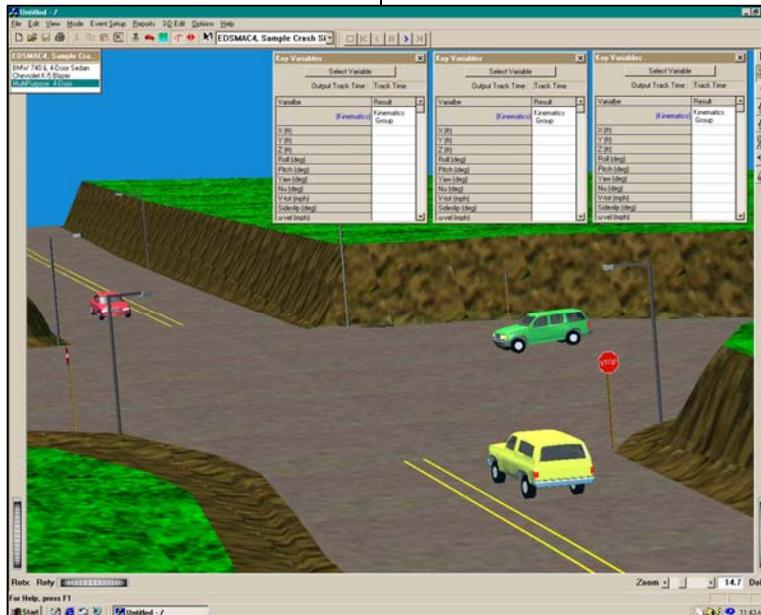


# Technical Newsletter

## PC Version of HVE Announced at Forum 2000

The "hottest news" at this year's HVE Forum, which took place May 8-12 at the Hyatt Islandia, Mission Bay in San Diego, was the announcement of a PC version of HVE. All HVE users who are up-to-date on their support will receive automatically this new version, expected to be shipped in August 2000. For more information on this, please see page 7.



This year we added three new classes: Advanced HVE-2D, Brake Designer and Theoretical and Applied Vehicle Dynamics (please see back page for more information on this course). Judging from the comments, these new classes were very successful.

For Monday's social hour we had hired Regis Philbin, disguised as Wes Grimes, to moderate the "Who wants to be a Jillionaire"

This was the 5<sup>th</sup> Annual Forum and we had the highest number of attendees ever with almost 60 engineers and safety researchers from all over the US, Canada, Argentina and Australia. Many attendees come back year after year to attend a variety of workshops about EDC's powerful human and vehicle dynamic simulation tools.

game. This was quite a fun event and at the end we had 5 Jillionaires.

### 2001 HVE Forum in Santa Fe

EDC is pleased to announce that the 2001 HVE Forum will take place at the famous Hotel Loretto, Santa Fe, New Mexico, May 7-11, 2001.

### WELCOME!

The EDC Technical Newsletter is published for the benefit of EDVAP, HVE-2D, and HVE users. Its purpose is to pass along ideas and innovations that might improve your use of EDC software. If you have questions or comments, please contact:

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## Newton on Motorcycle Collisions

A frequent question at the EDC customer technical support desk is “Can I use HVE to study motorcycle collisions?” During the pre-impact phase, HVE is perfect for producing a time-distance study to determine avoidability. You get a *free* visibility study to boot! But, what about the collision? To get the best possible answer, we decided to ask the man himself, Sir Isaac Newton.

**EDC:** Thank you for coming back for this interview. So tell us, can we study the dynamics of a vehicle vs. motorcycle collision?

**SIN:** In a word, *NO*. I mean, you can do the calculations, but the result is worthless!

**EDC:** Why is that?

**SIN:** If you believe in my laws of motion, the answer lies in my second and third laws.

**EDC:** Please explain.

**SIN:** OK, according to my third law, the collision force on the vehicle is the same as the force on the motorcycle, but in opposite directions. Now, according to my second law, the force on each object is equal to the product of mass times acceleration. In equation form,

$$F_1 = -F_2 \quad (3^{\text{rd}} \text{ law})$$

and

$$F_1 = m_1 a_1 \quad \text{and} \quad F_2 = m_2 a_2 \quad (2^{\text{nd}} \text{ law})$$

Substituting for  $F_1$  and  $F_2$ ,

$$m_1 a_1 = -m_2 a_2$$

Now, since  $a = dV/dt$  (thank goodness I also invented the calculus!), or  $a = \Delta V/\Delta t$  for the entire collision interval, we can again substitute

$$m_1 \frac{\Delta V_1}{\Delta t_1} = -m_2 \frac{\Delta V_2}{\Delta t_2}$$

Since  $\Delta t$  is the same for both the motorcycle and the vehicle,

$$m_1 \Delta V_1 = -m_2 \Delta V_2$$

In the above equation lies the reason that the calculation of speed change for a motorcycle collision is worthless. A simple rearrangement results in

$$\frac{m_1}{m_2} = -\frac{\Delta V_2}{\Delta V_1}$$

Or, stated in words, the ratio of the speed changes during the collision is inversely proportional to the ratio of the masses. Note that I didn't make any assumptions here, other than assuming my laws are valid (you can ignore Dr. Einstein, unless your vehicles are traveling at the speed of light). So the above result is true for every collision throughout the universe – whether you're talking about a car hitting a pickup or a motorcycle hitting a car. And it doesn't matter if you're using a hand-held calculator, a fancy computer program or the back of an envelope.

**EDC:** Sounds good. So, what's the problem?

**SIN:** It's the *mass ratio!* When analyzing anything, one should always study the sensitivity of the results to the inputs. If you perform such a study by varying the ranges of the estimated input parameters (such as stiffness, crush, approach and departure directions – not to mention the fact that the motorcycle's mass changes during the collision when its rider flies off) you'll find that the range of possible speed change for the car (heavier object) is quite reasonable (say 2 to 5 mph), but the range for the motorcycle (lighter object) is huge! Say, 20 to 50 mph. So, if you use such an approach, the findings in your report would be something like, “The speed of the Cadillac at impact was 35 to 40 mph and the speed of the motorcycle at impact was 25 to 75 mph.” Now, if that's helpful...

