this menu | Displays the list of valid options. |
| b begin recording | Verifies that the parameters have been initialized; sets <code>cigsimio_flag</code> to TRUE. |
| c close record file | If <code>cigsimio_open_flag</code> is TRUE, sets <code>cigsimio_flag</code> and <code>cigsimio_open_flag</code> to FALSE; calls <code>ifx_close</code> to close the file. If <code>cigsimio_open_flag</code> is FALSE, displays an error. |
| e end recording | If <code>cigsimio_flag</code> is TRUE, sets <code>cigsimio_close_flag</code> to TRUE; if not, outputs an error. |
| f # frames written | Displays the number of frames written, maximum number of frames, and number of bytes written. |
| i initialize | Prompts the user for the file name; sets <code>cigsimio_fn</code> ; initializes the frame and byte count parameters; sets <code>cigsimio_init_flag</code> to TRUE. |
| m change frames to record | Prompts the user for the number of frames to record; sets <code>max_num_io_frames</code> to the user's entry or to a default value if the entry exceeds the maximum allowed. |
| o open record file | Calls <code>ifx_open</code> to create and open the file; sets <code>cigsimio_open_flag</code> to TRUE. |
| q quit | Exits. |
| s write string to file | Prompts the user for the tag string; calls <code>cigsimio_write</code> to write the string to the file. |
| x exit | Exits. |

Called By: `gossip_tick`

Routines Called: `cigsimio_write`
`ifx_close`
`ifx_open`

printf
scanf
strlen
unbf_getchar

Parameters: none

Returns: none

2.13.7.2 cigsimio_msg_in

The `cigsimio_msg_in` function determines whether or not an incoming message should be written to the `cigsimio` buffer. This function is called every time a message is read from an incoming exchange packet.

The function call is `cigsimio_msg_in(p_addr, byte_count, frame_flag)`, where:

p_addr is a pointer to the incoming message
byte_count is the number of bytes in the message
frame_flag is <<TBD>>

`cigsimio_msg_in` first determines whether message recording or debug message display has been enabled through Gossip (i.e., if either `cigsimio_flag` or `cigsimio_log_request` is TRUE). If so, it calls `cigsimio_write` to copy the message to the buffer and, if recording is enabled, to write it to the disk file. The message is tagged TAG_MSG_TO_CIG.

Called By: cig_config
db_mcc_setup
file_control
get_msg_2d
hw_test
process_a_msg
upstart

Routines Called: cigsimio_write

Parameters: UNS_4 *p_addr
INT_4 byte_count
BOOLEAN frame_flag

Returns: none

2.13.7.3 cigsimio_msg_out

The `cigsimio_msg_out` function determines whether or not an outgoing message packet should be written to the `cigsimio` buffer. During a simulation, this function is called at the

end of each frame. During other states, it is called whenever a MSG_END message is received from the Simulation Host, indicating the end of a message packet.

The function call is `cigsimio_msg_out(p_addr, byte_count, frame_flag)`, where:

p_addr is a pointer to the message packet
byte_count is the number of bytes in the packet
frame_flag is <<TBD>>

`cigsimio_msg_out` first determines whether message recording or debug message display has been enabled through Gossip (i.e., if either `cigsimio_flag` or `cigsimio_log_request` is TRUE). If so, it calls `cigsimio_write` to copy the messages to the buffer and, if recording is enabled, to write them to the disk file. The message packet is tagged TAG_MSG_TO_CIG.

| | | |
|------------------|---|--|
| Called By: | <code>_set_up_for_next_frame</code> <code>cig_config</code> <code>db_mcc_setup</code> <code>file_control</code> <code>get_msg_2d</code> <code>hw_test</code> <code>upstart</code> | |
| Routines Called: | <code>cigsimio_write</code> | |
| Parameters: | <code>UNS_4</code> <code>INT_4</code> <code>BOOLEAN</code> | <code>*p_addr</code> <code>byte_count</code> <code>frame_flag</code> |
| Returns: | <code>none</code> | |

2.13.7.4 `cigsimio_write`

The `cigsimio_write` function writes incoming and outgoing messages to a temporary buffer and, if recording is enabled, to a file on disk. This function is called every time a message is received or a message packet is sent, but only if message recording and/or debug message display has been enabled through Gossip.

`cigsimio_write` also manages the record file. For example, it closes the file if it reaches its maximum size or the specified number of frames, and opens or closes the file per the user's request through Gossip.

The function call is `cigsimio_write(p_addr, byte_count, frame_flag, record_tag)`, where:

p_addr is a pointer to the message or packet to be written
byte_count is the number of bytes to be written
frame_flag is <<TBD>>
record_tag identifies the type of message: CIG-to-SIM or SIM-to-CIG

`cigsimio_write` does the following:

- If the Gossip user has requested that the record file be closed:
 - Sets `cigsimio_close_flag` and `cigsimio_open_flag` to FALSE.
 - Calls `ifx_close` to close the record file.
 - Sets `cigsimio_flag` to FALSE.
- If the record file has reached its maximum size:
 - Disables recording by setting `cigsimio_flag` to FALSE.
 - Calls `ifx_close` to close the record file.
 - Sets `cigsimio_open_flag` to FALSE.
- If the record file is not open:
 - Calls `ifx_open` to open the file.
 - Sets `cigsimio_open_flag` to TRUE.
- Creates a new tag record (specifying the number of frames written, current time, and byte count) and copies it to the `cigsimio` buffer.
- Copies the message(s) to the `cigsimio` buffer.
- If recording is enabled and either `frame_flag` is TRUE or the record tag is `TAG_MSG_FROM_CIG`:
 - Writes the messages from the buffer to the record file on disk.
 - Increments the number of frames written.
 - If the maximum number of frames has been written, closes the record file and turns recording off.

Called By: `cigsimio_msg_in`
 `cigsimio_msg_out`
 `gos_cigsimio`

Routines Called: `bcopy`
 `ifx_close`
 `ifx_open`
 `ifx_write`
 `read_watch`

Parameters: `UNS_4` `*p_addr`
 `INT_4` `byte_count`
 `BOOLEAN` `frame_flag`
 `UNS_1` `record_tag`

Returns: `none`

2.13.7.5 `cigsimio_get_data`

The `cigsimio_get_data` function returns a pointer to the `cigsimio` buffer. This function is called when the Host Interface debug display routines are ready to print the buffered messages to stdout.

The function call is `cigsimio_get_data(pkt_len)`, where `pkt_len` is a pointer for the size of the buffer.

`cigsimio_get_data` returns a pointer to the buffer and places the buffer size in the location specified by `pkt_len`.

Called By: `host_if_debug`

Routines Called: `none`

Parameters: `INT_4` `*pkt_len`

Returns: `*todisk_buffer`

2.13.7.6 `cigsimio_buffer_init`

The `cigsimio_buffer_init` function initializes the `cigsimio` buffer and sets the `cigsimio_log_request` variable to `TRUE` (indicating that debug display is enabled). This function is called at the beginning of every frame, to clear the buffer for the new messages from the current frame.

The function call is `cigsimio_buffer_init()`.

Called By: `host_if_debug`

Routines Called: `none`

Parameters: `none`

Returns: `none`

2.13.7.7 `cigsimio_frame_end`

The `cigsimio_frame_end` function sets the `cigsimio_log_request` variable to `FALSE`, then posts a message to the `cigsimio_complete` mailbox. This message tells `host_if_debug` that all messages from the previous frame have been written to the `cigsimio` buffer and are ready to be processed by `host_if_debug_tick`. This function is called at the end of every frame.

The function call is `cigsimio_frame_end()`.

Called By: `msg_end`

Routines Called: `sc_post`

Parameters: none

Returns: none

2.13.8 close_db.c

The close_db function closes and frees all database information, including names, headers, model address tables, and catalog tables. It also closes the terrain database and the DED file. This function is called when the Simulation Host sends a CIG Control-Stop message to end the simulation.

The function call is **close_db()**. If the system contains multiple backends, close_db frees and closes the database in each one.

Called By: msg_cig_ctl

Routines Called: free
XCLOSE

Parameters: none

Returns: none

2.13.9 clouds.c

The functions in the clouds.c CSU activate and manage cloud models. These functions are:

- cloud_init
- cloud_update
- cloud_update_model
- cloud_mgmt
- cloud_placement
- cloud_scud
- set_lut
- rnd

2.13.9.1 cloud_init

The cloud_init function sets up and initializes the cloud model and the cloud control structure. This function is called at viewport configuration time.

The function call is **cloud_init(type)**, where *type* is the type of cloud model: **CLOUD_TOP** or **CLOUD_BOT**. cloud_init does the following:

- Allocates and initializes the model call.

- Allocates and sets up the cloud control structure.

Called By: cig_config

Routines Called: aam_malloc
 GLOB
 INIT_MTX

Parameters: WORD type

Returns: none

2.13.9.2 cloud_update

The `cloud_update` function updates cloud parameters. This function is called when the Simulation Host sends a `MSG_CLOUD_STATE` message, which specifies the cloud top and bottom models and positions them at the desired altitudes.

The function call is `cloud_update(pmsg)`, where `pmsg` is a pointer to the `MSG_CLOUD_STATE` message. `cloud_update` does the following:

- If the cloud state in the message is FALSE (0):
 - Sets `clouds_wanted_G` to FALSE.
 - Turns off the cloud models.
 - If AAM2 exists, disables cloud processing there also.
 - Sets `cloud_state` to NULL.
- If the cloud state in the message is TRUE (1):
 - Validates the data in the message:
 - * If the cloud bottom in the message is below the top, sets the bottom equal to the top.
 - * If scud processing is enabled and the scud top and bottom are not outside the cloud top and bottom, sets the scud bottom to 5.0 meters below the cloud bottom, and sets the scud top to 5.0 meters above the cloud top.
 - Sets the new cloud (and scud) top and calls `cloud_update_model` to set the model's address.
 - Sets the new cloud (and scud) bottom and calls `cloud_update_model` to set the model's address.
 - Sets the scud top and bottom thickness parameters (the distance from the scud top to the cloud top and from the scud bottom to the cloud bottom).
 - Sets `new_cloud_data` to TRUE. This triggers `cloud_mgmt` to process the changes.

Called By: process_a_msg

Routines Called: AAM2_ADDR
 cloud_update_model

GLOB

Parameters: MSG_CLOUD_STATE *pmse

Returns: none

2.13.9.3 cloud_update_model

The `cloud_update_model` function sets up a cloud model's address.

The function call is `cloud_update_model(type, model_id)`, where:

type is **CLOUD_TOP** or **CLOUD_BOT**
model_id is the model id from the Simulation Host message

`cloud_update_model` gets the model's address from the DED model address table, then puts the model's address into the cloud control structure. If the system contains two backends, `cloud_update_model` updates both databases.

Called By: cloud_update

Routines Called: printf

Parameters: WORD type
 HWORD model_id

Returns: none

2.13.9.4 cloud_mgmt

The `cloud_mgmt` function manages cloud placement and effects. This function is called at the end of every frame to process the changes requested during that frame.

The function call is `cloud_mgmt()`. `cloud_mgmt` does the following:

- If the cloud has changed altitude (i.e., `new_cloud_data` is TRUE):
 - Sets `new_cloud_data` to FALSE.
 - Updates the top and bottom models' information.
- If the simulated vehicle is now below the clouds:
 - Sets the cloud state to **BELOW_CLOUDS**.
 - Turns on the cloud bottom model.
 - If AAM2 is present, turns on the cloud bottom model there also.
 - If the simulated vehicle is now in the bottom scud layer, calculates the scud ratio and calls `cloud_scud`.
 - If the vehicle is not in the bottom scud layer, calls `cloud_scud` with the scud ratio set to **NO_SCUD**.

- Calls `cloud_placement` to update the model's position.
- If the simulated vehicle is now above the clouds:
 - Sets the cloud state to `ABOVE_CLOUDS`.
 - Turns on the cloud top model.
 - If AAM2 is present, turns on the cloud top model there also.
 - If the simulated vehicle is now in the top scud layer, calculates the scud ratio and calls `cloud_scud`.
 - If the vehicle is not in the top scud layer, calls `cloud_scud` with the scud ratio set to `NO_SCUD`.
 - Calls `cloud_placement` to update the model's position.
- If the simulated vehicle is now in the clouds:
 - Turns off the top or bottom model (whichever was active, based on the previous cloud state).
 - If AAM2 is present, turns the cloud model off there also.
 - Calls `cloud_scud` with the scud ratio set to `FULL_SCUD`.
 - Sets the cloud state to `IN_THE_CLOUDS`.

Called By: `msg_end`

Routines Called: `AAM2_ADDR`
`cloud_placement`
`cloud_scud`
`GLOB`

Parameters: `none`

Returns: `none`

2.13.9.5 `cloud_placement`

The `cloud_placement` function updates the cloud model's position. This function is called to move the cloud model to keep it in line with the simulated vehicle. The cloud is moved in a fixed increment (`cloud_modulo`) set in the `clouds.h` include file.

The function call is `cloud_placement(pcloud)`, where *pcloud* is a pointer to the cloud's control information.

`cloud_placement` checks the simulated vehicle's new position, moves the cloud model in the required direction, and updates the cloud model's matrix accordingly.

Called By: `cloud_mgmt`

Routines Called: `GLOB`

Parameters: `CLOUD_CONTROL` `*pcloud`

Returns: none

2.13.9.6 cloud_scud

The `cloud_scud` function creates a scud effect that depends on the altitude of the simulated vehicle in comparison to the cloud and scud layer altitudes.

The function call is `cloud_scud(ratio)`, where *ratio* is one of the following:

- If the simulated vehicle is in a scud layer, the ratio is the distance between the vehicle and the edge of the scud layer, divided by the thickness of the scud layer.
- If the simulated vehicle is in the clouds, the ratio is `FULL_SCUD`.
- If the simulated vehicle is not in a scud layer or in the clouds, the ratio is `NO_SCUD`.

`cloud_scud` calls `set_lut` to select a lookup table entry suitable for the required scud effect. If the ratio is larger than the random number returned by `rnd`, it is treated as `FULL_SCUD`.

Called By: cloud_mgmt

Routines Called: rnd
set_lut

Parameters: REAL_4 ratio

Returns: none

2.13.9.7 set_lut

The `set_lut` function selects an entry from the 3-D lookup table (`lut3d`) to display a scud effect. The entry selected is based on whether the simulated vehicle is in the clouds, in a scud layer, or completely above or below the clouds and scud layers.

The function call is `set_lut(n, idx)`, where:

n is the backend id (0 or 1)
idx is index of the desired lookup table

Called By: cloud_scud

Routines Called: none

Parameters: INT_4 n
INT_4 idx

Returns: none

2.13.9.8 rnd

The `rnd` function is a random number generator. This function is used to generate a number to compare to the scud ratio calculated when the simulated vehicle is inside a scud layer. If the ratio exceeds the random number generated, the `FULL_SCUD` lookup table entry is selected.

The function call is `rnd()`.

Called By: `cloud_scud`

Routines Called: none

Parameters: none

Returns: `seed * .0000000004656613`

2.13.10 config_ballistics.c

The functions in the `config_ballistics.c` CSU are used to configure Ballistics and establish the communication path between Ballistics and the real-time software. These functions are:

- `config_ballistics`
- `bal_buffer_setup`

2.13.10.1 config_ballistics

The `config_ballistics` function reads the Ballistics configuration file (`ballist.cfg`). This file specifies whether to use a local Ballistics task or to interface with a Ballistics process running on another CPU. This function is called at initialization time.

The function call is `config_ballistics(tte, tid, base_priority)`, where:

tte is the Ballistics task's entry in the task table
tid is the task id assigned to the Ballistics task
base_priority is the task's priority

`config_ballistics` does the following:

- Initializes the Ballistics board type to `NO_BALLISTICS`.
- Checks to see if Ballistics processing has been disabled (by specifying the "b" argument on the startup command line). If so, sets `ball_is_present` to `FALSE` and exits.

- Sets ball_is_present to TRUE.
- Calls fopen to open the Ballistics configuration file.
 - If the file cannot be opened, or if the file specifies an invalid type, sets the Ballistics board type to MASTER147_BALLISTICS.
 - If the file specifies Slave Ballistics, calls bus_error to verify that the Slave board is present, then sets the Ballistics board type to SLAVE147_BALLISTICS.
 - If the file specifies Master Ballistics, sets the Ballistics board type to MASTER147_BALLISTICS.
- Calls fclose to close the Ballistics configuration file.
- If Master Ballistics is set, calls pcreate to create a task table entry for the Ballistics task.
- Pauses (using sc_delay) to give the task time to start up.
- Calls bal_buffer_setup to establish an interface to the Ballistics task.
- Calls mx_peek to get the MSG_B1_STATUS_RETURN returned by Ballistics after it initializes, then discards the message.

If an error is detected, the function exits with a 1.

Called By: main (in rtt.c)

Routines Called: bal_buffer_setup
 bus_error
 exit
 fclose
 fgets
 fopen
 GLOB
 mx_peek
 mx_skip
 pcreate
 printf
 sc_delay
 serror
 sscanf
 strcmp

Parameters: struct {int last;
 int in_use;
 int (*task_addr());
 char *name;
 int priority_offset;
 }
 INT_4 *tte
 INT_4 tid
 base_priority

Returns: none

2.13.10.2 bal_buffer_setup

The `bal_buffer_setup` function establishes the interface between the real-time software and Ballistics. The processes communicate via the Ballistics message queues, which are described in the Ballistics Processing CSC section.

The function call is `bal_buffer_setup()`. The function does the following:

- Pauses (using `sc_delay`) to wait for the Ballistics addresses to be published.
- Calls `mpv_nfind` to get the addresses and sizes of the three Ballistics message queues.
- If the addresses are not published yet, pauses and then calls `mpv_nfind` again. If it has 10 unsuccessful retries, `bal_buffer_setup` resets the Ballistics board type to `NO_BALLISTICS`, sets `ball_is_present` to `FALSE`, and quits.
- Gets the Ballistics queue parameters.
- If Ballistics printing is enabled, outputs the Ballistics message queue parameters to `stdout`.

The function returns `TRUE` if it is successful. It returns `FALSE` if `mpv_nfind` could not find the Ballistics message queue parameters.

Called By: `config_ballistics`

Routines Called: `GLOB`
`mpv_nfind`
`printf`
`sc_delay`

Parameters: `none`

Returns: `1 (TRUE)`
`0 (FALSE)`

2.13.11 config_color_table.c

The `config_color_table` function open a specified color table file. This function is called when the Simulation Host sends a `MSG_CIG_CTL - CIG_CONFIG` message. The name of the file can be specified with the `MSG_FILE_DESCR - DB_COLOR_CFG_0` (backend 0) or `DB_COLOR_CFG_1` (backend 1) message. The default file name is `color.cfg`.

The color table file contains the following:

- Color offset.
- Color description.
- 3-D lookup table (TX backends only).
- 2-D lookup table (TX backends only).
- ESIFA color (T backends only).

- Minimum acceptable fade value.
- Maximum acceptable fade value.
- DTP (thermal) switching value.

The function call is `config_color_table(pfn)`, where *pfn* is a pointer to the name of the color table file. `config_color_table` does the following:

- Opens the specified file.
- Gets and sets the values for all normal mode video registers.
- Gets and sets the values for all optional mode video registers.
- Gets and sets the values for video on/off.
- Gets and sets the values for `dtp_switching` (normal, alternate, and modifier).
- Gets and sets the values for the fade bits (`and_sky`, `or_sky`, `and_laser`, and `or_laser`).
- Clears the color descriptions from memory.
- Reads the color table and sets the specified values in memory.
- Closes the file.

The function exits with a 1 if the specified file could not be opened or the table contains too many entries.

Called By: `db_mcc_setup`

Routines Called: `exit`
 `fclose`
 `fgets`
 `fopen`
 `printf`
 `scanf`

Parameters: `BYTE` `*pfn`

Returns: `none`

2.13.12 `config_database.c`

The functions in the `config_database.c` CSU open the database configuration file. These functions are:

- `config_database`
- `errors`
- `func_msg`
- `print_pdbase`

2.13.12.1 `config_database`

The `config_database` function opens the database configuration (`database.cfg`) file to find and set the names of the terrain database and DED files, local terrain message parameters,

and terrain and field-of-view addresses. This function is called when the system is initialized.

A different database configuration file can be specified with the MSG_FILE_DESCR - DB_SETUP_0 (backend 0) or DB_SETUP_1 (backend 1) message. The database configuration file specifies the following:

- Database name.
- DED database name.
- Initial frame to return a local terrain message.
- Number of frames between subsequent local terrain messages.
- Terrain address and field-of-view table address for each AAM.

The function call is **config_database()**. The function does the following:

- Initializes the primary database control blocks.
- Sets the default database and DED file names.
- Sets up the VME offsets for active area memory in each backend.
- Sets the default local terrain frequency.
- Calls errors to check for errors.
- Sets up pointers to the DATABASE_MB mailboxes (one per rowcol_rd task).
- If a subsys.cfg file exists:
 - Calls get_database_name to get the name of the database file for each backend.
 - Sets the db_to_use variable for each backend.
 - Calls get_ded_name to get the name of the DED file for each backend.
 - Sets the ded_db_to_use variable for each backend.
 - Outputs the file names to stdout.
 - Calls errors to check for errors.
- If no subsys.cfg file is found:
 - Calls fopen to open the database.cfg file.
 - If no database.cfg file is found, outputs a message to stdout and returns a value indicating how many database management tasks need to be set up (one per backend).
 - If a database.cfg file is found, reads the configuration information (file names, local terrain message parameters, AAM terrain address, and AAM fov table address) for each database (each backend).
 - Calls errors to check for errors.
 - Closes the database.cfg file.

If no subsys.cfg or database.cfg file was found, the function returns 1 if one AAM is present, or 2 if two AAMs are present. If a configuration file was found, the function returns the number of AAMs as *i*. This triggers the creation of the correct number of rowcol_rd tasks (one per backend).

The function exits with a 1 if an error is found.

Called By: main (in rtt.c)

Routines Called: errors
 exit
 fclose

fgets
 fopen
 get_database_name
 get_ded_name
 printf
 sprintf
 sscanf
 strcpy
 strlen

Parameters: none

Returns: 1
 2
 i

2.13.12.2 errors

The errors function checks for the following errors for config_database:

- Invalid terrain/field-of-view table addresses.
- Invalid local terrain frequency parameter.

The function call is **errors (pdbase)**, where *pdbase* is a pointer to the primary database control block.

The function returns TRUE if an error is found, or FALSE if the data is valid.

Called By: config_database

Routines Called: bus_error
 func_msg

Parameters: DB_INFO *pdbase

Returns: 1 (TRUE)
 0 (FALSE)

2.13.12.3 func_msg

The func_msg function outputs the error "**** ERROR: <text>: DATABASE.CFG" to stdout. The variable text is supplied by the calling function.

The function call is **func_msg(s)**, where *s* is the error text to appear in the output message.

Called By: errors
open_dbase

Routines Called: printf

Parameters: BYTE s[]

Returns: none

2.13.12.4 print_pdbase

The `print_pdbase` function outputs the contents of a specified database configuration file to stdout. Specifically, it prints the following:

- Database identifier.
- Database file name.
- DED file name.
- Local terrain initial frame.
- Local terrain message frequency.
- Terrain address.
- Field-of-view table address.
- File descriptor.

The function call is `print_pdbase(pdb)`, where `pdb` is a pointer to the primary database control block.

This function is not currently used.

Called By: none

Routines Called: printf

Parameters: DB_INFO *pdb

Returns: none

2.13.13 db_mcc_setup.c

The `db_mcc_setup` function processes messages from the Simulation Host to prepare the CIG system to run a simulation. It can also prepare the CIG to act as an MCC station, although this mode is not currently used. `db_mcc_setup` is called when the CIG Control message from the Simulation Host specifies `C_DB_SETUP` or `C_MCC_SETUP`.

The function call is **db_mcc_setup(state)**, where *state* is the state the system is to be set up in: C_DB_SETUP (simulation mode) or C_MCC_SETUP (MCC station mode).

db_mcc_setup does the following:

- Initializes trajectory table static variables.
- Sets the default ESIFA (textures) file name if none has been specified.
- Sets the default color configuration file name if none has been specified.
- Outputs the ESIFA and color file names to stdout.
- Calls poll_shutdown to see if a system shutdown has been requested.
- Processes each message received from the Simulation Host:
 - Verifies that the packet length has not been exceeded; uses SYSERR to generate a MSG_SYS_ERROR if it has.
 - Calls cigsimio_msg_in to write the message to a buffer (if message recording or debug message display is enabled).
 - Processes the message based on its message type (see table below). Uses SYSERR to generate an error message if an invalid message is received.
- Returns control to upstart when it returns from cig_config or a simulation, or when it detects a CIG-Control Stop message.

The following table summarizes the processing performed by db_mcc_setup in response to each valid message type it receives from the Simulation Host. The first column lists the messages in alphabetical order. The second column briefly describes the purpose of the message (in *italics*), then lists the major steps performed by db_mcc_setup to process the message.

| Message from SIM Host | Processing by db_mcc_setup |
|--|---|
| MSG_ADD_TRAJ_TABLE | <i>Adds a trajectory table.</i> Calls mx_push to push MSG_B0_ADD_TRAJ_TABLE message onto Ballistics message queue. |
| MSG_AMMO_DEFINE | <i>Selects ammunition maps.</i> Loads specified ammo maps into memory. |
| MSG_CIG_CTL C_CIG_CONFIG C_START_2D_SETUP C_MCC_SIMUL C_SIMULATION C_STOP C_NULL | <i>Causes a transition to another performance state.</i> Calls config_color_table; calls cig_config; calls load_dbase for each backend. Calls cig_2d_setup. Calls simulation with state set to C_MCC_SIMUL. Calls simulation with state set to C_SIMULATION. Returns to upstart. No action. |
| MSG_DEFINE_TX_MODE | <i>Defines viewport switching data for TX backends.</i> Calls mpvideo_define_mode. |
| MSG_DELETE_TRAJ_TABLE | <i>Deletes a trajectory table.</i> Calls mx_push to push MSG_B0_DELETE_TRAJ_TABLE message onto Ballistics message queue. |
| MSG_DR11_PKT_SIZE | <i>Specifies exchange packet parameters.</i> Outputs data from message; sets CIG and SIM exchange packet sizes; validates local terrain chunk size and sets if valid; validates local terrain message interval and sets if valid; sets CIG hardware type. |

| | |
|-------------------------------------|---|
| MSG_END | <i>Signals end of packet buffer.</i> Calls <code>cigsimio_msg_out</code> to write the outgoing message packet to the <code>cigsimio</code> buffer if recording or debug display is enabled; if <code>ppm_message_flag</code> is TRUE, calls <code>esifa_send_req</code> and sets flag to FALSE; calls the appropriate <code>exchange_data</code> routine (through <code>*exchange_data</code>) to exchange packets. |
| MSG_FILE_DESCR | <i>Specifies database files to use for simulation.</i> |
| DB_SETUP | If no database has been specified, outputs a message; if specified, calls <code>open_dbase</code> . |
| DB_SETUP_0, DB_SETUP_1 | Calls <code>set_database_name</code> for specified backend; gets and outputs file name. |
| DB_DED_SETUP_0, DB_DED_SETUP_1 | Calls <code>set_ded_name</code> for specified backend; gets and outputs file name. |
| DB_COLOR_CFG_0, DB_COLOR_CFG_1 | Calls <code>set_color_config_name</code> for both backends; gets and outputs file name. |
| DB_ESIFA_LOAD_0, DB_ESIFA_LOAD_1 | Sets <code>esifa_load_wanted</code> to TRUE; outputs file name; calls <code>set_esifa_name</code> and <code>load_esifa</code> for specified backend. |
| DB_SUBSYS_0, DB_SUBSYS_1 | Calls <code>init_subsys_parser</code> ; opens file; calls <code>set_token_file</code> ; calls <code>parse_subsys_file</code> ; closes file; outputs names of all database files for both backends; if <code>esifa_name</code> is not set, sets it, sets <code>esifa_load_wanted</code> to TRUE, and calls <code>load_esifa</code> ; sets <code>db_to_use</code> and <code>ded_db_to_use</code> for both backends; calls <code>mpvideo_load</code> to load final lookup, 3d lookup, and <code>data_2d</code> tables for both backends. |
| DB_DATA_2D_0, DB_DATA_2D_1 | Calls <code>set_data_2d_name</code> for specified backend; outputs file name; calls <code>mpvideo_load</code> for specified backend. |
| DB_FINAL_LUT_0, DB_FINAL_LUT_1 | Calls <code>set_final_lut_name</code> for specified backend; outputs file name; calls <code>mpvideo_load</code> for specified backend. |
| DB_3D_LUT_0, DB_3D_LUT_1 | Calls <code>set_3d_lut_name</code> for specified backend; outputs file name; calls <code>mpvideo_load</code> for specified backend. |
| MSG_PPM_DISPLAY_MODE | <i>Changes the PPM display modes.</i> Calls <code>msg_ppm_display_mode</code> ; sets <code>ppm_message_flag</code> to TRUE. |
| MSG_PPM_DISPLAY_OFFSET | <i>Changes the PPM display offsets.</i> Calls <code>msg_ppm_display_offset</code> ; sets <code>ppm_message_flag</code> to TRUE. |
| MSG_PPM_PIXEL_LOCATION | <i>Sets a new PPM pixel location.</i> Calls <code>msg_ppm_pixel_location</code> ; sets <code>ppm_message_flag</code> to TRUE. |
| MSG_PPM_PIXEL_STATE | <i>Turns PPM pixel processing on or off.</i> Calls <code>msg_ppm_pixel_state</code> ; sets <code>ppm_message_flag</code> to TRUE. |
| MSG_SIO_CLOSE | <i>Closes a serial I/O device.</i> Calls <code>sio_close</code> . |
| MSG_SIO_INIT | <i>Opens a serial I/O device.</i> Calls <code>sio_init</code> . |

| | |
|---------------------|---|
| MSG_TF_INIT_HDR | <i>Controls how the CIG builds terrain feedback messages. Calls mx_push to push MSG_B0_TF_INIT_HDR message onto Ballistics message queue; if "own" vehicle, sets flags, vehicle id, counter, and frequency.</i> |
| MSG_TF_INIT_PT | <i>Specifies point for which terrain feedback is desired. Calls mx_push to push MSG_B0_TF_INIT_PT message onto Ballistics message queue.</i> |
| MSG_TF_STATE | <i>Enables/disables terrain feedback or changes frequency. Calls mx_push to push MSG_B0_TF_STATE message onto Ballistics message queue; if "own" vehicle, sets flags or changes frequency as indicated.</i> |
| MSG_TRAJ_ENTRY | <i>Adds an entry to a trajectory table. Calls mx_push to push MSG_B0_TRAJ_ENTRY message onto Ballistics message queue.</i> |
| MSG_TRAJ_ENTRY_XFER | <i>Downloads an entry to a Ballistics trajectory table. Verifies table has room; sets trajectory table entry data; calls mx_push to push MSG_B0_ADD_TRAJ_ENTRY message onto Ballistics message queue.</i> |
| MSG_TRAJ_TABLE_XFER | <i>Sets up a Ballistics trajectory table to be downloaded. Verifies no other table is in load process; sets data for trajectory table; calls mx_push to push MSG_B0_TRAJ_TABLE message onto Ballistics message queue.</i> |

Called By: upstart

Routines Called: *exchange_data
cig_2d_setup
cig_config
cigsimio_msg_in
cigsimio_msg_out
config_color_table
esifa_send_req
fclose
fopen
get_3d_lut_name
get_color_config_name
get_data_2d_name
get_database_name
get_ded_name
get_esifa_name
get_final_lut_name
GLOB
init_subsys_parser
load_dbase
load_esifa
mpvideo_define_mode
mpvideo_load
msg_ppm_display_mode
msg_ppm_display_offset
msg_ppm_pixel_location

msg_ppm_pixel_state
mx_push
open_dbase
parse_subsys_file
poll_shutdown
printf
set_3d_lut_name
set_color_config_name
set_data_2d_name
set_database_name
set_ded_name
set_esifa_name
set_final_lut_name
set_token_file
simulation
sio_close
sio_init
start_watch
strcmp
strcpy
strlen
strncmp
SYSERR

Parameters: INT_2 state

Returns: none

2.13.14 debug_initdr.c

The `debug_initdr` function calls the `host_if_debug_tick` function to initiate printing/display of all enabled message types in the incoming packet buffer, for debugging or testing purposes.

The function call is `debug_initdr()`.

This function is not currently used.

Called By: none

Routines Called: `host_if_debug_tick`

Parameters: none

Returns: none

2.13.15 ded_gm_pool.c

The functions in the `ded_gm_pool.c` CSU are used to create and manage DED memory pools. The standard DED pool, pool 0, is used for 3500-meter databases. In 7000-meter databases with large DED files, a second pool (pool 1) can be allocated and used also. Using standard load module AAM to store extra DED models is called DED wrapping.

The functions in this CSU are:

- `pool_init`
- `pool_get_off_24`
- `addr_in_pool`

The `DED_POOL` structure, used to manage DED memory, specifies the pool's start address, next and last available bus addresses, DED size, total byte count, and the offset to add to model addresses.

2.13.15.1 pool_init

The `pool_init` function sets up DED pool 0. It also sets up pool 1 if it determines that the additional memory is available and required.

The function call is `pool_init (pdbase, avail_gm, file_cut, vme_offset)`, where:

pdbase is a pointer to the primary database control block
avail_gm is the amount of hardware memory available in standard generic memory
file_cut is the size of pool 0 or the address of the first model in pool 1
vme_offset is the VME address offset to active area memory

`pool_init` does the following:

- Set up DED pool 0's entries using the passed parameters.
- Initializes DED pool 1's entries to 0.
- Determines whether pool 0 is large enough for the amount of generic memory required.
- If pool 0 is not large enough:
 - If the database has a 7000-meter viewing range, verifies that pool 1 is large enough, then sets up pool 1's entries.
 - If the database does not have a 7000-meter viewing range, outputs an error.

The function returns `TRUE` if it successfully initializes pool 1 for additional generic memory. It returns `FALSE` if pool 0 is adequate, or if additional memory is required but in not available.

Called By: `open_ded`

Routines Called: `printf`

| | | |
|-------------|---------|------------|
| Parameters: | DB_INFO | *pdbase |
| | INT_4 | avail_gm |
| | INT_4 | file_cut |
| | WORD | vme_offset |

| | |
|----------|-----------|
| Returns: | 1 (TRUE) |
| | 0 (FALSE) |

2.13.15.2 pool_get_off_24

The `pool_get_off_24` function returns the appropriate 24-bit offset for a given model address.

The function call is `pool_get_off_24(file_addr)`, where `file_addr` is the model address.

The function determines which pool the address is in by comparing it to the `file_cut` (the first model address in pool 1). It then returns the offset to that pool.

| | |
|------------|-----------------|
| Called By: | ded_model_trace |
|------------|-----------------|

| | |
|------------------|------|
| Routines Called: | none |
|------------------|------|

| | | |
|-------------|-------|-----------|
| Parameters: | INT_4 | file_addr |
|-------------|-------|-----------|

| | |
|----------|-------------------------------|
| Returns: | pools[0].adr_offset & MASK_24 |
| | pools[1].adr_offset & MASK_24 |

2.13.15.3 addr_in_pool

The `addr_in_pool` function returns TRUE if a specified address is valid (i.e., is within either DED pool).

The function call is `addr_in_pool(cmdn_addr, msg)`, where:

cmdn_addr is the command address to be checked
msg is TRUE if an error message is to be output if the address is valid, or FALSE if no output message is desired

If the *cmdn_addr* is in either DED pool, the function returns TRUE.

If the *cmdn_addr* is not in either pool, the function returns FALSE. If *msg* is TRUE, the function also outputs an error message showing the pool boundaries.

| | |
|------------|-----------------|
| Called By: | ded_model_trace |
| | open_ded |

| | | |
|------------------|-----------------------|-------------------|
| Routines Called: | printf | |
| Parameters: | INT_4 BOOLEAN | cmdnd_addr msg |
| Returns: | 1 (TRUE) 0 (FALSE) | |

2.13.16 ded_model_trace.c

The `ded_model_trace` function traces the Data Traversal Processor (DTP) commands for each dynamic model and special effect, and adjusts addresses based on the commands.

The function call is `ded_model_trace(ded_size, ded_start_adr, model_start_adr, gm_end_adr, shift_adr, last_shift_adr)`, where:

ded_size is the amount of memory available for all dynamic models (in both DED pools, if both are allocated)
ded_start_adr is the starting address of the current DED pool
model_start_adr is the starting address of the model to be traced
gm_end_adr is the highest address in the current DED pool
shift_adr is the address to shift boundary data to
last_shift_adr is the last possible address for command shifting

`ded_model_trace` does the following:

- Checks the model's start address to make sure it is in one of the DED pools.
- Steps through each DTP command for each model and each special effect.
- Resets the *shift_adr*.

The function returns the final value of *shift_adr* if it is successful. It returns -1 if the model's address is not in either DED pool.

The macros used by `ded_model_trace` (DED_BOUNDARY, PUSH_STACK, and POP_STACK) are described in Appendix B.

| | | |
|------------------|--|---------------------------|
| Called By: | open_ded | |
| Routines Called: | addr_in_pool DED_BOUNDARY pool_get_off_24 POP_STACK printf PUSH_STACK | |
| Parameters: | INT_4 INT_4 | ded_size ded_start_adr |

| | |
|-------|-----------------|
| INT_4 | model_start_adr |
| INT_4 | gm_end_adr |
| INT_4 | shift_adr |
| INT_4 | last_shift_adr |

Returns: shift_adr
 -1

2.13.17 dl_man.c (dl_setup)

The dl_setup function initializes various active area memory state tables.

The function call is **dl_setup()**. dl_setup does the following:

- Initializes tanks and other vehicles in the dynamic state table.
- Initializes static tanks and other static vehicles in the static state table.
- Initializes the multiple-frame effects linked list. (This structure is used when showing effects over multiple frames.)

Called By: active_area_init

Routines Called: INIT_MTX

Parameters: none

Returns: none

2.13.18 download_bvols.c

The download_bvols function downloads model directories, model entries, and bounding volumes to Ballistics.

The function call is **download_bvols(header_P, fd, dev_P, model_type)**, where:

header_P is a pointer to the database header data
fd is an identifier for the file containing the information to be downloaded
dev_P is a pointer to the Ballistics message queue
model_type is BX_DED_MODEL_DIRECTORY

download_bvols does the following:

- Allocates memory to work in.
- For the model directory:
 - Builds a structure with the model directory data.
 - Passes the data to Ballistics by calling mx_push to push a MSG_B0_MODEL_DIRECTORY message onto the Ballistics message queue.

- For each model entry:
 - Reads the entry from the specified file.
 - Builds a structure with the model's data.
 - Passes the data to Ballistics by calling `mx_push` to push a `MSG_B0_MODEL_ENTRY` message onto the Ballistics message queue.
- Frees the work area memory.
- Reads and validates the bounding volume count from the database header.
- Allocates memory to work in.
- For each bounding volume entry:
 - Reads the entry from the specified file.
 - Converts the bounding volume from fixed point to floating point.
 - Builds a structure with the `bvol`'s data.
 - Passes the data to Ballistics by calling `mx_push` to push a `MSG_B0_BVOL_ENTRY` message onto the Ballistics message queue.
- Frees the work area memory.

The function returns 0 if successful. It returns -1 if the number of bounding volumes is less than 0.

Called By: `open_ded`

Routines Called: `BCOPY`
 `free`
 `fxbvtofl_020`
 `malloc`
 `mx_error`
 `mx_push`
 `printf`
 `XLSEEK`
 `XREAD`

| | | |
|-------------|---|---|
| Parameters: | <code>DB_HDR_DBASE_DATA</code> <code>int</code> <code>MX_DEVICE</code> <code>BYTE</code> | <code>*header_P</code> <code>fd</code> <code>*dev_P</code> <code>model_type</code> |
|-------------|---|---|

Returns: 0
 -1

2.13.19 `effect_downcount.c`

The `effect_downcount` function counts down the frames for each stamp in a multiple-frame special effect. Once the complete effect has been displayed, it is removed from the active effects table. This function is called at the end of every frame.

The function call is `effect_downcount(pdbase, vme_offset)`, where:

pdbase is the pointer to the database control block
vme_offset is the VME address offset to active area memory

The active effects table is maintained in the first backend's active area memory only.

| | | |
|------------------|--------------------|-----------------------|
| Called By: | _downcount_effects | |
| Routines Called: | none | |
| Parameters: | DB_INFO INT_4 | *pdbase vme_offset |
| Returns: | none | |

2.13.20 file_control.c

The `file_control` function processes messages from the Simulation Host to handle file transfers to and from the Simulation Host, delete files, and produce a CIG disk directory list for the Simulation Host. `file_control` is called whenever the state requested by the Simulation Host is `C_FILE_XFER`.

The function call is `file_control(state)`, where *state* is the current state of the CIG system (`C_FILE_XFER`).

`file_control` does the following:

- Calls `poll_shutdown` to see if a system shutdown has been requested.
- For each message received from the Simulation Host:
 - Verifies that the packet length has not been exceeded. Calls `SYSERR` to generate an error message if it has.
 - Calls `cigsimio_msg_in` to write the message to a buffer (if message recording or debug display is enabled).
 - Processes the message according to its type (see table below).

The following table summarizes the processing performed by `file_control` in response to each valid message type it receives from the Simulation Host. The first column lists the messages in alphabetical order. The second column briefly describes the purpose of the message (in italicized letters), then lists the major steps performed by `file_control` to process the message.

| Message from SIM Host | Processing by file_control |
|---|--|
| MSG_CIG_CTL C_NULL C_STOP | <i>Causes a transition to another performance state.</i> No action. Returns control to upstart. |
| MSG_DR11_PKT_SIZE | <i>Specifies exchange packet parameters.</i> Sets CIG and SIM exchange packet sizes; validates local terrain chunk size and interval, and sets if valid; sets CIG hardware type. |
| MSG_END | <i>Signals end of packet buffer.</i> Calls cigsimio_msg_out to write outgoing message packet to buffer if recording is enabled; calls appropriate exchange_data routine (through *exchange_data) to exchange packets. |
| MSG_FILE_DESCR DB_CIG2SIM DB_SIM2CIG DB_DELETION DB_DIRECTORY DB_REN_FROM DB_REN_TO | <i>Transfers and manages files.</i> Opens and reads file header; generates MSG_FILE_STATUS acknowledgement message; uses *exchange_data to exchange packets; transfers and checksums each block; generates MSG_FILE_XFER acknowledgement messages; uses *exchange_data to exchange packets; closes file. Calls create_sz to create file with specified name and size; generates MSG_FILE_STATUS acknowledgement message. Calls system to delete file from CIG disk; generates MSG_FILE_STATUS acknowledgement message. Passes CIG directory contents to SIM using MSG_FILE_DESCR messages; generates MSG_FILE_STATUS acknowledgement message. Finds file with specified name; generates MSG_FILE_STATUS acknowledgement message. Calls system to rename file to specified name; generates MSG_FILE_STATUS acknowledgement message. |
| MSG_FILE_STATUS | <i>Provides response for file transfer.</i> No action if file block was received; resends block or aborts if SIM reports error. |
| MSG_FILE_XFER | <i>Contains the data to upload or download.</i> Reads or writes data; generates MSG_FILE_STATUS return message. |

Called By: upstart

Routines Called: *exchange_data
cigsimio_msg_in
cigsimio_msg_out
close
create_sz
GLOB
lseek
open
poll_shutdown

printf
read
rsec
start_watch
strcpy
strlen
SYSERR
system
write

Parameters: INT_2 state

Returns: none

2.13.21 fxbvtofl.c

The functions in the fxbvtofl.c CSU convert fixed point bounding volumes to floating point. These functions are:

- fxbvtofl_dart
- fxbvtofl
- fxbvtofl_020

2.13.21.1 fxbvtofl_dart

The fxbvtofl_dart function converts a fixed point bounding volume's vertex list to floating point.

The function call is **fxbvtofl_dart(tobv, frombv)**, where:

tobv is the floating point bvol entry
frombv is the fixed point bvol entry

This function is not currently used.

Called By: none

Routines Called: FXTO881

Parameters: BVOL_ENTRY *tobv
 FIX_BVOL_ENTRY *frombv

Returns: none

2.13.21.2 fxbvtofl

The fxbvtofl function converts a fixed point bounding volume's vertex list to floating point.

The function call is fxbvtofl (tobv, frombv), where:

tobv is the floating point bvol entry
frombv is the fixed point bvol entry

This function is not currently used.

| | | |
|------------------|------------------------------|------------------|
| Called By: | none | |
| Routines Called: | FXT0881 | |
| Parameters: | BVOL_ENTRY FIX_BVOL_ENTRY | *tobv *frombv |
| Returns: | none | |

2.13.21.3 fxbvtofl_020

The fxbvtofl_020 function converts a fixed point bounding volume's vertex list to floating point.

The function call is fxbvtofl_020(tobv, frombv), where:

tobv is the floating point bvol entry
frombv is the fixed point bvol entry

| | | |
|------------------|------------------------------|------------------|
| Called By: | download_bvols | |
| Routines Called: | FXT0881 | |
| Parameters: | BVOL_ENTRY FIX_BVOL_ENTRY | *tobv *frombv |
| Returns: | none | |

2.13.22 generic_lm.c

The functions in the generic_lm.c CSU are used to initialize and generate a generic load module containing one ocean polygon. This allows a system to go beyond the defined database boundaries while still retaining some orientation reference.

These functions are:

- `init_generic_lm`
- `generic_lm`

2.13.22.1 init_generic_lm

The `init_generic_lm` function initializes a generic load module. It generates the load module header, the required DTP commands, and the grid components.

The function call is `init_generic_lm(db_index, view_range)`, where:

db_index identifies the backend (0 or 1)

view_range is the viewing distance in meters (3500 or 7000).

The function returns FALSE if the `db_index` is not 0 or 1.

Called By: `load_modules`

Routines Called: `none`

Parameters: `INT_4` `db_index`
 `INT_4` `view_range`

Returns: `0 (FALSE)`

2.13.22.2 generic_lm

The `generic_lm` function generates the generic load module. It copies the load module to memory, then updates the load module header, DTP, and grid components.

The function call is `generic_lm(db_index, swx, swy, centoff, memptr)`, where:

db_index identifies the backend (0 or 1)

swx is the x coordinate of the load module's southwest corner

swy is the y coordinate of the load module's southwest corner

centoff is the offset to the center of the load module

memptr is a pointer to the AAM location for the new load module

| | | |
|------------------|--|--|
| Called By: | getside | |
| Routines Called: | none | |
| Parameters: | INT_4 INT_4 INT_4 REAL_4 GENLM | db_index swx swy centoff *memptr |
| Returns: | none | |

2.13.23 get_tx_lut_index.c

The `get_tx_lut_index` function returns the desired final output color table index.

The function call is `get_tx_lut_index(pview_mode)`, where `pview_mode` is a pointer to the system view mode. The function does the following:

- Isolates the sky color (`sky`).
- Isolates the time of day (`day`).
- Isolates the thermal flag (`thm`).
- If `thm` is 1 and the `thermal_mode_wanted` variable is TRUE, returns 10 (the default thermal). If not, returns (`sky * 3 + day`).

This function is not currently used.

| | | |
|------------------|---------------------|-------------|
| Called By: | none | |
| Routines Called: | GLOB | |
| Parameters: | INT_4 | *pview_mode |
| Returns: | sky * 3 + day 10 | |

2.13.24 global_init.c

The `global_init.c` CSU contains functions that initialize various global variables. These functions are:

- `host_if_buffer_init`
- `host_init_packet_sizes`

2.13.24.1 host_if_buffer_init

The `host_if_buffer_init` function initializes the output buffer header (packet version number and level) and, optionally, the input and output message buffers (INBUF and OUTBUF).

The function call is `host_if_buffer_init (init_INBUF_and_OUTBUF)`, where `init_INBUF_and_OUTBUF` is TRUE if the message buffers are to be initialized.

| | |
|------------------|--|
| Called By: | <code>init_mpv_interface</code> <code>initialize</code> |
| Routines Called: | none |
| Parameters: | BOOLEAN <code>init_INBUF_and_OUTBUF</code> |
| Returns: | none |

2.13.24.2 host_init_packet_sizes

The `host_init_packet_sizes` function initializes the following global variables to their default values, if they have not yet been set:

- DR11 incoming and outgoing exchange packet sizes.
- SCSI incoming and outgoing exchange packet sizes.
- Local terrain chunk size.
- Interval between local terrain messages.

The function call is `host_init_packet_sizes()`.

| | |
|------------------|-------------------------|
| Called By: | <code>initialize</code> |
| Routines Called: | none |
| Parameters: | none |
| Returns: | none |

2.13.25 gun_overlays.c

The functions in the `gun_overlays.c` CSU are used to build M1 and M2 overlays. These overlays are hard-coded displays of three-dimensional polygons that are displayed on the viewport, over the terrain display. The overlay shows objects that would normally obscure

the view of the terrain, to better emulate the real-world view out the vehicle's window. These overlays are vehicle-specific.

`gun_overlays.c` contains the following functions:

- `m1_gun_overlay`
- `m2_gun_overlay`
- `make_m1_overlays`
- `make_m2_overlays`

These functions apply to T backends only. Overlays for TX backends are generated by the 2-D Overlay Compiler CSC using Simulation Host messages.

2.13.25.1 `m1_gun_overlay`

The `m1_gun_overlay` function creates gun and gunner overlays for M1 vehicles. This function is called when the message from the Simulation Host is `MSG_GUN_OVERLAY` and the message type is `M1_OVERLAYS`.

Gun overlays show the components of the gun (on the simulation vehicle) that would be visible when looking out from the vehicle's window. Gunner overlays show cross-hairs and digits. The `MSG_GUN_OVERLAY` message specifies the digits to be displayed.

The function call is `m1_gun_overlay(pmsg, db)`, where:

pmsg is a pointer to the `MSG_GUN_OVERLAY` message
db is the double-buffer memory current base pointer

`m1_gun_overlay` does the following:

- Checks to see if an overlay has been defined.
- Updates the gun barrel viewport-to-turret transformation matrix.
- Updates the gunners overlay polygons.

Called By: `process_a_msg`

Routines Called: `syserr`

Parameters: `MSG_GUN_OVERLAY` `*pmsg`
`INT_4` `db`

Returns: `none`

2.13.25.2 `m2_gun_overlay`

The `m2_gun_overlay` function creates gun overlays for M2 vehicles. This function is called when the message from the Simulation Host is `MSG_GUN_OVERLAY` and the message type is `M2_OVERLAYS`.

Gun overlays show the components of the gun (on the simulation vehicle) that would be visible when looking out from the vehicle's window. Gunner overlays show cross-hairs and digits. The MSG_GUN_OVERLAY message specifies the digits to be displayed.

The function call is `m2_gun_overlay(pmsg, db)`, where:

pmsg is a pointer to the MSG_GUN_OVERLAY message
db is the double-buffer memory current base pointer

`m2_gun_overlay` does the following:

- Checks to see if an overlay has been defined.
- Updates the gun barrel viewport-to-turret transformation matrix.
- Updates the gunners overlay polygons.

Called By: `process_a_msg`

Routines Called: `syserr`

Parameters: `MSG_GUN_OVERLAY` `*pmsg`
 `INT_4` `db`

Returns: `none`

2.13.25.3 `make_m1_overlays`

The `make_m1_overlays` function sets up M1 overlay data at viewport configuration time. This function is called if the Simulation Host sends a MSG_OVERLAY_SETUP message with the type set to 1 (M1_OVERLAYS).

Note: The MSG_OVERLAY_SETUP message can specify *gunners_viewport* (the viewport that is to have the gunner's overlay) and *barrel_viewports* (the viewports the gun barrel is to be viewable in). These values are not currently used. The gunner's overlay is placed on any viewport belonging to a configuration node that has bit 0 of its branch mask set. The gun barrel overlay is placed on any viewport belonging to a configuration node that has bit 1 of its branch mask set.

The function call is `make_m1_overlays(po, ppg)`, where:

po is a pointer to the overlay parameters
ppg is a pointer to the M1_GUN_OVERLAY message

`make_m1_overlays` does the following:

- Allocates memory for the overlay.
- Outputs the matrix, vertex list, digits, ASCII data, etc.

- Loads the overlay digit vertices.
- Sets up the gun tube overlay.
- Sets up the matrix command.
- Generates the gun barrel polygon component.
- Sets the overlay_defined flag to TRUE.

Called By: overlay_setup

Routines Called: aam_malloc
id_4x3mtx
make_p_nt
swap_axis

Parameters: OVERLAY_PARAMS *po
M1_GUN_OVERLAY **ppg

Returns: none

2.13.25.4 make_m2_overlays

The make_m2_overlays routine sets up M2 overlay data at viewport configuration time. This function is called if the Simulation Host sends a MSG_OVERLAY_SETUP message with the message type set to 2 (M2_OVERLAYS).

Note: The MSG_OVERLAY_SETUP message can specify gunners_viewport (the viewport that is to have the gunner's overlay) and barrel_viewports (the viewports the gun barrel is to be viewable in). These values are not currently used. The gunner's overlay is placed on any viewport belonging to a configuration node that has bit 0 of its branch mask set. The gun barrel overlay is placed on any viewport belonging to a configuration node that has bit 1 of its branch mask set.

The function call is make_m2_overlays(po, ppg), where:

po is a pointer to the overlay parameters
ppg is a pointer to the M2_GUN_OVERLAY message

make_m2_overlays does the following:

- Allocates memory for the overlay.
- Builds the gunner display buffer.
- Loads the matrix.
- Outputs the gunner polygons.
- Loads the overlay digit vertices.
- Sets up the gun tube overlay.
- Sets up the matrix command.
- Generates the gun barrel's top, right, and left polygon components.
- Sets the overlay_defined flag to TRUE.

Called By: overlay_setup

Routines Called: aam_malloc
id_4x3mtx
make_p_nt
swap_axis

Parameters: OVERLAY_PARAMS *po
M2_GUN_OVERLAY **ppg

Returns: none

2.13.26 hw_test.c

The `hw_test` function processes messages from the Simulation Host to perform hardware tests. `hw_test` is called whenever the state requested by the Simulation Host is `C_TEST_MODE`.

Note: Hardware tests are not currently implemented.

The function call is `hw_test(state)`, where *state* is the current state of the CIG system (`C_TEST_MODE`).

`hw_test` does the following:

- Calls `poll_shutdown` to see if a system shutdown has been requested.
- For each valid message type it receives:
 - Verifies that the packet length has not been exceeded; calls `YSERR` to generate an error message if it has.
 - Calls `cigsimio_msg_in` to write the message to a buffer (if message recording or debug display is enabled).
 - Processes the message according to its type (see table below).

The following table summarizes the processing performed by `hw_test` in response to each valid message type it receives from the Simulation Host. The first column lists the messages in alphabetical order. The second column briefly describes the purpose of the message (in *italics*), then lists the major steps performed by `hw_test` to process the message.

| Message from SIM Host | Processing by hw_test |
|---------------------------------|--|
| MSG_CIG_CTL C_NULL C_STOP | Causes a transition to another performance state. No action. Returns to upstart. |
| MSG_DR11_PKT_SIZE | Specifies exchange packet parameters. Sets CIG and SIM exchange packet sizes; validates local terrain chunk size and message interval, and sets if valid; sets CIG hardware type. |
| MSG_END | Signals end of packet buffer. Calls cigsimio_msg_out to write outgoing message packet to buffer if recording is enabled; calls start_watch; calls appropriate exchange_data routine (through *exchange_data) to exchange packets. |
| MSG_TEST_NAME ECHO_PKT | Specifies test to be run. No action; test is not yet implemented. |

Called By: upstart

Routines Called: *exchange_data
cigsimio_msg_in
cigsimio_msg_out
GLOB
poll_shutdown
start_watch
SYSERR

Parameters: INT_2 state

Returns: none

2.13.27 init_sim.c (init_simulation)

The `init_simulation` function initializes a new simulation. This function is called whenever the Simulation Host sends a CIG Control message with the new CIG state set to `C_SIMULATION` or `C_MCC_SIMUL`.

The function call is `init_simulation (state, curr_sim_buf, sim_pdbase, pdynl, ptanks, pmodels, peffects)`, where:

state is the state the CIG is to be set up in (`C_DB_SETUP` or `C_MCC_SETUP`)
curr_sim_buf is the double buffer currently being loaded by the simulation
sim_pdbase is a pointer to the primary database control block
pdynl is a pointer to the structure containing the current state of all dynamic models
ptanks is a pointer to the tank table
pmodels is a pointer to the model table
peffects is a pointer to the dynamic effects table

init_simulation does the following:

- If AGPT mode is enabled, calls sim_gmbox. AGPT mode is a non-standard version of the GT100 system.
- Initializes various variables.
- Creates a dummy system view flags message to initialize the array.
- Calls backend_sim_init to prepare the backend to run a simulation.
- Calls sim_bal_init to initialize variables used in Ballistics messages.
- Calls sim_bal_start to put Ballistics into the run state and tell it where active area memory is.
- Initializes the simulated vehicle's AGL (altitude above ground level).
- Zeroes the system frame counter.
- Initializes the static tank and model pointers.
- Initializes the multiple and long effects pointers.
- If a second AAM is present, initializes its static tank and model pointers, and multiple and long effects pointers.
- Initializes the static vehicle pointers to multiple-frame effects.
- Initializes the multiple-frame effects pointers to subroutine calls.
- Turns off the system view flags.
- If a second AAM is present, updates it also.
- Clears any stray messages from the SIMULATION_MB mailbox.
- Posts a message and waits for the rowcol_rd task(s) to perform database management (unless database updates were disabled on the startup command line).
- Posts a message and waits for local_terrain to perform database feedback; sets the local terrain count to 0.
- Calls sysrup_on to enable system interrupts.
- Calls sim_bal_frame_rate to tell Ballistics the current CIG frame rate.
- Calls get_dtp_bank to determine which double buffer to use.
- Sets pointers to the dynamic model state table and the tank, model, and effects tables.
- If a second AAM is present, sets pointers to its tank, model, and effects tables.
- Calls _pend_on_frame_interrupt to wait for the next frame interrupt.

Called By: simulation

Routines Called:

| | |
|--------------------------|---------------------|
| _pend_on_frame_interrupt | |
| AAM2_ADDR | |
| backend_sim_init | |
| blcopy | |
| exit | |
| get_dtp_bank | |
| perror | (in AGPT mode only) |
| printf | |
| sc_accept | |
| sc_pend | |
| sc_post | |
| sim_bal_frame_rate | |
| sim_bal_init | |
| sim_bal_start | |
| sim_gmbox | (in AGPT mode only) |
| sysrup_on | |

| | | |
|-------------|--|--|
| Parameters: | INT_2 INT_2 DB_INFO INT_4 TANK INT_4 INT_4 | state *curr_sim_buf **sim_pdbase **pdynl **ptanks **pmodels **peffects |
| Returns: | none | |

2.13.28 load_dbase.c

The `load_dbase` function loads the terrain database into active area memory, and sets up various tables with the necessary data from the database. It also calls `open_ded` to load the contents of the dynamic elements database (DED). `load_dbase` is called after the viewport configuration tree has been created.

The function call is `load_dbase(pdbase)`, where *pdbase* is a pointer to the primary database control block.

`load_dbase` does the following:

- Determines how much generic memory is available. (This controls how many models can be read in.)
- If not enough memory is available, truncates the number of bytes to what is available.
- Reads in the data from the specified database.
- Reads in the overflow terrain data, if there is sufficient room.
- Calls `open_ded` to open the dynamic elements database, read the models in, and process them.
- Calls `load_modules` to load the initial load modules.
- Initializes the Load Module Branch Table, subroutine call table, and field-of-view test table for a 3500-meter or 7000-meter viewing range.

Called By: db_mcc_setup

Routines Called: bus_error
load_modules
open_ded
printf
XLSEEK
XREAD

Parameters: DB_INFO *pdbase

Returns: none

2.13.29 load_esifa.c

The `load_esifa` function downloads textures data to the ESIFA, for later download to the Pixel Processor Tilers (PPTs). This function is called when the backend is set up at system initialization time.

The function call is `load_esifa(pfilename, id)`, where:

pfilename is the name of the ESIFA textures file
id is the backend id

`load_esifa` does the following:

- Makes sure the `esifa_load_wanted` variable is TRUE.
- Opens the specified file.
- Reads the first line of the file to get the masks and file name need by `esifa_load`.
- Calls `esifa_load` to load the data into the subsystem boards.
- Closes the file.

Called By: `backend_setup`

Routines Called: `esifa_load`
 `fclose`
 `fgets`
 `fopen`
 `printf`
 `scanf`

Parameters: `UNS_1` `*pfilename[]`
 `INT_4` `id`

Returns: `none`

2.13.30 load_modules.c

The functions in the `load_modules.c` CSU are used to load new active area rows and columns from the terrain database when required. These functions are:

- `load_modules`
- `getlmdp`
- `getside`
- `whatdirptr`

2.13.30.1 load_modules

The `load_modules` function loads a portion of the terrain database into AAM, when AAM needs to be completed loaded or reloaded. This function is called to read the initial load modules into AAM, and is called during a simulation if the simulated vehicle is detected to be out of viewing range of active area memory. (Specifically, the vehicle must be more than one-half the width of AAM outside its boundaries. In this instance, none of the terrain that is currently visible to the vehicle is in AAM — usually, this is due to "warping" across the terrain. The `_rowcol_rd` function then calls `load_modules` to rebuild all of AAM based on the vehicle's current location.)

The function call is `load_modules(pdbase)`, where *pdbase* is a pointer to the primary database control block.

`load_modules` does the following:

- Determines the viewing range.
- Calls `init_generic_lm` to initialize a generic load module for the applicable viewing range.
- Initializes the direction offsets.
- Calculates the southwest corner of AAM based on the current coordinates of the simulated vehicle.
- Calculates the four borders of AAM.
- Starting at the southernmost row and working up, reads each AAM row from west to east, calling `getside` to load the appropriate load modules from the database.
- Calls `whatdirptr` to find the direction pointer after the first row of load modules is loaded.
- After reaching the northernmost row, resets the address of the south border.

Called By: `_rowcol_rd`
 `load_dbase`

Routines Called: `getside`
 `GLOB`
 `init_generic_lm`
 `printf`
 `whatdirptr`

Parameters: `DB_INFO` `*pdbase`

Returns: `none`

2.13.30.2 getlmdp

The `getlmdp` function gets a load module's disk pointer from the database.

The function call is `getlmdp(xmod, ymod, pdbase)`, where:

xmod is the load module array number x
ymod is the load module array number y
pdbase is a pointer to the primary database control block

The function returns 0 if the load module is not in the database. If 0 is returned, *getside* (the calling function) calls *generic_lm* to get a generic load module.

| | | |
|------------------|---------------------------|---|
| Called By: | <i>getside</i> | |
| Routines Called: | XLSEEK XREAD | |
| Parameters: | INT_4 INT_4 DB_INFO | <i>xmod</i> <i>ymod</i> * <i>pdbase</i> |
| Returns: | dbde.lm_loc 0 | |

2.13.30.3 *getside*

The *getside* function loads part of a row or column from the terrain database into active area memory. The number of load modules in the row or column actually loaded into AAM is 16 (the normal height/width of AAM) or 32 (the height/width of AAM if load module blocking is enabled).

The function call is *getside(lmdloc, xmod, ymod, xinc, yinc, diroff, pdbase, zeroit)*, where:

lmdloc is a pointer to the first load module on disk
xmod is the first load module's array number x (west column)
ymod is the first load module's array number y (south row)
xinc is the load module's array number increment x
yinc is the load module's array number increment y
diroff is a byte offset to the directory pointer in the load module header
pdbase is a pointer to the primary database control block
zeroit is a flag used to determine when the running average load module centroid should be zeroed

getside does the following for each new load module it loads into AAM:

- Sets the load module number and gets its AAM address.
- Calls *getlmdp* to get the load module's disk pointer from the database.
- If the load module is not in the database, calls *generic_lm* to get a generic load module.
- Reads in the load module.
- If working in subsystem 0, informs Ballistics of the new load module by pushing a MSG_B0_LM_READ message onto the Ballistics message queue.

- Updates the field-of-view tables for the new load module.

Called By: _rowcol_rd
 load_modules

Routines Called: getlmdp
 generic_lm
 GLOB
 mx_push
 XLSEEK
 XREAD

| | | |
|-------------|---------|---------|
| Parameters: | WORD | lmdloc |
| | INT_4 | xmod |
| | INT_4 | ymod |
| | INT_4 | xinc |
| | INT_4 | yinc |
| | WORD | diroff |
| | DB_INFO | *pdbase |
| | WORD | zeroit |

Returns: none

2.13.30.4 whatdirptr

The whatdirptr function finds the direction pointer for the load module at a specified location in a specified direction.

The function call is **whatdirptr(xmod, ymod, diroff, pdbase)**, where:

xmod is the load module's array number x (west column)
ymod is the load module's array number y (south row)
diroff is the byte offset to the direction pointer in the load module header
pdbase is a pointer to the primary database control block

Called By: _rowcol_rd
 load_modules

Routines Called: none

| | | |
|-------------|---------|---------|
| Parameters: | INT_4 | xmod |
| | INT_4 | ymod |
| | WORD | diroff |
| | DB_INFO | *pdbase |

Returns: <direction pointer>

2.13.31 loc_ter.c

The `loc_ter.c` CSU contains functions used to build local terrain messages for return to the Simulation Host. This feature is called "database feedback." These functions are:

- `local_terrain`
- `local_terrain_cleanup`

A local terrain message describes the terrain, roads, rivers, and buildings that lie within the four grids surrounding the simulated vehicle. (One grid is usually 125 meters per side. One load module is defined as four grids: two rows by two columns.)

The first frame at which a local terrain message is created, and the frame interval at which new messages are generated, are defined in the `memory_map_defines.h` file. Currently, the first frame is set to 16 and the default interval is set to 32. The interval can be changed using the `MSG_DR11_PKT_SIZE` or `MSG_LT_STATE` message.

Local terrain messages can also be sent on demand in response to a `MSG_RTN_LT` (return local terrain) message. This message is to be used by the MCC station only.

Each local terrain message contains the following:

- A header that specifies the number of polygon definitions and the number of bounding volumes (bvols) contained in the message.
- Polygons that describe the local terrain and the objects in it. These polygons are planar, convex, and three- or four-sided. Each polygon entry in the message specifies the soil type, priority code, minimum and maximum coordinates, and all polygon vertices in counter-clockwise order.
- Bounding volumes. A bvol definition contains one or more four-sided bounding boxes each of which has a planar, convex, polygonal base and a height (expressed in units on the z axis) for the volume given. Each bvol entry in the message specifies the bvol's height above the polygonal base, the bvol type identifier, the minimum and maximum coordinates, and the vertex list.

2.13.31.1 local_terrain

The `local_terrain` function builds local terrain messages based on the simulated vehicle's current position. These messages are used by the Simulation Host to provide collision detection with objects in the simulated environment, and to calculate the dynamics of the vehicle in operation.

The `local_terrain` task is loaded during the task initialization state. It is then suspended until a message is posted to its mailbox (`LOCAL_TERRAIN_MB`). `local_terrain` assumes that the simulation vehicle's current position (stored in the viewport positions array) has just been updated.

`local_terrain` does the following:

- Initializes the local terrain output buffer header (version and level).
- Calls `poll_shutdown` to see if a system shutdown has been requested.
- Waits for a message to be posted to the `LOCAL_TERRAIN_MB` mailbox.
- Calls `bal_get_db_pos` to find the simulated vehicle's current load module number and grid number.
- Calls `bal_get_lm_grid` to find the four grids that surround the simulated vehicle.
- Determines whether a new local terrain message needs to be built (i.e., if the simulated vehicle's position has changed since the last local terrain message).
- If the vehicle has moved, reinitializes the local terrain output buffer.
- Searches the four grids that lie around the simulated vehicle for polygons, and builds the polygon portion of the message.
- Searches the four grids that lie around the simulated vehicle for polygon components, and builds the polygon component portion of the message.
- Searches the four grids that lie around the simulated vehicle for bounding volumes, and builds the `bvol` portion of the message.
- Sets a pointer to the new local terrain message data.
- Creates the message header: message size, message type (`MSG_LOCAL_TERRAIN`), and the total number of polygons and `bvols` in the message. (The full message is divided into a series of smaller `MSG_LT_PIECE` messages by `loc_ter_msg` in the Message Processing CSC.)
- Posts a message to the `RTN_TERRAIN_MB` mailbox.

Called By: none (task created and started at initialization)

Routines Called: `bal_get_db_pos`
`bal_get_lm_grid`
`FXTO881`
`GLOB`
`poll_shutdown`
`printf` (in debug mode only)
`read_watch`
`rt_pend`
`rt_post`

Parameters: none

Returns: none

2.13.31.2 local_terrain_cleanup

The `local_terrain_cleanup` function deallocates the resources owned by the `local_terrain` task. This function is called if a system shutdown is requested by the Gossip user. The function is called via the `*task_cleanup` function pointer, which points to the cleanup routine's name in the task table.

The function call is `local_terrain_cleanup()`.

The function returns 1 if successful, or 0 if an error occurred.

Note: This function is not yet implemented. At the current time, it simply returns a 1 if called.

Called By: poll_shutdown (through *task_cleanup)

Routines Called: none

Parameters: none

Returns: 0
1

2.13.32 make_bbn.c

The functions in the make_bbn.c CSU can be used to make and modify hull-to-world matrices. These functions are:

- prt_mtx
- rotate_x
- rotate_y
- rotate_z
- multmatrix
- id_matrix

Note: These routines are called only by model_mtx, which is not currently called by any other function. Therefore, these functions are not currently used.

2.13.32.1 prt_mtx

The prt_mtx function copies a matrix in memory.

The function call is **prt_mtx(matrix, ptr)**, where:

matrix is the matrix

ptr is a pointer to the destination memory location

Called By: model_mtx

Routines Called: none

Parameters: REAL_4 matrix[4][3]
REAL_4 *ptr

Returns: none

2.13.32.2 rotate_x

The rotate_x function rotates a matrix about the X axis. It creates an identity matrix, rotates it appropriately, then multiplies it by the original matrix.

The function call is **rotate_x(theta, matrix)**, where:

theta is the angle of rotation
matrix is the matrix to be rotated

Called By: model_mtx

Routines Called: cos
 id_matrix
 multmatrix
 sin
 toradians

Parameters: REAL_4 theta
 REAL_4 matrix[4][3]

Returns: none

2.13.32.3 rotate_y

The rotate_y function rotates a matrix about the Y axis. It creates an identity matrix, rotates it appropriately, then multiplies it by the original matrix.

The function call is **rotate_y(theta, matrix)**, where:

theta is the angle of rotation
matrix is the matrix to be rotated

Called By: model_mtx

Routines Called: cos
 id_matrix
 multmatrix
 sin
 toradians

Parameters: REAL_4 theta
 REAL_4 matrix[4][3]

Returns: none

2.13.32.4 rotate_z

The rotate_z function rotates a matrix about the Z axis. It creates an identity matrix, rotates it appropriately, then multiplies it by the original matrix.

The function call is **rotate_z(theta, matrix)**, where:

theta is the angle of rotation
matrix is the matrix to be rotated

Called By: model_mtx

Routines Called: cos
 id_matrix
 multmatrix
 sin
 toradians

Parameters: REAL_4 theta
 REAL_4 matrix[4][3]

Returns: none

2.13.32.5 multmatrix

The multmatrix function multiplies (concatenates) two matrices together. This function is used to multiply a matrix by a rotation matrix.

The function call is **multmatrix(matrix, matrix_tmp)**, where:

matrix is the rotation matrix
matrix_tmp is the matrix to be rotated

Called By: rotate_x
 rotate_y
 rotate_z

Routines Called: none

Parameters: REAL_4 matrix[4][3]
 REAL_4 matrix_tmp[4][3]

Returns: none

2.13.32.6 id_matrix

The `id_matrix` function creates an identity matrix (positioned at the origin) for use in rotating matrices.

The function call is `id_matrix(matrix)`, where *matrix* is the identity matrix to be created.

Called By: model_mtx
rotate_x
rotate_y
rotate_z

Routines Called: none

Parameters: REAL_4 matrix[4][3]

Returns: none

2.13.33 mkmtx_nt.c

The functions in the `mkmtx_nt.c` CSU are used to perform computations on matrices. These functions are:

- make_p_nt
- rotate_x_nt
- rotate_y_nt
- rotate_z_nt
- swap_axis
- id_4x3mtx
- scale_mtx
- translate
- mult_4x3mtx
- getmatrix
- matrix2
- mtxcpy
- mat_copy
- mat_vec_mul
- mat_adjugate
- mat_transpose
- mat_scale
- mat_determinant
- mat_inverse
- vec_mat_mul
- make4x3

2.13.33.1 make_p_nt

The `make_p_nt` function converts a matrix to a perspective 4x3 matrix. The function creates an identity matrix, sets its field-of-view angles and offsets appropriately, then multiplies it by the original matrix.

The function call is `make_p_nt(itan_fov_i, itan_fov_j, hoffset_x, hoffset_y, matrix)`, where:

itan_fov_i is the inverse of the tangent of the horizontal field-of-view angle
itan_fov_j is the inverse of the tangent of the vertical field-of-view angle
hoffset_x is the horizontal offset of the x coordinate
hoffset_y is the horizontal offset of the y coordinate
matrix is the matrix to be converted

Called By: `make_m1_overlays`
 `make_m2_overlays`

Routines Called: `id_4x3mtx`
 `mult_4x3mtx`

Parameters: `REAL_8` `itan_fov_i`
 `REAL_8` `itan_fov_j`
 `REAL_4` `hoffset_x`
 `REAL_4` `hoffset_y`
 `REAL_4` `matrix[4][3]`

Returns: `none`

2.13.33.2 rotate_x_nt

The `rotate_x_nt` function rotates a 4x3 matrix about the X axis. The function creates an identity matrix, rotates it accordingly, then multiplies it by the original matrix.

The function call is `rotate_x_nt(cos_theta, sin_theta, matrix)`, where:

cos_theta is the cosine of the angle of rotation
sin_theta is the sine of the angle of rotation
matrix is the matrix to be rotated

Called By: `flea_init_cig_sw`
 `gos_model`

Routines Called: `id_4x3mtx`
 `mult_4x3mtx`

| | | |
|-------------|----------------------------|--|
| Parameters: | REAL_8 REAL_8 REAL_4 | cos_theta sin_theta matrix[4][3] |
| Returns: | none | |

2.13.33.3 rotate_y_nt

The rotate_y_nt function rotates a 4x3 matrix about the Y axis. The function creates an identity matrix, rotates it accordingly, then multiplies it by the original matrix.

The function call is rotate_y_nt(cos_theta, sin_theta, matrix), where:

cos_theta is the cosine of the angle of rotation
sin_theta is the sine of the angle of rotation
matrix is the matrix to be rotated

| | | |
|------------------|-------------------------------|--|
| Called By: | flea_init_cig_sw gos_model | |
| Routines Called: | id_4x3mtx mult_4x3mtx | |
| Parameters: | REAL_8 REAL_8 REAL_4 | cos_theta sin_theta matrix[4][3] |
| Returns: | none | |

2.13.33.4 rotate_z_nt

The rotate_z_nt function rotates a 4x3 matrix about the Z axis. The function creates an identity matrix, rotates it accordingly, then multiplies it by the original matrix.

The function call is rotate_z_nt(cos_theta, sin_theta, matrix), where:

cos_theta is the cosine of the angle of rotation
sin_theta is the sine of the angle of rotation
matrix is the matrix to be rotated

| | | |
|------------|---|--|
| Called By: | flea_init_cig_sw flea_simulate_vehicles gos_model | |
|------------|---|--|

Routines Called: id_4x3mtx
 mult_4x3mtx

Parameters: REAL_8 cos_theta
 REAL_8 sin_theta
 REAL_4 matrix[4][3]

Returns: none

2.13.33.5 swap_axis

The `swap_axis` function converts a matrix's axes so that the matrix conforms to the CIG's coordinate system, as follows:

```
xview = xworld
yview = -zworld
zview = yworld
```

The function call is `swap_axis(matrix)`, where *matrix* is the matrix to be converted. `swap_axis` first creates a 4x3 identity matrix, then sets this matrix to the following:

```
| 1  0  0 |
| 0  0  1 |
| 0 -1  0 |
| 0  0  0 |
```

`swap_axis` then multiplies this matrix by the original matrix.

Called By: make_cal_matrices
 make_m1_overlays
 make_m2_overlays

Routines Called: id_4x3mtx
 mult_4x3mtx

Parameters: REAL_4 matrix[4][3]

Returns: none

2.13.33.6 id_4x3mtx

The `id_4x3mtx` function creates a 4x3 identity matrix (positioned at the origin) for use in rotating matrices. The identity matrix is as follows:


```

| 1  0  0 |
| 0  1  0 |
| 0  0  1 |
| 0  0  0 |

```

The function call is `id_4x3mtx(matrix)`, where *matrix* is the new identity matrix.

Called By: flea_init_cig_sw
 flea_simulate_vehicles
 make_cal_matrices
 make_m1_overlays
 make_m2_overlays
 make_p_nt
 rotate_x_nt
 rotate_y_nt
 rotate_z_nt
 scale_mtx
 swap_axis
 translate

Routines Called: none

Parameters: REAL_4 matrix[4][3]

Returns: none

2.13.33.7 scale_mtx

The `scale_mtx` function scales (enlarges, reduces, or skews) a 4x3 matrix. The function creates an identity matrix, applies the scaling factor to it, then multiplies it by the original matrix.

The function call is `scale_mtx(scale, matrix)`, where:

scale is the scaling factor
matrix is the matrix to be scaled

This function is not currently used. (Scaling is a future system enhancement.)

Called By: none

Routines Called: id_4x3mtx
 mult_4x3mtx

Parameters: REAL_4 matrix[4][3]
 REAL_4 scale[3]

Returns: none

2.13.33.8 translate

The translate function moves a matrix to a new position by adding a translation value to each of its coordinates. The function creates an identity matrix, translates its coordinates, then multiplies it by the original matrix.

The function call is `translate(xval, yval, zval, matrix)`, where:

xval is the amount to be added to the x coordinate
yval is the amount to be added to the y coordinate
zval is the amount to be added to the z coordinate
matrix is the matrix to be translated

Translation amounts are specified in meters.

Called By: `flea_init_cig_sw`
`model_mtx`

Routines Called: `id_4x3mtx`
`mult_4x3mtx`

Parameters: `REAL_4` `xval`
`REAL_4` `yval`
`REAL_4` `zval`
`REAL_4` `matrix[4][3]`

Returns: none

2.13.33.9 mult_4x3mtx

The `mult_4x3mtx` function multiplies two 4x3 matrices together. This function is used to multiply a matrix by a rotation matrix.

The function call is `mult_4x3mtx(matrix, matrix_tmp)`, where:

matrix is the rotation matrix
matrix_tmp is the matrix to be rotated

Called By: `make_p_nt`
`rotate_x_nt`
`rotate_y_nt`
`rotate_z_nt`
`scale_mtx`

| | | |
|------------------|-----------|------------------|
| | swap_axis | |
| | translate | |
| Routines Called: | none | |
| Parameters: | REAL_4 | matrix[4][3] |
| | REAL_4 | matrix_tmp[4][3] |
| Returns: | none | |

2.13.33.10 getmatrix

The getmatrix function concatenates a matrix with another matrix.

The function call is **getmatrix(matrix, matrix_tmp)**, where:

matrix is the original matrix and the result matrix
matrix_tmp is the matrix to concatenate with the original matrix

This function is not currently used.

| | | |
|------------------|--------|------------------|
| Called By: | none | |
| Routines Called: | none | |
| Parameters: | REAL_4 | matrix[4][3] |
| | REAL_4 | matrix_tmp[4][3] |
| Returns: | none | |

2.13.33.11 matrix2

The matrix2 function concatenates (multiplies) two matrices to create a third matrix.

The function call is **matrix2(matrixa, matrixb, matrixc)**, where:

matrixa and *matrixb* are the matrices to be concatenated
matrixc is the result

This function is not currently used.

| | | |
|------------|------|--|
| Called By: | none | |
|------------|------|--|

Routines Called: none

Parameters: REAL_4 matrixa [4][3]
 REAL_4 matrixb [4][3]
 REAL_4 matrixc [4][3]

Returns: none

2.13.33.12 mtncpy

The `mtncpy` function copies a matrix from one memory location to another.

The function call is `mtncpy(to_matrix, from_matrix, matrix_type)`, where:

to_matrix is the destination location

from_matrix is the source location

matrix_type is the type of matrix (RTS3x3_TYPE, RTS4x3_TYPE, or ROT2x1_TYPE)

Called By: concat_mtx
 vpt_cnode_set_matrix
 vpt_update_mtx

Routines Called: none

Parameters: I4P to_matrix
 I4P from_matrix
 BYTE matrix_type

Returns: none

2.13.33.13 mat_copy

The `mat_copy` function copies a T matrix from one memory location to another.

The function call is `mat_copy(src, dest)`, where:

src is the source location

dest is the destination location

Called By: mat_transpose

Routines Called: none

| | | |
|-------------|----------------------|-------------|
| Parameters: | T_MATRIX T_MATRIX | src dest |
| Returns: | none | |

2.13.33.14 mat_vec_mul

The `mat_vec_mul` function multiplies a T vector by a T matrix and stores the result.

The function call is `mat_vec_mul(m, v, result)`, where:

m is the matrix
v is the vector
result is the result

This function is not currently used.

| | | |
|------------------|----------------------------------|------------------|
| Called By: | none | |
| Routines Called: | none | |
| Parameters: | T_MATRIX T_VECTOR T_VECTOR | m v result |
| Returns: | none | |

2.13.33.15 mat_adjugate

The `mat_adjugate` function calculates the adjugate matrix for a given T matrix.

The function call is `mat_adjugate(m, result)`, where:

m is the original matrix
result is the adjugate matrix

| | | |
|------------------|----------------------|-------------|
| Called By: | mat_inverse | |
| Routines Called: | none | |
| Parameters: | T_MATRIX T_MATRIX | m result |

Returns: none

2.13.33.16 mat_transpose

The `mat_transpose` function transposes a T matrix into a new matrix.

The function call is `mat_transpose(m, result)`, where:

m is the original matrix
result is the transposed matrix

Called By: mat_inverse

Routines Called: mat_copy

Parameters: T_MATRIX m
 T_MATRIX result

Returns: none

2.13.33.17 mat_scale

The `mat_scale` function scales (enlarges, reduces, or skews) a T matrix.

The function call is `mat_scale(mat, scale_factor, result)`, where:

mat is the original matrix
scale_factor is the amount by which to scale
result is the scaled matrix

Called By: mat_inverse

Routines Called: none

Parameters: T_MATRIX mat
 REAL_8 scale_factor
 T_MATRIX result

Returns: none

2.13.33.18 mat_determinant

The `mat_determinant` function returns the determinant of a T matrix.

The function call is `mat_determinant(m)`, where *m* is the original matrix.

| | | |
|------------------|----------------------|---|
| Called By: | mat_inverse | |
| Routines Called: | none | |
| Parameters: | T_MATRIX | m |
| Returns: | <matrix determinant> | |

2.13.33.19 mat_inverse

The `mat_inverse` function calculates the inverse of a given T matrix.

The function call is `mat_inverse(m, result)`, where:

m is the original matrix
result is the inverse matrix

To calculate the inverse of the matrix, `mat_inverse` does the following:

1. Gets the adjugate matrix.
2. Transposes the adjugate matrix.
3. Calculates the inverse of the determinant of the transposed matrix.
4. Scales the result of step 2 by the result of step 3.
5. Stores the result of step 4 in *result*.

This function is not currently used.

| | | |
|------------------|---|-------------|
| Called By: | none | |
| Routines Called: | mat_adjugate mat_determinant mat_scale mat_transpose | |
| Parameters: | T_MATRIX T_MATRIX | m result |

Returns: none

2.13.33.20 vec_mat_mul

The `vec_mat_mul` function multiplies a T vector by a T matrix and stores the result.

The function call is `vec_mat_mul(v, m, result)`, where:

v is the vector
m is the original matrix
result is the new matrix

Called By: find_pitch_and_roll

Routines Called: none

| | | |
|-------------|----------|--------|
| Parameters: | T_VECTOR | v |
| | T_MATRIX | m |
| | T_VECTOR | result |

Returns: none

2.13.33.21 make4x3

The `make4x3` function creates a 4x3 world/hull matrix given its heading, pitch, roll, and x, y, and z coordinates. It first computes values for the basic 3x3 portion of the matrix, then computes values for the x, y, z portion of the matrix.

