Therefore, we re-implemented the inspection dialog to contain a text box in which trainees can type a description of how they would inspect the part selected. This could include either the process needed to inspect a particular part or what to look for when inspecting that part. Furthermore, this modification allows MVIS to support inspection processes specific to each mine site.

2.2.3 *Lost in space*

During preliminary tests of MVIS, the scene in which a user was placed contained no visual clues (such as sky, ground, and horizon) that could be used to maintain orientation. If a user got lost, it was difficult to regain orientation. Without a horizon, the user had no idea which way was up. With the addition of scenic elements, navigation in the VR world was much easier. However, we felt the addition of a second visual perspective would be useful to help users determine their position in complex scenes where they might be required to navigate between several landmarks. For these reasons, the Position Locator view was added to the user interface of MVIS. The Position Locator is a separate window that views the scene from a third person perspective, as shown in Figure 4. An icon is used to represent the position and viewpoint direction in the scene. The Position Locator can toggle between two default viewing modes, top-down and front view, for convenience and ease of use, or the user can freely rotate the entire scene in the viewer to create their own view from the best possible vantage point. The Position Locator can be opened and closed throughout an inspection at the user's discretion.

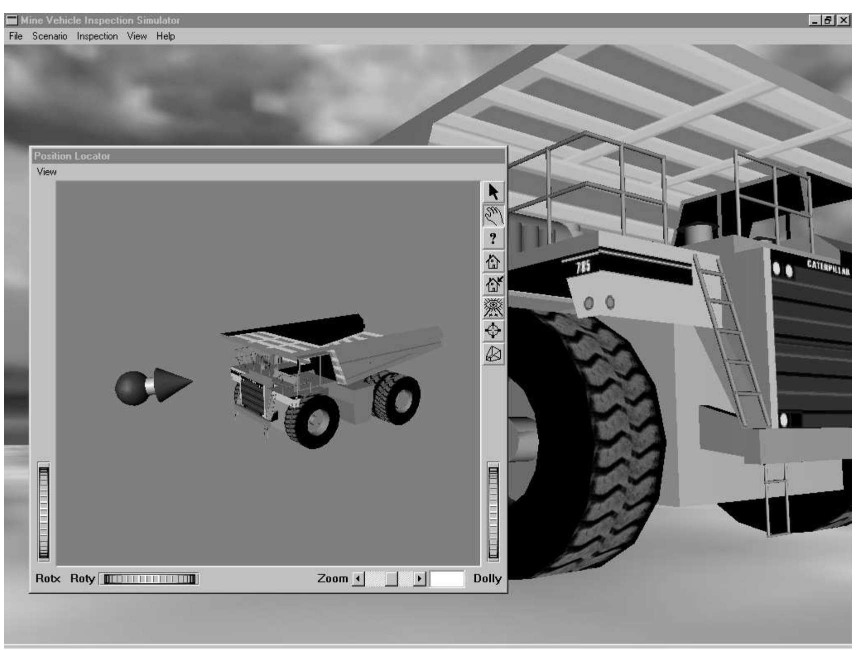

Figure 4: MVIS with the Position Locator View Open.

2.2.4 *Inspected part list*

In real inspections, inspectors are often required to maintain an inspection log. However, because MVIS is computer based, the simulation records details of an inspection using the Inspection Dialog box. As an additional tool to aid trainees using MVIS, an Inspected Part List is provided. The Inspected Part List is a separate window that floats on top of the application and maintains a list of parts the trainee has inspected. This window also allows easy access to inspection details on a part-by-part basis so trainees can review their work before completing the inspection. The Inspected Part List can be opened or closed throughout an inspection. An example of the Inspected Part List can be seen in Figure 1.

2.2.5 *Inspection administration*

Although MVIS is primarily a training tool, it is equally effective for vehicle operator evaluation. For this reason, it is important that trainees using the software are unable to tamper with scenario configurations after an inspection has begun in an attempt to gain an advantage on their performance evaluation. Several safeguards are built into MVIS to ensure that, once an inspection has begun, all user interface elements (menus and buttons) that gain access to scenario configurations are locked and cannot be accessed until the inspection is complete.

2.2.6 *Vehicle and vehicle configuration flexibility*

Another benefit of MVIS is its configuration flexibility. MVIS uses a standard graphics file format to represent vehicles in VR. With this feature, a mine company can provide inspection models for every type of vehicle employees would encounter at a particular job site. Another feature of the file format used in MVIS is part configurations for individual vehicle components. In order to use this feature, defective part versions of inspectable parts must be defined in the inspection model. An example of a defective part might be a leaky or cracked strut. Each part in a vehicle can have an unlimited number of defective part versions. At runtime MVIS uses vehicle configuration information to determine which defective part version will be used when the model is displayed. Data that defines a vehicle configuration is called a scenario and is stored in a file that accompanies a model. This file can store any number of scenarios for the vehicle it accompanies. To select a scenario at runtime, a menu option is available prior to starting an inspection that allows the MVIS administrator to select a scenario. As a second method for defining a vehicle scenario, a scenario configuration dialog is available. This dialog box displays a list of available parts as well as a list of defective part versions available for each part. The MVIS administrator can select individual defective parts to be included in a vehicle configuration.

2.3 *Future Enhancements*

MVIS is an ongoing project that is continually being enhanced and modified to reflect the needs of our customers and the latest trends in the mine safety industry. Enhancement ideas that we have received from mining professionals that are slated for addition to MVIS include improved inspection evaluation, proximity selection, inspection ordering, model and scenario customization, and an enhanced inspection dialog box.

2.3.1 *Improved inspection evaluation*

At this time, inspection results are produced in the form of a report. This form of performance evaluation is suitable when the number of inspection points is small but becomes cumbersome as the number of inspection points grows. To make the process of evaluating an inspection easier, an inspection performance evaluation program is in development. This program will allow evaluators to gain access to valuable information as quickly as possible using an intuitive graphical user interface. As an added feature, this software will also give the evaluator access to information that was previously inaccessible. For example, the package will allow the reviewer to play back an animation of the path the trainee took while inspecting a vehicle. As a training aid, this information is useful in determining if the trainee is taking the most efficient path around a vehicle during an inspection.