**EDC:** Now I get it. The calculation is valid, but it's too sensitive to be useful. But what about studying a collision between a car and a fully loaded semi-truck? Don't you have the same problem?

**SIN:** You sure do! Now, I have a question for you.

**EDC:** Fire away.

**SIN:** What's a motorcycle?

## User Hints and Tips

### HVE

- In the 3-D Editor, move the cross-hair selector into any of the planar views, click the right mouse button, and choose Decoration in order to get the translate and zoom dials and the tool buttons for that window (same as default in the perspective view).
- In all editors, push the Esc key in order to toggle between arrow-cursor mode for selecting objects (e.g. vehicle wheel) and hand-cursor mode for changing views. When the cursor is in hand-mode, press the left mouse button to rotate an object, the center mouse button to

translate an object, and both the left and center mouse buttons simultaneously to dolly in or out.

- In order to export data from the Variable Output report and import it into a spreadsheet or graphing program, first, choose File – Print from the main menu bar. In the Print dialog, select Print To File. If your spreadsheet will be more than 1 page long, do not Print Page Headers. Leave the font as Courier. Click OK. In the Printer File Selection dialog, choose the File Format to be Text. Enter a File Name, and click OK. This file can be imported into a spreadsheet program as either fixed-width or tab and space delimited text.

## HVE-2D

- In order to export data from the Variable Output report and import it into a spreadsheet or graphing program, first click the Print button in the Variable Output window. In the Print dialog, click Setup. In the Print Setup dialog, under Specific printer, choose Generic/Text Only on FILE:, and click OK. Click OK again in the Print dialog. Enter a file name and location in the Print To File dialog and click OK. This file can be imported into a spreadsheet program as either fixed-width or tab and space delimited text.
- When importing AutoCAD drawing files into HVE-2D, it is important that you understand how HVE-2D determines the origin. There are two coordinate systems in AutoCAD: a fixed coordinate system called the World Coordinate System (WCS), and a movable coordinate system called the user coordinate system (UCS). HVE-2D recognizes only the World Coordinate System origin.

The WCS origin is located in the lower left corner of the drawing where the X and Y axes intersect (0,0). The UCS is used to set up a new origin within the WCS. Moving the UCS can make it easier to work on particular sections of a drawing.

In order to return to the WCS, follow these instructions in AutoCAD.

1. From the Tools menu, choose UCS, and then Named UCS.
2. In the UCS Control dialog box, select \*WORLD\*.
3. Select Current
4. Click OK.

Once your drawing is in the WCS, you can select all objects in the drawing and move them

so that your intended origin in HVE-2D corresponds with the AutoCAD WCS origin.

- The scale at which you must import AutoCAD drawings into HVE-2D is decimal inches. HVE expects all information to be entered in what are called Program units. These are the units that are used for computations within HVE. Program units consist of the English units pounds, seconds, inches, and derivatives thereof. Vehicles and environments drawn to a metric scale must be converted to inches before importing (1 inch = 0.0254 meter). If you import a drawing and it appears very small with respect to an HVE vehicle, it is likely that your drawing is in the units of feet. If this is the case, scale the drawing by 12 before importing it into HVE-2D.

## Technical Session

The EDVSM model has been recently extended to include force and moments created by interaction between the vehicle body and environment terrain. Thus, the kinetic simulation of a complete vehicle rollover is now possible. Our Technical Session describes this model.

The general modeling approach used by the EDVSM body vs. terrain model is similar to the “hard point” method used by HVOSM-RD2. The vehicle body is comprised of nodes that may interact with the environment terrain. The nodes have material attributes and, thus, generate forces as a result of their interaction with the terrain. The forces are resolved into vehicle-fixed components, which are then summed to calculate forces and moments acting at the center of gravity of the sprung mass. These forces and moments are included in the equations of motion, along with suspension forces and aerodynamic forces, to calculate the current sprung mass linear and angular acceleration vectors.

### Node Definition

The nodes required by the model are the vertices supplied by the vehicle 3-D geometry file. Since every HVE vehicle has a geometry file, every vehicle has the nodes required to perform the simulation. A vehicle may have an unlimited number of nodes. The vehicle-fixed coordinates for each node are inherently included in the geometry file, as is the number of nodes.

Force and deformation can occur only at node coordinate locations, thus, the number of nodes determines the resolution of the model. For

example, a Generic Class 1 Passenger Car is comprised of 20 vertices. Thus, forces can be produced only at 20 locations on the vehicle (see Figure 1). On the other hand, a 1998 Ford Taurus 4-Dr Sedan in the EDC Vehicle Database is comprised of 2792 vertices (not including tires and wheels) (see Figure 2).. Thus, forces can be produced at 2792 locations on the Ford Taurus. The resulting analysis can include significantly more detail

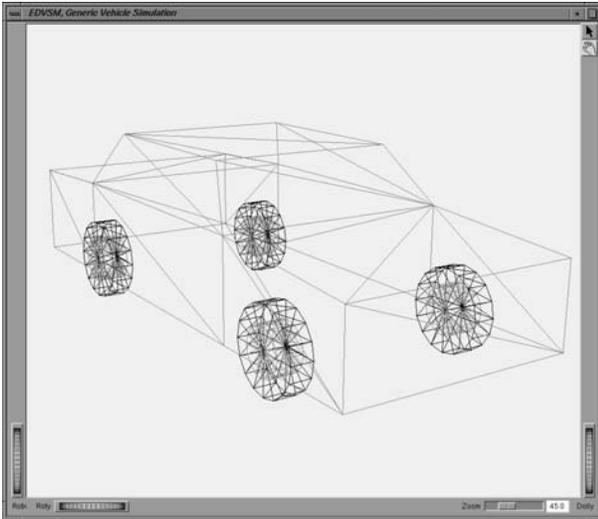


Figure 1 – Generic Vehicle (Passenger Car) in Wireframe. Vehicle has 20 nodes (vertices).