The function call is `make4x3(cz, sz, cx, sx, cy, sy, x, y, z, matrix)`, where:

cz is the cosine of the z angle
sz is the sine of the z angle
cx is the cosine of the x angle
sx is the sine of the x angle
cy is the cosine of the y angle
sy is the sine of the y angle
x is the x coordinate
y is the y coordinate
z is the z coordinate
matrix is the result matrix

Called By: concat_mtx
 flea_simulate_vehicles
 flea_update_pos

Routines Called: none

| | | |
|-------------|----------|--------|
| Parameters: | REAL_4 | CZ |
| | REAL_4 | SZ |
| | REAL_4 | CX |
| | REAL_4 | SX |
| | REAL_4 | CY |
| | REAL_4 | SY |
| | REAL_4 | X |
| | REAL_4 | Y |
| | REAL_4 | Z |
| | T_MATRIX | matrix |

Returns: none

2.13.34 model_mtx.c

The `model_mtx` function builds hull-to-world, turret-to-hull, and gun-to-turret matrices. The function call is `model_mtx(modnum)`, where *modnum* is the model number.

This function is not currently used.

Called By: none

Routines Called: GLOB
id_matrix
prt_mtx
rotate_x
rotate_y
rotate_z
translate

Parameters: INT_2 modnum

Returns: none

2.13.35 mx2_hword.c

The functions in the `mx2_hword.c` CSU handle half-word messages exchanges. These function are used for the interface between the real-time software (specifically, the MPV Interface CSC routines) and the Force board. These functions are:

- mx2_open
- mx2_push
- mx2_peek
- mx2_skip
- mx2_error
- mx2_hwcopy

These functions are also present in and are used by the Force Processing CSC (see section 2.18). The Routines Called and Called By lists in this section do not include any Force Processing functions. Similarly, the Routines Called and Called By lists in section 2.18 do not include any real-time software functions.

2.13.35.1 mx2_open

The `mx2_open` function initializes the message buffer given its start address and its size. At the current time, this function is used only by the Force Processing CSC (see section 2.18).

The function call is `mx2_open(dev_P, device_size)`, where:

dev_P is a pointer to the message buffer
device_size is the size of the message buffer

The function always returns `MX_DEVICE_OPENED`.

| | | |
|------------------|----------------------|-----------------------|
| Called By: | none | |
| Routines Called: | sc_lock sc_unlock | |
| Parameters: | MX2_DEVICE INT_4 | *dev_P device_size |
| Returns: | MX_DEVICE_OPENED | |

2.13.35.2 mx2_push

The `mx2_push` function pushes a message onto the message buffer. `mx2_push` first checks to see if the buffer has room for the message, then calls `mx2_hwcopy` to copy the message to the buffer.

The function call is `mx2_push(dev_P, source_address, message_code, message_size)`, where:

dev_P is a pointer to the message buffer
source_address is the address of the message
message_code is the message type indicator
message_size is the size of the message in bytes

The function returns `MX_MESSAGE_PUSHED` if successful. It returns `MX_DEVICE_FULL` if the message buffer is already full.

| | |
|------------|--------------|
| Called By: | mpvideo_boot |
|------------|--------------|

mpvideo_laser_request_range
 mpvideo_load
 mpvideo_send_req
 mpvideo_set_lut
 mpvideo_set_mode
 mpvideo_set_video
 mpvideo_sim_init

Routines Called: mx2_hwcopy
 sc_lock
 sc_unlock

Parameters: MX2_DEVICE *dev_P
 WORD source_address
 HWORD message_code
 HWORD message_size

Returns: MX_DEVICE_FULL
 MX_MESSAGE_PUSHED

2.13.35.3 mx2_peek

The `mx2_peek` function previews the top message in the message buffer and returns a pointer to it.

The function call is `mx2_peek(dev_P, message_code, message_size, message_addr)`, where:

dev_P is a pointer to the message buffer
message_code is a pointer to the message type indicator
message_size is a pointer to the message size in bytes
message_addr is a pointer to the message address

The function returns `MX_MESSAGE_PREVIEWED` if successful. It returns `MX_DEVICE_EMPTY` if the message buffer contains no messages.

Called By: mpvideo_boot
 mpvideo_load
 mpvideo_response

Routines Called: sc_lock
 sc_unlock

Parameters: MX2_DEVICE *dev_P
 HWORD *message_code
 HWORD *message_size
 BYTE **message_addr

Returns: MX_DEVICE_EMPTY
 MX_MESSAGE_PREVIEWED

2.13.35.4 mx2_skip

The mx2_skip function skips over first message in the message buffer. The skipped message is flushed from the buffer and the next message moves to the head of the queue.

The function call is **mx2_skip(dev_P)**, where *dev_P* is a pointer to the message buffer.

The function returns MX_MESSAGE_SKIPPED if successful. It returns MX_DEVICE_EMPTY if the message buffer contains no messages.

Called By: mpvideo_boot
 mpvideo_load
 mpvideo_response

Routines Called: sc_lock
 sc_unlock

Parameters: MX2_DEVICE *dev_P

Returns: MX_MESSAGE_SKIPPED
 MX_DEVICE_EMPTY

2.13.35.5 mx2_error

The mx2_error function returns an ASCII translation of an error code, for output to the operator.

The function call is **mx2_error(status)**, where *status* is the error condition.

This function is not currently used.

Called By: none

Routines Called: none

Parameters: WORD status

Returns: "DEVICE CLOSED"
 "DEVICE TABLE FULL"

"DEVICE OPENED"
 "DEVICE BUSY"
 "DEVICE EMPTY"
 "DEVICE FULL"
 "MESSAGE PUSHED"
 "MESSAGE POPPED"
 "MESSAGE PREVIEWED"
 "MESSAGE SKIPPED"
 "UNDEFINED ERROR"
 "UNDEFINED RETURN"

2.13.35.6 mx2_hwcopy

The mx2_hwcopy function does a half-word block copy.

The function call is `mx2_hwcopy(source_P, destination_P, byte_count)`, where:

source_P is the source location
destination_P is the destination location
byte_count is the number of bytes to be copied

| | | |
|------------------|--|---|
| Called By: | mpvideo_load mpvideo_response mx2_push | |
| Routines Called: | none | |
| Parameters: | INT_2 INT_2 INT_2 | *source_P *destination_P byte_count |
| Returns: | none | |

2.13.36 open_dbase.c

The functions in the open_dbase.c CSU are used to open the terrain database and initialize parameters for Ballistics. These functions are:

- open_dbase
- func_msg

2.13.36.1 open_dbase

The open_dbase function opens the terrain database and initializes configuration and active area memory parameters for Ballistics. This function is called when the Simulation Host sends a MSG_FILE_DESCR - DB_SETUP message.

The function call is `open_dbase(pdbase)`, where *pdbase* is a pointer to the primary database control block.

`open_dbase` does the following:

- Closes any open database.
- Opens the database file specified in the message or entered through the keyboard; calls `find_fn` to find the latest version of the specified file.
- Initializes the database header data to zero.
- Reads the file header.
- Allocates memory for a work area.
- Reads the tag record and reads the applicable data.
- Frees the allocated memory.
- Allocates memory for the terrain model address and catalog tables.
- Allocates memory for the special effects address and catalog tables.
- Initializes database variables: number of load module blocks per side, grid space, and number of load modules on a side of AAM.
- Takes the AAM address from the terrain database header and ORs it with the current `terrain_addr` which is set up with the AAM offset (from `config_database`).
- Copies the `terrain_addr` into the field-of-view table address. For a 7000-meter viewing range (i.e, with load module blocking enabled), divides this address by 2.
- Sets the remaining database variables: number of load modules per side of a load module block, load module width, load module block width, active area width, total number of load modules and load module blocks, etc.
- Calculates the amount of memory required for the database and calls `extended_ram_available` to see if the database is going to fit in the available RAM.
- Initializes Ballistics configuration parameters: processor type, frame rate, number of AAM partitions, maximum chord length, maximum model radius, maximum number of models, maximum number of active rounds, polygons, and bvols, etc.
- Sends the configuration data to Ballistics by pushing a `MSG_B0_BAL_CONFIG` message onto the Ballistics message queue.
- Initializes AAM partition information for Ballistics: number of load modules per side, total number of load modules in AAM, viewing distance, grid width, AAM base address, etc.
- Sends the AAM partition parameters to Ballistics by pushing a `MSG_B0_DATABASE_INFO` message onto the Ballistics message queue.

The terrain database is loaded into active area memory by `load_dbase`, which is called by `db_mcc_setup` after the viewport configuration tree is created.

Called By: `db_mcc_setup`

Routines Called: `exit`
 `extended_ram_available`
 `find_fn`
 `free`
 `func_msg`
 `GLOB`
 `malloc`
 `mx_push`
 `printf`
 `strlen`

SYSERR
 XCLOSE
 XLSEEK
 XOPEN
 XREAD

Parameters: DB_INFO *pdbase

 Returns: none

2.13.36.2 func_msg

The `func_msg` function outputs error messages related to opening the database. Specifically, it outputs "OPEN_DBASE" followed by text supplied by `open_dbase`.

The function call is `func_msg(s)`, where *s* is the additional text to be output to stdout.

Called By: open_dbase

 Routines Called: printf

 Parameters: BYTE s[]

 Returns: none

2.13.37 open_ded.c

The `open_ded` function opens the dynamic elements database (DED) file and processes the dynamic model list, changing the relative AAM addresses to absolute AAM addresses. The DED file name can be specified by the Simulation Host in the MSG_FILE_DESCR - DB_DED_SETUP_0 or DB_DED_SETUP_1 message, or it can be entered through the keyboard.

For 7000-meter databases, additional memory can be used to load extra DED models. The memory is allocated in two areas called pools: pool 0 is the standard pool and pool 1 is the additional ("wrap") pool. `open_ded` calls the `pool_init` function to initialize the standard pool and allocate the wrap pool if the additional memory is available and required.

The function call is `open_ded (pdbase, avail_gm, vme_offset)`, where:

pdbase is a pointer to the primary database control block
avail_gm is the amount of space in generic memory for model information
vme_offset is the VME address offset to active area memory

`open_ded` is called after the terrain database has been loaded into active area memory. `open_ded` does the following:

- Closes any open DED file.
- Allocates memory for a scratch buffer.
- Finds and opens the latest version of the specified DED file.
- Reads the database header and verifies it is valid.
- Allocates memory for the DED model address and catalog tables.
- Allocates memory for the DED special effects address and catalog tables.
- Initializes the file_cut (the point at which the DED file will be split into two pools, if required).
- Initializes the address of the first model to be placed into the wrap pool to 0.
- Reads in the model directory entries, and updates the address of the first model to go into the wrap pool.
- Reads in the effects directory, and updates the first wrap address again.
- Sets the file_cut value:
 - If the DED is too large for standard generic memory, the file_cut is the first wrap address (i.e., a model boundary).
 - If the DED fits into standard generic memory, the file_cut is the size of the standard pool.
- Sets up the DED memory pools:
 - Calls pool_init to initialize the pool(s).
 - Outputs the pool boundaries to stdout.
- Determines the memory address to shift boundary data to (the last allocated pool's start address plus the size of DED).
- Loads all models into generic model active area memory.
- Calls download_bvols to download the models and bounding volumes to Ballistics.
- Processes the model directory entries; calls ded_model_trace to trace all DTP commands.
- Processes the special effect directory entries; calls ded_model_trace to trace all DTP commands.
- Closes the DED file.
- Sets all invalid model and effect address table entries to the default entry. An address is considered invalid if it is 0 or is outside of both pools.
- Frees the scratch buffer.

The function returns 0 if the DED file is fully or partially loaded. It returns -1 if no DED file is found or the database header is invalid.

Called By: load_dbase

Routines Called: addr_in_pool
 ded_model_trace
 download_bvols
 find_fn
 free
 malloc
 pool_init
 printf
 strlen
 XCLOSE
 XLSEEK
 XOPEN
 XREAD

| | | |
|-------------|--------------------------|------------------------------------|
| Parameters: | DB_INFO INT_4 WORD | *pdbase; avail_gm vme_offset |
| Returns: | 0 -1 | |

2.13.38 otherveh_state.c

The `otherveh_state` function performs other vehicle model control. This function is called whenever the Simulation Host sends a `MSG_OTHERVEH_STATE` message to reposition dynamic vehicles in active area memory.

The function call is `otherveh_state(msgp, pdbase, vme_offset, db, model_num)`, where:

msgp is a pointer to the `MSG_OTHERVEH_STATE` message
pdbase is a pointer to the primary database control block
vme_offset is the VME address offset to active area memory
db is the current double-buffer base pointer
model_num is 1 (first model this frame) or 0 (not the first model)

`otherveh_state` does the following:

- If *model_num* is 1, resets the dynamic component counters.
- Checks to see if the vehicle is a tank.
 - If it is a tank, sets `veh_is_tank` to TRUE; makes sure there is enough room for a new tank; adds the tank.
 - If it is not a tank, sets `veh_is_tank` to FALSE; makes sure there is room for a new vehicle; adds the vehicle.
- Saves the model's matrix and center.
- Adds the model to the proper load module.
- Determines which list to add the model to (pre-process, post-process, or standard).

The function returns 0 if successful. It returns `E_LIMIT` if there is no room for a new model.

Called By: `msg_otherveh_state`

Routines Called: `FIND_LM`

| | | |
|-------------|--|---|
| Parameters: | MSG_OTHERVEH_STATE DB_INFO INT_4 INT_4 INT_4 | *msgp *pdbase vme_offset db model_num |
|-------------|--|---|

Returns: 0
 E_LIMIT

2.13.39 pretend_veh.c

The `pretend_veh` function processes Gossip vehicles. This function is called at the end of every frame to process changes to vehicles that were input by the Gossip user (via the Model menu) during the previous frame. `pretend_veh` adds and removes static vehicles, adds effects, and adds dynamic vehicles.

The function call is `pretend_veh (imsg, pretend_sv, pretend_ef, pretend_dv, remove_sv, INBUF, frame_count)`, where:

imsg is a pointer to the message packet from the Simulation Host
pretend_sv is a pointer to the static vehicle to be added
pretend_ef is a pointer to the effect to be added
pretend_dv is a pointer to the dynamic vehicle to be added
remove_sv is a pointer to the static vehicle to be removed
INBUF is a pointer to the incoming (SIM-to-CIG) message buffer
frame_count is the current frame number

The changes to the Gossip vehicles are entered via menus. The `gos_model` function builds Simulation Host-type messages for the changes and places them in the locations specified in the call (`pretend_sv`, `pretend_dv`, etc.). `pretend_veh` then takes the messages and puts them in the next incoming message packet for processing.

Requests to remove static vehicles may also come from the `_rowcol_rd` function. `_rowcol_rd` periodically checks to see that all static vehicles are within viewing range of the simulated vehicle. If a vehicle is detected to be out of range, `_rowcol_rd` generates a message to delete it and places it in the `remove_sv` location, for processing the next frame by `pretend_veh`.

`pretend_veh` returns TRUE if successful, or FALSE if it cannot process the message.

Called By: process_a_msg

Routines Called: getenv
 printf

| | | |
|-------------|---------|--------------|
| Parameters: | INT_4 | **imsg |
| | INT_4 | **pretend_sv |
| | INT_4 | **pretend_ef |
| | INT_4 | **pretend_dv |
| | INT_4 | **remove_sv |
| | MSG_BLK | *INBUF |
| | INT_4 | frame_count |

Returns: 1 (TRUE)

0 (FALSE)

2.13.40 rowcol_rd.c

The functions in the rowcol_rd.c CSU are responsible for determining whether new load modules need to be read from the terrain database into active area memory for hardware, local terrain, and Ballistics use. These functions are:

- rowcol_rd_1
- rowcol_rd_2
- rowcol_rd_3
- rowcol_rd_4
- _rowcol_rd
- rowcol_rd_1_cleanup
- rowcol_rd_2_cleanup
- rowcol_rd_3_cleanup
- rowcol_rd_4_cleanup
- _rowcol_rd_cleanup

The _rowcol_rd function performs all database management, and the _rowcol_rd_cleanup function performs all resource deallocation at shutdown. The other functions simply call _rowcol_rd or _rowcol_rd_cleanup for a specified subsystem/active area memory.

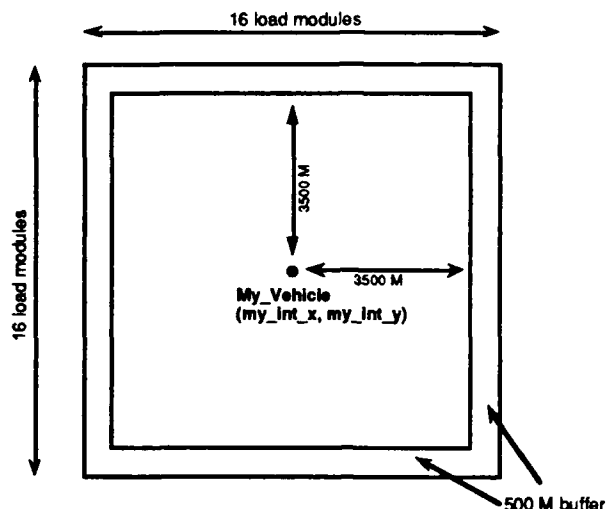
The terrain database, which is stored in the CIG, describes the entire terrain that can be displayed in the simulation. It also contains the graphic information used to display vehicles, houses, trees, hills, and other objects in the terrain.

The items stored in the terrain database are represented by connected polygons that are three-dimensional images. The polygons are grouped into compacted data structures such as terrain grids, polygon models, and stamp arrays. These structures are further grouped into unique static objects (rivers, roads, and other features that appear only once in the database) and generic models (houses, trees, vehicles, and other features that commonly recur in the database).

The terrain database is divided into units called load modules. One load module contains the instructions and data required to process a one-half kilometer square area of static objects. Each load module contains all the roads, rivers, terrains, buildings, and other features within a 500 by 500 meter area. The load modules in the terrain database are organized in rows and columns. The total size of the database is variable.

Each load module is divided into four areas called grids. Each grid is a 125-meter by 125-meter square.

Active area memory (AAM) contains the subset of the local terrain that can be viewed and interacted with at a given point in time by the simulation. The AAM stores an 8K by 8K area centered around the simulation vehicle. This provides a viewing range of 3500 meters in each direction, with a 500-meter buffer along each edge. The AAM contains 256 load modules (16 rows by 16 columns).



As the simulated vehicle moves toward an edge of active area memory, `_rowcol_rd` brings in new load modules from the terrain database, overwriting those areas that the vehicle is moving away from. The objective of this process is to keep the simulated vehicle in the center of active area memory.

Active area memory can be thought of as a window that moves over the terrain database. As the vehicle travels east, for example, the window must be moved east to keep the vehicle in the window's center. To do this, `_rowcol_rd` determines what column in the database lies east of the current east boundary of AAM. It then reads part of that column (the 16 load modules in the column that lie between AAM's north and south boundaries) into AAM. Finally, it shifts the west boundary of AAM over one column.

With very large terrain databases, load module blocking can be enabled. One load module block contains four load modules (two rows by two columns). Therefore, one load module block is 1000 meters by 1000 meters, or a one-kilometer square area. Load module blocking increases the amount of terrain that can be loaded into active area memory to 16K by 16K. It also doubles the viewing range of the simulated vehicle (from 3500 meters to 7000 meters).

2.13.40.1 `rowcol_rd_1`

The `rowcol_rd_1` function calls `_rowcol_rd` for subsystem 0. `rowcol_rd_1` is invoked by a mailbox message posted by `init_simulation`.

The function call is `rowcol_rd_1()`.

Called By: none (task created at initialization time)

Routines Called: `_rowcol_rd`

Parameters: none

Returns: none

2.13.40.2 rowcol_rd_2

The rowcol_rd_2 function calls `_rowcol_rd` for subsystem 1. rowcol_rd_2 is invoked by a mailbox message posted by `init_simulation`, if subsystem 1 is defined.

The function call is `rowcol_rd_2()`.

Called By: none (task created at initialization time)

Routines Called: `_rowcol_rd`

Parameters: none

Returns: none

2.13.40.3 rowcol_rd_3

The rowcol_rd_3 function calls `_rowcol_rd` for subsystem 2. rowcol_rd_3 is invoked by a mailbox message posted by `init_simulation`, if subsystem 2 is defined.

The function call is `rowcol_rd_3()`.

Called By: none (task created at initialization time)

Routines Called: `_rowcol_rd`

Parameters: none

Returns: none

2.13.40.4 rowcol_rd_4

The rowcol_rd_4 function calls `_rowcol_rd` for subsystem 3. rowcol_rd_4 is invoked by a mailbox message posted by `init_simulation`, if subsystem 3 is defined.

The function call is `rowcol_rd_4()`.

Called By: none (task created at initialization time)

Routines Called: _rowcol_rd

Parameters: none

Returns: none

2.13.40.5 _rowcol_rd

The `_rowcol_rd` function determines whether a new row or column of the terrain database needs to be read into active area memory. This task is invoked by the `rowcol_rd_*` functions when a message is posted to the database management mailbox. The primary function of `_rowcol_rd` is to keep the simulated vehicle in the center of active area memory.

The function call is `_rowcol_rd(pdbase)`, where *pdbase* is a pointer to the primary database control block.

When a message is posted to its mailbox, `_rowcol_rd` does the following:

- Initializes direction offsets.
- Calls `poll_shutdown` to see if a system shutdown has been requested.
- Checks to see if `reading_lm` is TRUE, indicating that load modules were read in during the last iteration:
 - If TRUE, sets it to FALSE.
 - If FALSE, posts a messages and waits to be woken up again.
- Pushes a `MSG_BO_AAM_SW_CORNER` message onto the Ballistics message queue to tell Ballistics where the southwest corner of active area memory is.
- Checks to see if the simulated vehicle is out of viewing range of AAM (i.e., is beyond an AAM boundary by a distance of more than one-half AAM width). If yes:
 - Sets `warp_in_progress` and `reading_lm` to TRUE.
 - Calls `load_modules` to reload all of AAM from the terrain database.
 - Sets `warp_in_progress` to FALSE.
- Checks to see if the simulated vehicle is inside AAM, or outside but within viewing range of it. If yes:
 - Compares the coordinates of the vehicle's centroid to the center of AAM.
 - If the vehicle is detected to be off-center, sets `reading_lm` to TRUE, then calls `whatdirptr` and `getside` to load a new row or column in the needed direction. For example, if the vehicle is detected to be too far away from the west boundary (i.e., is east of AAM center), a column is added to the east side and deleted from the west. This has the effect of shifting all of AAM east by one column.
 - Updates the applicable database data variables to reflect the change to AAM boundaries.
- Checks to make sure that all static vehicles are within the active area. If any static vehicle is found outside the simulated vehicle's viewing range:
 - Generates a `MSG_STATICVEH_REM` message (with the vehicle type set to 0).
 - Puts the message in global memory for processing (by `pretend_veh`) during the next frame.

Called By: rowcol_rd_1
 rowcol_rd_2
 rowcol_rd_3
 rowcol_rd_4

Routines Called: getside
 GLOB
 load_modules
 mx_push
 poll_shutdown
 printf
 rt_pend
 rt_post
 sc_delay
 whatdirptr

Parameters: DB_INFO *pdbase

Returns: none

2.13.40.6 rowcol_rd_1_cleanup

The rowcol_rd_1_cleanup function calls _rowcol_rd_cleanup for subsystem 0. This function is called when a system shutdown is requested by the Gossip user. The function is called via the *task_cleanup function pointer, which points to the cleanup routine's name in the task table.

The function call is rowcol_rd_1_cleanup().

Called By: poll_shutdown (through *task_cleanup)

Routines Called: _rowcol_rd_cleanup

Parameters: none

Returns: _rowcol_rd_cleanup(&db_control[0])

2.13.40.7 rowcol_rd_2_cleanup

The rowcol_rd_2_cleanup function calls _rowcol_rd_cleanup for subsystem 1. This function is called when a system shutdown is requested by the Gossip user. The function is called via the *task_cleanup function pointer, which points to the cleanup routine's name in the task table.

The function call is `rowcol_rd_2_cleanup()`.

Called By: `poll_shutdown` (through `*task_cleanup`)

Routines Called: `_rowcol_rd_cleanup`

Parameters: `none`

Returns: `_rowcol_rd_cleanup(&db_control[1])`

2.13.40.8 `rowcol_rd_3_cleanup`

The `rowcol_rd_3_cleanup` function calls `_rowcol_rd_cleanup` for subsystem 2. This function is called when a system shutdown is requested by the Gossip user. The function is called via the `*task_cleanup` function pointer, which points to the cleanup routine's name in the task table.

The function call is `rowcol_rd_3_cleanup()`.

Called By: `poll_shutdown` (through `*task_cleanup`)

Routines Called: `_rowcol_rd_cleanup`

Parameters: `none`

Returns: `_rowcol_rd_cleanup(&db_control[2])`

2.13.40.9 `rowcol_rd_4_cleanup`

The `rowcol_rd_4_cleanup` function calls `_rowcol_rd_cleanup` for subsystem 3. This function is called when a system shutdown is requested by the Gossip user. The function is called via the `*task_cleanup` function pointer, which points to the cleanup routine's name in the task table.

The function call is `rowcol_rd_4_cleanup()`.

Called By: `poll_shutdown` (through `*task_cleanup`)

Routines Called: `_rowcol_rd_cleanup`

Parameters: none

Returns: `_rowcol_rd_cleanup(&db_control[3])`

2.13.40.10 `_rowcol_rd_cleanup`

The `_rowcol_rd_cleanup` function deallocates the resources allocated to the `rowcol_rd` task for a specified backend. This function is called when a system shutdown is requested by the Gossip user.

The function call is `_rowcol_rd_cleanup(pdbase)`, where *pdbase* is the primary database control block for the backend.

The function returns 1 if successful, or 0 if an error occurred.

Note: This function is not yet implemented. At the current time, the function simply returns a 1 if called.

Called By: `rowcol_rd_1_cleanup`
`rowcol_rd_2_cleanup`
`rowcol_rd_3_cleanup`
`rowcol_rd_4_cleanup`

Routines Called: none

Parameters: `DB_INFO` *pdbase

Returns: 0
1

2.13.41 `rt_mailbox.c`

The `rt_mailbox.c` CSU contains special intertask mailbox functions used by the real-time software tasks.

The functions in this CSU are:

- `rt_pend`
- `rt_post`
- `rt_accept`

2.13.41.1 `rt_pend`

The `rt_pend` function waits for a message to be posted to a specific mailbox.

The function call is `rt_pend(mboxp, timeout, errp)`, where:

mboxp is a pointer to the intertask mailbox
timeout is the amount of time to wait for the message before timing out; 0 = use default
 timeout
errp is the error pointer

rt_pend does the following:

- Calls sc_pend to wait for the specified mailbox message. The timeout is set to the timeout specified in the call or to a default value.
- Calls poll_shutdown to see if a system shutdown has been initiated.

The function returns the value returned from sc_pend as result.

| | | |
|------------------|--|-----------------------------|
| Called By: | _pend_on_frame_interrupt _rowcol_rd bx_task exchange_flea_data flea flea_host_if host_if_debug local_terrain msg_end | |
| Routines Called: | poll_shutdown sc_pend | |
| Parameters: | char long int* | ** mboxp timeout errp |
| Returns: | result | |

2.13.41.2 rt_post

The rt_post function posts a message to a specified intertask mailbox by calling sc_post.

The function call is **rt_post(mboxp, msg, errp)**, where:

mboxp is a pointer to the mailbox
msg is a pointer to the message
errp is the error pointer

| | |
|------------|--|
| Called By: | _rowcol_rd bx_task local_terrain scratch_flea |
|------------|--|

| | | |
|------------------|---------------------|--------------------------|
| Routines Called: | sc_post | |
| Parameters: | char char int | **mboxp *msg *errp |
| Returns: | none | |

2.13.41.3 rt_accept

The `rt_accept` function clears any stray messages from a specified mailbox by calling `sc_accept`.

The function call is `rt_accept(mboxp, errp)`, where:

mboxp is a pointer to the mailbox
errp is the error pointer

The function returns the value returned by `sc_accept`.

This function is not currently used.

| | | |
|------------------|------------------------|------------------|
| Called By: | none | |
| Routines Called: | sc_accept | |
| Parameters: | char int | **mboxp *errp |
| Returns: | sc_accept(mboxp, errp) | |

2.13.42 rtt_init.c

The functions in the `rtt_init.c` CSU are used to parse the command line entered by the user at startup, and to initialize the system. These functions are:

- `initialize_defaults`
- `initialize`

2.13.42.1 initialize_defaults

The `initialize_defaults` function initializes various system variables to their default values. Currently, these variables are the CIG-SIM frame rate and the boolean that controls single-step mode.

The function call is `initialize_defaults()`.

Called By: `initialize`

Routines Called: `none`

Parameters: `none`

Returns: `none`

2.13.42.2 initialize

The initialize function parses the command line entered by the user to start up the system. Command line arguments are used to select the correct network interface as well as to toggle certain types of processing on and off. `initialize` then calls other functions to initialize the system in the desired manner.

The arguments that can be entered on the initialize command line are listed below, along with the variable(s) set if that argument is specified.

| Switch | Description | Variable(s) |
|--------|---|-----------------------------------|
| A | AGPT mode - host via socket to simnet server | agpt_mode |
| a | Aerial terrain feedback shutoff (altitude above ground) | feedback_shutoff_G |
| b | Ballistics processing disabled | ball_disable_wanted |
| c | Constrain database to initial load | database_disable_wanted |
| d | Download texture maps to IPPTs | esifa_load_wanted |
| e | Ethernet mode | enet_mode_G |
| f | Flea mode | flea_mode_G |
| h | Help | none |
| m | MPV mode | mpv_mode_local |
| p | Set CIG-SIM packet exchange size | dr1lin_pkt_size, dr1lout_pkt_size |
| s | Set speed (frame rate in Hz) | frame_rate |
| S | STG slaved | slave_stg |
| t | Set local terrain chunk size and interval | lt_chunk_size, lt_interval |
| v | Verbose | verbose_G |
| x | Socket interface mode | local_socket_name |
| z | SCSI mode | scsi_mode_local |

initialize does the following:

- Calls `initialize_defaults` to initialize various system parameters.
- Calls `clparse` to verify that the command line is valid.
- Calls `host_if_buffer_init` to reset the INBUF and OUTBUF buffers.
- Calls `host_init_packet_sizes` to initialize the CIG-SIM exchange packet sizes.
- Initializes the host interface based on the command line, as follows:
 - If Ethernet mode is requested ("e" argument), calls `init_enet_interface`.
 - If flea mode is requested, ("f" argument) calls `init_flea_interface`.
 - If MPV mode is requested ("m" argument), calls `init_mpv_interface`.
 - If SCSI mode is requested ("z" argument), calls `init_scsi_interface`.
 - If socket mode is requested ("x" argument), calls `init_socket_interface`.
 - If DR11 mode is requested (default), calls `init_dr11_interface`.
- Opens and parses the `subsys.cfg` file:
 - Calls `init_subsys_parser` to initialize the parser used to read the file.
 - Calls `fopen` to open the file.
 - Calls `set_token_file` and `parse_subsys_file` to read the file.
 - Calls `fclose` to close the file.
 - Calls the `get_*` functions to retrieve the specified file names, and outputs them to stdout.
- Calls `sys_control_init` to initialize the frame rate in the EVC board.
- For subsystem 0 (AAM1):
 - Calls `backend_setup` to configure the backend.
 - Calls `find_fn` to find the forcetask file ("force0").
 - Calls `mpvideo_boot` to start the MPV.
 - Calls `mpvideo_load` to load the 3-D and final lookup tables, the 2-D overlay file, and the 2-D task.
- If subsystem 1 (AAM2) exists:
 - Calls `backend_setup` to configure the backend.
 - Calls `find_fn` to find the forcetask file ("force1").
 - Calls `mpvideo_boot` to start the MPV.
 - Calls `mpvideo_load` to load the 3-D and final lookup tables, the 2-D overlay file, and the 2-D task.
- Calls `sys_control_init` to initialize the frame rate in the EVC board.
- Calls `sys_slave_sync` to synchronize the frame interval with an external master CIG, or `sys_master_sync` to set up the local CIG as the master.
- Calls `vpt_tree_init` to initialize the viewport configuration tree.

The function exits with 1 if an error was detected on the command line, or if `mpvideo_load` could not load a required file.

Called By: main (in rtt.c)

Routines Called: backend_setup
 clparse
 exit
 fclose
 find_fn
 fopen
 get_3d_lut_name
 get_color_config_name
 get_data_2d_name

```

get_database_name
get_ded_name
get_esifa_name
get_final_lut_name
host_if_buffer_init
host_init_packet_sizes
init_dr11_interface
init_enet_interface
init_flea_interface
init_mpv_interface
init_scsi_interface
init_socket_interface
init_subsys_parser
initialize_defaults
mpvideo_boot
mpvideo_load
parse_subsys_file
printf
set_token_file
strcpy
strlen
sys_control_init
sys_master_sync
sys_slave_sync
vpt_tree_init

```

| | | |
|-------------|-------------|-----------------|
| Parameters: | int char | argc *argv[] |
| Returns: | none | |

2.13.43 simulation.c

The functions in the simulation.c CSU form the message handler for the real-time simulation control of the CIG hardware and communications with the Simulation Host. These functions are:

- simulation
- process_a_msg
- syserr

2.13.43.1 simulation

The simulation function calls other functions to initialize all simulation variables and process the messages received from the Simulation Host. This function is called when the Simulation Host sends a MSG_CIG_CTL message with the new state set to C_SIMULATION or C_MCC_SIMUL.

The function call is **simulation(simstate)**, where *simstate* is the new state of the CIG system (C_SIMULATION or C_MCC_SIMUL).

simulation does the following:

- Calls `init_simulation` to initialize various simulation variables and table pointers, notify the backend to prepare for a simulation, initiate database management and database feedback, and enable system interrupts.
- Calls `poll_shutdown` to see if a system shutdown has been requested.
- Makes sure the packet size has not been exceeded.
- Tests to see if an interrupt has occurred by looking for a `SIMULATION_MB` mailbox message. If so, flushes the frame by calling `sc_accept`. This step is skipped if the simulation is running under Flea.
- Calls `process_a_msg` to process each runtime message received from the Simulation Host.
- Calls `stop_watch` to read and stop the timer.

Called By: `db_mcc_setup`

Routines Called: `asm`
 `GLOB`
 `init_simulation`
 `poll_shutdown`
 `printf`
 `process_a_msg`
 `sc_accept`
 `stop_watch`
 `syserr`

Parameters: `INT_2` `simstate`

Returns: `none`

2.13.43.2 `process_a_msg`

The `process_a_msg` function handles all messages received by the Simulation Host during a simulation. This function is called when the CIG is ready to start processing messages.

The function call is `process_a_msg(curr_sim_buf, pdbname, pdynl, ptanks, pmodels, peffects)`, where:

curr_sim_buf is the double buffer the real-time software is currently loading
pdbname is a pointer to the primary database control block
pdynl is a pointer to the structure containing the current state of all dynamic models
ptanks is the starting address of the tanks table
pmodels is the starting address of the dynamic models table
peffects is the starting address of the dynamic effects table

For each message it receives, `process_a_msg` does the following:

- Calls `cigsimio_msg_in` to write the message to a buffer (if message recording or debug display is enabled).
- Processes the message according to its type (see table below).

In most cases, `process_a_msg` simply calls a Message Interface (`msg_*`) function to handle the message. For messages that are to be forwarded to Ballistics, `process_a_msg` pushes the message onto the Ballistics message queue or calls a `sim_bal_*` routine.

The following table summarizes the processing performed by `process_a_msg` in response to each valid message type it receives from the Simulation Host. The first column lists the messages in alphabetical order. The second column briefly describes the purpose of the message (in italics), then lists the major steps performed by `process_a_msg` to process that message.

| Message from SIM Host | Processing by <code>process_a_msg</code> |
|-----------------------|--|
| MSG_IROTATION | <i>Updates a single rotation of an hprxyzs matrix.</i> Calls <code>msg_1rotation</code> . |
| MSG_3ROTATIONS | <i>Updates the rotation portion of an hprxyzs matrix.</i> Calls <code>msg_3rotations</code> . |
| MSG_ADD_TRAJ_TABLE | <i>Defines a new trajectory table.</i> Pushes MSG_B0_ADD_TRAJ_TABLE message onto Ballistics message queue. |
| MSG_AGL_SETUP | <i>Toggles AGL processing on and off.</i> Sets <code>agl_wanted</code> in global memory. |
| MSG_AMMO_DEFINE | <i>Define ammunition maps.</i> Loads the specified ammunition maps into memory. |
| MSG_CALIBRATION_IMAGE | <i>Displays offset image, color image, or BBN logo.</i> Calls <code>msg_calibration_image</code> . |
| MSG_CANCEL_ROUND | <i>Tells Ballistics to cancel a fired round.</i> Pushes MSG_B0_CANCEL_ROUND message onto Ballistics message queue. |
| MSG_CIG_CTL | <i>Causes a transition to another performance state.</i> Calls <code>msg_cig_ctl</code> . |
| MSG_CLOUD_STATE | <i>Positions cloud models at a specified altitude.</i> Calls <code>cloud_update</code> . |
| MSG_DELETE_TRAJ_TABLE | <i>Tells Ballistics to delete a downloaded trajectory table.</i> Pushes MSG_B0_DELETE_TRAJ_TABLE message onto Ballistics message queue. |
| MSG_DR11_PKT_SIZE | <i>Specifies exchange packet parameters.</i> Calls <code>msg_dr11_pkt_size</code> . |
| MSG_END | <i>Signals end of packet buffer.</i> Calls <code>pretend_veh</code> ; calls <code>msg_end</code> . |
| MSG_GUN_OVERLAY | <i>Changes gun/gunner overlays.</i> Calls <code>m1_gun_overlay</code> or <code>m2_gun_overlay</code> , based on type in message. |
| MSG_HPRXYZS_MATRIX | <i>Updates a configuration node's matrix.</i> Calls <code>msg_hprxyzs_matrix</code> . |
| MSG_LT_STATE | <i>Changes the local terrain frame interval and chunk size.</i> Calls <code>lt_state</code> . |

| | |
|-------------------------|--|
| MSG_OTHERVEH_STATE | <i>Describes the state of all dynamic vehicles in the terrain. Calls msg_otherveh_state.</i> |
| MSG_PASS_ON | <i>Provides data to be passed on to a specific subsystem in the CIG (e.g., 2-D overlay processor). Calls msg_pass_on.</i> |
| MSG_PPM_DISPLAY_MODE | <i>Changes PPM display modes. Calls msg_ppm_display_mode.</i> |
| MSG_PPM_DISPLAY_OFFSET | <i>Changes PPM display offsets. Calls msg_ppm_display_offset.</i> |
| MSG_PPM_PIXEL_LOCATION | <i>Sets a new PPM pixel location. Calls msg_ppm_pixel_location.</i> |
| MSG_PPM_PIXEL_STATE | <i>Turns PPM pixel processing on or off. Calls msg_ppm_pixel_state.</i> |
| MSG_PROCESS_CHORD | <i>Tells Ballistics to process a chord. Pushes MSG_B0_PROCESS_CHORD message onto Ballistics message queue.</i> |
| MSG_PROCESS_ROUND | <i>Tells Ballistics to process a fired round. Pushes MSG_B0_PROCESS_ROUND message onto Ballistics message queue.</i> |
| MSG_PROCESS_ROUND48 | <i>Tells Ballistics to process a fired round. Calls msg_process_round48.</i> |
| MSG_REQUEST_LASER_RANGE | <i>Asks for pixel depth for i, j position on screen. Calls msg_laser_request_range.</i> |
| MSG_REQUEST_POINT_INFO | <i>Asks for terrain characteristics at a specific point in the viewing range. Calls sim_bal_req_pt_info.</i> |
| MSG_ROT2x1_MATRIX | <i>Updates a configuration node's matrix. Calls msg_rot2x1_matrix.</i> |
| MSG_ROUND_FIRED | <i>Tells Ballistics that a round has been fired. Pushes MSG_B0_ROUND_FIRED message onto Ballistics message queue; if rtsw_timing flag is enabled, computes processing time for message and updates worst time if applicable.</i> |
| MSG_RTS4x3_MATRIX | <i>Updates a configuration node's matrix. Calls msg_rts4x3_matrix.</i> |
| MSG_SCALE | <i>Updates the scale portion of an hprxyzs matrix. Calls msg_scale.</i> |
| MSG_SHOW_EFFECT | <i>Used to show the effect of an impact on terrain or a vehicle. Calls msg_show_effect.</i> |
| MSG_SIO_WRITE | <i>Writes data to a serial device. Calls sio_write.</i> |
| MSG_STATICVEH_REM | <i>Removes a static vehicle from the local terrain. Calls msg_staticveh_rem.</i> |
| MSG_STATICVEH_STATE | <i>Adds a static vehicle to the local terrain. Calls msg_staticveh_state.</i> |
| MSG_SUBSYS_MODE | <i>Changes subsystem-specific parameters (e.g., color table, fade value, calibration mode). Calls msg_subsys_mode.</i> |

| | |
|------------------------|---|
| MSG_TF_INIT_HDR | <i>Controls the way the CIG builds a terrain feedback message.</i> Pushes MSG_B0_TF_INIT_HDR message onto Ballistics message queue; if "own" vehicle, sets flags and frequency variables. |
| MSG_TF_INIT_PT | <i>Specifies a point for which terrain feedback is desired.</i> Pushes MSG_B0_TF_INIT_PT message onto Ballistics message queue. |
| MSG_TF_STATE | <i>Disables/enables terrain feedback processing; changes frequency of own vehicle feedback.</i> Pushes MSG_B0_TF_STATE message onto Ballistics message queue; if message is for "own" vehicle, sets flags and frequency accordingly. |
| MSG_TF_VEHICLE_POS | <i>Provides new position of vehicle for which terrain feedback data is being collected.</i> Pushes MSG_B0_TF_VEHICLE_POS message onto Ballistics message queue. |
| MSG_TRAJ_CHORD | <i>Used for chords that represent trajectories.</i> Calls sim_bal_traj_chord; if rtsw_timing flag is enabled, computes processing time for message and updates worst time if applicable. |
| MSG_TRAJ_ENTRY | <i>Downloads an entry to a trajectory table.</i> Pushes MSG_B0_TRAJ_ENTRY message onto Ballistics message queue. |
| MSG_TRANSLATION | <i>Updates the translation portion of an hprxyzs matrix.</i> Calls msg_translation. |
| MSG_VIEW_FLAGS | <i>Updates system view flags (e.g., on/off, FLIR, DTV) and/or branch values.</i> Calls msg_view_flags. |
| MSG_VIEW_MAGNIFICATION | <i>Changes viewport's field-of-view and/or level of detail.</i> Calls msg_view_magnification. |
| MSG_VIEWPORT_UPDATE | <i>Modifies viewport parameters.</i> Calls msg_viewport_update. |

Called By: simulation

Routines Called:

- asm
- cigsimio_msg_in
- cloud_update
- GLOB
- lt_state
- m1_gun_overlay
- m2_gun_overlay
- msg_1rotation
- msg_3rotations
- msg_calibration_image
- msg_cig_ctl
- msg_dr11_pkt_size
- msg_end
- msg_hprxyzs_matrix

```

msg_laser_request_range
msg_otherveh_state
msg_pass_on
msg_ppm_display_mode
msg_ppm_display_offset
msg_ppm_pixel_location
msg_ppm_pixel_state
msg_process_round48
msg_rot2x1_matrix
msg_rts4x3_matrix
msg_scale
msg_show_effect
msg_staticveh_rem
msg_staticveh_state
msg_subsys_mode
msg_translation
msg_view_flags
msg_view_magnification
msg_viewport_update
mx_push
pretend_veh
printf          (in debug mode only)
read_watch
sim_bal_req_pt_info
sim_bal_traj_chord
sio_write
syserr

```

| | | |
|-------------|----------|---------------|
| Parameters: | INT_2 | *curr_sim_buf |
| | DB_INFO | *pdbname |
| | INT_4 | **pdynl |
| | TANK | **ptanks |
| | OMODEL | **pmodels |
| | SHOW_EFF | **peffects |

Returns: none

2.13.43.3 syserr

The `syserr` function is used to generate a `MSG_SYS_ERROR` message for return to the Simulation Host. This function is called if an error is detected in a SIM-to-CIG message packet (e.g., packet length overrun or illegal message type), or a function requested by the Simulation Host could not be performed (e.g., configuration tree initialization error or laser range request failure).

The function call is `syserr(error, state)`, where:

error is the error that was detected
state is the current state of the CIG

The MSG_SYS_ERROR message is included in every CIG-to-SIM message packet, even if no error has been detected. The syserr function is called only if an error occurs.

| | | |
|------------------|--|----------------|
| Called By: | _pend_on_frame_interrupt cig_config exchange_enet_data exchange_enet_data_sim lt_state m1_gun_overlay m2_gun_overlay mpvideo_response msg_cig_ctl msg_laser_request_range msg_pass_on msg_subsys_mode msg_viewport_update process_a_msg simulation | |
| Routines Called: | none | |
| Parameters: | INT_2 INT_2 | error state |
| Returns: | none | |

2.13.44 staticveh_remove.c

The staticveh_remove function deletes a static vehicle from the simulation environment. This function is called (once per backend) whenever the Simulation Host sends a MSG_STATICVEH_REM message.

The function call is staticveh_remove(msgp, pdbase, vme_offset, backend), where:

msgp is a pointer to the MSG_STATICVEH_REM message
pdbase is a pointer to the primary database control block
vme_offset is the VME address offset to active area memory
backend is the backend id

staticveh_remove does the following:

- Uses FIND_LM to determine the load module that contains the vehicle, based on its coordinates.
- Determines which list to remove the model from (pre-process, post-process, or standard process).
- If the backend is 0, calls sim_bal_static_rem to notify Ballistics to remove the vehicle from its tables.

- Deletes the vehicle from the applicable table, and decrements all associated counters.
- Removes any special effects associated with the vehicle.

Called By: msg_staticveh_rem

Routines Called: **FIND_LM**
 panic
 sim_bal_static_rem

Parameters: MSG_STATICVEH_REM *msgp
 DB_INFO *pdbase
 INT_4 vme_offset
 INT_4 backend

Returns: none

2.13.45 staticveh_state.c

The `staticveh_state` function adds a static vehicle to the simulation environment. This function is called (once per backend) whenever the Simulation Host sends a `MSG_STATICVEH_STATE` message.

The function call is `staticveh_state(msgp, pdbase, vme_offset, backend)`, where:

msgp is a pointer to the `MSG_STATICVEH_STATE` message
pdbase is a pointer to the primary database control block
vme_offset is the VME address offset to active area memory
backend is the backend id

`staticveh_state` does the following:

- Determines whether the vehicle is a tank; sets the `veh_is_tank` flag appropriately.
- Adds the vehicle to the appropriate table (tank or model).
- Increments the applicable model counter.
- Saves the model's matrix and center.
- Uses `FIND_LM` to determine the load module that contains the vehicle, based on its coordinates.
- Adds the vehicle to the appropriate load module table.
- Adds the vehicle to the appropriate model list (pre-process, post-process, or standard process).
- If the backend is 0, calls `sim_bal_static_add` to notify Ballistics to add the vehicle to its tables.

The function returns 0 if successful. It returns `E_LIMIT` if there is no room for the new tank or model.

Called By: msg_staticveh_state

| | | |
|------------------|--|--|
| Routines Called: | FIND_LM sim_bal_static_add | |
| Parameters: | MSG_STATICVEH_STATE DB_INFO INT_4 INT_4 | *msgp *pdbname vme_offset backend |
| Returns: | 0 E_LIMIT | |

2.13.46 sys_control.c

The functions in the `sys_control.c` CSU interface with the EVC (Ethernet VME Controller) board. The purpose of this board is to allow frame interrupts onto the VME bus.

These functions are:

- `sys_control_init`
- `sys_frame_rate`
- `set_leds`
- `sys_slave_sync`
- `sys_master_sync`
- `get_dtp_bank`
- `read_evc_control`
- `write_evc_control`
- `write_evc_frame`

The typedef for the EVC structure is also defined in this CSU. The EVC structure contains the following:

- Interrupt control register (`icr`).
- Interrupt vector (`ivr`).
- LED display value.
- System control register. This is a control word that describes the EVC mode, CIG mode (master or slave), the current EVC bank (the double buffer in use by the hardware this frame), and the frame rate.
- `Single_shot` system frame register, used for <<TBD>>.

2.13.46.1 sys_control_init

The `sys_control_init` function initializes frame interrupts. This function is called when the system is initialized. It is also called through Gossip if the user selects the `i` ("initialize EVC") option from the GT Hardware menu, reached through the Gossip System menu.

The function call is `sys_control_init(prate, ptime)`, where:

prate is a pointer to the CIG's frame rate; this can be entered by the user on the command line at startup; if no speed is specified, the initialize function sets a default value

ptime is a pointer to the frame time; this is calculated by `sys_frame_rate`

`sys_control_init` does the following:

- Sets `use_evc` to FALSE.
- Calls `sysrup_off` to disable system interrupts.
- Calls `bus_error` to look for the EVC board; if found, sets `use_evc` to TRUE.
- Sets the EVC's interrupt vector.
- Initializes the EVC's control register to normal mode.
- Calls `sys_master_sync` to set the EVC to operate as the master frame interrupt.
- Calls `sys_frame_rate` to set the EVC's frame rate.
- Sets the EVC's interrupt control register.

The function exits with a 1 if it cannot find the EVC board.

| | | |
|------------------|--|--|
| Called By: | <code>gos_system</code> <code>initialize</code> | |
| Routines Called: | <code>bus_error</code> <code>exit</code> <code>printf</code> <code>sys_frame_rate</code> <code>sys_master_sync</code> <code>sysrup_off</code> | |
| Parameters: | <code>INT_4</code> <code>INT_4</code> | <code>*prate</code> <code>*ptime</code> |
| Returns: | <code>none</code> | |

2.13.46.2 `sys_frame_rate`

The `sys_frame_rate` function sets the desired frame rate (10, 15, 30, or 60 Hz) in the EVC's system control register. The frame rate set is based on the speed entered by the operator on the command line (using the "s" argument) at startup. If no speed was specified, the default selected by the initialize function is used.

The function call is `sys_frame_rate(prate, ptime)`, where:

prate is a pointer to the frame rate

ptime is a pointer to the frame time; this is calculated by `sys_frame_rate`

If an invalid frame rate is specified in the call, `sys_frame_rate` assigns a default of 30. `sys_frame_rate` also calculates the frame time based on the frame rate.

| | | |
|------------------|------------------|------------------|
| Called By: | sys_control_init | |
| Routines Called: | printf | |
| Parameters: | INT_4 INT_4 | *prate *ptime |
| Returns: | none | |

2.13.46.3 set_leds

The `set_leds` function displays a value on the EVC's LED display. This function is called at the end of every frame during a simulation. It is also invoked through Gossip if the user selects the 1 ("write into leds") option from the GT Hardware menu, reached through the Gossip System menu.

The function call is `set_leds(value)`, where *value* is the value to be displayed on the LED.

The EVC LED display can show any of the following values:

- Model count.
- Frame count.
- Local terrain frame count.
- Overload indicator (appears only if a system overload is detected)

The `display_lights[]` array in global memory contains flags that enable/disable each of these counters to appear on the LED. The array is checked at the end of each frame to see which counts are to be passed to `set_leds` to display. The flags in `display_lights[]` can be changed using the 1 ("set display lights flags") option on the Gossip System menu.

| | | |
|------------------|-------------------------------|-------|
| Called By: | _display_lights gos_system | |
| Routines Called: | none | |
| Parameters: | INT_4 | value |
| Returns: | none | |

2.13.46.4 sys_slave_sync

The `sys_slave_sync` function synchronizes the CIG's frame interval with an external master CIG. This function is called at startup if the local CIG is operating in a slave mode. Slave mode is specified by entering the "S" argument on the startup command line.

The function call is `sys_slave_sync()`.

Called By: initialize

Routines Called: none

Parameters: none

Returns: none

2.13.46.5 `sys_master_sync`

The `sys_master_sync` function sets the local EVC to operate as the master frame interrupt. This function is called at startup if the CIG is operating in master mode (the default).

The function call is `sys_master_sync()`.

Called By: initialize
sys_control_init

Routines Called: none

Parameters: none

Returns: none

2.13.46.6 `get_dtp_bank`

The `get_dtp_bank` function returns the number of the double buffer currently being used by the Data Traversal Processor (DTP). The real-time software then sets the current simulation buffer to the opposite buffer. (The real-time software and the DTP alternate double buffers each frame. This provides the most recent data to the hardware while the software updates the other buffer.) This function is called at the beginning of a new simulation, and at the end of every frame during a simulation.

The function call is `get_dtp_bank()`.

The function obtains the bank number from the EVC's system control register. It returns EOF if the `use_evc` flag is false, indicating that the EVC board has not been initialized.

Called By: _reset_model_pointers
init_simulation

Routines Called: printf

Parameters: none

Returns: EOF
 pevc->control_r & EVC_BANK

2.13.46.7 read_evc_control

The `read_evc_control` function returns the contents of the EVC's system control register (`pevc->control_r`). This function is called through Gossip if the user selects the `d` ("display EVC register") option from the GT Hardware menu, reached through the Gossip System menu.

The function call is `read_evc_control()`.

The function returns the data in the control register as *value*. The *value* is set to EOF if the `use_evc` flag is false, indicating that the EVC board is not initialized.

Called By: gos_system

Routines Called: printf

Parameters: none

Returns: value

2.13.46.8 write_evc_control

The `write_evc_control` function writes a specified value to the EVC's system control register (`pevc->control_w`). This function is called through Gossip if the user selects the `c` ("write into EVC frame rate control word") option from the GT Hardware menu, reached through the Gossip System menu.

The function call is `write_evc_control(value)`, where *value* is the value to be written.

Called By: gos_system

Routines Called: printf

Parameters: INT_4 value

Returns: none

2.13.46.9 write_evc_frame

The `write_evc_frame` function writes a specified value to the EVC's system frame register (`pevc->single_shot`). This function is called through Gossip if the user selects the r ("write into EVC single shot word") from the GT Hardware menu, reached through the Gossip System menu.

The function call is `write_evc_frame(value)`, where *value* is the value to be written.

Called By: `gos_system`

Routines Called: `printf`

Parameters: `INT_4` value

Returns: none

2.13.47 upstart.c

The `upstart.c` CSU contains the driver for the real-time software. The functions in this CSU are:

- `upstart`
- `upstart_cleanup`

2.13.47.1 upstart

The `upstart` function is the driver for the real-time applications software. It establishes communication with the Simulation Host, reads a message, then calls the appropriate function based on the system state requested in the message.

The function call is `upstart()`. `upstart` does the following:

- Calls `start_watch` to start the system timer.
- Initializes the `local_terrain_wanted` variable to TRUE.
- Calls `poll_shutdown` to see if a system shutdown has been requested.
- Processes each message received from the Simulation Host:
 - Increments the packet buffer size; checks for packet buffer overflows.
 - Calls `cigsimio_msg_in` to write the message to a buffer (if message recording or debug display is enabled).
 - Processes the message according to its type (see table below).

The following table summarizes the processing performed by upstart in response to each valid message type it receives from the Simulation Host. The first column lists the messages in alphabetical order. The second column briefly describes the purpose of the message (in italics), then lists the major steps upstart performs to process the message.

| Message from SIM Host | Processing by upstart |
|--|--|
| MSG_AMMO_DEFINE | <i>Defines ammunition maps.</i> Loads the specified ammo_map tables into memory. |
| MSG_CIG_CTL C_DB_SETUP C_FILE_XFER C_MCC_SETUP C_NULL C_STOP C_TEST_MODE | <i>Causes a transition to another performance state.</i> Calls db_mcc_setup with state set to C_DB_SETUP. Calls file_control with state set to C_FILE_XFER. Calls db_mcc_setup with state set to C_MCC_SETUP. No action. No action. Calls hw_test with state set to C_TEST_MODE. |
| MSG_DR11_PKT_SIZE | <i>Specifies exchange packet parameters.</i> Outputs data from message to stdout; sets CIG and SIM exchange packet sizes; validates local terrain chunk size and message interval, and sets if valid; sets CIG hardware type. |
| MSG_END | <i>Signals end of packet buffer.</i> Calls cigsimio_msg_out to write outgoing message packet to buffer if recording is enabled; calls start_watch; calls appropriate exchange_data routine (through *exchange_data) to exchange packets. |
| MSG_PPM_DISPLAY_MODE | <i>Changes PPM display modes.</i> Calls msg_ppm_display_mode. |
| MSG_PPM_DISPLAY_OFFSET | <i>Changes PPM display offsets.</i> Calls msg_ppm_display_offset. |
| MSG_PPM_PIXEL_LOCATION | <i>Sets a new PPM pixel location.</i> Calls msg_ppm_pixel_location. |
| MSG_PPM_PIXEL_STATE | <i>Turns PPM pixel processing on or off.</i> Calls msg_ppm_pixel_state. |

Called By: none (task created and started at initialization time)

Routines Called:

- *exchange_data
- cigsimio_msg_in
- cigsimio_msg_out
- db_mcc_setup
- file_control
- GLOB
- hw_test
- msg_ppm_display_mode
- msg_ppm_display_offset
- msg_ppm_pixel_location
- msg_ppm_pixel_state
- poll_shutdown
- printf

start_watch
SYSERR

Parameters: none

Returns: none

2.13.47.2 upstart_cleanup

The `upstart_cleanup` function deallocates the resources owned by the `upstart` task. This function is called when a system shutdown is requested by the Gossip user. The function is called via the `*task_cleanup` function pointer, which points to the cleanup routine's name in the task table.

The function call is `upstart_cleanup()`.

The function returns 1 if successful, or 0 if an error occurred.

Note: This function is not yet implemented. At the current time, it simply returns a 1 if called.

Called By: poll_shutdown (through *task_cleanup)

Routines Called: none

Parameters: none

Returns: 0
1

2.14 Serial Device Input/Output (/cig/libsrc/libσιο)

The Serial Device Input/Output CSC lets the Simulation Host write to a serial I/O device during a simulation. Messages are used to open, write to, and close the device. This feature can be used to record simulation-related data to a serial printer, or to drive a serial device that performs sort of processing during the simulation.

A maximum of four serial devices can be open during one simulation. For each device, the Simulation Host specifies the following:

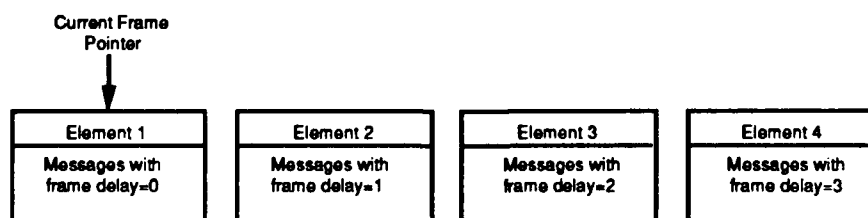
- The device name. This is used to establish an output channel to the device.
- A unique identifier (0-3).
- The maximum number of frames to delay before actually sending data to the device. This delay allows synchronization of data written to the device with outputs from other parts of the system.
- The maximum number of characters to be written to the device during any given frame.

Each write message specifies the following:

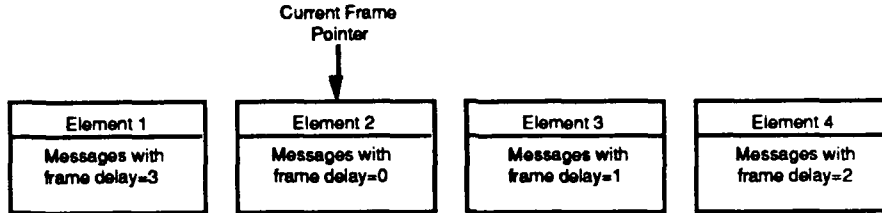
- The data to be sent.
- The identifier of the device to which the data is to be written.
- The number of frames to delay before writing the data. This delay must be less than or equal to the maximum delay specified for the device.

All data to be written to a device is buffered in a local queue until the specified frame delay expires. The queue is implemented as an array, with the array size set equal to the maximum frame delay plus 1. Each element in a device's array contains the data to be written to that device during a particular frame.

For example, a device with a maximum frame delay of 3 has an output queue array containing four elements. When the Simulation Host sends a write message, a Serial Device I/O function determines (based on the message's frame delay) which element the data is to be stored in. If it reaches the end of the array, it wraps back around to the first element.



At the end of each frame, a tick function accesses the current frame's element in each device's array, and writes all of the stored data to that device. The data in the element may come from multiple write messages. The tick function then moves the current frame pointer to the next element, for use during the next frame.



As shown in Figure 2-18, the Serial Device Input/Output CSC consists of only one CSU, `sio.c`. This CSU is described in this section.

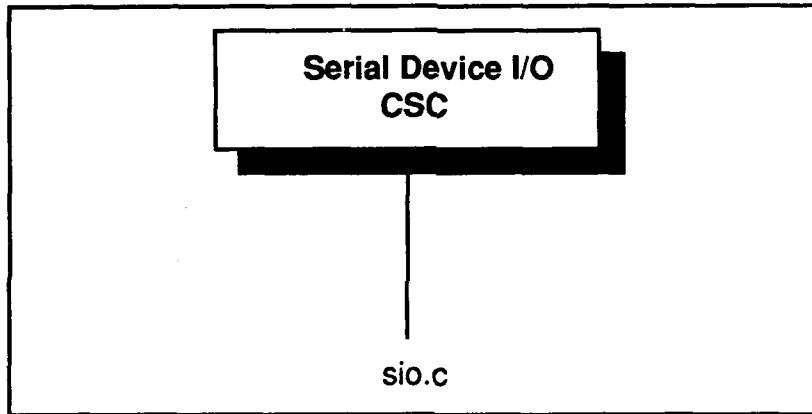


Figure 2-18. Serial Device Input/Output CSU

2.14.1 `sio.c`

The functions in the `sio.c` CSU handle all communication with the serial devices. These functions are:

- `sio_init`
- `sio_write`
- `sio_close`
- `sio_tick`

2.14.1.1 `sio_init`

The `sio_init` function opens a channel to a serial device. This function is called when the Simulation Host sends a `MSG_SIO_INIT` message during the "prepare for simulation" state. The message specifies the device name, an identifier to associate with the device, the maximum frame delay, and the maximum number of characters to be written during any one frame.

The function call is `sio_init(msgp)`, where `msgp` is a pointer to the `MSG_SIO_INIT` message.

`sio_init` does the following:

- Verifies that the identifier is valid.
- Makes sure the specified identifier is not already in use by another open device.
- Opens the device in write-only mode.
- Allocates memory for an output queue for the device; the number of array elements is set equal to one more than the maximum frame delay specified in the message.
- Allocates memory for each queue element (one per frame); the size of each element is set equal to the maximum number of characters per frame specified in the message.

The function returns 0 if successful. If an error occurs, the function returns `err` set to one of the following values:

| | |
|------------------|---------------------------------------|
| 14 (E_SIODEVID) | Invalid identifier. |
| 15 (E_SIOIDUSED) | Identifier already assigned. |
| 17 (E_SIOOPEN) | Error opening device. |
| 18 (E_SIOMEM) | Insufficient memory for output queue. |

Called By: `db_mcc_setup`

Routines Called: `calloc`
`free`
`ifx_open`
`malloc`

Parameters: `MSG_SIO_INIT` `*msgp`

Returns: `0`
`err`

2.14.1.2 `sio_write`

The `sio_write` function places the data sent by the Simulation Host for a serial device into the appropriate frame element of the device's output queue. This function is called when the Simulation Host sends a `MSG_SIO_WRITE` message. The message specifies the data, the data length in bytes, and the frame delay.

Data from multiple write messages to the same device to be output during the same frame is concatenated together.

The function call is `sio_write(msgp)`, where `msgp` is a pointer to the `MSG_SIO_WRITE` message.

`sio_write` does the following:

- Makes sure the specified identifier is valid.
- Makes sure the specified identifier is in use by an open device.
- Makes sure the specified frame delay does not exceed the device's maximum frame delay.
- Makes sure there is room in the specified frame element for the additional data (i.e., that the maximum length per frame specified by the Simulation Host will not be exceeded).
- Copies the data to the appropriate frame element in the device's output queue. If the message's frame delay is 1, for example, the data is written to the next element after the current one. When the end of the array is reached, `sio_write` wraps back around to the beginning.
- Increments the character count for the selected queue element by the size of the new data.

The function returns 0 if successful. If an error occurs, the function returns *err* set to one of the following values:

| | |
|---------------------|---|
| 14 (E_SIODEVID) | Invalid identifier. |
| 16 (E_SIOIDNOTUSED) | No currently open device has this identifier. |
| 20 (E_SIOOVFLO) | Output queue overflow. |
| 21 (E_SIOFRAME) | Invalid frame delay. |

Called By: `process_a_msg`

Routines Called: `bcopy`

Parameters: `MSG_SIO_WRITE` `*msgp`

Returns: 0
 `err`

2.14.1.3 `sio_close`

The `sio_close` function closes a channel to a specified serial device, and frees the memory allocated to its output queue. This function is called if the Simulation Host sends a `MSG_SIO_CLOSE` message, which is valid only during the "prepare for simulation" state.

The function call is `sio_close(msgp)`, where `msgp` is a pointer to the `MSG_SIO_CLOSE` message.

The function does the following:

- Makes sure the identifier is valid.
- Makes sure the device is currently open (i.e., that the identifier is flagged in-use).
- Frees the memory allocated to the device's output queue.
- Closes the channel to the device.
- Marks the identifier as not in-use.

The function returns 0 if successful. If an error occurs, the function returns *err* set to one of the following values:

| | |
|---------------------|---|
| 14 (E_SIODEVID) | Invalid identifier. |
| 16 (E_SIOIDNOTUSED) | No currently open device has this identifier. |
| 22 (E_SIOCLOSE) | Error closing device. |

Called By: db_mcc_setup

Routines Called: free
ifx_close

Parameters: MSG_SIO_CLOSE *msgp

Returns: 0
err

2.14.1.4 sio_tick

The `sio_tick` function writes the queued data to each open device. This function is called at the end of every frame while the CIG is in the simulation state. All data queued for a given device that has reached its specified frame delay is written to the device. Note that this data may be from multiple messages.

The function call is `sio_tick()`. For each identifier that is flagged as in-use, `sio_tick` does the following:

- Determines whether the current frame element in the device's queue contains data to write.
- Writes all data in the current frame element to the device.
- Resets the character count in the current frame element to 0.
- Increments the queue index (the pointer to the current queue element in the array) for use the next frame.

The function returns 0 if successful. If a write error occurs, the function returns *err* set to 19 (E_SIOWRITE).

Called By: msg_end

Routines Called: ifx_write

Parameters: none

Returns: 0
err

2.15 Token Processing (/cig/libsrc/libtoken)

The Token Processing CSC functions are used to parse and process the data in the subsystem configuration (subsys.cfg) file. This file, which is read at initialization time, identifies the data files to be used for the simulation exercise.

The default subsystem configuration file is subsys.cfg. The Simulation Host can load a different configuration file by sending a MSG_FILE_DESCR message with *db_req* set to DB_SUBSYS_0 or DB_SUBSYS_1. (The 0 or 1 identifies the backend.) Similarly, the Simulation Host can load an individual database file by sending a MSG_FILE_DESCR message with *db_req* set to the appropriate file type.

Each subsystem (backend) has its own set of database files. An array indexed by subsystem id is maintained for each file name. Separate functions are provided to set or return each file name.

The files identified in subsys.cfg, and the MSG_FILE_DESCR messages that can be used to specify them, are the following:

| File Name Array | File Contents | MSG_FILE_DESCR db_req setting |
|---------------------|---------------------------------|------------------------------------|
| database_name[] | Terrain database | DB_SETUP_0 DB_SETUP_1 |
| ded_name[] | Dynamic Elements Database (DED) | DB_DED_SETUP_0 DB_DED_SETUP_1 |
| final_lut_name[] | Final (2-D) lookup table | DB_FINAL_LUT_0 DB_FINAL_LUT_1 |
| 3d_lut_name[] | 3-D lookup table | DB_3D_LUT_0 DB_3D_LUT_1 |
| data_2d_name[] | 2-D overlay configuration data | DB_2D_DATA_0 DB_2D_DATA_1 |
| esifa_name[] | ESIFA textures | DB_ESIFA_LOAD_0 DB_ESIFA_LOAD_1 |
| color_config_name[] | Color configuration data | DB_COLOR_CFG_0 DB_COLOR_CFG_1 |

Figure 2-19 identifies the CSUs in the Token Processing CSC.

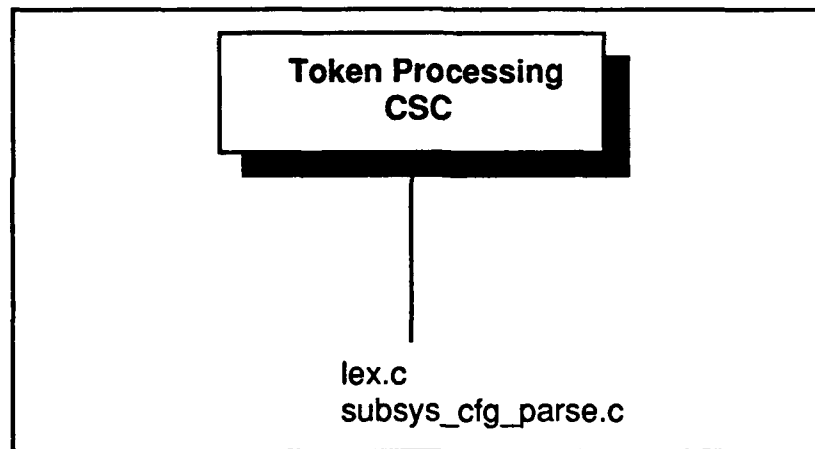


Figure 2-19. Token Processing CSUs

2.15.1 lex.c

The functions in the lex.c CSU are lexical utilities used to parse the subsystem configuration file. These functions are:

- set_token_file
- next_char
- scan_number
- next_token
- next_line
- swallow_token
- get_next_token
- get_current_token
- get_number_value
- get_string_value

The subsystem configuration file is composed of tokens followed by numeric or string values. All recognized tokens are defined in the lex.h and keywords.h include files.

2.15.1.1 set_token_file

The set_token_file function gets the name of the subsystem configuration file and sets it for the other Token Processing functions to use. It also initializes the work buffer and sets the buffer size. This function is called at start-up if a subsys.cfg file is found. It is also called if the Simulation Host sends a MSG_FILE_DESCR message with db_req set to DB_SUBSYS_0 or DB_SUBSYS_1.

The function call is set_token_file(file_ptr), where file_ptr is a pointer to the subsystem configuration file.

Called By: db_mcc_setup
initialize

Routines Called: none

Parameters: FILE *file_ptr

Returns: none

2.15.1.2 next_char

The `next_char` function fetches the next character from the file and sets a pointer (`input_char`) to it. If the buffer is empty, `next_char` reads in a new buffer of data.

The function call is `next_char()`.

If `next_char` finds the end of the file, it sets the input character to -1 and sets the end-of-file flag (`at_eof`) to TRUE.

Called By: next_token
scan_number

Routines Called: fread

Parameters: none

Returns: none

2.15.1.3 scan_number

The `scan_number` function scans over a number and converts it to binary. This function is called whenever the input character is a digit from 0 through 9.

The function call is `scan_number()`. The function converts the digit, then calls `next_char` to get the next digit. It continues to convert each digit until it receives a character outside the range 0 through 9.

Called By: next_token

Routines Called: next_char

Parameters: none

Returns: none

2.15.1.4 next_token

The `next_token` function examines the current input character (or a string of consecutive characters) and sets the variable `token` accordingly.

The function call is `next_token()`. The function does the following:

- Checks to see if the input character is a space; calls `next_char` to get another character if it is.
- Examines the input character.
- If the input character is not a letter, sets `token` to the appropriate recognized token.
 - In some cases, calls `next_char` to determine to correct token (e.g., checks for "=" after ">", and checks for a number after a minus sign).
 - If the character is between 0 and 9, calls `scan_number` to convert it to binary.
 - If the character is -1 (`next_char`'s signal for end-of-file), sets `token` to `tokenEOF`.
- If the input character is a letter:
 - Puts the letter into an array.
 - Calls `next_char` to get the next character and adds it to the array.
 - Compares the array with the list of valid words.
 - Keeps adding letters up to the maximum length allowed, looking for a match.
 - If a match is found, sets `token` to the matching word.
 - If no match is found, sets `token` to `tokenString`.

Called By: `get_next_token`
 `next_line`
 `parse_subsys_file`
 `swallow_token`

Routines Called: `next_char`
 `scan_number`
 `strcmp`

Parameters: `none`

Returns: `none`

2.15.1.5 next_line

The `next_line` function skips to the first token on the next line of the file. It calls `next_token` until it finds a `tokenEOL` token, then calls `next_token` once more so `token` is set to the first token on the following line.

The function call is `next_line()`.

Called By: none

Routines Called: next_token

Parameters: none

Returns: none

2.15.1.6 swallow_token

The `swallow_token` function checks that a particular token is present, then skips it by calling `next_token`. This function is used to verify that the correct starting and ending tokens are present in the file.

The function call is `swallow_token(tok)`, where *tok* is the token expected next in the file.

`swallow_token` returns 0 if the specified token was found. If a different token was found, the function outputs an error and returns 1.

Called By: parse_subsys_file

Routines Called: get_string_value
next_token
printf

Parameters: int tok

Returns: 0
1

2.15.1.7 get_next_token

The `get_next_token` function calls `next_token` to read the next token from the file. It then returns the new value of *token*.

The function call is `get_next_token()`.

Called By: parse_subsys_file

Routines Called: next_token

Parameters: none

Returns: token

2.15.1.8 get_current_token

The `get_current_token` function returns the current value of *token*.

The function call is `get_current_token()`.

Called By: parse_subsys_file

Routines Called: none

Parameters: none

Returns: token

2.15.1.9 get_number_value

The `get_number_value` function returns the current value of *token_num_value*. This value is set by `scan_number` and `next_token`. This function is used to get the subsystem (backend) id specified in the configuration file.

The function call is `get_number_value()`.

Called By: parse_subsys_file

Routines Called: none

Parameters: none

Returns: token_num_value

2.15.1.10 get_string_value

The `get_string_value` function returns the current value of *token_string_value*. This value is set by `next_token` when parsing the command lines in the subsystem configuration file. This function is used to determine which file name is being set, as well as to get the file name.

The function call is `get_string_value()`.

| | |
|------------------|--|
| Called By: | <code>parse_subsys_file</code> <code>swallow_token</code> |
| Routines Called: | <code>none</code> |
| Parameters: | <code>none</code> |
| Returns: | <code>token_string_value</code> |

2.15.2 `subsys_cfg_parse.c`

The functions in the `subsys_cfg_parse.c` CSU are used to read the information in the `subsys.cfg` configuration file. Routines are provided to get and set each file name.

The functions in this CSU are:

- `init_subsys_parser`
- `parse_subsys_file`
- `get_database_name`
- `get_ded_name`
- `get_final_lut_name`
- `get_3d_lut_name`
- `get_data_2d_name`
- `get_esifa_name`
- `get_color_config_name`
- `set_database_name`
- `set_ded_name`
- `set_final_lut_name`
- `set_3d_lut_name`
- `set_data_2d_name`
- `set_esifa_name`
- `set_color_config_name`

2.15.2.1 `init_subsys_parser`

The `init_subsys_parser` function initializes the names of all database configuration files for all backends to blanks. This function is called at startup, before the `subsys.cfg` file is opened and processed. It is also called if the Simulation Host sends a `MSG_FILE_DESCR` message with `db_req` set to `DB_SUBSYS_0` or `DB_SUBSYS_1` (before opening and processing the file specified in the message).

The function call is `init_subsys_parser()`.

| | |
|------------|--|
| Called By: | <code>db_mcc_setup</code> <code>initialize</code> |
|------------|--|

Routines Called: strcpy

Parameters: none

Returns: none

2.15.2.2 **parse_subsys_file**

The `parse_subsys_file` function reads the subsystem configuration file and sets the database file name variables with the file names specified in the file. This function is called at system initialization time to read and process the `subsys.cfg` file. It is also called if the Simulation Host sends a `MSG_FILE_DESCR` message with `db_req` set to `DB_SUBSYS_0` or `DB_SUBSYS_1`.

The function call is `parse_subsys_file()`. The function does the following:

- Verifies that the file begins with the `token_start` and `token_subsystem` tokens.
- Calls `get_number_value` to determine the subsystem (backend) id.
- Validates the subsystem id.
- Calls `next_token` to read each token in the file.
 - Makes sure the token is followed by a file name.
 - Copies the file name to the subsystem's element in the appropriate file name array.
- Stops processing when the `token_end` token is found.

The function returns `ERROR` if the file format is invalid, an unknown token is found, a token is not followed by a file name, or the subsystem id is invalid.

Called By: db_mcc_setup
 initialize

Routines Called: get_current_token
 get_next_token
 get_number_value
 get_string_value
 next_token
 printf
 strcpy
 swallow_token

Parameters: none

Returns: 1 (ERROR)

2.15.2.3 `get_database_name`

The `get_database_name` function returns the name of the terrain database file for a specified subsystem. Terrain database file names are stored in the `database_name[]` array, indexed by subsystem id.

The function call is `get_database_name(subsys)`, where *subsys* is the backend id.

| | |
|------------------|--|
| Called By: | <code>config_database</code> <code>db_mcc_setup</code> <code>initialize</code> |
| Routines Called: | <code>none</code> |
| Parameters: | <code>int</code> <code>subsys</code> |
| Returns: | <code>database_name[subsys]</code> |

2.15.2.4 `get_ded_name`

The `get_ded_name` function returns the name of the Dynamic Elements Database file for a specified subsystem. DED file names are stored in the `ded_name[]` array, indexed by subsystem id.

The function call is `get_ded_name(subsys)`, where *subsys* is the backend id.

| | |
|------------------|--|
| Called By: | <code>config_database</code> <code>db_mcc_setup</code> <code>initialize</code> |
| Routines Called: | <code>none</code> |
| Parameters: | <code>int</code> <code>subsys</code> |
| Returns: | <code>ded_name[subsys]</code> |

2.15.2.5 `get_final_lut_name`

The `get_final_lut_name` function returns the name of the final (2-D) lookup table file for a specified subsystem. Final lookup table names are stored in the `final_lut_name[]` array, indexed by subsystem id.

The function call is `get_final_lut_name(subsys)`, where *subsys* is the backend id.

Called By: db_mcc_setup
 initialize

Routines Called: none

Parameters: int subsys

Returns: final_lut_name[subsys]

2.15.2.6 **get_3d_lut_name**

The `get_3d_lut_name` function returns the name of the 3-D color lookup table file for a specified subsystem. 3-D lookup table file names are stored in the `lut_3d_name[]` array, indexed by subsystem id.

The function call is `get_3d_lut_name(subsys)`, where *subsys* is the backend id.

Called By: db_mcc_setup
 initialize

Routines Called: none

Parameters: int subsys

Returns: lut_3d_name[subsys]

2.15.2.7 **get_data_2d_name**

The `get_data_2d_name` function returns the name of the 2-D overlay data file for a specified subsystem. 2-D overlay database file names are stored in the `data_2d_name[]` array, indexed by subsystem id.

The function call is `get_data_2d_name(subsys)`, where *subsys* is the backend id.

Called By: db_mcc_setup
 initialize

Routines Called: none

Parameters: int subsys

Returns: data_2d_name[subsys]

2.15.2.8 **get_esifa_name**

The `get_esifa_name` function returns the name of the ESIFA textures file for a specified subsystem. Textures file names are stored in the `esifa_name[]` array, indexed by subsystem id.

The function call is `get_esifa_name(subsys)`, where *subsys* is the backend id.

Called By: db_mcc_setup
 initialize

Routines Called: none

Parameters: int subsys

Returns: esifa_name[subsys]

2.15.2.9 **get_color_config_name**

The `get_color_config_name` function returns the name of the color configuration file for a specified subsystem. Color configuration file names are stored in the `color_config_name[]` array, indexed by subsystem id.

The function call is `get_color_config_name(subsys)`, where *subsys* is the backend id.

Called By: db_mcc_setup
 initialize

Routines Called: none

Parameters: int subsys

Returns: color_config_name[subsys]

2.15.2.10 **set_database_name**

The `set_database_name` function sets the name of the terrain database file for a specified subsystem in the `database_name[]` array. This function is called when the Simulation Host

sends a MSG_FILE_DESCR message with *db_req* set to DB_SETUP_0 or DB_SETUP_1.

The function call is **set_database_name(subsys, name)**, where:

subsys is the backend id
name is the name of the file to be used

| | | |
|------------------|--------------|-----------------|
| Called By: | db_mcc_setup | |
| Routines Called: | strcpy | |
| Parameters: | int char | subsys *name |
| Returns: | none | |

2.15.2.11 set_ded_name

The **set_ded_name** function sets the name of the Dynamic Elements Database file for a specified subsystem in the `ded_name[]` array. This function is called when the Simulation Host sends a MSG_FILE_DESCR message with *db_req* set to DB_DED_SETUP_0 or DB_DED_SETUP_1.

The function call is **set_ded_name(subsys, name)**, where:

subsys is the backend id
name is the name of the file to be used

| | | |
|------------------|--------------|-----------------|
| Called By: | db_mcc_setup | |
| Routines Called: | strcpy | |
| Parameters: | int char | subsys *name |
| Returns: | none | |

2.15.2.12 set_final_lut_name

The **set_final_lut_name** function sets the name of the final (2-D) lookup table file for a specified subsystem in the `final_lut_name[]` array. This function is called when the Simulation Host sends a MSG_FILE_DESCR message with *db_req* set to DB_FINAL_LUT_0 or DB_FINAL_LUT_1.

The function call is `set_final_lut_name(subsys, name)`, where:

subsys is the backend id
name is the name of the file to be used

| | | |
|------------------|--------------|-----------------|
| Called By: | db_mcc_setup | |
| Routines Called: | strcpy | |
| Parameters: | int char | subsys *name |
| Returns: | none | |

2.15.2.13 set_3d_lut_name

The `set_3d_lut_name` function sets the name of the 3-D lookup table file for a specified subsystem in the `lut_3d_name[]` array. This function is called when the Simulation Host sends a `MSG_FILE_DESCR` message with *db_req* set to `DB_3D_LUT_0` or `DB_3D_LUT_1`.

The function call is `set_3d_lut_name(subsys, name)`, where:

subsys is the backend id
name is the name of the file to be used

| | | |
|------------------|--------------|-----------------|
| Called By: | db_mcc_setup | |
| Routines Called: | strcpy | |
| Parameters: | int char | subsys *name |
| Returns: | none | |

2.15.2.14 set_data_2d_name

The `set_data_2d_name` function sets the name of the 2-D overlay data file for a specified subsystem in the `data_2d_name[]` array. This function is called when the Simulation Host sends a `MSG_FILE_DESCR` message with *db_req* set to `DB_2D_DATA_0` or `DB_2D_DATA_1`.

The function call is `set_data_2d_name(subsys, name)`, where:

subsys is the backend id
name is the name of the file to be used

Called By: db_mcc_setup

Routines Called: strcpy

Parameters: int subsys
char *name

Returns: none

2.15.2.15 set_esifa_name

The `set_esifa_name` function sets the name of the ESIFA textures file for a specified subsystem in the `esifa_name[]` array. This function is called when the Simulation Host sends a `MSG_FILE_DESCR` message with *db_req* set to `DB_ESIFA_LOAD_0` or `DB_ESIFA_LOAD_1`.

The function call is `set_esifa_name(subsys, name)`, where:

subsys is the backend id
name is the name of the file to be used

Called By: db_mcc_setup

Routines Called: strcpy

Parameters: int subsys
char *name

Returns: none

2.15.2.16 set_color_config_name

The `set_color_config_name` function sets the name of the color configuration file for a specified subsystem in the `color_config_name[]` array. This function is called when the Simulation Host sends a `MSG_FILE_DESCR` message with *db_req* set to `DB_COLOR_CFG_0` or `DB_COLOR_CFG_1`.