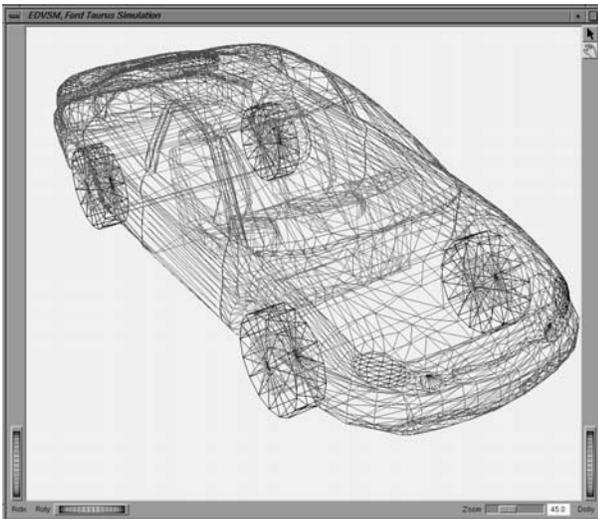


Figure 2 – 1998 Ford Taurus in Wireframe. Vehicle has 2792 nodes (vertices).

#### Node Material Attributes

The *HVE* simulation environment supplies each node with a complete set of material attributes; the attributes are user-editable. However, the *EDVSM*

body model uses only the exterior stiffness,  $K_v$ , and vertex friction,  $\mu_v$ . The material attributes are omni-directional (i.e., force-displacement characteristics of the node are independent of the direction of deformation).

The material attributes are not assigned according to the area surrounding each vertex. Routines of significantly greater complexity are required for such an approach (e.g., *DyMESH*). Thus, closely spaced vertices will create a harder region than widely spaced vertices. To some degree, this correlates with one's intuition because complex regions comprised of many vertices, such as door pillars, tend to be harder than flat areas comprised of fewer vertices, such as door panels. However, the user should be aware of this characteristic when assigning stiffness values.

Because node force is not assigned according to the area surrounding the vertex, the proper selection of  $K_v$  depends on the number of vertices included in the vehicle geometry. Experience has shown that a value of 15-25 lb/in<sup>2</sup> (actually interpreted as lb/vertex) is reasonable for vehicles having 1000 to 3000 vertices. Because the forces are impulsive, the effect of selecting a lower value of  $K_v$  is to decrease the peak force and increase the deformation and duration of impact. Selecting a higher stiffness generally increases the peak force and decreases the deformation and duration of impact. In any case, the impulse (area under the force vs time curve) is approximately the same over a rather wide range of stiffness values. The basic approach is to select a  $K_v$  value that results in a crush depth that approximates the actual crush.

$K_v$  is assigned using the *HVE* Vehicle Editor by clicking on the desired surface icon (*front*, *right*, *back*, *left*, *top* or *bottom*), choosing the Stiffness dialog and entering the desired  $K_v$  stiffness value (*A* and *B* stiffnesses are also available in the dialog, but are not used by the *EDVSM* body model).

The default body-terrain friction coefficient is 0.50. The body-terrain friction may be modified using environment friction zones.

#### Node Force

The force at each node (or vertex) is calculated from the penetration of the node into the surface terrain. An *HVE* function, called *GetSurfaceInfo()*, is used to perform this calculation (see Figure 3), the same as for calculating tire radial force. These calculations require that each vertex be transformed from the

vehicle-fixed coordinate system to the earth-fixed coordinate system. The node deformation is then calculated in the earth-fixed coordinate system (see Figure 4). The earth-fixed node velocity is then calculated to determine the direction of the friction force. The earth-fixed normal component of the node deformation is calculated and applied to the friction coefficient to determine the frictional force component. Ten percent restitution is applied during unloading. Finally, the total force is calculated in the earth-fixed coordinate system and resolved in the vehicle-fixed coordinate system to be applied to the vehicle sprung mass (Figure 5). This procedure is performed for each vertex in the vehicle geometry file.

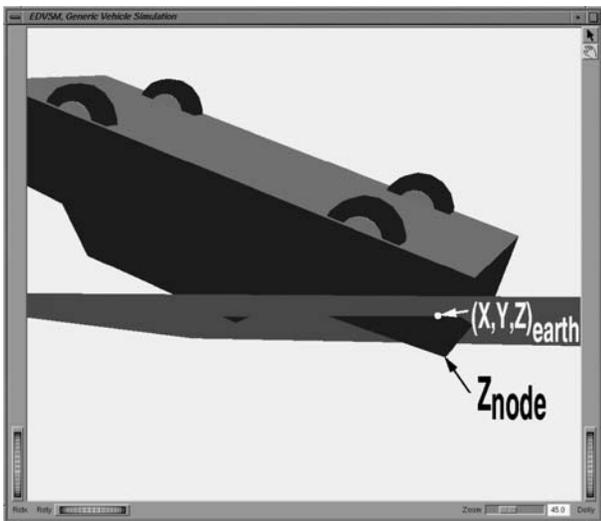


Figure 3 – Body vs ground interaction using GetSurfaceInfo()

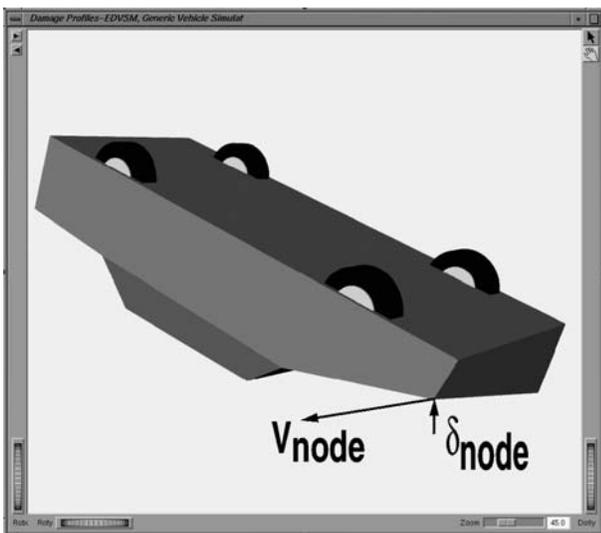


Figure 4 – Node deformation (displacement) and velocity

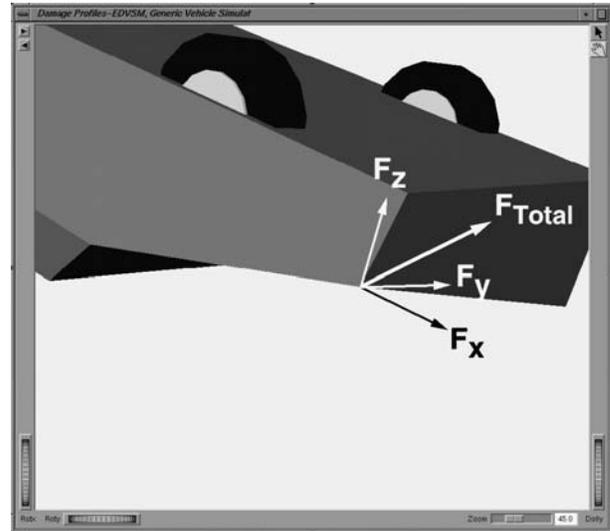


Figure 5 – Vehicle-fixed node force components

Forces and Moments on Sprung Mass

Once the 3-dimensional force components are known for each vertex location, it is a simple matter to calculate the total forces and moments on the sprung mass:

$$F_{xVehicle} = \sum_{i=1}^{NumNodes} F_{xNode}$$

$$F_{yVehicle} = \sum_{i=1}^{NumNodes} F_{yNode}$$

$$F_{zVehicle} = \sum_{i=1}^{NumNodes} F_{zNode}$$

$$F_{xVehicle} = \sum_{i=1}^{NumNodes} (F_{zNode} y_{Node} - F_{yNode} z_{Node})$$

$$F_{yVehicle} = \sum_{i=1}^{NumNodes} (F_{xNode} z_{Node} - F_{zNode} x_{Node})$$

$$F_{zVehicle} = \sum_{i=1}^{NumNodes} (F_{yNode} x_{Node} - F_{xNode} y_{Node})$$

Note that the vertex x,y,z coordinates used in the above calculations are based on the current node deformation. This is important for two reasons:

First, current node coordinates define the moment arm for a node’s moment calculations, thus, current deformation must be considered, and second, if the vehicle rolls twice (or more) on the same portion of the vehicle, the calculation procedure must remember the deformation associated with previous contact.

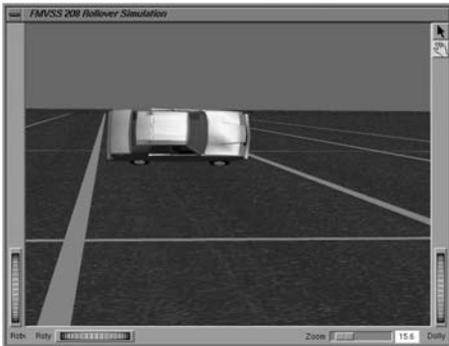


Figure 6  
 $t=0.9$  sec  
 Following  
 Launch

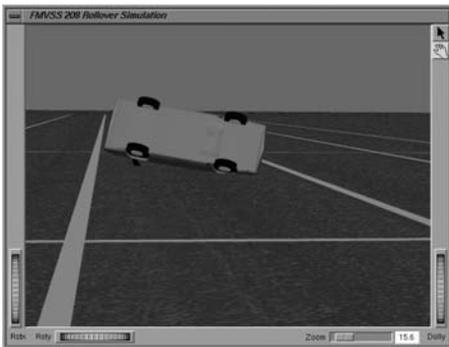


Figure 7  
 $t=1.4$  sec

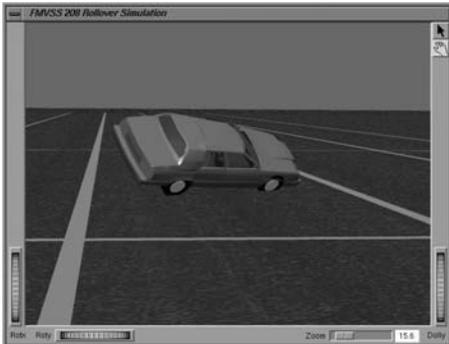


Figure 8  
 $t=3.0$  sec

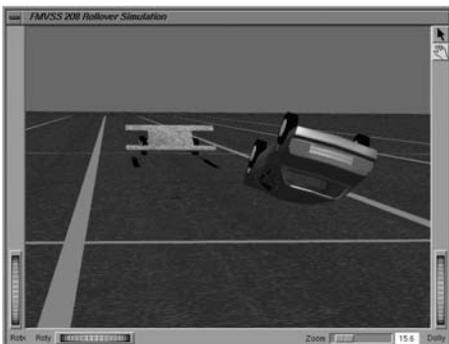


Figure 9  
 $t=5.1$  sec  
 (~rest)

Frames from simulation of FMVSS 208 Rollover Test.

A full description of the model was presented in March at the SAE International Congress and Exposition (SAE Paper No. 2000-01-0852; please contact EDC Customer Service if you would like to receive a free copy of the paper). The paper includes several examples of the use of 3-dimensional rollover simulation. One of the examples is an FMVSS rollover test (see Figures 6 though 10). Other examples include handling studies and real-world rollover crashes.