The function call is `set_color_config_name(subsys, name)`, where:

subsys is the backend id

name is the name of the file to be used

Called By: db_mcc_setup

Routines Called: strcpy

Parameters: int subsys
char *name

Returns: none

2.16 System Utilities (/cig/libsrc/libutil)

The System Utilities CSC contains a set of utility functions used throughout the real-time software. These utilities provide the ability to do the following:

- Block-copy data.
- Open, read, and close file directories.
- Find fields in a file header.
- Find the latest version of a file with a given name.
- Convert S-format files into executable code.
- Perform VT100 graphics control.

Figure 2-20 identifies the CSUs in the System Utilities CSC.

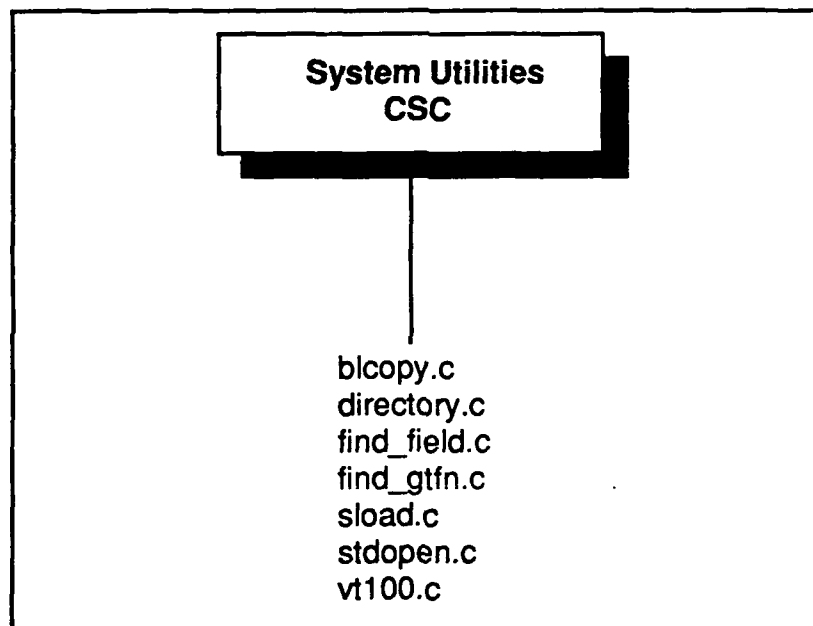


Figure 2-20. System Utilities CSUs

2.16.1 blcopy.c

The `blcopy` function block-copies a specified number of bytes from one memory location to another. For example, this function is used to copy data from AAM1 to AAM2.

The function call is `blcopy(from, to, count)`, where:

from is a pointer to the source location
to is a pointer to the destination location
count is the number of bytes to be copied

Called By: `_copy_reconfigurable_viewports_section`

```

_move_load_module_stp_to_quad_buffer
_update_second_active_area_memory
active_area_init
init_simulation

```

Routines Called: none

Parameters: int *from
 int *to
 int count

Returns: none

2.16.2 directory.c

The functions in the `directory.c` CSU are used to open, read, and close file directories. These functions are:

- `OpenDir`
- `ReadDir`
- `CloseDir`
- `GetFileName`

2.16.2.1 OpenDir

The `OpenDir` function opens a directory in read-only mode.

The function call is `OpenDir(dirname)`, where *dirname* is the name of the directory to be opened.

If successful, `OpenDir` returns the directory description as *desc*. If the directory could not be opened, `OpenDir` outputs an error and returns `ERROR`.

Called By: find_fn

Routines Called: ifx_open
 printf

Parameters: char *dirname

Returns: desc
 -1 (ERROR)

2.16.2.2 ReadDir

The ReadDir function reads a specified entry from a specified directory.

The function call is **ReadDir(desc, pde)**, where:

desc is the directory description returned from OpenDir
pde is a pointer to the entry to be read

The function returns RET_OK if successful. It outputs an error and returns a 1 if the specified entry could not be read or has never been used.

| | | |
|------------------|--------------------|--------------|
| Called By: | find_fn | |
| Routines Called: | ifx_read printf | |
| Parameters: | int IFXDIRENTRY | desc *pde |
| Returns: | 0 (RET_OK) 1 | |

2.16.2.3 CloseDir

The CloseDir function closes an open directory.

The function call is **CloseDir(desc)**, where *desc* is the description returned by OpenDir for the directory.

| | | |
|------------------|-----------|------|
| Called By: | find_fn | |
| Routines Called: | ifx_close | |
| Parameters: | int | desc |
| Returns: | none | |

2.16.2.4 GetFileName

The GetFileName function extracts a file name from a directory entry.

The function call is **GetFileName(pde, pfn)**, where:

pde is a pointer to the directory entry

pfn is a pointer to the file name

GetFileName puts the file name (including the extension, if any) in the location referenced by *pfn*.

Called By: find_fn

Routines Called: none

Parameters: IFXDIRENTY *pde
char *pfn

Returns: none

2.16.3 find_field.c (FindField)

The FindField function locates a specified header descriptor and returns its associated data field. This function is used by mpvideo_load to get information such as the file type and file length from the GSP header.

The function call is **FindField(ss, buf)**, where:

ss is the field name to be found

buf is the header descriptor to be searched

FindField uses search to find the specified field, then parses it to find the data. It returns the data as *ps*. *ps* is set to NULL if the field cannot be found.

Called By: mpvideo_load

Routines Called: search

Parameters: char *ss
char *buf

Returns: ps

2.16.4 find_gtfn.c (find_fn)

The `find_fn` function finds the file that has the highest extension and whose name matches a given character string. This ensures that the calling procedure loads the latest version of a file.

The function call is `find_fn(compare, size, exact, filename)`, where:

compare is the name to be matched

size is the number of characters in the compare string

exact specifies whether or not the file name must match the compare string exactly

filename is a pointer to the file name found by `find_fn`

`find_fn` does the following:

- If an exact match is specified:
 - Converts the compare string to uppercase.
 - Tries to open a file with that name.
 - If a match is found, puts the name in *filename*, outputs a message, and closes the file.
 - If no match is found, outputs a message and continues to search as if an exact match had not been specified.
- If an exact match is not specified, or an exact match cannot be found:
 - Converts the compare string to uppercase.
 - Finds the directory name in the compare string.
 - Calls `OpenDir` to open the directory.
 - Allocates memory for a directory entry block to work in.
 - Calls `ReadDir` to read each directory entry, looking for matching file names.
 - If a match is found, checks to see if the extension is greater than any previous match found.
 - If the extension is greater than any previous match, extracts the file name (by calling `GetFileName`) and saves it.
 - When all directory entries have been read, calls `CloseDir` to close the directory.
 - Frees the directory entry memory block.
 - If a match was found, puts the name in *filename* and outputs a message.

The function returns `TRUE` if a match is found, or `FALSE` if no match is found. It returns `ERROR` if the directory could not be opened or the working directory could not be allocated.

Called By: `flea_init_cig_sw`
 `gos_120tx`
 `initialize`
 `open_dbase`
 `open_ded`

Routines Called: `calloc`
 `close`
 `CloseDir`

free
 GetFileName
 open
 OpenDir
 printf
 ReadDir
 strcat
 strcmp
 strcpy
 strlen
 strncmp
 strncpy
 toupper

| | | |
|-------------|-------------------------------------|--|
| Parameters: | char int BOOLEAN char | *compare size exact *filename |
| Returns: | 1 (TRUE) 0 (FALSE) -1 (ERROR) | |

2.16.5 sload.c

The functions in the sload.c CSU are used to convert a Motorola S-format file into executable code. These functions are:

- sload
- get_record
- send_data
- check_sum
- get_binary_data
- get_char
- ctoi

2.16.5.1 sload

The sload function converts a Motorola S-format file into executable code. It reads data from the disk in sector-sized chunks, breaks the ASCII down into record-sized lines, then stores the binary data. This function is used to load the forcetask file.

The function call is **sload(filename, offset, wsize)**, where:

filename is the file to be converted
offset is the amount to add to the binary data address
wsize is the size of the destination granularity: c (character) or w (word)

sload does the following:

- Validates the value specified for *wsize*.
- Calls `open` to open the specified file.
- Calls `get_record` to get each record from the file.
- Call `check_sum` to perform a checksum on each record.
- If the record is S7, S8, or S9, closes the file and returns OK.
- If the record is S0 or S5, ignores it.
- If the record is S1, S2, or S3, calls `get_binary_address` and `send_data` to collect the addresses.

The function returns OK if successful. It returns ERROR if the write size is invalid, the file could not be opened, a record has a bad checksum, or an early end-of-file is detected.

Called By: bootforce

Routines Called: check_sum
 close
 get_binary_data
 get_char
 get_record
 open
 printf
 send_data

Parameters: char *filename
 INT_4 offset
 char wsize

Returns: 0 (OK)
 -1 (ERROR)

2.16.5.2 get_record

The `get_record` function fills a string buffer with exactly one Motorola S-format record.

The function call is `get_record(record)`, where *record* is the record to be read. `get_record` does the following:

- Calls `get_char` to get the first character from the record.
 - If the character is 'S' (the leading character), ignores it.
 - If the character is 'EOF' (end-of-file), returns a 0 and stops.
 - If the character is anything else, stores it.
- Calls `get_char` to read the next three characters (the record type and byte count).
- Calls `get_binary_data` to get the byte count.
- Calls `get_char` to read the remaining bytes (based on the byte count).

The function returns the S-format byte count if successful. It returns 0 if there are no records in the file.

Called By: sload

Routines Called: get_binary_data
 get_char
 printf

Parameters: BYTE record[]

Returns: 0
 byte_count

2.16.5.3 send_data

The `send_data` function writes ASCII record data to memory in ascending bytes from a given start address.

The function call is `send_data(address, cptr, count, wsize)`, where:

address is the initial load address (absolute S-format)
cptr is a pointer to the ASCII record characters
count is the number of characters to transmit
wsize is the size of the destination granularity: **c** (character) or **w** (word)

Called By: sload

Routines Called: get_binary_data

Parameters: WORD address
 char *cptr
 INT_4 count
 char wsize

Returns: none

2.16.5.4 check_sum

The `check_sum` function verifies the checksum byte of an S-format record.

The function call is `check_sum(pointer, count)`, where:

pointer points to the record to be checksummed
count is the byte count

The *answer* returned by the function is 0 if the checksum byte is correct. A non-zero value indicates a bad checksum.

Called By: sload

Routines Called: get_binary_data

Parameters: char *pointer
 INT_4 count

Returns: answer

2.16.5.5 get_binary_data

The `get_binary_data` function receives a pointer to a character string and returns the binary equivalent of the first specified number of characters.

The function call is `get_binary_data(cptr, count)`, where:

cptr is a pointer to the character string
count is the number of characters (starting from the beginning of the string) to be converted

The result is returned as *binary_data*.

Called By: check_sum
 get_record
 send_data
 sload

Routines Called: ctoi

Parameters: char *cptr
 INT_4 count

Returns: binary_data

2.16.5.6 get_char

The `get_char` function returns the next available ASCII character from a sector-sized buffer. If the buffer is empty, `get_char` reads the next sector from disk. If there is no next sector, `get_char` returns EOF.

The function call is `get_char()`.

Called By: get_record

Routines Called: read

Parameters: none

Returns: *bptr++
 EOF

2.16.5.7 ctoi

The ctoi function converts a character to an integer, and returns the integer.

The function call is **ctoi(c)**, where *c* is the character to be converted.

Called By: get_binary_data

Routines Called: none

Parameters: char c

Returns: c - '0'
 c - 'A' + 10

2.16.6 stdopen.c

The stdopen function opens the console as stdin (in read-only mode), stdout (in write-only mode), and stderr (in write-only mode).

The function call is **stdopen()**.

This function is not currently used.

Called By: none

Routines Called: ifx_open

Parameters: none

Returns: none

2.16.7 vt100.c

The functions in the vt100.c CSU provide VT100 graphics control. These function are used primarily by the Flea and Gossip menu handlers. The functions are:

- cup
- sgr
- double_top
- double_bot
- double_off
- blank
- save_cur
- restore_cur
- scroll_reg

2.16.7.1 cup

The cup function positions the cursor at a specified row and column.

The function call is `cup(r, c)`, where:

r is the row
c is the column

Called By:

- derror
- flea_agpt_locations
- flea_agpt_locations_main_menu
- flea_agpt_switches
- flea_agpt_switches_main_menu
- flea_atp
- flea_atp_main_menu
- flea_bal_opts
- flea_bal_opts_main_menu
- flea_draw_2d
- flea_graphics_test
- flea_graphics_test_main_menu
- flea_prompt
- flea_switches
- flea_switches_main_menu
- flea_veh_control
- flea_veh_control_main_menu
- gos_db_query
- gos_db_query_menu
- gos_main_menu
- gos_ppm_query
- gos_ppm_query_menu
- gos_prompt
- gossip_tick
- host_if_debug_main_menu
- host_if_debug_menu

host_if_disable_debug_msgs
host_if_display_enabled_msgs
host_if_enable_debug_msgs
host_list_msgs
menu_header
model_demo
tick
tick_main_menu
tick_ppm
tick_ppm_menu
tick_ppm_menu_header
tick_ppm_update_info
tick_script
tick_script_main_menu
update_menu_header

Routines Called: printf

Parameters: INT_4 r
 INT_4 c

Returns: none

2.16.7.2 sgr

The sgr function is used for special graphics renditions.

The function call is sgr(v), where v is the row number.

This function is not currently used.

Called By: none

Routines Called: printf

Parameters: INT_4 v

Returns: none

2.16.7.3 double_top

The double_top function represents double-wide, double-high for the top half of the monitor screen.

The function call is double_top(s), where s is the starting line.

This function is not currently used.

Called By: none

Routines Called: printf

Parameters: BYTE s

Returns: none

2.16.7.4 double_bot

The double_bot function represents double-wide, double-high for the bottom half of the monitor screen.

The function call is **double_bot(s)**, where *s* is the starting line.

This function is not currently used.

Called By: none

Routines Called: printf

Parameters: BYTE s

Returns: none

2.16.7.5 double_off

The double_off function returns to single-high and single-width. This reverses the effect of double_top and/or double_bot.

The function call is **double_off()**.

This function is not currently used.

Called By: none

Routines Called: printf

Parameters: none

Returns: none

2.16.7.6 blank

The blank function clears the screen from a given starting position.

The function call is **blank(m)**, where *m* is the character position from which the screen is to be blanked.

Called By:

- flea_agpt_locations_main_menu
- flea_agpt_switches_main_menu
- flea_atp_main_menu
- flea_bal_opts
- flea_bal_opts_main_menu
- flea_graphics_test_main_menu
- flea_switches
- flea_switches_main_menu
- flea_veh_control
- flea_veh_control_main_menu
- gos_db_query
- gos_db_query_menu
- gos_main_menu
- gos_ppm_query
- gos_ppm_query_menu
- gossip_tick
- host_if_debug_main_menu
- host_if_display_enabled_msgs
- host_list_msgs
- model_demo
- tick
- tick_main_menu
- tick_ppm
- tick_ppm_menu
- tick_script
- tick_script_main_menu

Routines Called: printf

Parameters: INT_4 m

Returns: none

2.16.7.7 save_cur

The save_cur function saves the current cursor position.

The function call is **save_cur()**.

This function is not currently used.

Called By: none

Routines Called: printf

Parameters: none

Returns: none

2.16.7.8 restore_cur

The `restore_cur` function restores the cursor position to the location saved by `save_cur`.

The function call is **restore_cur()**.

This function is not currently used.

Called By: none

Routines Called: printf

Parameters: none

Returns: none

2.16.7.9 scroll_reg

The `scroll_reg` function sets the top and bottom boundaries of the scrolling region.

The function call is **scroll_reg(t, b)**, where:

t is the top of the scroll region
b is the bottom of the scroll region

This function is not currently used.

Called By: none

Routines Called: printf

Parameters: INT_4 t
 INT_4 b

Returns: none

2.17 Viewport Configuration (/cig/libsrc/libvpt)

The Viewport Configuration CSC is responsible for initializing and building the configuration tree before runtime. The configuration tree describes the relationship between the physical components of the simulated vehicle and the location of the viewports. The data used to set up the configuration tree is input via messages received from the Simulation Host.

The configuration tree consists of the following:

- One root node, which marks the start of the configuration tree. This node contains no data and must be the first node created.
- One or more matrix nodes, each of which contains a transformation matrix that specifies rotation angles (heading, pitch, and roll) and translation values. The matrices in all nodes in a traversal path of the tree are concatenated to generate the view of the world for the viewport represented by that path. Matrix nodes are designated as either dynamic (ones that are updated during the simulation) or static (ones that do not change during the simulation).
- Zero or more conditional (branch) nodes, each of which branch into one of two traversal paths based on a runtime condition. The node branched to if the condition is true is the conditional node's "true child" and the node branched to if the condition is false is the "false child." The branch values are stored in the system view flags array. The branch values in effect at any given time in the simulation are set via messages sent from the Simulation Host.
- Viewport parameters for each viewport. These parameters are the screen resolution, viewing range, near plane, field-of-view angles, level-of-detail multiplier, and aspect ratio (currently not used). Viewport parameters are associated with the final node in each traversal path in the configuration tree.

Note that the same viewport may be defined multiple times, each with different parameters. A conditional node enables a change to new viewport parameters during the simulation.

- One or more sets of graphics path parameters for each viewport. A graphics path is a window on a viewport. On a T backend, there is one graphics path per viewport. On a TX backend, there are two or four graphics paths per viewport, depending on the resolution. The graphics path parameters are used to load the hardware.

The structure of the configuration tree cannot be changed during runtime — all nodes and viewport definitions must be created at CIG initialization time. However, various parameters *within* the configuration tree do change during the simulation. Therefore, some Viewport Configuration functions are called to update configuration tree structures during runtime.

Specifically, messages can be used to update the following structures after the configuration tree has been created:

- Dynamic matrices. The Simulation Host can provide a new matrix or a change (e.g., rotation) to the current matrix.

- Branch values for conditional nodes. Changing the branch values during a simulation causes selection of a different traversal path and, typically, different viewport parameters.
- Certain viewport parameters (the level-of-detail multiplier and the field-of-view angles). Although a message is available to change these parameters directly, it is recommended that all desirable viewport parameter combinations be built into the configuration tree and selected using branch values.

The configuration tree can contain a maximum of 64 nodes. Each node is referenced by a unique index, which is used in messages sent to update the node during the simulation. The root node is always assigned node_index 0. A node that has viewport parameters attached to it must have a node_index between 1 and 31.

Every matrix node in the configuration tree must be defined in one of two formats: RTS4x3 (4 x 3 rotation translation scale) or HPRXYZS (3 x 3 scale heading pitch roll translation). A matrix node's format can be redefined during the simulation.

The format of each of these matrix structures is as follows:

RTS4x3 (4 x 3 rotation translation scale)

The matrix format is:

| | | | | | | | | | | | | |
|--|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
| <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="padding: 2px 10px;">rotation[0,0]</td> <td style="padding: 2px 10px;">rotation[0,1]</td> <td style="padding: 2px 10px;">rotation[0,2]</td> </tr> <tr> <td style="padding: 2px 10px;">rotation[1,0]</td> <td style="padding: 2px 10px;">rotation[1,1]</td> <td style="padding: 2px 10px;">rotation[1,2]</td> </tr> <tr> <td style="padding: 2px 10px;">rotation[2,0]</td> <td style="padding: 2px 10px;">rotation[2,1]</td> <td style="padding: 2px 10px;">rotation[2,2]</td> </tr> <tr> <td style="padding: 2px 10px;">translation.x</td> <td style="padding: 2px 10px;">translation.y</td> <td style="padding: 2px 10px;">translation.z</td> </tr> </table> | rotation[0,0] | rotation[0,1] | rotation[0,2] | rotation[1,0] | rotation[1,1] | rotation[1,2] | rotation[2,0] | rotation[2,1] | rotation[2,2] | translation.x | translation.y | translation.z |
| rotation[0,0] | rotation[0,1] | rotation[0,2] | | | | | | | | | | |
| rotation[1,0] | rotation[1,1] | rotation[1,2] | | | | | | | | | | |
| rotation[2,0] | rotation[2,1] | rotation[2,2] | | | | | | | | | | |
| translation.x | translation.y | translation.z | | | | | | | | | | |

where:

rotation is an angle in degrees

translation is a distance in meters

The typedef for this matrix structure is:

```
typedef struct {
    REAL_4      rotation[3][3];
    R4P3D      translation;
} RTS4x3_MTX;
```

HPRXYZS (3 x 3 scale heading pitch roll translation)

The matrix format is:

| | | | | | | | | | | | | | | | |
|---|-----------------|---------------|------|---------------|---------------|---------------|---------|---------|---------|-------------|---------------|-------------|------------|-----------------|--|
| <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="padding: 2px 10px;">heading</td> <td style="padding: 2px 10px;">pitch</td> <td style="padding: 2px 10px;">roll</td> </tr> <tr> <td style="padding: 2px 10px;">translation.x</td> <td style="padding: 2px 10px;">translation.y</td> <td style="padding: 2px 10px;">translation.z</td> </tr> <tr> <td style="padding: 2px 10px;">scale.x</td> <td style="padding: 2px 10px;">scale.y</td> <td style="padding: 2px 10px;">scale.z</td> </tr> <tr> <td style="padding: 2px 10px;">scale order</td> <td style="padding: 2px 10px;">heading order</td> <td style="padding: 2px 10px;">pitch order</td> </tr> <tr> <td style="padding: 2px 10px;">roll order</td> <td style="padding: 2px 10px;">translate order</td> <td></td> </tr> </table> | heading | pitch | roll | translation.x | translation.y | translation.z | scale.x | scale.y | scale.z | scale order | heading order | pitch order | roll order | translate order | |
| heading | pitch | roll | | | | | | | | | | | | | |
| translation.x | translation.y | translation.z | | | | | | | | | | | | | |
| scale.x | scale.y | scale.z | | | | | | | | | | | | | |
| scale order | heading order | pitch order | | | | | | | | | | | | | |
| roll order | translate order | | | | | | | | | | | | | | |

where:

heading = -yaw = -z rotation in degrees

pitch = x rotation in degrees

roll = y rotation in degrees

translation is a distance in meters

scale is a scaling factor (used to enlarge or reduce matrices)
the *order* values specify the order in which the matrices are to be concatenated

The typedef for this matrix structure is:

```
typedef struct {
    REAL_4      heading;
    REAL_4      pitch;
    REAL_4      roll;
    R4P3D       translation;
    R4P3D       scale;
    UNS_1       concat_order[5];
} RTS3x3_MTX;
```

A third matrix format, **ROT2x1 (2 x 1 rotation)**, can be used to rotate a matrix along one axis. Matrix nodes cannot be defined as this matrix format, although they can be updated by it. The matrix format for ROT2x1 is:

$$\begin{bmatrix} \cos(\text{rotation}^{\circ}) & \sin(\text{rotation}^{\circ}) \\ \text{rotation axis} & \end{bmatrix}$$

where:

rotation is the angle of rotation in degrees

rotation axis is the axis along which rotation is to occur: 0 (x), 1 (y), or 2 (z)

The typedef for this matrix structure is:

```
typedef struct {
    REAL_4      cos_rotation;
    REAL_4      sin_rotation;
    UNS_1       rotation_axis;
    UNS_1       unused[3];
} ROT2x1_MTX;
```

The functions in the Viewport Configuration CSC do the following:

- Create all configuration nodes, viewport parameter entries, and graphics path entries, based on data received from the Simulation Host.
- Generate DTP-style matrices from the matrices provided by the Simulation Host.
- Generate DTP code for the overlays.
- Process the system view flags/branch values and load them into the T&C (Timing and Control) board.
- Provide an interface to the Gossip user to test the viewport configuration process without connection to a Simulation Host.

The configuration tree is built according to messages received from the Simulation Host. To initiate this process, *db_mcc_setup* (in the Real-Time Processing CSC) calls the

`cig_config` function (in the CIG Configuration CSC). `cig_config` in turn calls the Viewport Configuration functions to configure the nodes, viewports, and graphics paths.

Most of the CSUs in the Viewport Configuration CSC fall into one of the following groups:

`cnode_*` CSUs

Contain functions that operate on configuration nodes.

`vpt_*` CSUs

Contain functions that operate on nodes that have viewport parameters attached to them.

`mtx_*` CSUs

Contain functions that perform matrix-specific operations.

`path_*` CSUs

Contain functions that operate on graphics path parameters.

`tst_*` CSUs

Contain functions useful for testing the viewport configuration process. These include a routine that can be used to create the tree from data in an ASCII file created offline.

`u_*` CSUs

Contain the update functions used to actually modify the viewport objects. These routines are called by the other Viewport Configuration CSUs.

Many of the function names are preceded with `vpt_` followed by the CSU type. For example, most of the functions that deal with configuration nodes begin with `vpt_cnode`. Similarly, most of the update functions begin with `vpt_update`.

Figure 2-21 identifies the CSUs in Viewport Configuration. The functions performed by these CSUs are described in this section.

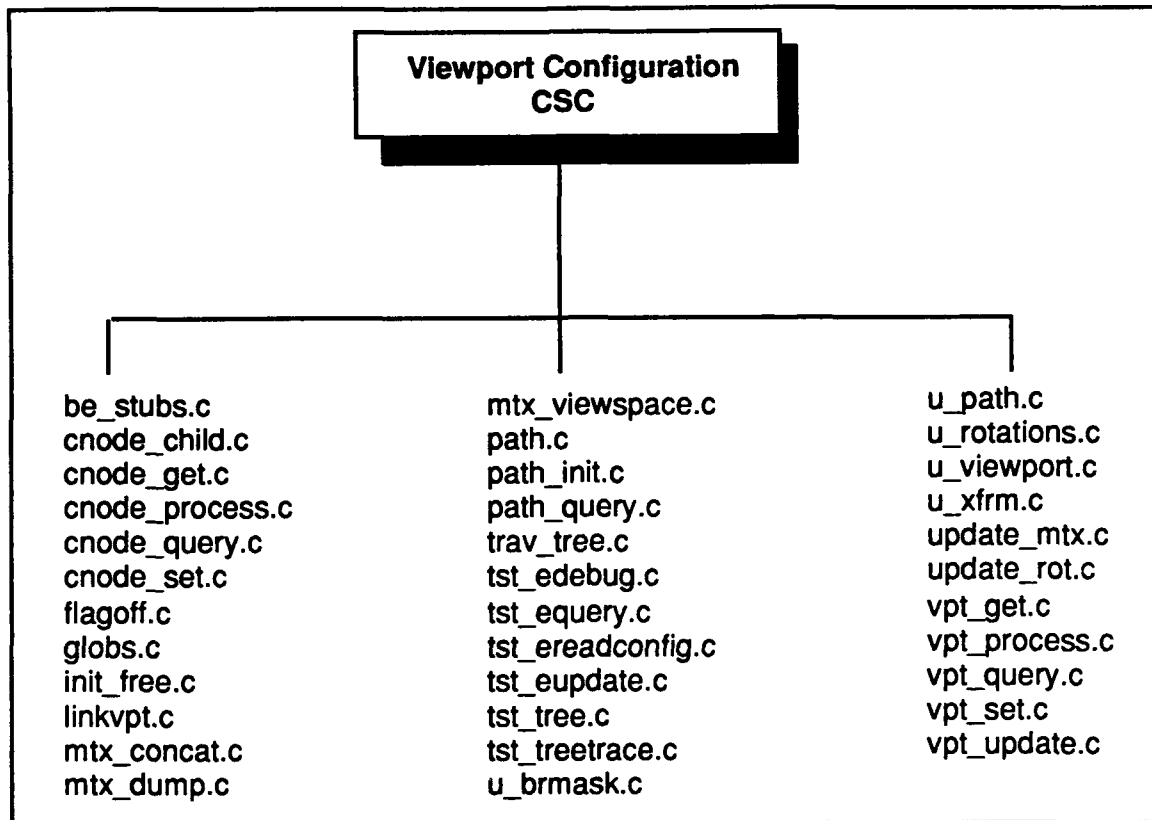


Figure 2-21. Viewport Configuration CSUs

2.17.1 be_stubs.c

The functions in the `be_stubs.c` CSU are used to interface to the backend. These functions are the following:

- `be_query_num_paths`
- `find_be_id`
- `be_query_buffer_offset`
- `be_qulm`
- `be_query_lm_per_lmb_side`
- `vpt_init_mode_on`
- `vpt_init_mode_off`
- `aam_free`

2.17.1.1 be_query_num_paths

The `be_query_num_paths` function determines the number of graphics path required to build a viewport. This function is called when viewport parameters are created for configuration nodes.

The function call is `be_query_num_paths(vpt_id, n_vpts, res_i, res_j, num_pi, num_pj, start_p)`, where:

vpt_id is the viewport identifier
n_vpts is the number of viewports
res_i is the number of pixels in each row (horizontal)
res_j is the number of pixels in each column (vertical)
num_pi is a pointer to the number of paths in the i direction
num_pj is a pointer to the number of paths in the j direction (currently always 1)
start_p is a pointer to the starting path id

be_query_num_paths does the following:

- Calls find_be_id to get the viewport's backend id.
- Calls backend_get_object_addr to get the address of the backend.
- For a TX backend, sets the number of graphics paths to 1, 2, or 4 based on the desired resolution and the number of viewports.
- For a T backend, sets the number of graphics paths to 1.
- Determines the start path id based on which backend the viewport is in, the type of backend, and the resolution.
- Sets the remaining values.

The function returns SUCCEED if it is successful. It returns FAIL if the backend identifier is invalid or the backend could not be found.

Called By: vpt_vpt_process

Routines Called: backend_get_object_addr
find_be_id
printf

| | | |
|-------------|-------|----------|
| Parameters: | INT_2 | vpt_id |
| | INT_2 | n_vpts |
| | INT_4 | res_i |
| | INT_4 | res_j |
| | INT_2 | *num_pi |
| | INT_2 | *num_pj |
| | INT_2 | *start_p |

Returns: 1 (SUCCEED)
0 (FAIL)

2.17.1.2 find_be_id

The find_be_id function, given a viewport id, returns the corresponding backend id. It returns 0 if the viewport id is between 0 and 7, 1 if the viewport id is between 8 and 15, and -1 (an error) if the viewport id is anything else.

The function call is find_be_id(vpt), where vpt is the viewport id.

Called By: be_query_num_paths

Routines Called: none

Parameters: INT_2 vpt

Returns: 0
1
-1

2.17.1.3 be_query_buffer_offset

The `be_query_buffer_offset` function returns the offset to the current double buffer. The offset is 0 if DB0 is current, or the size of the buffer (`DB_BUFSIZE`) if DB1 is current.

The function call is `be_query_buffer_offset()`. The function returns the offset as *temp*. If viewport initialization mode (`vpt_init_mode`) is TRUE, indicating that viewport initialization is in progress, the function always returns 0.

Called By: concat_mtx
process_vflags
process_vpos
vpt_update_all
vpt_update_fov
vpt_update_fov_lod
vpt_update_lodm
vpt_update_near_plane
vpt_update_one_path
vpt_update_rez
vpt_update_view_range
vptq_activevpt

Routines Called: none

Parameters: none

Returns: temp

2.17.1.4 be_query_db0

The `be_query_db0` function returns DB0.

The function call is `be_query_db0()`.

Called By: dtp_trav1

Routines Called: none

Parameters: none

Returns: DB0

2.17.1.5 be_qulm

The `be_qulm` function returns database-specific load module data for a specified viewport. The values it returns are the the inverse of the load module block width and the number of load module blocks per side of active area memory.

The function call is `be_qulm(vpt_id, inv_lmb_width, lmb_per_side)`, where:

vpt_id is the viewport id
inv_lmb_width is a pointer to the inverse of the width of a load module block
lmb_per_side is a pointer to the number of load module blocks per side of AAM

`be_qulm` determines which backend the viewport is in, then puts the data into the locations passed in the call.

Called By: dtp_trav2

Routines Called: none

Parameters: INT_2 vpt_id
 REAL_4 *inv_lmb_width
 REAL_4 *lmb_per_side

Returns: none

2.17.1.6 be_query_lm_per_lmb_side

The `be_query_lm_per_lmb_side` function returns the number of load modules on a side of a load module block for a given database. This value is used for scaling when load module blocking is enabled. Usually, the value is 1 for 3500-meter (non-blocked) databases and 2 for 7000-meter (blocked) databases.

The function call is `be_query_lm_per_lmb_side(vpt_id)`, where *vpt_id* is the viewport id.

The function determines which database to query based on the viewport id, then returns the result as *temp*.

Called By: vpt_vpt_process

Routines Called: none

Parameters: INT_2 vpt_id

Returns: temp

2.17.1.7 vpt_init_mode_on

The `vpt_init_mode_on` function sets the viewport initialization mode (`vpt_init_mode`) variable to `TRUE`. This variable indicates whether or not viewport configuration is in progress. `vpt_init_mode_on` is called by `cig_config` before it starts building the configuration tree.

The function call is `vpt_init_mode_on(backend)`, where *backend* is the id of the backend to be initialized.

The function also sets the `init_backend` variable to the specified backend.

Called By: cig_config

Routines Called: none

Parameters: INT_4 backend

Returns: none

2.17.1.8 vpt_init_mode_off

The `vpt_init_mode_off` function sets the viewport initialization mode (`vpt_init_mode`) variable to `FALSE`. This variable indicates whether or not viewport configuration is in progress. `vpt_init_mode_off` is called by `cig_config` after the configuration tree has been built and the DTP compiler has finished.

The function call is `vpt_init_mode_off()`.

Called By: cig_config

Routines Called: none

Parameters: none

Returns: none

2.17.1.9 aam_free

The `aam_free` function is a dummy function that performs no action. This function is used to <<TBD>>.

The function call is `aam_free(ptr)`, where *ptr* is the location to be freed.

Called By: `vpt_tree_free`

Routines Called: none

Parameters: `UNS_1` *ptr

Returns: none

2.17.2 cnode_child.c

The functions in the `cnode_child.c` CSU are used to add branch and standard (matrix) child nodes to the configuration tree at initialization time. These functions are:

- `vpt_cnode_set_bchild`
- `vpt_cnode_set_stdchild`

2.17.2.1 vpt_cnode_set_bchild

The `vpt_cnode_set_bchild` function adds branch child nodes (the children of branch nodes) to the configuration tree.

The function call is `vpt_cnode_set_bchild(new_node, parent_node, true_child_flag)`, where:

new_node is a pointer to the new child node

parent_node is a pointer to the child's parent node

true_child_flag indicates whether this is the branch node's true child or the false child

`vpt_cnode_set_bchild` does the following:

- For a true child, puts the pointer to the child in the parent's true child slot, or outputs an error if this slot is already filled.
- For a false child, puts the pointer to the child in the parent's false child slot, or outputs an error if this slot is already filled.

Called By: vpt_cnode_process

Routines Called: printf
vpti_state_dcnode (in debug mode only)

Parameters: CONFIGURATION_NODE *new_node
CONFIGURATION_NODE *parent_node
UNS_1 true_child_flag

Returns: none

2.17.2.2 vpt_cnode_set_stdchild

The `vpt_cnode_set_stdchild` adds matrix child nodes (the children of matrix nodes) to the configuration tree.

The function call is `vpt_cnode_set_stdchild(new_node, parent_node)`, where:

new_node is a pointer to the new child node
parent_node is a pointer to the child's parent node

`vpt_cnode_set_stdchild` does the following:

- If the parent's first child slot is empty, (i.e., the parent has no other children), puts a pointer to the child in that slot.
- If the parent's first child slot is filled (i.e., the parent has at least one other child), traverses down the parent node's sibling list. Puts a pointer to the new node in the sibling pointer slot of the last sibling.

Called By: vpt_cnode_process

Routines Called: printf (in debug mode only)
vpti_state_dcnode (in debug mode only)

Parameters: CONFIGURATION_NODE *new_node
CONFIGURATION_NODE *parent_node

Returns: none

2.17.3 cnode_get.c (vpt_cnode_get)

The `vpt_cnode_get` function allocates memory for a configuration node and returns a pointer to that node. This function is called by `vpt_cnode_process` each time it adds a new node to the configuration tree.

The function call is `vpt_cnode_get(node_index)`, where *node_index* is the index of the node for which a pointer is to be returned.

`vpt_cnode_get` does the following:

- Verifies that the *node_index* is valid and the array can hold another pointer. Outputs an error if the node cannot be added.
- Calls `vpti_get_ptr_cnode` to make sure this node does not already have a pointer set to it. Outputs an error if it has.
- Calls `calloc` to allocate memory for this configuration node.
 - If memory is available, calls `vpti_set_ptr_cnode` to add the pointer to the node pointers allocation table (`Gvpt_cnode_pointers`).
 - If not enough memory is available, outputs an error.

The function returns the pointer assigned to the node as *cnode*.

Called By: `vpt_cnode_process`

Routines Called: `calloc`
`printf`
`vpti_get_ptr_cnode`
`vpti_set_ptr_cnode`

Parameters: `INT_2` `node_index`

Returns: `cnode`

2.17.4 `cnode_process.c` (`vpt_cnode_process`)

The `vpt_cnode_process` function is responsible for placing all configuration node information into the configuration tree. This function is called by `cig_config` when the Simulation Host sends a `MSG_CREATE_CONFIGNODE` message. Based on the node's type, `vpt_cnode_process` calls the appropriate function to add the new node.

The function call is `vpt_cnode_process(node_index, parent_index, node_type, matrix_type, true_child_flag, static_mtx_flag, branch_index, branch_mask, matrix, description)`, where:

node_index is the unique index used to reference this node

parent_index is the *node_index* of this node's parent node

node_type is **0** (matrix node), **1** (branch node), or **2** (branch/matrix node — for future expansion)

matrix_type is **0** (HPRXYZS matrix) or **1** (RTS4x3 matrix); matrices cannot be defined as **2** (ROT2x1 matrix)

true_child_flag is **0** (false child of a branch node) or **1** (true child of a branch node)

static_mtx_flag is **0** (dynamic node, matrix will move in runtime) or **1** (static node, matrix will not change during the simulation)

branch_index is the node's index into the branch value array (for branch nodes only)

branch_mask is the node's branch mask (branch values for a branch node, values controlling overlay placement for a matrix node)
matrix is the node's initial rotation matrix
description is a text string describing the node

vpt_cnode_process does the following:

- Calls vpt_cnode_get to get a pointer to the new node.
- Copies the node index, type, and description to the new node entry.
- If this is the root node (node_index = 0):
 - Resets the vehicle_id.
 - Calls vpt_root_init to initialize the root node, view positions array, and view flags array.
 - Returns the status returned by vpt_root_init.
- If this is a child node:
 - Loads the parent index into the node entry.
 - Calls vpti_get_ptr_cnode to get the pointer for the parent node, and loads it into the node entry.
 - If the parent is a branch node, calls vpt_cnode_set_bchild to add the new child node.
 - If the parent is a matrix node, calls vpt_cnode_set_stdchild to add the new child node.
- If this is a matrix node:
 - Calls vpt_cnode_set_matrix to generate the node's matrix and load it into active area memory.
- If this is a branch (conditional) node:
 - Calls vpt_cnode_set_branch to add the node's branch index and branch mask, and to set a pointer to the view flags/branch value array.
- If this is a child of the root node (i.e., a world/hull matrix node):
 - Assigns the next vehicle id and sets it in the node entry.
 - Calls process_vppos to load the vehicle's current position.

The function returns SUCCEED if the node is added to the configuration tree successfully. It returns FAIL if memory could not be allocated for the new node, or if one of the called routines could not add the node for any reason.

Called By: cig_config
 p_configtree_node

Routines Called: printf
 process_vppos
 strcpy
 vpt_cnode_get
 vpt_cnode_set_bchild
 vpt_cnode_set_branch
 vpt_cnode_set_matrix
 vpt_cnode_set_stdchild
 vpt_root_init
 vpti_get_ptr_cnode
 vpti_state_dcnode (in debug mode only))

| | | |
|-------------|----------|-----------------|
| Parameters: | INT_2 | node_index |
| | INT_2 | parent_index |
| | UNS_1 | node_type |
| | UNS_1 | matrix_type |
| | UNS_1 | true_child_flag |
| | UNS_1 | static_mtx_flag |
| | UNS_1 | branch_index |
| | UNS_4 | branch_mask |
| | MTXUNION | *matrix |
| | UNS_1 | description[] |

Returns: 1 (SUCCEED)
 0 (FAIL)

2.17.5 cnode_query.c

The functions in the cnode_query.c CSU are used to read configuration node data. These functions are:

- vpt_cnode_query
- vpt_cnode_qroot

2.17.5.1 vpt_cnode_query

The vpt_cnode_query function copies information from the configuration node structure to a query structure. This function is used in testing only.

The function call is `vpt_cnode_query(cp, ci)`, where:

cp is a pointer to the configuration node
ci is a pointer to the information structure

vpt_cnode_query does the following:

- Initializes the query information structure.
- Puts all data from the configuration node (node index, parent index, matrix type, etc.) into the query information structure.

Called By: tst_tretrace
 vptq_brvals
 vptq_cnout
 vptq_dynmtx

Routines Called: none

| | | |
|-------------|--------------------|-----|
| Parameters: | CONFIGURATION_NODE | *cp |
| | VPT_CNODE_INFO | *ci |

Returns: none

2.17.5.2 vpt_cnode_qroot

The `vpt_cnode_qroot` function returns a pointer to the root node, which it finds by calling `vpti_get_ptr_cnode`.

The function call is `vpt_cnode_qroot()`.

Called By: `dtp_compiler`
`process_vflags`
`process_vppos`
`vptq_activept`

Routines Called: `vpti_get_ptr_cnode`

Parameters: none

Returns: `vpti_get_ptr_cnode(0)`

2.17.6 cnode_set.c

The functions in the `cnode_set.c` CSU are used to add branch and matrix node parameters to the configuration tree. These functions are:

- `vpt_cnode_set_branch`
- `vpt_cnode_set_matrix`

2.17.6.1 vpt_cnode_set_branch

The `vpt_cnode_set_branch` function sets the special parameters that pertain only to branch (conditional) nodes. This function is called by `vpt_cnode_process` when adding a branch node to the configuration tree.

The function call is `vpt_cnode_set_branch(new_node, branch_mask, branch_index)`, where:

new_node is a pointer to the new node's entry in the configuration tree
branch_mask is the node's branch mask
branch_index is the index into the branch value array

`vpt_cnode_set_branch` does the following:

- Puts the node's branch mask into the node entry.

- Determines the node's branch value pointer by using its node index to index into the branch value array. (The address of this array is stored in the root node's branch value pointer.)
- Puts the node's branch value pointer into the node entry.

Called By: vpt_cnode_process

Routines Called: printf (in debug mode only)
vpti_get_ptr_cnode
vpti_state_dcnode (in debug mode only)

Parameters: CONFIGURATION_NODE* new_node
UNS_4 branch_mask
UNS_1 branch_index

Returns: none

2.17.6.2 vpt_cnode_set_matrix

The `vpt_cnode_set_matrix` function sets the special parameters required for matrix nodes, generates the DTP matrix, and loads the matrix into active area memory. This function is called by `vpt_cnode_process` when adding a matrix node to the configuration tree.

The function call is `vpt_cnode_set_matrix(new_node, matrix_type, static_mtx_flag, matrix, branch_mask)`, where:

new_node is a pointer to the new node entry
matrix_type is 0 (HPRXYZS matrix) or 1 (RTS4x3 matrix)
static_mtx_flag is 0 (dynamic node, matrix will move in runtime) or 1 (static node, matrix will not change during the simulation)
matrix is the node's initial rotation matrix
branch_mask is the node's branch mask (used to indicate whether or not overlays are to be displayed on the viewport)

`vpt_cnode_set_matrix` does the following:

- Puts the matrix type and static matrix flag into the new node's entry.
- Allocates memory for the matrix in the node.
- Allocates memory for the DTP matrix in active area memory.
- Makes a copy of the matrix.
- Allocates memory for a copy of the matrix (for dynamic matrices only), for use in terrain feedback processing.
- Calls `concat_mtx` to generate the DTP-style matrix and load it into active area memory.
- Puts the node's branch mask into the node entry.

The function returns SUCCEED if the matrix data was generated successfully. It returns FAIL if memory could not be allocated for the node matrix, the DTP matrix, or the copy of the dynamic matrix.

Called By: vpt_cnode_process

Routines Called: aam_malloc
 calloc
 concat_mtx
 mtxcpy
 printf
 r4mat_dump (in debug mode only)
 vpti_state_dcnode (in debug mode only)

Parameters: CONFIGURATION_NODE* new_node
 UNS_1 matrix_type
 UNS_1 static_mtx_flag
 UNS_4 branch_mask
 MTXUNION *matrix

Returns: 1 (SUCCEED)
 0 (FAIL)

2.17.7 flagoff.c

The flagoff function turns off all Viewport Configuration debug flags. This function is called by cig_config (in the CIG Configuration CSC) when it processes the CIG Control-Stop message after the configuration tree has been built.

The function call is **flagoff()**. flagoff sets Gvpt_dtree_short to TRUE and sets the following variables to FALSE:

- Gvpt_dmatrix
- Gvpt_dvptnode
- Gvpt_dpath
- Gvpt_dlodmult
- Gvpt_dcnode
- Gvpt_state_dtproc
- Gvpt_state_efillt
- Gvpt_state_edtpc

These variables are maintained using the functions in globs.c. For definitions of the variables, see globs.c.

Called By: cig_config

Routines Called: vpti_set_state_dcnode
 vpti_set_state_dlodmult
 vpti_set_state_dmatrix
 vpti_set_state_dpath

vpti_set_state_dtproc
vpti_set_state_dtree_short
vpti_set_state_dvptnode
vpti_set_state_edtpc
vpti_set_state_efillt

Parameters: none

Returns: none

2.17.8 globs.c (vpti_*)

The globs.c CSU contains functions that manage the global variables that keep track of Viewport Configuration status. These functions can be used to obtain the current value of a variable or to change the variable's setting.

The Viewport Configuration variables that can be managed using these routines are listed in the following table.

| Variable | Type | Description |
|------------------------|-------------------------------|---|
| Gvpt_dcnode | BOOLEAN | If TRUE and if debug mode is enabled, status and information messages are output when nodes are configured. |
| Gvpt_dlodmult | BOOLEAN | <<TBD>>. This variable is used by test routines only. |
| Gvpt_dmatrix | BOOLEAN | If TRUE and if debug mode is enabled, status and information messages are output when configuration node matrices are manipulated. |
| Gvpt_dpath | BOOLEAN | If TRUE and if debug mode is enabled, status and information messages are output when graphics path parameters are configured. |
| Gvpt_dtproc | BOOLEAN | If TRUE and if debug mode is enabled, status and information message are output by cig_config as it processes configuration messages, and by fill_tree as it sets the graphics paths. |
| Gvpt_dtree_short | BOOLEAN | If TRUE, the information displayed through Gossip for a configuration node is reduced. This variable is used by test routines only. |
| Gvpt_dvptnode | BOOLEAN | If TRUE and if debug mode is enabled, status and information messages are output when viewport parameters are configured. |
| Gvpt_edtpc | BOOLEAN | If TRUE and if debug mode is enabled, cig_config exits before calling dtp_compiler. |
| Gvpt_efillt | BOOLEAN | If TRUE and if debug mode is enabled, cig_config exits before calling fill_tree. |
| Gvpt_panel_align | BOOLEAN | <<TBD>> |
| Gvpt_path_entry_index | INT_2 | The index of the current entry in the graphics path pointer table. |
| Gvpt_vpt_entry_index | INT_2 | The index of the current entry in the viewport pointer table. |
| Gvpt_cnode_pointers[] | CONFIGURATION_- NODE | Array of pointers to all configuration nodes. |
| Gvpt_path_pointers[] | GRAPHICS_PATH_- PARAMETERS | Array of pointers to all graphics path parameter entries. |
| Gvpt_vpt_pointers[] | VIEWPORT_- PARAMETERS | Array of pointers to all viewport parameter entries. |

The routines in globs.c are summarized in the following table. The first column shows the function's name and parameters. The second column describes the function's purpose. The third column identifies the function(s) that call this routine. The functions are listed in alphabetical order, not the order in which they appear in the globs.c file.

| globs.c Function | Description | Called By |
|--------------------------------------|--|---|
| vpti_change_path_entry_index (value) | Sets Gvpt_path_entry_index to the specified <i>value</i> . | vpt_tree_init |
| vpti_change_vpt_entry_index (value) | Sets Gvpt_vpt_entry_index to the specified <i>value</i> . | vpt_tree_init |
| vpti_get_pathptr_cnode (cnode_index) | Returns Gvpt_cnode_pointers [cnode_index]->view_param_ptr->path_param_ptr. Returns 0 if <i>cnode_index</i> is invalid. | none |
| vpti_get_ptr_cnode(index) | Returns Gvpt_cnode_pointers[index]. Returns 0 if <i>index</i> is invalid. | gos_locate, tst_treetrace, vpt_vpt_set, vpt_cnode_get, vpt_cnode_process, vpt_cnode_groot, vpt_cnode_set_branch, vpt_cnode_linkvpt, vpt_update_mtx, vpt_update_rot, vpt_update_brmask, vpt_update_one_path, vpt_tree_free, vpt_root_init, vptq_dynmtx, vptq_cnout, vptq_cnptrs, vptq_brvals |
| vpti_get_ptr_path(index) | Returns Gvpt_path_pointers [index]. Returns 0 if <i>index</i> is invalid. | fill_tree, vpt_tree_free, vptq_grptrs, vptq_grout |
| vpti_get_ptr_vpt(index) | Returns Gvpt_vpt_pointers [index]. Returns 0 if <i>index</i> is invalid. | vpt_tree_free, trav_tree, vptq_vpout, vptq_vpptrs, vptq_vptbrout, vptq_activevpt |
| vpti_get_vptptr_cnode (cnode_index) | Returns Gvpt_cnode_pointers [cnode_index]->view_param_ptr. Returns 0 if <i>cnode_index</i> is invalid. | vpt_update_all, vpt_update_fov, vpt_update_fov_lod, vpt_update_rez, vpt_update_lodm, vpt_update_near_plane, vpt_update_view_range |
| vpti_increment_path_entry_index () | Adds 1 to Gvpt_path_entry_index. | vpt_path_get |
| vpti_increment_vpt_entry_index() | Adds 1 to Gvpt_vpt_entry_index. | vpt_vpt_get |
| vpti_set_ptr_cnode(index, ptr) | Sets the specified <i>index</i> in Gvpt_cnode_pointers[] to the specified pointer (<i>ptr</i>). | vpt_cnode_get, vpt_tree_free, vpt_tree_init |
| vpti_set_ptr_path(index, ptr) | Sets the specified <i>index</i> in Gvpt_path_pointers[] to the specified pointer (<i>ptr</i>). | vpt_tree_free, vpt_tree_init, vpt_path_get |
| vpti_set_ptr_vpt(index, ptr) | Sets the specified <i>index</i> in Gvpt_vpt_pointers[] to the specified pointer (<i>ptr</i>). | vpt_tree_free, vpt_tree_init, vpt_vpt_get |
| vpti_set_state_dcnode(value) | Sets Gvpt_dcnode to the specified <i>value</i> . | flagoff, vpt_tree_init |
| vpti_set_state_dlodmult(value) | Sets Gvpt_dlodmult to the specified <i>value</i> . | flagoff, vpt_tree_init |
| vpti_set_state_dmatrix(value) | Sets Gvpt_dmatrix to the specified <i>value</i> . | flagoff, vpt_tree_init |

| | | |
|------------------------------------|---|--|
| vpti_set_state_dpath(value) | Sets Gvpt_dpath to the specified value. | flagoff, vpt_tree_init |
| vpti_set_state_dtproc(value) | Sets Gvpt_dtproc to the specified value. | flagoff, vpt_tree_init |
| vpti_set_state_dtree_short (value) | Sets Gvpt_dtree_short to the specified value. | flagoff, vpt_tree_init |
| vpti_set_state_dvptnode(value) | Sets Gvpt_dvptnode the specified value. | flagoff, vpt_tree_init |
| vpti_set_state_edtpc(value) | Sets Gvpt_edtpc to the specified value. | flagoff, vpt_tree_init |
| vpti_set_state_efillt(value) | Sets Gvpt_efillt to the specified value. | flagoff, vpt_tree_init |
| vpti_set_state_panel_align (value) | Sets Gvpt_panel_align to the specified value. | vpt_tree_init |
| vpti_state_dcnode() | Returns the value of Gvpt_dcnode. | vpt_cnode_process, vpt_cnode_set_bchild, vpt_cnode_set_stdchild, vpt_cnode_set_branch, vpt_cnode_set_matrix, vpt_update_mtx, vpt_update_rot, vpt_update_brmask, p_configtree_node, tst_edebug. |
| vpti_state_dlodmult() | Returns the value of Gvpt_dlodmult. | tst_edebug |
| vpti_state_dmatrix() | Returns the value of Gvpt_dmatrix. | concat_mtx, mtx_non_perspective, mtx_perspective, old_mtx_perspective, vpt_path_update, tst_edebug |
| vpti_state_dpath() | Returns the value of Gvpt_dpath. | vpt_path_process, vpt_path_query, vpt_path_setup, vpt_path_update, tst_edebug |
| vpti_state_dtproc() | Returns the value of Gvpt_dtproc. | cig_config, fill_tree, tst_edebug |
| vpti_state_dtree_short() | Returns the value of Gvpt_dtree_short. | tst_edebug, pr_branch, pr_matrix |
| vpti_state_dvptnode() | Returns the value of Gvpt_dvptnode. | vpt_vpt_process, vpt_vpt_set, tst_edebug, p_viewport_state |
| vpti_state_edtpc() | Returns the value of Gvpt_edtpc. | cig_config, tst_edebug |
| vpti_state_efillt() | Returns the value of Gvpt_efillt. | cig_config, tst_edebug |
| vpti_state_panel_align() | Returns the value of Gvpt_panel_align. | vpt_path_process, vpt_path_update, tst_edebug |
| vpti_togstate_dcnode() | Toggles the state of Gvpt_dcnode. | tst_edebug |
| vpti_togstate_dlodmult() | Toggles the state of Gvpt_dlodmult. | tst_edebug |
| vpti_togstate_dmatrix() | Toggles the state of Gvpt_dmatrix. | tst_edebug |
| vpti_togstate_dpath() | Toggles the state of Gvpt_dpath. | tst_edebug |
| vpti_togstate_dtproc() | Toggles the state of Gvpt_dtproc. | tst_edebug |
| vpti_togstate_dtree_short() | Toggles the state of Gvpt_dtree_short. | tst_edebug |

| | | |
|-----------------------------|---|--------------|
| vpti_togstate_dvptnode() | Toggles the state of Gvpt_dvptnode. | tst_edebug |
| vpti_togstate_edtpc() | Toggles the state of Gvpt_edtpc. | tst_edebug |
| vpti_togstate_efillt() | Toggles the state of Gvpt_efillt. | tst_edebug |
| vpti_togstate_panel_align() | Toggles the state of Gvpt_panel_align. | tst_edebug |
| vpti_val_path_entry_index() | Returns the value of Gvpt_path_entry_index. | vpt_path_get |
| vpti_val_vpt_entry_index() | Returns the value of Gvpt_vpt_entry_index. | vpt_vpt_get |

Called By: see above table

Routines Called: none

Parameters: see above table

Returns: see above table

2.17.9 init_free.c

The functions in the init_free.c CSU are used to initialize and remove the viewport configuration tree. These functions are:

- vpt_root_init
- vpt_tree_init
- vpt_tree_free

2.17.9.1 vpt_root_init

The vpt_root_init function allocates memory for the view positions and view flags/branch value arrays. It also sets pointers in the root node to these arrays. This function is called by vpt_cnode_process when adding the root node (node_index = 0) to the configuration tree.

The function call is vpt_root_init(). vpt_root_init does the following:

- Gets the pointer to the root node.
- Stores a pointer to the view positions array in the root node's first child pointer (which is otherwise unused).
- Allocates memory for the view positions array in the dynamic section of active area memory.
- Stores a pointer to the branch value array in the root node's branch_value pointer.
- Allocates memory for the branch value array in the dynamic section of active area memory.

The function returns SUCCEED if the structures are allocated successfully. It returns FAIL if it could not get a pointer to the root node or allocate memory for one of the arrays.

Called By: vpt_cnode_process

Routines Called: aam_malloc
printf
vpti_get_ptr_cnode

Parameters: none

Returns: 1 (SUCCEED)
0 (FAIL)

2.17.9.2 vpt_tree_init

The vpt_tree_init function initializes all viewport configuration static variables and static pointer lists. This function is called at system initialization time and when the Simulation Host sends a CIG Control-Stop message to stop the simulation. It can also be invoked through Gossip by selecting the 8 ("configtree init") option from the Gossip main menu, or the I ("Tree Initialize") option from the Viewport Test menu.

The function call is vpt_tree_init(). vpt_tree_init does the following:

- Sets the following global variables to FALSE:
 - Gvpt_dmatrix
 - Gvpt_dvptnode
 - Gvpt_dpath
 - Gvpt_dlodmult
 - Gvpt_dcnode
 - Gvpt_dtproc
 - Gvpt_efillt
 - Gvpt_edtpc
- Sets the following global variables to TRUE:
 - Gvpt_dtree_short
 - Gvpt_panel_align
- Initializes the viewport parameters entry index and the graphics path parameters entry index to 0.
- Sets the pointer to every configuration node to 0.
- Sets the pointer to every viewport parameter entry to 0
- Sets the pointer to every graphics path entry to 0.

Called By: gossip_tick
initialize
msg_cig_ctl
tst_tree

Routines Called: vpti_change_path_entry_index
 vpti_change_vpt_entry_index
 vpti_set_ptr_cnode
 vpti_set_ptr_path
 vpti_set_ptr_vpt
 vpti_set_state_dcnode
 vpti_set_state_dlodmult
 vpti_set_state_dmatrix
 vpti_set_state_dpath
 vpti_set_state_dtproc
 vpti_set_state_dtree_short
 vpti_set_state_dvptnode
 vpti_set_state_edtpc
 vpti_set_state_efillt
 vpti_set_state_panel_align

Parameters: none

Returns: none

2.17.9.3 vpt_tree_free

The `vpt_tree_free` function frees the memory allocated for all configuration nodes, viewport parameters, and graphics path parameters. This function is called when the Simulation Host sends a CIG Control-Stop message to stop the simulation. It is also called through Gossip if the user selects the F ("Tree Free") option from the Viewport Test menu.

The function call is `vpt_tree_free()`. `vpt_tree_free` does the following:

- For each configuration node:
 - Gets the pointer to the node.
 - If the root node, frees the view flags/branch value and view positions arrays.
 - Frees the allocated DTP matrix area.
 - Frees the memory allocated for the node.
 - Sets the node's pointer to 0.
- For each viewport parameter entry:
 - Gets the pointer to the entry.
 - Frees the viewing range, near plane, and lod multiplier.
 - Frees the memory allocated for the entry.
 - Sets the entry's pointer to 0.
- For each graphics path parameter entry:
 - Gets the pointer to the entry.
 - Frees the field-of-view vectors, perspective matrix, non-perspective matrix, and resolution.
 - Gets the pointer to the path.
 - Frees the memory allocated for the path.
 - Sets the entry's pointer to 0.

Called By: msg_cig_ctl

tst_tree

Routines Called: aam_free
 free
 vpti_get_ptr_cnode
 vpti_get_ptr_path
 vpti_get_ptr_vpt
 vpti_set_ptr_cnode
 vpti_set_ptr_path
 vpti_set_ptr_vpt

Parameters: none

Returns: none

2.17.10 linkvpt.c (vpt_cnode_linkvpt)

The `vpt_cnode_linkvpt` function is responsible for setting a viewport node's pointer to the correct index in the view positions array. This array contains one entry for each simulation vehicle (currently only one). The array is pointed to by the root configuration node.

The function call is `vpt_cnode_linkvpt(vpt_node, ptr_vppos, index)`, where:

vpt_node is a pointer to the viewport parameters node
ptr_vppos is a pointer to the view positions array
index is the configuration node's index

`vpt_cnode_linkvpt` does the following:

- Calls `vpti_get_ptr_cnode` to get the pointer to the view positions array (stored in the root node's first child pointer slot).
- Calls `vpti_get_ptr_cnode` to get a pointer to the specified configuration node.
- Sets the node's viewport parameters pointer to the specified viewport node.
- Matches the viewport with a hull/world (simulation vehicle) transformation matrix, by finding the vehicle id in the view positions array. Currently, only one simulation vehicle is supported, so there is only one element in the array.

The *status* returned by the function is 1 (SUCCEED) if it is successful, or 0 (FAIL) if the configuration node pointer is NULL or the node index is invalid.

Called By: vpt_vpt_process

Routines Called: vpti_get_ptr_cnode

Parameters: VIEWPORT_PARAMETERS *vpt_node
 R4P3D **ptr_vppos
 INT_2 index

Returns: status

2.17.11 `mtx_concat.c` (`concat_mtx`)

The `concat_mtx` function creates or updates the DTP matrix for a specified configuration node, and places the matrix into active area memory. This function is called to generate and load the initial matrix for each matrix node during viewport configuration. It is also called to update dynamic matrices during the simulation if the Simulation Hosts sends any of the following messages: `MSG_ROT2x1_MATRIX`, `MSG_RTS4x3_MATRIX`, `MSG_HPRXYZS_MATRIX`, `MSG_TRANSLATION`, `MSG_SCALE`, `MSG_1ROTATION`, or `MSG_3ROTATIONS`.

The function call is `concat_mtx(config_node, pmtx)`, where:

config_node is a pointer to the configuration node
pmtx is the node's new matrix

`concat_mtx` does the following:

- Verifies that the DTP matrix address is valid.
- If the matrix is defined as dynamic, finds the offset to the current double buffer and finds the location in active area memory for the matrix.
- Unpacks the matrix sent from the Simulation Host.
- For an RTS4x3 matrix:
 - Calls `mtxcpy` to copy the new matrix to AAM.
- For an ROT2x1 matrix:
 - Determines which axis the matrix is to be rotated along.
 - Updates the matrix's rotation values in AAM.
- For an RTS3x3 (HPRXYZS) matrix:
 - Calls `make4x3` to create the matrix, performing the concatenations in the order specified in the message.
- If this is a dynamic matrix node, calls `mtxcpy` to copy the matrix to the configuration node's entry for use in terrain feedback processing.

If successful, the function returns *err_code* set to 1 (TRUE). If an invalid DTP matrix address is detected, the function returns no value.

Called By: `vpt_cnode_set_matrix`
`vpt_update_mtx`
`vpt_update_rot`

Routines Called: `be_query_buffer_offset`
`cos`
`make4x3`
`mtxcpy`
`printf` (in debug mode only)
`r4mat_dump` (in debug mode only)
`sin`
`TORAD`

vpti_state_dmatrix (in debug mode only)

Parameters: CONFIGURATION_NODE *config_node
MTXUNION *pmtx

Returns: err_code

2.17.12 mtX_dump.c

The functions in the mtX_dump.c CSU can be used to dump a matrix to stdout. These functions are:

- r4mat_dump
- r8mat_dump

2.17.12.1 r4mat_dump

The r4mat_dump function dumps a matrix to stdout. This function is called only by test routines or if debug mode is enabled.

The function call is **r4mat_dump(str, mat)**, where:

str is a string to display (on stdout) to describe the matrix

mat is a pointer to the location in active area memory that contains the matrix

r4mat_dump first calls bus_error to verify that the matrix address is valid. It then outputs the matrix to stdout.

Called By: concat_mtx (in debug mode only)
p_configtree_node (in debug mode only)
pr_matrix
vpt_cnode_set_matrix (in debug mode only)
vpt_path_update (in debug mode only)
vptq_cnout
vptq_dynmtx
vptq_grout

Routines Called: bus_error
printf

Parameters: char *str
REAL_4 mat[4][3]

Returns: none

2.17.12.2 r8mat_dump

The `r8mat_dump` function dumps a matrix to stdout.

The function call is `r8mat_dump(str, mat)`, where:

str is a string to display (on stdout) to describe the matrix
mat is a pointer to the location in active area memory that contains the matrix

`r8mat_dump` first calls `bus_error` to verify that the matrix address is valid. It then outputs the matrix to stdout.

This function is not currently used.

| | | |
|------------------|---|---|
| Called By: | none | |
| Routines Called: | <code>bus_error</code> <code>printf</code> | |
| Parameters: | <code>char</code> <code>REAL_8</code> | <code>*str</code> <code>mat[4][3]</code> |
| Returns: | none | |

2.17.13 mtx_viewspace.c

The functions in the `mtx_viewspace.c` CSU generate perspective view matrices for use by the Polygon Processor, and non-perspective view matrices for use by DTP. These functions are:

- `mtx_non_perspective`
- `mtx_perspective`
- `old_mtx_perspective`

2.17.13.1 mtx_non_perspective

The `mtx_non_perspective` function produces a view matrix without perspective for use by the Poly Processor. This function is called when graphics path parameters are updated.

The function call is `mtx_non_perspective(cos_i, sin_i, matrix)`, where:

cos_i is the cosine of the graphics path
sin_i is the sine of the graphics path
matrix is the destination matrix

Called By: vpt_path_update

Routines Called: printf (in debug mode only)
vpti_state_dmatrix (in debug mode only)

Parameters: REAL_4 cos_i
REAL_4 sin_i
T_MATRIX matrix

Returns: none

2.17.13.2 mtm_perspective

The *mtm_perspective* function produces a view matrix with perspective for use by DTP. When graphics path parameters are updated, this function is called (instead of *old_mtm_perspective*) if the *Gvpt_panel_align* variable is TRUE.

The function call is *mtm_perspective(thx, thy, I, J, zn, paneln, paneli, scale, matrix)*, where:

thx is the tangent of one-half the horizontal channel field of view divided by the number of panels
thy is the tangent of one-half the vertical channel field of view
I is the number of horizontal pixels in the panel
J is the number of vertical pixels in the panel
zn is the distance to the near plane
paneln is the number of panels
paneli is the panel number (leftmost is 0)
scale is the scale factor used to scale matrices if load module blocking is enabled
matrix is the destination matrix

Called By: vpt_path_update

Routines Called: printf (in debug mode only)
vpti_state_dmatrix (in debug mode only)

Parameters: float thx
float thy
int I
int J
float zn
int paneln
int paneli
float scale
REAL_4 matrix[4][3]

Returns: none

2.17.13.3 old_mtx_perspective

The `old_mtx_perspective` function produces a view matrix with perspective for use by DTP. When graphics path parameters are updated, this function is called (instead of `mtx_perspective`) if the `Gvpt_panel_align` variable is FALSE.

The function call is `old_mtx_perspective(itan_i, itan_j, off_x, off_y, cos_i, sin_i, sc, matrix)`, where:

itan_i is the inverse of the tangent of the field-of-view angle i (horizontal)
itan_j is the inverse of the tangent of the field-of-view angle j (vertical)
off_x is the horizontal offset
off_y is the vertical offset
cos_i is the cosine of the graphics path
sin_i is the sine of the graphics path
sc is the scale factor used to scale matrices if load module blocking is enabled
matrix is the destination matrix

Called By: vpt_path_update

Routines Called: printf (in debug mode only)
 vpti_state_dmatrix (in debug mode only)

| | | |
|-------------|----------|--------|
| Parameters: | REAL_4 | itan_i |
| | REAL_4 | itan_j |
| | REAL_4 | off_x |
| | REAL_4 | off_y |
| | REAL_4 | cos_i |
| | REAL_4 | sin_i |
| | REAL_4 | sc |
| | T_MATRIX | matrix |

Returns: none

2.17.14 path.c

The functions in the `path.c` CSU set and update graphics path parameters. These functions are:

- `vpt_path_process`
- `vpt_path_update`

2.17.14.1 vpt_path_process

The `vpt_path_process` function initializes the fov-related fields in the graphics path parameters and the viewport parameter entries. This function is called when a node with viewport parameters is first defined and when it is updated.

The function call is `vpt_path_process (graphics_path, num_of_paths_i, num_of_paths_j, vpt_rez, vpt_fov, offset)`, where:

graphics_path is a pointer to the graphics path parameters
num_of_paths_i is the number of paths in the i direction
num_of_paths_j is the number of paths in the j direction
vpt_rez is the viewport's resolution
vpt_fov is the viewport's field of view
offset is the offset to the current double buffer

`vpt_path_process` processes each graphics path in turn. For each path, it does the following:

- Divides the field of view and resolution by the number of paths.
- Calculates and sets the path's field-of-view vectors.
- If panel alignment is enabled, sets the path's panel align value.
- Sets the path's resolution.
- Calculates the path's center.
- Calls `vpt_path_update` to set the dynamic values in each path.

The function returns `SUCCEED` if it is successful. It returns `FAIL` if `vpt_path_update` could not update the path parameters.

| | | |
|------------------|---|--|
| Called By: | <code>vpt_update</code> | |
| Routines Called: | <code>printf</code> <code>tan</code> <code>TORAD</code> <code>vpt_path_update</code> <code>vpti_state_dpath</code> <code>vpti_state_panel_align</code> | (in debug mode only) (in debug mode only) |
| Parameters: | <code>GRAPHICS_PATH_PARAMETERS</code> <code>INT_2</code> <code>INT_2</code> <code>I4IJ</code> <code>R4IJ</code> <code>UNS_4</code> | <code>*graphics_path</code> <code>num_of_paths_i</code> <code>num_of_paths_j</code> <code>vpt_rez</code> <code>vpt_fov</code> <code>offset</code> |
| Returns: | <code>1 (SUCCEED)</code> <code>0 (FAIL)</code> | |

2.17.14.2 vpt_path_update

The `vpt_path_update` function updates a graphics path's matrices, field-of-view vectors, and screen constants for DTP. This function is called after the path parameters are initialized.

The function call is `vpt_path_update(graphics_path, offset)`, where:

graphics_path is a pointer to the graphics path
offset is the offset to the current double buffer

`vpt_path_update` does the following:

- Verifies that all of the graphics path parameters are present.
- Calculates the inverse of the tangent of the fov angles.
- Calculates the cosine and sine of the graphics path center.
- Calls `mtx_non_perspective` to build a non-perspective view matrix for DTP.
- Sets the DTP commands for processing of the perspective matrix.
- Calls `mtx_perspective` (if panel alignment is enabled) or `old_mtx_perspective` (if panel alignment is not enabled) to build a perspective view matrix for the Poly Processor.
- Sets the path's field-of-view vectors.
- Sets the path's screen resolution constants.

The function returns SUCCEED if the graphics path is updated successfully. It returns FAIL if any of the graphics path's pointers are NULL.

| | | |
|------------------|---|--|
| Called By: | <code>vpt_path_process</code> <code>vpt_update_one_path</code> | |
| Routines Called: | <code>atan</code> <code>cos</code> <code>mtx_non_perspective</code> <code>mtx_perspective</code> <code>old_mtx_perspective</code> <code>printf</code> <code>r4mat_dump</code> (in debug mode only) <code>sin</code> <code>tan</code> <code>TORAD</code> <code>vpti_state_dmatrix</code> (in debug mode only) <code>vpti_state_dpath</code> (in debug mode only) <code>vpti_state_panel_align</code> | |
| Parameters: | <code>GRAPHICS_PATH_PARAMETERS</code> <code>UNS_4</code> | <code>*graphics_path</code> <code>offset</code> |
| Returns: | 1 (SUCCEED) | |

0 (FAIL)

2.17.15 path_init.c

The functions in the `path_init.c` CSU allocate, initialize, and set up graphics path data for configuration nodes that have viewport parameters. These functions are:

- `vpt_path_get`
- `vpt_path_init`
- `vpt_path_setup`

2.17.15.1 vpt_path_get

The `vpt_path_get` function allocates memory for the graphics path parameters node and sets the pointers in the path pointer table. This function is called whenever a new viewport parameters node is defined.

The function call is `vpt_path_get(num_paths)`, where *num_paths* is the number of graphics paths required.

`vpt_path_get` does the following:

- Verifies that the array will hold another pointer.
- Allocates memory for the number of graphics paths specified.
- Verifies that the memory was allocated.
- Adds the entry to the `Gvpt_path_pointers[]` table.
- Increments the path entry index.
- Sets up the graphics path sibling pointers (each points to the next path).

If successful, the functions returns a pointer to the first graphics path structure as *gp*.

Called By: `vpt_path_setup`

Routines Called: `calloc`
`printf`
`vpti_increment_path_entry_index`
`vpti_set_ptr_path`
`vpti_val_path_entry_index`

Parameters: `INT_2` `num_paths`

Returns: `gp`

2.17.15.2 vpt_path_init

The `vpt_path_init` function allocates DTP memory for the perspective matrix, non-perspective matrix, field-of-view vectors, and screen constants. This function is called whenever a new viewport parameters node is defined.

The function call is `vpt_path_init(graphics_path)`, where *graphics_path* is a pointer to the graphics path parameters.

`vpt_path_init` does the following:

- Allocates memory for the perspective matrix.
- Allocates memory for the non-perspective matrix.
- Allocates memory for the field-of-view vectors.
- Allocates memory for the resolution.
- Verifies that memory was allocated for all of the structures.

Called By: `vpt_path_setup`

Routines Called: `aam_malloc`
 `printf`

Parameters: `GRAPHICS_PATH_PARAMETERS` `*graphics_path`

Returns: `none`

2.17.15.3 vpt_path_setup

The `vpt_path_setup` function allocates and initializes graphics path nodes, sets pointers to the viewport node, and sets the path id and sibling pointers. This function is called whenever a node with viewport parameters is added to the configuration tree.

The function call is `vpt_path_setup(viewport, vpt_path_param_ptr, num_of_paths_i, num_of_paths_j, start_path_id)`, where:

viewport is a pointer to the viewport parameters
vpt_path_param_ptr is a pointer to the graphics path parameters
num_of_paths_i is the number of paths in the i direction
num_of_paths_j is the number of paths in the j direction
start_path_id is the number of the first path in the structure; this varies by type of backend

For each graphics path entry in the structure, `vpt_path_setup` does the following:

- Calls `vpt_path_get` to allocate memory for the graphics paths and get a pointer to the first path structure in the group.
- Sets the viewport pointer to point to the first path.

- Calls `vpt_path_init` to allocate memory for the matrices, fov vectors, etc.
- Sets the graphics path pointer to point to the viewport.
- Sets the graphics path's path id to the start path id.

The function always returns SUCCEED.

Called By: `vpt_vpt_set`

Routines Called: `printf` (in debug mode only)
`vpt_path_get`
`vpt_path_init`
`vpti_state_dpath` (in debug mode only)

Parameters: `VIEWPORT_PARAMETERS` *viewport
`GRAPHICS_PATH_PARAMETERS` **vpt_path_param_ptr
`INT_2` num_of_paths_i
`INT_2` num_of_paths_j
`INT_2` start_path_id

Returns: 1 (SUCCEED)

2.17.16 `path_query.c` (`vpt_path_query`)

The `vpt_path_query` function copies graphics path node information (path id, field-of-view vectors, resolution, screen constants, etc.) to a query structure. This function is used in testing only.

The function call is `vpt_path_query(gp, pi)`, where:

gp is a pointer to the graphics path parameters
pi is a pointer to the query structure

`vpt_path_query` zeroes out the query structure before copying the data to it.

Called By: `vptq_grout`

Routines Called: `printf` (in debug mode only)
`vpti_state_dpath` (in debug mode only)

Parameters: `GRAPHICS_PATH_PARAMETERS` *gp
`VPT_PATH_INFO` *pi

Returns: none

2.17.17 `trav_tree.c`

The `trav_tree` function traverses up each viewport node and sets up a branch array for each viewport. This array can be used to determine which viewports are active at any given time.

The function call is `trav_tree()`.

| | |
|------------------|--|
| Called By: | <code>cig_config</code> <code>tst_equery</code> |
| Routines Called: | <code>printf</code> <code>vpti_get_ptr_vpt</code> |
| Parameters: | none |
| Returns: | none |

2.17.18 `tst_edebug.c`

The `tst_edebug` function reports the state of all Viewport Configuration debug flags and lets the Gossip user toggle them. This function is called if the user selects the 1 ("Change debug switches") option from the Viewport Test menu.

The function call is `tst_edebug()`. `tst_edebug` displays the Current Debug Switches menu showing the current state of each debug flag. (The function calls the `vpti_state_*` functions to determine the current states.) The user can select an option from the menu to toggle the state of the corresponding flag.

The following table identifies the options on the Current Debug Switches menu and shows the steps performed by `tst_edebug` in response to each selection. For definitions of the variables referenced here, see `globals.c`.

| Current Debug Switches Menu Option | Processing by tst_edebug |
|------------------------------------|---|
| 1 Debug Matrix | Calls vpti_togstate_dmatrix to toggle Gvpt_dmatrix. |
| 2 Debug Viewport Node | Calls vpti_togstate_dvptnode to toggle Gvpt_dvptnode. |
| 3 Debug Path | Calls vpti_togstate_dpath to toggle Gvpt_dpath. |
| 4 Debug Config Node | Calls vpti_togstate_dcnode to toggle Gvpt_dcnode. |
| 5 Debug LOD | Calls vpti_togstate_dlodmult to toggle Gvpt_dlodmult. |
| 6 Short tree debug | Calls vpti_togstate_dtree_short to toggle Gvpt_dtree_short. |
| 7 Tree proc debug | Calls vpti_togstate_dtproc to toggle Gvpt_dtproc. |
| 8 Exit at fill tree | Calls vpti_togstate_efillt to toggle Gvpt_efillt. |
| 9 Exit at dtp comp | Calls vpti_togstate_edtpc to toggle Gvpt_edtpc. |
| a Panel alignment | Calls vpti_togstate_panel_align to toggle Gvpt_panel_align. |
| x Exit this menu | Exits. |

Called By: tst_tree

Routines Called: printf
 scanf
 vpti_state_dcnode
 vpti_state_dlodmult
 vpti_state_dmatrix
 vpti_state_dpath
 vpti_state_dtproc
 vpti_state_dtree_short
 vpti_state_dvptnode
 vpti_state_edtpc
 vpti_state_efillt
 vpti_state_panel_align
 vpti_togstate_dcnode
 vpti_togstate_dlodmult
 vpti_togstate_dmatrix
 vpti_togstate_dpath
 vpti_togstate_dtproc
 vpti_togstate_dtree_short
 vpti_togstate_dvptnode
 vpti_togstate_edtpc
 vpti_togstate_efillt
 vpti_togstate_panel_align

Parameters: none

Returns: none

2.17.19 `tst_equery.c`

The functions in the `tst_equery.c` CSU let the Gossip user query (view) the data in any configuration node, viewport parameters, or graphics path parameters structure. These functions are:

- `tst_equery`
- `vptq_grptrs`
- `vptq_vpptrs`
- `vptq_cnptrs`
- `vptq_brvals`
- `vptq_activept`
- `vptq_vptbrout`
- `vptq_dynmtx`
- `vptq_cnout`
- `vptq_vpout`
- `vptq_grout`

The `tst_equery` function presents a menu from which the user selects the type of data to view. Each `vptq_*` function displays a specific type of data.

2.17.19.1 `tst_equery`

The `tst_equery` function presents a menu to the Gossip user to allow viewing of configuration tree node data, viewport parameters, and graphics path parameters. This function is called if the user selects the 2 ("Query mode") option from the Viewport Test menu.

The function call is `tst_equery`. The following table identifies the options supported by `tst_equery`, and shows the steps performed by `tst_equery` for each user selection.

| Query Mode Menu Option | Processing by <code>tst_query</code> |
|--|--------------------------------------|
| ? Display options | Displays this menu. |
| 1 Show confignode pointers table | Calls <code>vptq_cnptrs</code> . |
| 2 Show viewport pointers table | Calls <code>vptq_vpptrs</code> . |
| 3 Show graphics path pointers table | Calls <code>vptq_grptrs</code> . |
| 4 Query confignode given table offset | Calls <code>vptq_cnout</code> . |
| 5 Query viewport given table offset | Calls <code>vptq_vpout</code> . |
| 6 Query graphics path given table offset | Calls <code>vptq_grout</code> . |
| 7 Show branch node info | Calls <code>vptq_brvals</code> . |
| 8 Show matrix node info | Calls <code>vptq_dynmtx</code> . |
| 9 Show viewport branch mask info | Calls <code>vptq_vptbrout</code> . |
| A Compute active viewports | Calls <code>vptq_activevpt</code> . |
| B Call trav tree | Calls <code>trav_tree</code> . |
| X Exit this menu | Exits. |

Called By: `tst_tree`

Routines Called:

- `printf`
- `scanf`
- `trav_tree`
- `vptq_activevpt`
- `vptq_brvals`
- `vptq_cnout`
- `vptq_cnptrs`
- `vptq_dynmtx`
- `vptq_grout`
- `vptq_grptrs`
- `vptq_vpout`
- `vptq_vpptrs`
- `vptq_vptbrout`

Parameters: none

Returns: none

2.17.19.2 `vptq_grptrs`

The `vptq_grptrs` function displays the graphics path pointers for each node with viewport parameters. This function is called if the Gossip user selects the 3 ("Show graphics path pointers table") option from the Query Mode menu.

The function call is `vptq_grptrs()`.

Called By: tst_equery

Routines Called: printf
 vpti_get_ptr_path

Parameters: none

Returns: none

2.17.19.3 vptq_vpptrs

The vptq_vpptrs function displays the viewport node pointers for every node with viewport parameters. This function is called if the Gossip user selects the 2 ("Show viewport pointers table") option from the Query Mode menu.

The function call is vptq_vpptrs().

Called By: tst_equery

Routines Called: printf
 vpti_get_ptr_vpt

Parameters: none

Returns: none

2.17.19.4 vptq_cnptrs

The vptq_cnptrs function displays the configuration node pointers for all nodes in the configuration tree. This function is called if the Gossip user selects the 1 ("Show confignode pointers table") option from the Query Mode menu.

The function call is vptq_cnptrs().

Called By: tst_equery

Routines Called: printf
 vpti_get_ptr_cnode

Parameters: none

Returns: none

2.17.19.5 vptq_brvals

The vptq_brvals function displays information on all branch (conditional) nodes in the configuration tree. The displayed shows each node's node index, branch mask, branch index, current branch value, and description. This function is called if the Gossip user selects the 7 ("Show branch node info") option from the Query Mode menu.

The function call is vptq_brvals().

Called By: tst_equery

Routines Called: printf
scanf
vpt_cnode_query
vpti_get_ptr_cnode

Parameters: none

Returns: none

2.17.19.6 vptq_activept

The vptq_activept function determines the node index and viewport id of each viewport that is currently active, using the array created by trav_tree. This function is called if the Gossip user selects the A ("Compute active viewports") option from the Query Mode menu.

The function call is vptq_activept().

Called By: tst_equery

Routines Called: be_query_buffer_offset
printf (in debug mode only)
vpt_cnode_groot
vpt_get_ptr_vpt

Parameters: none

Returns: none

2.17.19.7 vptq_vptbrout

The vptq_vptbrout function displays branch mask information for each viewport node. The display shows each node's viewport id, node index, and branch value status. This function is called if the Gossip user selects the 9 ("Show viewport branch mask info") option from the Query Mode menu.

The function call is vptq_vptbrout().

| | |
|------------------|-------------------------------------|
| Called By: | tst_equery |
| Routines Called: | printf scanf vpti_get_ptr_vpt |
| Parameters: | none |
| Returns: | none |

2.17.19.8 vptq_dynmtx

The vptq_dynmtx function displays matrix information for every configuration node defined as a dynamic (changeable) matrix node. The display shows each node's matrix type, description, and current matrix. This function is called if the Gossip user selects the 8 ("Show matrix node info") option from the Query Mode menu.

The function call is vptq_dynmtx().

| | |
|------------------|--|
| Called By: | tst_equery |
| Routines Called: | printf r4mat_dump scanf vpt_cnode_query vpti_get_ptr_cnode |
| Parameters: | none |
| Returns: | none |

2.17.19.9 vptq_cnout

The vptq_cnout function displays detailed information describing a specific configuration node. The user is first prompted for the configuration node pointer. The display includes the node's index, parent index, matrix type, branch index, sibling and child pointers, matrix, etc. This function is called if the Gossip user selects the 4 ("Query confignode given table offset") option from the Query Mode menu.

The function call is vptq_cnout().

| | |
|------------------|--|
| Called By: | tst_equery |
| Routines Called: | printf r4mat_dump scanf vpt_cnode_query vpti_get_ptr_cnode |
| Parameters: | none |
| Returns: | none |

2.17.19.10 vptq_vpout

The vptq_vpout function displays detailed information describing a specific viewport node. The user is first prompted for the viewport parameters pointer. The display includes the node index, viewport id, field-of-view parameters, level-of-detail parameters, resolution, near plane, viewing range, etc. This function is called if the Gossip user selects the 5 ("Query viewport given table offset") option from the Query Mode menu.