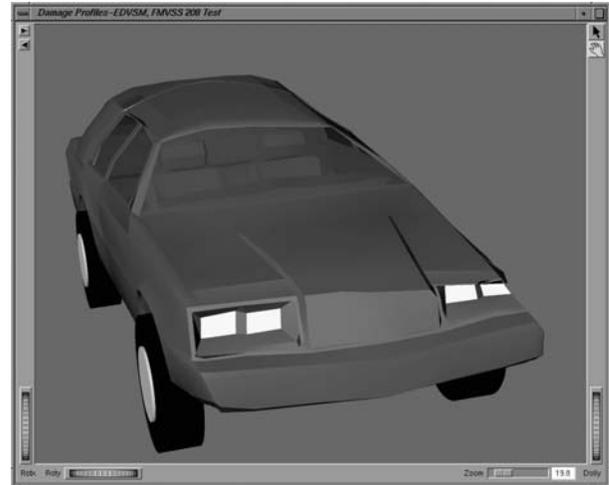


Figure 10 – Simulated vehicle damage resulting from FMVSS Rollover Test.

One final word of caution: Just because it can now be done does not mean it is easy! Although a typical rollover simulation performed for illustrative purposes may take little time (say, about an hour), it can take a significant amount of time to duplicate the exact number of rolls and vehicle damage from an actual case study or experiment.

## SAE 2001: Call for Papers

After 10 years of organizing the SAE Accident Reconstruction Session, Terry Day and Wesley Grimes have resigned their positions as Session Organizers.

The 2001 SAE Accident Reconstruction Sessions will be organized by Raymond M. Brach and Alan Thebert.

If you would like to submit an abstract for the 2001 Accident Reconstruction Session, please contact:

Alan Thebert  
 Tel: 810-786-6868  
 Fax: 810-786-0033  
 althebert@home.com

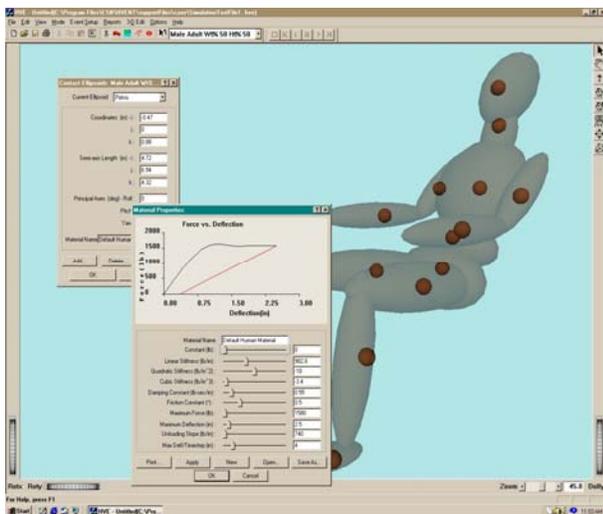
Raymond M. Brach,  
 Tel: 219-631-6127  
 Fax: 219-631-8355  
 raymond.m.brach.1@nd.edu

## Product Announcements

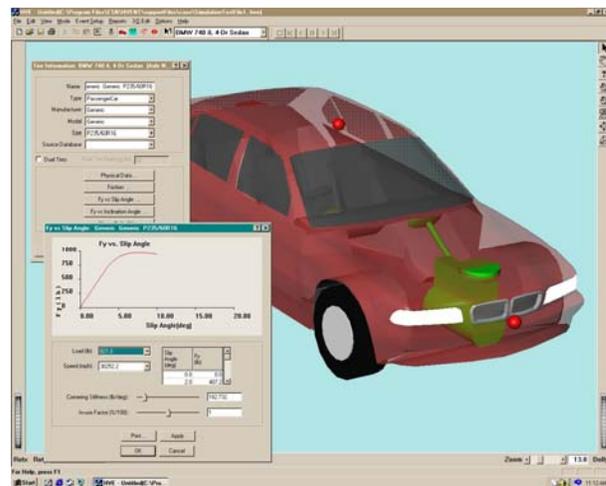
### PC Version of HVE

Version 4 of the *HVE* 3-D simulation environment was unveiled during the opening remarks at the 2000 *HVE* Forum. Previous versions of *HVE* have been available only on a Silicon Graphics workstation. *HVE* Version 4 will be fully compatible with Windows 95, 98, 2000 and NT operating systems, allowing users to install *HVE* directly on their own desktop PC, laptop or network server. Flexible licensing options will allow single- and multi-user configurations.

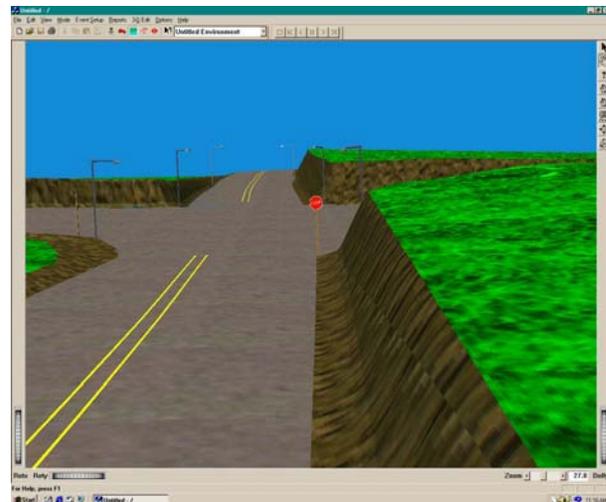
*HVE* Version 4 will run on an off-the-shelf PC configured with a Pentium (or similar) processor and standard OpenGL-compliant graphics card. Extremely fast graphics and processing performance may be obtained with the use of a Pentium III processor (or similar) and a medium-priced graphics card. If you wish to produce output directly to video tape, you can add a video card to your PC (if you don't already have one). Detailed minimum and recommended system requirements will be announced prior to the release of Version 4.



Pricing for *HVE* Version 4 has been substantially restructured from previous versions of *HVE*. A software bundle of *HVE* with *EDSMAC4* will now be available for under \$10,000. Additionally, a multi-license discount structure and floating network license capabilities provide companies with the opportunity to efficiently and affordably provide *HVE* access to a large number of employees.