The function call is vptq_vpout().

| | |
|------------------|--|
| Called By: | tst_equery |
| Routines Called: | printf scanf vpt_vpt_query vpti_get_ptr_vpt |
| Parameters: | none |
| Returns: | none |

2.17.19.11 vptq_grout

The `vptq_grout` function displays detailed information describing a specific graphics path. The user is first prompted for the graphics path pointer. The display includes the path id, viewport id, panel alignment setting, field-of-view angles, screen resolution, vector data, screen constants, etc. If the node has a sibling, the user is given the option of dumping the sibling's data also. This function is called if the Gossip user selects the 6 ("Query graphics path given table offset") option from the Query Mode menu.

The function call is `vptq_grout()`.

| | |
|------------------|--|
| Called By: | tst_equery |
| Routines Called: | printf r4mat_dump scanf vpt_path_query vpti_get_ptr_path |
| Parameters: | none |
| Returns: | none |

2.17.20 tst_ereadconfig.c

The functions in the `tst_ereadconfig.c` CSU support building a configuration tree from an ASCII file created offline. These functions accommodate testing the viewport configuration process without connection to a Simulation Host.

The functions in `tst_ereadconfig` are:

- `tst_ereadconfig`
- `p_configtree_node`
- `p_viewport_state`
- `p_overlay_setup`
- `setup_p_terrain_feedback`
- `p_terrain_feedback`

The messages (commands) that can be included in the ASCII configuration file are defined in the `vpi_msgs.h` file. These are not the same messages as those used by the Simulation Host to define a viewport configuration tree.

2.17.20.1 `tst_ereadconfig`

The `tst_ereadconfig` function reads and processes an ASCII viewport configuration file created offline. This function is called if the Gossip user selects the "Read configuration file and process" option from the Viewport Test menu.

The function call is `tst_ereadconfig()`. `tst_ereadconfig` does the following:

- Prompts the user to enter the name of the configuration file to be processed.
- Opens the specified file.
- Reads a line from the file into a command buffer.
- Processes the message in the command buffer as follows:
 - START_CONFIGTREE_NODE - Calls `p_configtree_node`.
 - START_VIEWPORT_STATE - Calls `p_viewport_state`.
 - START_OVERLAY_SETUP - Calls `p_overlay_setup`.
 - START_TERRAIN_FEEDBACK - Calls `setup_p_terrain_feedback`.
 - START_TERRAIN_FEEDBACK_POINT_INIT - Calls `p_terrain_feedback`.
- When an END message is detected, closes the file.

The function exits with a 1 if the specified file cannot be opened.

| | |
|------------------|--|
| Called By: | <code>tst_tree</code> |
| Routines Called: | <code>exit</code> <code>fclose</code> <code>fopen</code> <code>fscanf</code> <code>p_configtree_node</code> <code>p_overlay_setup</code> <code>p_terrain_feedback</code> <code>p_viewport_state</code> <code>printf</code> <code>scanf</code> <code>setup_p_terrain_feedback</code> <code>strcmp</code> |
| Parameters: | none |
| Returns: | none |

2.17.20.2 `p_configtree_node`

The `p_configtree_node` function handles the creation of all configuration nodes specified in the ASCII viewport configuration file. It builds a Simulation Host-type message, then calls the appropriate `vpt_` function to create the configuration node. This function is called if the file specifies `START_CONFIGTREE_NODE`.

The function call is `p_configtree_node()`. `p_configtree_node` does the following:

- Initializes the `MSG_CREATE_CONFIGNODE` message.
- Reads each parameter in turn from the file into the command buffer.
- Determines the parameter from the command buffer, then reads the corresponding value from the file to build the message.
- Stops reading the file when it detects an `END_CONFIGTREE_NODE` command.
- Calls `vpt_cnode_process` to create the node.

Called By: `tst_ereadconfig`

Routines Called: `fgetc`
`fscanf`
`printf`
`r4mat_dump` (in debug mode only)
`strcmp`
`vpt_cnode_process`
`vpti_state_dcnode` (in debug mode only)

Parameters: none

Returns: none

2.17.20.3 `p_viewport_state`

The `p_viewport_state` function handles the creation of all viewport parameters specified in the ASCII viewport configuration file. It builds a Simulation Host-type message, then calls the appropriate `vpt_` function to create the viewport parameters. This function is called if the file specifies `START_VIEWPORT_STATE`.

The function call is `p_viewport_state()`. `p_viewport_state` does the following:

- Initializes the `MSG_VIEWPORT_STATE` message.
- Reads each parameter in turn from the file into the command buffer.
- Determines the parameter from the command buffer, then reads the corresponding value from the file to build the message.
- Stops reading the file when it detects an `END_VIEWPORT_STATE` command.
- Calls `vpt_vpt_process` to create the viewport parameters.

Called By: `tst_ereadconfig`

Routines Called: `fscanf`
`printf`
`strcmp`
`vpt_vpt_process`
`vpti_state_dvptnode` (in debug mode only)

Parameters: none

Returns: none

2.17.20.4 p_overlay_setup

The `p_overlay_setup` function handles the creation of all gun barrel and gunner overlays specified in the ASCII viewport configuration file by building a Simulation Host-type message. This function is called if the file specifies `START_OVERLAY_SETUP`.

The function call is `p_overlay_setup()`. `p_overlay_setup` does the following:

- Initializes the `MSG_OVERLAY_SETUP` message.
- Reads each parameter in turn from the file into the command buffer.
- Determines the parameter from the command buffer, then reads the corresponding value from the file to build the message.
- Stops reading the file when it detects an `END_OVERLAY_SETUP` command.

Called By: `tst_ereadconfig`

Routines Called: `fscanf`
`printf`
`strcmp`

Parameters: none

Returns: none

2.17.20.5 setup_p_terrain_feedback

The `setup_p_terrain_feedback` function handles the creation of the terrain feedback header record specified in the ASCII viewport configuration file, by building a Simulation Host-type message. This function is called if the file specifies `START_TERRAIN_FEEDBACK`.

The function call is `setup_p_terrain_feedback()`. The function does the following:

- Initializes a `MSG_TERRAIN_FEEDBACK_SETUP` message.
- Reads the point count from the file and puts it into the message.

Called By: `tst_ereadconfig`

Routines Called: `fscanf`

Parameters: none

Returns: none

2.17.20.6 p_terrain_feedback

The `p_terrain_feedback` function handles the creation of all terrain feedback points records specified in the ASCII viewport configuration file, by building a Simulation Host-type message. This function is called if the file specifies `START_TERRAIN_FEEDBACK_POINT_INIT`.

The function call is `p_terrain_feedback()`. The function does the following:

- Initializes the `MSG_TERRAIN_FEEDBACK_POINT_INIT` message.
- Reads each parameter in turn from the file into the command buffer.
- Determines the parameter from the command buffer, then reads the corresponding value from the file to build the message.
- Stops reading the file when it detects an `END_TERRAIN_FEEDBACK_POINT_INIT` command.

Called By: `tst_ereadconfig`

Routines Called: `fscanf`
`printf`
`strcmp`

Parameters: none

Returns: none

2.17.21 tst_eupdate.c

The `tst_eupdate` function can be used to update configuration node data, viewport parameters, and graphics path parameters for debugging or testing purposes. This function is called if the Gossip user selects the U ("Update config node and viewport information") option from the Viewport Test menu.

The function call is `tst_eupdate()`. `tst_eupdate` presents a menu that allows the user to select the data to be changed. It then prompts the user for the new values and calls the appropriate `vpt_update_*` function to make the change.

The following table lists the options supported by `tst_eupdate`, and shows the major steps it performs for each selection.

| Update Menu Option | Processing by tst_eupdate |
|-------------------------------|---|
| 0 Update branch mask | Prompts user for configuration node index and branch mask; calls vpt_update_brmask. |
| 1 Update 4x3 matrix | Prompts user for configuration node index, time stamp, and new matrix; calls vpt_update_4x3_matrix. |
| 2 Update 3x3 matrix | Prompts user for configuration node index, time stamp, heading, pitch, roll, x, y, and z; calls vpt_update_3x3_matrix. |
| 3 Update hprxyzs | Prompts user for configuration node index, time stamp, heading, pitch, roll, x, y, and z; calls vpt_update_hprxyzs. |
| 4 Update translation | Prompts user for configuration node index, time stamp, and translation x, y, and z; calls vpt_update_translation. |
| 5 Update scale | Prompts user for configuration node index, time stamp, and scale x, y, and z; calls vpt_update_scale. |
| 6 Update 2x1 heading | Prompts user for configuration node index, time stamp, and heading value; calculates rotation values; calls vpt_update_2x1_heading. |
| 7 Update 2x1 pitch | Prompts user for configuration node index, time stamp, and pitch value; calculates rotation values; calls vpt_update_2x1_pitch. |
| 8 Update 2x1 roll | Prompts user for configuration node index, time stamp, and roll value; calculates rotation values; calls vpt_update_2x1_roll. |
| 9 Update heading | Prompts user for configuration node index, time stamp, and heading value; calls vpt_update_heading. |
| A Update pitch | Prompts user for configuration node index, time stamp, and pitch value; calls vpt_update_pitch. |
| B Update roll | Prompts user for configuration node index, time stamp, and roll value; calls vpt_update_roll. |
| C Update heading, pitch, roll | Prompts user for configuration node index, time stamp, heading, pitch, and roll; calls vpt_update_hpr. |
| D Update all viewport values | Prompts user for node index, fov angles, resolution, viewing range, near plane, and lod multiplier; calls vpt_update_all. |
| E Update field of view | Prompts user for node index and fov angles; calls vpt_update_fov. |
| F Update lod multiplier | Prompts user for node index and lod multiplier; calls vpt_update_lodm. |
| G Update near plane | Prompts user for node index and near plane; calls vpt_update_near_plane. |
| H Update resolution | Prompts user for node index and resolution; calls vpt_update_rez. |
| I Update viewing range | Prompts user for node index and viewing range; calls vpt_update_view_range. |
| J Update graphics path | Prompts user for node index, path index, path fov, path resolution, and path center in degrees; calls vpt_update_one_path. |

| | |
|--------|--------|
| X Exit | Exits. |
|--------|--------|

Called By: tst_tree

Routines Called: cos
 printf
 scanf
 sin
 TORAD
 vpt_update_2x1_heading
 vpt_update_2x1_pitch
 vpt_update_2x1_roll
 vpt_update_3x3_matrix
 vpt_update_4x3_matrix
 vpt_update_all
 vpt_update_brmask
 vpt_update_fov
 vpt_update_heading
 vpt_update_hpr
 vpt_update_hprxyzs
 vpt_update_lodm
 vpt_update_near_plane
 vpt_update_one_path
 vpt_update_pitch
 vpt_update_rez
 vpt_update_roll
 vpt_update_scale
 vpt_update_translation
 vpt_update_view_range

Parameters: none

Returns: none

2.17.22 tst_tree.c

The functions in the `tst_tree.c` CSU are used to present a user interface to the Viewport Configuration test routines. These functions are:

- `tst_tree`
- `mem_check`

2.17.22.1 tst_tree

The `tst_tree` function provides an interface for the user for debug, update, and test options that can be used to exercise the Viewport Configuration tree. This function is invoked

through Gossip when the user selects the 7 ("configtree menu") option from the Gossip main menu.

The function call is `tst_tree()`. The following table identifies the options displayed and supported by `tst_tree`, and shows the steps it performs for each user selection.

| Viewport Test Menu Option | Processing by <code>tst_tree</code> |
|---|--------------------------------------|
| ? Display options | Displays this menu. |
| 0 Read configuration file and process | Calls <code>tst_ereadconfig</code> . |
| 1 Change debug switches | Calls <code>tst_edebug</code> . |
| 2 Query mode | Calls <code>tst_equery</code> . |
| F Tree Free | Calls <code>vpt_tree_free</code> . |
| I Tree Initialize | Calls <code>vpt_tree_init</code> . |
| M Memory alloc test | Calls <code>print_allocp</code> . |
| T Trace tree information | Calls <code>tst_treetrace</code> . |
| U Update config node and viewport information | Calls <code>tst_eupdate</code> . |
| X Exit | Exits. |

Called By: `gossip_tick`

Routines Called:

- `print_allocp`
- `printf`
- `scanf`
- `tst_edebug`
- `tst_equery`
- `tst_ereadconfig`
- `tst_eupdate`
- `tst_treetrace`
- `vpt_tree_free`
- `vpt_tree_init`

Parameters: `none`

Returns: `none`

2.17.22.2 `mem_check`

The `mem_check` function calls `malloc` to determine the next available memory address, displays the address, then frees the memory.

The function call is `mem_check()`.

This function is not currently used.

Called By: none

Routines Called: free
malloc
printf

Parameters: none

Returns: none

2.17.23 tst_treetrace.c

The functions in the `tst_treetrace.c` CSU are used to trace a node's path through the configuration tree. These functions are:

- `tst_treetrace`
- `pr_branch`
- `pr_matrix`

2.17.23.1 tst_treetrace

The `tst_treetrace` function, given a node index, displays the node's information and all information about the node's children. This function is called if the Gossip user selects the T ("Tree trace information") option from the Viewport Test menu.

The function call is `tst_treetrace()`. The function does the following:

- Prompts the user for the starting node index.
- Calls `vpti_get_ptr_cnode` to get a pointer to the starting node.
- Calls `vpt_cnode_query` to get information on the starting node.
- If the node is a branch (conditional) node, calls `pr_branch` to display the information. If the node is a matrix node, calls `pr_matrix` to display the information.
- If the node has children, repeats the above process for each child node.
- Prompts the user for another starting node; repeats until the user enters **999**.

Called By: `tst_tree`

Routines Called: `pr_branch`
`pr_matrix`
`printf`
`scanf`
`vpt_cnode_query`
`vpti_get_ptr_cnode`

Parameters: none

Returns: none

2.17.23.2 pr_branch

The `pr_branch` function displays information on branch (conditional) nodes. This function is called by `tst_tretrace` if the node to be displayed is defined as a branch node.

The function call is `pr_branch(info)`, where *info* is a pointer to the configuration node information structure.

`pr_branch` outputs the node's node index, branch index, branch mask, and description. If the `Gvpt_dtree_short` variable is set to `FALSE`, it also outputs the node's parent index, true child flag, and vehicle id.

Called By: `tst_tretrace`

Routines Called: `printf`
`vpti_state_dtree_short`

Parameters: `VPT_CNODE_INFO` *info

Returns: none

2.17.23.3 pr_matrix

The `pr_matrix` function displays information on matrix nodes. This function is called by `tst_tretrace` if the node to be displayed is defined as a matrix node.

The function call is `pr_matrix(info)`, where *info* is a pointer to the configuration node information structure.

`pr_matrix` outputs the node's node index, matrix type, static matrix flag, branch mask, and description. If the node has viewport parameters attached, `pr_matrix` outputs a statement to that effect.

If the `Gvpt_dtree_short` variable is set to `FALSE`, `pr_matrix` also outputs the node's parent index, true child flag, vehicle id, and, if the matrix type is `RTS4x3`, the node's matrix.

Called By: `tst_tretrace`

Routines Called: `printf`
`r4mat_dump`

vpti_state_dtree_short

Parameters: VPT_CNODE_INFO *info

Returns: none

2.17.24 u_brmask.c (vpt_update_brmask)

The `vpt_update_brmask` function updates (changes) the branch mask of a specified configuration node. This function is called if the Gossip user selects the 0 ("Update branch mask") option from the Update menu.

The function call is `vpt_update_brmask(node_index, br_mask)`, where:

node_index is the unique index used to reference this node
br_mask is the new branch mask

`vpt_update_brmask` does the following:

- Gets a pointer to the node.
- Makes sure this is *not* the root node (`node_index = 0`).
- Updates the node's branch mask.

The function returns `SUCCEED` if it is successful. It returns `FAIL` if the specified node is the root node, or if it could not get a pointer to the node.

Called By: tst_eupdate

Routines Called: printf
 vpti_get_ptr_cnode
 vpti_state_dcnode (in debug mode only)

Parameters: INT_2 node_index
 UNS_4 br_mask

Returns: 1 (SUCCEED)
 0 (FAIL)

2.17.25 u_path.c (vpt_update_one_path)

The `vpt_update_one_path` function updates a single graphics path's parameters (field-of-view angles, resolution, and path center). This function is called if the Gossip user selects the J ("Update graphics path") option from the Update menu.

The function call is `vpt_update_one_path(node_index, path_id, fov, rez, center)`, where:

node_index is the unique index used to reference this node
path_id identifies the graphics path
fov is the path's field-of-view
rez is the path's resolution
center is the center of the path in degrees

`vpt_update_one_path` does the following:

- Gets a pointer to the specified node.
- Verifies that the node has viewport parameters attached to it.
- Sets the new values.
- Calls `vpt_path_update` to update the path with the new parameters.

The function returns SUCCEED if it is successful. It returns FAIL if it cannot get a pointer to the node, the node does not have viewport parameters, or `vpt_path_update` cannot update the graphics path.

Called By: `tst_eupdate`

Routines Called: `be_query_buffer_offset`
 `vpt_path_update`
 `vpti_get_ptr_cnode`

| | | |
|-------------|---------------------|-------------------------|
| Parameters: | <code>INT_2</code> | <code>node_index</code> |
| | <code>INT_2</code> | <code>path_id</code> |
| | <code>R4IJ</code> | <code>fov</code> |
| | <code>I4IJ</code> | <code>rez</code> |
| | <code>REAL_4</code> | <code>center</code> |

Returns: `1 (SUCCEED)`
 `0 (FAIL)`

2.17.26 `u_rotations.c`

The functions in the `u_rotations.c` CSU update part or all of the rotation matrix for a given configuration node. These functions are:

- `vpt_update_2x1_heading`
- `vpt_update_2x1_pitch`
- `vpt_update_2x1_roll`
- `vpt_update_heading`
- `vpt_update_pitch`
- `vpt_update_roll`
- `vpt_update_hpr`

2.17.26.1 vpt_update_2x1_heading

The `vpt_update_2x1_heading` function is used to update a matrix node's heading. This function is called when the Simulation Host sends a `MSG_ROT2x1_MATRIX` message to rotate an `RTS4x3` matrix around axis 0. It is also invoked through Gossip if the user selects the 6 ("Update 2x1 heading") option from the Update menu.

The function call is `vpt_update_2x1_heading(node_index, time_stamp, cosrotation, sinrotation)`, where:

node_index is the unique index used to reference this node
time_stamp is the time stamped in the Simulation Host message
cosrotation is the cosine of the angle of rotation
sinrotation is the sine of the angle of rotation

`vpt_update_2x1_heading` calls `vpt_update_rot` to perform the indicated rotation. It then returns the *status* returned from `vpt_update_rot`: SUCCEED or FAIL.

| | | |
|------------------|--|--|
| Called By: | <code>msg_rot2x1_matrix</code> <code>tst_eupdate</code> | |
| Routines Called: | <code>printf</code> <code>vpt_update_rot</code> | |
| Parameters: | <code>INT_2</code> <code>INT_2</code> <code>REAL_4</code> <code>REAL_4</code> | <code>node_index</code> <code>time_stamp</code> <code>cosrotation</code> <code>sinrotation</code> |
| Returns: | <code>status</code> | |

2.17.26.2 vpt_update_2x1_pitch

The `vpt_update_2x1_pitch` function is used to update a matrix node's pitch. This function is called when the Simulation Host sends a `MSG_ROT2x1_MATRIX` message to rotate an `RTS4x3` matrix around axis 1. It is also invoked through Gossip if the user selects the 7 ("Update 2x1 pitch") option from the Update menu.

The function call is `vpt_update_2x1_pitch(node_index, time_stamp, cosrotation, sinrotation)`, where:

node_index is the unique index used to reference this node
time_stamp is the time stamped in the Simulation Host message
cosrotation is the cosine of the angle of rotation
sinrotation is the sine of the angle of rotation

`vpt_update_2x1_pitch` calls `vpt_update_rot` to perform the indicated rotation. It then returns the *status* returned from `vpt_update_rot`: SUCCEED or FAIL.

| | | |
|------------------|--|--|
| Called By: | <code>msg_rot2x1_matrix</code> <code>tst_eupdate</code> | |
| Routines Called: | <code>printf</code> <code>vpt_update_rot</code> | |
| Parameters: | <code>INT_2</code> <code>INT_2</code> <code>REAL_4</code> <code>REAL_4</code> | <code>node_index</code> <code>time_stamp</code> <code>cosrotation</code> <code>sinrotation</code> |
| Returns: | <code>status</code> | |

2.17.26.3 `vpt_update_2x1_roll`

The `vpt_update_2x1_roll` function is used to update a matrix node's roll. This function is called when the Simulation Host sends a `MSG_ROT2x1_MATRIX` message to rotate an RTS4x3 matrix around axis 2. It is also invoked through Gossip if the user selects the 8 ("Update 2x1 roll") option from the Update menu.

The function call is `vpt_update_2x1_roll(node_index, time_stamp, cosrotation, sinrotation)`, where:

node_index is the unique index used to reference this node
time_stamp is the time stamped in the Simulation Host message
cosrotation is the cosine of the angle of rotation
sinrotation is the sine of the angle of rotation

`vpt_update_2x1_roll` calls `vpt_update_rot` to perform the indicated rotation. It then returns the *status* returned from `vpt_update_rot`: SUCCEED or FAIL.

| | | |
|------------------|--|--|
| Called By: | <code>msg_rot2x1_matrix</code> <code>tst_eupdate</code> | |
| Routines Called: | <code>printf</code> <code>vpt_update_rot</code> | |
| Parameters: | <code>INT_2</code> <code>INT_2</code> <code>REAL_4</code> <code>REAL_4</code> | <code>node_index</code> <code>time_stamp</code> <code>cosrotation</code> <code>sinrotation</code> |

Returns: status

2.17.26.4 vpt_update_heading

The `vpt_update_heading` function is used to update a matrix node's heading. This function is called when the Simulation Host sends a `MSG_1ROTATION` message to rotate an `HPRXYZS` matrix around axis 0 (heading). It is also invoked through Gossip if the user selects the 9 ("Update heading") option from the Update menu.

The function call is `vpt_update_heading(node_index, time_stamp, rotation)`, where:

node_index is the unique index used to reference this node
time_stamp is the time stamped in the Simulation Host message
rotation is the angle of rotation in degrees

`vpt_update_heading` calls `vpt_update_rot` to perform the indicated rotation. It then returns the *status* returned from `vpt_update_rot`: SUCCEED or FAIL.

Called By: msg_1rotation
 tst_eupdate

Routines Called: printf
 vpt_update_rot

Parameters: INT_2 node_index
 INT_2 time_stamp
 REAL_4 rotation

Returns: status

2.17.26.5 vpt_update_pitch

The `vpt_update_pitch` function is used to update a matrix node's pitch. This function is called when the Simulation Host sends a `MSG_1ROTATION` message to rotate an `HPRXYZS` matrix around axis 1 (pitch). It is also invoked through Gossip if the user selects the A ("Update pitch") option from the Update menu.

The function call is `vpt_update_pitch(node_index, time_stamp, rotation)`, where:

node_index is the unique index used to reference this node
time_stamp is the time stamped in the Simulation Host message
rotation is the angle of rotation in degrees

`vpt_update_pitch` calls `vpt_update_rot` to perform the indicated rotation. It then returns the *status* returned from `vpt_update_rot`: SUCCEED or FAIL.

Called By: msg_1rotation
 tst_eupdate

Routines Called: printf
 vpt_update_rot

Parameters: INT_2 node_index
 INT_2 time_stamp
 REAL_4 rotation

Returns: status

2.17.26.6 vpt_update_roll

The `vpt_update_roll` function is used to update a matrix node's roll. This function is called when the Simulation Host sends a `MSG_1ROTATION` message to rotate an `HPRXYZS` matrix around axis 2 (roll). It is also invoked through Gossip if the user selects the **B** ("Update roll") option from the Update menu.

The function call is `vpt_update_roll(node_index, time_stamp, rotation)`, where:

node_index is the unique index used to reference this node
time_stamp is the time stamped in the Simulation Host message
rotation is the angle of rotation in degrees

`vpt_update_roll` calls `vpt_update_rot` to perform the indicated rotation. It then returns the *status* returned from `vpt_update_rot`: SUCCEED or FAIL.

Called By: msg_1rotation
 tst_eupdate

Routines Called: printf
 vpt_update_rot

Parameters: INT_2 node_index
 INT_2 time_stamp
 REAL_4 rotation

Returns: status

2.17.26.7 vpt_update_hpr

The `vpt_update_hpr` function is used to update a matrix node's heading, pitch, and roll. This function is called when the Simulation Host sends a `MSG_3ROTATIONS` message

for an HPRXYZS matrix. It is also invoked through Gossip if the user selects the C ("Update heading, pitch, roll") option from the Update menu.

The function call is `vpt_update_hpr(node_index, time_stamp, h, p, r)`, where:

node_index is the unique index used to reference this node
time_stamp is the time stamped in the Simulation Host message
h is the new heading in degrees
p is the new pitch in degrees
r is the new roll in degrees

`vpt_update_hpr` calls `vpt_update_rot` to perform the indicated rotations. It then returns the *status* returned from `vpt_update_rot`: SUCCEED or FAIL.

| | | |
|------------------|---|--|
| Called By: | <code>msg_3rotations</code> <code>tst_eupdate</code> | |
| Routines Called: | <code>printf</code> <code>vpt_update_rot</code> | |
| Parameters: | <code>INT_2</code> <code>INT_2</code> <code>REAL_4</code> <code>REAL_4</code> <code>REAL_4</code> | <code>node_index</code> <code>time_stamp</code> <code>h</code> <code>p</code> <code>r</code> |
| Returns: | <code>status</code> | |

2.17.27 u_viewport.c

The functions in the `u_viewport.c` CSU are used to update a configuration node's viewport parameters. These functions are:

- `vpt_update_fov`
- `vpt_update_fov_lod`
- `vpt_update_lodm`
- `vpt_update_near_plane`
- `vpt_update_rez`
- `vpt_update_view_range`
- `vpt_update_all`

Most of these functions are currently used only for testing (via Gossip).

2.17.27.1 vpt_update_fov

The `vpt_update_fov` function is used to update a viewport node's field-of-view. This function is invoked through Gossip if the user selects the E ("Update field of view") option from the Update menu.

The function call is **vpt_update_fov(index, fov)**, where:

index is the viewport node's index
fov is the new field-of-view

vpt_update_fov gets a pointer to the viewport parameters, then calls **vpt_update** to perform the update. The function returns the *status* (SUCCEED or FAIL) returned from **vpt_update**. It returns FAIL if it could not get a pointer to the viewport parameters.

| | | |
|------------------|---|--------------|
| Called By: | tst_eupdate | |
| Routines Called: | be_query_buffer_offset vpt_update vpti_get_vptptr_cnode | |
| Parameters: | INT_2 R4IJ | index fov |
| Returns: | status 0 (FAIL) | |

2.17.27.2 vpt_update_fov_lod

The **vpt_update_fov_lod** function updates a viewport node's field-of-view and level-of-detail multiplier. This function is called when the Simulation Host sends a **MSG_VIEW_MAGNIFICATION** message.

The function call is **vpt_update_fov_lod(index, fov, lod)**, where:

index is the viewport node's index
fov is the new field-of-view value
lod is the new level-of-detail value

vpt_update_fov_lod gets a pointer to the viewport parameters, then calls **vpt_update** to perform the update. The function returns the *status* (SUCCEED or FAIL) returned from **vpt_update**. It returns FAIL if it could not get a pointer to the viewport parameters.

| | | |
|------------------|---|--------------|
| Called By: | msg_view_magnification | |
| Routines Called: | be_query_buffer_offset vpt_update vpti_get_vptptr_cnode | |
| Parameters: | INT_2 R4IJ | index fov |

REAL_4 lod

Returns: status
0 (FAIL)

2.17.27.3 vpt_update_lodm

The `vpt_update_lodm` function is used to update a viewport node's level-of-detail multiplier. This function is invoked through Gossip if the user selects the F ("Update lod multiplier") option from the Update menu.

The function call is `vpt_update_lodm(index, lod_multiplier)`, where:

index is the viewport node's index
lod_multiplier is the new level-of-detail

`vpt_update_lodm` gets a pointer to the viewport parameters, then calls `vpt_update` to perform the update. The function returns the *status* (SUCCEED or FAIL) returned from `vpt_update`. It returns FAIL if it could not get a pointer to the viewport parameters.

Called By: tst_eupdate

Routines Called: be_query_buffer_offset
vpt_update
vpti_get_vptptr_cnode

Parameters: INT_2 index
REAL_4 lod_multiplier

Returns: status
0 (FAIL)

2.17.27.4 vpt_update_near_plane

The `vpt_update_near_plane` function is used to update a viewport node's near plane (the closest point that can be seen from the viewport). This function is invoked through Gossip if the user selects the G ("Update near plane") option from the Update menu.

The function call is `vpt_update_near_plane(index, near_plane)`, where:

index is the viewport node's index
near_plane is the near plane value

`vpt_update_near_plane` gets a pointer to the viewport parameters, then calls `vpt_update` to perform the update. The function returns the *status* (SUCCEED or FAIL) returned from `vpt_update`. It returns FAIL if it could not get a pointer to the viewport parameters.

Called By: tst_eupdate

Routines Called: be_query_buffer_offset
 vpt_update
 vpti_get_vptptr_cnode

Parameters: INT_2 index
 REAL_4 near_plane

Returns: status
 0 (FAIL)

2.17.27.5 vpt_update_rez

The `vpt_update_rez` function is used to update a viewport node's screen resolution. This function is invoked through Gossip if the user selects the H ("Update resolution") option from the Update menu.

The function call is `vpt_update_rez(index, rez)`, where:

index is the viewport node's index
rez is the new screen resolution

`vpt_update_rez` gets a pointer to the viewport parameters, then calls `vpt_update` to perform the update. The function returns the *status* (SUCCEED or FAIL) returned from `vpt_update`. It returns FAIL if it could not get a pointer to the viewport parameters.

Called By: tst_eupdate

Routines Called: be_query_buffer_offset
 vpt_update
 vpti_get_vptptr_cnode

Parameters: INT_2 index
 I4IJ rez

Returns: status
 0 (FAIL)

2.17.27.6 vpt_update_view_range

The `vpt_update_view_range` function is used to update a viewport node's viewing range (the distance that can be seen from the viewport). This function is invoked through Gossip if the user selects the I ("Update viewing range") option from the Update menu.

The function call is **vpt_update_view_range(index, viewing_range)**, where:

index is the viewport node's index
viewing_range is the viewing range in meters

vpt_update_view_range gets a pointer to the viewport parameters, then calls **vpt_update** to perform the update. The function returns the *status* (SUCCEED or FAIL) returned from **vpt_update**. It returns FAIL if it could not get a pointer to the viewport parameters.

Called By: **tst_eupdate**

Routines Called: **be_query_buffer_offset**
 vpt_update
 vpti_get_vptptr_cnode

Parameters: **INT_2** **index**
 REAL_4 **viewing_range**

Returns: **status**
 0 (FAIL)

2.17.27.7 **vpt_update_all**

The **vpt_update_all** function is used to update all dynamic parameters associated with a specified viewport. This function is invoked through Gossip if the user selects the **D** ("Update all viewport values") from the Update menu.

The function call is **vpt_update_all(index, fov, rez, viewing_range, near_plane, lod_multiplier)**, where:

index is the viewport node's index
fov is the new field-of-view value
rez is the new resolution
viewing_range is the new viewing range in meters
near_plane is the new near plane value
lod_multiplier is the new level-of-detail multiplier

vpt_update_all gets a pointer to the viewport parameters, then calls **vpt_update** to perform the update. The function returns the *status* (SUCCEED or FAIL) returned from **vpt_update**. It returns FAIL if it could not get a pointer to the viewport parameters.

Called By: **tst_eupdate**

Routines Called: **be_query_buffer_offset**
 vpt_update
 vpti_get_vptptr_cnode

| | | |
|-------------|---|--|
| Parameters: | INT_2 R4IJ I4IJ REAL_4 REAL_4 REAL_4 | index fov rez viewing_range near_plane lod_multiplier |
| Returns: | status 0 (FAIL) | |

2.17.28 u_xfrm.c

The functions in the u_xfrm.c CSU process changes to the transformation matrices in the configuration tree. These functions are:

- vpt_update_4x3_matrix
- vpt_update_3x3_matrix
- vpt_update_hprxyzs
- vpt_update_scale
- vpt_update_translation

2.17.28.1 vpt_update_4x3_matrix

The vpt_update_4x3_matrix function is used to replace the matrix of a configuration node defined with a matrix type of RTS4x3_TYPE. This function is called when the Simulation Host sends a MSG_RTS4x3_MATRIX message. It is also invoked through Gossip if the user selects the 1 ("Update 4x3 matrix") option from the Update menu.

The function call is vpt_update_4x3_matrix(node_index, time_stamp, matrix), where:

node_index is the unique index used to reference this node
time_stamp is the time stamped in the Simulation Host message
matrix is the new transformation matrix

vpt_update_4x3_matrix calls vpt_update_mtx to perform the actual update, then returns the status (SUCCEED or FAIL) returned from vpt_update_mtx.

| | | |
|------------------|----------------------------------|--------------------------|
| Called By: | msg_rts4x3_matrix tst_eupdate | |
| Routines Called: | printf vpt_update_mtx | |
| Parameters: | INT_2 INT_2 | node_index time_stamp |

MTXUNION

*matrix

Returns: status

2.17.28.2 vpt_update_3x3_matrix

The `vpt_update_3x3_matrix` function is used to replace the matrix of a configuration node defined with a matrix type of `RTS3x3_TYPE`. This function is invoked through Gossip if the user selects the 2 ("Update 3x3 matrix") option from the Update menu.

The function call is `vpt_update_3x3_matrix(node_index, time_stamp, matrix)`, where:

node_index is the unique index used to reference this node
time_stamp is the time stamped in the Simulation Host message
matrix is the new transformation matrix

`vpt_update_3x3_matrix` calls `vpt_update_mtx` to perform the actual update, then returns the *status* (SUCCEED or FAIL) returned from `vpt_update_mtx`.

Called By: tst_eupdate

Routines Called: printf
vpt_update_mtxParameters: INT_2 node_index
INT_2 time_stamp
MTXUNION *matrix

Returns: status

2.17.28.3 vpt_update_hprxyzs

The `vpt_update_hprxyzs` function is used to replace the matrix of a configuration node defined with a matrix type of `RTS3x3_TYPE`. This function is called when the Simulation Host sends a `MSG_HPRXYZS` message. It is also invoked through Gossip if the user selects the 3 ("Update hprxyzs") option from the Update menu.

The function call is `vpt_update_hprxyzs(node_index, time_stamp, matrix)`, where:

node_index is the unique index used to reference this node
time_stamp is the time stamped in the Simulation Host message
matrix is the new transformation matrix

`vpt_update_hprxyzs` calls `vpt_update_mtx` to perform the actual update, then returns the *status* (SUCCEED or FAIL) returned from `vpt_update_mtx`.

Called By: msg_hprxyzs_matrix
 tst_eupdate

Routines Called: printf
 vpt_update_mtx

Parameters: INT_2 node_index
 INT_2 time_stamp
 MTXUNION *matrix

Returns: status

2.17.28.4 vpt_update_scale

The vpt_update_scale function is used to change the scale value of a configuration node defined with a matrix type of HPRXYZS_TYPE. This function is called when the Simulation Host sends a MSG_SCALE message. It is also invoked through Gossip if the user selects the 5 ("Update scale") option from the Update menu.

The function call is vpt_update_scale(node_index, time_stamp, x, y, z), where:

node_index is the unique index used to reference this node
time_stamp is the time stamped in the Simulation Host message
x is the new x scale factor
y is the new y scale factor
z is the new z scale factor

vpt_update_scale calls vpt_update_mtx to perform the actual update, then returns the *status* (SUCCEED or FAIL) returned from vpt_update_mtx.

Note: The MSG_SCALE message is reserved for future expansion.

Called By: msg_scale
 tst_eupdate

Routines Called: printf
 vpt_update_mtx

Parameters: INT_2 node_index
 INT_2 time_stamp
 REAL_4 x
 REAL_4 y
 REAL_4 z

Returns: status

2.17.28.5 vpt_update_translation

The `vpt_update_translation` function is used to change the translation value of a configuration node defined with a matrix type of `HPRXYZS_TYPE`. This function is called when the Simulation Host sends a `MSG_TRANSLATION` message. It is also invoked through Gossip if the user selects the 4 ("Update translation") option from the Update menu.

The function call is `vpt_update_translation(node_index, time_stamp, x, y, z)`, where:

node_index is the unique index used to reference this node
time_stamp is the time stamped in the Simulation Host message
x is the new x translation value
y is the new y translation value
z is the new z translation value

`vpt_update_translation` calls `vpt_update_mtx` to perform the actual update, then returns the *status* (SUCCEED or FAIL) returned from `vpt_update_mtx`.

Called By: msg_translation
 tst_eupdate

Routines Called: printf
 vpt_update_mtx

| | | |
|-------------|--------|------------|
| Parameters: | INT_2 | node_index |
| | INT_2 | time_stamp |
| | REAL_4 | x |
| | REAL_4 | y |
| | REAL_4 | z |

Returns: status

2.17.29 update_mtx.c (vpt_update_mtx)

The `vpt_update_mtx` function replaces or modifies the transformation matrices in the configuration tree. This function is called by the functions in the `u_xfrm.c` CSU, which in turn are called when the Simulation Host sends messages to update matrices, and when the Gossip user selects an option to change a matrix.

The function call is `vpt_update_mtx(node_index, time_stamp, matrix_type, matrix)`, where:

node_index is the unique index used to reference this node
time_stamp is the time stamped in the Simulation Host message

matrix_type is 0 (HPRXYZS matrix), 1 (RTS4x3 matrix), or 2 (ROT2x1 matrix)
matrix is a pointer to the new matrix

vpt_update_mtx does the following:

- Gets a pointer to the node.
- Verifies that this is not the root node; returns an error and terminates if it is.
- If the complete matrix is being changed, calls mtxcpy to copy the new matrix to the configuration node.
- If only the scale or translation is being changed, changes the values in the matrix in the configuration node.
- Calls concat_mtx to update the copy of the matrix used by DTP.
- If this is a hull/world node (i.e., a child of the root node), calls process_vppos to update the simulated vehicle's current position.

The function returns SUCCEED if it is able to update the matrix. It returns FAIL if it cannot get a pointer to the node or the specified node is the root node.

Called By: vpt_update_3x3_matrix
 vpt_update_4x3_matrix
 vpt_update_hprxyzs
 vpt_update_scale
 vpt_update_translation

Routines Called: concat_mtx
 mtxcpy
 printf
 process_vppos
 vpti_get_ptr_cnode
 vpti_state_dcnode (in debug mode only)

Parameters: INT_2 node_index
 INT_2 time_stamp
 UNS_1 matrix_type

Returns: 1 (SUCCEED)
 0 (FAIL)

2.17.30 update_rot.c (vpt_update_rot)

The vpt_update_rot function updates the rotation values in the transformation matrices in the configuration tree. This function is called by the functions in the u_rotations.c CSU, which in turn are called when the Simulation Host sends messages to rotate matrices, or the Gossip user selects an option to rotate a matrix.

The function call is vpt_update_rot(*node_index*, *time_stamp*, *type*, *rotation_axis*, *rotation*), where:

node_index is the unique index used to reference this node

time_stamp is the time stamped in the Simulation Host message
type is the type of rotation: ROT2x1_TYPE, ROT1_TYPE (for one rotation), or
 ROT3_TYPE (for three rotations)
rotation_axis is the axis to be rotated: 0 (heading), 1 (pitch), or 2 (roll)
rotation is the angle of rotation

vpt_update_rot does the following:

- Gets a pointer to the node.
- Verifies that this is not the root node; returns an error and terminates if it is.
- Updates the rotation value(s) in the node's matrix, based on the node's matrix type and the rotation type specified in the call.
- Calls concat_mtx to update the copy of the matrix used by DTP.
- If this is a hull/world node (i.e., a child of the root node), calls process_vppos to update the simulated vehicle's current position.

The function returns SUCCEED if it is able to update the matrix. It returns FAIL if it cannot get a pointer to the node or the specified node is the root node.

| | | |
|------------------|--|--|
| Called By: | vpt_update_2x1_heading vpt_update_2x1_pitch vpt_update_2x1_roll vpt_update_heading vpt_update_hpr vpt_update_pitch vpt_update_roll | |
| Routines Called: | concat_mtx printf process_vppos vpti_get_ptr_cnode vpti_state_dcnode | (in debug mode only) |
| Parameters: | INT_2 INT_2 UNS_1 UNS_1 REAL_4 | node_index time_stamp type rotation_axis *rotation |
| Returns: | 1 (SUCCEED) 0 (FAIL) | |

2.17.31 vpt_get.c (vpt_vpt_get)

The vpt_vpt_get function allocates memory for a new viewport parameter node and returns a pointer to it. This function is called whenever a configuration node with viewport parameters attached to it is defined.

The function call is vpt_vpt_get(). The function does the following:

- Verifies that the viewport parameters array will hold another pointer.
- Allocates memory for the new viewport parameters.
- Verifies that the memory was allocated.
- Places the new entry in the viewport parameters pointers table (Gvpt_vpt_pointers).
- Increments the Gvpt_vpt_entry_index.

If successful, the function returns a pointer to the viewport parameters entry as *viewpt*.

Called By: vpt_vpt_process

Routines Called: calloc
printf
vpti_increment_vpt_entry_index
vpti_set_ptr_vpt
vpti_val_vpt_entry_index

Parameters: none

Returns: viewpt

2.17.32 vpt_process.c (vpt_vpt_process)

The `vpt_vpt_process` function creates and initializes viewport parameters entries in the viewport configuration tree. This function is called whenever a node with viewport parameters attached to it is defined.

The function call is `vpt_vpt_process(node_index, viewport_id, database_id, fov, resolution, viewing_range, near_plane, lod_multiplier, aspect_ratio, n_vpts)`, where:

node_index is the unique index used to reference this node
viewport_id is the identifier assigned to this viewport
database_id is the database identifier (for future use)
fov is the viewport's field-of-view
resolution is the viewport's screen resolution
viewing_range is the distance that can be viewed from the viewport
near_plane is the closest point that can be seen from the viewport
lod_multiplier is the viewport's level-of-detail multiplier
aspect_ratio is the ratio of the sides (width:height) of the viewport (for future use)
n_vpts is the number of viewports

`vpt_vpt_process` does the following:

- Calls `vpt_vpt_get` to get a pointer for the new viewport node.
- Calls `vpt_cnode_linkvpt` to set the node's pointer to the correct index in the view positions array.
- Calls `be_query_num_paths` to determine how many graphics paths are needed.
- Sets the offset to 0 (for double buffer 0).

- Calls `be_query_lm_per_lmb_side` to get the number of load modules per load module block side. This value is used to scale the images in the viewport for the larger viewing range if load module blocking is enabled.
- Set the number of viewports.
- Calls `vpt_vpt_set` to place the viewport parameter data in the configuration tree.

The function returns `SUCCEED` if the viewport parameters are initialized successfully. It returns `FAIL` if the pointer to the `vpos` array could not be set, graphics paths could not be allocated, or viewport setup failed.

Called By: `cig_config`
 `p_viewport_state`

Routines Called: `be_query_lm_per_lmb_side`
 `be_query_num_paths`
 `printf`
 `vpt_cnode_linkvpt`
 `vpt_vpt_get`
 `vpt_vpt_set`
 `vpti_state_dvptnode` (in debug mode only)

Parameters: `INT_2` `node_index`
 `INT_2` `viewport_id`
 `UNS_1` `database_id`
 `R4IJ` `fov`
 `I4IJ` `resolution`
 `REAL_4` `viewing_range`
 `REAL_4` `near_plane`
 `REAL_4` `lod_multiplier`
 `REAL_4` `aspect_ratio`
 `UNS_2` `n_vpts`

Returns: `1 (SUCCEED)`
 `0 (FAIL)`

2.17.33 `vpt_query.c (vpt_vpt_query)`

The `vpt_vpt_query` function copies the viewport parameters node information to a query structure that can be displayed through Gossip. This function is used for testing only.

The function call is `vpt_vpt_query(vp, vi)`, where:

`vp` is a pointer to the viewport parameters
`vi` is a pointer to the query structure

The function zeroes out the query structure before copying the new data to it.

Called By: `vptq_vpout`

Routines Called: none

Parameters: VIEWPORT_PARAMETERS *vp
VPT_VPT_INFO *vi

Returns: none

2.17.34 vpt_set.c (vpt_vpt_set)

The `vpt_vpt_set` function places new viewport parameter data into the configuration tree. This function is called whenever a node with viewport parameters is defined.

The function call is `vpt_vpt_set(viewport, node_index, viewport_id, database_id, fov, rez, viewing_range, near_plane, lod_multiplier, aspect_ratio, paths_i, paths_j, start_path_id, offset)`, where:

viewport is a pointer to the viewport parameters
node_index is the unique index used to reference this node
viewport_id is the identifier assigned to this viewport
database_id is the database identifier (for future use)
fov is the viewport's field-of-view
resolution is the viewport's screen resolution
viewing_range is the distance that can be viewed from the viewport
near_plane is the closest point that can be seen from the viewport
lod_multiplier is the viewport's level-of-detail multiplier
aspect_ratio is the ratio of the sides (width:height) of the viewport (for future use)
paths_i is the number of graphics paths in the i direction
paths_j is the number of graphics paths in the j direction
start_path_id is a pointer to the first graphics path
offset is the offset to the current double buffer (always 0 for initialization)

`vpt_vpt_set` does the following:

- Allocates active area memory for the values required by the DTP (near plane, lod multiplier, and viewing range).
- Fill the viewport node with the parameters passed in.
- Calls `vpt_path_setup` to allocate and fill the graphics paths data.
- Calls `vpt_update` to set the final dynamic viewport data.

The function returns `SUCCEED` if the viewport parameters are added successfully. It returns `FAIL` if active area memory could not be allocated.

Called By: vpt_vpt_process

Routines Called: aam_malloc
printf
vpt_path_setup

| | | |
|-------------|---------------------|----------------------|
| | vpt_update | |
| | vpti_get_ptr_cnode | |
| | vpti_state_dvptnode | (in debug mode only) |
| Parameters: | INT_2 | node_index |
| | INT_2 | viewport_id |
| | UNS_1 | database_id |
| | R4IJ | fov |
| | I4IJ | rez |
| | REAL_4 | viewing_range |
| | REAL_4 | near_plane |
| | REAL_4 | lod_multiplier |
| | REAL_4 | aspect_ratio |
| | INT_2 | paths_i |
| | INT_2 | paths_j |
| | INT_2 | start_path_id |
| | UNS_4 | offset |
| Returns: | 1 (SUCCEED) | |
| | 0 (FAIL) | |

2.17.35 vpt_update.c

The `vpt_update` function finalizes the viewport parameters data, then calls `vpt_path_process` to finalize the viewport's graphics paths data. This function is called for each viewport node defined at initialization time. It is also called whenever a viewport node is updated with the `MSG_VIEW_MAGNIFICATION` message or through Gossip.

The function call is `vpt_update(viewport, fov, rez, viewing_range, near_plane, lod_multiplier, offset)`, where:

viewport is a pointer to the viewport parameters
fov is the viewport's field-of-view
rez is the viewport's screen resolution
viewing_range is the distance that can be viewed from the viewport
near_plane is the closest point that can be seen from the viewport
lod_multiplier is the viewport's level-of-detail multiplier
offset is the offset to the current double buffer

`vpt_update` does the following:

- Verifies that the near plane, lod multiplier, and viewing range have been allocated.
- Fills the viewport node.
- Sets the near and far plane values.
- Calculates the level-of-detail multiplier based on the field of view and the horizontal screen resolution.
- Loads the level-of-detail multiplier.
- Calls `vpt_path_process` to set the graphics paths.

The function returns SUCCEED if the viewport node is added successfully. It returns FAIL if no viewport parameters were specified, any of the allocatable values were not allocated, the graphics paths could not be set, or no viewport node was specified.

Called By: vpt_update_all
 vpt_update_fov
 vpt_update_fov_lod
 vpt_update_lodm
 vpt_update_near_plane
 vpt_update_rez
 vpt_update_view_range
 vpt_vpt_set

Routines Called: printf
 tan
 TORAD
 vpt_path_process

Parameters: VIEWPORT_PARAMETERS *viewport
 R4IJ fov
 I4IJ rez
 REAL_4 scale
 REAL_4 viewing_range
 REAL_4 near_plane
 REAL_4 lod_multiplier
 UNS_4 offset

Returns: 1 (SUCCEED)
 0 (FAIL)

2.18 Force Processing (/cig/othersrc/force)

The Force Processing CSC gives the GT100 CIG the ability to display two-dimensional, non-perspective visual data as an overlay on top of the three-dimensional, perspective image of the database. The Force task is the task that runs on the Force board and serves as the data processing interface between the CIG real-time task and the 2-D processor task. The Force board is the physical interface between the VME chassis and the 2-D processor board. This CSC is present on TX backends only.

The real-time software provides 2-D overlay information to the Force board via the Force task. The Force task then writes the data to the GSP, the graphics processor chip on the MPV (Micro Processor Video) board. The GSP contains memory for code storage and for storing and manipulating the 2-D image. The Force board can also read data from GSP memory about particular attributes of the displayed image.

The Force task communicates with the GSP to do the following:

Display the 2-D overlays.

The original 2-D overlay configuration is passed to Force by the linkup function in the 2-D Overlay Compiler component. The configuration includes the component pointer table, component descriptor table, and window descriptor table. These structures are downloaded into GSP memory and used to generate the overlays displayed on the viewports.

Change the 2-D overlays during runtime.

Each frame, runtime changes to 2-D components are passed to Force from the real-time software. Each message consists of the command (CHANGE_DRAW_2D, DRAW_TEXT_2D, ROTATE_TRANSLATE_2D, etc.) and any arguments (theta, x translation, y translation, etc.) required for that command. Processing for these messages is as follows:

1. The Simulation Host sends a MSG_PASS_ON message to specify the 2-D component changes.
2. The real-time software writes the message to Force memory.
3. The Force task writes the message to GSP memory.
4. The GSP parses each command in the message, updates the component descriptor table in its memory, then regenerates the 2-D overlays.

A new PASS_ON message is expected every frame. If none is sent, the Force task reprocesses the last PASS_ON message it received.

The format for each 2-D runtime command is described in the "2-D Commands and Parameters" document.

Return messages to simulation.

Messages such as error reports can be returned from Force to the Simulation Host. The Force task places the data in Force board memory. The real-time software puts the data into a MSG_PASS_BACK message and returns it to the Simulation Host.

Process laser range request messages.

The Simulation Host can use the MSG_REQUEST_LASER_RANGE message to request the depth of the pixel located at the screen position represented by i, j , where i is the horizontal coordinate (column) and j is the vertical coordinate (row). The real-time software uses the Force interface to request the pixel depth information from the MPV. The real-time software takes the returned value and sends a MSG_LASER_RETURN message to the Simulation Host.

Process mail.

This process triggers the Force/MPV interface to send and receive data such as pass on, pass back, and laser range request messages.

Download and change the 2-D and 3-D color lookup tables.

The 2-D (final) and 3-D lookup tables are downloaded to the GSP memory through the Force-MPV interface. The active lookup table can be changed using the MSG_SUBSYS_MODE message.

Turn the video channels on and off.

The MPV video channels can be controlled using the MSG_VIEWPORT_UPDATE message.

Change MPV modes.

The MPV mode defines the viewport's resolution, panel orientation, and image offset. A viewport's mode can be changed using the MSG_SUBSYS_MODE message.

Start or stop the GSP task.

The MPV Interface CSC starts the GSP task initially, and stops and restarts it when testing GSP memory. GSP can also be stopped and restarted via Gossip.

Test reading from/writing to GSP memory.

GSP memory testing is performed by the MPV Interface CSC at GSP initialization time. Memory testing can also be invoked through Gossip.

The force and GSP tasks are initially loaded and started by functions in the MPV Interface CSC, when the MPV is initialized. The MPV Interface routines and the Force board communicate using two different interface methods: message buffers and the Force front-end control register.

Message Buffers

Messages are passed using half-word message buffers. Messages sent from the real-time software (via the MPV Interface routines) to Force are prefixed with MSG_F0. Messages returned from Force are prefixed with MSG_F1.

Both the MPV Interface functions and the Force functions use the routines in the mx2_hword.c CSU to manage and use the message buffers. This CSU is part of both the Real-Time Processing CSC and the Force Processing CSC.

Force Front-End Control Register

For some functions, the MPV Interface routines place commands directly into the Force board's front-end control register (FE_CONTROL). This interface uses an intertask mailbox. The commands are queued in the Force-MPV mailbox until the end of the frame, at which time a message is sent to Force to trigger processing of the queued commands.

Messages passed between the real-time software and the 2-D processor task (on the GSP) are handled in a different manner:

- The Simulation Host sends "pass on" messages to update 2-D overlays during the simulation. The message is received by process_a_msg, which calls an MPV Interface routine. The MPV Interface function places the message in an outgoing buffer (data_buf_out).
- After processing a "pass on" message, the GSP sends a "pass back" message in reply. The message is placed in an incoming buffer (data_buf_in). The MPV Interface routine sets a pointer to the message for return to the Simulation Host.
- The above scenario applies only to changes to the 2-D overlays. The original overlays created before the simulation starts (using the 2-D Overlay Compiler) are not passed through the MPV Interface routines. The 2-D Overlay Compiler's linkup function places the GSP download commands directly into the FE_CONTROL register.

The Gossip user can interact with the MPV and the GSP through the gos_mpvio function, as follows:

1. The user selects option 4 ("120tx menu") from the Gossip main menu.
2. The user selects option H ("MPV/Force message interface") from the 120tx menu.
3. The Message Interface - RTSW to Force Message menu appears. This menu can be used to send messages to the Force board.

The Force Processing functions used to process messages from the real-time software are named in the format f0_<message>. There is a separate function for each message type supported. The functions are defined in the FG_message_table[] array, which is defined by the init_jump_table function. The f1_process_messages function indexes into this array to call the correct function for each message it receives.

The message buffers used as the interface between the real-time software and Force are summarized below. The name shown in quotation marks in the Buffer Name column is the name used in this section to refer to that buffer.

| Buffer Name | Purpose/Contents | Messages Pushed By | Messages Popped By |
|--|--|------------------------------|------------------------------|
| FG_to_force_buf ("to_force buffer") | Messages from the real-time software that affect the simulation. | various libmpvideo functions | f1_process_messages |
| FG_from_force_buf ("from_force buffer") | Responses to real-time messages. | f0_* functions | various libmpvideo functions |
| FG_force_query_buf ("force_query buffer") | Messages from Gossip for testing/debugging. | gos_mpvio | f1_process_messages |
| FG_force_reply_buf ("force_reply buffer") | Responses to Gossip messages. | f0_* functions | gos_mpvio |

When an f0_* function is called, the calling function passes it a parameter that identifies which outgoing buffer to use for its response messages.

The following table identifies all messages, in alphabetical order, that may be passed from the real-time software or Gossip to Force Processing. The table also identifies the function(s) in the real-time/Gossip software that push the message onto the to_force or force_query buffer, and the Force Processing function that processes the message.

| RTSW --> Force Message | Sent From (RTSW Function) | Processed By (Force Function) |
|-----------------------------|--|-------------------------------|
| MSG_F0_3DLUT_DOWNLOAD | gos_mvpio, mpvideo_sim_init | f0_3dlut_download |
| MSG_F0_3DLUT_SWITCH | gos_mvpio, mpvideo_set_lut | f0_3dlut_switch |
| MSG_F0_ALLLUT_SWITCH | gos_mvpio, mpvideo_set_lut | f0_alllut_switch |
| MSG_F0_DEBUG_DISABLE | gos_mvpio | f0_debug_disable |
| MSG_F0_DEBUG_ENABLE | gos_mvpio | f0_debug_enable |
| MSG_F0_FINAL_LUT_DOWNLOAD | gos_mvpio, mpvideo_load | f0_final_lut_download |
| MSG_F0_FINAL_LUT_SWITCH | gos_mvpio, mpvideo_set_lut | f0_final_lut_switch |
| MSG_F0_MODE_SELECT | gos_mvpio, mpvideo_set_mode | f0_mode_select |
| MSG_F0_MPV_INIT | gos_mvpio | f0_mpv_init |
| MSG_F0_MPV_LUT_TYPE_REQUEST | gos_mvpio, mpvideo_boot | f0_mpv_lut_type_request |
| MSG_F0_MPV_PEEK | gos_mvpio | f0_mpv_peek |
| MSG_F0_MPV_POKE | gos_mvpio | f0_mpv_poke |
| MSG_F0_MPV_POKE16 | gos_mvpio | f0_mpv_poke16 |
| MSG_F0_MPV_RESET | gos_mvpio, mpvideo_boot | f0_mpv_reset |
| MSG_F0_MPV_TASK_CONTROL | gos_mvpio | f0_mpv_task_control |
| MSG_F0_MPV_TEST | gos_mvpio | f0_mpv_test |
| MSG_F0_MPV_WRITE | gos_mvpio | f0_mpv_write |
| MSG_F0_PASS_ON | none | f0_pass_on |
| MSG_F0_PIXEL_DEPTH_REQUEST | gos_mvpio, mpvideo_laser_request_range | f0_pixel_depth_request |
| MSG_F0_QUERY | gos_mvpio | f0_query |
| MSG_F0_SET_DISPLAY | gos_mvpio, mpvideo_set_video | f0_set_display |
| MSG_F0_TRIGGER | gos_mvpio, mpvideo_send_req | f0_trigger |

The next table identifies all messages, in alphabetical order, that may be returned from Force to the real-time software or Gossip. The table also identifies the Force function(s) that push the message onto the from_force or force_reply buffer, and the function(s) in the real-time/Gossip software that process it.

| Force --> RTSW Message | Sent From (Force Function) | Processed By (RTSW Function) |
|---------------------------|--|--|
| MSG_F1_ACKNOWLEDGE | f0_3dlut_download, f0_3dlut_switch, f0_alllut_switch, f0_debug_disable, f0_debug_enable, f0_final_lut_download, f0_final_lut_switch, f0_mode_select, f0_mpv_poke, f0_mpv_poke16, f0_mpv_reset, f0_mpv_write f0_pass_on, f0_set_display, gsp_io | gos_mpvio, mpvideo_boot, mpvideo_load, mpvideo_response, prtackerr |
| MSG_F1_MPV_IOCTL | f0_trigger | gos_mpvio, mpvideo_response |
| MSG_F1_MPV_LUT_TYPE | f0_mpv_lut_type_request | gos_mpvio, mpvideo_boot, mpvideo_response |
| MSG_F1_MPV_MEMORY | f0_mpv_peek | gos_mpvio, mpvideo_response |
| MSG_F1_PIXEL_ADDR | f0_pixel_depth_request | gos_mpvio, mpvideo_response |
| MSG_F1_PIXEL_DEPTH_RETURN | f0_trigger | gos_mpvio, mpvideo_response |
| MSG_F1_STATUS | none | gos_mpvio, mpvideo_response, prtstaterr |
| MSG_F1_TEXT | f0_query | gos_mpvio, mpvideo_response |

The typedefs that define the structures of all Force-RTSW messages are contained in the mpvideo_msg.h file.

The following table illustrates the structure of the Force-MPV software mailboxes. This structure is defined in the mpv_mdef.h file.

| Offset | 0x7800000 (channel 0) | 0x7802000 (channel 1) |
|------------|-----------------------|-----------------------|
| 0x00000000 | MPV_BUFF_IN0 | MPV_BUFF_IN1 |
| 0x00001000 | MPV_BUFF_OUT0 | MPV_BUFF_OUT1 |
| 0x00001800 | PIXEL_REQUEST_0A | PIXEL_REQUEST_1A |
| 0x00001820 | PIXEL_REQUEST_0B | PIXEL_REQUEST_1B |
| 0x00001840 | PIXEL_I_LOC_0A | PIXEL_I_LOC_1A |
| 0x00001850 | PIXEL_J_LOC_0A | PIXEL_J_LOC_1A |
| 0x00001860 | PIXEL_DEPTH_0A | PIXEL_DEPTH_1A |
| 0x00001870 | PIXEL_I_LOC_0B | PIXEL_I_LOC_1B |
| 0x00001880 | PIXEL_J_LOC_0B | PIXEL_J_LOC_1B |
| 0x00001890 | PIXEL_DEPTH_0B | PIXEL_DEPTH_1B |
| 0x000018A0 | PIXEL_ID_0A | PIXEL_ID_1A |
| 0x000018B0 | PIXEL_ID_0B | PIXEL_ID_1B |
| 0x000018C0 | | |
| 0x000018D0 | | |
| 0x000018E0 | SWITCH_2DLUT_FLAG_0 | SWITCH_2DLUT_FLAG_1 |
| 0x000018F0 | NEW_2DLUT_VALUE_0 | NEW_2DLUT_VALUE_1 |
| 0x00001900 | SWITCH_MODE_FLAG_0 | SWITCH_MODE_FLAG_1 |
| 0x00001910 | NEW_MODE_0 | NEW_MODE_1 |
| 0x00001920 | NEW_HSBLNK_0 | NEW_HSBLNK_1 |
| 0x00001930 | NEW_HEBLNK_0 | NEW_HEBLNK_1 |
| 0x00001940 | NEW_VSBLNK_0 | NEW_VSBLNK_1 |
| 0x00001950 | NEW_VEBLNK_0 | NEW_VEBLNK_1 |

| | |
|------------|---------------|
| 0x07801E00 | ILLOP_FLAG |
| 0x07801E10 | ILLOP_COUNT |
| 0x07801E20 | ILLOP_ADDRESS |
| 0x07801E40 | ILLOP_OPCODE |

| | |
|------------|--------------------|
| 0x07801F00 | CLUT_ADDR_PTR |
| 0x07801F20 | CLUT_LOADED_FLAG |
| 0x07801F30 | |
| 0x07801F40 | CLUT_A_SWITCH_FLAG |
| 0x07801F50 | CLUT_B_SWITCH_FLAG |
| 0x07801F60 | NEW_CLUT_A_ADDR |
| 0x07801F80 | NEW_CLUT_B_ADDR |
| 0x07801FA0 | CLUT_A_SWITCH_ACK |
| 0x07801FB0 | CLUT_B_SWITCH_ACK |

Figure 2-22 identifies the CSUs in the Force Processing CSC. The functions performed by these CSUs are described in this section.

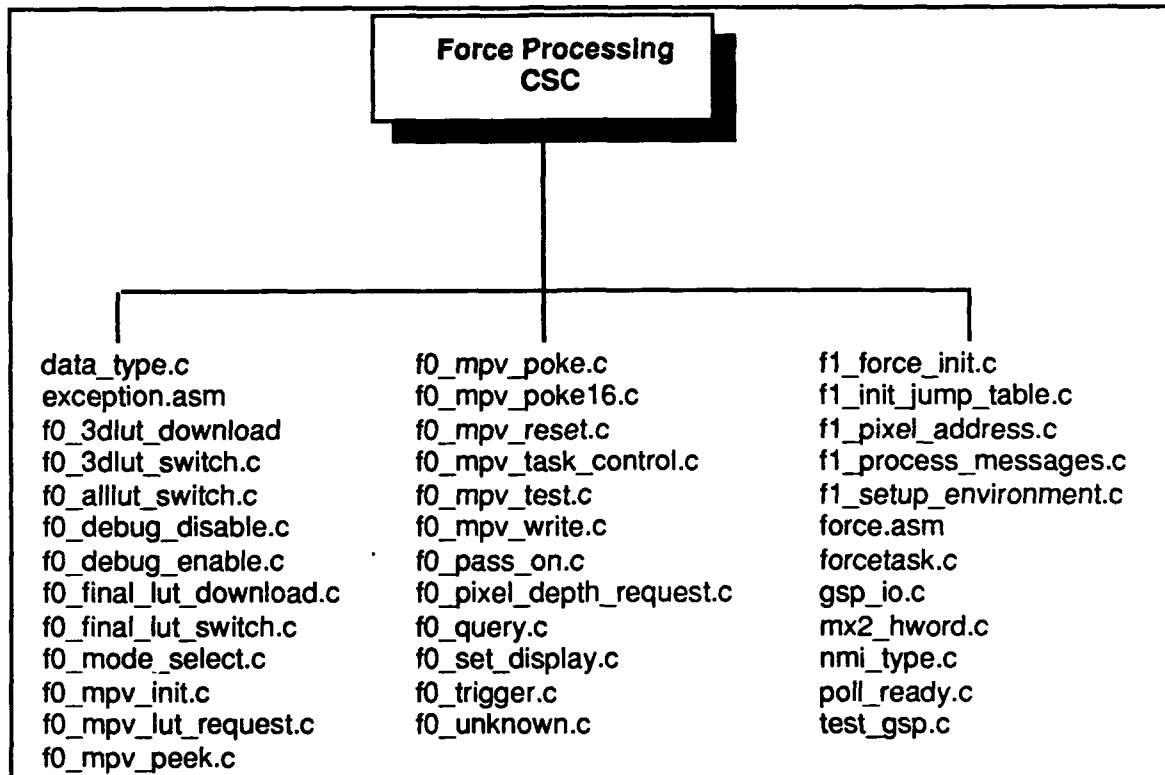


Figure 2-22. Force Processing CSUs

2.18.1 data_type.c

The `data_type` function reads data from and writes data to GSP memory. This function is called by `main` (in `forcetask.c`) if the command in the `FE_CONTROL` register is `SUBSYS_READ_START`, `SUBSYS_WRITE_START`, `SUBSYS_READ_MORE`, or `SUBSYS_WRITE_MORE`.

The function call is `data_type()`. `data_type` does the following:

- Retrieves the type of front-end command: read data or write data.
- If the command is read data:
 - Calls `gsp_ioctl_write` to set the GSP host control word for read mode.
 - Calls `gsp_read` to read the data as specified by the command.
- If the command is write data:
 - Calls `gsp_ioctl_write` to set the GSP host control word for write mode.
 - Calls `gsp_write` to write the data as specified by the command.
 - Reads the data back and verifies it with `compare_buffers`.

Called By: `main`

Routines Called: compare_buffers
 gsp_ioctl_write
 gsp_read
 gsp_write

Parameters: none

Returns: none

2.18.2 exception.asm

The functions in the exception.asm CSU are used to initialize the exception vector table. These functions are:

- excep_init
- spur_int

2.18.2.1 excep_init

The excep_init function first determines the base address of the Force board from the current code. It then initializes the vector base register (VBR) of the 68010 and all entries in the exception vector table to point to spur_int.

The function call is **excep_init()**.

Called By: f1_force_init

Routines Called: spur_int

Parameters: none

Returns: none

2.18.2.2 spur_int

The spur_int function disables interrupts, then saves all of the 68010 data registers into the structure "context." The order of the save is as follows: D0-D7, A0-A6, SSP, USP, PC, SR.

The function call is **spur_int()**.

Called By: excep_init

Routines Called: none

Parameters: none

Returns: none

2.18.3 f0_3dlut_download.c

The `f0_3dlut_download` function processes the `MSG_F0_3DLUT_DOWNLOAD` message. This message is sent by `mpvideo_sim_init` at the beginning of a simulation to download 16 3-D color lookup tables. The message can also be sent through Gossip by selecting the 1 ("3D_LUT_DOWNLOAD") option from the `gos_mpvio` menu. After the tables are downloaded, one can be put into effect using the `MSG_F0_3DLUT_SWITCH` or `MSG_F0_ALLLUT_SWITCH` message.

The function call is `f0_3dlut_download(message_P, buffer_P)`, where:

message_P is a pointer to the `MSG_F0_3DLUT_DOWNLOAD` message

buffer_P is a pointer to the buffer to be used for the response message

`f0_3dlut_download` does the following:

- Pushes a `MSG_F1_ACKNOWLEDGE` message onto the response buffer with the acknowledgement code set to 0.
- Calls `gsp_ioctl_write` to set the GSP host control word for read mode.
- Calls `gsp_read` to read the color lookup tables into Force memory.
- If the 16 tables are found:
 - Uses `gsp_write` to download the 3-D color lookup tables from Force memory into the 2-D task tables in GSP memory.
 - Verifies the data back with `gsp_read`.
 - Calls `gsp_write` to write the lookup table loaded flag to GSP memory.
 - Sets the `FG_3dlut_downloaded_flag` to TRUE.
 - Pushes a `MSG_F1_ACKNOWLEDGE` message onto the response buffer, with the acknowledgement code set to 1 (success).
- If the tables are not found:
 - Sets `FG_3dlut_downloaded_flag` to FALSE.
 - Pushes a `MSG_F1_ACKNOWLEDGE` message onto the response buffer, with the acknowledgement code set to 0xFFFF (error).
- Calls `gsp_write` to write the lookup table switch acknowledgement flags to GSP memory.
- Calls `gsp_ioctl_write` to set the GSP host control word for write mode.
- Calls `gsp_write` to download the tables to the appropriate addresses in the MPV.

The function returns the *status* received from `mx2_push`.

Called By: `f1_process_messages` (through `*FG_message_table`)

Routines Called: `gsp_ioctl_write`

gsp_read
gsp_write
mx2_push

Parameters: UNS_4 *message_P
 UNS_4 *buffer_P

Returns: status

2.18.4 f0_3dlut_switch.c

The `f0_3dlut_switch` function processes the `MSG_F0_3DLUT_SWITCH` message. This message is used to put a specified 3-D color lookup table into effect. (The table must have already been downloaded to the GSP.) The message is sent by `mpvideo_set_lut` if the Simulation Host sends a `MSG_SUBSYS_MODE` message that specifies only a new 3-D table. The message can also be sent through Gossip by selecting the 2 ("3D_LUT_SWITCH") option from the `gos_mpvio` menu.

The function call is `f0_3dlut_switch(message_P, buffer_P)`, where:

message_P is a pointer to the `MSG_F0_3DLUT_SWITCH` message
buffer_P is a pointer to the buffer to be used for the response message

`f0_3dlut_switch` does the following:

- If the `FG_3dlut_downloaded_flag` is TRUE (3-D color lookup tables have been downloaded by `f0_3dlut_download`):
 - Calls `gsp_ioctl_write` to set the GSP host control word for write mode.
 - Calls `gsp_write` to write the new table address in the GSP and set the GSP's switch flag for the specified channel.
 - Calls `gsp_write` to write the appropriate acknowledgement flag to the GSP.
 - Pushes a `MSG_F1_ACKNOWLEDGE` message onto the response buffer, with the acknowledgement code set to the new table id (success)..
- If the `FG_3dlut_downloaded_flag` is FALSE (`f0_3dlut_download` did not download tables):
 - Pushes a `MSG_F1_ACKNOWLEDGE` message onto the response buffer with the acknowledgement code set to `0xFFFF` (error).

The function always returns 0.

Called By: `f1_process_messages` (through `*FG_message_table`)

Routines Called: `gsp_ioctl_write`
 `gsp_write`
 `mx2_push`

Parameters: MSG_F0_3DLUT_SWITCH *message_P
 UNS_4 *buffer_P

Returns: 0

2.18.5 f0_alllut_switch.c

The `f0_alllut_switch` function processes the `MSG_F0_ALLLUT_SWITCH` message. This message is used to put both a new 3-D lookup table and a new final (2-D) lookup table into effect. The 3-D table must have already been downloaded to the GSP. The message is sent by `mpvideo_set_lut` if the Simulation Host sends a `MSG_SUBSYS_MODE` message that specifies both a new 3-D table and a new 2-D table. The message can also be sent through Gossip by selecting the 3 ("ALL_LUT_SWITCH") option from the `gos_mpvio` menu.

The function call is `f0_alllut_switch(message_P, buffer_P)`, where:

message_P is a pointer to the `MSG_F0_ALLLUT_SWITCH` message
buffer_P is a pointer to the buffer to be used for the response message

`f0_alllut_switch` does the following:

- Calls `gsp_ioctl_read` to read the GSP host control word.
- Calls `gsp_ioctl_write` to modify the host control word to set the data strobe bit on; this signals the GSP that I/O is required.
- Determines the MPV buffer base address from the host control word.
- Calls `gsp_ioctl_write` to set the host control word for write mode.
- If `FG_3dlut_downloaded_flag` is TRUE (`f0_3dlut_download` has downloaded 3-D color tables):
 - Gets the new 3-D table id from the message.
 - Finds the table in Force memory.
 - Finds the correct address in GSP memory.
 - Calls `gsp_write` to download the table to GSP memory.
- If `FG_3dlut_downloaded_flag` is FALSE (`f0_3dlut_download` has not downloaded 3-D color tables):
 - Sets the 3-D table id to 0x00FF (error).
- Gets the new 2-D table id from the message.
- Calls `gsp_write` to download the new 2-D table to GSP memory.
- Pushes a `MSG_F1_ACKNOWLEDGE` message onto the response buffer; the acknowledgement code is set to the new 2-D table value OR'd with the new 3-D table value (which is 0x00FF if 3-D tables have not been downloaded to the GSP).

The function always returns 0.

Called By: `f1_process_messages` (through `*FG_message_table`)

Routines Called: `gsp_ioctl_read`
`gsp_ioctl_write`
`gsp_write`
`mx2_push`

Parameters: MSG_F0_ALLLUT_SWITCH *message_P
 UNS_4 *buffer_P

Returns: 0

2.18.6 f0_debug_disable.c

The `f0_debug_disable` function processes the `MSG_F0_DEBUG_DISABLE` message. This message is used to disable Force debug mode. The message can be generated through Gossip by selecting the L ("DEBUG DISABLE") option on the `gos_mpvio` menu.

At the current time, the Force debug flag is used only by `gsp_io`. If debug is enabled, `gsp_io` returns a status message.

The function call is `f0_debug_disable(message_P, buffer_P)`, where:

message_P is a pointer to the `MSG_F0_DEBUG_DISABLE` message
buffer_P is a pointer to the buffer to be used for the response message

`f0_debug_disable` does the following:

- Pushes a `MSG_F1_ACKNOWLEDGE` message onto the response buffer, with the acknowledgement code set to 0 (success).
- Sets the `FG_debug_flag` variable to FALSE.

The function returns the *status* received from `mx2_push`.

Called By: f1_process_messages (through *FG_message_table)

Routines Called: mx2_push

Parameters: UNS_4 *message_P
 UNS_4 *buffer_P

Returns: status

2.18.7 f0_debug_enable.c

The `f0_debug_enable` function processes the `MSG_F0_DEBUG_ENABLE` message. This message is used to enable Force debug mode. The message is generated through Gossip by selecting the K ("DEBUG ENABLE") option from the `gos_mpvio` menu.

At the current time, the Force debug flag is used only by `gsp_io`. If debug is enabled, `gsp_io` returns a status message.

The function call is `f0_debug_enable(message_P, buffer_P)`, where:

message_P is a pointer to the MSG_F0_DEBUG_ENABLE message
buffer_P is a pointer to the buffer to be used for the response message

f0_debug_enable does the following:

- Pushes a MSG_F1_ACKNOWLEDGE message onto the response buffer, with the acknowledgement code set to 0 (success).
- Sets the FG_debug_flag variable to TRUE.

The function returns the *status* received from mx2_push.

Called By: f1_process_messages (through *FG_message_table)

Routines Called: mx2_push

Parameters: UNS_4 *message_P
 UNS_4 *buffer_P

Returns: status

2.18.8 f0_final_lut_download.c

The f0_final_lut_download function processes the MSG_F0_FINAL_LUT_DOWNLOAD message. This message is used to download the final (2-D) color lookup table to the GSP. The message is sent by mpvideo_load if the Simulation Host sends a MSG_FILE_DESCR message that specifies a final lookup table. The message can also be generated through Gossip by selecting the 4 ("FINAL_LUT_DWNLD") option from the gos_mpvio menu.

The function call is f0_final_lut_download(message_P, buffer_P), where:

message_P is a pointer to the MSG_F0_FINAL_LUT_DOWNLOAD message
buffer_P is a pointer to the buffer to be used for the response message

f0_final_lut_download does the following:

- If FG_final_lut_type is 0 (2-D table cannot be downloaded to this MPV board — final lookup table is stored in PROM):
 - Pushes a MSG_F1_ACKNOWLEDGE message onto the response buffer, with the acknowledgement code set to 0xFFFF (error).
- If the entry number in the message is greater than or equal to 192 (the maximum allowed is 191):
 - Pushes a MSG_F1_ACKNOWLEDGE message onto the response buffer, with the acknowledgement code set to 0xFFFE (error).
- If the FG_final_lut_type is 1 (this MPV board has downloadable memory for lookup tables) and the entry number is valid:
 - Finds the specified entry's table and address offsets.
 - Finds the appropriate destination address in the MPV.
 - For each two bytes of data in the message (maximum 256, or 512 bytes):
 - * Calls gsp_write to write the data to the GSP.

- * Calls `gsp_read` to read the data back to compare it.
- Calls `gsp_ioctl_write` to set the GSP host control word for write mode.
- Calls `gsp_write` to download all of the data from the message to GSP memory.
- Pushes a `MSG_F1_ACKNOWLEDGE` message onto the response buffer, with the acknowledgement code set to the entry number from the message.

The function always returns 0.

Called By: `f1_process_messages` (through `*FG_message_table`)

Routines Called: `gsp_read`
`gsp_write`
`mx2_push`

Parameters: `MSG_F0_FINAL_LUT_DOWNLOAD` `*message_P`
`UNS_4` `*buffer_P`

Returns: 0

2.18.9 `f0_final_lut_switch.c`

The `f0_final_lut_switch` function processes the `MSG_F0_FINAL_LUT_SWITCH` message. This message is used to put a specified final (2-D) color lookup table into effect. The message is sent by `mpvideo_set_lut` if the Simulation Host sends a `MSG_SUBSYS_MODE` message that specifies only a new 2-D table. The message can also be generated through Gossip by selecting the 5 ("FINAL_LUT_SWITCH") option from the `gos_mpvio` menu.

The function call is `f0_final_lut_switch(message_P, buffer_P)`, where:

message_P is a pointer to the `MSG_F0_FINAL_LUT_SWITCH` message
buffer_P is a pointer to the buffer to be used for the response message

`f0_final_lut_switch` does the following:

- Calls `gsp_ioctl_read` to read the GSP host control word.
- Calls `gsp_ioctl_write` to change the GSP host control word to set the data strobe bit on; this signals the GSP that I/O is required.
- Determines the MPV buffer base address from the host control word.
- Calls `gsp_ioctl_write` to set the GSP host control word for write mode.
- Gets the new 2-D table id (value) from the message.
- Calls `gsp_write` to download the new 2-D table to GSP memory.
- Pushes a `MSG_F1_ACKNOWLEDGE` message onto the response buffer, with the acknowledgement code set to the new 2-D lut value.

The function always returns 0.

Called By: `f1_process_messages` (through `*FG_message_table`)

Routines Called: `gsp_ioctl_read`
`gsp_ioctl_write`
`gsp_write`
`mx2_push`

Parameters: `MSG_F0_FINAL_LUT_SWITCH` `*message_P`
`UNS_4` `*buffer_P`

Returns: `0`

2.18.10 `f0_mode_select.c`

The `f0_mode_select` function processes the `MSG_F0_MODE_SELECT` message. This message is used to put the desired resolution and panel orientation into effect. The message is sent by `mpvideo_set_mode` to load the default mode when the MPV is initialized, and later to change the mode if the Simulation Host sends a `MSG_SUBSYS_MODE` message. The message can also be generated through Gossip by selecting the 6 ("MODE_SELECT") option from the `gos_mpvio` menu.

This message is supported only with the Value-Added MPV board (revision 5).

The function call is `f0_mode_select(message_P, buffer_P)`, where:

message_P is a pointer to the `MSG_F0_MODE_SELECT` message
buffer_P is a pointer to the buffer to be used for the response message

`f0_mode_select` does the following:

- If `FG_mpv_type` is 0 (older MPV board):
 - Pushes a `MSG_F1_ACKNOWLEDGE` message onto the response buffer with the acknowledgement code set to `0xFFFF` (error).
- If `FG_mpv_type` is 1 (Value-Added MPV board):
 - Retrieves the new mode, orientation, resolution *i* and *j*, and offset *i* and *j* from the message.
 - Puts the data into the `mode_select_data` structure.
 - Calls `gsp_ioctl_read` to read the GSP host control word.
 - Calls `gsp_ioctl_write` to modify the host control word to set the data strobe bit on; this signals the GSP that I/O is required.
 - Determines the MPV buffer base address from the host control word.
 - Calls `gsp_ioctl_write` to set the host control word for write mode.
 - Calls `gsp_write` to write the new values from the `mode_select_data` structure into MPV memory.
 - Calls `f1_pa_new_orientation` to change the viewport's orientation.
 - Calls `f1_pa_new_resolution` to change the viewport's resolution.
 - Pushes a `MSG_F1_ACKNOWLEDGE` message onto the response buffer, with the acknowledgement code set to the 2-D lookup table value written into the MPV board's configuration register.

The function returns the *status* received from `mx2_push` if successful. It returns 0 if the `mpv_type` is 0.

Called By: `f1_process_messages` (through `*FG_message_table`)

Routines Called: `mx2_push`
`gsp_ioctl_read`
`gsp_ioctl_write`
`gsp_write`
`f1_pa_new_orientation`
`f1_pa_new_resolution`

Parameters: `MSG_F0_MODE_SELECT` `*message_P`
`UNS_4` `*buffer_P`

Returns: 0
`status`

2.18.11 `f0_mpv_init.c`

The `f0_mpv_init` function processes the `MSG_F0_MPV_INIT` message. This message is used to initialize the MPV. The message can be generated through Gossip by selecting the 7 ("MPV_INIT") option from the `gos_mpvio` menu.

The function call is `f0_mpv_init(message_P, buffer_P)`, where:

message_P is a pointer to the `MSG_F0_MPV_INIT` message
buffer_P is a pointer to the buffer to be used for the response message

This function is not currently implemented. It always returns 0.

Called By: `f1_process_messages` (through `*FG_message_table`)

Routines Called: none

Parameters: `UNS_4` `*message_P`
`UNS_4` `*buffer_P`

Returns: 0

2.18.12 `f0_mpv_lut_type_request.c`

The `f0_mpv_lut_type_request` function processes the `MSG_F0_MPV_LUT_TYPE_REQUEST` message. This message is used to determine the MPV's board type and

whether or not the board is capable of accepting downloaded final (2-D) lookup tables. The function returns the data in a MSG_F1_MPV_LUT_TYPE message.

The MSG_F0_MPV_LUT_TYPE_REQUEST message is sent by mpvideo_boot when the system is initialized. The message can also be generated through Gossip by selecting the 8 ("MPV_LUT_TYPE_REQ") option from the gos_mpvio menu.

The function call is **f0_mpv_lut_type_request(message_P, buffer_P)**, where:

message_P is a pointer to the MSG_F0_MPV_LUT_TYPE_REQUEST message
buffer_P is a pointer to the buffer to be used for the response message

f0_mpv_lut_type_request does the following:

- Gets the MPV type from the FG_mpv_type global variable (1=Value-Added MPV board, 0=older MPV board).
- Gets the final lookup table type from the FG_final_lut_type global variable (1=final lookup table can be downloaded, 0=final lookup table is in PROM).
- Pushes a MSG_F1_MPV_LUT_TYPE message containing the above parameters onto the response buffer.

The function returns the *status* received from mx2_push.

Called By: f1_process_messages (through *FG_message_table)

Routines Called: mx2_push

Parameters: UNS_4 *message_P
 UNS_4 *buffer_P

Returns: status

2.18.13 f0_mpv_peek.c

The f0_mpv_peek function processes the MSG_F0_MPV_PEEK message. This message is used to read data from GSP memory. The message specifies the starting address and the number of bytes to read. The data is returned in a MSG_F1_MPV_MEMORY message.

The MSG_F0_MPV_PEEK message can be generated through Gossip by selecting the 9 ("MPV_PEEK") option from the gos_mpvio menu.

The function call is **f0_mpv_peek(message_P, buffer_P)**, where:

message_P is a pointer to the MSG_F0_MPV_PEEK message
buffer_P is a pointer to the buffer to be used for the response message

f0_mpv_peek does the following:

- Converts the byte count specified in the message to a half-word count (maximum 256 half-words, for 512 bytes).
- Calls `gsp_ioctl_write` to set the GSP host control word for read mode.
- Calls `gsp_read` to read the specified amount of data from GSP memory, starting at the specified address.
- Pushes a `MSG_F1_MPV_MEMORY` message with the data read from the GSP onto the response buffer.

The function always returns 0.

Called By: `f1_process_messages` (through `*FG_message_table`)

Routines Called: `gsp_ioctl_write`
`gsp_read`
`mx2_push`

Parameters: `MSG_F0_MPV_PEEK` `*message_P`
`UNS_4` `*buffer_P`

Returns: 0

2.18.14 `f0_mpv_poke.c`

The `f0_mpv_poke` function processes the `MSG_F0_MPV_POKE` message. This message is used to write one 32-bit value to GSP memory. The message specifies the starting address and the data to be written. The message can be generated through Gossip by selecting the A ("MPV_POKE") option from the `gos_mpvio` menu.

The function call is `f0_mpv_poke(message_P, buffer_P)`, where:

message_P is a pointer to the `MSG_F0_MPV_POKE` message
buffer_P is a pointer to the buffer to be used for the response message

`f0_mpv_poke` does the following:

- Pushes a `MSG_F1_ACKNOWLEDGE` message onto the response buffer, with the acknowledgement code set to 0 (success).
- Calls `gsp_ioctl_write` to set the GSP host control word for write mode.
- Calls `gsp_write` to write the data from the message to the specified location.

The function returns the *status* received from `mx2_push`.

Called By: `f1_process_messages` (through `*FG_message_table`)

Routines Called: `gsp_ioctl_write`
`gsp_write`
`mx2_push`

Parameters: MSG_F0_MPV_POKE *message_P
 UNS_4 *buffer_P

Returns: status

2.18.15 f0_mpv_poke16.c

The `f0_mpv_poke16` function processes the `MSG_F0_MPV_POKE16` message. This message is used to write one 16-bit value to GSP memory. The message specifies the starting address and the data to be written. The message can be generated through Gossip by selecting the **M** ("MPV POKE16") option from the `gos_mpvio` menu.

The function call is `f0_mpv_poke16(message_P, buffer_P)`, where:

message_P is a pointer to the `MSG_F0_MPV_POKE16` message
buffer_P is a pointer to the buffer to be used for the response message

`f0_mpv_poke16` does the following:

- Pushes a `MSG_F1_ACKNOWLEDGE` message onto the response buffer, with the acknowledgement code set to 0 (success).
- Calls `gsp_write` to write the data from the message to the specified location.

The function returns the *status* received from `mx2_push`.

Called By: f1_process_messages (through *FG_message_table)

Routines Called: gsp_write
 mx2_push

Parameters: MSG_F0_MPV_POKE *message_P
 UNS_4 *buffer_P

Returns: status

2.18.16 f0_mpv_reset.c

The `f0_mpv_reset` function processes the `MSG_F0_MPV_RESET` message. This message is used to reset the MPV board. The message is sent by `mpvideo_boot` when the system is initialized if the MPV board is detected to be a Value-Added MPV. The message can also be generated through Gossip by selecting the **B** ("MPV_RESET") option from the `gos_mpvio` menu.

The function call is `f0_mpv_reset(message_P, buffer_P)`, where:

message_P is a pointer to the MSG_F0_MPV_RESET message
buffer_P is a pointer to the buffer to be used for the response message

f0_mpv_reset does the following:

- Calls gsp_reset to reset the MPV board.
- Sets nmi_set_flag to 0 (this indicates that the GSP is not running).
- Pushes a MSG_F1_ACKNOWLEDGE reply message onto the response buffer, with the acknowledgement code set to 0 (success).

The function returns the *status* received from mx2_push.

Called By: f1_process_messages (through *FG_message_table)

Routines Called: gsp_reset
 mx2_push

Parameters: UNS_4 *message_P
 UNS_4 *buffer_P

Returns: status

2.18.17 f0_mpv_task_control.c

The f0_mpv_task_control function processes the MSG_F0_MPV_TASK_CONTROL message. This message is used to start or stop the MPV task. The message can be generated through Gossip by selecting the C ("MPV_TASK_CTL") option from the gos_mpvio menu.

The function call is f0_mpv_task_control(message_P, buffer_P), where:

message_P is a pointer to the MSG_F0_MPV_TASK_CONTROL message
buffer_P is a pointer to the buffer to be used for the response message

This function is not currently implemented. It always returns 0.

Called By: f1_process_messages (through *FG_message_table)

Routines Called: none

Parameters: UNS_4 *message_P
 UNS_4 *buffer_P

Returns: 0

2.18.18 f0_mpv_test.c

The `f0_mpv_test` function processes the `MSG_F0_MPV_TEST` message. This message is used to request that the Force task perform MPV/Force interface tests and report the results. The message can be generated through Gossip by selecting the **D** ("MPV_TEST") option from the `gos_mpvio` menu.

The function call is `f0_mpv_test(message_P, buffer_P)`, where:

message_P is a pointer to the `MSG_F0_MPV_TEST` message

buffer_P is a pointer to the buffer to be used for the response message

This function is not currently implemented. It always returns 0.

Called By: `f1_process_messages` (through `*FG_message_table`)

Routines Called: none

Parameters: `UNS_4` `*message_P`
`UNS_4` `*buffer_P`

Returns: 0

2.18.19 f0_mpv_write.c

The `f0_mpv_write` function processes the `MSG_F0_MPV_WRITE` message. This message is used to write up to 512 bytes of data to GSP memory. The message specifies the data to be written and the starting destination address. The message can be generated through Gossip by selecting the **E** ("MPV_WRITE") option from the `gos_mpvio` menu.

The function call is `f0_mpv_write(message_P, buffer_P)`, where:

message_P is a pointer to the `MSG_F0_MPV_WRITE` message

buffer_P is a pointer to the buffer to be used for the response message

`f0_mpv_write` does the following:

- Converts the byte count in the message to a half-word count.
- Calls `gsp_ioctl_write` to set the GSP host control word for write mode.
- Calls `gsp_write` to write the data from the message to the specified address in GSP memory.
- Pushes a `MSG_F1_ACKNOWLEDGE` message onto the response buffer, with the acknowledgement code set to 0 (success).

The function always returns 0.

Called By: f1_process_messages (through *FG_message_table)

Routines Called: gsp_ioctl_write
gsp_write
mx2_push

Parameters: MSG_F0_MPV_WRITE *message_P
UNS_4 *buffer_P

Returns: 0

2.18.20 f0_pass_on.c

The `f0_pass_on` function processes the `MSG_F0_PASS_ON` message. This message is sent when the Simulation Host sends messages that are to be forwarded to an imbedded subsystem. Currently, the only subsystem that receives `pass_on` messages is the 2-D processor task. The message is used to update 2-D overlay components (stored in GSP memory) during runtime.

The `MSG_F0_PASS_ON` message is not currently used. For real-time `PASS_ON` messages, the `msg_pass_on` function (in the Message Processing CSC) puts the message data in a buffer and the Force task writes it to GSP memory. The `MSG_F0_PASS_ON` message cannot be generated through Gossip either, as the `F` ("PASS_ON") option on the `gos_mpvio` menu is not currently implemented.

The function call is `f0_pass_on(message_P, buffer_P)`, where:

message_P is a pointer to the `MSG_F0_PASS_ON` message
buffer_P is a pointer to the buffer to be used for the response message

`f0_pass_on` does the following:

- Reads and saves the GSP host control word.
- Calls `gsp_ioctl_write` to modify the host control word to set the data strobe bit on; this signals the GSP that I/O is required.
- Gets the MPV buffer base address from the control word.
- Calls `gsp_ioctl_write` to set the host control word for write mode.
- Calls `gsp_write` to write the new data to GSP memory.
- Pushes a `MSG_F1_ACKNOWLEDGE` message onto the response buffer, with the acknowledgement code set to 0 (success).
- Calls `gsp_ioctl_write` to restore the original control word, turning the data strobe bit off.

The function always returns 0.

Called By: f1_process_messages (through *FG_message_table)

Routines Called: gsp_ioctl_read

gsp_ioctl_write
gsp_write
mx2_push

Parameters: MSG_F0_PASS_ON *message_P
 UNS_4 *buffer_P

Returns: 0

2.18.21 f0_pixel_depth_request.c

The `f0_pixel_depth_request` function processes the `MSG_F0_PIXEL_DEPTH_REQUEST` message. This message is used to obtain a depth value for a specified pixel location. The message is sent by `mpvideo_laser_request_range` when the Simulation Host sends a `MSG_LASER_REQUEST_RANGE` message for a TX backend. The message can also be generated through Gossip by selecting the G ("PIXEL_DEPTH_REQ") option from the `gos_mpvio` menu.

`f0_pixel_depth_request` takes the data from the `MSG_F0_PIXEL_DEPTH_REQUEST` message and puts it into several arrays that are used by `f0_trigger` to download the request to the MPV.

The function call is `f0_pixel_depth_request(message_P, buffer_P)`, where:

message_P is a pointer to the `MSG_F0_PIXEL_DEPTH_REQUEST` message
buffer_P is a pointer to the buffer to be used for the response message

`f0_pixel_depth_request` does the following:

- Gets the channel number, pixel location (i,j), and range id from the message.
- If the channel number is greater than 1, returns 0 and terminates.
- Calls `f1_pa_fb_offset` to get the pixel location's frame buffer address offset.
- Sets the channel's element in the `FG_pixel_addr[]` array to the pixel's GSP address. `f0_trigger` uses this value when sending the request to the MPV.
- Sets the channel's element in the `FG_pixel_id[]` array to the range id from the message. `f0_trigger` uses this value when sending the request to the MPV.
- Sets the channel's element in the `FG_pixel_depth_flag[]` array to TRUE. This prompts `f0_trigger` to read the depth data returned from the MPV and generate a `MSG_F1_PIXEL_DEPTH_RETURN` message.
- Pushes a `MSG_F1_PIXEL_ADDR` message onto the response buffer.
- Sets the channel's element in the `FG_new_pixel_req_flag[]` array to 4. This tells `f0_trigger` that there is a depth request to send to the MPV.
- Sets the `FG_pixel_depth_message` flag to TRUE. This tells `gsp_io` that pixel locations have been set.

The function always returns 0.

Called By: f1_process_messages (through *FG_message_table)

Routines Called: f1_pa_fb_offset
 mx2_push

Parameters: MSG_F0_PIXEL_DEPTH_REQUEST *message_P
 UNS_4 *buffer_P

Returns: 0

2.18.22 f0_query.c

The f0_query.c CSU contains the function used to process the MSG_F0_QUERY message. It also contains various functions used to manipulate character strings. The functions in this CSU are:

- f0_query
- strcpy
- strcat
- strlen

2.18.22.1 f0_query

The f0_query function processes the MSG_F0_QUERY message. This message is used to transfer Gossip data to and request general information from the Force task. The message can be generated through Gossip by selecting the I ("QUERY") option from the gos_mpvio menu. The Gossip user specifies the query code and text.

The function call is f0_query(message_P), where message_P is a pointer to the MSG_F0_QUERY message.

f0_query does the following:

- Selects a predefined string based on the query code in the message.
- Copies the string.
- Concatenates the string and the text provided in the message.
- Puts the concatenated string in the reply message.
- Pushes a MSG_F1_TEXT message onto the force_reply buffer.

The function always returns 1.

Called By: f1_process_messages (through *FG_message_table)

Routines Called: mx2_push
 strcat
 strcpy

Parameters: MSG_F0_QUERY *message_P

Returns: 1

2.18.22.2 strcpy

The strcpy function copies one string to another.

The function call is **strcpy(string1, string2)**, where:

string1 is the destination string
string2 is the source string

Called By: f0_query

Routines Called: none

Parameters: char *string1
char *string2

Returns: none

2.18.22.3 strcat

The strcat routine concatenates a string onto the end of another string.

The function call is **strcat(string1, string2)**, where:

string1 is the first string
string2 is the string to be added to the end of *string1*

The concatenated string is stored in *string1*.

Called By: f0_query

Routines Called: strlen

Parameters: char *string1
char *string2

Returns: none

2.18.22.4 strlen

The strlen function determines the length of a given string.

The function call is `strlen(string)`, where *string* is a pointer to the string. The string length is returned as *index*.

| | | |
|------------------|--------|---------|
| Called By: | strcat | |
| Routines Called: | none | |
| Parameters: | char | *string |
| Returns: | index | |

2.18.23 f0_set_display.c

The `f0_set_display` function processes the `MSG_F0_SET_DISPLAY` message. This message is used to turn the video channels driven by the MPV board on and off. The message is sent by `mpvideo_set_video` at the beginning of a simulation (to turn all channels on) and at the end of a simulation (to turn all channels off). It is also sent during a simulation if the Simulation Host sends a `MSG_VIEWPORT_UPDATE` message. The message can also be generated through Gossip by selecting the H ("SET_DISPLAY") option from the `gos_mpvio` menu.

The function call is `f0_set_display(message_P, buffer_P)`, where:

message_P is a pointer to the `MSG_F0_SET_DISPLAY` message

buffer_P is a pointer to the buffer to be used for the response message

`f0_set_display` does the following:

- Calls `gsp_ioctl_write` to set the GSP host control word for write mode.
- If the message specifies `MPV_VIDEO_ON`:
 - Sets the `mpv_video_code` to ON.
 - Calls `gsp_write` to write the `mpv_video_code` to the video control address.
- If the message specifies `MPV_VIDEO_OFF`:
 - Sets the `mpv_video_code` to OFF.
 - Calls `gsp_write` to write the `mpv_video_code` to the video control address.
- Pushes a `MSG_F1_ACKNOWLEDGE` message onto the response buffer, with the acknowledgement code set to the `mpv_video_code`.

The function always returns 0.

| | |
|------------|---|
| Called By: | f1_process_messages (through *FG_message_table) |
|------------|---|

| | | |
|------------------|---|---|
| Routines Called: | <code>gsp_ioctl_write</code> <code>gsp_write</code> <code>mx2_push</code> | |
| Parameters: | <code>MSG_F0_SET_DISPLAY</code> <code>UNS_4</code> | <code>*message_P</code> <code>*buffer_P</code> |
| Returns: | 0 | |

2.18.24 `f0_trigger.c`

The `f0_trigger` function processes the `MSG_F0_TRIGGER` message. This message triggers the MPV I/O to communicate directly with the MPV board to process all requests queued during the preceding frame. The function returns a `MSG_F1_PIXEL_DEPTH` message for each channel for which laser processing has been requested. It also returns a `MSG_F1_MPV_IOCTL` message if an illegal opcode trap is detected on the MPV.

The `MSG_F0_TRIGGER` message is sent by `mpvideo_send_req` every frame, after all of the frame's messages have been processed by the real-time software. The message can also be generated through Gossip by selecting the J ("TRIGGER") option from the `gos_mpvio` menu.

The MPV locations for each channel's pixel depth request and return data are specified in terms of their offset from the MPV board's base address. The offsets are defined in the `mpv_mdef.h` file.

The function call is `f0_trigger(message_P, buffer_P)`, where:

message_P is a pointer to the `MSG_F0_TRIGGER` message
buffer_P is a pointer to the buffer to be used for the response message

`f0_trigger` does the following:

- Calls `gsp_ioctl_read` to read the GSP host control word.
- Calls `gsp_ioctl_write` to modify the host control word to set the data strobe bit on; this signals the GSP that I/O is required.
- Determines the MPV buffer base address from the host control word.
- Calls `gsp_ioctl_write` to set the host control word for read mode.
- If `FG_pixel_depth_flag[0]` is TRUE, indicating that channel 0 has a laser depth request pending:
 - Sets the channel number to 0.
 - Calls `gsp_read` to read the pixel depth for channel 0 (located at the MPV's base address plus the offset specified by `PIXEL_DEPTH_A_OFF`).
 - Calls `gsp_read` to read the range id for this request (located at the MPV's base address plus the offset specified by `PIXEL_ID_A_OFF`).
 - Pushes a `MSG_F1_PIXEL_DEPTH_RETURN` message for channel 0 onto the response buffer.
- If `FG_pixel_depth_flag[1]` is TRUE, indicating that channel 1 has a laser depth request pending:
 - Sets the channel number to 1.

- Calls `gsp_read` to read the pixel depth for channel 1 (located at the MPV's base address plus the offset specified by `PIXEL_DEPTH_B_OFF`).
- Calls `gsp_read` to read the range id for this request (located at the MPV's base address plus the offset specified by `PIXEL_ID_B_OFF`).
- Pushes a `MSG_F1_PIXEL_DEPTH_RETURN` message for channel 1 onto the response buffer.
- Calls `gsp_ioctl_write` to set the host control word for write mode.
- If `FG_new_pixel_req_flag[0]` is greater than 0 (indicating that channel 0 has a new pixel depth request message to send to the MPV; `f0_pixel_depth_request` sets this value to 4):
 - Decrements the value in `FG_new_pixel_req_flag[0]`.
 - Calls `gsp_write` to write the pixel address to the MPV (located at the MPV's based address plus the offset in `PIXEL_REQUEST_A_OFF`).
 - Calls `gsp_write` to write the pixel id to the MPV (at the MPV's base address plus the offset in `PIXEL_ID_A_OFF`).
- If `FG_new_pixel_req_flag[1]` is greater than 0 (indicating that channel 1 has a new pixel depth request message to send to the MPV; `f0_pixel_depth_request` sets this value to 4):
 - Decrements the value in `FG_new_pixel_req_flag[1]`.
 - Calls `gsp_write` to write the pixel address to the MPV (located at the MPV's based address plus the offset in `PIXEL_REQUEST_B_OFF`).
 - Calls `gsp_write` to write the pixel id to the MPV (at the MPV's base address plus the offset in `PIXEL_ID_B_OFF`).
- Calls `gsp_ioctl_write` to set the host control word for read mode.
- Calls `gsp_read` to check for any illegal opcodes from the GSP.
- If any opcode errors were found, pushes a `MSG_F1_MPV_IOCTL` onto the response buffer.

The function returns the *status* received from `mx2_push`.

Called By: `f1_process_messages` (through `*FG_message_table`)

Routines Called: `gsp_ioctl_read`
`gsp_ioctl_write`
`gsp_read`
`gsp_write`
`mx2_push`

Parameters: `UNS_4` `*message_P`
`UNS_4` `*buffer_P`

Returns: `status`

2.18.25 `f0_unknown.c`

The `f0_unknown` function is called if an unknown message type is received from the real-time software. The function does no processing.

The function call is `f0_unknown(message_P, buffer_P)`, where:

message_P is a pointer to the unknown message
buffer_P is a pointer to the buffer to be used for the response message

The function always returns 0.

Called By: f1_process_messages (through *FG_message_table)

Routines Called: none

Parameters: UNS_4 *message_P
 UNS_4 *buffer_P

Returns: 0

2.18.26 f1_force_init.c

The f1_force_init function initializes the Force task upon initial (cold) start.

The function call is f1_force_init(). The function does the following:

- Calls excep_init to initialize the exception vector table.
- Initializes the Force interface mailbox.
- Initializes the Force control register in the Force interface mailbox for GSP I/O (as opposed to test mode in which the GSP is not actually read or written to).
- Initializes the sync registers in the Force interface mailbox.
- Calls init_ports to initialize the Force-GSP interface.
- Calls f1_pa_init to initialize the pixel address object .
- Calls gsp_read to determine the MPV resolution (from the GSP configuration register).
- Calls f1_pa_new_resolution to set the MPV resolution (RES_640x480 or RES_320x240).
- Initializes the FG_final_lut_type global variable to MPV_NO_LUT_DWNLD (2-D lookup table is not downloadable because table is contained in PROM).
- Initializes the FG_pixel_depth_message global variable to FALSE (no locations have been set for laser range processing).
- Sets the FG_mpv_type global variable based on the setting of the MPV DIP switch: 1 for Value-Added MPV boards, 0 for older boards.
- If the MPV type is 1 (Value-Added MPV), sets FG_final_lut_type to MPV_LUT_DWNLD (2-D lookup table can be downloaded to the MPV).
- Calls f1_setup_environment to set up the Force environment variables to the real-time software.
- Calls f1_init_jump_table to initialize the array used to call the appropriate f0_* function for each message received from the real-time software.

Called By: main

Routines Called: `excep_init`
 `f1_init_jump_table`
 `f1_pa_init`
 `f1_pa_new_resolution`
 `f1_setup_environment`
 `gsp_read`
 `init_ports`

Parameters: `none`

Returns: `none`

2.18.27 `f1_init_jump_table.c`

The `f1_init_jump_table` function initializes the Force message processing jump table (`FG_message_table`). This array contains one entry for each valid message type that can be received from the real-time software. Each entry in the array contains the name of the `f0_*` function to call for that message type. The `f1_process_messages` function indexes into `FG_message_table[]` to call the appropriate `f0_*` function for each message it receives.

The function call is `f1_init_jump_table()`. The function first initializes all 255 entries to point to the `f0_unknown` function, then modifies the entries for all valid message types.

The index number assigned to each valid message type is defined in the `mpvideo_msg.h` file.

Called By: `f1_force_init`

Routines Called: `none`

Parameters: `none`

Returns: `none`

2.18.28 `f1_pixel_address.c`

The functions in the `f1_pixel_address.c` CSU are used to return the frame buffer address offset for a given pixel location. The CSU contains a separate function for each resolution and orientation. These functions are:

- `f1_pa_init`
- `f1_pa_new_orientation`
- `f1_pa_new_resolution`
- `f1_pa_fb_offset`
- `f1_pa_640x480_v`
- `f1_pa_320x240_v`

- f1_pa_640x256_v
- f1_pa_640x240_v
- f1_pa_640x480_h
- f1_pa_320x240_h
- f1_pa_640x256_h
- f1_pa_640x240_h

The pa_FP_table array contains one element for each supported orientation/resolution. Each element contains the name of the f1_pa_*_v or f1_pa_*_h function used to process frame buffer address requests for viewports with the specified attributes.

The f1_pa_*_v and f1_pa_*_h functions are called via the *pixel_address_FP function pointer. This pointer is set by indexing into pa_FP_table[] with a specified orientation and resolution.

2.18.28.1 f1_pa_init

The f1_pa_init function initializes the pa_FP_table array when the Force board is initialized. pa_FP_table[] contains one entry for each supported orientation/resolution combination. Each entry contains the name of the f1_pa_*_v or f1_pa_*_h function that processes frame buffer address requests for viewports with that orientation and resolution.

The function call is f1_pa_init(). The function does the following:

- Defines each element in the pa_FP_table array.
- Sets the default viewport orientation to vertical.
- Sets the default viewport resolution to 640 x 480.
- Sets the *pixel_address_FP function pointer to the default orientation and resolution. This function pointer is used by other Force functions to index into the pa_FP_table for a given orientation and resolution.

The function always returns 1.

Called By: f1_force_init

Routines Called: none

Parameters: none

Returns: 1

2.18.28.2 f1_pa_new_orientation

The f1_pa_new_orientation function changes the orientation of a viewport. This function is called to load the default orientation when the MPV is initialized, and later to change the orientation if the Simulation Host sends a MSG_SUBSYS_MODE message. A new orientation can also be specified through Gossip. Orientation changes are supported only by the Value-Added MPV board.

The function call is **f1_pa_new_orientation(new_orientation)**, where *new_orientation* is ORIENT_VERTICAL or ORIENT_HORIZONTAL.

f1_pa_new_orientation does the following:

- Verifies that the new orientation is valid.
- Resets the *pixel_address_FP function pointer to reflect the new orientation.

The function returns 1 if successful. It returns 0 if the new orientation is invalid.

| | | |
|------------------|----------------|-----------------|
| Called By: | f0_mode_select | |
| Routines Called: | none | |
| Parameters: | HWOR | new_orientation |
| Returns: | 0 1 | |

2.18.28.3 f1_pa_new_resolution

The f1_pa_new_resolution function changes the resolution of a viewport. This function is called to load the default resolution when the MPV is initialized, and later to change the resolution if the Simulation Host sends a MSG_SUBSYS_MODE message. A new resolution can also be specified through Gossip. Resolution changes are supported only by the Value-Added MPV board.

The function call is **f1_pa_new_resolution(new_resolution)**, where *new_resolution* is RES_640x480, RES_320x240, RES_640x256, or RES_640x240.

f1_pa_new_resolution does the following:

- Verifies that the new resolution is valid.
- Resets the *pixel_address_FP function pointer to reflect the new resolution.

The function returns 1 if successful. It returns 0 if the new resolution is invalid.

| | | |
|------------------|---------------------------------|----------------|
| Called By: | f0_mode_select f1_force_init | |
| Routines Called: | none | |
| Parameters: | HWOR | new_resolution |

Returns: 0
 1

2.18.28.4 f1_pa_fb_offset

The `f1_pa_fb_offset` function finds the frame buffer address offset for a given pixel location on a specified viewport. This function is called to process laser range requests.

The function call is `f1_pa_fb_offset(pixel_i, pixel_j, viewport)`, where:

pixel_i is the horizontal coordinate of the pixel
pixel_j is the vertical coordinate of the pixel
viewport is the viewport number (0 or 1)

`f1_pa_fb_offset` uses the `*pixel_address_FP` function pointer to call the appropriate `f1_pa*_v` or `f1_pa*_h` function to determine the pixel's frame buffer address offset. It then returns this value as *fb_offset*.

Called By: f0_pixel_depth_request
 gsp_io

Routines Called: *pixel_address_FP

Parameters: HWORD pixel_i
 HWORD pixel_j
 HWORD viewport

Returns: fb_offset

2.18.28.5 f1_pa_640x480_v

The `f1_pa_640x480_v` function returns the frame buffer address offset for a given pixel location for viewports with 640 x 480 resolution and vertical panel orientation.

The function call is `f1_pa_640x480_v(pixel_i, pixel_j, viewport)`, where:

pixel_i is the horizontal coordinate of the pixel
pixel_j is the vertical coordinate of the pixel
viewport is the viewport number (always 0)

`f1_pa_640x480_v` does the following:

- Verifies that the viewport number is 0 and the pixel location is valid (`pixel_i < 640` and `pixel_j < 480`).
- Sets the panel offset (panel starting address) based on the specified horizontal offset, and reduces the horizontal offset accordingly.
- Computes the total offset by OR'ing the panel, horizontal, and vertical offsets.

The function returns the frame buffer address offset (*gsp_total_offset*) if successful. It returns 0 if the viewport number or pixel location is invalid.

Called By: f1_pa_fb_offset (through *pixel_address_FP)

Routines Called: none

Parameters: WORD pixel_i
 WORD pixel_j
 WORD viewport

Returns: 0
 gsp_total_offset

2.18.28.6 f1_pa_320x240_v

The f1_pa_320x240_v function returns the frame buffer address offset for a given pixel location for viewports with 320 x 240 resolution and vertical panel orientation.

The function call is **f1_pa_320x240_v(pixel_i, pixel_j, viewport)**, where:

pixel_i is the horizontal coordinate of the pixel
pixel_j is the vertical coordinate of the pixel
viewport is the viewport number (0 or 1)

f1_pa_320x240_v does the following:

- Verifies that the viewport number is either 0 or 1 and the pixel location is valid (*pixel_i* < 320 and *pixel_j* < 240).
- Sets the panel offset (panel starting address) based on the specified horizontal offset, and reduces the horizontal offset accordingly.
- Modifies the panel offset if working with viewport 1.
- Computes the total offset by OR'ing the panel, horizontal, and vertical offsets.

The function returns the frame buffer address offset (*gsp_total_offset*) if successful. It returns 0 if the viewport number or pixel location is invalid.

Called By: f1_pa_fb_offset (through *pixel_address_FP)

Routines Called: none

Parameters: WORD pixel_i
 WORD pixel_j
 WORD viewport

Returns: 0
 gsp_total_offset

2.18.28.7 f1_pa_640x256_v

The f1_pa_640x256_v function returns the frame buffer address for a given pixel location for viewports with 640 x 256 resolution and vertical panel orientation.

The function call is **f1_pa_640x256_v(pixel_i, pixel_j, viewport)**, where:

pixel_i is the horizontal coordinate of the pixel
pixel_j is the vertical coordinate of the pixel
viewport is the viewport number (0 or 1)

f1_pa_640x256_v does the following:

- Verifies that the viewport number is either 0 or 1 and the pixel location is valid (*pixel_i* < 640 and *pixel_j* < 256).
- Sets the panel offset (panel starting address) based on the specified horizontal offset, and reduces the horizontal offset accordingly.
- Modifies the panel offset if working with viewport 1.
- Computes the total offset by OR'ing the panel, horizontal, and vertical offsets.

The function returns the frame buffer address offset (*gsp_total_offset*) if successful. It returns 0 if the viewport number or pixel location is invalid.

Called By: f1_pa_fb_offset (through *pixel_address_FP)

Routines Called: none

Parameters: HWORD pixel_i
 HWORD pixel_j
 HWORD viewport

Returns: 0
 gsp_total_offset

2.18.28.8 f1_pa_640x240_v

The f1_pa_640x240_v function returns the frame buffer address for a given pixel location for viewports with 640 x 240 resolution and vertical orientation.

The function call is **f1_pa_640x240_v(pixel_i, pixel_j, viewport)**, where:

pixel_i is the horizontal coordinate of the pixel
pixel_j is the vertical coordinate of the pixel
viewport is the viewport number (always 0)

`f1_pa_640x240_v` does the following:

- Verifies that the viewport number is 0 and the pixel location is valid (`pixel_i < 640` and `pixel_j < 240`).
- Sets the panel offset (panel starting address) based on the specified horizontal offset, and reduces the horizontal offset accordingly.
- Computes the total offset by OR'ing the panel, horizontal, and vertical offsets.

The function returns the frame buffer address offset (*`gsp_total_offset`*) if successful. It returns 0 if the viewport number or pixel location is invalid.

Called By: `f1_pa_fb_offset` (through `*pixel_address_FP`)

Routines Called: none

Parameters: HWORD `pixel_i`
 HWORD `pixel_j`
 HWORD `viewport`

Returns: 0
 `gsp_total_offset`

2.18.28.9 `f1_pa_640x480_h`

The `f1_pa_640x480_h` function returns the frame buffer address for a given pixel location for viewports with 640 x 480 resolution and horizontal panel orientation.

The function call is `f1_pa_640x480_h(pixel_i, pixel_j, viewport)`, where:

`pixel_i` is the horizontal coordinate of the pixel
`pixel_j` is the vertical coordinate of the pixel
`viewport` is the viewport number (always 0)

`f1_pa_640x480_h` does the following:

- Verifies that the viewport number is 0 and the pixel location is valid (`pixel_i < 640` and `pixel_j < 480`).
- Sets the panel offset (panel starting address) based on the specified vertical offset, and reduces the vertical offset accordingly.
- Computes the total offset by OR'ing the panel, horizontal, and vertical offsets.

The function returns the frame buffer address offset (*`gsp_total_offset`*) if successful. It returns 0 if the viewport number or pixel location is invalid.

Called By: `f1_pa_fb_offset` (through `*pixel_address_FP`)

Routines Called: none

| | | |
|-------------|----------------------------|--------------------------------|
| Parameters: | HWORDB HWORDB HWORDB | pixel_i pixel_j viewport |
|-------------|----------------------------|--------------------------------|

| | |
|----------|-----------------------|
| Returns: | 0 gsp_total_offset |
|----------|-----------------------|

2.18.28.10 f1_pa_320x240_h

The `f1_pa_320x240_h` function returns the frame buffer address for a given pixel location for viewports with 320 x 240 resolution and horizontal panel orientation.

The function call is `f1_pa_320x240_h(pixel_i, pixel_j, viewport)`, where:

pixel_i is the horizontal coordinate of the pixel
pixel_j is the vertical coordinate of the pixel
viewport is the viewport number (0 or 1)

`f1_pa_320x240_h` does the following:

- Verifies that the viewport number is either 0 or 1 and the pixel location is valid ($pixel_i < 320$ and $pixel_j < 240$).
- Sets the panel offset (panel starting address) based on the specified vertical offset, and reduces the vertical offset accordingly.
- Modifies the panel offset if working with viewport 1.
- Computes the total offset by OR'ing the panel, horizontal, and vertical offsets.

The function returns the frame buffer address offset (*gsp_total_offset*) if successful. It returns 0 if the viewport number or pixel location is invalid.

| | | |
|------------|-----------------|-----------------------------|
| Called By: | f1_pa_fb_offset | (through *pixel_address_FP) |
|------------|-----------------|-----------------------------|

| | |
|------------------|------|
| Routines Called: | none |
|------------------|------|

| | | |
|-------------|----------------------------|--------------------------------|
| Parameters: | HWORDB HWORDB HWORDB | pixel_i pixel_j viewport |
|-------------|----------------------------|--------------------------------|

| | |
|----------|-----------------------|
| Returns: | 0 gsp_total_offset |
|----------|-----------------------|

2.18.28.11 f1_pa_640x256_h

The `f1_pa_640x256_h` function returns the frame buffer address for a given pixel location for viewports with 640 x 256 resolution and horizontal panel orientation.

The function call is `f1_pa_640x256_h(pixel_i, pixel_j, viewport)`, where:

pixel_i is the horizontal coordinate of the pixel
pixel_j is the vertical coordinate of the pixel
viewport is the viewport number (0 or 1)

`f1_pa_640x256_h` does the following:

- Verifies that the viewport number is either 0 or 1 and the pixel location is valid ($\text{pixel}_i < 640$ and $\text{pixel}_j < 256$).
- Sets the panel offset (panel starting address) based on the specified vertical offset, and reduces the vertical offset accordingly.
- Modifies the panel offset if working with viewport 1.
- Computes the total offset by OR'ing the panel, horizontal, and vertical offsets.

The function returns the frame buffer address offset (*gsp_total_offset*) if successful. It returns 0 if the viewport number or pixel location is invalid.

Called By: `f1_pa_fb_offset` (through `*pixel_address_FP`)

Routines Called: `none`

Parameters: `HWND` `pixel_i`
 `HWND` `pixel_j`
 `HWND` `viewport`

Returns: `0`
 `gsp_total_offset`

2.18.28.12 `f1_pa_640x240_h`

The `f1_pa_640x240_h` function returns the frame buffer address for a given pixel location for viewports with 640 x 240 resolution and horizontal orientation.

The function call is `f1_pa_640x240_h(pixel_i, pixel_j, viewport)`, where:

pixel_i is the horizontal coordinate of the pixel
pixel_j is the vertical coordinate of the pixel
viewport is the viewport number (always 0)

`f1_pa_640x240_h` does the following:

- Verifies that the viewport number is 0 and the pixel location is valid ($\text{pixel}_i < 640$ and $\text{pixel}_j < 240$).
- Sets the panel offset (panel starting address) based on the specified vertical offset, and reduces the vertical offset accordingly.
- Computes the total offset by OR'ing the panel, horizontal, and vertical offsets.

The function returns the frame buffer address offset (*gsp_total_offset*) if successful. It returns 0 if the viewport number or pixel location is invalid.

Called By: f1_pa_fb_offset (through *pixel_address_FP)

Routines Called: none

Parameters: HWORD pixel_i
 HWORD pixel_j
 HWORD viewport

Returns: 0
 gsp_total_offset

2.18.29 f1_process_messages.c

The `f1_process_messages` function handles the messages that are sent to Force from the real-time software and Gossip. It previews each message in both incoming message buffers (to_force and force_query), and calls the appropriate `f0_*` function to process it.

The function call is `f1_process_messages()`. The function does the following:

- Calls `mx2_peek` to preview the top message in the `to_force` buffer (used for messages from the real-time software).
- If a message is found (indicated by a status of `MX_MESSAGE_PREVIEWED` from `mx2_push`):
 - Calls `se_clock` to read the Force timers and store the values.
 - Turns on the Force lights.
 - Indexes into the `*FG_message_table` with the message code; this invokes the appropriate `f0_*` routine to process the message. Specifies `FG_from_force_buf` as the response buffer to be used by the `f0_*` routine.
 - Calls `mx2_skip` to remove the processed message from the `to_force` buffer.
 - Turns off the Force lights.
 - Calls `se_clock` to read the Force timers and store the values.
- Calls `mx2_peek` to preview the top message in the `force_query` buffer (used for messages from Gossip).
- If a message is found (indicated by a status of `MX_MESSAGE_PREVIEWED` from `mx2_push`):
 - Calls `se_clock` to read the Force timers and store the values.
 - Turns on the Force lights.
 - Indexes into the `*FG_message_table` with the message code; this invokes the appropriate `f0_*` routine to process the message. Specifies `FG_force_reply_buf` as the response buffer to be used by the `f0_*` routine.
 - Calls `mx2_skip` to remove the processed message from the `force_query` buffer.
 - Turns off the Force lights.
 - Calls `se_clock` to read the Force timers and store the values.

Called By: poll_ready

Routines Called: *FG_message_table
mx2_peek
mx2_skip
se_clock

Parameters: none

Returns: none

2.18.30 f1_setup_environment.c

The `f1_setup_environment` function sets up the environment variables for the Force software. This function is called when the Force board is initialized.

The function call is `f1_setup_environment()`. The function does the following:

- Sets up the global variables for the message buffers.
- Sets up the Force environment variables for the Force-CIG type, the software version, and the size of each message buffer.
- Sets the `force_started` variable to TRUE; this tells the real-time software that the environment setup is complete.
- Calls `mx2_open` to open the Force-RTSW and Force-Gossip message buffers.

The function always returns TRUE.

Called By: f1_force_init

Routines Called: mx2_open

Parameters: none

Returns: TRUE

2.18.31 force.asm

The `force.asm` CSU contains a group of subroutines used by the Force functions to read from and write to the GSP. These functions are the following:

- `init_ports`
- `gsp_write`
- `gsp_read`
- `gsp_ioctl_read`
- `gsp_ioctl_write`

- `gsp_reset`

This module is written in assembly language to obtain optimal performance from the 68230-to-GSP interface.

2.18.31.1 `init_ports`

The `init_ports` function is called at start-up to initialize the Force-GSP interface. The function call is `init_ports()`.

Called By: `f1_force_init`

Routines Called: `none`

Parameters: `none`

Returns: `none`

2.18.31.2 `gsp_write`

The `gsp_write` function writes a block of data from the Force board's memory down to the GSP. This function is used to download subsystem mode data, color lookup tables, 2-D overlay data, and pixel addresses and ids for laser range processing.

The function call is `gsp_write(number_hwords, data_buffer, gsp_address)`, where:

number_hwords is the number of words to be written to the GSP
data_buffer is the location of the data in Force memory
gsp_address is the address to write to

Called By: `data_type`
`f0_3dlut_download`
`f0_3dlut_switch`
`f0_alllut_switch`
`f0_final_lut_download`
`f0_final_lut_switch`
`f0_mode_select`
`f0_mpv_poke`
`f0_mpv_poke16`
`f0_mpv_write`
`f0_pass_on`
`f0_set_display`
`f0_trigger`
`gsp_io`
`main`
`nmi_type`

| | | |
|------------------|--------------------------|--|
| | poll_ready test_gsp | |
| Routines Called: | none | |
| Parameters: | HWORDB HWORDB WORD | number_hwords *data_buffer gsp_address |
| Returns: | none | |

2.18.31.3 gsp_read

The `gsp_read` function reads a block of data from the GSP into Force memory. This function is used to read color lookup tables, pixel depths and ids, and the MPV's resolution. It is also used to check for illegal opcode errors and to verify writes to the GSP.

The function call is `gsp_read (number_hwords, data_buffer, gsp_address)`, where:

number_hwords is the number of words to be read from the GSP
data_buffer is the location of the data in Force memory
gsp_address is the address to read from

| | | |
|------------------|---|--|
| Called By: | data_type f0_3dlut_download f0_final_lut_download f0_mpv_peek f0_trigger f1_force_init gsp_io main test_gsp | |
| Routines Called: | none | |
| Parameters: | HWORDB HWORDB WORD | number_hwords *data_buffer gsp_address |
| Returns: | none | |

2.18.31.4 gsp_ioctl_read

The `gsp_ioctl_read` function reads the control word from the GSP host interface control register. This function is used to read the control word before modifying it to set the data strobe bit on to signal the GSP of required I/O.

The function call is `gsp_ioctl_read()`. The function returns the control word as an integer (half word = 16 bits).

Called By: `f0_alllut_switch`
 `f0_final_lut_switch`
 `f0_mode_select`
 `f0_pass_on`
 `f0_trigger`
 `gsp_io`
 `main`

Routines Called: `none`

Parameters: `none`

Returns: `control_data`

2.18.31.5 gsp_ioctl_write

The `gsp_ioctl_write` function writes the control word to the GSP host interface control register. This function is used to set the control word for read or write mode, or to set the data strobe bit on to signal the GSP of required I/O.

The function call is `gsp_ioctl_write(control_data)`, where `control_data` is the control word to be written.

Called By: `data_type`
 `f0_3dlut_download`
 `f0_3dlut_switch`
 `f0_alllut_switch`
 `f0_final_lut_switch`
 `f0_mode_select`
 `f0_mpv_peek`
 `f0_mpv_poke`
 `f0_mpv_write`
 `f0_pass_on`
 `f0_set_display`
 `f0_trigger`
 `gsp_io`
 `main`

nmi_type
poll_ready
test_gsp

Routines Called: none

Parameters: int control_data

Returns: none

2.18.31.6 gsp_reset

The `gsp_reset` function resets the Value-Added MPV board. This function is called when the system is initialized if a Value-Added MPV is detected. The function can also be invoked through Gossip by selecting the **B** ("MPV_RESET") option on the `gos_mpvio` menu.

The function call is `gsp_reset()`.

Called By: f0_mpv_reset

Routines Called: none

Parameters: none

Returns: none

2.18.32 forcetask.c

The `forcetask.c` CSU contains the main Force Processing task and various functions related to timing. The functions in this CSU are:

- main
- compare_buffers
- restart_clock
- red_clock
- se_clock

2.18.32.1 main

The main function processes commands placed in the Force front-end control register by the real-time software and Gossip. This task is loaded and started by the `bootforce` function in the MPV Interface CSC.

The function call is **main()**. **main** does the following:

- Calls **f1_force_init** to initialize the Force control registers, various parameters, and the Force-GSP interface.
- Turns off the Force lights.
- Calls **poll_ready** to read the command in the **FE_CONTROL** register.
- Processes each message, calling other Force functions as appropriate.
- Clears the ready bit in the **FE_CONTROL** register.

The following table describes the processing performed by **main** for each command sent by **linkup** or **gos_mvpio**. The first column identifies the command, preceded by the upper byte of the value in the **FE_CONTROL** register (this is the value returned by **poll_ready**). The second column describes the purpose of the command (in italics), then shows the major steps performed by **main** to process that command.

| Message | Processing by main |
|---|---|
| 0 SUBSYS_MAIL_SEND | <i>Process mail, pixel depth information, and pass_on 2-D components to/from the GSP.</i> Makes sure nmi_set_flag is 1 (triggers GSP I/O processing); turns Force lights on; calls se_clock ; calls gsp_io ; calls se_clock ; turns Force lights off. |
| 1 SUBSYS_READ_START, SUBSYS_WRITE_START, SUBSYS_READ_MORE, SUBSYS_WRITE_MORE | <i>Send data to or receive data from the GSP.</i> Turns Force lights on; calls se_clock ; calls data_type ; calls se_clock ; turns Force lights off. |
| 2 SUBSYS_NMI_START | <i>Start the GSP task.</i> Calls nmi_type . |
| 3 SUBSYS_TEST_MEM | <i>Test the ability to read from/write to GSP memory.</i> Calls test_gsp ; if any errors are returned, sets Force control register. |
| 6 SUBSYS_STOP | <i>Halt the GSP task.</i> Calls gsp_ioctl_write to set halt mode; sets nmi_set_flag to 0. |
| 10 SUBSYS_READ_HCTRL | <i>Read the control register.</i> Calls gsp_ioctl_read ; puts response in data_buf_in . |
| 11 SUBSYS_WRITE_HCTRL | <i>Write to the control register.</i> Calls gsp_ioctl_write to write data from data_buf_out . |
| 12 SUBSYS_READ_HDATA | <i>Read data from GSP memory.</i> Calls gsp_read to read data into data_buf_in . |
| 13 SUBSYS_WRITE_HDATA | <i>Write data to GSP memory.</i> Calls gsp_ioctl_write to set write mode; calls gsp_write to write data from data_buf_out ; calls gsp_ioctl_write to set read mode; calls gsp_read and compare_buffers to verify data was written correctly. |
| 15 | <i>Reset Force clock.</i> Calls restart_clock . |

Called By: none

Routines Called: `compare_buffers`
 `data_type`
 `fl_force_init`
 `gsp_io`
 `gsp_ioctl_read`
 `gsp_ioctl_write`
 `gsp_read`
 `gsp_write`
 `nmi_type`
 `poll_ready`
 `red_clock`
 `restart_clock`
 `se_clock`
 `test_gsp`

Parameters: `none`

Returns: `none`

2.18.32.2 `compare_buffers`

The `compare_buffers` function is a boolean function that compares the contents of two buffers. This function is used to verify writes to GSP memory.

The function call is `compare_buffer(hword_count, ptr1, ptr2)`, where:

hword_count is the length of the data to be compared
ptr1 and *ptr2* are pointers to the buffers to be compared

The function returns TRUE if the buffer contents are equal, and FALSE if they are not.

Called By: `data_type`
 `main`

Routines Called: `none`

Parameters: `HWWORD` `hword_count`
 `HWWORD` `*ptr1`
 `HWWORD` `*ptr2`

Returns: `1 (TRUE)`
 `0 (FALSE)`

2.18.32.3 restart_clock

The `restart_clock` function resets the Force clocks to 0.

The function call is `restart_clock()`.

Called By: `main`

Routines Called: `none`

Parameters: `none`

Returns: `none`

2.18.32.4 red_clock

The `red_clock` function reads the Force clocks and places the values read into the locations passed in the call.

The function call is `red_clock(timerval, pittimer)`, where:

timerval is a pointer to real-time clock

pittimer is a pointer to pit clock

Called By: `se_clock`

Routines Called: `none`

Parameters: `UNS_2` `*timerval`
 `UNS_4` `*pittimer`

Returns: `none`

2.18.32.5 se_clock

The `se_clock` function triggers the Force clock to be read and the values placed into a timing array. The timing array, `timit[]`, is index by a code supplied by the calling function. Each element in the array contains the real-time and pit timer values returned by `red_clock`.

The function call is `se_clock(code)`, where *code* is the index (0-511) into the `timit[]` array. The function does the following:

- Sets the *code* to 0 if it is greater than 511.
- Calls `red_clock` to read the Force timers and place the values in the element specified by *code* in the `timit[]` array.

Called By: `f1_process_messages`
 `main`
 `poll_ready`

Routines Called: `red_clock`

Parameters: `UNS_2` `code`

Returns: `none`

2.18.33 `gsp_io.c`

The `gsp_io` function processes mail and pixel depth data to and from the GSP. This function is called when the command in the Force front-end control register is `SUBSYS_MAIL_SEND`.

The function call is `gsp_io()`. `gsp_io` does the following:

- Calls `gsp_ioctl_read` to read the control word.
- Calls `gsp_ioctl_write` to modify the host control word to set the data strobe bit on; this signals the GSP that I/O is required.
- Determines the buffer id and base address from the host control word.
- If the `FG_debug_flag` is on, pushes a `MSG_F1_ACKNOWLEDGE` message onto the `force_reply` buffer to return status.
- Gets the data buffer size from `SUB_DATA_BUFF`.
- Calls `gsp_ioctl_write` to set the host control word for write mode.
- Calls `gsp_write` to write the SIM-to-2D data to 2D memory.
- If `FG_pixel_depth_message` is `FALSE` (no pixel locations selected for laser range processing):
 - Calls `f1_pa_fb_offset` to get the GSP address offsets of the default pixel location for each channel.
 - Calls `gsp_write` to write the pixel address offsets to GSP memory.
- Calls `gsp_ioctl_write` to set the host control word for read mode.
- Calls `gsp_read` to put the data from the 2D-to-SIM buffer into Force memory.
- Calls `gsp_ioctl_write` to set the host control word for read mode.
- Calls `gsp_read` to put the pixel depth return data for both channels into Force memory.
- Calls `gsp_ioctl_write` to restore the original control word, turning the data strobe bit off.
- Clears the ready bit in the front-end control register to signal the real-time software that it is done.

Called By: `main`

Routines Called: f1_pa_fb_offset
 gsp_ioctl_read
 gsp_ioctl_write
 gsp_read
 gsp_write
 mx2_push

Parameters: none

Returns: none

2.18.34 mx2_hword.c

The functions in the mx2_hword.c CSU manage the half-word message buffers used for the interface between Force Processing and the real-time software. These functions are:

- mx2_open
- mx2_push
- mx2_peek
- mx2_skip
- mx2_error
- mx2_hwcopy

These functions are also present in the Real-Time Processing CSC (see section 2.13). The Routines Called and Called By lists in this section do not include any real-time software (e.g., MPV Interface) functions. Similarly, the Routines Called and Called By lists in section 2.13 do not include any Force Processing functions.

The mx2_hword.c file also contains the typedef for the message buffer (MX2_DEVICE) and message header (MESSAGE_HEADER) structures.

2.18.34.1 mx2_open

The mx2_open function initializes a half-word message buffer with a specified size.

The function call is **mx2_open(dev_P, device_size)**, where:

dev_P is a pointer to the message buffer
device_size is the size of the message buffer

The function always returns MX_DEVICE_OPENED.

Called By: f1_setup_environment

Routines Called: sc_lock
 sc_unlock

Parameters: MX2_DEVICE *dev_P
 INT_4 device_size

Returns: MX_DEVICE_OPENED

2.18.34.2 mx2_push

The mx2_push function pushes a message onto a message buffer.

The function call is `mx2_push(dev_P, source_address, message_code, message_size)`, where:

dev_P is a pointer to the message buffer
source_address is the address of the message
message_code is the message type indicator
message_size is the size of the message in bytes

mx2_push does the following:

- Checks to see if the buffer has room for the message.
- Calls mx2_hwcopy to copy the message to the buffer.

The function returns `MX_MESSAGE_PUSHED` if successful. It returns `MX_DEVICE_FULL` if the message buffer is already full.

Called By: f0_3dlut_download
 f0_3dlut_switch
 f0_alllut_switch
 f0_debug_disable
 f0_debug_enable
 f0_final_lut_download
 f0_final_lut_switch
 f0_mode_select
 f0_mpv_lut_type_request
 f0_mpv_peek
 f0_mpv_poke
 f0_mpv_poke16
 f0_mpv_reset
 f0_mpv_write
 f0_pass_on
 f0_pixel_depth_request
 f0_query
 f0_set_display
 f0_trigger
 gsp_io

Routines Called: mx2_hwcopy
 sc_lock
 sc_unlock

| | | |
|-------------|--------------------------------------|--|
| Parameters: | MX2_DEVICE WORD HWORD HWORD | *dev_P source_address message_code message_size |
|-------------|--------------------------------------|--|

| | |
|----------|-------------------------------------|
| Returns: | MX_DEVICE_FULL MX_MESSAGE_PUSHED |
|----------|-------------------------------------|

2.18.34.3 mx2_peek

The `mx2_peek` function previews the top message in the message buffer and returns a pointer to it.

The function call is `mx2_peek(dev_P, message_code, message_size, message_addr)`, where:

dev_P is a pointer to the message buffer
message_code is a pointer to the message type indicator
message_size is a pointer to the message size in bytes
message_addr is a pointer to the message address

The function returns `MX_MESSAGE_PREVIEWED` if successful. It returns `MX_DEVICE_EMPTY` if the message buffer contains no messages.

| | |
|------------|---------------------|
| Called By: | f1_process_messages |
|------------|---------------------|

| | |
|------------------|----------------------|
| Routines Called: | sc_lock sc_unlock |
|------------------|----------------------|

| | | |
|-------------|--------------------------------------|--|
| Parameters: | MX2_DEVICE HWORD HWORD BYTE | *dev_P *message_code *message_size **message_addr |
|-------------|--------------------------------------|--|

| | |
|----------|---|
| Returns: | MX_DEVICE_EMPTY MX_MESSAGE_PREVIEWED |
|----------|---|

2.18.34.4 mx2_skip

The `mx2_skip` function skips over first message in the message buffer. The skipped message is flushed from the buffer and the next message moves to the head of the queue.

The function call is `mx2_skip(dev_P)`, where *dev_P* is a pointer to the message buffer.

The function returns `MX_MESSAGE_SKIPPED` if successful. It returns `MX_DEVICE_EMPTY` if the message buffer contains no messages.

Called By: `f1_process_messages`

Routines Called: `sc_lock`
`sc_unlock`

Parameters: `MX2_DEVICE` `*dev_P`

Returns: `MX_MESSAGE_SKIPPED`
`MX_DEVICE_EMPTY`

2.18.34.5 `mx2_error`

The `mx2_error` function returns an ASCII translation of an error code, for output to the operator.

The function call is `mx2_error(status)`, where *status* is the error condition.

This function is not currently used.

Called By: `none`

Routines Called: `none`

Parameters: `WORD` `status`

Returns: `"DEVICE CLOSED"`
`"DEVICE TABLE FULL"`
`"DEVICE OPENED"`
`"DEVICE BUSY"`
`"DEVICE EMPTY"`
`"DEVICE FULL"`
`"MESSAGE PUSHED"`
`"MESSAGE POPPED"`
`"MESSAGE PREVIEWED"`
`"MESSAGE SKIPPED"`
`"UNDEFINED ERROR"`
`"UNDEFINED RETURN"`

2.18.34.6 `mx2_hwcopy`

The `mx2_hwcopy` function does a half-word block copy.

The function call is `mx2_hwcopy(source_P, destination_P, byte_count)`, where:

source_P is the source location
destination_P is the destination location
byte_count is the number of bytes to be copied

Called By: `mx2_push`

Routines Called: `none`

Parameters: `INT_2` `*source_P`
 `INT_2` `*destination_P`
 `INT_2` `byte_count`

Returns: `none`

2.18.35 `nmi_type.c`

The `nmi_type` function starts the GSP task. This function is called if the command in the Force front-end control register is `SUBSYS_NMI_START`.

The function call is `nmi_type()`. The function does the following:

- Puts the GSP start address into a data buffer.
- Calls `gsp_ioctl_write` to set the host interface control word to write mode.
- Calls `gsp_write` to write the start address into the NMI vector area of GSP memory.
- Calls `gsp_ioctl_write` to set the GSP host interface control register to flush and clear the GSP cache.
- Calls `gsp_ioctl_write` to set the GSP host interface control register to start the GSP task.
- Sets the NMI flag for other routines to check before writing to the control register.
- Clears the `FE_CONTROL` ready bit.

The NMI (non-maskable interrupt) is a bit in the GSP host interface control register.

Called By: `main`

Routines Called: `gsp_ioctl_write`
 `gsp_write`

Parameters: `none`

Returns: `none`

2.18.36 poll_ready.c

The `poll_ready` function polls the ready bit in the Force front-end control register until the bit is set. (This register is used to pass messages from the real-time software to the Force task.) `poll_ready` then returns the upper byte of the value in the control register. This value identifies the command to be performed.

The function call is `poll_ready()`. The function does the following:

- Sets up the address for the front-end control register.
- Turns the Force lights on.
- Checks the `control_change` variable in the Force mailbox to see if the Simulation Host has specified a new 3-D color lookup table. If yes:
 - Calls `se_clock` to read and store the Force timer values.
 - Calls `gsp_ioctl_write` to set the host control word for write mode.
 - Calls `gsp_write` to notify the GSP of the table switch.
 - Calls `se_clock` to read and store the Force timer values.
- Checks the `control_change` variable in the Force mailbox to see if the Simulation Host has specified a new 2-D (final) lookup table. If yes:
 - Calls `se_clock` to read and store the Force timer values.
 - Calls `gsp_write` to notify the GSP of the table switch.
 - Calls `se_clock` to read and store the Force timer values.
- Checks the `req_control` variable in the Force mailbox to see if the Simulation Host has specified changes to the video control registers. If yes:
 - Calls `se_clock` to read and store the Force timer values.
 - Calls `gsp_ioctl_write` to set the host control word for write mode.
 - Calls `gsp_write` to notify the GSP of the new control values.
 - Calls `se_clock` to read and store the Force timer values.
 - Turns the Force lights off.
- If the ready bit is set:
 - Turns the Force lights off.
 - Calls `se_clock` to read and store the Force timer values.
 - Returns the upper byte of the front-end control register.
- Calls `f1_process_messages` to process the messages placed in the Force message buffers by the real-time software.
- Turns the Force lights off.

The function returns the upper byte of the value in the Force front-end control register.

Called By: `main`

Routines Called: `f1_process_messages`
 `gsp_ioctl_write`
 `gsp_write`
 `se_clock`

Parameters: `none`

Returns: (*fe_ctl & MSG_MASK) >> 4

2.18.37 test_gsp.c

The test_gsp function writes a pattern to GSP memory, reads it back, and compares the data. This function is called by main if the command in the FE_CONTROL register is SUBSYS_TEST_MEM.

The function call is test_gsp(). test_gsp does the following:

- Writes a test pattern to a buffer area.
- Calls gsp_ioctl_write to set the host control register for write mode.
- Calls gsp_write to write the data in the SUB_DATA_BUFF buffer to GSP memory.
- Calls gsp_ioctl_write to set the host control register for read mode.
- Calls gsp_read to read GSP memory into the RETURN_DATA_BUFF buffer.
- Compares the data in the two buffers.

The function reports the number of errors detected as *err_count*.

Called By: main

Routines Called: gsp_ioctl_write
gsp_read
gsp_write

Parameters: none

Returns: err_count

3 RESOURCE UTILIZATION

3.1 Disk Space Requirements

The total amount of disk space required to house the object files for all of the CIG real-time functions is <<TBD>> bytes (approximately <<TBD>> megabytes).

3.2 Memory Requirements

The system's memory requirements vary based on application-specific parameters and system options. In general, a minimum of <<TBD>> megabytes of CPU memory is required.

A minimum of <<TBD>> megabytes of memory is required for active area memory. Additional AAM memory is required for databases with an extended viewing range (greater than 4000 meters).

APPENDIX A. SYSTEM INCLUDE FILES

Include files define data structures and parameters used throughout the system. Although many include files are used exclusively by functions in one area, others are used by multiple CSCs. For easy reference, all include files are described in this appendix, in alphabetical order. Each subsection title identifies the full path name of the file.

A.1 /cig/include/backend.h

The backend.h file contains the typedefs for the AAM and backend object structures. It also defines the maximum number of backends.

Included By:

- aa_init.c
- backend_color.c
- backend_laser.c
- backend_man.c
- backend_thermal.c
- backend_video.c
- be_stubs.c
- cal.c
- esifa_man.c
- mpvideo_man.c
- msg_calibration_image.c

A.2 /cig/include/bal_real_time.h

The bal_real_time.h file includes the following real-time software header files, used by Ballistics: rt_definitions.h, rt_types.h, and rt_macros.h.

Included By:

- b0_*.c (all files)
- bx_*.c (all files)
- gos_bal_query
- mx_*.c (all files)
- shot_report.c

A.3 /cig/include/bal_struct.h

The bal_struct.h file defines the Ballistics structures for chord data, trajectory position, trajectory data, and projected data. This file also includes standard.h and sim_cig_if.h

Included By: real_timevpt.h

A.4 /cig/include/ballistics.h

The ballistics.h file includes all of the common Ballistics header files:

- bx_defines.h
- bx_messages.h
- bx_rtdb_structs.h
- bx_structs.h

- bx_macros.h
- bm_functions.h
- mx_defines.h
- slave133_functions.h (if running on a Slave board)

Included By: b0_*.c (all files)
 bx_*.c (all files)
 flea_decode_data.c
 gos_bal_query.c
 shot_report.c

A.5 /cig/include/bbncype.h

The bbncype.h file defines character-testing macros (isalpha, isdigit, isascii, etc.) and character-conversion macros (tolower, toupper, and toascii).

Included By: bbncype.c

A.6 /cig/include/bm_functions.h

The bm_functions.h file declares all Ballistics message functions (b0_bal_config, b0_database_info, b0_add_traj_table, etc.).

Included By: ballistics.h
 bx_init.c
 bx_reset.c

A.7 /cig/include/bp_functions.h

The bp_functions.h file is not currently used.

A.8 /cig/include/bx_defines.h

The bx_defines.h file defines the following:

- The MALLOC macro (described in Appendix B).
- The maximum number of bvol types, model types, AAM partitions, messages, static vehicles, rounds, bvol cache entries, polygon cache entries, load modules, vehicle load modules, trajectories, terrain feedback points, and terrain feedback vehicles.
- DTP data transformation commands.
- DTP data components commands.
- DTP data traversal commands.
- Database effect model numbers.

Included By: ballistics.h

A.9 /cig/include/bx_externs.h

The bx_externs.h file declares external variables for Ballistics, including:

- Input and output buffers.
- Global (G_*) variables.
- Temporary variables used for message processing.

Included By: b0_*.c (all files)
 bx_chord_intersect.c
 bx_compute_round.c
 bx_find_vehicle.c
 bx_functions.c
 bx_get_lm_data.c
 bx_init.c
 bx_model_int.c
 bx_probe.c
 bx_reset.c
 bx_tf_pack.c
 bx_trajectory.c
 gos_bal_query.c

A.10 /cig/include/bx_globals.h

The bx_globals.h file declares variables for Ballistics, including:

- Input and output buffers.
- Global (G_*) variables.
- Temporary variables used for message processing.

Included By: bx_task

A.11 /cig/include/bx_macros.h

The bx_macros.h file defines the following macros used by various functions in Ballistics:

- DELETE_ROUND
- DELETE_STAT_VEH
- FREE_LM_CACHE
- GET_CHORD_END
- GET_DB_POS
- GET_LB_FROM_LM
- NEW_ROUND
- NEW_STAT_VEH

These macros are described in Appendix B.

Included By: ballistics.h

A.12 /cig/include/bx_messages.h

The bx_messages.h file contains the following:

- Declaration of the maximum message size.
- Definitions for the bal_board_type (Ballistics board type) variable.
- Definitions for code trace bits.
- The addresses of the boards.
- Typedefs for all simulation-to-Ballistics (MSG_B0_*) messages.
- Typedefs for all Ballistics-to-simulation (MSG_B1_*) messages.

Included By: bal_routines.c
 ballistics.h
 config_ballistics.c
 db_mcc_setup.c
 download_bvols.c
 load_modules.c
 msg_process_round48.c
 open_dbase.c
 open_ded.c
 rowcol_rd.c
 simulation.c

A.13 /cig/include/bx_rtdb_structs.h

The bx_rtdb_structs.h file defines the structure of the real-time database for Ballistics. It includes typedefs for the following:

- Floating bounding volume entry.
- Single-transform model structure.
- Show effects stamp structure.
- Tank structure.
- Database directory entry.
- Runtime database header.
- Fixed bounding volume entry.
- Generic load module directory entry.
- Grid components.
- Grid locator information.
- Load module header.
- Load module statistics (generic model, unique static, and terrain grid polygon count, plus total bytes per load module).
- Polygon data (info word).
- Polygon list of vertices and alpha betas for *texturing*.

This file also defines the maximum number of models that can be put in the generic module of the runtime database, the maximum number of stamps possible in one unique static object definition, and the number of z values in a grid component.

Included By: ballistics.h

A.14 /cig/include/bx_structs.h

The bx_structs.h file contains structure definitions for Ballistics. It includes typedefs for the following:

- Load module/grid search list.
- Static vehicle.
- Bounding volume cache entry.
- Terrain and object polygon.
- Polygon cache entry.
- Load module cache entry.
- Trajectory table entry.
- Trajectory table.
- Point data.
- Chord.
- Round data.
- Terrain corners.

Included By: ballistics.h

A.15 /cig/include/cigsimio.h

The cigsimio.h file contains the structures used for writing messages to a file during runtime (to record a script for later playback or to display messages to stdout). This file defines the message structure and the tag records.

Included By: cigsimio_obj.c
 flea_script.c
 host_if_debug.c
 print_msg.c

A.16 /cig/include/clouds.h

The clouds.h file defines cloud control structures, including cloud states and cloud control blocks.

Included By: flea.c
 gossip.c
 init_sim.c
 msg_cig_ctl.c
 msg_drll.c
 msg_end.c
 msg_pass_on.c
 msg_subsys_mode.c
 msg_vport.c
 real_time.h
 real_timevpt.h
 simulation.c

A.17 /gt/include/clparse.h

The clparse.h file is used to parse the command line entered to start up the system. It defines the structure used to define each valid switch.

Included By: bx147_main.c
 loadmpv.c
 rtt.c
 rtt_init.c

A.18 /cig/include/db_struct.h

The db_struct.h file defines MAX_DB_PARTITIONS and GMAL_SIZE. It also contains the typedefs for the database_pointers, db_info, and lms_data (load module specific data) structures.

This file includes standard.h and model_struct.h.

Included By: real_timevpt.h

A.19 /cig/include/def_alloc.h

The def_alloc.h file defines DYNAMIC as 0 and SYSTEM as 1.

Included By: cig_config.c
 clouds.c
 flagoff.c
 gun_overlays.c
 init_free.c
 msg_end.c
 mtx_concat.c
 path.c
 path_init.c
 real_time.h
 vpt_set.c

A.20 /cig/include/def_mtx_type.h

The def_mtx_type.h file defines configuration node types (MATRIX_NODE, BRANCH_NODE, and BRANCH_MTX_NODE) and matrix types (RTS3x3_TYPE, RTS4x3_TYPE, ROT2x1_TYPE, TRANSLATION, SCALE, ROT1_TYPE, and ROT3_TYPE).

Included By: encode_routines.c
 flea_bal_opts.c
 flea_init_cig_sw.c
 print_msg.c
 tick.c
 vpi_struct.h

A.21 /cig/include/defines_2d.h

The defines_2d.h file contains definitions used by the 2-D compiler, including:

- All 2-D database commands (N_*, A_*, and B_*).
- Return codes (end of file, too many errors, invalid window number, etc.).
- Color, plane, and static/dynamic commands.
- MPV addresses (base component pointers and base program area).
- MPV default screen parameters (e.g., dimensions and pitch).
- MPV space allocation.
- Array sizes (maximum number of component pointers, windows, component descriptions, etc.).
- The maximum number of 2-D compiler errors allowed before the compilation is aborted.

Included By: global_2d.h
 globfir_2d.h

A.22 /cig/include/definitions.h

The definitions.h file defines miscellaneous constants and structures used by the real-time software. It includes:

- Various definitions used for by Ballistics to parse bounding volume structures and report hits.
- Definitions of various macros (ABSVAL, SET_OUT_BITS, SET_OUT_M2BITS, XREAD, XOPEN, XCLOSE, XLSEEK, XWRITE, AAREAD). These are described in Appendix B.
- The typedef for the load module/grid search list structure.
- Pointers for messages and other parameters.

Included By: flea.c
 flea_bal_opts.c
 flea_simulate_vehicles.c
 global_init.c
 gossip.c
 host_dr11_if.c
 host_mpv_if.c
 host_socket_if.c
 init_sim.c
 mpvideo_response.c
 msg_cig_ctl.c
 msg_dr11.c
 msg_end.c
 msg_laser.c
 msg_lt_state.c
 msg_pass_on.c
 msg_ppm.c
 msg_process_round48.c
 msg_subsys_mode.c
 real_time.h

```
real_timevpt.h
msg_vport.c
rtt_init.c
simulation.c
```

A.23 /cig/include/demo_struct.h

The demo_struct.h file specifies the following:

- Various limits for Flea exercises (MAX_DEMO_MODELS, MAX_HITS, MAX_COLLISIONS, etc.).
- The typedef for the DEMO1 structure used for Flea demos (model rotation, starting position, spacing between models, etc.).
- The typedefs for the F_SIMIN and F_SIMOUT structures, used to exchange messages with the real-time software during a Flea exercise.
- The typedef for the POI (point of interest) structure.
- The typedef for the SIM_VEH_STRUCT (simulated vehicle) structure.

Included By:

```
dynamic_demo.c
encode_routines.c
flea.c
flea_agl_terrain_follow.c
flea_agpt_locations.c
flea_agpt_switches.c
flea_bal_opts.c
flea_db_traverse.c
flea_decode_data.c
flea_encode_data.c
flea_init_cig_sw.c
flea_ppm_obj.c
flea_script.c
flea_simulate_vehicles.c
flea_switches.c
flea_update_pos.c
flea_veh_control.c
get_sio_data.c
model_demo.c
tick.c
tick_ppm.c
tick_script.c
update_2d.c
update_agpt_2d.c
```

A.24 /cig/include/dgi_std.h

The dgi_std.h file helps make the code compiler-independent (avoiding differences in storage allocation caused by differences in C compilers) by defining basic data types, as follows:

| Storage Allocated | C Language | Independent Data Type |
|-------------------------|----------------|-----------------------|
| 18 bit char | char | char |
| 16 bit signed integer | short | INT_2 |
| 32 bit signed integer | int | INT_4 |
| 8 bit unsigned integer | unsigned char | BYTE, BOOLEAN |
| 16 bit unsigned integer | unsigned short | HWORD |
| 32 bit unsigned integer | unsigned int | WORD |
| 32 bit real | float | REAL_4 |
| 64 bit real | double | REAL_8 |

This file is also located in the /cig/othersrc/force directory.

Included By:

- aa_init.c
- backend_*.c (all files)
- bit_bt.c
- bootforce.c
- bootmpv.c
- cf_translator.c
- cig_2d_setup.c
- cig_comp_2d.c
- comp.c
- draw_line.c
- esifa_*.c (all files)
- f0_*.c (all files)
- f1_*.c (all files)
- flea.c
- flea_bal_opts.c
- flea_simulate_vehicles.c
- forcetask.c
- get_thing.c
- get_vehicle_position.c
- global_init.c
- gossip.c
- gsp_io.c
- host_dr11_if.c
- host_ex_if.c
- host_mpv_if.c
- host_socket_if.c
- init_sim.c
- init_stuff.c
- load_esifa.c
- loadmpv.c
- mpvideo_*.c (all files)
- msg_*.c (all files except msg_calibration_image.c)
- mx2_hword.c
- mx3_hword.c
- nmi_type.c
- otherveh_state.c
- oval_rect.c
- poll_ready.c

```
poly.c
ppm_obj.c
pretend_veh.c
print_msg.c
proc_cmd.c
real_time.h
replace_mod.c
simulation.c
staticveh_remove.c
staticveh_state.c
string.c
sys_control.c
sysdefs2.h
test_commands.c
test_gsp.c
text.c
u_*_2d.c (all files)
window.c
```

A.25 /cig/include/dgi_stdg.h

The `dgi_stdg.h` file defines various graphics structures. It includes typedefs for the following:

- 2-D, 3-D, and 4-D vertex points.
- 4x3 matrix.
- 2-D and 3-D bounding boxes.
- Red, green, blue.
- Red, green, blue, opaque.
- Hue, saturation, lightness.
- Hue, saturation, lightness, opaque.

Included By:

```
cf_translator.c
flea.c
flea_bal_opts.c
flea_simulate_vehicles.c
get_vehicle_position.c
global_init.c
gossip.c
host_dr11_if.c
host_ex_if.c
host_mpv_if.c
host_socket_if.c
init_sim.c
mpvideo_response.c
msg_*.c (all files except msg_calibration_image.c and
msg_syserr.c)
otherveh_state.c
pretend_veh.c
print_msg.c
real_time.h
simulation.c
staticveh_remove.c
```

staticveh_state.c

A.26 /cig/include/dig_defines.h

The dig_defines.h file defines variables used for the digitizer interface.

Included By: flea_demo.c
 gos_locate.c

A.27 /cig/include/dig_struct.h

The dig_struct.h file defines the DIGITIZER_INTERFACE structure.

Included By: flea_demo.c

A.28 /cig/include/ecompile1.h

The ecompiler1.h file contains defines for the DTP command generator, including various DTP addresses, maximum values, and the typedef for the where_process structure (used for pre- and post-processing models and effects).

This file includes the real_time.h and ememory_map.h files.

Included By: dtp_compiler.c
 dtp_funcs.c
 dtp_trav1.c
 dtp_trav2.c
 gossip.c
 init_sim.c
 msg_cig_ctl.c
 msg_dr11.c
 msg_end.c
 msg_pass_on.c
 msg_vport.c
 otherveh_state.c
 real_time.h
 real_timevpt.h
 simulation.c
 staticveh_remove.c
 staticveh_state.c

A.29 /cig/include/ememory_map.h

The ememory_map.h file provides external memory declarations. It includes the following:

- General-use variables, such as My Vehicle id, names of the loaded files, and the database column markers.
- Database format variables.
- Database management variables, such as the number of load modules on a side, load module width, and the total number of load modules.

- Variables for ballistics and flea.
- Timing and control word variables.
- Local terrain and range variables.
- Declarations for the DR11-W interface.
- Declarations to support runtime configurable DR packet sizes.
- Intertask Semaphore mailbox declarations.
- Debugging and data gathering variables.
- Variables for Flea's keyboard interface.
- FOGM missile mode global variables.
- Variables used with Force and GSP.
- Single step flags.
- Ballistics flags.
- Helicopter blade rotation variables.
- The GLOB (global memory) macro.

This file also includes the memory_map_defines.h file.

Included By:

- aam_manager.c
- autopilot.c
- bal_routines.c
- be_stubs.c
- bx_task.c
- cal.c
- cig_config.c
- cig_getm_2d.c
- cigsimio_obj.c
- close_db.c
- clouds.c
- config_ballistics.c
- config_color_table.c
- config_database.c
- db_mcc_setup.c
- debug_initdr.c
- ded_model_trace.c
- dtp_emu.c
- dynamic_demo.c
- effect_downcount.c
- file_control.c
- flea.c
- flea_*.c (all files except flea_simulate_vehicles.c)
- generic_lm.c
- get_sio_data.c
- get_tx_lut_index.c
- gos_120tx.c
- gos_db_query.c
- gos_memory.c
- gos_model.c
- gos_mpv.c
- gos_mpvio.c
- gos_polys.c
- gos_system.c
- gossip.c
- gun_overlays.c
- host_enet_if.c


```
host_flea_if.c
host_if_debug.c
host_scsi_if.c
hw_test.c
load_dbase.c
load_modules.c
loc_ter.c
loc_ter_msg.c
make_bbn.c
make_bbn_logo.c
mkcal.c
model_demo.c
model_mtx.c
model_mtx.c
msg_calibration_image.c
msg_cig_ctl.c
msg_drll.c
msg_end.c
msg_pass_on.c
msg_subsys_mode.c
msg_vport.c
open_dbase.c
open_ded.c
rowcol_rd.c
show_effect_msg.c
simulation.c
tick.c
tick_ppm.c
tick_script.c
update_2d.c
update_agpt_2d.c
```

A.30 /cig/include/esifa.h

The esifa.h file defines the structures used to communicate with the ESIFA board on the SCSI bus using the ifx_ioctl call. It includes the typedefs for the ESIFA object and the ESIFA ports structure.

```
Included By:    backend_color.c
                backend_man.c
                esifa_*.c (all files)
                flea.c
                gossip.c
                msg_cig_ctl.c
                msg_drll.c
                msg_end.c
                msg_pass_on.c
                msg_subsys_mode.c
                msg_vport.c
                ppm_obj.c
                real_time.h
                real_timevpt.h
                simulation.c
```

A.31 /cig/othersrc/force/f1_defines.h

The f1_defines.h file defines Force constants such as the following:

- The size of each Force message buffer.
- The base address of each Force message buffer.
- Typedefs for the MODE_SELECT_STRUCT and SWITCH_2DLUT_STRUCT structures.

Included By: f0_*.c (all files)
 f1_*.c (all files)
 f1_defines.h
 forcetask.c
 gsp_io.c
 poll_ready.c

A.32 /cig/othersrc/force/f1_externs.h

The f1_externs.h file defines various external Force global variables, including:

- The pointer to the Force environment.
- Pointers to the message buffers.
- nmi_set_flag (indicates whether or not GSP is running).
- Force scratch buffer (force_tmp_buffer[]).
- Function jump table for message processing (*FG_message_table[]).
- Local analogues of the MPV registers.
- FG_mpv_type, FG_final_lut_type, FG_mpv_mode, and FG_mpv_orient.
- FG_pixel_addr[], FG_pixel_id[], and FG_new_pixel_req_flag[].
- FG_mpv_cluts_gsp and FG_mpv_cluts_force.
- FG_3dlut_downloaded_flag.
- FG_pixel_depth_message and FG_pixel_depth_flag[].
- FG_debug_flag.

Included By: f0_*.c (all files)
 f1_externs.h
 f1_force_init.c
 f1_init_jump_table.c
 f1_process_messages.c
 f1_setup_environment.c
 gsp_io.c
 poll_ready.c

A.33 /cig/othersrc/force/f1_globals.h

The f1_globals.h file defines various Force global variables, including:

- Pointers to the message buffers.
- nmi_set_flag (indicates whether or not GSP is running).
- Force scratch buffer (force_tmp_buffer[]).
- *force_interface (mailbox address)

- Function jump table for message processing (*FG_message_table[]).
- Local analogues of the MPV registers.
- FG_mpv_type, FG_final_lut_type, FG_mpv_mode, and FG_mpv_orient.
- FG_pixel_addr[], FG_pixel_id[], and FG_new_pixel_req_flag[].
- FG_mpv_cluts_gsp and FG_mpv_cluts_force.
- FG_3dlut_downloaded_flag.
- FG_pixel_depth_message and FG_pixel_depth_flag[].
- FG_debug_flag.

Included By: forcetask.c

A.34 /cig/othersrc/force/force_defines.h

The force_defines.h file, which contains Force and GSP definitions, serves as the interface between the real-time software, Force, and the GSP. It includes defines for the following:

- FE_CONTROL (the front-end control register).
- FORCE_CONTROL (the Force control register).
- Force return status and error areas.
- Pixel depth request values.
- Lookup table variables.
- Incoming and outgoing data buffer areas.
- Video control variables.
- GSP host control interface words.
- The READ_CLOCK, RESTART_CLOCK, and CHECK_CLOCK macros (no longer used).
- The typedef for the FORCE_INTERFACE structure.

Included By: data_type.c
 f0_set_display.c
 gsp_io.c
 nmi_type.c
 test_gsp.c

A.35 /cig/othersrc/force/force_env.h

The force_env.h file contains the typedef for the FORCE_ENVIRONMENT structure, which defines Force memory.

This file is also located in the /cig/include directory.

Included By: f1_defines.h
 f1_init_jump_table.c
 f1_process_messages.c
 force_env.h
 force_rtsw_if.h

A.36 /cig/othersrc/force/force_rtsw_if.h

The force_rtsw_if.h file defines the interface between Force and the real-time software. It defines the following:

- MAX_ORIENTATIONS and MAX_RESOLUTIONS.
- ORIENT_VERTICAL and ORIENT_HORIZONTAL.
- RES_640x180, RES_320x240, RES_640x256, and RES_640x240.
- The FORCE_ENVIRONMENT structure.
- The message code and body of the MSG_F0_QUERY message.
- The message code and body of the MSG_F1_TEXT message.

Included By: none

A.37 /cig/othersrc/force/force.h.asm

The force.h.asm file defines constants for the Force data link. It sets up the 68230 base register and defines GCR codes, address select codes for GSP registers, and LED bit definitions.

Included By: force.asm

A.38 /cig/include/functions.h

The functions.h file defines the following macros used by various functions in the real-time software. These macros are described in Appendix B.

- AAM2_ADDR
- DART_ENQUEUE
- DUMP_DART_BUFFER
- EXCHANGE_FLEA_DATA
- FIND_LM
- FXTO881
- INIT_MTX
- OPEN_FLEA_DATA
- SYSERR
- TRIGGER_FORCE
- WAIT_FORCE

Included By: backend_color.c
backend_paths.c
backend_thermal.c
cf_translator.c
esifa_laser.c
esifa_man.c
flea.c
flea_simulate_vehicles.c
init_sim.c
mpvideo_laser.c
mpvideo_man.c
mpvideo_response.c
msg_cig_ctl.c
msg_drll.c
msg_end.c
msg_laser.c
msg_laser_return.c

```
msg_lt_state.c
msg_pass_on.c
msg_ppm.c
msg_process_round48.c
msg_vport.c
otherveh_state.c
real_time.h
real_timevpt.h
staticveh_remove.c
staticveh_state.c
```

A.39 /cig/include/global_2d.h

The global_2d.h file includes the defines_2d.h and struct_2d.h include files. Collectively, these files declare all global I/O variables, global temporary compiler variables, and compiler product variables for the 2-D compiler.

```
Included By:    bit_blt.c
                cig_comp_2d.c
                cig_getm_2d.c
                cig_link_2d.c
                comp.c
                draw_line.c
                get_thing.c
                init_stuff.c
                oval_rect.c
                poly.c
                proc_cmd.c
                string.c
                text.c
                u_comp_2d.c
                u_getm_2d.c
                u_link_2d.c
                window.c
```

A.40 /cig/include/globfir_2d.h

The globfir_2d.h file includes the defines_2d.h and struct_2d.h include files. Collectively, these files declare all global I/O variables, global temporary compiler variables, and compiler product variables for the 2-D compiler.

```
Included By:    cig_2d_setup.c
                u_main2d.c
```

A.41 /cig/include/if_cig2sim.h

The if_cig2sim.h file defines the structures of the runtime messages sent from the CIG to the Simulation Host. These messages are:

- MSG_AGL
- MSG_HIT_RETURN

- MSG_LASER_RETURN
- MSG_LOCAL_TERRAIN
- MSG_LT_PIECE
- MSG_MISS
- MSG_PASS_BACK
- MSG_RETURN_POINT_INFO
- MSG_SHOT_REPORT
- MSG_TF_HDR
- MSG_TF_PT

Included By:

- flea.c
- flea_bal_opts.c
- flea_simulate_vehicles.c
- global_init.c
- gossip.c
- init_sim.c
- msg_cig_ctl.c
- msg_dr11.c
- msg_effect.c
- msg_end.c
- msg_laser_return.c
- msg_pass_back.c
- msg_pass_on.c
- msg_process_round48.c
- msg_subsys_mode.c
- msg_veh_state.c
- msg_vport.c
- print_msg.c
- sim_cig_if.h

A.42 /cig/include/if_ctl_err.h

The if_ctl_err.h file defines the structures of the control and error messages passed between the CIG and the Simulation Host. These messages are:

- MSG_CIG_CTL
- MSG_DR11_PKT_SIZE
- MSG_SYS_ERROR

This file also defines the structure of the message header (MSG_HDR), end of message indicator (MSG_END), and packet header (MSG_BLK).

Included By:

- flea.c
- flea_bal_opts.c
- flea_simulate_vehicles.c
- global_init.c
- gossip.c
- host_dr11_if.c
- host_ex_if.c
- host_mpv_if.c
- host_socket_if.c
- init_sim.c
- mpvideo_response.c

msg_*.c (all files except msg_calibration_image.c)
 otherveh_state.c
 pretend_veh.c
 print_msg.c
 sim_cig_if.h
 simulation.c
 staticveh_remove.c
 staticveh_state.c

A.43 /cig/include/if_hdr_str.h

The if_hdr_str.h defines the matrix structures (RTS4x3_MTX, RTS3x3_MTX, ROT2x1_MTX, MTXUNION, and XYZHPR). It also defines the structures for field-of-view, resolution, and the vector for describing angles of rotation.

Included By:

- flea.c
- flea_bal_opts.c
- flea_simulate_vehicles.c
- global_init.c
- gossip.c
- init_sim.c
- mpvideo_response.c
- msg_*.c (all files except msg_calibration_image.c and msg_syserr.c)
- otherveh_state.c
- print_msg.c
- sim_cig_if.h
- simulation.c
- staticveh_remove.c
- staticveh_state.c

A.44 /cig/include/if_init.h

The if_init.h file defines the structures of the initialization messages sent to the CIG from the Simulation Host. These messages are:

- MSG_2D_SETUP
- MSG_TRAJ_TABLE_XFER
- MSG_TRAJ_ENTRY_XFER
- MSG_CREATE_CONFIGNODE
- MSG_VIEWPORT_STATE
- MSG_OVERLAY_SETUP
- MSG_DEFINE_TX_MODE
- MSG_AMMO_DEFINE

Included By:

- gossip.c
- print_msg.c
- sim_cig_if.h
- simulation.c

A.45 /cig/include/if_msg_ids.h

The if_msg_ids.h file defines the numerical message code for each valid message type.

Included By: flea.c
 gossip.c
 host_ex_if.c
 msg_cig_ctl.c
 msg_dr11.c
 msg_end.c
 msg_pass_on.c
 msg_subsys_mode.c
 msg_vport.c
 simulation.c

A.46 /cig/include/if_rva2net.h

The if_rva2net.h file provides the message structures for alternate versions of some of the standard Ballistics messages. These messages, which allow for 48-bit identifiers, are not used with the standard GT100 system.