*HVE* Version 4 was ported directly from *HVE* Version 2.2 (SGI workstation version), and provides users with the exact same functionality and reliability. The PC version of *HVE* will have slightly different viewers and dialogs, but *HVE* users (and even *HVE-2D* users) will quickly adapt to the new interface. *HVE* users with current Update/Technical Support policies will receive *HVE* Version 4 as part of their regular updates.



As more information about *HVE* Version 4 becomes available, it will be posted on our website at [www.edccorp.com](http://www.edccorp.com). There will be a *HVE* FAQ page in the Products Section. Several screenshots from Version 4 are already displayed on our home page. Contact Joe Canova, Director of Sales & Marketing, to receive answers to your questions and obtain pricing information. Joe may be reached via email at [canova@edccorp.com](mailto:canova@edccorp.com) or by phone at 503-644-4500 ext 200.

## SIMON<sup>®</sup>

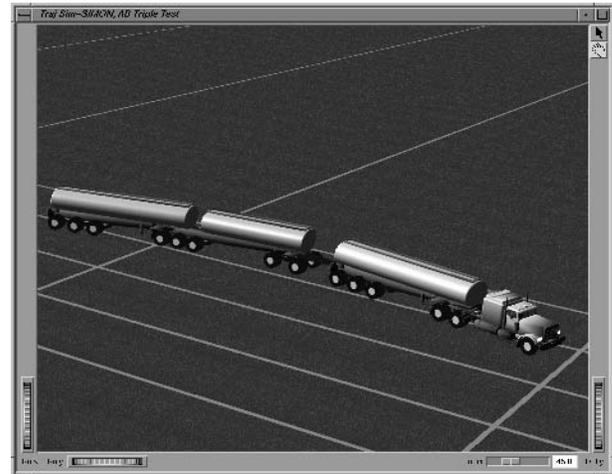
*SIMON* is an *HVE*-compatible dynamic simulation model of the response of one or more vehicles to driver inputs, factors related to the environment (e.g. terrain, atmosphere) and inter-vehicle collision(s). *SIMON* was built from the ground up employing the latest advances in software and simulation technology. *SIMON* was specifically designed to take advantage of the rich feature set available in the *HVE* simulation environment, including the *HVE* Brake Designer, Driver Model and Tire Blow-out Model. *SIMON* provides an advanced analysis capability for simulation studies involving single vehicles, articulated vehicles, collisions, vehicle design issues and safety research. A detailed overview of *SIMON*'s general features and capabilities, engineering model and software model was in a 2000 *HVE* Forum workshop.

*SIMON* is a newly developed simulation model and uses a new, general purpose 3-D dynamics engine developed by Engineering Dynamics Corporation. The dynamics engine allows a sprung mass with six degrees of freedom (x, y, z, roll, pitch, yaw) and unsprung masses with up to five degrees of freedom (axle roll, z, steer, left wheel spin, right wheel spin) per axle. Each vehicle model may have up to three axles (six axles for full trailers) and single or dual tires. Independent and solid axle suspensions are allowed.



Human occupants may also be included in *SIMON* simulations. Placing a human in a vehicle affects the vehicle inertial properties and weight distribution, however, human motion relative to the vehicle is not modeled.

*SIMON* may be used to simulate virtually any articulated multi-vehicle configuration, including A-trains, B-trains and AB-combinations. Articulated vehicles are created from individual unit vehicles using compatible front and rear connections. Full trailers may be created using a semi-trailer and front dolly.



For simulation studies involving vehicle-to-vehicle and vehicle-to-barrier collisions, *SIMON* uses the *DyMESH*<sup>®</sup> 3-D collision model to calculate 3-D forces and moments between the interacting meshes of each vehicle model. These forces and moments are included with aerodynamic, suspension and inter-vehicle connection forces calculated by *SIMON* at each time step. Vehicle body damage from a collision simulation is visualized as the 3-D mesh geometry changes during the event. Detailed information about *DyMESH* is available in SAE 1999-01-0104 "The *DyMESH* Method for 3-Dimensional Multi-Vehicle Collision Simulation" and SAE 2000-01-0844 "Validation of *DyMESH* for Vehicles vs. Barrier Collisions".



*SIMON* will be available to *HVE* users later this summer, after completion of a comprehensive matrix of validation tests. For more information about how to put *SIMON* to work for you, please contact the Sales Department or visit our website at [www.edccorp.com](http://www.edccorp.com).

## HVE Version 3 Available Soon

Version 3 of the *HVE* 3D simulation environment will be shipped the week of June 19, 2000. New functionality implemented in Version 3 will allow for simulation studies involving steer degree of freedom, change in weight distribution due to occupant loading, and events including more than 3 trailers. *HVE* users will notice several "clean-ups" have also been implemented.

*HVE* Version 3 has been compiled for both IRIX 6.3 and IRIX 6.5 operating systems. This has eliminated the interrupted message queue process and event reset problems, which may have been experienced by *HVE* users with the IRIX 6.5 operating system. *HVE* users will be sent the proper *HVE* version corresponding to their IRIX version.

*HVE* users still using IRIX 6.3 may now wish to update to IRIX 6.5. It is not mandatory that you do so in order to use *HVE*. If you are going to update to IRIX 6.5, please contact EDC Technical Support for basic instructions before proceeding with the update.

## Past Technical Sessions Now Available

EDC has reformatted and compiled all of the Technical Session, Tips, and Contributor's Corner columns from each Technical Newsletter, dating from Jan/Feb 1986 to present. The valuable information presented in these columns will increase your knowledge of the physics models and the *HVE*, *HVE-2D*, and *EDVAP* programs, as well as provide examples of powerful applications of the software.

## HVE-2D FAQ's

*This section contains answers to questions submitted to Technical Support by users of the new HVE-2D version 1.3.*

**Q. If I try to run an *EDCRASH* event without specifying damage profiles for one or both vehicles, I get an error message about a floating-point error. Why?**

A. This problem is resolved by downloading an *HVE-2D* physics software patch from the EDC ftp site. Detailed instructions on how to download this file have been mailed to all *HVE-2D* users who have received *HVE-2D* version 1.3. Please contact Technical Support if you need further assistance.