- MSG_HIT_RETURN48
- MSG_TF_PT48
- MSG_SHOT_REPORT48

Included By: msg_process_round48.c
 print_msg.c

A.47 /cig/include/if_sim2cig.h

The if_sim2cig.h file defines the structures of the messages sent to the CIG by the Simulation Host. These messages are:

- MSG_1ROTATION
- MSG_3ROTATIONS
- MSG_ADD_TRAJ_TABLE
- MSG_AGL_SETUP
- MSG_CALIBRATION_IMAGE
- MSG_CANCEL_ROUND
- MSG_CLOUD_STATE
- MSG_DATA_TEST
- MSG_DELETE_TRAJ_TABLE
- MSG_GUN_OVERLAY
- MSG_HPRXYZS_MATRIX
- MSG_LT_STATE
- MSG_OBSCURE
- MSG_OTHERVEH_STATE
- MSG_PASS_ON
- MSG_PPM_DISPLAY_MODE
- MSG_PPM_DISPLAY_OFFSET

- MSG_PPM_PIXEL_LOCATION
- MSG_PPM_PIXEL_STATE
- MSG_PROCESS_CHORD
- MSG_PROCESS_ROUND
- MSG_PROCESS_ROUND48
- MSG_REQUEST_LASER_RANGE
- MSG_REQUEST_POINT_INFO
- MSG_ROT2x1_MATRIX
- MSG_ROUND_FIRED
- MSG_RTS4x3_MATRIX
- MSG_SCALE
- MSG_SHOW_EFFECT
- MSG_SIO_CLOSE
- MSG_SIO_INIT
- MSG_SIO_WRITE
- MSG_STATICVEH_REM
- MSG_STATICVEH_STATE
- MSG_SUBSYS_MODE
- MSG_TF_INIT_HDR
- MSG_TF_INIT_PT
- MSG_TF_STATE
- MSG_TF_VEHICLE_POS
- MSG_TRAJ_CHORD
- MSG_TRAJ_ENTRY
- MSG_TRANSLATION
- MSG_VIEW_FLAGS
- MSG_VIEW_MAGNIFICATION
- MSG_VIEWPORT_UPDATE

Included By:

- flea.c
- flea_bal_opts.c
- flea_simulate_vehicles.c
- gossip.c
- init_sim.c
- msg_cig_ctl.c
- msg_drll.c
- msg_effect.c
- msg_end.c
- msg_laser.c
- msg_lt_state.c
- msg_pass_on.c
- msg_ppm.c
- msg_process_round48.c
- msg_subsys_mode.c
- msg_veh_state.c
- msg_vflags.c
- msg_vport.c
- otherveh_state.c
- print_msg.c
- sim_cig_if.h
- simulation.c
- staticveh_remove.c
- staticveh_state.c

A.48 /cig/include/if_tst_ctl.h

The if_tst_ctl.h file defines the structures of the SIM-to-CIG messages used for file control and hardware testing. These messages are:

- MSG_FILE_DESCR
- MSG_FILE_STATUS
- MSG_FILE_XFER
- MSG_TEST_NAME

Included By: gossip.c
 print_msg.c
 simulation.c

A.49 /cig/include/if_veh_eff.h

The if_veh_eff.h file contains defines that affect dynamic vehicles and special effects. It defines system limits (MAX_NUM_TANKS, MAX_NUM_VEH, MAX_ACT_EFF, MAX_STAT_TANKS, and MAX_STAT_VEH), ASID bumper number characters, and ASID special effects.

Included By: gossip.c
 init_sim.c
 msg_cig_ctl.c
 msg_drll.c
 msg_effect.c
 msg_end.c
 msg_pass_on.c
 msg_veh_state.c
 msg_vport.c
 otherveh_state.c
 print_msg.c
 sim_cig_if.h
 simulation.c
 staticveh_remove.c
 staticveh_state.c

A.50 /gt/include/ifxvisi.h

The ifxvisi.h file provides definitions used when using the Ready Systems IFX routines to manage and access files. It includes IFX function codes; the access modes for ifx_open; the options for ifx_mount, ifx_delete, and ifx_rmdir; I/O control operation codes; device types; IFX error codes; and the structure of the directory entry.

Included By: bx147_main.c
 cigsimio_obj.c
 directory.c
 esifa_load.c
 esifa_man.c
 esifa_query.c

```
find_gtfn.c
flea_script.c
host_enet_if.c
host_scsi_if.c
ppm_obj.c
rtt.c
rtt_init.c
sio.c
stdopen.c
tick_script.c
```

A.51 /cig/include/keywords.h

The keywords.h file defines the table of keywords recognized by lexical analyzer in the Token Processing CSC. This file includes lex.h.

Included By: lex.c

A.52 /cig/include/kludge.h

The kludge.h file defines the AAM1_TO_AAM2 and VME_TO_VMX macros (described in Appendix B). It also declares several of the Message Processing functions.

Included By: msg_cig_ctl.c
 msg_dr11.c
 msg_effect.c
 msg_end.c
 msg_veh_state.c
 msg_vport.c
 simulation.c

A.53 /cig/include/lex.h

The lex.h file defines the lexical tokens recognized by the lexical analyser in the Token Processing CSC.

Included By: keyword.h
 lex.c
 subsys_cfg_parse.c

A.54 /cig/include/m2_config.h

The m2_config.h file contains defines specific to the M2. It defines channel and gunner resolution, viewport angular offsets, pitch up/down angular offsets, field-of-view sizes for all channels, and texture map definitions.

Included By: gun_overlays.c

A.55 /gt/include/math.h

The math.h file declares standard math functions.

Included By:

- bal_routines.c
- bx_bvol_int.c
- bx_poly_int.c
- bx_task.c
- cnode_child.c
- cnode_process.c
- cnode_query.c
- cnode_set.c
- dtp_emu.c
- dynamic_demo.c
- encode_routines.c
- fill_tree.c
- flea_agl_terrain_follow.c
- flea_agpt_locations.c
- flea_agpt_switches.c
- flea_bal_opts.c
- flea_db_traverse.c
- flea_decode_data.c
- flea_init_cig_sw.c
- flea_ppm_obj.c
- flea_script.c
- flea_simulate_vehicles.c
- flea_switches.c
- flea_update_pos.c
- flea_veh_control.c
- gos_120tx.c
- gos_model.c
- gos_mpv.c
- gos_mpvio.c
- gossip.c
- linkvpt.c
- mkcal.c
- model_demo.c
- mtx_concat.c
- mtx_viewspace.c
- mx_error.c
- path.c
- path_init.c
- path_query.c
- shot_report.c
- simulation.c
- tick_ppm.c
- tick_script.c
- trav_tree.c
- tst_eupdate.c
- u_brmask.c
- u_path.c
- u_rotations.c

```
u_viewport.c
u_xfrm.c
update_2d.c
update_agpt_2d.c
update_mtx.c
update_rot.c
vpt_process.c
vpt_query.c
vpt_set.c
vpt_update.c
```

A.56 /cig/include/mbx.h

The mbx.h file contains defines for the interface with the Force board. It includes defines for the following:

- The FORCE_INTERFACE structure.
- NMI and GSP configuration addresses.
- Force masks (slave/host, resolution, front ready, force busy, etc.).
- FE_CONTROL register commands (SUBSYS_READ_START, SUBSYS_TEST_MEM, etc.).
- Video control parameters (VIDEO_CTL_ADDR, VIDEO_ON_CODE, etc.).
- GSP memory start and end addresses.

This file is also located in the /cig/othersrc/force directory.

Included By:

```
f0_*.c (all files)
f1_*.c (all files)
flea.c
forcetask.c
gossip.c
msg_cig_ctl.c
msg_dr11.c
msg_end.c
msg_pass_on.c
msg_subsys_mode.c
msg_vport.c
poll_ready.c
process_vflags.c
real_time.h
real_timevpt.h
simulation.c
```

A.57 /cig/include/memory_map.h

The memory_map.h file contains external memory declarations such as the following:

- Variables describing the simulated vehicle (myveh_id, myveh_type, etc.).
- Database management variables.
- Local terrain and range variables.
- Terrain feedback variables.
- Declarations for the DR11-W interface.

- Intertask semaphore mailbox declarations.
- The display_lights array.
- Viewport position and rotation data for flying and setting individual views.
- Variables used by Flea's keyboard interface for flying.
- Helicopter blade rotation variables.
- Initialized values for the message packet size and local terrain chunk size.
- The GLOB (global memory) macro, defined in Appendix B.

This file include memory_map_defines.h

Included By: upstart.c

A.58 /cig/include/memory_map_defines.h

The memory_map_defines.h file defines variables used in external memory declarations, including the following:

- The size of a load module.
- The areas of the 64KW memory board (32KW of space for the double-buffer state table and 32KW of generic memory for the database).
- Byte offsets to data in double-buffered state table memory.
- Declarations for the DR11-W interface.
- Local terrain message interval and starting frame number.
- Intertask semaphore mailbox locations.
- Display lights locations.
- Viewport position and rotation data for flying and setting individual views.
- Helicopter blade rotation variables, used in simulation.

Included By:

- aa_init.c
- backend_branch.c
- backend_color.c
- backend_man.c
- backend_paths.c
- backend_thermal.c
- ball_effect_add.c
- cig_link_2d.c
- dl_man.c
- ememory_map.h
- esifa_man.c
- global_init.c
- host_ex_if.c
- init_sim.c
- memory_map.h
- mpvideo_man.c
- msg_effect.c
- msg_laser_return.c
- msg_pass_back.c
- msg_veh_state.c
- otherveh_state.c
- process_vflags.c
- process_vppos.c
- rtt.c
- rtt_init.c

staticveh_remove.c
staticveh_state.c
sys_control.c

A.59 /cig/include/model_struct.h

The model_struct.h file provides the typedefs for the following model structures:

- Static tank.
- Single-transform model.
- ASID single-transform model.
- Remove static model.
- Tank.
- Show effects stamp.
- ASID show effects stamp.
- Fake dynamic vehicle.

This file includes standard.h, poly_struct.h, and sim_cig_if.h.

Included By: db_struct.h
 real_timevpt.h

A.60 /cig/other/src/force/mpv_mdef.h

The mpv_mdef.h file defines memory locations in the MPV that are used by Force and the 2-D task. It includes MPV register locations and locations used in the Force/MPV interface.

Included By: f1_defines.h

A.61 /cig/other/src/force/mpv_memory_defines.h

The mpv_memory_defines.h file defines MPV register locations.

Included By: mpv_mdef.h
 mpv_memory_defines.h

A.62 /cig/include/mpv_struct.h

The mpv_struct.h file provides typedefs for the following MPV structures:

- Color table.
- Fade transfer.
- Video control.
- DTP mode switch.

This file includes standard.h.

Included By: process_vflags.c
 real_timevpt.h

A.63 /cig/include/mpvideo.h

The mpvideo.h file defines the interface to the MPV board. It defines the following:

- The MPVIO_INTERFACE structure.
- All Force commands (SUBSYS_READ_START, SUBSYS_MAIL_SEND, etc.).
- Video control commands.
- Force/GSP masks.
- The WAIT_MPVIO macro.
- The MPVIDEO_CONTROL and MPVIDEO_OBJ structures.

Included By: backend_man.c
 bootforce.c
 bootmpv.c
 cig_2d_setup.c
 cig_comp_2d.c
 cig_link_2d.c
 esifa_man.c
 loadmpv.c
 mpvideo_*.c (all files except mpvideo_print.c)

A.64 /cig/include/mpvideo_msg.h

The mpvideo_msg.h file provides the typedefs for all messages sent between the real-time software and the MPV via the Force board. Both M_F0_* (RTSW->Force) and M_F1_* (Force->RTSW) messages are included. This file also defines the message codes and various variables used in the messages.

This file is also located in the /cig/othersrc/force directory.

Included By: bootmpv.c
 f0_*.c (all files)
 f1_*.c (all files)
 forcetask.c
 gos_mpvio.c
 gsp_io.c
 loadmpv.c
 mpvideo_laser.c
 mpvideo_lut.c
 mpvideo_man.c
 mpvideo_mode.c
 mpvideo_msg.h
 mpvideo_response.c
 poll_ready.c

A.65 /cig/include/mx_defines.h

The mx_defines.h file defines the following:

- Constants used for Ballistics message queue processing (MX_DEVICE_CLOSED, MX_DEVICE_TABLE_FULL, etc.).
- The MX_DEVICE and MESSAGE_HEADER structures.
- The BCOPY macro (described in Appendix B).

Included By: bal_routines.c
 ballistic.h
 config_ballistics.c
 download_bvols.c
 load_modules.c
 mx_*.c (all files)
 open_dbase.c
 rowcol_rd.c
 simulation.c

A.66 /cig/include/mx2_defines.h

The mx2_defines.h file defines constants used for MPV message queue processing. It includes constants for the MX buffer status (MX_DEVICE_CLOSED, MX_DEVICE_TABLE_FULL, etc.) and message status (MX_MESSAGE_SKIPPED, MX_MESSAGE_PUSHED, etc.).

This file is also located in the /cig/othersrc/force directory.

Included By: bootmpv.c
 f0_*.c (all files)
 f1_process_messages.c
 gos_mpvio.c
 loadmpv.c
 mpvideo_laser.c
 mpvideo_lut.c
 mpvideo_man.c
 mpvideo_mode.c
 mpvideo_response.c
 mx2_hword.c
 mx3_hword.c

A.67 /cig/include/overlay3d_struct.h

The overlay3d_struct.h file provides the typedefs for the M1 gun overlay, M2 gun overlay, gun barrel overlay, calibration overlay, and overlay parameters structures.

This file includes the standard.h and poly_struct.h files.

Included By: dtp_trav2.c
 real_timevpt.h

A.68 /cig/include/ovrly_defs.h

The ovrly_defs.h file defines constants used to create calibration overlays (for example, the dimensions of the frame triangles).

Included By: flea.c
 gossip.c
 real_time.h
 simulation.c

A.69 /cig/include/poly_struct.h

The poly_struct.h file provides the typedefs for the polygon command lines, poly info word, polygon list, and stamp list.

This file includes the standard.h and traverse_cmd_defs.h files.

Included By: model_struct.h
 overlay3d_struct.h
 real_timevpt.h
 vpi_viewport.h

A.70 /cig/include/ppm.h

The ppm.h file contains definitions used when processing PPM messages. It defines the board values and message codes, and provides the typedef for the PPM_DATA_TYPE structure.

Included By: msg_ppm.c

A.71 /cig/include/print_msg_externs.h

The print_msg_externs.h file is not currently used.

Included By: none

A.72 /cig/include/rcinclude.h

The rcinclude.h file is used by the DTP command generator and the Runtime Command Library. It does the following:

- Declares all RCL functions (rcl_push, rcl_pop, etc.).
- Declares address and pointer variables used by the RCL commands.
- Defines the RCL_UNION structure.
- Defines the macros used by dtp_trav1 and dtp_trav2 to generate RCL commands. These macros, which are defined in Appendix B, are used to pass the appropriate data to rcl_command, rcl_lblcmd, rcl_data, and rcl_component.

Included By: dtp_compiler.c
 dtp_funcs.c
 dtp_trav1.c
 dtp_trav2.c
 gos_model.c
 rcfuncs.c

replace_mod.c
test_commands.c

A.73 /cig/include/real_time.h

The real_time.h file includes many of the include files used in the real-time software. The files it includes are the following:

- stdio.h
- dgi_std.c.h
- dgi_stdg.h
- functions.h
- sim_cig_if.h
- rtdb_struct.h
- structures.h
- definitions.h
- ovrly_defs.h
- def_alloc.h
- mbx.h
- esifa.h
- clouds.h
- ecompiler1.h

Included By:

aam_manager.c
autopilot.c
b0_*.c (all files)
bal_get_db_pos.c
bal_get_lm_grid.c
bal_routines.c
ball_effect_add.c
bx_*.c (all files)
cal.c
cig_getm_2d.c
cig_link_2d.c
cigsimio_obj.c
close_db.c
clouds.c
config_ballistics.c
config_color_table.c
config_database.c
db_mcc_setup.c
debug_initdr.c
ded_model_trace.c
ded_object.c
dl_man.c
dl_man.c
download_bvols.c
dtp_emu.c
dynamic_demo.c
effect_downcount.c
file_control.c
find_field.c
find_gtf.c

flea_*.c (all files except flea_simulate_vehicles.c)
fxbvtofl.c
generic_lm.c
get_sio_data.c
get_tx_lut_index.c
gos_*.c (all files except gos_locate.c)
host_enet_if.c
host_flea_if.c
host_if_debug.c
host_scsi_if.c
hw_test.c
load_dbase.c
load_modules.c
loc_ter.c
loc_ter_msg.c
make_bbn.c
make_bbn_logo.c
mkcal.c
model_demo.c
model_mtx.c
msg_calibration_image.c
mx_*.c (all files)
open_dbase.c
open_ded.c
rowcol_rd.c
shot_report.c
show_effect_msg.c
sio.c
sload.c
tick.c
tick_ppm.c
tick_script.c
update_2d.c
update_agpt_2d.c
upstart.c
vt100.c

A.74 /cig/include/real_timevpt.h

The real_timevpt.h file includes the following files:

- stdio.h
- standard.h
- functions.h
- rldb_struct.h
- poly_struct.h
- model_struct.h
- db_struct.h
- bal_struct.h
- mpv_struct.h
- vpi_struct.h
- overlay3d_struct.h
- sim_cig_if.h

- definitions.h
- mbx.h
- esifa.h
- clouds.h
- ecompiler1.h

Included By: be_stubs.c
 cig_config.c
 gun_overlays.c
 overlay_setup.c

A.75 /cig/include/rt_definitions.h

The `rt_definitions.h` file defines constants used throughout the system (e.g., `PI`, `TRUE`, `FALSE`, `NULL`, and various constants useful as tolerance and threshold levels).

Included By: *bal_real_time.h*

A.76 /cig/include/rt_macros.h

The `rt_macros.h` file defines the following macros: `DEGREE_TO_RADIAN`, `TORAD`, `RADIAN_TO_DEGREE`, `ABSVAL`, `SQUARE`, `MAGSQ2D`, `MAGSQ3D`, `CUBE`, `SIGN`, `MAX`, `MIN`, `INIT_MTX`, `FIND_LM`, `FXT0881`, `FLTOFX`, and `FXTOFL`. These are described in Appendix B.

Included By: *bal_real_time.h*

A.77 /cig/include/rt_types.h

The `rt_types.h` file defines the data types used throughout the system (`INT_2`, `INT_4`, etc.).

Included By: *bal_real_time*

A.78 /cig/othersrc/force/rtcdefines.h

The `rtcdefines.h` file defines constants used by the `forcetask` to read and reset the clock.

Included By: *forcetask.c*

A.79 /cig/include/rtdb_struct.h

The `rtdb_struct.h` file defines the following real-time database structures:

- Database version and tag.
- Database header data.
- Database header overflow and landmark data.
- Generic module directory entry data and name.
- Model and catalog tables.

- Database directory entry.
- Load module header.
- Grid locator information.
- Fixed bvol entry
- Load module statistics.
- Floating bvol entry.

This file also defines the maximum number of models that can be put in the generic module of the runtime database, the maximum number of stamps in one unique static object definition, and the number of z values in a grid component.

Included By: flea.c
 flea_bal_opts.c
 gossip.c
 init_sim.c
 msg_cig_ctl.c
 msg_dr11.c
 msg_effect.c
 msg_end.c
 msg_pass_on.c
 msg_subsys_mode.c
 msg_veh_state.c
 msg_vflags.c"
 msg_vport.c
 otherveh_state.c
 real_time.h
 real_timevpt.h
 simulation.c
 staticveh_remove.c
 staticveh_state.c

A.80 /cig/include/sim_cig_defines.h

The sim_cig_defines.h file defines the message code for every CIG->SIM and SIM->CIG message. It also defines M_LAST_VALID_MSG as the last (highest) valid message code.

Included By: flea_simulate_vehicles.c
 global_init.c
 host_dr11_if.c
 host_mpv_if.c
 host_socket_if.c
 init_sim.c
 mpvideo_response.c
 msg_effect.c
 msg_laser.c
 msg_laser_return.c
 msg_lt_state.c
 msg_pass_back.c
 msg_ppm.c
 msg_process_round48.c
 msg_syserr.c
 msg_veh_state.c
 msg_vflags.c

```
print_msg.c
rtt_init.c
sim_cig_if.h
```

A.81 /cig/include/sim_cig_if.h

The `sim_cig_if.h` file includes the files that define common structures, vehicles and effects, and all messages passed between the CIG and the Simulation Host. These files are:

| | |
|---------------------------|--|
| <code>if_hdr_str.h</code> | commonly used structure definitions |
| <code>if_veh_eff.h</code> | vehicle and effect definitions |
| <code>if_ctl_err.h</code> | CIG control, error, and packet definition messages |
| <code>if_init.h</code> | initialization messages |
| <code>if_tst_ctl.h</code> | test and control messages |
| <code>if_sim2cig.h</code> | runtime SIM-to-CIG messages |
| <code>if_cig2sim.h</code> | runtime CIG-to-SIM messages |

This file also includes `sim_cig_defines.h`, which defines all valid message codes.

| | |
|--------------|--------------------------------|
| Included By: | <code>bal_struct.h</code> |
| | <code>cf_translator.c</code> |
| | <code>encode_routines.c</code> |
| | <code>model_struct.h</code> |
| | <code>real_time.h</code> |
| | <code>real_timevpt.h</code> |

A.82 /cig/include/slave133_functions.h

The `slave133_functions.h` file declares the `slave133_malloc` function. This file is included by `ballistics.h` when building the version of Ballistics that runs on a Slave board.

| | |
|--------------|---------------------------|
| Included By: | <code>ballistics.h</code> |
|--------------|---------------------------|

A.83 /cig/include/standard.h

The `standard.h` file defines the standard data types (`INT_2`, `INT_4`, `BYTE`, etc.); 2-, 3-, and 4-dimensional vertex points; 4x3 and 4x4 matrices; 2- and 3-dimensional bounding boxes; red, green, blue; red, green, blue, opaque; hue, saturation, lightness; hue, saturation, lightness, opaque.

| | |
|--------------|------------------------------------|
| Included By: | <code>bal_struct.h</code> |
| | <code>cnode_*.c</code> (all files) |
| | <code>db_struct.h</code> |
| | <code>dtp_*.c</code> (all files) |
| | <code>encode_routines.c</code> |
| | <code>fill_tree.c</code> |
| | <code>flagoff.c</code> |
| | <code>globs.c</code> |
| | <code>init_free.c</code> |
| | <code>linkvpt.c</code> |
| | <code>model_struct.h</code> |

mpv_struct.h
mtx_*.c (all files)
overlay3d_struct.h
path.c
path_init.c
path_query.c
poly_struct.h
process_vflags.c
process_vppos.c
rcfuncs.c
real_timevpt.h
trav_tree.c
tst_*.c (all files)
u_brmask.c
u_path.c
u_rotations.c
u_viewport.c
u_xfrm.c
update_mtx.c
update_rot.c
vpi_query.h
vpi_struct.h
vpi_viewport.h
vpt_*.c (all files)

A.84 /gt/include/stdio.h

The stdio.h file is the Ready Systems standard input/output header file. It defines flags used for file i/o, defines various constants, and declares file i/o functions.

Included By:

- aa_init.c
- backend_*.c (all files)
- bootforce.c
- bootmpv.c
- buffer_errors.c
- bx147_main.c
- bx_task.c
- bx_task.c
- cf_translator.c
- cig_2d_setup.c
- cnode_*.c (all files)
- config_database.c
- db_mcc_setup.c
- directory.c
- download_bvols.c
- dtp_*.c (all files)
- esifa_*.c (all files)
- flagoff.c
- flea.c
- flea_bal_opts.c
- flea_simulate_vehicles.c
- globs.c
- gossip.c

host_dr11_if.c
host_ex_if.c
host_mpv_if.c
host_socket_if.c
init_free.c
init_sim.c
lex.c
linkvpt.c
load_esifa.c
loadmpv.c
mkmtx_nt.c
mpvideo_*.c (all files except mpvideo_print.c)
msg_*.c (all files except msg_calibration_image.c)
mtx_concat.c
mtx_dump.c
otherveh_state.c
path.c
path_init.c
path_query.c
ppm_obj.c
pretend_veh.c
print_msg.c
real_time.h
real_timevpt.h
rtt.c
rtt_init.c
shot_report.c
simulation.c
staticveh_remove.c
staticveh_state.c
subsys_cfg_parse.c
sys_control.c
tst_*.c (all files)
u_*.c (all files)
update_mtx.c
update_rot.c
vpt_*.c (all files)

A.85 /gt/include/strings.h

The strings.h file is a standard header file that declares all string-related functions.

Included By:

- flea.c
- flea_atp.c
- flea_bal_opts.c
- flea_switches.c
- host_if_debug.c
- mx_error.c
- print_msg.c
- rtt.c
- rtt_init.c
- tick.c
- tick_ppm.c

tick_script.c

A.86 /cig/include/struct_2d.h

The struct_2d.h file defines the window structures used by the 2-D compiler.

Included By: global_2d.h
 globfir_2d.h

A.87 /cig/include/structures.h

The structures.h file defines various data structures used to process overlays and static and dynamic models. It includes typedefs for the following structures:

- Component data type (3-D point, 2-D point, and vector).
- Texture map index.
- Polygon information word.
- Polygon and stamp lists.
- Gunner, bun barrel, and calibration overlays.
- Field-of-view test table.
- Load module call tables.
- Static and dynamic tanks.
- Static and dynamic single-transform models.
- Remove static model.
- Show effects (stamp structure).
- Ballistics chord data.
- Trajectory positions and data.
- Load module-specific data.
- Grid component definition.

This file also defines the following:

- DTP data transformation commands.
- DTP data component commands.
- DTP data traversal commands.
- Ballistics and local terrain data pointers.
- Bounding plane definitions.
- Channel definitions.

Included By: flea.c
 flea_bal_opts.c
 gossip.c
 init_sim.c
 msg_cig_ctl.c
 msg_dr11.c
 msg_effect.c
 msg_end.c
 msg_pass_on.c
 msg_subsys_mode.c
 msg_veh_state.c
 msg_vport.c
 otherveh_state.c

real_time.h
simulation.c
staticveh_remove.c
staticveh_state.c

A.88 /cig/include/subsys_cfg_parse.h

The `subsys_cfg_parse.h` file defines the maximum number of subsystems and the maximum length of a `subsys.cfg` file.

Included By: `subsys_cfg_parse.c`

A.89 /gt/include/sysdefs.h

The `sysdefs.h` file provides system definitions for operating system versions RTOS.101 and RTOS.102. It includes the following:

- System-wide memory, resource, and software and hardware fault definitions.
- Task definitions.
- I/O control system definitions.
- VRTX return codes.
- Disk manager fault codes.
- File control system error codes.
- Special character definitions.
- 68901 equates.
- System interrupt equates.
- Definitions and structures used by `file_control`.

Included By: `bx147_main.c`
 `rtt.c`
 `rtt_init.c`

A.90 /cig/include/sysdefs2.h

The `sysdefs2.h` file provides system definitions for operating system version FOS.100, which allows the use of high-speed disks. It includes the following:

- System-wide memory, resource, and software and hardware fault definitions.
- Task definitions.
- I/O control system definitions.
- VRTX return codes.
- Disk manager fault codes.
- File control system error codes.
- Special character definitions.
- 68901 equates.
- System interrupt equates.
- Definitions and structures used by `file_control`.

This file includes the `dgi_std.c` file.

Included By: `getch.c`

A.91 /cig/include/tflat.h

The tflat.h file defines Ballistics round trajectories for a completely flat trajectory. This is a default table loaded for testing purposes.

Included By: bx_init.c

A.92 /cig/include/tflat_7k.h

The tflat_7k.h file defines Ballistics round trajectories for a completely flat trajectory, for use with 7000-meter viewing ranges. This is a default table loaded for testing purposes.

Included By: bx_init.c

A.93 /cig/include/tflat_fast.h

The tflat_fast.h file defines Ballistics round trajectories for a completely flat trajectory with a very fast fly-out. This is a default table loaded for testing purposes.

Included By: bx_init.c

A.94 /cig/include/tflat_slow.h

The tflat_slow.h file defines Ballistics round trajectories for a completely flat trajectory with a very slow fly-out. This is a default table loaded for testing purposes.

Included By: bx_init.c

A.95 /cig/include/traverse_cmd_defs.h

The traverse_cmd_defs.h file defines the following:

- The typedef for the texture map indices structure.
- The command_id values for all transform data, data components, traverse data DTP commands.
- Constants used for Ballistics and local terrain traversal.
- Maximum buffer sizes.
- Bounding plane definitions.
- Channel definitions.

Included By: poly_struct.h

A.96 /cig/include/u105mmsabot30hz.h

The u105mmsabot30hz.h file defines Ballistics round trajectories for a u105mmsabot round with a 30 Hz sample rate. This is a default table loaded for testing purposes.

Included By: bx_init.c

A.97 /cig/include/u25mmheat.h

The u25mmheat.h file defines Ballistics round trajectories for a u25mmheat round with a 15 Hz sample rate. This is a default table loaded for testing purposes.

Included By: bx_init.c

A.98 /cig/libsrc/libvpt/vpi_msgs.h

The vpi_msgs.h file provides the typedefs for the messages that may appear in the ASCII viewport configuration file processed by tst_ereadconfig. It also defines the message codes and provides the typedefs for the fov, resolution, and terrain feedback point structures.

Included By: tst_ereadconfig.c

A.99 /cig/include/vpi_query.h

The vpi_query.h file defines the typedefs for the vpt_cnode_info, vpt_path_info, and vpt_vpt_info structures used when querying information in the Viewport Configuration tree.

Included By: cnode_query.c
 path_init.c
 path_query.c
 tst_equery.c
 tst_tretrace.c
 vpt_query.c

A.100 /cig/include/vpi_struct.h

The vpi_struct.h file defines the following for the Viewport Configuration CSC:

- The maximum number of configuration nodes and viewport nodes.
- The typedefs for the RTS3x3_MTX, RTS4x3_MTX, and ROT2x1 matrix structures.
- The typedef for the MTXUNION structure.

This file also includes standard.h and def_mtx_type.h.

Included By: be_stubs.c
 cnode_*.c (all files)
 dtp_*.c (all files)
 fill_tree.c
 flagoff.c
 globs.c
 gos_locate.c
 init_free.c
 linkvpt.c

```

mkmtx_nt.c
mtx_*.c (all files)
path.c
path_init.c
path_query.c
process_vppos.c
real_timevpt.h
trav_tree.c
tst_*.c (all files except tst_edebug.c)
u_brmask.c
u_path.c
u_rotations.c
u_viewport.c
u_xfrm.c
update_mtx.c
update_rot.c
vpi_viewport.h
vpt_*.c (all files)

```

A.101 /cig/include/vpi_viewport.h

The vpi_viewport.h file defines the following for the Viewport Configuration CSC:

- The SUCCEED and FAIL return values.
- The TORAD and toradians macros (described in Appendix B).
- The maximum number of branch values.
- The typedefs for the system view flags and the view positions (vppos) array structures.
- The typedef for the configuration node, viewport parameters, and graphics path parameters structure.
- The typedefs for the fov vector, screen, and screen constants structures.

This file also includes standard.h, vpi_struct.h, and poly_struct.h.

```

Included By:
be_stubs.c
cig_config.c
cnode_*.c (all files)
dtp_*.c (all files)
fill_tree.c
flagoff.c
globs.c
gos_locate.c
init_free.c
linkvpt.c
mtx_concat.c
path.c
path_init.c
path_query.c
process_vflags.c
process_vppos.c
trav_tree.c
tst_*.c (all files except tst_edebug.c)
u_brmask.c

```

u_path.c
u_rotations.c
u_viewport.c
u_xfrm.c
update_mtx.c
update_rot.c
vpt_*.c (all files)

APPENDIX B. SYSTEM MACROS

Macros are used throughout the system to perform specialized functions. Most of the macros that are used by more than one function are defined in one of the following files:

bx_macros.h

Macros used exclusively by Ballistics.

functions.h

Macros used throughout the real-time software.

rfuncs.c and rcinclude.h

Macros used by the Runtime Command Library (RCL) and the DTP Command Generator.

rt_macros

Macros used throughout the real-time software.

Macros that are used in only one function are usually defined in the source file that contains the function.

Although some macros are used exclusively in one area of the system, others are used by multiple CSCs. For easy reference, all macros are described in this appendix, in alphabetical order. Each macro's description specifies where the macro is defined, which functions use it, what routines it calls, and what parameters it takes.

In section 2 of this document, macros are treated as functions — i.e., if a function uses a macro, the macro is listed in the function's Routines Called list.

B.1 AAM1_TO_AAM2

The AAM1_TO_AAM2 macro determines (using AAM2_OFFSET) the location in active area memory in backend 1 (AAM2) that corresponds to a given location in active area memory in backend 0 (AAM1).

The usage is AAM1_TO_AAM2(addr), where *addr* is the address in backend 0's active area memory.

| | | |
|------------------|---|------|
| Defined In: | kludge.h | |
| Called By: | _handle_point_lights _update_second_active_area_memory | |
| Routines Called: | none | |
| Parameters: | INT_4 | addr |

B.2 AAM2_ADDR

The AAM2_ADDR macro <<TBD>>.

The usage is AAM2_ADDR(addr), where *addr* is <<TBD>>

| | |
|------------------|--|
| Defined In: | functions.h process_vflags.c |
| Called By: | backend_set_color backend_set_thermal backend_update_view_paths cloud_mgmt cloud_update init_simulation process_vflags |
| Routines Called: | none |
| Parameters: | INT_4 addr |

B.3 AAREAD

The AAREAD macro, defined in definitions.h, is not currently used.

B.4 ABSVAL

The ABSVAL macro, defined in definitions.h and rt_macros.h, is not currently used.

B.5 BCOPY

The BCOPY macro is used to copy a specified number of bytes. The usage is BCOPY(source, dest, byte_count), where:

source is a pointer to the source location
dest is a pointer to the destination location
byte_count is the number of bytes to be copied

BCOPY passes these parameters to bcopy, which performs the copy. The BCOPY macro has been retained for backward compatibility.

| | |
|-------------|--------------|
| Defined In: | mx_defines.h |
|-------------|--------------|

Called By: b0_add_static_vehicle
 b0_bal_config
 b0_bvol_entry
 b0_database_info
 b0_model_entry
 bx_chord_intersect
 download_bvols
 mx_push

Routines Called: bcopy

Parameters: WORD *source
 WORD *dest
 HWORD byte_count

B.6 CHECK_FORCE

The CHECK_FORCE macro checks to see if the Force task is running by reading the ready bit (FRONT_RDY_MASK) in the front-end control register (FE_CONTROL). If Force is running, the Gossip operation is denied and the user is asked to retry later.

The usage is CHECK_FORCE.

Defined In: gos_120tx.c
 gos_mpv.c

Called By: gos_mpv

Routines Called: printf

Parameters: none

B.7 CHECKROT

The CHECKROT macro is used to validate rotation values for Flea vehicles. Two versions of this macro exist.

The CHECKROT macro in fleasimulate_vehicles.c is used to validate the rotation value for a Flea vehicle, and to change it if it is outside the range 0-360 degrees. The usage is CHECKROT(x), where x is the rotation in degrees. If x is greater than or equal to 360.0, CHECKROT subtracts 360.0. If x is less than or equal to 360.0, CHECKROT adds 360.0.

Defined In: fleasimulate_vehicles.c

adr is the command address
wc is the number of words to be moved
str is a string to be output to identify the operation

Defined In: ded_model_trace.c

Called By: ded_model_trace

Routines Called: printf
 PUSH_STACK

Parameters: INT_4 adr
 INT_4 wc
 char str[]

B.11 DEGREE_TO_RADIAN

The DEGREE_TO_RADIAN macro, defined in rt_macros.h, is not current used.

B.12 DELETE_ROUND

The DELETE_ROUND macro is used by Ballistics to remove a round from the active list and put it on the free list.

The usage is DELETE_ROUND(*dead_round_P*), where *dead_round_P* is a pointer to the round to be deleted.

Defined In: bx_macros.h

Called By: b0_cancel_round
 b0_new_frame
 b0_process_round
 b0_round_fired

Routines Called: none

Parameters: ROUND_DATA *dead_round_P

B.13 DELETE_STAT_VEH

The DELETE_STAT_VEH macro is used by Ballistics to remove a static vehicle from a load module list and put it on the free list.

The usage is **DELETE_STAT_VEH**(*dead_sv_P*, *table_P*), where:

dead_sv_P is a pointer to the static vehicle to be deleted
table_P is a pointer to the vehicle table

| | | |
|------------------|--------------------------|------------------------|
| Defined In: | bx_macros.h | |
| Called By: | b0_delete_static_vehicle | |
| Routines Called: | none | |
| Parameters: | STAT_VEH STRUCT_P_SV | *dead_sv_P *table_P |

B.14 DOWNLOAD_DATA

The **DOWNLOAD_DATA** macro downloads 2-D overlay data into GSP memory. This macro is used by linkup to download the 2-D overlays after they are generated by the 2-D overlay compiler.

The usage is **DOWNLOAD_DATA**. The macro does the following:

- Calls the **WAIT_MPVIO** macro to wait for the ready bit in the Force front-end control register to be set, indicating that the MPV is ready to receive data.
- Sets the GSP addresses in the MPV mailbox.
- Copies the compiler data to the *data_area*.
- Sets the *data_count* in the MPV mailbox.
- Sets the Force command in *fe_control* to **SUBSYS_WRITE_START**.

| | |
|------------------|---------------|
| Defined In: | cig_link_2d.c |
| Called By: | linkup |
| Routines Called: | WAIT_MPVIO |
| Parameters: | none |

B.15 dtp.* (DTP Macros)

Macros are used by the DTP Command Generator functions (and some testing functions in Gossip) to interface to the Runtime Command Library (RCL). The macros call RCL routines to generate the actual commands that are downloaded to the hardware.

Each DTP hardware command has one or more supporting macros. The macro called by the DTP Command Generator functions depends on the desired command, whether a label is being used, and whether relative or absolute addressing is being used.

The following table lists each DTP macro and identifies its parameters, calling routines, and called routines. It also identifies the DTP command generated by RCL for each macro. Detailed descriptions of the hardware commands are beyond the scope of this document.

Defined In: rcinclude.h

Called By: see table below

Routines Called: see table below

Parameters: see table below

| Macro (parameters) | DTP Hardware Command Generated | Called By | Routines Called |
|---|-----------------------------------|-------------------------------|--------------------|
| dtp_bcn(label, mask, channel_data_offset) | Branch Channel Non-Zero | test_commands | rcl_iblcmd |
| dtp_bcnr(label, mask, channel_data_offset) | Branch Channel Non-Zero Relative | test_commands | rcl_iblcmd |
| dtp_bcnrs(aam_address, mask, channel_data_offset) | Branch Channel Non-Zero Relative | none | rcl_command |
| dtp_bcns(aam_address, mask, channel_data_offset) | Branch Channel Non-Zero | none | rcl_command |
| dtp_bcz(label, mask, channel_data_offset) | Branch Channel Zero | test_commands | rcl_iblcmd |
| dtp_bczr(label, mask, channel_data_offset) | Branch Channel Zero Relative | test_commands | rcl_iblcmd |
| dtp_bczrs(aam_address, mask, channel_data_offset) | Branch Channel Zero Relative | none | rcl_command |
| dtp_bczs(aam_address, mask, channel_data_offset) | Branch Channel Zero | none | rcl_command |
| dtp_bdgr(label, cos_squared) | Branch DOT Greater Than Relative | test_commands | rcl_iblcmd |
| dtp_bdgrs(pc_offset, cos_squared) | Branch DOT Greater Than Relative | none | rcl_command |
| dtp_bdlr(label, cos_squared) | Branch DOT Less Than Relative | replace_mod, test_commands | rcl_iblcmd |
| dtp_bdlrs(pc_offset, cos_squared) | Branch DOT Less Than Relative | none | rcl_command |
| dtp_bgn(label, mask) | Branch Generic Non-Zero | test_commands | rcl_iblcmd |

| | | | |
|--|---------------------------------------|--|-------------|
| dtb_bgn(aam_address, mask) | Branch Generic Non-Zero | none | rcl_command |
| dtb_bgz(label, mask) | Branch Generic Zero | test_commands | rcl_iblcmd |
| dtb_bgzs(aam_address, mask) | Branch Generic Zero | none | rcl_command |
| dtb_blm(dtp_viewpoint_address, dtp_result_address, x_multiplier, y_multiplier) | Base Load Module Calculation | dtp_trav2 | rcl_command |
| dtb_bnz(label, mask, dtp_address) | Branch Non-Zero | dtp_trav1, dtp_trav2, test_commands | rcl_iblcmd |
| dtb_bnzr(label, mask, dtp_address) | Branch Non-Zero Relative | test_commands | rcl_iblcmd |
| dtb_bnzrs(aam_address, mask, dtp_address) | Branch Non-Zero Relative | none | rcl_command |
| dtb_bnzs(aam_address, mask, dtp_address) | Branch Non-Zero Relative | none | rcl_command |
| dtb_bpc() | Bounding Plane Normals Calculation | dtp_trav2 | rcl_command |
| dtb_bpcx() | Bounding Plane Normals Calculation TX | none | rcl_command |
| dtb_bru(label) | Branch Unconditionally | dtp_trav1, dtp_trav2, replace_mod, test_commands | rcl_iblcmd |
| dtb_brur(label) | Branch Unconditionally Relative | test_commands | rcl_iblcmd |
| dtb_brurs(pc_offset) | Branch Unconditionally | none | rcl_command |
| dtb_brus(aam_address) | Branch Unconditionally Relative | dtp_trav1, dtp_trav2 | rcl_command |
| dtb_brz(label, mask, dtp_address) | Branch Zero | dtp_trav2, replace_mod, test_commands | rcl_iblcmd |
| dtb_brzr(label, mask, dtp_address) | Branch Zero Relative | test_commands | rcl_iblcmd |
| dtb_brzrs(pc_offset, mask, dtp_address) | Branch Zero Relative | none | rcl_command |
| dtb_brzs(aam_address, mask, dtp_address) | Branch Zero | none | rcl_command |
| dtb_dot(vx, vy, vz) | Dot Product | replace_mod, test_commands | rcl_command |
| dtb_elm() | End Load Module | test_commands | rcl_command |
| dtb_end() | End Current Path | dtp_trav1, dtp_trav2, test_commands | rcl_command |
| dtb_fov(label, radius) | Field of View Test | replace_mod, test_commands | rcl_iblcmd |
| dtb_fovr(label, radius) | Field of View Test Relative | test_commands | rcl_iblcmd |
| dtb_fovrs(pc_offset, radius) | Field of View Test Relative | none | rcl_command |

| | | | |
|---|--|--|-------------|
| dtp_fovs(aam_address, radius) | Field of View Test | none | rcl_command |
| dtp_gdc(label, centroid_x, centroid_y, centroid_z, asid) | Generic Data Call | none | rcl_iblcmd |
| dtp_gdci(label, centroid_x, centroid_y, centroid_z, asid, dptr) | Generic Data Call | test_commands | rcl_iblcmd |
| dtp_gdcir(label, centroid_x, centroid_y, centroid_z, asid, dptr) | Generic Data Call Relative | none | rcl_iblcmd |
| dtp_gdcirs(aam_address, centroid_x, centroid_y, centroid_z, asid, dptr) | Generic Data Call Relative | none | rcl_command |
| dtp_gdcis(aam_address, centroid_x, centroid_y, centroid_z, asid, dptr) | Generic Data Call | none | rcl_command |
| dtp_gdcn(label, centroid_x, centroid_y, centroid_z) | Generic Data Call | none | rcl_iblcmd |
| dtp_gdcnr(label, centroid_x, centroid_y, centroid_z) | Generic Data Call Relative | none | rcl_iblcmd |
| dtp_gdcnrs(aam_address, centroid_x, centroid_y, centroid_z) | Generic Data Call Relative | none | rcl_command |
| dtp_gdcns(aam_address, centroid_x, centroid_y, centroid_z) | Generic Data Call | none | rcl_command |
| dtp_gdcr(label, centroid_x, centroid_y, centroid_z, asid) | Generic Data Call Relative | test_commands | rcl_iblcmd |
| dtp_gdcrs(aam_address, centroid_x, centroid_y, centroid_z, asid) | Generic Data Call Relative | none | rcl_command |
| dtp_gdcs(aam_address, centroid_x, centroid_y, centroid_z, asid) | Generic Data Call | none | rcl_command |
| dtp_gr(offset) | Generic Return | outahere, replace_mod, test_commands | rcl_command |
| dtp_lmi(label, radius) | Load Module In Field of View Test | test_commands | rcl_iblcmd |
| dtp_lmirl(label, radius) | Load Module In Field of View Test Relative | test_commands | rcl_iblcmd |
| dtp_lmirs(pc_offset, radius) | Load Module In Field of View Test Relative | none | rcl_command |
| dtp_lmisl(aam_address, radius) | Load Module In Field of View Test | none | rcl_command |
| dtp_lod(label, range_squared) | Level of Detail Test | replace_mod, test_commands | rcl_iblcmd |
| dtp_lodr(label, range_squared) | Level of Detail Test Relative | test_commands | rcl_iblcmd |
| dtp_lodrs(pc_offset, range_squared) | Level of Detail Test Relative | none | rcl_command |
| dtp_lods(aam_address, range_squared) | Level of Detail Test | none | rcl_command |
| dtp_lwd(label, dtp_address, word_count) | Load Words | dtp_trav1, test_commands | rcl_iblcmd |
| dtp_lwdr(label, dtp_address, word_count) | Load Words Relative | none | rcl_iblcmd |

| | | | |
|--|-----------------------------------|---|-------------|
| dtp_lwdrs(pc_offset, dtp_address, word_count) | Load Words Relative | none | rcl_command |
| dtp_lwds(aam_address, dtp_address, word_count) | Load Words | dtp_trav1, dtp_trav2 | rcl_command |
| dtp_mml(dtp_address_a, dtp_address_b, dtp_address_c) | Matrix Multiply Local (A*B=>C) | none | rcl_command |
| dtp_mmpre(dtp_address_a, dtp_address_b, dtp_address_c) | Matrix Multiply Pre (A*B=>C) | none | rcl_command |
| dtp_mmpst(dtp_address_a, dtp_address_b, dtp_address_c) | Matrix Multiply Post (A*B=>C) | dtp_trav1, dtp_trav2 | rcl_command |
| dtp_mwd(dtp_address_a, dtp_address_b, word_count) | Move Words | dtp_trav1 | rcl_command |
| dtp_ngc(centroid_x, centroid_y, centroid_z) | Non-Generic Centroid | test_commands | rcl_command |
| dtp_oio(output_offset, word_count) | Output Indirect Offset | test_commands | rcl_command |
| dtp_oos(output_offset, word_count, stack_offset) | Output Offset Stack | test_commands | rcl_command |
| dtp_osd(label) | Output Single Word Direct | dtp_trav2 | rcl_iblcmd |
| dtp_osds(aam_address) | Output Single Word Direct | none | rcl_command |
| dtp_owd(label, word_count) | Output Words Direct | dtp_trav2, outahere, replace_mod, test_commands | rcl_iblcmd |
| dtp_owds(aam_address, word_count) | Output Words Direct | dtp_trav2 | rcl_command |
| dtp_owdsc(label, end_label) | Output Words Direct - Set Count | outahere, test_commands | rcl_iblcmd |
| dtp_owo(aam_address_offset, word_count) | Output Words Offset | replace_mod, test_commands | rcl_command |
| dtp_owr(label, word_count) | Output Words Relative | test_commands | rcl_iblcmd |
| dtp_owrs(pc_offset, word_count) | Output Words Relative | none | rcl_command |
| dtp_owrsc(label, end_label) | Output Words Relative - Set Count | none | rcl_iblcmd |
| dtp_rc() | Range Calculation | replace_mod, test_commands | rcl_command |
| dtp_sub(label) | Subroutine Call | replace_mod, test_commands | rcl_iblcmd |
| dtp_subr(label) | Subroutine Call Relative | test_commands | rcl_iblcmd |
| dtp_subrs(pc_offset) | Subroutine Call Relative | none | rcl_command |
| dtp_subs(aam_address) | Subroutine Call | dtp_trav2 | rcl_command |
| dtp_tbc(total_time) | Time Base Calculation | replace_mod, test_commands | rcl_command |
| dtp_tbdr(label, start_time, end_time) | Time Base Data Relative | replace_mod, test_commands | rcl_iblcmd |
| dtp_tbdrs(pc_offset, start_time, end_time) | Time Base Data Relative | none | rcl_command |

| | | | |
|-----------------------------------|----------------------|-------------------------------|-------------|
| dtp_tbrt(label, maximum_time) | Time Branch Relative | replace_mod, test_commands | rcl_iblcmd |
| dtp_tbrs(pc_offset, maximum_time) | Time Branch Relative | none | rcl_command |

B.16 DUMP_DART_BUFFER

The DUMP_DART_BUFFER macro, defined in functions.h, is no longer used.

B.17 ERRMSG

The ERRMSG macro prints an error for the Runtime Command Library (RCL) functions. The usage is ERRMSG(*a*, *b*), where:

a is the error message text
b is the name of the calling routine

Defined In: rcfuncs.c

Called By: rcl_patch_adrs
 rcl_pop
 rcl_push
 rcl_set_cntlbl
 rcl_set_label

Routines Called: printf

Parameters: char a[]
 char b[]

B.18 EXCHANGE_FLEA_DATA

The EXCHANGE_FLEA_DATA macro is used by Flea to exchange message packets with the real-time software. It generates the MSG_END message and the message header, posts a message to the FLEA_INPUT_MB mailbox, then waits for a message to be posted to the FLEA_OUTPUT_MB mailbox.

The usage is EXCHANGE_FLEA_DATA(*flea_ims*, *flea_oms*), where:

flea_ims is a pointer to the Flea-to-CIG message packet
flea_oms is a pointer to the CIG-to-Flea message packet

Defined In: functions.h

Called By: flea

flea_init_cig_sw

Routines Called: sc_pend
 sc_post

Parameters: INT_4 *flea_imsg
 INT_4 *flea_omsg

B.19 FIND_LM

The FIND_LM macro finds the load module that a given x, y location lies in. It is assumed that the point is within active area memory.

The usage is FIND_LM(x, y, lm, inv_width, mask, num_per_side), where:

x is the location's x coordinate
y is the location's y coordinate
lm is the number of the load module
inv_width is the inverse of the width of a load module
mask is the mask of the number of load module blocks per side
num_per_side is the number of load modules per side of AAM

Defined In: functions.h
 rt_macros.h

Called By: bal_get_db_pos
 ball_effect_add
 bx_probe
 gos_bal_query
 otherveh_state
 show_effect_msg
 staticveh_remove
 staticveh_state

Routines Called: none

Parameters: INT_4 x
 INT_4 y
 INT_4 lm
 REAL_4 inv_width
 INT_4 mask
 HWORD num_per_side

B.20 FLTOFX

The FLTOFX macro, defined in rt_macros.h, is no longer used.

B.21 FREE_LM_CACHE

The `FREE_LM_CACHE` macro, when given a load module in the Ballistics database cache, puts the bounding volumes in that load module on the free bvol list, and puts the polygons in that load module on the free polygon lists.

The usage is `FREE_LM_CACHE(lm_dir)`, where *lm_dir* is a load module in the cache.

| | | |
|------------------|--|---------|
| Defined In: | bx_macros.h | |
| Called By: | b0_lm_read bx_new_bvol bx_new_poly | |
| Routines Called: | none | |
| Parameters: | LM_CACHE_ENTRY | *lm_dir |

B.22 FXT0881

The `FXT0881` macro converts a fixed value to floating point. The usage is `FXT0881(fxd,flt, bits)`, where:

fxd is the fixed point value to be converted
flt is the floating point value (result)
bits is the number of fractional bits in the fixed point number

| | | |
|------------------|--|--------------------|
| Defined In: | functions.h rt_macros.h | |
| Called By: | bx_get_lm_data esifa_laser_return fxbvtofl fxbvtofl_020 fxbvtofl_dart local_terrain mpvideo_response | |
| Routines Called: | none | |
| Parameters: | INT_2 REAL_4 INT_4 | fxd flt bits |

B.23 FXTOFL

The FXTOFL macro, defined in `rt_macros.h`, is no longer used.

B.24 GET_CHORD_END

The GET_CHORD_END macro, defined in `bx_macros.h`, is not currently used.

B.25 GET_DB_POS

The GET_DB_POS macro is used by Ballistics to find the load module that corresponds to a given point in the database.

The usage is `GET_DB_POS(point_P, lm_width, inv_lm_width, lm_per_side)`, where:

point_P is a pointer to the location in the database
lm_width is the width of a load module
inv_lm_width is inverse of the width of a load module
lm_per_side is the number of load modules in a row or column of AAM

Defined In: `bx_macros.h`

Called By: `b0_process_chord`
 `b0_tf_vehicle_pos`
 `b0_traj_chord`
 `bx_trajectory`

Routines Called: `none`

| | | |
|-------------|-------------------------|---------------------------|
| Parameters: | <code>POINT_DATA</code> | <code>*point_P</code> |
| | <code>HWORD</code> | <code>lm_width</code> |
| | <code>REAL_4</code> | <code>inv_lm_width</code> |
| | <code>HWORD</code> | <code>lm_per_side</code> |

B.26 GET_LB_FROM_LM

The GET_LB_FROM_LM macro is used by Ballistics to take a load module number and calculate the number of the load block that module is in.

The usage is `GET_LB_FROM_LM(lm, lb)`, where:

lm is the load module number (0 to 1023)
lb is the load block number (0 to 255)

Defined In: bx_macros.h

Called By: b0_process_chord
 b0_round_fired
 bx_chord_intersect
 bx_round_tracer_position

Routines Called: none

Parameters: INT_4 lm
 INT_4 lb

B.27 GLOB

The GLOB macro has no effect — GLOB(x) is defined as x. This macro was required in an earlier implementation to access global memory on a specific platform.

Defined In: ememory_map.h
 memory_map.h

Called By: _rowcol_rd
 autopilot
 bal_buffer_setup
 bx_task
 cal
 cig_config
 cloud_init
 cloud_mgmt
 cloud_placement
 cloud_update
 config_ballistics
 db_mcc_setup
 dtp_emu
 file_control
 flea_atp
 flea_bal_opts
 flea_graphics_test
 flea_init_cig_sw
 flea_switches
 flea_veh_control
 get_tx_lut_index
 getside
 gos_120tx
 gos_model
 gos_mpvio
 gos_system
 host_if_debug_tick

hw_test
 load_modules
 local_terrain
 model_mtx
 msg_calibration_image
 msg_cig_ctl
 msg_dr11_pkt_size
 open_dbase
 process_a_msg
 sim_bal_* (all functions except sim_bal_init)
 simulation
 tick
 update_2d
 upstart

Routines Called: none

Parameters: none

B.28 INCR_COMPONENT

The `INCR_COMPONENT` macro is used by the Runtime Command Library functions to update a component's word count, polygon count, and vertex count.

The usage is `INCR_COMPONENT(incr)`, where *incr* is the count increment.

Defined In: rfuncs.c

Called By: rcl_component
rcl_data

Routines Called: none

Parameters: WORD incr

B.29 INIT_MTX

The `INIT_MTX` macro initializes a 4x3 matrix to the identity matrix. The last column is assumed and zeroes are assumed loaded. This routine is used to initialize the matrices for all static and dynamic vehicles on start-up.

The usage is `INIT_MTX(matrix)`, where *matrix* is the model's transformation matrix.

Defined In: functions.h
rt_macros.h

Called By: cloud_init
 dl_setup

Routines Called: none

Parameters: REAL_4 matrix

B.30 MAGSQ2D

The MAGSQ2D macro, defined in `rt_macros.h`, is not currently used.

B.31 MAGSQ3D

The MAGSQ3D macro, defined in `rt_macros.h`, is not currently used.

B.32 MALLOC

The MALLOC macro is used to allocate memory for Ballistics structures. MALLOC calls `slave133_malloc` if Ballistics is running on a slave board; otherwise it calls the standard `malloc` routine.

The usage is `MALLOC(size)`, where *size* is the amount of memory to be allocated.

Defined In: bx_defines.h

Called By: b0_add_traj_table
 b0_database_info

Routines Called: malloc
 slave133_malloc

Parameters: int size

B.33 MAX

The MAX macro, defined in `rt_macros.h`, is not currently used.

B.34 MIN

The MIN macro, defined in `rt_macros.h`, is not currently used.

B.35 NEW_ROUND

The NEW_ROUND macro is used by Ballistics to get a new round from the free list and set a pointer to it.

The usage is NEW_ROUND(*new_round_P*), where *new_round_P* is the pointer for the new round.

| | | |
|------------------|------------------------------------|--------------|
| Defined In: | bx_macros.h | |
| Called By: | b0_process_round b0_round_fired | |
| Routines Called: | none | |
| Parameters: | ROUND_DATA | *new_round_P |

B.36 NEW_STAT_VEH

The NEW_STAT_VEH macro is used by Ballistics to get a static vehicle from the free list and put it in the vehicle table list of a specified load module.

The usage is NEW_STAT_VEH (*veh_table_P*, *new_sv_P*), where:

veh_table_P is a pointer to the vehicle table
new_sv_P is the pointer to the new vehicle

new_sv_P is set to NULL if no pointers are available (i.e., the maximum number of static vehicles has been reached).

| | | |
|------------------|-------------------------|---------------------------|
| Defined In: | bx_macros.h | |
| Called By: | b0_add_static_vehicle | |
| Routines Called: | none | |
| Parameters: | STRUCT_P_SV STAT_VEH | *veh_table_P *new_sv_P |

B.37 OPEN_FLEA_DATA

The OPEN_FLEA_DATA macro is used by Flea to obtain the file descriptors for the input and output channels for Flea-CIG communications. The macro waits for a message to be posted to the FLEA_OUTPUT_MB mailbox, then sets pointers to the input and output packet buffers.

The usage is OPEN_FLEA_DATA(input_ptr, output_ptr), where:

input_ptr is a pointer to the Flea-to-CIG message packet buffer
output_ptr is a pointer to the CIG-to-Flea message packet buffer

| | | |
|------------------|----------------|---------------------------|
| Defined In: | functions.h | |
| Called By: | flea | |
| Routines Called: | sc_pend | |
| Parameters: | INT_4 INT_4 | *input_ptr *output_ptr |

B.38 OUTPUT_MESSAGE

The OUTPUT_MESSAGE macro, used by Flea, copies messages and message headers to the output message buffer. This macro is defined and used in two different places.

The OUTPUT_MESSAGE macro defined in cf_translator.c is used by config_translator and the process_* functions to copy messages to a temporary message buffer (output_msg_buffer). The usage is OUTPUT_MESSAGE(message), where message is the message or message header to be copied. The macro also keeps track of the size of the output message buffer.

| | |
|-------------|--|
| Defined In: | cf_translator.c |
| Called By: | config_translator process_2d_setup process_2d_setup process_add_traj_table process_agl_setup process_ammo_define process_cig_ctl process_configtree_node process_define_tx_mode process_dr11_pkt_size process_file_description |

```

process_lt_state
process_lt_state
process_overlay_setup
process_ppm_display_mode
process_ppm_display_offset
process_ppm_pixel_location
process_ppm_pixel_state
process_sio_close
process_sio_init
process_tf_init_hdr
process_tf_init_pt
process_tf_state
process_traj_entry
process_viewport_state

```

Routines Called: bcopy

Parameters: <message structure> message

The OUTPUT_MESSAGE macro defined in fleas_init_cig_sw is used by that function to copy messages from the temporary buffer (config_msgs_P) to the message packet (fleas_img) that will be sent to the real-time software at the next exchange. The macro calculates the size of each message it adds and increments the packet size accordingly.

The usage is OUTPUT_MESSAGE(message_structure), where message_structure is the message structure to be copied.

Defined In: fleas_init_cig_sw.c

Called By: fleas_init_cig_sw

Routines Called: bcopy

Parameters: <message structure> message_structure

B.39 PAGE_FORMAT

The PAGE_FORMAT macro is used by the Ballistics portion of Gossip to handle displays that exceed one page (16 lines).

The usage is PAGE_FORMAT(lines), where lines is the number of lines in the display.

Defined In: bx_probe.c
 gos_bal_query.c

Called By: bx_probe
 gos_bal_query

Routines Called: printf
 scanf

Parameters: INT lines

B.40 poly.* (Poly Processor Macros)

Macros are used by the DTP Command Generator functions (and some testing functions in Gossip) to interface to the Runtime Command Library (RCL). These macros call RCL routines that generate the actual commands that are downloaded to the Polygon Processor.

Each Poly Processor command has one or more supporting macros. The following table lists each Poly Processor macro and identifies its parameters, calling routines, and called routines. It also identifies the Poly Processor command generated by RCL for each macro. Detailed descriptions of the hardware commands are beyond the scope of this document.

Defined In: rcinclude.h

Called By: see table below

Routines Called: see table below

Parameters: see table below

| Macro (parameters) | Poly Processor Command Generated | Called By | Routines Called |
|--|----------------------------------|---|-----------------------------|
| poly_ab(alpha_0, beta_0, alpha_1, beta_1) | Alpha Betas | none | rcl_data |
| poly_bvc(ballistics_bit, local_terrain_bit) | Bounding Volume Component | none | rcl_component |
| poly_efs(label, number_of_frames) | Effect Stage | none | rcl_iblcmd |
| poly_efsr(label, number_of_frames) | Effect Stage Relative | none | rcl_iblcmd |
| poly_flu() | Flush | dtp_trav1, test_commands | rcl_command |
| poly_fsw() | Form Stamp Words | dtp_trav2 | rcl_command |
| poly_gc(ballistics_bit, local_terrain_bit) | Grid Component | none | rcl_component |
| poly_inf(information_word) | Info Word | double_lite, single_lite, test_commands, triple_lite, vasi_lite | rcl_data |
| poly_lmf(matrix_pointer) | Load Matrix Full | none | rcl_command, rcl_stuff_data |
| poly_lsc(x, y, z, w) | Load Screen Constants | none | rcl_command |
| poly_mmf(matrix_pointer) | Matrix Multiply Full | replace_mod, test_commands | rcl_command, rcl_stuff_data |
| poly_pc(ballistics_bit, local_terrain_bit) | Poly Component | double_lite, single_lite, test_commands, triple_lite, vasi_lite | rcl_component |
| poly_poly(poly_info_word, vertex_list, alpha, beta) | Polygon Entry | none | rcl_data |
| poly_rm1() | Recall Matrix 1 | dtp_trav2, replace_mod, test_commands | rcl_command |
| poly_rm2() | Recall Matrix 2 | none | rcl_command |
| poly_rm3() | Recall Matrix 3 | none | rcl_command |
| poly_rm4() | Recall Matrix 4 | none | rcl_command |
| poly_sc(ballistics_bit, local_terrain_bit) | Stamp Component | none | rcl_component |
| poly_sci(ballistics_bit, local_terrain_bit, stamp_info_word, stamp_half_width, stamp_height) | Stamp Component Incomplete | none | rcl_component, rcl_data |
| poly_sec(ballistics_bit, local_terrain_bit) | Special Effect Component | none | rcl_component |
| poly_sm1() | Save Matrix 1 | dtp_trav2 | rcl_command |
| poly_sm2() | Save Matrix 2 | none | rcl_command |
| poly_sm3() | Save Matrix 3 | none | rcl_command |
| poly_sm4() | Save Matrix 4 | none | rcl_command |

| | | | |
|---|-------------------|---|-------------|
| poly_stamp(stamp_info_word, stamp_half_width, stamp_height, stamp_center_x, stamp_center_y, stamp_center_z) | Stamp List Entry | none | rcl_data |
| poly_tog() | Channel Toggle | dtp_trav2 | rcl_command |
| poly_vtxe(x_value, y_value, z_value) | Vertex List Entry | double_lite, single_lite, test_commands, triple_lite, vasi_lite | rcl_data |
| poly_vtxl(index_0, index_1, index_2, index_3) | Vertex List | double_lite, single_lite, test_commands, triple_lite, vasi_lite | rcl_data |

B.41 POP_STACK

The POP_STACK macro pops the next address off the DED model trace stack. The address is set to 0 if the stack is empty.

The usage is POP_STACK.

Defined In: ded_model_trace.c

Called By: ded_model_trace

Routines Called: none

Parameters: none

B.42 PRINTD4

The PRINTD4 macro prints a 32-bit word in hexadecimal and decimal format. The address at which to start printing is in the pointer variable *pntr2*.

The usage is PRINTD4().

Defined In: gos_memory.c

Called By: gos_memory

Routines Called: printf

Parameters: none

B.43 PRINTD8

The PRINTD8 macro prints a double in hexadecimal and decimal format. The address at which to start printing is in the pointer variable *pntr2*.

The usage is PRINTD8().

Defined In: gos_memory.c

Called By: gos_memory

Routines Called: printf

Parameters: none

B.44 PRINTHEX4

The PRINTHEX4 macro prints a 32-bit word in hexadecimal format. The address at which to start printing is in the pointer variable *pntr2*.

The usage is PRINTHEX4().

Defined In: gos_memory.c

Called By: gos_memory

Routines Called: printf

Parameters: none

B.45 PRINTHEX8

The PRINTHEX8 macro prints a 64-bit word in hexadecimal format. The address at which to start printing is in the pointer variable *pntr2*.

The usage is PRINTHEX8().

Defined In: gos_memory.c

| | | |
|------------------|------------------|-------------|
| Routines Called: | ERRMSG printf | |
| Parameters: | WORD WORD | *store m |

B.49 ROOMCHECK

The ROOMCHECK macro verifies that there is enough space for a new RCL command. The usage is ROOMCHECK(name, wd_cnt), where:

name is a pointer to the routine name
wd_cnt is the number of command WORDs

The function outputs an error if space is insufficient.

| | | |
|------------------|--|-----------------|
| Defined In: | rcfuncs.c | |
| Called By: | rcl_command rcl_component rcl_iblcmd | |
| Routines Called: | ERRMSG | |
| Parameters: | char WORD | *name wd_cnt |

B.50 SEND_TF_INFO

The SEND_TF_INFO macro generates MSG_TF_HDR (terrain feedback header) and MSG_TF_PT (terrain feedback point) messages, and puts them in the outgoing message packet. The usage is SEND_TF_INFO().

| | | |
|------------------|---------------------|--|
| Defined In: | bal_routines.c | |
| Called By: | sim_bal_process_msg | |
| Routines Called: | none | |
| Parameters: | none | |

B.51 SET_OUT_BITS

The SET_OUT_BITS macro, defined in definitions.h, is not currently used.

B.52 SET_OUT_M2BITS

The SET_OUT_M2BITS macro, defined in definitions.h, is not currently used.

B.53 SET_PPM_DISPLAY_OFFSET

The SET_PPM_DISPLAY_OFFSET macro puts new PPM display offset values into the Flea output work buffer (p_flea_out). It also adjusts the values if out of range. After setting the new values, it sets ppm_display_offset_flag in p_flea_out to TRUE.

The usage is SET_PPM_DISPLAY_OFFSET().

Defined In: tick_ppm.c

Called By: tick_ppm

Routines Called: none

Parameters: none

B.54 SET_PPM_PIXEL_LOCATION

The SET_PPM_PIXEL_LOCATION macro puts new PPM pixel location values into the Flea output work buffer (p_flea_out). It also adjusts the values if out of range. After setting the new values, it sets ppm_pixel_location_flag in p_flea_out to TRUE.

The usage is SET_PPM_PIXEL_LOCATION().

Defined In: tick_ppm.c

Called By: tick_ppm

Routines Called: none

Parameters: none

B.55 SIGN

The SIGN macro, defined in `rt_macros.h`, is not currently used.

B.56 SQUARE

The SQUARE macro, defined in `rt_macros.h`, is not currently used.

B.57 SYSERR

The SYSERR macro adds a `MSG_SYS_ERROR` message to the output buffer and ends processing of input messages by pointing to a dummy end statement.

The usage is `SYSERR(error, state)`, where:

error is the error message
state is the current state of the CIG

Defined In: `functions.h`

Called By: `db_mcc_setup`
 `exchange_flea_data`
 `exchange_scsi_data`
 `exchange_scsi_data_sim`
 `file_control.`
 `get_msg_2d`
 `hw_test`
 `open_dbase`
 `upstart`

Routines Called: `none`

Parameters: `INT_2` `error`
 `INT_2` `state`

B.58 TODEG

The TODEG macro converts an angle from radians to degrees by multiplying the given value by 57.29578122.

The usage is `TODEG(angle)`, where *angle* is the angle in radians to be converted.

Defined In: `flea_simulate_vehicles.c`

Called By: find_pitch_and_roll

Routines Called: none

Parameters: REAL_4 angle

B.59 TORAD

The TORAD macro converts an angle from degrees to radians by multiplying the given value by 0.017453292.

The usage is **TORAD**(angle), where *angle* is the angle in degrees to be converted.

Defined In:

- autopilot.c
- dynamic_demo.c
- encode_routines.c
- flea_agl_terrain_follow.c
- flea_agpt_switches.c
- flea_bal_opts.c
- flea_db_traverse.c
- flea_decode_data.c
- flea_init_cig_sw.c
- flea_ppm_obj.c
- flea_script.c
- flea_simulate_vehicles.c
- flea_switches.c
- flea_update_pos.c
- flea_veh_control.c
- gos_model.c
- rt_macros.h
- tick_ppm.c
- tick_script.c
- update_2d.c
- update_agpt_2d.c
- vpi_viewport.h

Called By:

- autopilot
- dynamic_demo
- flea_init_cig_sw
- flea_simulate_vehicles
- flea_update_pos
- gos_model
- mtx_concat
- send_gun_overlay
- tst_eupdate
- upd_rotation_values
- vpt_path_process
- vpt_path_update

vpt_update

Routines Called: none

Parameters: INT angle

B.60 toradians

The `toradians` macro converts an angle into radians. The usage is `toradians(angle)`. The routine multiplies the given angle by 0.017453293.

Defined In: dig_defines.h
make_bbn.c
mkmtx_nt.c
model_mtx.c
vpi_viewport.h

Called By: rotate_x
rotate_y
rotate_z

Routines Called: none

Parameters: INT angle

B.61 TRIGGER_FORCE

The `TRIGGER_FORCE` macro, defined in `functions.h`, is no longer used.

B.62 VME_TO_VMX

The `VME_TO_VMX` macro converts a VME address to a VMX address. The usage is `VME_TO_VMX(addr)`, where `addr` is the VME address to be converted.

Defined In: cal.c
kludge.h
msg_calibration_image.c
msg_effect.c
msg_veh_state.c

Called By: cal
msg_calibration_image
msg_otherveh_state

msg_show_effect
 msg_staticveh_rem
 msg_staticveh_state

Routines Called: none

Parameters: INT_4 addr

B.63 WAIT_FORCE

The WAIT_FORCE macro, defined in functions.h, is no longer used.

B.64 WAIT_MPVIO

The WAIT_MPVIO macro waits until the ready bit (FRONT_RDY_MASK) in the Force front-end control register is set, indicating that the MPV is ready to receive data. The macro outputs a message every 50,000 attempts. When the ready bit is set, the calling function continues processing.

The usage is WAIT_MPVIO(*pmbx*), where *pmbx* is a pointer to the MPV I/O interface mailbox.

Defined In: mpvideo.h

Called By: DOWNLOAD_DATA
 mpvideo_boot
 mpvideo_load
 mpvideo_sim_init

Routines Called: printf

Parameters: MPVIO_INTERFACE *pmbx

B.65 WAIT_MPVREPLY

The WAIT_MPVREPLY macro waits for a message to be placed in the mpvio_from_buf message buffer. The macro uses mx2_peek to check the buffer. When the status returned from mx2_peek is MX_MESSAGE_PREVIEWED, the calling function continues processing.

The usage is WAIT_MPVREPLY().

Defined In: bootmpv.c

Called By: mpvideo_boot

Routines Called: mx2_peek

Parameters: none

B.66 XCLOSE

The XCLOSE macro calls the standard close routine to close files. Previously, this macro was used to call fclose for a special platform. The macro has been retained for backward compatibility.

Defined In: definitions.h

Called By: close_db
get_lm
open_dbase
open_ded

Routines Called: close

Parameters: none

B.67 XLSEEK

The XLSEEK macro calls the standard lseek routine to move to the beginning of a file. Previously, this macro was used to call flseek for a special platform. The macro has been retained for backward compatibility.

Defined In: definitions.h

Called By: ded_load_dtp_code
download_bvols
get_lm
getlmdp
getside
load_dbase
open_dbase
open_ded

Routines Called: lseek

Parameters: none

B.68 XOPEN

The XOPEN macro calls the standard open routine to open files. Previously, this macro was used to call fopen for a special platform. The macro has been retained for backward compatibility.

Defined In: definitions.h

Called By: get_lm
open_dbase
open_ded

Routines Called: open

Parameters: none

B.69 XREAD

The XREAD macro calls the standard read routine to read files. Previously, this macro was used to call fread for a special platform. The macro has been retained for backward compatibility.

Defined In: definitions.h

Called By: ded_load_dtp_code
download_bvols
get_lm
getlmdp
getside
load_dbase
open_dbase
open_ded

Routines Called: read

Parameters: none

B.70 XWRITE

The XWRITE macro, defined in definitions h, is no longer used.

APPENDIX C. OPERATING SYSTEM ROUTINES

This appendix provides brief descriptions of the various operating system calls and standard C library routines used by the CIG Real-Time software.

C.1 Special OS Service Libraries

The following table describes the system-level service routines used by the CIG Real-Time software.

| Routine | Description | Called By |
|---------------------------------|--|--|
| read_watch() | Gets the cumulative number of 500 uS ticks. Returns the number as <i>watch_count</i> . | _move_load_module_stp_to_quad_buffer, _set_up_for_next_frame, cigsimio_write, exchange_enet_data_sim, local_terrain, msg_cig_ctl, msg_end, msg_laser_request_range, msg_pass_on, process_a_msg |
| start_watch() | Determines which type of CPU board it is executing on, sets up the timer registers appropriately, clears the stopwatch storage areas, starts the timer, and enables the interrupts. Returns <i>board</i> . | _pend_on_frame_interrupt, cig_config, db_mcc_setup, exchange_enet_data_sim, file_control, get_msg_2d, hw_test, upstart |
| stop_watch() | Gets the cumulative number of 500 (100)uS ticks, stops the timer, and turns the timer interrupts off. Returns <i>watch_count</i> . | _pend_on_frame_interrupt, simulation |
| sysrup_off() | Ignores system/frame interrupts by moving the address of a null interrupt service routine into the 68010 exception vector space. | _pend_on_frame_interrupt, dtp_emu, gos_model, gos_system, main (rtt.c), msg_cig_ctl, s_step, sys_control_init |
| sysrup_on(mailbox_ptr, message) | Enables system/frame interrupts by moving the address of the interrupt service routine in to the 68010 exception vector space. Wakes up a pending routine by moving the calling task's mailbox address and the message to be returned to locations known to the isr. | dtp_emu, gos_model, gos_single_step, gos_system, host_if_debug, init_simulation, s_step |

C.2 Task Management (sc_*) Routines

The following table describes the routines that handle intertask mailbox communication and the creation and deletion of tasks and queues. These routines are standard Ready Systems' VRTX C interface libraries.

| Routine | Description | Called By |
|-------------|--|---|
| sc_accept | Clears messages from the specified mailbox. | host_if_debug, init_simulation, msg_end, simulation |
| sc_delay | Pauses for a specified delay. | _rowcol_rd, bal_buffer_setup, bootforce, config_ballistics, exchange_enet_data, flea_host_if, flea_io_task, mpvideo_boot, mpvideo_load, mpvideo_sim_init, slave_cig_enet_sync |
| sc_fcreate | Creates a flag group. | main (rtt.c) |
| sc_fdelete | Deletes a flag group. | main (rtt.c) |
| sc_finquiry | Inquires on a flag group | main (rtt.c) |
| sc_fpend | Pends on a flag group. | main (rtt.c) |
| sc_fpost | Posts to a flag group. | poll_shutdown |
| sc_lock | Locks a queue to prevent concurrent use. | mx2_open, mx2_peek, mx2_push, mx2_skip, mx3_open, mx3_peek, mx3_push, mx3_skip, mx_open, mx_peek, mx_push, mx_skip |
| sc_pend | Waits for a message to be posted to the specified mailbox. | flea_init_cig_sw, init_simulation |
| sc_post | Posts a message to the specified mailbox. | _database_disable, _handle_request_local_terrain, cigsimio_frame_end, config_ballistics, exchange_flea_data, flea, flea_host_if, flea_init_cig_sw, init_simulation |
| sc_screate | Creates a semaphore. | main (rtt.c) |
| sc_sdelete | Deletes a semaphore. | main (rtt.c) |
| sc_sinquiry | Inquires on a semaphore's status. | poll_shutdown |
| sc_spend | Pends on a semaphore | main (rtt.c) |
| sc_spost | Posts to a semaphore. | rtt_shutdown |
| sc_tinquiry | Inquires on a task, | flea_io_task, main (bx147_main.c), main (rtt.c), poll_shutdown |
| sc_tresume | Resumes a suspended task. | flea, main (rtt.c) |
| sc_tsuspend | Suspends a task. | flea_io_task, main (bx147_main.c) |
| sc_unlock | Unlocks a locked queue. | mx2_open, mx2_peek, mx2_push, mx2_skip, mx3_open, mx3_peek, mx3_push, mx3_skip, mx_open, mx_peek, mx_push, mx_skip |

C.3 IFX File Management (ifx_*) Routines

The following table identifies the Ready Systems' IFX routines used by the CIG Real-Time Software to manage files and devices.

| Routine | Description | Called By |
|-------------|------------------------------|--|
| ifx_close | Closes a file or device. | CloseDir, cigsimio_write, esifa_load, flea_abs_playback, gos_cigsimio, sio_close, tick_script |
| ifx_ioctl | Sets i/o control. | esifa_download, esifa_laser_return, esifa_load, esifa_read, esifa_read_ports, esifa_send_req, esifa_setup, esifa_write, esifa_write_ports, open_enet_interface |
| ifx_open | Opens a file or device. | OpenDir, cigsimio_write, esifa_load, esifa_setup, flea_abs_playback, gos_cigsimio, open_enet_interface, sio_init, stdopen, tick_script |
| ifx_read | Reads from a file or device. | ReadDir, esifa_load, exchange_dr11_data, exchange_dr11_data_sim, get_next_packet |
| ifx_sposn | Rewinds a file. | flea_abs_playback |
| ifx_tdelete | Deletes a task. | poll_shutdown |
| ifx_write | Writes to a file or device. | cigsimio_write, exchange_dr11_data, exchange_dr11_data_sim, sio_tick |

C.4 GTOS Routines

The following routines, which are called by various functions in the real-time software, are part of the GT operating system.

| Routine | Description | Called By |
|--------------|---|---|
| cif_connect | Connects to an interface. | open_mpv_interface |
| cif_init | Initializes the communications driver. | open_mpv_interface |
| cif_receive | Receives a buffer. | exchange_mpv_data, exchange_mpv_data_sim |
| cif_send | Sends a buffer. | exchange_mpv_data, exchange_mpv_data_sim |
| clparse | Parses the command line entered by the user. | initialize |
| mpv_ncatalog | Catalogs a name. | disable_restart |
| mpv_nfind | Finds a name. | bal_buffer_setup, check_restart |
| panic | Outputs an error message. | msg_laser_return, staticveh_remove |
| pcreate | Creates a new task. | agpt_init, config_ballistics, main (rtt.c) |
| perror | Prints an error to a file. | open_socket_interface |
| print_allocp | Prints a free list. | tst_tree |
| saccept | Accepts from a socket. | open_socket_interface |
| sbind | Binds a name to a socket. | open_socket_interface |
| search | Searches for an occurrence of a string within a string. | FindField, esifa_load |
| serror | Outputs IFX, VRTX, and MPV errors. | agpt_init, config_ballistics, main (bx147_main.c), main (rtt.c), poll_shutdown, rtt_shutdown |
| sgbuffer | Gets a buffer from the socket. | exchange_socket_data, exchange_socket_data_sim, open_socket_interface |
| sibuffer | Initializes a socket buffer. | open_socket_interface |
| slisten | Listens to a socket. | open_socket_interface |
| spbuffer | Puts a socket buffer. | exchange_socket_data, exchange_socket_data_sim |
| srecv | Receives data from a socket. | exchange_socket_data, exchange_socket_data_sim |
| ssend | Sends data to a socket. | exchange_socket_data, exchange_socket_data_sim |
| ssocket | Opens a socket. | open_socket_interface |

C.5 Standard C Runtime Libraries

The following table identifies the standard C system calls, input/output routines, and runtime libraries used by the CIG Real-Time software.

| Routine | Description | Called By |
|-----------|--|---|
| acos | Computes an arc cosine. | find_pitch_and_roll |
| atan | Computes an arc tangent. | vpt_path_update |
| atoi | Converts a string to int. | host_if_disable_debug_msgs, host_if_enable_debug_msgs |
| bcopy | Copies a specified number of bytes from one location to another. | backend_set_branch, BCOPY, cal , cig_config, cigsimio_write, config_translator, esifa_queue_data, exchange_enet_data, exchange_enet_data_sim, flea_abs_playback, flea_bal_opts, flea_init_cig_sw, msg_calibration_image, open_enet_interface, process_* (Flea cf_translator functions), sio_write, slave_cig_enet_sync, upd_add_static_veh, upd_flea_vehicles, upd_rem_static_veh, upd_send_dynamic, upd_sio_write, upd_subsys_mode, upd_view_mag, upd_viewport_up |
| bzero | Zeroes out a buffer. | config_translator, process_* (Flea cf_translator functions) |
| calloc | Allocates memory and initializes to zero. | autopilot, cig_2d_setup, dynamic_demo, find_fn, flea, sio_init, vpt_cnode_get, vpt_cnode_set_matrix, vpt_path_get, vpt_vpt_get |
| close | Closes a file. | close_db, compile_2d, file_control, find_fn, flea, get_lm, gos_model , mpvideo_load, open_dbase, open_ded, sload |
| cmd | Sends a command to sio. | getch |
| cos | Calculates a cosine. | autopilot, concat_mtx, dynamic_demo, flea_init_cig_sw, flea_simulate_vehicles, flea_update_pos, gos_model, rotate_x, rotate_y, rotate_z, send_gun_overlay, tst_eupdate, upd_rotation_values, vpt_path_update |
| creat | Creates a file. | main (u_main2d.c) |
| create_sz | Creates a file with a specified size. | file_control |

| | | |
|---------|---|--|
| exit | Deletes the current task. | config_ballistics, config_color_table, config_database, config_translator, exchange_enet_data, flea, flea_host_if, flea_init_cig_sw, gossip, init_simulation, initialize, main (bx147_main.c), main (rt.c), mpvideo_load, open_dbase, open_dr11_interface, open_enet_interface, open_scsi_interface, open_socket_interface, slave_cig_enet_sync, sys_control_init, tst_ereadconfig |
| fclose | Closes an I/O stream. | compile_2d, config_ballistics, config_color_table, config_database, config_translator, db_mcc_setup, flea_draw_2d, initialize, load_esifa, tst_ereadconfig |
| fflush | Writes all currently buffered characters in an output stream. | host_if_debug_tick |
| fgetc | Reads next character from stream. | p_configtree_node, process_2d_setup, process_configtree_node, read_a_keyword, remove_comment_lines, remove_white_space |
| fgets | Reads next line from stream. | config_ballistics, config_color_table, config_database, flea, flea_draw_2d, get_msg_2d, load_esifa, process_agl_setup, process_cig_ctl, process_configtree_node, process_define_tx_node, process_file_description, process_overlay_setup, process_tf_init_hdr, process_tf_init_pt, process_viewport_state, remove_comment_lines |
| fopen | Opens an I/O stream. | config_ballistics, config_color_table, config_database, config_translator, db_mcc_setup, flea, flea_draw_2d, initialize, load_esifa, main, tst_ereadconfig |
| fprintf | Writes using format to specified stream. | flea, flea_printf, print_msg_* |
| fputc | Writes character to stream. | print_msg_sio_write, slave_cig_enet_sync |
| fread | Reads specified number of characters from stream. | next_char |
| free | Frees allocated memory. | autopilot, b0_add_traj_table, backend_setup, bx_reset, cig_2d_setup, close_db, ded_uninit, download_bvols, dtp_compiler, dynamic_demo, esifa_setup, find_fn, flea, flea_init_cig_sw, mem_check, msg_calibration_image, open_dbase, open_ded, sio_close, sio_init, vpt_tree_free |

| | | |
|---------|--|---|
| fscanf | Reads from stream using format. | p_configtree_node, p_overlay_setup, p_terrain_feedback, p_viewport_state, process_* (Flea cf_translator functions), read_a_keyword, setup_p_terrain_feedback, tst_ereadconfig |
| getenv | Get string value associated with environment variable | pretend_veh |
| gets | Gets a string. | get_sio_write_data, gos_mpvio |
| isalpha | Tests character to see if letter. | get_thing |
| isdigit | Tests character to see if digit. | flea_draw_2d, get_thing |
| isprint | Tests character to see if printable. | flea_agpt_locations, flea_agpt_switches, flea_atp, flea_bal_opts, flea_graphics_test, flea_switches, flea_veh_control, gossip_tick, tick, tick_ppm, tick_script |
| isspace | Tests character to see if space, tab, carriage return, newline, vertical tab, or formfeed. | flea_agpt_locations, flea_agpt_switches, flea_atp, flea_bal_opts, flea_draw_2d, flea_graphics_test, flea_switches, flea_veh_control, gossip_tick, tick, tick_ppm, tick_script |
| lseek | Moves the read/write pointer. | ded_load_dtp_code, download_bvols, file_control, get_lm, getlmdp, getside, gos_model, load_dbase, open_dbase, open_ded |
| malloc | Allocates memory. | b0_add_traj_table, b0_database_info, backend_setup, ded_setup, download_bvols, dtp_compiler, esifa_setup, flea, flea_init_cig_sw, host_if_debug_init, mem_check, mpvideo_setup, msg_calibration_image, open_dbase, open_ded, sio_init |
| max | Determines the largest of a set of values. | exchange_enet_data, exchange_enet_data_sim, slave_cig_enet_sync |
| min | Determines the smallest of a set of values. | mpvideo_pass_on |
| open | Opens a file. | file_control, find_fn, flea, get_lm, gos_model, gossip, mpvideo_load, open_dbase, open_ded, open_dr11_interface, open_scsi_interface, sload |
| outhexl | Outputs hex data. | b0_delete_static_vehicle, b0_state_control, b0_traj_chord, b0_traj_entry, bx_task |
| printf | Writes to stdout. | (used extensively throughout system) |
| puts | Writes to stdout. | b0_bvol_entry, b0_delete_static_vehicle, b0_inapp_message, b0_print, b0_state_control, b0_traj_chord, b0_traj_entry, b0_undefined_message, bx_task |

| | | |
|----------|--|--|
| read | Reads a file. | ded_load_dtp_code, download_bvols, exchange_scsi_data, exchange_scsi_data_sim, file_control, get_char, get_lm, getlmdp, getside, gos_model, load_dbase, mpvideo_load, open_dbase, open_ded |
| read_tty | Reads operator input. | flea, flea_getchar, gos_getchar |
| rewind | Repositions stream pointer to beginning of file. | flea |
| rsec | Reads multiple sectors from disk. | file_control |
| scanf | Reads from stdin. | dtp_emu, flea, flea_bal_opts, flea_draw_2d, flea_switches, flea_veh_control, gos_120tx, gos_bal_query, gos_cigsimio, gos_db_query, gos_locate, gos_memory, gos_model, gos_mpv, gos_mpvio, gos_ppm_query, gos_system, gossip_tick, host_if_disable_debug_msgs, host_if_enable_debug_msgs, main, model_demo, tick, tick_ppm, tick_script, tst_edebug, tst_equery, tst_ereadconfig, tst_eupdate, tst_tree, tst_treetrace, vptq_brvals, vptq_cnout, vptq_dynmtx, vptq_grout, vptq_vpout, vptq_vptbrout |
| sin | Calculates a sine. | autopilot, concat_mtx, dynamic_demo, flea_init_cig_sw, flea_simulate_vehicles, flea_update_pos, gos_model, rotate_x, rotate_y, rotate_z, send_gun_overlay, tst_eupdate, upd_rotation_values, vpt_path_update |
| sprintf | Places formatted string in character array. | config_database, open_scsi_interface |
| sqrt | Calculates a square root. | dtp_emu, find_pitch_and_roll, gos_model |
| sscanf | Scans input from stdin. | config_ballistics, config_color_table, config_database, flea, flea_draw_2d, get_sio_write_data, init_enet_interface, load_esifa, mpvideo_load |
| strcat | Concatenates two strings. | find_fn, get_sio_write_data |
| strcmp | Compares two strings. | config_ballistics, config_translator, db_mcc_setup, find_fn, flea, flea_draw_2d, flea_printf, msg_shell_sort, next_token, p_configtree_node, p_overlay_setup, p_terrain_feedback, p_viewport_state, process_* (Flea cf_translator functions), setup_comp_start, tst_ereadconfig |

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|--------------|---|--|
| strcpy | Copies a string. | config_database, config_translator, db_mcc_setup, file_control, find_fn, fleas, fleas_agpt_locations, fleas_agpt_locations_main_menu, fleas_agpt_switches, fleas_agpt_switches_main_menu, fleas_atp, fleas_atp_main_menu, fleas_bal_opts, fleas_bal_opts_main_menu, fleas_graphics_test, fleas_graphics_test_main_menu, fleas_init_cig_sw, fleas_prompt, fleas_switches, fleas_switches_main_menu, fleas_veh_control, fleas_veh_control_main_menu, gos_db_query_menu, gos_prompt, host_if_disable_debug_msgs, host_if_enable_debug_msgs, init_subsys_parser, initialize, main, parse_subsys_file, set_3d_lut_name, set_color_config_name, set_data_2d_name, set_database_name, set_ded_name, set_esifa_name, set_final_lut_name, tick_script, tick_script_main_menu, vpt_cnode_process |
| strlen | Returns string length. | config_database, db_mcc_setup, file_control, find_fn, fleas_init_cig_sw, get_sio_write_data, gos_cigsimio, gossip, initialize, open_dbase, open_ded, setup_define_string, setup_text |
| strncmp | Compares first n characters of two strings. | db_mcc_setup, find_fn, mpvideo_load |
| strncpy | Copies first n characters of string. | find_fn |
| strchr | Searches string for last occurrence of character. | esifa_load |
| strtol | Converts an ASCII string to a long. | esifa_load, mpvideo_load |
| system | Executes a shell command. | file_control |
| tan | Calculates a tangent. | vpt_path_process, vpt_path_update, vpt_update |
| toupper | Converts a character to uppercase. | find_fn |
| unbf_getchar | Performs an unbuffered getchar. | cal, dtp_emu, gos_120tx, gos_bal_query, gos_cigsimio, gos_db_query, gos_memory, gos_model, gos_mpv, gos_mvpio, gos_ppm_query, gos_system, gossip, host_if_debug_menu, host_if_display_enabled_msgs, s_step |
| ungetc | Performs an unbuffered getchar. | read_a_keyword, remove_comment_lines, remove_white_space |
| write | Writes a specified number of bytes. | exchange_scsi_data, exchange_scsi_data_sim, file_control, gos_model, linkup |

APPENDIX D. GLOSSARY OF TERMS AND ABBREVIATIONS

| | |
|--------------------|---|
| 2-D | Two-dimensional. |
| AAM | Active area memory. Memory that contains the currently viewable database and models. AAM contains 256 terrain load modules (16 rows by 16 columns). This provides a 3500-meter viewing range, plus a 500-meter buffer, in each direction. If load module blocking is enabled, AAM is effectively quadrupled. |
| AGL | Above ground level. If AGL processing is enabled (via the MSG_AGL_SETUP message), the simulated vehicle's altitude above ground level is calculated and returned to the Simulation Host every frame. |
| ASID | Application-specific identification data. ASIDs are used to add unique data (bumper numbers, smoke plume, dust cloud, etc.) to a model. |
| aspect ratio | The ratio of the sides (width:height) of the viewport. |
| backend | A 9U Channel Subassembly in the CIG. The backend contains special-purpose graphics boards that transform terrain, model, and special effects data to viewpoint space. One CIG can contain two backends. |
| bvol | Bounding volume. The volume of the bounding box that is used to completely enclose an object in the simulation environment. |
| centroid | The theoretical "center" of an object, around which the object is rotated. The centroid's coordinates are the averages of the corresponding coordinates of a given set and, for a given planar or three-dimensional figure (such as a triangle or sphere), correspond to the center of mass of a thin plate of uniform thickness and consistency or a body of uniform consistency having the same boundary. |
| channel | A connection to a viewport. One channel may have multiple graphics paths. |
| CIG | Computer Image Generation System. The process of generating a 3-D, perspective accurate scene via a computer. |
| clipping | Removing back-facing polygons or parts of polygons that lie partially outside the viewing pyramid. |
| conditional node | A node in the configuration tree that causes a branch into one of two traversal paths based on some runtime condition. |
| configuration tree | A structure that defines the relationship between each physical component of the simulation vehicle and the location of the viewports. |

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| data message | Smallest data component of a packet buffer. |
| data message header | A message that describes the contents of a data message. |
| DED | Dynamic Elements Database. |
| double-buffer memory | Memory that contains the dynamic models built by the real-time software and processed by the hardware. Dual buffering allows for one buffer to be used by the hardware while the other is being updated by the software. The buffer used for each purpose switches each frame, so the hardware is always using the buffer updated by the software during the previous frame. |
| downloading | The process of transferring data from the Simulation Host to the CIG. |
| DR11-W | A Digital Equipment Corp. standard interface that enables the Simulation Host and the CIG processor to communicate at a high transmission rate. |
| DTP | Data Traversal Processor. |
| ESIFA | Enhanced Subsystem Interface Adapter. The subsystem card that provides a communications path between the real-time software and the other boards in the 9U, including the Pixel Processor Memory (PPM) and the Pixel Processor Tiler (PPT). |
| EVC | Ethernet VME Controller. The board in the CIG that allows frame interrupts onto the VME bus. |
| dynamic vehicle | A vehicle whose position and orientation is redefined in every frame sent by the Simulation Host. |
| false child | The configuration tree node branched to from a conditional node if the runtime conditions is false. |
| fov | Field of view. The volume of space which encompasses all objects that are visible from a specific viewpoint and view angle. |
| frame | Information displayed on a video monitor for a duration determined by the frame speed (e.g., 33.3 milliseconds at 30 Hz or 66.6 milliseconds at 15 Hz). |
| frame event | An interrupt signal given by the hardware. |
| frame rate | The rate at which a new image is created and displayed on the screen. |
| frame time | The amount of time each frame is displayed. |

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| graphics path | A window on a viewport. A T backend has one graphics path per viewport. A TX backend may have two or four graphics paths, depending on viewport resolution. Graphics path parameters are the viewport parameters that are used to load the hardware. |
| GSP | Graphics System Processor. The TMS34010 graphics processor on the MPV board that generates and controls 2-D graphics. |
| graphics processor | First board in the graphics pipeline that processes 3-D data and converts it into 2-D screen space for the tiler, based on the input of graphics processor commands. Also called the Poly Processor. |
| heading | The direction the viewer is pointing. |
| hull transformation | Description of the position and orientation of the base of a vehicle. |
| Hz | Hertz; cycles per second. |
| load module | A unit of terrain in the terrain database, measuring 500 meters by 500 meters. Data is brought into active area memory in whole load modules only. |
| load module block | A structure containing four load modules (two rows by two columns, for a total size of 1000 meters by 1000 meters). Blocking load modules doubles the viewing range and quadruples the amount of terrain that can be loaded into active area memory. |
| lod | Level of detail. The selective reduction of model detail (polygon count) or texture map detail based on distance from the viewer. |
| lookup table | A table used to convert color-map addresses into the actual color values displayed. |
| lut | Lookup table. |
| matrix | A rectangular array of elements arranged in rows and columns. |
| matrix node | A node in the configuration tree that contains a transformation matrix. The matrices in each node in a traversal path are concatenated to generate the view of the world for the viewport represented by that path. |
| MCC | Management, Command, and Control. The computer on the simulation network that monitors and controls the entire simulation exercise. |
| model | Generally used to refer to models of arbitrary, three-dimensional objects such as buildings and vehicles. |
| model space | The coordinate system used to define and build a particular model. The vehicle's centroid is defined as location (0,0,0). |

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|-----------------|---|
| MPV | Micro Processor Video. The last board in the graphics pipeline in a TX backend. |
| My_Vehicle | The simulation vehicle. |
| object | All simulated models: vehicles, hidden obstacles, etc. |
| overlay | A two-dimensional view that is displayed on a viewport on top of the three-dimensional view of the terrain. |
| packet buffer | Several data messages grouped together that describe one frame time. |
| pitch | The angle at which the viewer is looking up or down. |
| pixel | Picture element. The smallest addressable element on a video screen. |
| point lights | Light sources that can be defined from a specific location in xyz world space. This differs from directional lighting which is defined from a certain direction and originates at infinity. |
| Poly Processor | See graphics processor. |
| polygon | A closed, planar figure bounded by straight lines and consisting of three or four vertices. |
| PPM | Pixel Processor Memory. A board in a T backend that assembles individual pixels from the PPT into a display matrix that is the final spatial representation of an image. |
| PPT | Pixel Processor Tiler. An integer processor board that tiles three- and four-sided polygons with face shading or texturing pixels. |
| real-time | The ability to respond rapidly, frequently, or both to an event or transaction. Also refers to the software that is used to run real-time operations. |
| roll | The angle which measures the amount of rotation along the viewing vector (tilt). |
| rotation | The process by which coordinates are rotated around a particular axis. Used to define the direction of the viewing window. |
| rotation matrix | A means of specifying orientation. |
| RCL | Runtime command library. A set of routines used to generate hardware commands for the DTP and the Poly Processor. |
| RTS | Rotation translation scale. |

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| scaling | The process by which an object's coordinates are changed to effectively enlarge, reduce, or skew the object in a particular direction. |
| SIM | The Simulation Host computer. The computer that controls the simulated vehicle's behavior. |
| simulation | The process that involves a computerized model of specific, significant features of some physical or logical system or environment. |
| simulation vehicle | The vehicle represented by a simulated viewpoint. Also called simulated vehicle or My_Vehicle. |
| simulator | A simulation unit consisting of a Simulation Host, a CIG, one or more monitors, and the vehicle controls. Also called a Vehicle Simulator Unit. |
| static vehicle | A vehicle with no anticipated movement, tracked only when its status changes. |
| subsystem | See backend. |
| T&C | Timing and Control. Board that controls all CIG synchronization and timing. |
| terrain database | The database on the CIG that contains the polygons that describe the simulation terrain and all objects (houses, trees, etc.) in it. |
| translation | The process by which coordinates are "moved" from one location to another. |
| transformation | A combination of translations and rotations that convert the coordinates of a point in one coordinate system into coordinates in another coordinate system. |
| transformation matrix | A matrix used to describe the position and orientation of an object. |
| true child | The configuration tree node branched to from a conditional node if the runtime conditions is true. |
| vector | A straight line with a specific direction. |
| vertex | A point in space, the termination point of a line, or the intersection point of two or more lines. |
| viewpoint | The direction of view from the user's eye to the target or object being viewed. |
| viewport | A display screen connected to the CIG. Each viewport simulates the view of the world from a specific window of the simulated vehicle. |

- viewport parameters The screen resolution, viewing range, near plane, field-of-view angles, level-of-detail multiplier, and aspect ratio of a viewport.
- viewspace The area that falls within the field of view of a viewport.
- VME Versa Module European. An industry-standard bus.
- world space The absolute coordinate system used to define the simulation area. A three-dimensional space fixed relative to the world. Location (0,0) is the southwest corner of the database.

APPENDIX E. CROSS-REFERENCE TABLES

This appendix contains the following cross-reference tables:

- E.1 CSUs (source files) mapped to CSCs.
- E.2 Data type names mapped to typedef locations.
- E.3 Function names mapped to source file locations, with section numbers.
- E.4 Macro names mapped to source file locations, with section numbers.

E.1 CSUs Mapped To CSCs

The following list shows every CSU (.c or .asm file) in the GT Real-Time Software CSCI, and identifies the CSC to which it belongs. The CSUs are listed in alphabetical order.

| CSU | CSC |
|----------------------------|---------------------------|
| aa_init.c | Backend Manager |
| aam_manager.c | CIG Configuration |
| agpt_init.c | Real-Time Processing |
| agpt_statistics.c | User Interface Mode |
| autopilot.c | Stand-Alone Host Emulator |
| b0_aam_centroid.c | Ballistics Processing |
| b0_aam_sw_corner.c | Ballistics Processing |
| b0_add_static_vehicle.c | Ballistics Processing |
| b0_add_traj_table.c | Ballistics Processing |
| b0_bal_config.c | Ballistics Processing |
| b0_bvol_entry.c | Ballistics Processing |
| b0_cancel_round.c | Ballistics Processing |
| b0_cig_frame_rate.c | Ballistics Processing |
| b0_database_info.c | Ballistics Processing |
| b0_delete_static_vehicle.c | Ballistics Processing |
| b0_delete_traj_table.c | Ballistics Processing |
| b0_error_detected.c | Ballistics Processing |
| b0_inapp_message.c | Ballistics Processing |
| b0_lm_read.c | Ballistics Processing |
| b0_model_directory.c | Ballistics Processing |
| b0_model_entry.c | Ballistics Processing |
| b0_new_frame.c | Ballistics Processing |
| b0_print.c | Ballistics Processing |
| b0_process_chord.c | Ballistics Processing |
| b0_process_round.c | Ballistics Processing |
| b0_round_fired.c | Ballistics Processing |
| b0_state_control.c | Ballistics Processing |
| b0_status_request.c | Ballistics Processing |
| b0_tf_init_hdr.c | Ballistics Processing |
| b0_tf_init_pt.c | Ballistics Processing |
| b0_tf_state.c | Ballistics Processing |
| b0_tf_vehicle_pos.c | Ballistics Processing |
| b0_traj_chord.c | Ballistics Processing |
| b0_traj_entry.c | Ballistics Processing |
| b0_undefined_message.c | Ballistics Processing |
| backend_branch.c | Backend Manager |

CSU

backend_color.c
 backend_laser.c
 backend_man.c
 backend_paths.c
 backend_thermal.c
 backend_video.c
 bal_get_db_pos.c
 bal_get_lm_grid.c
 bal_routines.c
 ball_effect_add.c
 bbncycle.c
 be_stubs.c
 bit_blt.c
 blcopy.c
 bootforce.c
 bootmpv.c
 buffer_errors.c
 bx147_main.c
 bx_bvol_int.c
 bx_chord_intersect.c
 bx_compute_round.c
 bx_find_vehicle.c
 bx_functions.c
 bx_get_lm_data.c
 bx_get_lm_grid.c
 bx_init.c
 bx_model_int.c
 bx_poly_int.c
 bx_probe.c
 bx_reset.c
 bx_task.c
 bx_tf_pack.c
 bx_trajectory.c
 cat.c
 cf_translator.c
 cig_2d_setup.c
 cig_comp_2d.c
 cig_config.c
 cig_getm_2d.c
 cig_link_2d.c
 cigsimio_obj.c
 close_db.c
 clouds.c

CSC

Backend Manager
 Backend Manager
 Backend Manager
 Backend Manager
 Backend Manager
 Backend Manager
 Real-Time Processing
 Real-Time Processing
 Real-Time Processing
 Real-Time Processing
 CIG Configuration
 Viewport Configuration
 2-D Overlay Compiler
 System Utilities
 MPV Interface
 MPV Interface
 User Interface Mode
 Task Initialization
 Ballistics Processing
 Ballistics Processing
 Ballistics Processing
 Ballistics Processing
 Ballistics Processing
 Ballistics Processing
 Ballistics Processing
 Ballistics Processing
 Ballistics Processing
 Ballistics Processing
 Ballistics Processing
 Ballistics Processing
 Ballistics Processing
 Ballistics Processing
 Ballistics Processing
 Ballistics Processing
 Ballistics Processing
 Ballistics Processing
 Ballistics Processing
 Ballistics Processing
 Real-Time Processing
 Stand-Alone Host Emulator
 2-D Overlay Compiler
 2-D Overlay Compiler
 CIG Configuration
 2-D Overlay Compiler
 2-D Overlay Compiler
 Real-Time Processing
 Real-Time Processing
 Real-Time Processing

CSU

cnode_child.c
 cnode_get.c
 cnode_process.c
 cnode_query.c
 cnode_set.c
 comp.c
 config_ballistics.c
 config_color_table.c
 config_database.c
 data_type.c
 db_mcc_setup.c
 debug_initdr.c
 ded_gm_pool.c
 ded_model_trace.c
 ded_object.c
 directory.c
 dl_man.c
 download_bvols.c
 draw_line.c
 dtp_compiler.c
 dtp_emu.c
 dtp_funcs.c
 dtp_trav1.c
 dtp_trav2.c
 dynamic_demo.c
 effect_downcount.c
 encode_routines.c
 esifa_fade.c
 esifa_laser.c
 esifa_load.c
 esifa_man.c
 esifa_query.c
 esifa_special.c
 esifa_thermal.c
 esifa_video.c
 exception.asm
 f0_3dlut_download.c
 f0_3dlut_switch.c
 f0_alllut_switch.c
 f0_debug_disable.c
 f0_debug_enable.c
 f0_final_lut_download.c
 f0_final_lut_switch.c

CSC

Viewport Configuration
 Viewport Configuration
 Viewport Configuration
 Viewport Configuration
 Viewport Configuration
 2-D Overlay Compiler
 Real-Time Processing
 Real-Time Processing
 Real-Time Processing
 Force Processing
 Real-Time Processing
 Real-Time Processing
 Real-Time Processing
 Real-Time Processing
 User Interface Mode
 System Utilities
 Backend Manager, Real-Time Processing
 Real-Time Processing
 2-D Overlay Compiler
 DTP Command Generator
 User Interface Mode
 DTP Command Generator
 DTP Command Generator
 DTP Command Generator
 Stand-Alone Host Emulator
 Real-Time Processing
 Stand-Alone Host Emulator
 ESIFA Interface
 ESIFA Interface
 ESIFA Interface
 ESIFA Interface
 ESIFA Interface
 ESIFA Interface
 ESIFA Interface
 ESIFA Interface
 Force Processing
 Force Processing
 Force Processing
 Force Processing
 Force Processing
 Force Processing
 Force Processing
 Force Processing

CSU

flea_update_pos.c
 flea_veh_control.c
 force.asm
 forcetask.c
 fxbvtofl.c
 generic_lm.c
 get_sio_data.c
 get_thing.c
 get_tx_lut_index.c
 get_vehicle_position.c
 getch.c
 global_init.c
 globs.c
 gos_120tx.c
 gos_bal_query.c
 gos_db_query.c
 gos_locate.c
 gos_memory.c
 gos_model.c
 gos_mpv.c
 gos_mpvio.c
 gos_polys.c
 gos_system.c
 gossip.c
 gsp_io.c
 gun_overlays.c
 host_dr11_if.c
 host_enet_if.c
 host_flea_if.c
 host_if_debug.c
 host_mpv_if.c
 host_scsi_if.c
 host_socket_if.c
 hw_test.c
 init_free.c
 init_sim.c
 init_stuff.c
 lex.c
 linkvpt.c
 load_dbase.c
 load_esifa.c
 load_modules.c
 loadmpv.c

CSC

Stand-Alone Host Emulator
 Stand-Alone Host Emulator
 Force Processing
 Force Processing
 Real-Time Processing
 Real-Time Processing
 Stand-Alone Host Emulator
 2-D Overlay Compiler
 Real-Time Processing
 CIG Configuration
 CIG Configuration
 Real-Time Processing
 Viewport Configuration
 User Interface Mode
 User Interface Mode
 User Interface Mode
 User Interface Mode
 User Interface Mode
 User Interface Mode
 User Interface Mode
 User Interface Mode
 User Interface Mode
 User Interface Mode
 User Interface Mode
 Force Processing
 Real-Time Processing
 Host Interface Manager
 Host Interface Manager
 Host Interface Manager
 Host Interface Manager
 Host Interface Manager
 Host Interface Manager
 Host Interface Manager
 Real-Time Processing
 Viewport Configuration
 Real-Time Processing
 2-D Overlay Compiler
 Token Processing
 Viewport Configuration
 Real-Time Processing
 Real-Time Processing
 Real-Time Processing
 MPV Interface

CSU

mx_skip.c
 mx_wcopy.c
 nmi_type.c
 open_dbase.c
 open_ded.c
 otherveh_state.c
 oval_rect.c
 overlay_setup.c
 path.c
 path_init.c
 path_query.c
 poll_ready.c
 poly.c
 ppm_obj.c
 pretend_veh.c
 print_msg.c
 proc_cmd.c
 process_vflags.c
 process_vpops.c
 rfuncs.c
 replace_mod.c
 rowcol_rd.c
 rt_mailbox.c
 rtt.c
 rtt_init.c
 shot_report.c
 show_effect_msg.c
 simulation.c
 sio.c
 sload.c
 staticveh_remove.c
 staticveh_state.c
 stdopen.c
 string.c
 subsys_cfg_parse.c
 sys_control.c
 test_commands.c
 test_gsp.c
 text.c
 tick.c
 tick_ppm.c
 tick_script.c
 trav_tree.c

CSC

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tst_edebug.c
tst_equery.c
tst_ereadconfig.c
tst_eupdate.c
tst_tree.c
tst_treetrace.c
u_brmask.c)
u_comp_2d.c
u_getm_2d.c
u_link_2d.c
u_main2d.c
u_path.c
u_rotations.c
u_viewport.c
u_xfrm.c
update_2d.c
update_agpt_2d.c
update_mtx.c
update_rot.c
upstart.c
vpt_get.c
vpt_process.c
vpt_query.c
vpt_set.c
vpt_update.c
vt100.c
window.c

CSC

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E.2 Data Type Names Mapped To Typedefs

The following list shows the special data types used throughout the real-time software, and identifies the file(s) that contain the type definition. The type names are listed in alphabetical order.

| Data Type | Typedef Location |
|----------------------|--|
| (*MAT_PTR4)[3] | /cig/include/rt_types.h |
| (*MAT_PTR8)[3] | /cig/include/rt_types.h |
| (*PFI2)() | /cig/include/dgi_stdg.h, standard.h |
| (*PFI4)() | /cig/include/dgi_stdg.h, standard.h |
| (*PFR4)() | /cig/include/dgi_stdg.h, standard.h |
| (*PFR8)() | /cig/include/dgi_stdg.h, standard.h |
| 4RGO | /cig/include/standard.h |
| AAM | /cig/include/backend.h |
| ALLOC_POLY | /cig/include/struct_2d.h |
| ASID_OMODEL | /cig/include/model_struct.h, structures.h |
| ASID_SHOW_EFF | /cig/include/model_struct.h, structures.h |
| AUTOP | /cig/libsrc/libflea/autopilot.c |
| B1BBOX2D | /cig/include/dgi_stdg.h, standard.h |
| B1BBOX3D | /cig/include/dgi_stdg.h, standard.h |
| B1HSL | /cig/include/dgi_stdg.h, standard.h |
| B1HSLO | /cig/include/dgi_stdg.h, standard.h |
| B1MTX4X3 | /cig/include/dgi_stdg.h, standard.h |
| B1MTX4X4 | /cig/include/dgi_stdg.h, standard.h |
| B1P2D | /cig/include/dgi_stdg.h, standard.h |
| B1P3D | /cig/include/dgi_stdg.h, standard.h |
| B1P4D | /cig/include/dgi_stdg.h, standard.h |
| B1RGB | /cig/include/dgi_stdg.h, standard.h |
| B1RGO | /cig/include/dgi_stdg.h, standard.h |
| BACKEND_OBJ | /cig/include/backend.h |
| BOOLEAN | /cig/include/dgi_stdc.h, rt_types.h, standard.h; /cig/othersrc/force/dgi_stdc.h |
| BVOL_CACHE_ENTRY | /cig/include/bx_structs.h |
| BVOL_ENTRY | /cig/include/bx_rtdb_structs.h, rtdb_struct.h |
| BX_MODEL | /cig/include/bx_rtdb_structs.h |
| BX_SHOW_EFF | /cig/include/bx_rtdb_structs.h |
| BX_TANK | /cig/include/bx_rtdb_structs.h |
| BYTE | /cig/include/dgi_stdc.h, rt_types.h, standard.h; /cig/othersrc/force/dgi_stdc.h |
| CAL_OVRLY | /cig/include/overlay3d_struct.h, structures.h |
| CATALOG_TABLE_STRUCT | /cig/include/rtdb_struct.h |

| Data Type | Typedef Location |
|-----------------------------|---|
| CHAN_CNST | /cig/include/poly_struct.h, structures.h |
| CHAN_SETCMD | /cig/include/poly_struct.h, structures.h |
| CHORD | /cig/include/bx_structs.h |
| CHORD_DATA | /cig/include/bal_struct.h, structures.h |
| CLOUD_CONTROL | /cig/include/clouds.h |
| CMD | /cig/include/poly_struct.h, structures.h |
| CMDR_OVRLY | /cig/include/overlay3d_struct.h, structures.h |
| COLOR_TABLE | /cig/include/mpv_struct.h, structures.h |
| COMMAND_LINE1 | /cig/include/bx_rtdb_structs.h, poly_struct.h, structures.h |
| COMMAND_LINE2 | /cig/include/bx_rtdb_structs.h, poly_struct.h, structures.h |
| CONFIGURATION_NODE | /cig/include/vpi_viewport.h |
| DB_DIR_ENTRY | /cig/include/bx_rtdb_structs.h, rtdb_struct.h |
| DB_HDR | /cig/include/bx_rtdb_structs.h |
| DB_HDR_DBASE_DATA | /cig/include/rtdb_struct.h |
| DB_HDR_LMARKS_DATA | /cig/include/rtdb_struct.h |
| DB_HDR_OFLOW_DATA | /cig/include/rtdb_struct.h |
| DB_INFO | /cig/include/db_struct.h, structures.h |
| DB_PTRS | /cig/include/db_struct.h, structures.h |
| DB_TAG_STRUCT | /cig/include/rtdb_struct.h |
| DB_VERSION_STRUCT | /cig/include/rtdb_struct.h |
| DED_POOL | /cig/libsrc/librtu/ded_gm_pool.c, open_ded.c |
| DEMO1 | /cig/include/demo_struct.h |
| DIGITIZER_INTERFACE | /cig/include/dig_struct.h |
| DTP_CMND_INF | /cig/libsrc/librtu/ded_model_trace.c |
| DTP_MODE_SWITCH | /cig/include/mpv_struct.h, structures.h |
| DTP_TRACE_STRUCT | /cig/libsrc/libgossip/ded_object.c |
| EDGE_FLG | /cig/include/definitions.h |
| EO_EFFECTS | /cig/include/structures.h |
| EO_OVRLY | /cig/include/structures.h |
| ESIFA_DOWNLOAD_QUEUE_STRUCT | /cig/libsrc/libesifa/esifa_man.c |
| ESIFA_OBJ | /cig/include/esifa.h |
| ESIFA_PORTS | /cig/include/esifa.h |
| EVC | /cig/libsrc/librtu/sys_control.c |
| F_SIMIN | /cig/include/demo_struct.h |
| F_SIMOUT | /cig/include/demo_struct.h |
| FADE_DESCR | /cig/libsrc/libflea/flea_agpt_switches.c |
| FADE_TRANSFER | /cig/include/mpv_struct.h, structures.h |
| FAKE_DV | /cig/include/model_struct.h, structures.h |
| FIX_BVOL_ENTRY | /cig/include/bx_rtdb_structs.h, rtdb_struct.h |
| FORCE_ENVIRONMENT | /cig/include/force_env.h; /cig/othersrc/force/force_env.h, force_rtsw_if.h |
| FORCE_INTERFACE | /cig/include/mbx.h; /cig/othersrc/force/force_defines.h, mbx.h |

| Data Type | Typedef Location |
|--------------------------|--|
| FOV | /cig/include/if_hdr_str.h; cig/libsrc/libvpt/vpi_msgs.h |
| FOV_VECTORS | /cig/include/vpi_viewport.h |
| FOVTT | /cig/include/poly_struct.h, structures.h |
| GENLM | /cig/libsrc/librti/generic_lm.c |
| GM_DE | /cig/include/bx_rtdb_structs.h |
| GM_DIR_ENTRY_DATA | /cig/include/rtdb_struct.h |
| GM_DIR_ENTRY_NAME | /cig/include/rtdb_struct.h |
| GRAPHICS_PATH_PARAMETERS | /cig/include/vpi_viewport.h |
| GRID_COMP_DEF | /cig/include/bx_rtdb_structs.h, poly_struct.h, structures.h |
| GRID_LOC | /cig/include/bx_rtdb_structs.h, rtdb_struct.h |
| GUN_B | /cig/include/overlay3d_struct.h, structures.h |
| GUN_B_LSIDE | /cig/include/overlay3d_struct.h, structures.h |
| GUN_B_RSIDE | /cig/include/overlay3d_struct.h, structures.h |
| GUNNER_OVRLY | /cig/include/overlay3d_struct.h, structures.h |
| HWORDB | /cig/include/dgi_std.h, rt_types.h, standard.h; /cig/othersrc/force/dgi_std.h |
| I2BBOX2D | /cig/include/dgi_std.h, standard.h |
| I2BBOX3D | /cig/include/dgi_std.h, standard.h |
| I2HSL | /cig/include/dgi_std.h, standard.h |
| I2HSLO | /cig/include/dgi_std.h, standard.h |
| I2IJ | /cig/include/standard.h |
| I2MTX4X3 | /cig/include/dgi_std.h, standard.h |
| I2MTX4X4 | /cig/include/dgi_std.h, standard.h |
| I2P2D | /cig/include/dgi_std.h, standard.h |
| I2P3D | /cig/include/dgi_std.h, rt_types.h, standard.h |
| I2P3D | /cig/include/dgi_std.h, standard.h |
| I2RGB | /cig/include/dgi_std.h, standard.h |
| I2RGBO | /cig/include/dgi_std.h, standard.h |
| I4BBOX2D | /cig/include/dgi_std.h, standard.h |
| I4BBOX3D | /cig/include/dgi_std.h, standard.h |
| I4HSL | /cig/include/dgi_std.h, standard.h |
| I4HSLO | /cig/include/dgi_std.h, standard.h |
| I4IJ | /cig/include/standard.h |
| I4MTX4X3 | /cig/include/dgi_std.h, standard.h |
| I4MTX4X4 | /cig/include/dgi_std.h, standard.h |
| I4P2D | /cig/include/dgi_std.h, standard.h |
| I4P3D | /cig/include/dgi_std.h, rt_types.h, standard.h |
| I4P4D | /cig/include/dgi_std.h, standard.h |
| I4RGB | /cig/include/dgi_std.h, standard.h |
| I4RGBO | /cig/include/dgi_std.h |
| INT_2 | /cig/include/dgi_std.h, rt_types.h, standard.h; /cig/othersrc/force/dgi_std.h |

| Data Type | Typedef Location |
|------------------------------|---|
| INT_4 | /cig/include/dgi_std.c.h, rt_types.h, standard.h; /cig/othersrc/force/dgi_std.c.h |
| IOB | /cig/libsrc/libasio/sio.c |
| LM_CACHE_ENTRY | /cig/include/bx_structs.h |
| LM_CALL1 | /cig/include/poly_struct.h, structures.h |
| LM_CALL2 | /cig/include/poly_struct.h, structures.h |
| LM_H | /cig/include/bx_rtdb_structs.h, rtdb_struct.h |
| LM_SEARCH_LIST | /cig/include/bx_structs.h |
| LM_STATS | /cig/include/bx_rtdb_structs.h, rtdb_struct.h |
| LMS_DATA | /cig/include/db_struct.h, structures.h |
| LT_BVOL_ENTRY | /cig/include/if_cig2sim.h |
| LT_POLY_ENTRY | /cig/include/if_cig2sim.h |
| M1_GUN_OVERLAY | /cig/include/overlay3d_struct.h, structures.h |
| M2_GUN_OVERLAY | /cig/include/overlay3d_struct.h, structures.h |
| MAT_UNIT | /cig/include/poly_struct.h, structures.h |
| MATRIX4[3][3] | /cig/include/rt_types.h |
| MATRIX8[3][3] | /cig/include/rt_types.h |
| MDL_ADDR_STRUCT | /cig/libsrc/libgossip/ded_object.c |
| MESSAGE_HEADER | /cig/include/mx_defines.h; /cig/libsrc/libgossip/mx3_hword.c; /cig/libsrc/librtt/mx2_hword.c; /cig/othersrc/force/mx2_hword.c |
| MODE_SELECT_STRUCT | /cig/othersrc/force/fl_defines.h |
| MODEL_TABLE_STRUCT | /cig/include/rtdb_struct.h |
| MPVIDEO_CONTROL | /cig/include/mpvideo.h |
| MPVIDEO_OBJ | /cig/include/mpvideo.h |
| MPVIO_INTERFACE | /cig/include/mpvideo.h |
| MSG_1ROTATION | /cig/include/if_sim2cig.h |
| MSG_2D_SETUP | /cig/include/if_init.h |
| MSG_3ROTATIONS | /cig/include/if_sim2cig.h |
| MSG_ADD_TRAJ_TABLE | /cig/include/if_sim2cig.h |
| MSG_AGL | /cig/include/if_cig2sim.h |
| MSG_AGL_SETUP | /cig/include/if_sim2cig.h |
| MSG_AMMO_DEFINE | /cig/include/if_init.h |
| MSG_B0_AAM_CENTROID | /cig/include/bx_messages.h |
| MSG_B0_AAM_SW_CORNER | /cig/include/bx_messages.h |
| MSG_B0_ADD_STATIC_VEHICLE | /cig/include/bx_messages.h |
| MSG_B0_ADD_TRAJ_TABLE | /cig/include/bx_messages.h |
| MSG_B0_BAL_CONFIG | /cig/include/bx_messages.h |
| MSG_B0_BVOL_ENTRY | /cig/include/bx_messages.h |
| MSG_B0_CANCEL_ROUND | /cig/include/bx_messages.h |
| MSG_B0_CIG_FRAME_RATE | /cig/include/bx_messages.h |
| MSG_B0_DATABASE_INFO | /cig/include/bx_messages.h |
| MSG_B0_DELETE_STATIC_VEHICLE | /cig/include/bx_messages.h |

| Data Type | Typedef Location |
|---------------------------|--|
| MSG_B0_DELETE_TRAJ_TABLE | /cig/include/bx_messages.h |
| MSG_B0_LM_READ | /cig/include/bx_messages.h |
| MSG_B0_MODEL_DIRECTORY | /cig/include/bx_messages.h |
| MSG_B0_MODEL_ENTRY | /cig/include/bx_messages.h |
| MSG_B0_NEW_FRAME | /cig/include/bx_messages.h |
| MSG_B0_PRINT | /cig/include/bx_messages.h |
| MSG_B0_PROCESS_CHORD | /cig/include/bx_messages.h |
| MSG_B0_PROCESS_ROUND | /cig/include/bx_messages.h |
| MSG_B0_ROUND FIRED | /cig/include/bx_messages.h |
| MSG_B0_STATE_CONTROL | /cig/include/bx_messages.h |
| MSG_B0_TF_INIT_HDR | /cig/include/bx_messages.h |
| MSG_B0_TF_INIT_PT | /cig/include/bx_messages.h |
| MSG_B0_TF_STATE | /cig/include/bx_messages.h |
| MSG_B0_TF_VEHICLE_POS | /cig/include/bx_messages.h |
| MSG_B0_TRAJ_CHORD | /cig/include/bx_messages.h |
| MSG_B0_TRAJ_ENTRY | /cig/include/bx_messages.h |
| MSG_B1_GLOBAL_ADDR | /cig/include/bx_messages.h |
| MSG_B1_HIT_RETURN | /cig/include/bx_messages.h |
| MSG_B1_MISS | /cig/include/bx_messages.h |
| MSG_B1_ROUND_POSITION | /cig/include/bx_messages.h |
| MSG_B1_SHOT_REPORT | /cig/include/bx_messages.h |
| MSG_B1_STATUS_RETURN | /cig/include/bx_messages.h |
| MSG_B1_TF_HDR | /cig/include/bx_messages.h |
| MSG_B1_TF_PT | /cig/include/bx_messages.h |
| MSG_CALIBRATION_IMAGE | /cig/include/if_sim2cig.h |
| MSG_CANCEL_ROUND | /cig/include/if_sim2cig.h |
| MSG_CIG_CTL | /cig/include/if_ctl_err.h |
| MSG_CLOUD_STATE | /cig/include/if_sim2cig.h |
| MSG_CREATE_CONFIGNODE | /cig/include/if_init.h; /cig/libsrc/libvpt/vpi_msgs.h |
| MSG_DATA_TEST | /cig/include/if_sim2cig.h |
| MSG_DEFINE_TX_MODE | /cig/include/if_init.h |
| MSG_DELETE_TRAJ_TABLE | /cig/include/if_sim2cig.h |
| MSG_DR11_PKT_SIZE | /cig/include/if_ctl_err.h |
| MSG_F0_3DLUT_DOWNLOAD | /cig/include/mpvideo_msg.h; /cig/othersrc/force/mpvideo_msg.h |
| MSG_F0_3DLUT_SWITCH | /cig/include/mpvideo_msg.h; /cig/othersrc/force/mpvideo_msg.h |
| MSG_F0_ALLLUT_SWITCH | /cig/include/mpvideo_msg.h; /cig/othersrc/force/mpvideo_msg.h |
| MSG_F0_FINAL_LUT_DOWNLOAD | /cig/include/mpvideo_msg.h; /cig/othersrc/force/mpvideo_msg.h |
| MSG_F0_FINAL_LUT_SWITCH | /cig/include/mpvideo_msg.h; /cig/othersrc/force/mpvideo_msg.h |

| Data Type | Typedef Location |
|----------------------------|---|
| MSG_F0_MODE_SELECT | /cig/include/mpvideo_msg.h; /cig/othersrc/force/mpvideo_msg.h |
| MSG_F0_MPV_PEEK | /cig/include/mpvideo_msg.h; /cig/othersrc/force/mpvideo_msg.h |
| MSG_F0_MPV_POKE | /cig/include/mpvideo_msg.h; /cig/othersrc/force/mpvideo_msg.h |
| MSG_F0_MPV_POKE16 | /cig/include/mpvideo_msg.h; /cig/othersrc/force/mpvideo_msg.h |
| MSG_F0_MPV_TASK_CONTROL | /cig/othersrc/force/mpvideo_msg.h; /cig/include/mpvideo_msg.h |
| MSG_F0_MPV_WRITE | /cig/include/mpvideo_msg.h; /cig/othersrc/force/mpvideo_msg.h |
| MSG_F0_PASS_ON | /cig/include/mpvideo_msg.h; /cig/othersrc/force/mpvideo_msg.h |
| MSG_F0_PIXEL_DEPTH_REQUEST | /cig/include/mpvideo_msg.h; /cig/othersrc/force/mpvideo_msg.h |
| MSG_F0_QUERY | /cig/include/mpvideo_msg.h; /cig/othersrc/force/force_rtsw_if.h, mpvideo_msg.h |
| MSG_F0_SET_DISPLAY | /cig/include/mpvideo_msg.h; /cig/othersrc/force/mpvideo_msg.h |
| MSG_F1_ACKNOWLEDGE | /cig/include/mpvideo_msg.h; /cig/othersrc/force/mpvideo_msg.h |
| MSG_F1_FINAL_LUT_ADDR | /cig/include/mpvideo_msg.h; /cig/othersrc/force/mpvideo_msg.h |
| MSG_F1_MPV_IOCTL | /cig/include/mpvideo_msg.h; /cig/othersrc/force/mpvideo_msg.h |
| MSG_F1_MPV_LUT_TYPE | /cig/include/mpvideo_msg.h; /cig/othersrc/force/mpvideo_msg.h |
| MSG_F1_MPV_MEMORY | /cig/include/mpvideo_msg.h; /cig/othersrc/force/mpvideo_msg.h |
| MSG_F1_PIXEL_ADDR | /cig/include/mpvideo_msg.h; /cig/othersrc/force/mpvideo_msg.h |
| MSG_F1_PIXEL_DEPTH_RETURN | /cig/include/mpvideo_msg.h; /cig/othersrc/force/mpvideo_msg.h |
| MSG_F1_STATUS | /cig/include/mpvideo_msg.h; /cig/othersrc/force/mpvideo_msg.h |
| MSG_F1_TEXT | /cig/include/mpvideo_msg.h; /cig/othersrc/force/force_rtsw_if.h, mpvideo_msg.h |
| MSG_FILE_DESCR | /cig/include/if_tst_ctl.h, sysdefs2.h |
| MSG_FILE_STATUS | /cig/include/if_tst_ctl.h, sysdefs2.h |
| MSG_FILE_XFER | /cig/include/if_tst_ctl.h, sysdefs2.h |
| MSG_GUN_OVERLAY | /cig/include/if_sim2cig.h |
| MSG_HDR | /cig/include/if_ctl_err.h |
| MSG_HIT_RETURN | /cig/include/if_cig2sim.h |
| MSG_HIT_RETURN48 | /cig/include/if_rva2net.h |
| MSG_HPRXYZS_MATRIX | /cig/include/if_sim2cig.h |
| MSG_LASER_RETURN | /cig/include/if_cig2sim.h |

| Data Type | Typedef Location |
|---------------------------------|-------------------------------|
| MSG_LOCAL_TERRAIN | /cig/include/if_cig2sim.h |
| MSG_LT_PIECE | /cig/include/if_cig2sim.h |
| MSG_LT_STATE | /cig/include/if_sim2cig.h |
| MSG_MISS | /cig/include/if_cig2sim.h |
| MSG_OBSCURE | /cig/include/if_sim2cig.h |
| MSG_OTHERVEH_STATE | /cig/include/if_sim2cig.h |
| MSG_OVERLAY_SETUP | /cig/libsrc/libvpt/vpi_msgs.h |
| MSG_PASS_BACK | /cig/include/if_cig2sim.h |
| MSG_PASS_ON | /cig/include/if_sim2cig.h |
| MSG_PPM_DISPLAY_MODE | /cig/include/if_sim2cig.h |
| MSG_PPM_DISPLAY_OFFSET | /cig/include/if_sim2cig.h |
| MSG_PPM_PIXEL_LOCATION | /cig/include/if_sim2cig.h |
| MSG_PPM_PIXEL_STATE | /cig/include/if_sim2cig.h |
| MSG_PROCESS_CHORD | /cig/include/if_sim2cig.h |
| MSG_PROCESS_ROUND | /cig/include/if_sim2cig.h |
| MSG_PROCESS_ROUND48 | /cig/include/if_sim2cig.h |
| MSG_REQUEST_LASER_RANGE | /cig/include/if_sim2cig.h |
| MSG_REQUEST_POINT_INFO | /cig/include/if_sim2cig.h |
| MSG_RETURN_POINT_INFO | /cig/include/if_cig2sim.h |
| MSG_ROT2x1_MATRIX | /cig/include/if_sim2cig.h |
| MSG_ROUND_FIRED | /cig/include/if_sim2cig.h |
| MSG_RTS4x3_MATRIX | /cig/include/if_sim2cig.h |
| MSG_SCALE | /cig/include/if_sim2cig.h |
| MSG_SHOT_REPORT | /cig/include/if_cig2sim.h |
| MSG_SHOT_REPORT48 | /cig/include/if_rva2net.h |
| MSG_SHOW_EFFECT | /cig/include/if_sim2cig.h |
| MSG_SIO_CLOSE | /cig/include/if_sim2cig.h |
| MSG_SIO_INIT | /cig/include/if_sim2cig.h |
| MSG_SIO_WRITE | /cig/include/if_sim2cig.h |
| MSG_STATICVEH_REM | /cig/include/if_sim2cig.h |
| MSG_STATICVEH_STATE | /cig/include/if_sim2cig.h |
| MSG_STRUCT | /cig/include/cigsimio.h |
| MSG_SUBSYS_MODE | /cig/include/if_sim2cig.h |
| MSG_SYS_ERROR | /cig/include/if_ctl_err.h |
| MSG_TERRAIN_FEEDBACK_POINT_INIT | /cig/libsrc/libvpt/vpi_msgs.h |
| MSG_TERRAIN_FEEDBACK_SETUP | /cig/libsrc/libvpt/vpi_msgs.h |
| MSG_TEST_NAME | /cig/include/if_tst_ctl.h |
| MSG_TF_HDR | /cig/include/if_cig2sim.h |
| MSG_TF_INIT_HDR | /cig/include/if_sim2cig.h |
| MSG_TF_INIT_PT | /cig/include/if_sim2cig.h |
| MSG_TF_PT | /cig/include/if_cig2sim.h |
| MSG_TF_PT48 | /cig/include/if_rva2net.h |

| Data Type | Typedef Location |
|------------------------|---|
| MSG_TF_STATE | /cig/include/if_sim2cig.h |
| MSG_TF_VEHICLE_POS | /cig/include/if_sim2cig.h |
| MSG_TRAJ_CHORD | /cig/include/if_sim2cig.h |
| MSG_TRAJ_ENTRY | /cig/include/if_sim2cig.h |
| MSG_TRAJ_ENTRY_XFER | /cig/include/if_init.h |
| MSG_TRAJ_TABLE_XFER | /cig/include/if_init.h |
| MSG_TRANSLATION | /cig/include/if_sim2cig.h |
| MSG_VIEW_FLAGS | /cig/include/if_sim2cig.h |
| MSG_VIEW_MAGNIFICATION | /cig/include/if_sim2cig.h |
| MSG_VIEWPORT_STATE | /cig/include/if_init.h |
| MSG_VIEWPORT_STATE | /cig/libsrc/libvpt/vpi_msgs.h |
| MSG_VIEWPORT_UPDATE | /cig/include/if_sim2cig.h |
| MSG_BLK | /cig/include/if_ctl_err.h |
| MTXUNION | /cig/include/if_hdr_str.h, vpi_struct.h |
| MX2_DEVICE | /cig/libsrc/libgossip/mx3_hword.c; /cig/libsrc/librt/mx2_hword.c; /cig/othersrc/force/mx2_hword.c |
| MX_DEVICE | /cig/include/mx_defines.h |
| OMODEL | /cig/include/model_struct.h, structures.h |
| OVERLAY_PARAMS | /cig/include/overlay3d_struct.h |
| POI | /cig/include/demo_struct.h |
| POINT_DATA | /cig/include/bx_structs.h |
| POLY_CACHE_ENTRY | /cig/include/bx_structs.h |
| POLY_ENTRY | /cig/include/bx_structs.h |
| POLY_INFO_WORD | /cig/include/bx_rtdb_structs.h, poly_struct.h, structures.h |
| POLYGON_LIST | /cig/include/bx_rtdb_structs.h, poly_struct.h, structures.h |
| PPM_DATA_TYPE | /cig/include/ppm.h |
| PREAMBLE | /cig/libsrc/libhost/host_enet_if.c |
| PRINT_MSG_STRUCT | /cig/libsrc/libhost/host_if_debug.c; /cig/libsrc/libmsg/print_msg.c |
| PROJ_DATA | /cig/include/bal_struct.h, structures.h |
| PROJ_DATA_2 | /cig/include/bal_struct.h, structures.h |
| R4BBOX2D | /cig/include/dgi_stdg.h, standard.h |
| R4BBOX3D | /cig/include/dgi_stdg.h, standard.h |
| R4HSL | /cig/include/dgi_stdg.h, standard.h |
| R4HSLO | /cig/include/dgi_stdg.h, standard.h |
| R4IJ | /cig/include/standard.h |
| R4MTX4X3 | /cig/include/dgi_stdg.h, standard.h |
| R4MTX4X4 | /cig/include/dgi_stdg.h, standard.h |
| R4P2D | /cig/include/dgi_stdg.h, standard.h |
| R4P3D | /cig/include/dgi_stdg.h, rt_types.h, standard.h |
| R4P4D | /cig/include/dgi_stdg.h, standard.h |
| R4RGB | /cig/include/dgi_stdg.h, standard.h |

| Data Type | Typedef Location |
|------------------------|--|
| R4RGBO | /cig/include/dgi_stdg.h, standard.h |
| R8BBOX2D | /cig/include/dgi_stdg.h, standard.h |
| R8BBOX3D | /cig/include/dgi_stdg.h, standard.h |
| R8HSL | /cig/include/dgi_stdg.h, standard.h |
| R8HSLO | /cig/include/dgi_stdg.h, standard.h |
| R8MTX4X3 | /cig/include/dgi_stdg.h, standard.h |
| R8MTX4X4 | /cig/include/dgi_stdg.h, standard.h |
| R8P2D | /cig/include/dgi_stdg.h, standard.h |
| R8P3D | /cig/include/dgi_stdg.h, standard.h |
| R8P4D | /cig/include/dgi_stdg.h, standard.h |
| R8RGB | /cig/include/dgi_stdg.h, standard.h |
| R8RGBO | /cig/include/dgi_stdg.h, standard.h |
| RCL_UNION | /cig/include/rcinclude.h |
| REAL_4 | /cig/include/dgi_stdg.h, rt_types.h, standard.h; /cig/othersrc/force/dgi_stdg.h |
| REAL_8 | /cig/include/dgi_stdg.h, rt_types.h, standard.h; /cig/othersrc/force/dgi_stdg.h |
| RESOLUTION | /cig/include/if_hdr_str.h; /cig/libsrc/libvpt/vpi_msgs.h |
| RGBPOLY_LIST | /cig/include/poly_struct.h, structures.h |
| ROT2x1_MTX | /cig/include/if_hdr_str.h, vpi_struct.h |
| ROUND_DATA | /cig/include/bx_structs.h |
| RTS3x3_MTX | /cig/include/if_hdr_str.h, vpi_struct.h |
| RTS4x3_MTX | /cig/include/if_hdr_str.h, vpi_struct.h |
| SCREEN | /cig/include/vpi_viewport.h |
| SCREEN_POSITION_STRUCT | /cig/libsrc/libflea/tick_ppm.c |
| SCRN_CONSTANTS | /cig/include/vpi_viewport.h |
| SEARCH_LIST | /cig/include/definitions.h |
| SG_OVERLAY_SETUP | /cig/include/if_init.h |
| SHORT_LONG_ADDR | /cig/libsrc/libmpvideo/bootforce.c |
| SHOW_EFF | /cig/include/model_struct.h, structures.h |
| SIM_VEH_STRUCT | /cig/include/demo_struct.h |
| SIO_CTL | /cig/libsrc/libvio/sio.c |
| SOMODEL | /cig/include/model_struct.h, structures.h |
| SREM | /cig/include/model_struct.h, structures.h |
| STAMP_LIST | /cig/include/poly_struct.h, structures.h |
| STANK | /cig/include/model_struct.h, structures.h |
| STAT_VEH | /cig/include/bx_structs.h |
| STRING | /cig/include/standard.h, dgi_stdg.h; /cig/othersrc/force/dgi_stdg.h |
| STRUCT2D | /cig/include/struct_2d.h |
| STRUCT_P_BVOL | /cig/include/bx_structs.h |
| STRUCT_P_POLY | /cig/include/bx_structs.h |
| STRUCT_P_ROUND | /cig/include/bx_structs.h |

| Data Type | Typedef Location |
|-------------------------|--|
| STRUCT_P_SV | /cig/include/bx_structs.h |
| STRUCT_P_TF_PT | /cig/libsrc/libball/bx_tf_pack.c |
| SWITCH_2DLUT_STRUCT | /cig/other/src/force/fl_defines.h |
| T_MATRIX[3][3] | /cig/include/vpi_struct.h |
| T_VECTOR[3] | /cig/include/vpi_struct.h |
| TABLE1 | /cig/libsrc/libflea/flea_agpt_switches.c |
| TAC_STATUS | /cig/include/definitions.h |
| TANK | /cig/include/model_struct.h, structures.h |
| tasks | /cig/include/sysdefs2.h |
| TERRAIN_CORNERS | /cig/include/bx_structs.h |
| TEXTURE_INDEX | /cig/include/structures.h, traverse_cmd_defs.h |
| TEXTURE_MAP | /cig/include/poly_struct.h, structures.h |
| TF1 | /cig/include/if_hdr_str.h |
| TF2 | /cig/include/if_hdr_str.h |
| TF_DATA_HDR | /cig/include/bx_structs.h |
| TF_PT | /cig/libsrc/libball/bx_tf_pack.c |
| TF_TYPE | /cig/include/if_hdr_str.h; /cig/libsrc/libvpt/vpi_msgs.h |
| TRAJ_DATA | /cig/include/bal_struct.h, structures.h |
| TRAJ_DATA_2 | /cig/include/bal_struct.h, structures.h |
| TRAJ_ENTRY | /cig/include/bx_structs.h |
| TRAJ_POS | /cig/include/bal_struct.h, structures.h |
| TRAJ_POS_2 | /cig/include/bal_struct.h, structures.h |
| TRAJ_TABLE | /cig/include/bx_structs.h |
| UIR4P | /cig/include/standard.h, structures.h |
| UIR4P3D | /cig/include/standard.h, structures.h |
| UNS_1 | /cig/include/dgi_std.h, /standard.h; /cig/other/src/force/dgi_std.h |
| UNS_2 | /cig/include/dgi_std.h, standard.h; /cig/other/src/force/dgi_std.h |
| UNS_4 | /cig/include/dgi_std.h, standard.h; /cig/other/src/force/dgi_std.h |
| V_FLAGS | /cig/include/vpi_viewport.h |
| VECTOR4[3] | /cig/include/rt_types.h |
| VECTOR8[3] | /cig/include/rt_types.h |
| VIDEO_CONTROL | /cig/include/mpv_struct.h, structures.h |
| VIEWPORT_PARAMETERS | /cig/include/vpi_viewport.h |
| VPOS_ARRAY | /cig/include/vpi_viewport.h |
| VPT_CNODE_INFO | /cig/include/vpi_query.h |
| VPT_PATH_INFO | /cig/include/vpi_query.h |
| VPT_VPT_INFO | /cig/include/vpi_query.h |
| WHERE_PROCESS | /cig/include/ecompile1.h |
| WINDOW_DESCRIPTOR_TABLE | /cig/include/struct_2d.h |

Data Type**Typedef Location**

WORD

`/cig/include/dgi_std.h, rt_types.h, standard.h;
/cig/other/src/force/dgi_std.h`

X'ZHPR

`/cig/include/ff_hdr_str.h`

E.3 Function Names Mapped To Source File Locations

The following list shows each function in the real-time software, and identifies the file in which the function is located. The third column shows the section number in which the function is described in this document.

| Function Name | Location | Section |
|--|--|------------|
| _copy_reconfigurable_viewports_section | /cig/libsrc/libmsg/msg_end.c | 2.12.6.13 |
| _database_disable | /cig/libsrc/libmsg/msg_end.c | 2.12.6.10 |
| _display_lights | /cig/libsrc/libmsg/msg_end.c | 2.12.6.3 |
| _downcount_effects | /cig/libsrc/libmsg/msg_end.c | 2.12.6.2 |
| _handle_point_lights | /cig/libsrc/libmsg/msg_end.c | 2.12.6.11 |
| _handle_request_local_terrain | /cig/libsrc/libmsg/msg_end.c | 2.12.6.9 |
| _move_load_module_stp_to_quad_buffer | /cig/libsrc/libmsg/msg_end.c | 2.12.6.4 |
| _pend_on_frame_interrupt | /cig/libsrc/libmsg/msg_end.c | 2.12.6.6 |
| _process_agl | /cig/libsrc/libmsg/msg_end.c | 2.12.6.7 |
| _reset_model_pointers | /cig/libsrc/libmsg/msg_end.c | 2.12.6.12 |
| _rowcol_rd | /cig/libsrc/librtt/rowcol_rd.c | 2.13.40.5 |
| _rowcol_rd_cleanup | /cig/libsrc/librtt/rowcol_rd.c | 2.13.40.10 |
| _set_up_for_next_frame | /cig/libsrc/libmsg/msg_end.c | 2.12.6.8 |
| _update_second_active_area_memory | /cig/libsrc/libmsg/msg_end.c | 2.12.6.5 |
| aam_free | /cig/libsrc/libvpt/be_stubs.c | 2.17.1.9 |
| aam_malloc | /cig/libsrc/libconfig/aam_manager.c | 2.5.1.1 |
| active_area_init | /cig/libsrc/libbackend/aa_init.c | 2.3.1.1 |
| addr_in_pool | /cig/libsrc/librtt/ded_gm_pool.c | 2.13.15.3 |
| agpt_init | /cig/libsrc/librtt/agpt_init.c | 2.13.1 |
| agpt_statistics | /cig/libsrc/libgossip/ | 2.9.1 |
| autopilot | /cig/libsrc/libflea/autopilot.c | 2.7.1 |
| b0_aam_centroid | /cig/libsrc/libball/b0_aam_centroid.c | 2.4.2.1 |
| b0_aam_sw_corner | /cig/libsrc/libball/b0_aam_sw_corner.c | 2.4.2.2 |
| b0_add_static_vehicle | /cig/libsrc/libball/b0_add_static_vehicle.c | 2.4.2.3 |
| b0_add_traj_table | /cig/libsrc/libball/b0_add_traj_table.c | 2.4.2.4 |
| b0_bal_config | /cig/libsrc/libball/b0_bal_config.c | 2.4.2.5 |
| b0_bvol_entry | /cig/libsrc/libball/b0_bvol_entry.c | 2.4.2.6 |
| b0_cancel_round | /cig/libsrc/libball/b0_cancel_round.c | 2.4.2.7 |
| b0_cig_frame_rate | /cig/libsrc/libball/b0_cig_frame_rate.c | 2.4.2.8 |
| b0_database_info | /cig/libsrc/libball/b0_database_info.c | 2.4.2.9 |
| b0_delete_static_vehicle | /cig/libsrc/libball/b0_delete_static_vehicle.c | 2.4.2.10 |
| b0_delete_traj_table | /cig/libsrc/libball/b0_delete_traj_table.c | 2.4.2.11 |
| b0_error_detected | /cig/libsrc/libball/b0_error_detected.c | 2.4.2.12 |
| b0_inapp_message | /cig/libsrc/libball/b0_inapp_message.c | 2.4.2.13 |
| b0_lm_read | /cig/libsrc/libball/b0_lm_read.c | 2.4.2.14 |
| b0_model_directory | /cig/libsrc/libball/b0_model_directory.c | 2.4.2.15 |
| b0_model_entry | /cig/libsrc/libball/b0_model_entry.c | 2.4.2.16 |
| b0_new_frame | /cig/libsrc/libball/b0_new_frame.c | 2.4.2.17 |
| b0_print | /cig/libsrc/libball/b0_print.c | 2.4.2.18 |
| b0_process_chord | /cig/libsrc/libball/b0_process_chord.c | 2.4.2.19 |
| b0_process_round | /cig/libsrc/libball/b0_process_round.c | 2.4.2.20 |
| b0_round_fired | /cig/libsrc/libball/b0_round_fired.c | 2.4.2.21 |
| b0_state_control | /cig/libsrc/libball/b0_state_control.c | 2.4.2.22 |
| b0_status_request | /cig/libsrc/libball/b0_status_request.c | 2.4.2.23 |
| b0_tf_init_hdr | /cig/libsrc/libball/b0_tf_init_hdr.c | 2.4.2.24 |
| b0_tf_init_pt | /cig/libsrc/libball/b0_tf_init_pt.c | 2.4.2.25 |
| b0_tf_state | /cig/libsrc/libball/b0_tf_state.c | 2.4.2.26 |
| b0_tf_vehicle_pos | /cig/libsrc/libball/b0_tf_vehicle_pos.c | 2.4.2.27 |

| Function Name | Location | Section |
|------------------------------|--|------------|
| b0_traj_chord | /cig/libsrc/libball/b0_traj_chord.c | 2.4.2.28 |
| b0_traj_entry | /cig/libsrc/libball/b0_traj_entry.c | 2.4.2.29 |
| b0_undefined_message | /cig/libsrc/libball/b0_undefined_message.c | 2.4.2.30 |
| backend_clear_laser_requests | /cig/libsrc/libbackend/backend_man.c | 2.3.5.6 |
| backend_get_object_addr | /cig/libsrc/libbackend/backend_man.c | 2.3.5.5 |
| backend_laser_request_range | /cig/libsrc/libbackend/backend_laser.c | 2.3.4.1 |
| backend_reset | /cig/libsrc/libbackend/backend_man.c | 2.3.5.2 |
| backend_response | /cig/libsrc/libbackend/backend_laser.c | 2.3.4.2 |
| backend_send_req | /cig/libsrc/libbackend/backend_man.c | 2.3.5.4 |
| backend_set_branch | /cig/libsrc/libbackend/backend_branch.c | 2.3.2 |
| backend_set_color | /cig/libsrc/libbackend/backend_color.c | 2.3.3 |
| backend_set_paths | /cig/libsrc/libbackend/backend_paths.c | 2.3.6.1 |
| backend_set_thermal | /cig/libsrc/libbackend/backend_thermal.c | 2.3.7 |
| backend_set_video | /cig/libsrc/libbackend/backend_video.c | 2.3.8 |
| backend_setup | /cig/libsrc/libbackend/backend_man.c | 2.3.5.1 |
| backend_sim_init | /cig/libsrc/libbackend/backend_man.c | 2.3.5.3 |
| backend_update_view_paths | /cig/libsrc/libbackend/backend_paths.c | 2.3.6.2 |
| bal_buffer_setup | /cig/libsrc/librvt/config_ballistics.c | 2.13.10.2 |
| bal_get_db_pos | /cig/libsrc/librvt/bal_get_db_pos.c | 2.13.2 |
| bal_get_lm_grid | /cig/libsrc/librvt/bal_get_lm_grid.c | 2.13.3 |
| ball_effect_add | /cig/libsrc/librvt/ball_effect_add.c | 2.13.5 |
| bnctype | /cig/libsrc/libconfig/bnctype.c | 2.5.2 |
| be_query_buffer_offset | /cig/libsrc/libvpt/be_stubs.c | 2.17.1.3 |
| be_query_db0 | /cig/libsrc/libvpt/be_stubs.c | 2.17.1.4 |
| be_query_lm_per_lmb_side | /cig/libsrc/libvpt/be_stubs.c | 2.17.1.6 |
| be_query_num_paths | /cig/libsrc/libvpt/be_stubs.c | 2.17.1.1 |
| be_qulm | /cig/libsrc/libvpt/be_stubs.c | 2.17.1.5 |
| blank | /cig/libsrc/libutil/vt100.c | 2.16.7.6 |
| blcopy | /cig/libsrc/libutil/blcopy.c | 2.16.1 |
| bootforce | /cig/libsrc/libmpvideo/bootforce.c | 2.11.1.1 |
| bx_bvol_int | /cig/libsrc/libball/bx_bvol_int.c | 2.4.3.1 |
| bx_chord_intersect | /cig/libsrc/libball/bx_chord_intersect.c | 2.4.3.2 |
| bx_delete_round | /cig/libsrc/libball/bx_functions.c | 2.4.3.5.2 |
| bx_delete_stat_veh | /cig/libsrc/libball/bx_functions.c | 2.4.3.5.10 |
| bx_dist_sq_pt_line | /cig/libsrc/libball/bx_functions.c | 2.4.3.5.11 |
| bx_find_round_hit | /cig/libsrc/libball/bx_compute_round.c | 2.4.3.3.5 |
| bx_find_shot_report | /cig/libsrc/libball/bx_compute_round.c | 2.4.3.3.3 |
| bx_find_vehicle | /cig/libsrc/libball/bx_find_vehicle.c | 2.4.3.4 |
| bx_free_lm_cache | /cig/libsrc/libball/bx_functions.c | 2.4.3.5.6 |
| bx_get_chord_end | /cig/libsrc/libball/bx_functions.c | 2.4.3.5.4 |
| bx_get_db_pos | /cig/libsrc/libball/bx_functions.c | 2.4.3.5.3 |
| bx_get_lb_from_lm | /cig/libsrc/libball/bx_functions.c | 2.4.3.5.8 |
| bx_get_lm_data | /cig/libsrc/libball/bx_get_lm_data.c | 2.4.3.6 |
| bx_get_lm_grid | /cig/libsrc/libball/bx_get_lm_grid.c | 2.4.3.7 |
| bx_guntip_within_db | /cig/libsrc/libball/bx_compute_round.c | 2.4.3.3.2 |
| bx_init | /cig/libsrc/libball/bx_init.c | 2.4.1.1 |
| bx_model_int | /cig/libsrc/libball/bx_model_int.c | 2.4.3.8 |
| bx_new_bvol | /cig/libsrc/libball/bx_functions.c | 2.4.3.5.5 |
| bx_new_poly | /cig/libsrc/libball/bx_functions.c | 2.4.3.5.7 |
| bx_new_round | /cig/libsrc/libball/bx_functions.c | 2.4.3.5.1 |
| bx_new_stat_veh | /cig/libsrc/libball/bx_functions.c | 2.4.3.5.9 |
| bx_poly_int | /cig/libsrc/libball/bx_poly_int.c | 2.4.3.9 |
| bx_probe | /cig/libsrc/libball/bx_probe.c | 2.4.1.2 |
| bx_reset | /cig/libsrc/libball/bx_reset.c | 2.4.1.3 |
| bx_return_miss | /cig/libsrc/libball/bx_compute_round.c | 2.4.3.3.1 |
| bx_round_tracer_position | /cig/libsrc/libball/bx_compute_round.c | 2.4.3.3.4 |
| bx_task | /cig/libsrc/libball/bx_task.c | 2.4.1.4.1 |
| bx_task_cleanup | /cig/libsrc/libball/bx_task.c | 2.4.1.4.2 |

| Function Name | Location | Section |
|------------------------------|---|------------|
| bx_tf_copy_msg | /cig/libsrc/libball/bx_tf_pack.c | 2.4.3.10.4 |
| bx_tf_free_tf_pts | /cig/libsrc/libball/bx_tf_pack.c | 2.4.3.10.7 |
| bx_tf_init_pt_cache | /cig/libsrc/libball/bx_tf_pack.c | 2.4.3.10.1 |
| bx_tf_new_tf_pts | /cig/libsrc/libball/bx_tf_pack.c | 2.4.3.10.6 |
| bx_tf_next | /cig/libsrc/libball/bx_tf_pack.c | 2.4.3.10.3 |
| bx_tf_pt_data | /cig/libsrc/libball/bx_tf_pack.c | 2.4.3.10.5 |
| bx_tf_pts | /cig/libsrc/libball/bx_tf_pack.c | 2.4.3.10.2 |
| bx_trajectory | /cig/libsrc/libball/bx_trajectory.c | 2.4.3.11 |
| cal | /cig/libsrc/librtt/cal.c | 2.13.6 |
| cancel_round | /cig/libsrc/libflea/encode_routines.c | 2.7.4.28 |
| check_restart | /cig/gtbinsrc/rtt/rtt.c | 2.1.3.2 |
| check_sum | /cig/libsrc/libutil/sload.c | 2.16.5.4 |
| cig_2d_setup | /cig/libsrc/lib2d/cig_2d_setup.c | 2.2.2 |
| cig_config | /cig/libsrc/libconfig/cig_config.c | 2.5.3 |
| cigsimio_buffer_init | /cig/libsrc/librtt/cigsimio_obj.c | 2.13.7.6 |
| cigsimio_frame_end | /cig/libsrc/librtt/cigsimio_obj.c | 2.13.7.7 |
| cigsimio_get_data | /cig/libsrc/librtt/cigsimio_obj.c | 2.13.7.5 |
| cigsimio_msg_in | /cig/libsrc/librtt/cigsimio_obj.c | 2.13.7.2 |
| cigsimio_msg_out | /cig/libsrc/librtt/cigsimio_obj.c | 2.13.7.3 |
| cigsimio_write | /cig/libsrc/librtt/cigsimio_obj.c | 2.13.7.4 |
| clear | /cig/libsrc/libbackend/aa_init.c | 2.3.1.2 |
| clear_line | /cig/libsrc/libhost/host_if_debug.c | 2.10.4.5 |
| close_db | /cig/libsrc/librtt/close_db.c | 2.13.8 |
| CloseDir | /cig/libsrc/libutil/directory.c | 2.16.2.3 |
| cloud_init | /cig/libsrc/librtt/clouds.c | 2.13.9.1 |
| cloud_mgmt | /cig/libsrc/librtt/clouds.c | 2.13.9.4 |
| cloud_placement | /cig/libsrc/librtt/clouds.c | 2.13.9.5 |
| cloud_scud | /cig/libsrc/librtt/clouds.c | 2.13.9.6 |
| cloud_update | /cig/libsrc/librtt/clouds.c | 2.13.9.2 |
| cloud_update_model | /cig/libsrc/librtt/clouds.c | 2.13.9.3 |
| compare_buffers | /cig/othersrc/force/forcetask.c | 2.18.32.2 |
| compile_2d (CIG version) | /cig/libsrc/lib2d/cig_comp_2d.c | 2.2.3 |
| compile_2d (offline version) | /cig/libsrc/lib2d/u_comp_2d.c | 2.2.15 |
| concat_mtx | /cig/libsrc/libvpt/mtx_concat.c | 2.17.11 |
| config_ballistics | /cig/libsrc/librtt/config_ballistics.c | 2.13.10.1 |
| config_color_table | /cig/libsrc/librtt/config_color_table.c | 2.13.11 |
| config_database | /cig/libsrc/librtt/config_database.c | 2.13.12.1 |
| config_translator | /cig/libsrc/libflea/cf_translator.c | 2.7.2.1 |
| ctoi | /cig/libsrc/libutil/sload.c | 2.16.5.7 |
| cup | /cig/libsrc/libutil/vt100.c | 2.16.7.1 |
| data_type | /cig/othersrc/force/data_type.c | 2.18.1 |
| db_mcc_setup | /cig/libsrc/librtt/db_mcc_setup.c | 2.13.13 |
| debug_initdr | /cig/libsrc/librtt/debug_initdr.c | 2.13.14 |
| ded_add_effect | /cig/libsrc/libgossip/ded_object.c | 2.9.3.4 |
| ded_add_model | /cig/libsrc/libgossip/ded_object.c | 2.9.3.3 |
| ded_adjust_addr_tables | /cig/libsrc/libgossip/ded_object.c | 2.9.3.6 |
| ded_cross_border | /cig/libsrc/libgossip/ded_object.c | 2.9.3.9 |
| ded_dtp_trace | /cig/libsrc/libgossip/ded_object.c | 2.9.3.12 |
| ded_init_mdl_addr | /cig/libsrc/libgossip/ded_object.c | 2.9.3.2 |
| ded_load_dtp_code | /cig/libsrc/libgossip/ded_object.c | 2.9.3.13 |
| ded_model_end_addr | /cig/libsrc/libgossip/ded_object.c | 2.9.3.5 |
| ded_model_offset | /cig/libsrc/libgossip/ded_object.c | 2.9.3.14 |
| ded_model_trace | /cig/libsrc/librtt/ded_model_trace.c | 2.13.16 |
| ded_object_debug | /cig/libsrc/libgossip/ded_object.c | 2.9.3.16 |
| ded_print_tables | /cig/libsrc/libgossip/ded_object.c | 2.9.3.15 |
| ded_process_directory | /cig/libsrc/libgossip/ded_object.c | 2.9.3.11 |
| ded_relocate_model | /cig/libsrc/libgossip/ded_object.c | 2.9.3.10 |
| ded_setup | /cig/libsrc/libgossip/ded_object.c | 2.9.3.1 |

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|---------------------------|--|-----------|
| ded_sub_end | /cig/libsrc/libgossip/ded_object.c | 2.9.3.8 |
| ded_uninit | /cig/libsrc/libgossip/ded_object.c | 2.9.3.7 |
| demor | /cig/libsrc/libflea/flea_agpt_switches.c | 2.7.8.7 |
| disable_restart | /cig/gtbinsrc/rtt/rtt.c | 2.1.3.3 |
| display | /cig/libsrc/libgossip/dtp_emu.c | 2.9.4.2 |
| dl_setup | /cig/libsrc/libbackend/dl_man.c | 2.3.9 |
| dl_setup | /cig/libsrc/librtt/dl_man.c | 2.13.17 |
| double_bot | /cig/libsrc/libutil/vt100.c | 2.16.7.4 |
| double_lite | /cig/libsrc/libgossip/replace_mod.c | 2.9.18.3 |
| double_off | /cig/libsrc/libutil/vt100.c | 2.16.7.5 |
| double_top | /cig/libsrc/libutil/vt100.c | 2.16.7.3 |
| download_bvols | /cig/libsrc/librtt/download_bvols.c | 2.13.18 |
| dtp_compiler | /cig/libsrc/libgendtp/dtp_compiler.c | 2.8.1 |
| dtp_emu | /cig/libsrc/libgossip/dtp_emu.c | 2.9.4.1 |
| dtp_malloc | /cig/libsrc/libgendtp/dtp_funcs.c | 2.8.2.5 |
| dtp_malloc_init | /cig/libsrc/libgendtp/dtp_funcs.c | 2.8.2.6 |
| dtp_trav1 | /cig/libsrc/libgendtp/dtp_trav1.c | 2.8.3 |
| dtp_trav2 | /cig/libsrc/libgendtp/dtp_trav2.c | 2.8.4 |
| dynamic_aam_init | /cig/libsrc/libconfig/aam_manager.c | 2.5.1.4 |
| dynamic_demo | /cig/libsrc/libflea/dynamic_demo.c | 2.7.3 |
| effect_downcount | /cig/libsrc/librtt/effect_downcount.c | 2.13.19 |
| errors | /cig/libsrc/librtt/config_database.c | 2.13.12.2 |
| esifa_ConfigData | /cig/libsrc/libesifa/esifa_man.c | 2.6.4.5 |
| esifa_download | /cig/libsrc/libesifa/esifa_query.c | 2.6.5.5 |
| esifa_get_object_addr | /cig/libsrc/libesifa/esifa_man.c | 2.6.4.4 |
| esifa_laser_request_range | /cig/libsrc/libesifa/esifa_laser.c | 2.6.2.1 |
| esifa_laser_return | /cig/libsrc/libesifa/esifa_laser.c | 2.6.2.2 |
| esifa_load | /cig/libsrc/libesifa/esifa_load.c | 2.6.3 |
| esifa_queue_data | /cig/libsrc/libesifa/esifa_man.c | 2.6.4.6 |
| esifa_queue_download | /cig/libsrc/libesifa/esifa_man.c | 2.6.4.7 |
| esifa_read | /cig/libsrc/libesifa/esifa_query.c | 2.6.5.3 |
| esifa_read_ports | /cig/libsrc/libesifa/esifa_query.c | 2.6.5.1 |
| esifa_send_queue | /cig/libsrc/libesifa/esifa_man.c | 2.6.4.8 |
| esifa_send_req | /cig/libsrc/libesifa/esifa_man.c | 2.6.4.3 |
| esifa_set_fade | /cig/libsrc/libesifa/esifa_fade.c | 2.6.1 |
| esifa_set_special | /cig/libsrc/libesifa/esifa_special.c | 2.6.6 |
| esifa_set_thermal | /cig/libsrc/libesifa/esifa_thermal.c | 2.6.7 |
| esifa_set_video | /cig/libsrc/libesifa/esifa_video.c | 2.6.8 |
| esifa_setup | /cig/libsrc/libesifa/esifa_man.c | 2.6.4.1 |
| esifa_sim_init | /cig/libsrc/libesifa/esifa_man.c | 2.6.4.2 |
| esifa_write | /cig/libsrc/libesifa/esifa_query.c | 2.6.5.4 |
| esifa_write_ports | /cig/libsrc/libesifa/esifa_query.c | 2.6.5.2 |
| except_init | /cig/other/src/force/exception.asm | 2.18.2.1 |
| exchange_dr11_data | /cig/libsrc/libhost/host_dr11_if.c | 2.10.1.2 |
| exchange_dr11_data_sim | /cig/libsrc/libhost/host_dr11_if.c | 2.10.1.3 |
| exchange_enet_data | /cig/libsrc/libhost/host_enet_if.c | 2.10.2.2 |
| exchange_enet_data_sim | /cig/libsrc/libhost/host_enet_if.c | 2.10.2.3 |
| exchange_flea_data | /cig/libsrc/libhost/host_flea_if.c | 2.10.3.2 |
| exchange_mpv_data | /cig/libsrc/libhost/host_mpv_if.c | 2.10.5.2 |
| exchange_mpv_data_sim | /cig/libsrc/libhost/host_mpv_if.c | 2.10.5.3 |
| exchange_scsi_data | /cig/libsrc/libhost/host_scsi_if.c | 2.10.6.2 |
| exchange_scsi_data_sim | /cig/libsrc/libhost/host_scsi_if.c | 2.10.6.3 |
| exchange_socket_data | /cig/libsrc/libhost/host_socket_if.c | 2.10.7.2 |
| exchange_socket_data_sim | /cig/libsrc/libhost/host_socket_if.c | 2.10.7.3 |
| extended_ram_available | /cig/libsrc/libbackend/aa_init.c | 2.3.1.3 |
| f0_3dlut_download | /cig/other/src/force/f0_3dlut_download.c | 2.18.3 |
| f0_3dlut_switch | /cig/other/src/force/f0_3dlut_switch.c | 2.18.4 |
| f0_alllut_switch | /cig/other/src/force/f0_alllut_switch.c | 2.18.5 |

| Function Name | Location | Section |
|-------------------------------|--|------------|
| f0_debug_disable | /cig/other/src/force/f0_debug_disable.c | 2.18.6 |
| f0_debug_enable | /cig/other/src/force/f0_debug_enable.c | 2.18.7 |
| f0_final_lut_download | /cig/other/src/force/f0_final_lut_download.c | 2.18.8 |
| f0_final_lut_switch | /cig/other/src/force/f0_final_lut_switch.c | 2.18.9 |
| f0_mode_select | /cig/other/src/force/f0_mode_select.c | 2.18.10 |
| f0_mpv_init | /cig/other/src/force/f0_mpv_init.c | 2.18.11 |
| f0_mpv_lut_type_request | /cig/other/src/force/f0_mpv_lut_type_request.c | 2.18.12 |
| f0_mpv_peek | /cig/other/src/force/f0_mpv_peek.c | 2.18.13 |
| f0_mpv_poke | /cig/other/src/force/f0_mpv_poke.c | 2.18.14 |
| f0_mpv_poke16 | /cig/other/src/force/f0_mpv_poke16.c | 2.18.15 |
| f0_mpv_reset | /cig/other/src/force/f0_mpv_reset.c | 2.18.16 |
| f0_mpv_task_control | /cig/other/src/force/f0_mpv_task_control.c | 2.18.17 |
| f0_mpv_test | /cig/other/src/force/f0_mpv_test.c | 2.18.18 |
| f0_mpv_write | /cig/other/src/force/f0_mpv_write.c | 2.18.19 |
| f0_pass_on | /cig/other/src/force/f0_pass_on.c | 2.18.20 |
| f0_pixel_depth_request | /cig/other/src/force/f0_pixel_depth_request.c | 2.18.21 |
| f0_query | /cig/other/src/force/f0_query.c | 2.18.22.1 |
| f0_set_display | /cig/other/src/force/f0_set_display.c | 2.18.23 |
| f0_trigger | /cig/other/src/force/f0_trigger.c | 2.18.24 |
| f0_unknown | /cig/other/src/force/f0_unknown.c | 2.18.25 |
| f1_force_init | /cig/other/src/force/f1_force_init.c | 2.18.26 |
| f1_init_jump_table | /cig/other/src/force/f1_init_jump_table.c | 2.18.27 |
| f1_pa_320x240_h | /cig/other/src/force/f1_pixel_address.c | 2.18.28.10 |
| f1_pa_320x240_v | /cig/other/src/force/f1_pixel_address.c | 2.18.28.6 |
| f1_pa_640x240_h | /cig/other/src/force/f1_pixel_address.c | 2.18.28.12 |
| f1_pa_640x240_v | /cig/other/src/force/f1_pixel_address.c | 2.18.28.8 |
| f1_pa_640x256_h | /cig/other/src/force/f1_pixel_address.c | 2.18.28.11 |
| f1_pa_640x256_v | /cig/other/src/force/f1_pixel_address.c | 2.18.28.7 |
| f1_pa_640x480_h | /cig/other/src/force/f1_pixel_address.c | 2.18.28.9 |
| f1_pa_640x480_v | /cig/other/src/force/f1_pixel_address.c | 2.18.28.5 |
| f1_pa_fb_offset | /cig/other/src/force/f1_pixel_address.c | 2.18.28.4 |
| f1_pa_init | /cig/other/src/force/f1_pixel_address.c | 2.18.28.1 |
| f1_pa_new_orientation | /cig/other/src/force/f1_pixel_address.c | 2.18.28.2 |
| f1_pa_new_resolution | /cig/other/src/force/f1_pixel_address.c | 2.18.28.3 |
| f1_process_messages | /cig/other/src/force/f1_process_messages.c | 2.18.29 |
| f1_setup_environment | /cig/other/src/force/f1_setup_environment.c | 2.18.30 |
| file_control | /cig/libsrc/librtu/file_control.c | 2.13.20 |
| fill_tree | /cig/libsrc/libconfig/fill_tree.c | 2.5.4.1 |
| find_be_id | /cig/libsrc/libvpt/be_stubs.c | 2.17.1.2 |
| find_fn | /cig/libsrc/libutil/find_gfn.c | 2.16.4 |
| find_pitch_and_roll | /cig/libsrc/libflea/flea_simulate_vehicles.c | 2.7.20.2 |
| FindField | /cig/libsrc/libutil/find_field.c | 2.16.3 |
| fire_round | /cig/libsrc/libflea/encode_routines.c | 2.7.4.2.5 |
| flagoff | /cig/libsrc/libvpt/flagoff.c | 2.17.7 |
| flea | /cig/libsrc/libflea/flea.c | 2.7.5.1 |
| flea_abs_playback | /cig/libsrc/libflea/flea_script.c | 2.7.19.1 |
| flea_agl_terrain_follow | /cig/libsrc/libflea/flea_agl_terrain_follow.c | 2.7.6 |
| flea_agpt_locations | /cig/libsrc/libflea/flea_agpt_locations.c | 2.7.7.1 |
| flea_agpt_locations_main_menu | /cig/libsrc/libflea/flea_agpt_locations.c | 2.7.7.2 |
| flea_agpt_switches | /cig/libsrc/libflea/flea_agpt_switches.c | 2.7.8.1 |
| flea_agpt_switches_main_menu | /cig/libsrc/libflea/flea_agpt_switches.c | 2.7.8.6 |
| flea_atp | /cig/libsrc/libflea/flea_atp.c | 2.7.9.1 |
| flea_atp_main_menu | /cig/libsrc/libflea/flea_atp.c | 2.7.9.2 |
| flea_bal_opts | /cig/libsrc/libflea/flea_bal_opts.c | 2.7.10.1 |
| flea_bal_opts_main_menu | /cig/libsrc/libflea/flea_bal_opts.c | 2.7.10.2 |
| flea_calibration_image | /cig/libsrc/libflea/flea_ppm_obj.c | 2.7.18.2 |
| flea_cleanup | /cig/libsrc/libflea/flea.c | 2.7.5.1.1 |
| flea_db_traverse | /cig/libsrc/libflea/flea_db_traverse.c | 2.7.11 |