**Q. When I open the Damage Profile Preview Window for an *EDSMAC* simulation, the vehicle does not look damaged. Why?**

A. You must open both a Trajectory Simulation and a Damage Profile Preview Window for your event in the Playback Editor to view properly vehicle damage. Similar to playing a Trajectory Simulation, when you press the Play button in the Playback Editor you will see the damage displayed as a function of time. More detailed instructions on viewing damage are included in the file *HVE2d/damage.DOC*.

**Q. When I am in the Vehicle Editor and I click on the CG of the vehicle, I notice that "Import Vehicle Drawing" is now grayed out (compared to *HVE-2D* version 1.2). Why?**

A. With the implementation of vehicle damage profile viewing for *EDSMAC* events, the vehicle images used in the Event and Playback Editors had to be changed to specific discretized vehicle meshes. These vehicle images are scaled based upon vehicle dimensions entered by the user in the Vehicle Editor. It is no longer possible to import and use your own vehicle images in *HVE-2D* version 1.3.

**Q. I notice that the size of case files saved in version 1.3 are much larger than version 1.2 cases? Why? Also, how can I reduce the size of case files?**

A. If you save a case after executing the event, the output tracks (time-based data) now include the damage profiles, which is a large amount of additional data. If you want to minimize the size of your files to save space on your hard drive, press the reset button in the Event Editor before saving the file for the final time. This will erase your output tracks, but will not affect your event set-up. The next time you open the file again, simply run the event to recreate the output tracks.

**Q. I am using Windows NT as the operating system for my PC, and sometimes I can't enter values into the driver control tables (e.g. throttle, brakes, and steering) or the *EDCRASH* damage profile crush depth table. Why?**

A. When using the NT operating system, these tables may sometimes stop responding to user inputs. This problem is related to *HVE-2D*'s ability to run in Windows 3.1 (a 16-bit operating system). The workaround for this problem is to save your file and exit *HVE-2D*, then shut down and restart your computer. You can then restart *HVE-2D* and pick up where you left off.

## Contributor's Corner

*With the success of the White Paper Session at the 2000 HVE Forum last month, we were inspired to introduce the Contributor's Corner as a new feature of the EDC Technical Newsletter. This is another chance to share tips and techniques with fellow users!*

*James Sneddon, Senior Consultant and Lecturer at the Northwestern University Traffic Institute, has been invited to write the first column on a topic of interest to many HVE-2D users: enlarging windows and making videos of HVE-2D simulations. Topics of future columns are up to you. If you have an idea for a contribution that you would like to make to the newsletter, please contact Sydney Roberts to discuss the idea and request author instructions.*

### CREATING VIDEOS WITH HVE-2D

Videos of an HVE-2D simulation can be created with your PC and videocassette recorder. The videotape is an effective exhibit for trials, depositions, hearings and settlement proceedings.

To create a video, you will need to convert the computer's VGA signal to composite video or S-Video (Super Video). This will require special hardware. Peripheral devices such as TV View Gold and Iomega Buzz connect to your PC's parallel port or monitor output. The video output from these peripherals is connected to your videocassette recorder.

The introduction of DVD-ROM drives has spawned a new generation of PC video cards that include video-out. This new technology comes standard on many new PC's, and permits connecting a television or VCR directly to your PC. Due to the high resolution of DVD, S-Video is the preferred format. S-Video contains 400 lines of resolution, compared to 240 lines for standard video. To record this signal, a SVHS videocassette recorder is required. These models are less common than standard VHS VCR's, but models are available for around \$300.

Consider purchasing a VCR with a flying erase head and editing capabilities. This will prevent the "snow" effect when stopping or pausing the tape during recording.

Most SVHS videocassette recorders can record on both SVHS and standard VHS tapes. However, the SVHS tape can only be played in a SVHS videocassette recorder. Therefore, it may be necessary to dub the SVHS recording to standard VHS for distribution to attorneys and use in court.

Routing the video signal to your VCR can be hardware or software controlled, and may require changing your display properties. Since these procedures vary by device, familiarize yourself with your hardware.

Your video should display only the simulation view of the Playback Window. However, most video output hardware will display the entire desktop. Therefore, the taskbar, wallpaper, and all windows and icons will appear in your video unless you maximize the Playback Window. Many users have noticed "graffiti" when either maximizing or resizing the Playback Window. A black border appears instead of the "graffiti" when operating under Windows NT. This can be corrected by resetting the monitor resolution.

First, ensure that your monitor display resolution is set to 1024 by 768 pixels or greater. Check the display properties by double-clicking the display icon in the Windows Control Panel, or move the mouse to a blank area of your desktop and click the right mouse button. Select *Properties* from the pop-up menu.

The display properties window will appear. Click on the *Settings* tab, and check the screen area setting. Move the slider to the right to increase the resolution to 1024 by 768 pixels if necessary. Not all graphics cards support this resolution. If that is the case with your PC, you will not be able to move the slider past 800 by 600 pixels (or 640 by 480 pixels). If this occurs, check the color setting immediately to the left of the screen area settings. Reset the colors setting to *256 Colors* if not already set. Reducing the color setting may permit a higher screen resolution. Try again to set the screen resolution to 1024 by 768 pixels.

Next, open the Playback Window in HVE-2D. The size of the Playback Window will be proportional to the screen area at the time it is opened. With the Playback Window open, reset the screen area to 640 by 480 pixels by using the procedure previously described. The Playback Window will now be larger than the desktop, but can be maximized without the "graffiti" appearing. The maximize button near the right side of the title bar may now be off the desktop. You can still maximize the window by double-clicking the title bar, or click the icon in the upper left corner of the window, and select *maximize* from the pop-up menu. Scale and center the view in the Playback Window as desired for your video.

The Windows taskbar will also appear in your video unless you hide it from view. To hide the taskbar, move the mouse pointer over the edge of the

taskbar. As it passes over the edge, the pointer will change from a normal select (single arrow) to a vertical resize (double arrow). With the vertical resize pointer visible, click and drag the top of the taskbar downward. The taskbar will change to a thin gray line. To restore the taskbar, move the pointer over the taskbar until the vertical resize pointer appears. Click and drag the taskbar upward until the taskbar returns.

To play the simulation in the *HVE-2D* Playback Window, the play button must be clicked in the Playback Editor. However, with the Playback Window maximized, the playback editor is not visible. This requires maximizing the Playback Window after clicking the play button in the Playback Editor. To prevent the simulation from starting immediately, delay the start of the simulation. An initial time delay of five seconds usually provides sufficient time.

Enter an initial time delay by inputting a value for  $dt$  ( $T_{\text{delay}}$ ) in the Variable Output Window. This will have to be done for each active trajectory simulation in the Playback Window. If a trajectory simulation is already delayed, add the initial time delay to the current value for  $dt$ .

With an output signal routed to the VCR, click the play button in the Playback Editor; maximize the Playback Window; move the mouse pointer off the desktop (else it will appear in your video); and press record button on the VCR. These actions must be completed, and the VCR must be recording before the simulation begins. Use the pause function on the VCR to ensure that it begins recording as soon as the record button is depressed, and to provide seamless transition between views.

Your selection of colors for the vehicles and environment will affect the quality of your video. Pure colors such as red, blue and green tend to "bleed" into the adjacent pixels when viewed on a television. The vehicles appear to glow on the TV screen. To minimize this effect, select darker colors for the vehicles. In the vehicle viewer, click on the center of mass, and select Color from the pop-up menu. A pallet of forty-eight basic colors will appear. This pallet includes darker colors that will work better when creating videos. Darker colors should also be used when importing an environment file.

Use presentation software such as PowerPoint to add title and narrative slides to your video. You can display slides in "full screen," and record them to videotape. Then pause the video, and switch to *HVE-2D* to record your simulation. Your final product will be a professional looking presentation.

## Top Ten "Wish List"

The following is the Top 10 features lists produced by the User's Groups at the 2000 *HVE* Forum:

### *HVE*

1. Output Reports should include every parameter used in the simulation (e.g., *EDSMAC4* currently does not show accelerometer locations).
2. Set up an *HVE* User's Group page on the EDC web site.
3. Display all terrain information in the Environment Data report (Note: this can result in a huge report because the terrain often contains several thousand vertices!).
4. Allow user to attach camera Look At coordinates to a moving object.
5. Allow vehicle lights (headlights, taillights, brake lights, blinkers).
6. Allow the user to display tire track trace in Trajectory Simulations.
7. Undo.
8. Display an icon at vehicle connection locations.
9. Allow dynamic shifting of payloads.
10. Allow user to select shift points as a function of engine speed.

### *HVE-2D*

- 1) More robust print routine. (print preview; scale to fit; center plot; select print area.)
- 2) Improved tutorials.
- 3) Impact Configuration Screen in *EDCRASH* (like *EDVAP*).
- 4) FAQ on website. Links to read me files, bug fixes, workarounds, etc.
- 5) Extend *EDSMAC* and *EDCRASH* to include 3 axles, and dual tires & trailers.
- 6) Check for Newton's 3<sup>rd</sup> Law for direction (like *EDVAP*).
- 7) Copy tire data to all tires.
- 8) Enter *EDCRASH* output directly into *EDSMAC*.
- 9) Export trajectory simulation to .dxf file and .avi files.
- 10) Permit more than two vehicles in *EDSMAC*.

## Technical Support

Technical Support can be reached by telephone between 8:00 AM and 5:00 PM PST at 503-644-4500 and by email at [support@edccorp.com](mailto:support@edccorp.com). Please be ready to provide your user ID# , your name, your company name and contact phone number when you call or include it directly in your email.

## EDC's Website

Make sure to visit the EDC web site at <http://www.edccorp.com> to check out upcoming events and new products, and to visit our library of technical papers and other reference materials. You can order all of these publications from EDC, many of them free of charge.

## Training Courses

### ***New EDC Training:***

**Theoretical and Applied Vehicle Dynamics** extends the theory of the SAE course and includes direct applications using the *HVE* three-dimensional simulation environment as well as a solid theoretical background for such simulations. The course is focused toward those with an advanced interest in vehicle dynamics, accident reconstruction and simulation.

The course will take place at the California State University, Northridge (North of Los Angeles). We will soon be mailing out a detailed course schedule and outline. If you would like to sign up for the course now, please call EDC.

### Engineering Dynamics Corporation Training Course

Theoretical and Applied Vehicle Dynamics

Los Angeles, CA ..... August 21 - 23, 2000

### ***Other EDC Training***

EDC provides excellent 1-week training courses on the use of EDC Reconstruction and Simulation software. Even long-time users agree that the courses are extremely beneficial and challenging.

The courses are designed to investigate fully the program's inner workings. Lectures are full of helpful hints gained from years of experience. Our last two courses have been full, so register early to avoid missing out!

### Engineering Dynamics Corporation Training Courses

EDC Simulations

Los Angeles, CA ..... January 22-26, 2001

EDC Reconstruction

Coral Gables, FL ..... November 13-17, 2000

2001 *HVE* Forum

Santa Fe, NM ..... Apr/May, 2001

### ***NUTI Training***

NUTI offers four different courses using *EDVAP* and/or *HVE-2D*. For more information about the courses and registration, please contact NUTI at (800) 323-4011.

### Northwestern University Traffic Institute Training Courses

MATAR (*EDCRASH*)

Evanston, IL ..... September 25 - 29, 2000

COMPTAR I (*EDCRASH*)

Evanston, IL ..... September 18 - 22, 2000

COMPTAR III (*EDSMAC*)

Evanston, IL ..... October 2 - 6, 2000

COMPTAR IV (*EDCRASH* & *EDSMAC* Extended)

Evanston, IL ..... call for scheduling

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