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| flea_decode_data | /cig/libsrc/libflea/flea_decode_data.c | 2.7.12 |
| flea_demo | /cig/libsrc/libflea/flea_demo.c | 2.7.13 |
| flea_draw_2d | /cig/libsrc/libflea/flea_draw_2d.c | 2.7.14 |
| flea_dummy_getchar | /cig/libsrc/libflea/flea.c | 2.7.5.4 |
| flea_encode_data | /cig/libsrc/libflea/flea_encode_data.c | 2.7.15 |
| flea_error_print | /cig/libsrc/libflea/encode_routines.c | 2.7.4.22 |
| flea_getchar | /cig/libsrc/libflea/flea.c | 2.7.5.3 |
| flea_graphics_test | /cig/libsrc/libflea/flea_graphics_test.c | 2.7.16.1 |
| flea_graphics_test_main_menu | /cig/libsrc/libflea/flea_graphics_test.c | 2.7.16.2 |
| flea_host_if | | |
| flea_init_cig_sw | /cig/libsrc/libflea/flea_init_cig_sw.c | 2.7.17 |
| flea_initialized | /cig/libsrc/libflea/flea.c | 2.7.5.8 |
| flea_IO_mode | /cig/libsrc/libflea/flea.c | 2.7.5.5 |
| flea_IO_off | /cig/libsrc/libflea/flea.c | 2.7.5.7 |
| flea_IO_on | /cig/libsrc/libflea/flea.c | 2.7.5.6 |
| flea_io_task | /cig/libsrc/libflea/flea.c | 2.7.5.2 |
| flea_io_task_cleanup | /cig/libsrc/libflea/flea.c | 2.7.5.12 |
| flea_ppm_display_mode | /cig/libsrc/libflea/flea_ppm_obj.c | 2.7.18.3 |
| flea_ppm_display_offset | /cig/libsrc/libflea/flea_ppm_obj.c | 2.7.18.4 |
| flea_ppm_pixel_location | /cig/libsrc/libflea/flea_ppm_obj.c | 2.7.18.5 |
| flea_ppm_pixel_state | /cig/libsrc/libflea/flea_ppm_obj.c | 2.7.18.6 |
| flea_printf | /cig/libsrc/libflea/flea.c | 2.7.5.10 |
| flea_prompt | /cig/libsrc/libflea/tick.c | 2.7.26.3 |
| flea_simulate_vehicles | /cig/libsrc/libflea/flea_simulate_vehicles.c | 2.7.20.1 |
| flea_switches | /cig/libsrc/libflea/flea_switches.c | 2.7.21.1 |
| flea_switches_main_menu | /cig/libsrc/libflea/flea_switches.c | 2.7.21.2 |
| flea_update_pos | /cig/libsrc/libflea/flea_update_pos.c | 2.7.22 |
| flea_veh_control | /cig/libsrc/libflea/flea_veh_control.c | 2.7.23.1 |
| flea_veh_control_main_menu | /cig/libsrc/libflea/flea_veh_control.c | 2.7.23.2 |
| ftoh | /cig/libsrc/libgossip/dtp_emu.c | 2.9.4.6 |
| func_msg (config_database) | /cig/libsrc/librtu/config_database.c | 2.13.12.3 |
| func_msg (open_dbase) | /cig/libsrc/librtu/open_dbase.c | 2.13.36.2 |
| fxbvtofl | /cig/libsrc/librtu/fxbvtofl.c | 2.13.21.2 |
| fxbvtofl_020 | /cig/libsrc/librtu/fxbvtofl.c | 2.13.21.3 |
| fxbvtofl_dart | /cig/libsrc/librtu/fxbvtofl.c | 2.13.21.1 |
| generic_lm | /cig/libsrc/librtu/generic_lm.c | 2.13.22.2 |
| get_3d_lut_name | /cig/libsrc/libtoken/subsys_cfg_parse.c | 2.15.2.6 |
| get_binary_data | /cig/libsrc/libutil/sload.c | 2.16.5.5 |
| get_char | /cig/libsrc/libutil/sload.c | 2.16.5.6 |
| get_color_config_name | /cig/libsrc/libtoken/subsys_cfg_parse.c | 2.15.2.9 |
| get_current_token | /cig/libsrc/libtoken/lex.c | 2.15.1.8 |
| get_data_2d_name | /cig/libsrc/libtoken/subsys_cfg_parse.c | 2.15.2.7 |
| get_database_name | /cig/libsrc/libtoken/subsys_cfg_parse.c | 2.15.2.3 |
| get_ded_name | /cig/libsrc/libtoken/subsys_cfg_parse.c | 2.15.2.4 |
| get_dtp_bank | /cig/libsrc/librtu/sys_control.c | 2.13.46.6 |
| get_esifa_name | /cig/libsrc/libtoken/subsys_cfg_parse.c | 2.15.2.8 |
| get_final_lut_name | /cig/libsrc/libtoken/subsys_cfg_parse.c | 2.15.2.5 |
| get_lm | /cig/libsrc/libgossip/dtp_emu.c | 2.9.4.9 |
| get_msg_2d | /cig/libsrc/lib2d/cig_getm_2d.c | 2.2.4 |
| get_msg_2d (offline version) | /cig/libsrc/lib2d/u_getm_2d.c | 2.2.16 |
| get_next_message | /cig/libsrc/libflea/flea_script.c | 2.7.19.3 |
| get_next_packet | /cig/libsrc/libflea/flea_script.c | 2.7.19.2 |
| get_next_token | /cig/libsrc/libtoken/lex.c | 2.15.1.7 |
| get_number_value | /cig/libsrc/libtoken/lex.c | 2.15.1.9 |
| get_record | /cig/libsrc/libutil/sload.c | 2.16.5.2 |
| get_sio_write_data | /cig/libsrc/libflea/get_sio_data.c | 2.7.24 |
| get_string_value | /cig/libsrc/libtoken/lex.c | 2.15.1.10 |
| get_thing | /cig/libsrc/lib2d/get_thing.c | 2.2.8 |

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|------------------------------|--|------------|
| get_tx_lut_index | /cig/libsrc/librtt/get_tx_lut_index.c | 2.13.23 |
| get_vehicle_position | /cig/libsrc/libconfig/get_vehicle_position.c | 2.5.5 |
| getch | /cig/libsrc/libconfig/getch.c | 2.5.6 |
| GetFileName | /cig/libsrc/libutil/directory.c | 2.16.2.4 |
| getlmdp | /cig/libsrc/librtt/load_modules.c | 2.13.30.2 |
| getmatrix | /cig/libsrc/librtt/mkmtx_nt.c | 2.13.33.10 |
| getside | /cig/libsrc/librtt/load_modules.c | 2.13.30.3 |
| gos_120tx | /cig/libsrc/libgossip/gos_120tx.c | 2.9.5 |
| gos_bal_query | /cig/libsrc/libgossip/gos_bal_query.c | 2.9.6 |
| gos_cigsimio | /cig/libsrc/librtt/cigsimio_obj.c | 2.13.7.1 |
| gos_db_query | /cig/libsrc/libgossip/gos_db_query.c | 2.9.7.1 |
| gos_db_query_menu | /cig/libsrc/libgossip/gos_db_query.c | 2.9.7.3 |
| gos_display_db_info | /cig/libsrc/libgossip/gos_db_query.c | 2.9.7.2 |
| gos_dummy_getchar | /cig/libsrc/libgossip/gossip.c | 2.9.15.9 |
| gos_getchar | /cig/libsrc/libgossip/gossip.c | 2.9.15.8 |
| gos_IO_off | /cig/libsrc/libgossip/gossip.c | 2.9.15.11 |
| gos_IO_on | /cig/libsrc/libgossip/gossip.c | 2.9.15.10 |
| gos_locate | /cig/libsrc/libgossip/gos_locate.c | 2.9.8 |
| gos_main_menu | /cig/libsrc/libgossip/gossip.c | 2.9.15.7 |
| gos_memory | /cig/libsrc/libgossip/gos_memory.c | 2.9.9 |
| gos_model | /cig/libsrc/libgossip/gos_model.c | 2.9.10.1 |
| gos_mpv | /cig/libsrc/libgossip/gos_mpv.c | 2.9.11 |
| gos_mpvio | /cig/libsrc/libgossip/gos_mpvio.c | 2.9.12 |
| gos_polys | /cig/libsrc/libgossip/gos_polys.c | 2.9.13 |
| gos_ppm_query | /cig/libsrc/libbackend/ppm_obj.c | 2.3.10.5 |
| gos_ppm_query_menu | /cig/libsrc/libbackend/ppm_obj.c | 2.3.10.6 |
| gos_prompt | /cig/libsrc/libgossip/gossip.c | 2.9.15.6 |
| gos_single_step | /cig/libsrc/libgossip/gossip.c | 2.9.15.5 |
| gos_system | /cig/libsrc/libgossip/gos_system.c | 2.9.14 |
| gos_timing_printout | /cig/libsrc/libgossip/gossip.c | 2.9.15.3 |
| gossip | /cig/libsrc/libgossip/gossip.c | 2.9.15.1 |
| gossip_cleanup | /cig/libsrc/libgossip/gossip.c | 2.9.15.12 |
| gossip_tick | /cig/libsrc/libgossip/gossip.c | 2.9.15.2 |
| gsp_io | /cig/othersrc/force/gsp_io.c | 2.18.33 |
| gsp_ioctl_read | /cig/othersrc/force/force.asm | 2.18.31.4 |
| gsp_ioctl_write | /cig/othersrc/force/force.asm | 2.18.31.5 |
| gsp_read | /cig/othersrc/force/force.asm | 2.18.31.3 |
| gsp_reset | /cig/othersrc/force/force.asm | 2.18.31.6 |
| gsp_write | /cig/othersrc/force/force.asm | 2.18.31.2 |
| hexdisplay | /cig/libsrc/libgossip/dtp_emu.c | 2.9.4.5 |
| host_disable_all_debug_msgs | /cig/libsrc/libhost/host_if_debug.c | 2.10.4.3 |
| host_enable_all_debug_msgs | /cig/libsrc/libhost/host_if_debug.c | 2.10.4.2 |
| host_if_buffer_init | /cig/libsrc/librtt/global_init.c | 2.13.24.1 |
| host_if_debug | /cig/libsrc/libhost/host_if_debug.c | 2.10.4.13 |
| host_if_debug_init | /cig/libsrc/libhost/host_if_debug.c | 2.10.4.4 |
| host_if_debug_main_menu | /cig/libsrc/libhost/host_if_debug.c | 2.10.4.10 |
| host_if_debug_menu | /cig/libsrc/libhost/host_if_debug.c | 2.10.4.11 |
| host_if_debug_tick | /cig/libsrc/libhost/host_if_debug.c | 2.10.4.12 |
| host_if_disable_debug_msgs | /cig/libsrc/libhost/host_if_debug.c | 2.10.4.9 |
| host_if_display_enabled_msgs | /cig/libsrc/libhost/host_if_debug.c | 2.10.4.6 |
| host_if_enable_debug_msgs | /cig/libsrc/libhost/host_if_debug.c | 2.10.4.8 |
| host_init_packet_sizes | /cig/libsrc/librtt/global_init.c | 2.13.24.2 |
| host_list_msgs | /cig/libsrc/libhost/host_if_debug.c | 2.10.4.7 |
| htof | /cig/libsrc/libgossip/dtp_emu.c | 2.9.4.7 |
| hw_test | /cig/libsrc/librtt/hw_test.c | 2.13.26 |
| hxflt | /cig/libsrc/libgossip/dtp_emu.c | 2.9.4.4 |
| id_4x3mtx | /cig/libsrc/librtt/mkmtx_nt.c | 2.13.33.6 |
| id_matrix | /cig/libsrc/librtt/make_bbn.c | 2.13.32.6 |

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| init_dr11_interface | /cig/libsrc/libhost/host_dr11_if.c | 2.10.1.4 |
| init_dtp_stacks | /cig/libsrc/libgendtp/dtp_funcs.c | 2.8.2.4 |
| init_enet_interface | /cig/libsrc/libhost/host_enet_if.c | 2.10.2.5 |
| init_flea_interface | /cig/libsrc/libhost/host_flea_if.c | 2.10.3.4 |
| init_generic_lm | /cig/libsrc/librtu/generic_lm.c | 2.13.22.1 |
| init_mpv_interface | /cig/libsrc/libhost/host_mpv_if.c | 2.10.5.4 |
| init_ports | /cig/other/src/force/force.asm | 2.18.31.1 |
| init_print_msg_array | /cig/libsrc/libmsg/print_msg.c | 2.12.19.2 |
| init_scsi_interface | /cig/libsrc/libhost/host_scsi_if.c | 2.10.6.4 |
| init_simulation | /cig/libsrc/librtu/init_sim.c | 2.13.27 |
| init_socket_interface | /cig/libsrc/libhost/host_socket_if.c | 2.10.7.4 |
| init_stuff | /cig/libsrc/lib2d/init_stuff.c | 2.2.9 |
| init_subsys_parser | /cig/libsrc/libtoken/subsys_cfg_parse.c | 2.15.2.1 |
| initialize | /cig/libsrc/librtt/rtt_init.c | 2.13.42.2 |
| initialize_defaults | /cig/libsrc/librtt/rtt_init.c | 2.13.42.1 |
| linkup | /cig/libsrc/lib2d/cig_link_2d.c | 2.2.5 |
| linkup (offline version) | /cig/libsrc/lib2d/u_link_2d.c | 2.2.17 |
| load_dbase | /cig/libsrc/librtt/load_dbase.c | 2.13.28 |
| load_esifa | /cig/libsrc/librtt/load_esifa.c | 2.13.29 |
| load_modules | /cig/libsrc/librtt/load_modules.c | 2.13.30.1 |
| loc_ter_msg | /cig/libsrc/libmsg/loc_ter_msg.c | 2.12.1 |
| local_terrain | /cig/libsrc/librtt/loc_ter.c | 2.13.31.1 |
| local_terrain_cleanup | /cig/libsrc/librtt/loc_ter.c | 2.13.31.2 |
| lt_state | /cig/libsrc/libmsg/msg_lt_state.c | 2.12.9 |
| m1_gun_overlay | /cig/libsrc/librtt/gun_overlays.c | 2.13.25.1 |
| m2_gun_overlay | /cig/libsrc/librtt/gun_overlays.c | 2.13.25.2 |
| main (ballistics) | /cig/gtbinsrc/bx147_main.c | 2.1.1.1 |
| main (force) | /cig/other/src/force/forcetask.c | 2.18.32.1 |
| main (rtt) | /cig/gtbinsrc/rtt/rtt.c | 2.1.3.1 |
| main (2-D compiler) | /cig/libsrc/lib2d/u_main_2d.c | 2.2.18 |
| make4x3 | /cig/libsrc/librtt/mkmtx_nt.c | 2.13.33.21 |
| make_bbn_logo | /cig/libsrc/libgossip/make_bbn_logo.c | 2.9.16 |
| make_cal_matrices | /cig/gtbinsrc/rtt/mkcal.c | 2.1.2.2 |
| make_cal_overlay | /cig/gtbinsrc/rtt/mkcal.c | 2.1.2.1 |
| make_cal_patterns | /cig/gtbinsrc/rtt/mkcal.c | 2.1.2.3 |
| make_m1_overlays | /cig/libsrc/librtt/gun_overlays.c | 2.13.25.3 |
| make_m2_overlays | /cig/libsrc/librtt/gun_overlays.c | 2.13.25.4 |
| make_p_nt | /cig/libsrc/librtt/mkmtx_nt.c | 2.13.33.1 |
| mat_adjugate | /cig/libsrc/librtt/mkmtx_nt.c | 2.13.33.15 |
| mat_copy | /cig/libsrc/librtt/mkmtx_nt.c | 2.13.33.13 |
| mat_determinant | /cig/libsrc/librtt/mkmtx_nt.c | 2.13.33.18 |
| mat_inverse | /cig/libsrc/librtt/mkmtx_nt.c | 2.13.33.19 |
| mat_mult | /cig/libsrc/libgossip/dtp_emu.c | 2.9.4.8 |
| mat_scale | /cig/libsrc/librtt/mkmtx_nt.c | 2.13.33.17 |
| mat_transpose | /cig/libsrc/librtt/mkmtx_nt.c | 2.13.33.16 |
| mat_vec_mul | /cig/libsrc/librtt/mkmtx_nt.c | 2.13.33.14 |
| matrix2 | /cig/libsrc/librtt/mkmtx_nt.c | 2.13.33.11 |
| mem_check | /cig/libsrc/libvpt/tst_tree.c | 2.17.22.2 |
| menu_header | /cig/libsrc/libflea/tick.c | 2.7.26.5 |
| model_demo | /cig/libsrc/libflea/model_demo.c | 2.7.25 |
| model_mtx | /cig/libsrc/librtt/model_mtx.c | 2.13.34 |
| mpvideo_boot | /cig/libsrc/libmpvideo/bootmpv.c | 2.11.2.1 |
| mpvideo_define_mode | /cig/libsrc/libmpvideo/mpvideo_mode.c | 2.11.7.2 |
| mpvideo_get_object_addr | /cig/libsrc/libmpvideo/mpvideo_man.c | 2.11.6.6 |
| mpvideo_laser_request_range | /cig/libsrc/libmpvideo/mpvideo_laser.c | 2.11.4 |
| mpvideo_load | /cig/libsrc/libmpvideo/loadmpv.c | 2.11.3 |
| mpvideo_num_paths | /cig/libsrc/libmpvideo/mpvideo_query.c | 2.11.11 |
| mpvideo_pass_back | /cig/libsrc/libmpvideo/mpvideo_pass_back.c | 2.11.8 |

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| mpvideo_pass_on | /cig/libsrc/libmpvideo/mpvideo_pass_on.c | 2.11.9 |
| mpvideo_response | /cig/libsrc/libmpvideo/mpvideo_response.c | 2.11.12 |
| mpvideo_send_req | /cig/libsrc/libmpvideo/mpvideo_man.c | 2.11.6.5 |
| mpvideo_set_lut | /cig/libsrc/libmpvideo/mpvideo_lut.c | 2.11.5 |
| mpvideo_set_mode | /cig/libsrc/libmpvideo/mpvideo_mode.c | 2.11.7.1 |
| mpvideo_set_video | /cig/libsrc/libmpvideo/mpvideo_man.c | 2.11.6.1 |
| mpvideo_setup | /cig/libsrc/libmpvideo/mpvideo_man.c | 2.11.6.2 |
| mpvideo_sim_init | /cig/libsrc/libmpvideo/mpvideo_man.c | 2.11.6.4 |
| mpvideo_stop | /cig/libsrc/libmpvideo/mpvideo_man.c | 2.11.6.3 |
| mpvmsg_from_buf_addr | /cig/libsrc/libmpvideo/bootforce.c | 2.11.1.7 |
| mpvmsg_query_buf_addr | /cig/libsrc/libmpvideo/bootforce.c | 2.11.1.4 |
| mpvmsg_reply_buf_addr | /cig/libsrc/libmpvideo/bootforce.c | 2.11.1.5 |
| mpvmsg_to_buf_addr | /cig/libsrc/libmpvideo/bootforce.c | 2.11.1.6 |
| msg_1rotation | /cig/libsrc/libmsg/msg_vport.c | 2.12.18.8 |
| msg_3rotations | /cig/libsrc/libmsg/msg_vport.c | 2.12.18.9 |
| msg_calibration_image | /cig/libsrc/libmsg/msg_calibration_image.c | 2.12.2 |
| msg_cig_ctl | /cig/libsrc/libmsg/msg_cig_ctl.c | 2.12.3 |
| msg_dr11_pkt_size | /cig/libsrc/libmsg/msg_dr11.c | 2.12.4 |
| msg_end | /cig/libsrc/libmsg/msg_end.c | 2.12.6.1 |
| msg_hprxyzs_matrix | /cig/libsrc/libmsg/msg_vport.c | 2.12.18.5 |
| msg_laser_request_range | /cig/libsrc/libmsg/msg_laser.c | 2.12.7 |
| msg_laser_return | /cig/libsrc/libmsg/msg_laser_return.c | 2.12.8 |
| msg_otherveh_state | /cig/libsrc/libmsg/msg_veh_state.c | 2.12.16.1 |
| msg_pass_back | /cig/libsrc/libmsg/msg_pass_back.c | 2.12.10 |
| msg_pass_on | /cig/libsrc/libmsg/msg_pass_on.c | 2.12.11 |
| msg_ppm_display_mode | /cig/libsrc/libmsg/msg_ppm.c | 2.12.12.1 |
| msg_ppm_display_offset | /cig/libsrc/libmsg/msg_ppm.c | 2.12.12.2 |
| msg_ppm_pixel_location | /cig/libsrc/libmsg/msg_ppm.c | 2.12.12.3 |
| msg_ppm_pixel_state | /cig/libsrc/libmsg/msg_ppm.c | 2.12.12.4 |
| msg_process_round48 | /cig/libsrc/libmsg/msg_process_round48.c | 2.12.13 |
| msg_rot2x1_matrix | /cig/libsrc/libmsg/msg_vport.c | 2.12.18.3 |
| msg_rts4x3_matrix | /cig/libsrc/libmsg/msg_vport.c | 2.12.18.4 |
| msg_scale | /cig/libsrc/libmsg/msg_vport.c | 2.12.18.7 |
| msg_shell_sort | /cig/libsrc/libhost/host_if_debug.c | 2.10.4.1 |
| msg_show_effect | /cig/libsrc/libmsg/msg_effect.c | 2.12.5 |
| msg_staticveh_rem | /cig/libsrc/libmsg/msg_veh_state.c | 2.12.16.3 |
| msg_staticveh_state | /cig/libsrc/libmsg/msg_veh_state.c | 2.12.16.2 |
| msg_subsys_mode | /cig/libsrc/libmsg/msg_subsys_mode.c | 2.12.14 |
| msg_syserr | /cig/libsrc/libmsg/msg_syserr.c | 2.12.15 |
| msg_translation | /cig/libsrc/libmsg/msg_vport.c | 2.12.18.6 |
| msg_view_flags | /cig/libsrc/libmsg/msg_vflags.c | 2.12.17 |
| msg_view_magnification | /cig/libsrc/libmsg/msg_vport.c | 2.12.18.2 |
| msg_viewport_update | /cig/libsrc/libmsg/msg_vport.c | 2.12.18.1 |
| mtx_non_perspective | /cig/libsrc/libvpt/mtx_viewspace.c | 2.17.13.1 |
| mtx_perspective | /cig/libsrc/libvpt/mtx_viewspace.c | 2.17.13.2 |
| mtxcpy | /cig/libsrc/librtt/mkmtx_nt.c | 2.13.33.12 |
| mult_4x3mtx | /cig/libsrc/librtt/mkmtx_nt.c | 2.13.33.9 |
| multmatrix | /cig/libsrc/librtt/make_bbn.c | 2.13.32.5 |
| mx2_error (force) | /cig/other/src/force/mx2_hword.c | 2.13.34.5 |
| mx2_error (rtsw) | /cig/libsrc/librtt/mx2_hword.c | 2.13.35.5 |
| mx2_hwcopy (force) | /cig/other/src/force/mx2_hword.c | 2.13.34.6 |
| mx2_hwcopy (rtsw) | /cig/libsrc/librtt/mx2_hword.c | 2.13.35.6 |
| mx2_open (force) | /cig/other/src/force/mx2_hword.c | 2.13.34.1 |
| mx2_open (rtsw) | /cig/libsrc/librtt/mx2_hword.c | 2.13.35.1 |
| mx2_peek (force) | /cig/other/src/force/mx2_hword.c | 2.13.34.3 |
| mx2_peek (rtsw) | /cig/libsrc/librtt/mx2_hword.c | 2.13.35.3 |
| mx2_push (force) | /cig/other/src/force/mx2_hword.c | 2.13.34.2 |
| mx2_push (rtsw) | /cig/libsrc/librtt/mx2_hword.c | 2.13.35.2 |

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| mx2_skip (force) | /cig/othersrc/force/mx2_hword.c | 2.13.34.4 |
| mx2_skip (rtsw) | /cig/libsrc/librt/mx2_hword.c | 2.13.35.4 |
| mx3_error | /cig/libsrc/libgossip/mx3_hword.c | 2.9.17.5 |
| mx3_hwcopy | /cig/libsrc/libgossip/mx3_hword.c | 2.9.17.6 |
| mx3_open | /cig/libsrc/libgossip/mx3_hword.c | 2.9.17.1 |
| mx3_peek | /cig/libsrc/libgossip/mx3_hword.c | 2.9.17.3 |
| mx3_push | /cig/libsrc/libgossip/mx3_hword.c | 2.9.17.2 |
| mx3_skip | /cig/libsrc/libgossip/mx3_hword.c | 2.9.17.4 |
| mx_error | /cig/libsrc/libball/mx_error.c | 2.4.4.1 |
| mx_open | /cig/libsrc/libball/mx_open.c | 2.4.4.2 |
| mx_peek | /cig/libsrc/libball/mx_peek.c | 2.4.4.3 |
| mx_push | /cig/libsrc/libball/mx_push.c | 2.4.4.4 |
| mx_skip | /cig/libsrc/libball/mx_skip.c | 2.4.4.5 |
| mx_wcopy | /cig/libsrc/libball/mx_wcopy.c | 2.4.4.6 |
| new_pos_orient | /cig/libsrc/libflea/flea_agpt_locations.c | 2.7.7.3 |
| next_char | /cig/libsrc/libtoken/lex.c | 2.15.1.2 |
| next_line | /cig/libsrc/libtoken/lex.c | 2.15.1.5 |
| next_token | /cig/libsrc/libtoken/lex.c | 2.15.1.4 |
| nmi_type | /cig/othersrc/force/nmi_type.c | 2.13.35 |
| old_mtx_perspective | /cig/libsrc/libvpt/mtx_viewspace.c | 2.17.13.3 |
| open_dbase | /cig/libsrc/librt/open_dbase.c | 2.13.36.1 |
| open_aed | /cig/libsrc/librt/open_ded.c | 2.13.37 |
| open_dr11_interface | /cig/libsrc/libhost/host_dr11_if.c | 2.10.1.1 |
| open_enet_interface | /cig/libsrc/libhost/host_enet_if.c | 2.10.2.1 |
| open_flea_interface | /cig/libsrc/libhost/host_flea_if.c | 2.10.3.1 |
| open_mpv_interface | /cig/libsrc/libhost/host_mpv_if.c | 2.10.5.1 |
| open_scsi_interface | /cig/libsrc/libhost/host_scsi_if.c | 2.10.6.1 |
| open_socket_interface | /cig/libsrc/libhost/host_socket_if.c | 2.10.7.1 |
| OpenDir | /cig/libsrc/libutil/directory.c | 2.16.2.1 |
| otherveh_state | /cig/libsrc/librt/otherveh_state.c | 2.13.38 |
| outhere | /cig/libsrc/libgossip/replace_mod.c | 2.9.18.6 |
| outdisplay | /cig/libsrc/libgossip/dtp_emu.c | 2.9.4.3 |
| overlay_setup | /cig/libsrc/libconfig/overlay_setup.c | 2.5.7 |
| p_configtree_node | /cig/libsrc/libvpt/tst_ereadconfig.c | 2.17.20.2 |
| p_overlay_setup | /cig/libsrc/libvpt/tst_ereadconfig.c | 2.17.20.4 |
| p_terrain_feedback | /cig/libsrc/libvpt/tst_ereadconfig.c | 2.17.20.6 |
| p_viewport_state | /cig/libsrc/libvpt/tst_ereadconfig.c | 2.17.20.3 |
| parse_subsys_file | /cig/libsrc/libtoken/subsys_cfg_parse.c | 2.15.2.2 |
| pix_mult | /cig/gtbinsrc/rt/mkcal.c | 2.1.2.4 |
| poll_ready | /cig/othersrc/force/poll_ready.c | 2.13.36 |
| poll_shutdown (ballistics) | /cig/gtbinsrc/bx147_main.c | 2.1.1.2 |
| poll_shutdown (rt) | /cig/gtbinsrc/rt/rt.c | 2.1.3.5 |
| pool_get_off_24 | /cig/libsrc/librt/ded_gm_pool.c | 2.13.15.2 |
| pool_init | /cig/libsrc/librt/ded_gm_pool.c | 2.13.15.1 |
| pop_node | /cig/libsrc/libgendtp/dtp_funcs.c | 2.8.2.2 |
| power | /cig/libsrc/libconfig/fill_tree.c | 2.5.4.2 |
| ppm_get_data | /cig/libsrc/libbackend/ppm_obj.c | 2.3.10.3 |
| ppm_init | /cig/libsrc/libbackend/ppm_obj.c | 2.3.10.2 |
| ppm_load | /cig/libsrc/libbackend/ppm_obj.c | 2.3.10.4 |
| ppm_setup | /cig/libsrc/libbackend/ppm_obj.c | 2.3.10.1 |
| pr_branch | /cig/libsrc/libvpt/tst_treetrace.c | 2.17.23.2 |
| pr_matrix | /cig/libsrc/libvpt/tst_treetrace.c | 2.17.23.3 |
| pretend_veh | /cig/libsrc/librt/pretend_veh.c | 2.13.39 |
| print_msg_1rotation | /cig/libsrc/libmsg/print_msg.c | 2.12.19.1 |
| print_msg_2d_setup | /cig/libsrc/libmsg/print_msg.c | 2.12.19.1 |
| print_msg_3rotations | /cig/libsrc/libmsg/print_msg.c | 2.12.19.1 |
| print_msg_add_traj_table | /cig/libsrc/libmsg/print_msg.c | 2.12.19.1 |
| print_msg_agl | /cig/libsrc/libmsg/print_msg.c | 2.12.19.1 |

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|-------------------------------|--------------------------------|-----------|
| print_msg_agl_setup | /cig/libsrc/libmsg/print_msg.c | 2.12.19.1 |
| print_msg_ammo_define | /cig/libsrc/libmsg/print_msg.c | 2.12.19.1 |
| print_msg_calibration_image | /cig/libsrc/libmsg/print_msg.c | 2.12.19.1 |
| print_msg_cancel_round | /cig/libsrc/libmsg/print_msg.c | 2.12.19.1 |
| print_msg_cig_ctl | /cig/libsrc/libmsg/print_msg.c | 2.12.19.1 |
| print_msg_cloud_state | /cig/libsrc/libmsg/print_msg.c | 2.12.19.1 |
| print_msg_create_confignode | /cig/libsrc/libmsg/print_msg.c | 2.12.19.1 |
| print_msg_default | /cig/libsrc/libmsg/print_msg.c | 2.12.19.1 |
| print_msg_define_tx_mode | /cig/libsrc/libmsg/print_msg.c | 2.12.19.1 |
| print_msg_delete_traj_table | /cig/libsrc/libmsg/print_msg.c | 2.12.19.1 |
| print_msg_dr11_pkt_size | /cig/libsrc/libmsg/print_msg.c | 2.12.19.1 |
| print_msg_end | /cig/libsrc/libmsg/print_msg.c | 2.12.19.1 |
| print_msg_file_descr | /cig/libsrc/libmsg/print_msg.c | 2.12.19.1 |
| print_msg_file_status | /cig/libsrc/libmsg/print_msg.c | 2.12.19.1 |
| print_msg_file_xfer | /cig/libsrc/libmsg/print_msg.c | 2.12.19.1 |
| print_msg_gun_overlay | /cig/libsrc/libmsg/print_msg.c | 2.12.19.1 |
| print_msg_hit_return | /cig/libsrc/libmsg/print_msg.c | 2.12.19.1 |
| print_msg_hit_return48 | /cig/libsrc/libmsg/print_msg.c | 2.12.19.1 |
| print_msg_hprxyzs_matrix | /cig/libsrc/libmsg/print_msg.c | 2.12.19.1 |
| print_msg_laser_return | /cig/libsrc/libmsg/print_msg.c | 2.12.19.1 |
| print_msg_local_terrain | /cig/libsrc/libmsg/print_msg.c | 2.12.19.1 |
| print_msg_lt_piece | /cig/libsrc/libmsg/print_msg.c | 2.12.19.1 |
| print_msg_lt_state | /cig/libsrc/libmsg/print_msg.c | 2.12.19.1 |
| print_msg_miss | /cig/libsrc/libmsg/print_msg.c | 2.12.19.1 |
| print_msg_obscure | /cig/libsrc/libmsg/print_msg.c | 2.12.19.1 |
| print_msg_otherveh_state | /cig/libsrc/libmsg/print_msg.c | 2.12.19.1 |
| print_msg_overlay_setup | /cig/libsrc/libmsg/print_msg.c | 2.12.19.1 |
| print_msg_pass_back | /cig/libsrc/libmsg/print_msg.c | 2.12.19.1 |
| print_msg_pass_on | /cig/libsrc/libmsg/print_msg.c | 2.12.19.1 |
| print_msg_ppm_display_mode | /cig/libsrc/libmsg/print_msg.c | 2.12.19.1 |
| print_msg_ppm_display_offset | /cig/libsrc/libmsg/print_msg.c | 2.12.19.1 |
| print_msg_ppm_pixel_location | /cig/libsrc/libmsg/print_msg.c | 2.12.19.1 |
| print_msg_ppm_pixel_state | /cig/libsrc/libmsg/print_msg.c | 2.12.19.1 |
| print_msg_process_chord | /cig/libsrc/libmsg/print_msg.c | 2.12.19.1 |
| print_msg_process_round | /cig/libsrc/libmsg/print_msg.c | 2.12.19.1 |
| print_msg_process_round48 | /cig/libsrc/libmsg/print_msg.c | 2.12.19.1 |
| print_msg_request_laser_range | /cig/libsrc/libmsg/print_msg.c | 2.12.19.1 |
| print_msg_request_point_info | /cig/libsrc/libmsg/print_msg.c | 2.12.19.1 |
| print_msg_return_point_info | /cig/libsrc/libmsg/print_msg.c | 2.12.19.1 |
| print_msg_rot2x1_matrix | /cig/libsrc/libmsg/print_msg.c | 2.12.19.1 |
| print_msg_round_fired | /cig/libsrc/libmsg/print_msg.c | 2.12.19.1 |
| print_msg_rts4x3_matrix | /cig/libsrc/libmsg/print_msg.c | 2.12.19.1 |
| print_msg_scale | /cig/libsrc/libmsg/print_msg.c | 2.12.19.1 |
| print_msg_shot_report | /cig/libsrc/libmsg/print_msg.c | 2.12.19.1 |
| print_msg_shot_report48 | /cig/libsrc/libmsg/print_msg.c | 2.12.19.1 |
| print_msg_show_effect | /cig/libsrc/libmsg/print_msg.c | 2.12.19.1 |
| print_msg_sio_close | /cig/libsrc/libmsg/print_msg.c | 2.12.19.1 |
| print_msg_sio_init | /cig/libsrc/libmsg/print_msg.c | 2.12.19.1 |
| print_msg_sio_write | /cig/libsrc/libmsg/print_msg.c | 2.12.19.1 |
| print_msg_staticveh_rem | /cig/libsrc/libmsg/print_msg.c | 2.12.19.1 |
| print_msg_staticveh_state | /cig/libsrc/libmsg/print_msg.c | 2.12.19.1 |
| print_msg_subsys_mode | /cig/libsrc/libmsg/print_msg.c | 2.12.19.1 |
| print_msg_sys_error | /cig/libsrc/libmsg/print_msg.c | 2.12.19.1 |
| print_msg_test_name | /cig/libsrc/libmsg/print_msg.c | 2.12.19.1 |
| print_msg_tf_hdr | /cig/libsrc/libmsg/print_msg.c | 2.12.19.1 |
| print_msg_tf_init_hdr | /cig/libsrc/libmsg/print_msg.c | 2.12.19.1 |
| print_msg_tf_init_pt | /cig/libsrc/libmsg/print_msg.c | 2.12.19.1 |
| print_msg_tf_pt | /cig/libsrc/libmsg/print_msg.c | 2.12.19.1 |

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|------------------------------|--|-----------|
| print_msg_tf_pt48 | /cig/libsrc/libmsg/print_msg.c | 2.12.19.1 |
| print_msg_tf_state | /cig/libsrc/libmsg/print_msg.c | 2.12.19.1 |
| print_msg_tf_vehicle_pos | /cig/libsrc/libmsg/print_msg.c | 2.12.19.1 |
| print_msg_traj_chord | /cig/libsrc/libmsg/print_msg.c | 2.12.19.1 |
| print_msg_traj_entry | /cig/libsrc/libmsg/print_msg.c | 2.12.19.1 |
| print_msg_traj_entry_xfer | /cig/libsrc/libmsg/print_msg.c | 2.12.19.1 |
| print_msg_traj_table_xfer | /cig/libsrc/libmsg/print_msg.c | 2.12.19.1 |
| print_msg_translation | /cig/libsrc/libmsg/print_msg.c | 2.12.19.1 |
| print_msg_view_flags | /cig/libsrc/libmsg/print_msg.c | 2.12.19.1 |
| print_msg_view_magnification | /cig/libsrc/libmsg/print_msg.c | 2.12.19.1 |
| print_msg_viewport_state | /cig/libsrc/libmsg/print_msg.c | 2.12.19.1 |
| print_msg_viewport_update | /cig/libsrc/libmsg/print_msg.c | 2.12.19.1 |
| print_pdbase | /cig/libsrc/librtt/config_database.c | 2.13.12.4 |
| process_2d_setup | /cig/libsrc/libflea/cf_translator.c | 2.7.2.14 |
| process_a_msg | /cig/libsrc/librtt/simulation.c | 2.13.43.2 |
| process_add_traj_table | /cig/libsrc/libflea/cf_translator.c | 2.7.2.12 |
| process_agl_setup | /cig/libsrc/libflea/cf_translator.c | 2.7.2.10 |
| process_ammunition_define | /cig/libsrc/libflea/cf_translator.c | 2.7.2.19 |
| process_chord | /cig/libsrc/libflea/encode_routines.c | 2.7.4.26 |
| process_cig_ctl | /cig/libsrc/libflea/cf_translator.c | 2.7.2.2 |
| process_command | /cig/libsrc/lib2d/proc_cmd.c | 2.2.12 |
| process_configtree_node | /cig/libsrc/libflea/cf_translator.c | 2.7.2.4 |
| process_define_tx_mode | /cig/libsrc/libflea/cf_translator.c | 2.7.2.6 |
| process_dr11_pkt_size | /cig/libsrc/libflea/cf_translator.c | 2.7.2.16 |
| process_file_description | /cig/libsrc/libflea/cf_translator.c | 2.7.2.3 |
| process_lt_state | /cig/libsrc/libflea/cf_translator.c | 2.7.2.15 |
| process_overlay_setup | /cig/libsrc/libflea/cf_translator.c | 2.7.2.7 |
| process_ppm_display_mode | /cig/libsrc/libflea/cf_translator.c | 2.7.2.20 |
| process_ppm_display_offset | /cig/libsrc/libflea/cf_translator.c | 2.7.2.21 |
| process_ppm_pixel_location | /cig/libsrc/libflea/cf_translator.c | 2.7.2.22 |
| process_ppm_pixel_state | /cig/libsrc/libflea/cf_translator.c | 2.7.2.23 |
| process_round | /cig/libsrc/libflea/encode_routines.c | 2.7.4.27 |
| process_sio_close | /cig/libsrc/libflea/cf_translator.c | 2.7.2.17 |
| process_sio_init | /cig/libsrc/libflea/cf_translator.c | 2.7.2.11 |
| process_tf_init_hdr | /cig/libsrc/libflea/cf_translator.c | 2.7.2.8 |
| process_tf_init_pt | /cig/libsrc/libflea/cf_translator.c | 2.7.2.9 |
| process_tf_state | /cig/libsrc/libflea/cf_translator.c | 2.7.2.18 |
| process_traj_entry | /cig/libsrc/libflea/cf_translator.c | 2.7.2.13 |
| process_vflags | /cig/libsrc/libconfig/process_vflags.c | 2.5.8 |
| process_viewport_state | /cig/libsrc/libflea/cf_translator.c | 2.7.2.5 |
| process_vppos | /cig/libsrc/libconfig/process_vppos.c | 2.5.9 |
| prt_mtx | /cig/libsrc/librtu/make_bbn.c | 2.13.32.1 |
| prtackerr | /cig/libsrc/libmpvideo/bootmpv.c | 2.11.2.3 |
| prtmngerr | /cig/libsrc/libmpvideo/bootmpv.c | 2.11.2.2 |
| prtstaterr | /cig/libsrc/libmpvideo/bootmpv.c | 2.11.2.4 |
| push_node | /cig/libsrc/libgendtp/dtp_funcs.c | 2.8.2.1 |
| put_in_hdr | /cig/libsrc/libflea/encode_routines.c | 2.7.4.23 |
| r4mat_dump | /cig/libsrc/libvpt/mtx_dump.c | 2.17.12.1 |
| r8mat_dump | /cig/libsrc/libvpt/mtx_dump.c | 2.17.12.2 |
| rcl_command | /cig/libsrc/libgendtp/rcfuncs.c | 2.8.5.11 |
| rcl_component | /cig/libsrc/libgendtp/rcfuncs.c | 2.8.5.12 |
| rcl_data | /cig/libsrc/libgendtp/rcfuncs.c | 2.8.5.13 |
| rcl_init_adrs | /cig/libsrc/libgendtp/rcfuncs.c | 2.8.5.6 |
| rcl_init_stack | /cig/libsrc/libgendtp/rcfuncs.c | 2.8.5.1 |
| rcl_lblcmd | /cig/libsrc/libgendtp/rcfuncs.c | 2.8.5.10 |
| rcl_patch_adrs | /cig/libsrc/libgendtp/rcfuncs.c | 2.8.5.4 |
| rcl_pop | /cig/libsrc/libgendtp/rcfuncs.c | 2.8.5.3 |
| rcl_push | /cig/libsrc/libgendtp/rcfuncs.c | 2.8.5.2 |

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|-----------------------|--|-----------|
| rcl_rtn_adrs | /cig/libsrc/libgendtp/rcfuncs.c | 2.8.5.7 |
| rcl_set_cntlbl | /cig/libsrc/libgendtp/rcfuncs.c | 2.8.5.9 |
| rcl_set_errptr | /cig/libsrc/libgendtp/rcfuncs.c | 2.8.5.5 |
| rcl_set_label | /cig/libsrc/libgendtp/rcfuncs.c | 2.8.5.8 |
| rcl_set_modloc | /cig/libsrc/libgossip/gos_model.c | 2.9.10.2 |
| rcl_stuff_data | /cig/libsrc/libgendtp/rcfuncs.c | 2.8.5.14 |
| read_a_keyword | /cig/libsrc/libflea/cf_translator.c | 2.7.2.24 |
| read_evc_control | /cig/libsrc/librtu/sys_control.c | 2.13.46.7 |
| ReadDir | /cig/libsrc/libutil/directory.c | 2.16.2.2 |
| red_clock | /cig/othersrc/force/forcetask.c | 2.18.32.4 |
| remove_comment_lines | /cig/libsrc/libflea/cf_translator.c | 2.7.2.26 |
| remove_white_space | /cig/libsrc/libflea/cf_translator.c | 2.7.2.25 |
| replace_mod | /cig/libsrc/libgossip/replace_mod.c | 2.9.18.1 |
| restart_clock | /cig/othersrc/force/forcetask.c | 2.18.32.3 |
| restore_cur | /cig/libsrc/libutil/vt100.c | 2.16.7.8 |
| return_aam_ptr | /cig/libsrc/libconfig/aam_manager.c | 2.5.1.2 |
| rnd | /cig/libsrc/librtu/clouds.c | 2.13.9.8 |
| rotate_x | /cig/libsrc/librtu/make_bbn.c | 2.13.32.2 |
| rotate_x_nt | /cig/libsrc/librtu/mkmtx_nt.c | 2.13.33.2 |
| rotate_y | /cig/libsrc/librtu/make_bbn.c | 2.13.32.3 |
| rotate_y_nt | /cig/libsrc/librtu/mkmtx_nt.c | 2.13.33.3 |
| rotate_z | /cig/libsrc/librtu/make_bbn.c | 2.13.32.4 |
| rotate_z_nt | /cig/libsrc/librtu/mkmtx_nt.c | 2.13.33.4 |
| rowcol_rd_1 | /cig/libsrc/librtu/rowcol_rd.c | 2.13.40.1 |
| rowcol_rd_1_cleanup | /cig/libsrc/librtu/rowcol_rd.c | 2.13.40.6 |
| rowcol_rd_2 | /cig/libsrc/librtu/rowcol_rd.c | 2.13.40.2 |
| rowcol_rd_2_cleanup | /cig/libsrc/librtu/rowcol_rd.c | 2.13.40.7 |
| rowcol_rd_3 | /cig/libsrc/librtu/rowcol_rd.c | 2.13.40.3 |
| rowcol_rd_3_cleanup | /cig/libsrc/librtu/rowcol_rd.c | 2.13.40.8 |
| rowcol_rd_4 | /cig/libsrc/librtu/rowcol_rd.c | 2.13.40.4 |
| rowcol_rd_4_cleanup | /cig/libsrc/librtu/rowcol_rd.c | 2.13.40.9 |
| rt_accept | /cig/libsrc/librtu/rt_mailbox.c | 2.13.41.3 |
| rt_pend | /cig/libsrc/librtu/rt_mailbox.c | 2.13.41.1 |
| rt_post | /cig/libsrc/librtu/rt_mailbox.c | 2.13.41.2 |
| rtn_entry_pt | /cig/libsrc/libmpvideo/bootforce.c | 2.11.1.3 |
| rtu_shutdown | /cig/gtbinsrc/rtu/ru.c | 2.1.3.4 |
| s_step | /cig/libsrc/libgossip/gossip.c | 2.9.15.4 |
| save_cur | /cig/libsrc/libutil/vt100.c | 2.16.7.7 |
| scale_mtx | /cig/libsrc/librtu/mkmtx_nt.c | 2.13.33.7 |
| scan_number | /cig/libsrc/libtoken/lex.c | 2.15.1.3 |
| scratch_flea | /cig/libsrc/libflea/flea.c | 2.7.5.9 |
| scroll_reg | /cig/libsrc/libutil/vt100.c | 2.16.7.9 |
| se_clock | /cig/othersrc/force/forcetask.c | 2.18.32.5 |
| send_ammo_define | /cig/libsrc/libflea/encode_routines.c | 2.7.4.32 |
| send_data | /cig/libsrc/libutil/sload.c | 2.16.5.3 |
| send_gun_overlay | /cig/libsrc/libflea/encode_routines.c | 2.7.4.31 |
| set_3d_lut_name | /cig/libsrc/libtoken/subsys_cfg_parse.c | 2.15.2.13 |
| set_color_config_name | /cig/libsrc/libtoken/subsys_cfg_parse.c | 2.15.2.15 |
| set_command_2d | /cig/libsrc/libflea/flea_agpt_switches.c | 2.7.8.2 |
| set_data_2d_name | /cig/libsrc/libtoken/subsys_cfg_parse.c | 2.15.2.14 |
| set_database_name | /cig/libsrc/libtoken/subsys_cfg_parse.c | 2.15.2.10 |
| set_ded_name | /cig/libsrc/libtoken/subsys_cfg_parse.c | 2.15.2.11 |
| set_entry_pt | /cig/libsrc/libmpvideo/bootforce.c | 2.11.1.2 |
| set_esifa_name | /cig/libsrc/libtoken/subsys_cfg_parse.c | 2.15.2.15 |
| set_final_lut_name | /cig/libsrc/libtoken/subsys_cfg_parse.c | 2.15.2.12 |
| set_leds | /cig/libsrc/librtu/sys_control.c | 2.13.46.3 |
| set_lut | /cig/libsrc/librtu/clouds.c | 2.13.9.7 |
| set_token_file | /cig/libsrc/libtoken/lex.c | 2.15.1.1 |

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| setup_bit_blt | /cig/libsrc/lib2d/bit_blt.c | 2.2.1 |
| setup_comp_start | /cig/libsrc/lib2d/comp.c | 2.2.6 |
| setup_define_string | /cig/libsrc/lib2d/string.c | 2.2.13 |
| setup_define_window | /cig/libsrc/lib2d/window.c | 2.2.19 |
| setup_draw_line | /cig/libsrc/lib2d/draw_line.c | 2.2.7 |
| setup_oval_rectangle | /cig/libsrc/lib2d/oval_rect.c | 2.2.10 |
| setup_p_terrain_feedback | /cig/libsrc/libvpt/tst_ereadconfig.c | 2.17.20.5 |
| setup_poly | /cig/libsrc/lib2d/poly.c | 2.2.11 |
| setup_text | /cig/libsrc/lib2d/text.c | 2.2.14 |
| sgr | /cig/libsrc/libutil/vt100.c | 2.16.7.2 |
| shot_report | /cig/libsrc/libball/shot_report.c | 2.4.3.12 |
| show_effect_msg | /cig/libsrc/libmsg/show_effect_msg.c | 2.12.20 |
| sim_bal_agl_wanted | /cig/libsrc/librt/bal_routines.c | 2.13.4.5 |
| sim_bal_frame_rate | /cig/libsrc/librt/bal_routines.c | 2.13.4.3 |
| sim_bal_init | /cig/libsrc/librt/bal_routines.c | 2.13.4.1 |
| sim_bal_process_msg | /cig/libsrc/librt/bal_routines.c | 2.13.4.6 |
| sim_bal_process_tracer | /cig/libsrc/librt/bal_routines.c | 2.13.4.7 |
| sim_bal_req_pt_info | /cig/libsrc/librt/bal_routines.c | 2.13.4.4 |
| sim_bal_reset | /cig/libsrc/librt/bal_routines.c | 2.13.4.12 |
| sim_bal_round_fired | /cig/libsrc/librt/bal_routines.c | 2.13.4.9 |
| sim_bal_start | /cig/libsrc/librt/bal_routines.c | 2.13.4.2 |
| sim_bal_static_add | /cig/libsrc/librt/bal_routines.c | 2.13.4.10 |
| sim_bal_static_rem | /cig/libsrc/librt/bal_routines.c | 2.13.4.11 |
| sim_bal_tf_veh_update | /cig/libsrc/librt/bal_routines.c | 2.13.4.13 |
| sim_bal_traj_chord | /cig/libsrc/librt/bal_routines.c | 2.13.4.8 |
| simulation | /cig/libsrc/librt/simulation.c | 2.13.43.1 |
| single_lite | /cig/libsrc/libgossip/replace_mod.c | 2.9.18.2 |
| sio_close | /cig/libsrc/libvio/sio.c | 2.14.1.3 |
| sio_init | /cig/libsrc/libvio/sio.c | 2.14.1.1 |
| sio_tick | /cig/libsrc/libvio/sio.c | 2.14.1.4 |
| sio_write | /cig/libsrc/libvio/sio.c | 2.14.1.2 |
| slave_cig_enet_sync | /cig/libsrc/libhost/host_enet_if.c | 2.10.2.4 |
| sload | /cig/libsrc/libutil/sload.c | 2.16.5.1 |
| spur_int | /cig/othersrc/force/exception.asm | 2.18.2.2 |
| staticveh_remove | /cig/libsrc/librt/staticveh_remove.c | 2.13.44 |
| staticveh_state | /cig/libsrc/librt/staticveh_state.c | 2.13.45 |
| status_mpvideo_print | /cig/libsrc/libmpvideo/mpvideo_print.c | 2.11.10.1 |
| stdopen | /cig/libsrc/libutil/stdopen.c | 2.16.6 |
| strcat | /cig/othersrc/force/f0_query.c | 2.18.22.3 |
| strcpy | /cig/othersrc/force/f0_query.c | 2.18.22.2 |
| strlen | /cig/othersrc/force/f0_query.c | 2.18.22.4 |
| swallow_token | /cig/libsrc/libtoken/lex.c | 2.15.1.6 |
| swap_axis | /cig/libsrc/librt/mkmtx_nt.c | 2.13.33.5 |
| sys_control_init | /cig/libsrc/librt/sys_control.c | 2.13.46.1 |
| sys_frame_rate | /cig/libsrc/librt/sys_control.c | 2.13.46.2 |
| sys_master_sync | /cig/libsrc/librt/sys_control.c | 2.13.46.5 |
| sys_slave_sync | /cig/libsrc/librt/sys_control.c | 2.13.46.4 |
| syserr | /cig/libsrc/librt/simulation.c | 2.13.43.3 |
| system_aam_init | /cig/libsrc/libconfig/aam_manager.c | 2.5.1.3 |
| test_commands | /cig/libsrc/libgossip/test_commands.c | 2.9.19 |
| test_gsp | /cig/othersrc/force/test_gsp.c | 2.13.37 |
| tick | /cig/libsrc/libflea/tick.c | 2.7.26.2 |
| tick_init | /cig/libsrc/libflea/tick.c | 2.7.26.1 |
| tick_main_menu | /cig/libsrc/libflea/tick.c | 2.7.26.4 |
| tick_ppm | /cig/libsrc/libflea/tick_ppm.c | 2.7.27.1 |
| tick_ppm_menu | /cig/libsrc/libflea/tick_ppm.c | 2.7.27.2 |
| tick_ppm_menu_header | /cig/libsrc/libflea/tick_ppm.c | 2.7.27.3 |
| tick_ppm_update_info | /cig/libsrc/libflea/tick_ppm.c | 2.7.27.4 |

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|------------------------|---|------------|
| tick_script | /cig/libsrc/libflea/tick_script.c | 2.7.28.1 |
| tick_script_main_menu | /cig/libsrc/libflea/tick_script.c | 2.7.28.2 |
| toggle_mpvideo_print | /cig/libsrc/libmpvideo/mpvideo_print.c | 2.11.10.2 |
| translate | /cig/libsrc/librtt/mkmtx_nt.c | 2.13.33.8 |
| trav_tree | /cig/libsrc/libvpt/trav_tree.c | 2.17.17 |
| triple_lite | /cig/libsrc/libgossip/replace_mod.c | 2.9.18.4 |
| tst_edebug | /cig/libsrc/libvpt/tst_edebug.c | 2.17.18 |
| tst_equery | /cig/libsrc/libvpt/tst_equery.c | 2.17.19.1 |
| tst_ereadconfig | /cig/libsrc/libvpt/tst_ereadconfig.c | 2.17.20.1 |
| tst_eupdate | /cig/libsrc/libvpt/tst_eupdate.c | 2.17.21 |
| tst_tree | /cig/libsrc/libvpt/tst_tree.c | 2.17.22.1 |
| tst_treetrace | /cig/libsrc/libvpt/tst_treetrace.c | 2.17.23.1 |
| upd_add_static_veh | /cig/libsrc/libflea/encode_routines.c | 2.7.4.9 |
| upd_auto_fire | /cig/libsrc/libflea/encode_routines.c | 2.7.4.7 |
| upd_chord_fired | /cig/libsrc/libflea/encode_routines.c | 2.7.4.6 |
| upd_clouds | /cig/libsrc/libflea/encode_routines.c | 2.7.4.14 |
| upd_count_hits_per_min | /cig/libsrc/libflea/encode_routines.c | 2.7.4.11 |
| upd_dynamic_matrix | /cig/libsrc/libflea/encode_routines.c | 2.7.4.3 |
| upd_flea_vehicles | /cig/libsrc/libflea/encode_routines.c | 2.7.4.24 |
| upd_lt_state | /cig/libsrc/libflea/encode_routines.c | 2.7.4.30 |
| upd_matrix_values | /cig/libsrc/libflea/encode_routines.c | 2.7.4.1 |
| upd_ppm | /cig/libsrc/libflea/flea_ppm_obj.c | 2.7.18.1 |
| upd_rem_static_veh | /cig/libsrc/libflea/encode_routines.c | 2.7.4.8 |
| upd_req_agl | /cig/libsrc/libflea/encode_routines.c | 2.7.4.15 |
| upd_req_lrange | /cig/libsrc/libflea/encode_routines.c | 2.7.4.17 |
| upd_req_point | /cig/libsrc/libflea/encode_routines.c | 2.7.4.16 |
| upd_rotation_values | /cig/libsrc/libflea/encode_routines.c | 2.7.4.2 |
| upd_round_fired | /cig/libsrc/libflea/encode_routines.c | 2.7.4.5 |
| upd_send_dynamic | /cig/libsrc/libflea/encode_routines.c | 2.7.4.10 |
| upd_send_stop | /cig/libsrc/libflea/encode_routines.c | 2.7.4.21 |
| upd_show_eff | /cig/libsrc/libflea/encode_routines.c | 2.7.4.13 |
| upd_sio_write | /cig/libsrc/libflea/encode_routines.c | 2.7.4.29 |
| upd_subsys_mode | /cig/libsrc/libflea/encode_routines.c | 2.7.4.19 |
| upd_view_flags | /cig/libsrc/libflea/encode_routines.c | 2.7.4.4 |
| upd_view_mag | /cig/libsrc/libflea/encode_routines.c | 2.7.4.18 |
| upd_view_mode | /cig/libsrc/libflea/encode_routines.c | 2.7.4.12 |
| upd_viewport_up | /cig/libsrc/libflea/encode_routines.c | 2.7.4.20 |
| update_2d | /cig/libsrc/libflea/update_2d.c | 2.7.29 |
| update_agpt_2d | /cig/libsrc/libflea/update_agpt_2d.c | 2.7.30 |
| update_dyn_demo | /cig/libsrc/libflea/flea_agpt_locations.c | 2.7.7.4 |
| update_mag | /cig/libsrc/libflea/flea_agpt_switches.c | 2.7.8.3 |
| update_menu_header | /cig/libsrc/libflea/tick.c | 2.7.26.6 |
| update_subsys_mode | /cig/libsrc/libflea/flea_agpt_switches.c | 2.7.8.4 |
| update_vpt | /cig/libsrc/libflea/flea_agpt_switches.c | 2.7.8.5 |
| upstart | /cig/libsrc/librtt/upstart.c | 2.13.47.1 |
| upstart_cleanup | /cig/libsrc/librtt/upstart.c | 2.13.47.2 |
| vasi_lite | /cig/libsrc/libgossip/replace_mod.c | 2.9.18.5 |
| vec_mat_mul | /cig/libsrc/librtt/mkmtx_nt.c | 2.13.33.20 |
| vpt_cnode_get | /cig/libsrc/libvpt/cnode_get.c | 2.17.3 |
| vpt_cnode_linkvpt | /cig/libsrc/libvpt/linkvpt.c | 2.17.10 |
| vpt_cnode_process | /cig/libsrc/libvpt/cnode_process.c | 2.17.4 |
| vpt_cnode_qroot | /cig/libsrc/libvpt/cnode_query.c | 2.17.5.2 |
| vpt_cnode_query | /cig/libsrc/libvpt/cnode_query.c | 2.17.5.1 |
| vpt_cnode_set_bchild | /cig/libsrc/libvpt/cnode_child.c | 2.17.2.1 |
| vpt_cnode_set_branch | /cig/libsrc/libvpt/cnode_set.c | 2.17.6.1 |
| vpt_cnode_set_matrix | /cig/libsrc/libvpt/cnode_set.c | 2.17.6.2 |
| vpt_cnode_set_stdchild | /cig/libsrc/libvpt/cnode_child.c | 2.17.2.2 |
| vpt_init_mode_off | /cig/libsrc/libvpt/be_subst.c | 2.17.1.8 |

| Function Name | Location | Section |
|---------------------------------|----------------------------------|-----------|
| vpt_init_mode_on | /cig/libsrc/libvpt/be_stubs.c | 2.17.1.7 |
| vpt_path_get | /cig/libsrc/libvpt/path_init.c | 2.17.15.1 |
| vpt_path_init | /cig/libsrc/libvpt/path_init.c | 2.17.15.2 |
| vpt_path_process | /cig/libsrc/libvpt/path.c | 2.17.14.1 |
| vpt_path_query | /cig/libsrc/libvpt/path_query.c | 2.17.16 |
| vpt_path_setup | /cig/libsrc/libvpt/path_init.c | 2.17.15.3 |
| vpt_path_update | /cig/libsrc/libvpt/path.c | 2.17.14.2 |
| vpt_root_init | /cig/libsrc/libvpt/init_free.c | 2.17.9.1 |
| vpt_tree_free | /cig/libsrc/libvpt/init_free.c | 2.17.9.3 |
| vpt_tree_init | /cig/libsrc/libvpt/init_free.c | 2.17.9.2 |
| vpt_update | /cig/libsrc/libvpt/vpt_update.c | 2.17.35 |
| vpt_update_2x1_heading | /cig/libsrc/libvpt/u_rotations.c | 2.17.26.1 |
| vpt_update_2x1_pitch | /cig/libsrc/libvpt/u_rotations.c | 2.17.26.2 |
| vpt_update_2x1_roll | /cig/libsrc/libvpt/u_rotations.c | 2.17.26.3 |
| vpt_update_3x3_matrix | /cig/libsrc/libvpt/u_xfrm.c | 2.17.28.2 |
| vpt_update_4x3_matrix | /cig/libsrc/libvpt/u_xfrm.c | 2.17.28.1 |
| vpt_update_all | /cig/libsrc/libvpt/u_viewport.c | 2.17.27.7 |
| vpt_update_brmask | /cig/libsrc/libvpt/u_brmask.c | 2.17.24 |
| vpt_update_fov | /cig/libsrc/libvpt/u_viewport.c | 2.17.27.1 |
| vpt_update_fov_lod | /cig/libsrc/libvpt/u_viewport.c | 2.17.27.2 |
| vpt_update_heading | /cig/libsrc/libvpt/u_rotations.c | 2.17.26.4 |
| vpt_update_hpr | /cig/libsrc/libvpt/u_rotations.c | 2.17.26.7 |
| vpt_update_hprxyzs | /cig/libsrc/libvpt/u_xfrm.c | 2.17.28.3 |
| vpt_update_lodm | /cig/libsrc/libvpt/u_viewport.c | 2.17.27.3 |
| vpt_update_mtx | /cig/libsrc/libvpt/update_mtx.c | 2.17.29 |
| vpt_update_near_plane | /cig/libsrc/libvpt/u_viewport.c | 2.17.27.4 |
| vpt_update_one_path | /cig/libsrc/libvpt/u_path.c | 2.17.25 |
| vpt_update_pitch | /cig/libsrc/libvpt/u_rotations.c | 2.17.26.5 |
| vpt_update_rez | /cig/libsrc/libvpt/u_viewport.c | 2.17.27.5 |
| vpt_update_roll | /cig/libsrc/libvpt/u_rotations.c | 2.17.26.6 |
| vpt_update_rot | /cig/libsrc/libvpt/update_rot.c | 2.17.30 |
| vpt_update_scale | /cig/libsrc/libvpt/u_xfrm.c | 2.17.28.4 |
| vpt_update_translation | /cig/libsrc/libvpt/u_xfrm.c | 2.17.28.5 |
| vpt_update_view_range | /cig/libsrc/libvpt/u_viewport.c | 2.17.27.6 |
| vpt_vpt_get | /cig/libsrc/libvpt/vpt_get.c | 2.17.31 |
| vpt_vpt_process | /cig/libsrc/libvpt/vpt_process.c | 2.17.32 |
| vpt_vpt_query | /cig/libsrc/libvpt/vpt_query.c | 2.17.33 |
| vpt_vpt_set | /cig/libsrc/libvpt/vpt_set.c | 2.17.34 |
| vpti_change_path_entry_index | /cig/libsrc/libvpt/globs.c | 2.17.8 |
| vpti_change_vpt_entry_index | /cig/libsrc/libvpt/globs.c | 2.17.8 |
| vpti_get_pathptr_cnode | /cig/libsrc/libvpt/globs.c | 2.17.8 |
| vpti_get_ptr_cnode | /cig/libsrc/libvpt/globs.c | 2.17.8 |
| vpti_get_ptr_path | /cig/libsrc/libvpt/globs.c | 2.17.8 |
| vpti_get_ptr_vpt | /cig/libsrc/libvpt/globs.c | 2.17.8 |
| vpti_get_vptptr_cnode | /cig/libsrc/libvpt/globs.c | 2.17.8 |
| vpti_increment_path_entry_index | /cig/libsrc/libvpt/globs.c | 2.17.8 |
| vpti_increment_vpt_entry_index | /cig/libsrc/libvpt/globs.c | 2.17.8 |
| vpti_set_ptr_cnode | /cig/libsrc/libvpt/globs.c | 2.17.8 |
| vpti_set_ptr_path | /cig/libsrc/libvpt/globs.c | 2.17.8 |
| vpti_set_ptr_vpt | /cig/libsrc/libvpt/globs.c | 2.17.8 |
| vpti_set_state_dcnode | /cig/libsrc/libvpt/globs.c | 2.17.8 |
| vpti_set_state_dlodmult | /cig/libsrc/libvpt/globs.c | 2.17.8 |
| vpti_set_state_dmatrix | /cig/libsrc/libvpt/globs.c | 2.17.8 |
| vpti_set_state_dpath | /cig/libsrc/libvpt/globs.c | 2.17.8 |
| vpti_set_state_dtproc | /cig/libsrc/libvpt/globs.c | 2.17.8 |
| vpti_set_state_dtree_short | /cig/libsrc/libvpt/globs.c | 2.17.8 |
| vpti_set_state_dvptnode | /cig/libsrc/libvpt/globs.c | 2.17.8 |
| vpti_set_state_edtpc | /cig/libsrc/libvpt/globs.c | 2.17.8 |

| Function Name | Location | Section |
|----------------------------|-----------------------------------|------------|
| vpti_set_state_efillt | /cig/libsrc/libvpt/globs.c | 2.17.8 |
| vpti_set_state_panel_align | /cig/libsrc/libvpt/globs.c | 2.17.8 |
| vpti_state_dcnode | /cig/libsrc/libvpt/globs.c | 2.17.8 |
| vpti_state_dlodmult | /cig/libsrc/libvpt/globs.c | 2.17.8 |
| vpti_state_dmatrix | /cig/libsrc/libvpt/globs.c | 2.17.8 |
| vpti_state_dpath | /cig/libsrc/libvpt/globs.c | 2.17.8 |
| vpti_state_dtproc | /cig/libsrc/libvpt/globs.c | 2.17.8 |
| vpti_state_dtree_short | /cig/libsrc/libvpt/globs.c | 2.17.8 |
| vpti_state_dvptnode | /cig/libsrc/libvpt/globs.c | 2.17.8 |
| vpti_state_edtpc | /cig/libsrc/libvpt/globs.c | 2.17.8 |
| vpti_state_efillt | /cig/libsrc/libvpt/globs.c | 2.17.8 |
| vpti_state_panel_align | /cig/libsrc/libvpt/globs.c | 2.17.8 |
| vpti_togstate_dcnode | /cig/libsrc/libvpt/globs.c | 2.17.8 |
| vpti_togstate_dlodmult | /cig/libsrc/libvpt/globs.c | 2.17.8 |
| vpti_togstate_dmatrix | /cig/libsrc/libvpt/globs.c | 2.17.8 |
| vpti_togstate_dpath | /cig/libsrc/libvpt/globs.c | 2.17.8 |
| vpti_togstate_dtproc | /cig/libsrc/libvpt/globs.c | 2.17.8 |
| vpti_togstate_dtree_short | /cig/libsrc/libvpt/globs.c | 2.17.8 |
| vpti_togstate_dvptnode | /cig/libsrc/libvpt/globs.c | 2.17.8 |
| vpti_togstate_edtpc | /cig/libsrc/libvpt/globs.c | 2.17.8 |
| vpti_togstate_efillt | /cig/libsrc/libvpt/globs.c | 2.17.8 |
| vpti_togstate_panel_align | /cig/libsrc/libvpt/globs.c | 2.17.8 |
| vpti_val_path_entry_index | /cig/libsrc/libvpt/globs.c | 2.17.8 |
| vpti_val_vpt_entry_index | /cig/libsrc/libvpt/globs.c | 2.17.8 |
| vptq_activept | /cig/libsrc/libvpt/tst_equery.c | 2.17.19.6 |
| vptq_brvals | /cig/libsrc/libvpt/tst_equery.c | 2.17.19.5 |
| vptq_cnout | /cig/libsrc/libvpt/tst_equery.c | 2.17.19.9 |
| vptq_cnptrs | /cig/libsrc/libvpt/tst_equery.c | 2.17.19.4 |
| vptq_dynmtx | /cig/libsrc/libvpt/tst_equery.c | 2.17.19.8 |
| vptq_grout | /cig/libsrc/libvpt/tst_equery.c | 2.17.19.11 |
| vptq_grptrs | /cig/libsrc/libvpt/tst_equery.c | 2.17.19.2 |
| vptq_vpout | /cig/libsrc/libvpt/tst_equery.c | 2.17.19.10 |
| vptq_vpptrs | /cig/libsrc/libvpt/tst_equery.c | 2.17.19.3 |
| vptq_vptbrout | /cig/libsrc/libvpt/tst_equery.c | 2.17.19.7 |
| what_node_on_stack | /cig/libsrc/libgendtp/dtp_funcs.c | 2.8.2.3 |
| whatdirptr | /cig/libsrc/librti/load_modules.c | 2.13.30.4 |
| write_evc_control | /cig/libsrc/librti/sys_control.c | 2.13.46.8 |
| write_evc_frame | /cig/libsrc/librti/sys_control.c | 2.13.46.9 |

E.4 Macro Names Mapped To Source File Locations

The following list shows each macro function used by the real-time software, and identifies the file in which the macro is defined. The third column shows the section number in which the macro is described in this document.

| Macro Name | Location | Section |
|------------------|--|---------|
| AAM1_TO_AAM2 | /cig/include/kludge.h | B.1 |
| AAM2_ADDR | /cig/include/functions.h; | |
| | /cig/libsrc/libconfig/process_vflags.c | B.2 |
| AAREAD | /cig/include/definitions.h | B.3 |
| ABSVL | /cig/include/definitions.h, rt_macros.h | B.4 |
| BCOPY | /cig/include/mx_defines.h | B.5 |
| CHECK_FORCE | /cig/libsrc/libgossip/gos_120tx.c, gos_mpv.c | B.6 |
| CHECKROT | /cig/libsrc/libflea/flea_simulate_vehicles.c | B.7 |
| CUBE | /cig/include/rt_macros.h | B.8 |
| DART_ENQUEUE | /cig/include/functions.h | B.9 |
| DED_BOUNDARY | /cig/libsrc/librtt/ded_model_trace.c | B.10 |
| DEGREE_TO_RADIAN | /cig/include/rt_macros.h | B.11 |
| DELETE_ROUND | /cig/include/bx_macros.h | B.12 |
| DELETE_STAT_VEH | /cig/include/bx_macros.h | B.13 |
| DOWNLOAD_DATA | /cig/libsrc/lib2d/cig_link_2d.c | B.14 |
| dtp_bcn | /cig/include/rcinclude.h | B.15 |
| dtp_bcnr | /cig/include/rcinclude.h | B.15 |
| dtp_bcnrs | /cig/include/rcinclude.h | B.15 |
| dtp_bcnz | /cig/include/rcinclude.h | B.15 |
| dtp_bczr | /cig/include/rcinclude.h | B.15 |
| dtp_bczrs | /cig/include/rcinclude.h | B.15 |
| dtp_bczs | /cig/include/rcinclude.h | B.15 |
| dtp_bdgr | /cig/include/rcinclude.h | B.15 |
| dtp_bdgrs | /cig/include/rcinclude.h | B.15 |
| dtp_bdlr | /cig/include/rcinclude.h | B.15 |
| dtp_bdlrs | /cig/include/rcinclude.h | B.15 |
| dtp_bgn | /cig/include/rcinclude.h | B.15 |
| dtp_bgns | /cig/include/rcinclude.h | B.15 |
| dtp_bgz | /cig/include/rcinclude.h | B.15 |
| dtp_bgzs | /cig/include/rcinclude.h | B.15 |
| dtp_blm | /cig/include/rcinclude.h | B.15 |
| dtp_bnz | /cig/include/rcinclude.h | B.15 |
| dtp_bnzs | /cig/include/rcinclude.h | B.15 |
| dtp_bnzrs | /cig/include/rcinclude.h | B.15 |
| dtp_bnzrs | /cig/include/rcinclude.h | B.15 |
| dtp_bnzrs | /cig/include/rcinclude.h | B.15 |
| dtp_bpc | /cig/include/rcinclude.h | B.15 |
| dtp_bpcx | /cig/include/rcinclude.h | B.15 |
| dtp_bru | /cig/include/rcinclude.h | B.15 |
| dtp_brur | /cig/include/rcinclude.h | B.15 |
| dtp_brurs | /cig/include/rcinclude.h | B.15 |
| dtp_brus | /cig/include/rcinclude.h | B.15 |
| dtp_brz | /cig/include/rcinclude.h | B.15 |
| dtp_brzr | /cig/include/rcinclude.h | B.15 |
| dtp_brzrs | /cig/include/rcinclude.h | B.15 |
| dtp_brzrs | /cig/include/rcinclude.h | B.15 |
| dtp_brzs | /cig/include/rcinclude.h | B.15 |
| dtp_dot | /cig/include/rcinclude.h | B.15 |
| dtp_elm | /cig/include/rcinclude.h | B.15 |

| Macro Name | Location | Section |
|------------------|---------------------------------|---------|
| dtp_end | /cig/include/rcinclude.h | B.15 |
| dtp_fov | /cig/include/rcinclude.h | B.15 |
| dtp_fovr | /cig/include/rcinclude.h | B.15 |
| dtp_fovrs | /cig/include/rcinclude.h | B.15 |
| dtp_fovs | /cig/include/rcinclude.h | B.15 |
| dtp_gdc | /cig/include/rcinclude.h | B.15 |
| dtp_gdci | /cig/include/rcinclude.h | B.15 |
| dtp_gdcir | /cig/include/rcinclude.h | B.15 |
| dtp_gdcirs | /cig/include/rcinclude.h | B.15 |
| dtp_gdcis | /cig/include/rcinclude.h | B.15 |
| dtp_gdcn | /cig/include/rcinclude.h | B.15 |
| dtp_gdcnr | /cig/include/rcinclude.h | B.15 |
| dtp_gdcnrs | /cig/include/rcinclude.h | B.15 |
| dtp_gdcns | /cig/include/rcinclude.h | B.15 |
| dtp_gdcr | /cig/include/rcinclude.h | B.15 |
| dtp_gdcrs | /cig/include/rcinclude.h | B.15 |
| dtp_gdcs | /cig/include/rcinclude.h | B.15 |
| dtp_gr | /cig/include/rcinclude.h | B.15 |
| dtp_lmi | /cig/include/rcinclude.h | B.15 |
| dtp_lmir | /cig/include/rcinclude.h | B.15 |
| dtp_lmirs | /cig/include/rcinclude.h | B.15 |
| dtp_lmis | /cig/include/rcinclude.h | B.15 |
| dtp_lod | /cig/include/rcinclude.h | B.15 |
| dtp_lodr | /cig/include/rcinclude.h | B.15 |
| dtp_lodrs | /cig/include/rcinclude.h | B.15 |
| dtp_lods | /cig/include/rcinclude.h | B.15 |
| dtp_lwd | /cig/include/rcinclude.h | B.15 |
| dtp_lwdr | /cig/include/rcinclude.h | B.15 |
| dtp_lwdrs | /cig/include/rcinclude.h | B.15 |
| dtp_lwds | /cig/include/rcinclude.h | B.15 |
| dtp_mml | /cig/include/rcinclude.h | B.15 |
| dtp_mmpre | /cig/include/rcinclude.h | B.15 |
| dtp_mmpst | /cig/include/rcinclude.h | B.15 |
| dtp_mwd | /cig/include/rcinclude.h | B.15 |
| dtp_ngc | /cig/include/rcinclude.h | B.15 |
| dtp_oio | /cig/include/rcinclude.h | B.15 |
| dtp_oos | /cig/include/rcinclude.h | B.15 |
| dtp_osd | /cig/include/rcinclude.h | B.15 |
| dtp_osds | /cig/include/rcinclude.h | B.15 |
| dtp_owd | /cig/include/rcinclude.h | B.15 |
| dtp_owds | /cig/include/rcinclude.h | B.15 |
| dtp_owdsc | /cig/include/rcinclude.h | B.15 |
| dtp_owo | /cig/include/rcinclude.h | B.15 |
| dtp_owr | /cig/include/rcinclude.h | B.15 |
| dtp_owrs | /cig/include/rcinclude.h | B.15 |
| dtp_owrsc | /cig/include/rcinclude.h | B.15 |
| dtp_rc | /cig/include/rcinclude.h | B.15 |
| dtp_sub | /cig/include/rcinclude.h | B.15 |
| dtp_subr | /cig/include/rcinclude.h | B.15 |
| dtp_subrs | /cig/include/rcinclude.h | B.15 |
| dtp_subs | /cig/include/rcinclude.h | B.15 |
| dtp_tbc | /cig/include/rcinclude.h | B.15 |
| dtp_tbdr | /cig/include/rcinclude.h | B.15 |
| dtp_tbdrs | /cig/include/rcinclude.h | B.15 |
| dtp_tbrr | /cig/include/rcinclude.h | B.15 |
| dtp_tbrs | /cig/include/rcinclude.h | B.15 |
| DUMP_DART_BUFFER | /cig/include/functions.h | B.16 |
| ERRMSG | /cig/libsrc/libgendtp/rcfuncs.c | B.17 |

| Macro Name | Location | Section |
|--------------------|--|---------|
| EXCHANGE_FLEA_DATA | /cig/include/functions.h | B.18 |
| FIND_LM | /cig/include/functions.h, rt_macros.h | B.19 |
| FLTOFX | /cig/include/rt_macros.h | B.20 |
| FREE_LM_CACHE | /cig/include/bx_macros.h | B.21 |
| FXT0881 | /cig/include/functions.h, rt_macros.h | B.22 |
| FXT0FL | /cig/include/rt_macros.h | B.23 |
| GET_CHORD_END | /cig/include/bx_macros.h | B.24 |
| GET_DB_POS | /cig/include/bx_macros.h | B.25 |
| GET_LB_FROM_LM | /cig/include/bx_macros.h | B.26 |
| GLOB | /cig/include/ememory_map.h, memory_map.h | B.27 |
| INCR_COMPONENT | /cig/libsrc/libgendtp/rcfuncs.c | B.28 |
| INIT_MTX | /cig/include/functions.h, rt_macros.h | B.29 |
| MAGSQ2D | /cig/include/rt_macros.h | B.30 |
| MAGSQ3D | /cig/include/rt_macros.h | B.31 |
| MALLOC | /cig/include/bx_defines.h | B.32 |
| MAX | /cig/include/rt_macros.h | B.33 |
| MIN | /cig/include/rt_macros.h | B.34 |
| NEW_ROUND | /cig/include/bx_macros.h | B.35 |
| NEW_STAT_VEH | /cig/include/bx_macros.h | B.36 |
| OPEN_FLEA_DATA | /cig/include/functions.h | B.37 |
| OUTPUT_MESSAGE | /cig/libsrc/libflea/cf_translator.c, flea_init_cig_sw.c | B.38 |
| PAGE_FORMAT | /cig/libsrc/libball/bx_probe.c | B.39 |
| | /cig/libsrc/libgossip/gos_bal_query.c | B.40 |
| poly_ab | /cig/include/rcinclude.h | B.40 |
| poly_bvc | /cig/include/rcinclude.h | B.40 |
| poly_efs | /cig/include/rcinclude.h | B.40 |
| poly_efs_r | /cig/include/rcinclude.h | B.40 |
| poly_flu | /cig/include/rcinclude.h | B.40 |
| poly_fsw | /cig/include/rcinclude.h | B.40 |
| poly_gc | /cig/include/rcinclude.h | B.40 |
| poly_inf | /cig/include/rcinclude.h | B.40 |
| poly_lmf | /cig/include/rcinclude.h | B.40 |
| poly_lsc | /cig/include/rcinclude.h | B.40 |
| poly_mmf | /cig/include/rcinclude.h | B.40 |
| poly_pc | /cig/include/rcinclude.h | B.40 |
| poly_poly | /cig/include/rcinclude.h | B.40 |
| poly_rm1 | /cig/include/rcinclude.h | B.40 |
| poly_rm2 | /cig/include/rcinclude.h | B.40 |
| poly_rm3 | /cig/include/rcinclude.h | B.40 |
| poly_rm4 | /cig/include/rcinclude.h | B.40 |
| poly_sc | /cig/include/rcinclude.h | B.40 |
| poly_sci | /cig/include/rcinclude.h | B.40 |
| poly_sec | /cig/include/rcinclude.h | B.40 |
| poly_sm1 | /cig/include/rcinclude.h | B.40 |
| poly_sm2 | /cig/include/rcinclude.h | B.40 |
| poly_sm3 | /cig/include/rcinclude.h | B.40 |
| poly_sm4 | /cig/include/rcinclude.h | B.40 |
| poly_stamp | /cig/include/rcinclude.h | B.40 |
| poly_tog | /cig/include/rcinclude.h | B.40 |
| poly_vtxe | /cig/include/rcinclude.h | B.40 |
| poly_vtxl | /cig/include/rcinclude.h | B.40 |
| POP_STACK | /cig/libsrc/librt/ded_model_trace.c | B.41 |
| PRINTD4 | /cig/libsrc/libgossip/gos_memory.c | B.42 |
| PRINTD8 | /cig/libsrc/libgossip/gos_memory.c | B.43 |
| PRINTHEX4 | /cig/libsrc/libgossip/gos_memory.c | B.44 |
| PRINTHEX8 | /cig/libsrc/libgossip/gos_memory.c | B.45 |
| PUSH_STACK | /cig/libsrc/librt/ded_model_trace.c | B.46 |

| Macro Name | Location | Section |
|------------------------|--|---------|
| RADIAN_TO_DEGREE | /cig/include/rt_macros.h | B.47 |
| ROOM4LABEL | /cig/libsrc/libgendtp/rcfuncs.c | B.48 |
| ROOMCHECK | /cig/libsrc/libgendtp/rcfuncs.c | B.49 |
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