WINTER 2014 ENGINEERING DYNAMICS CORPORATION

Technical Newsletter

Available on-line in the EDC Library at www.edccorp.com

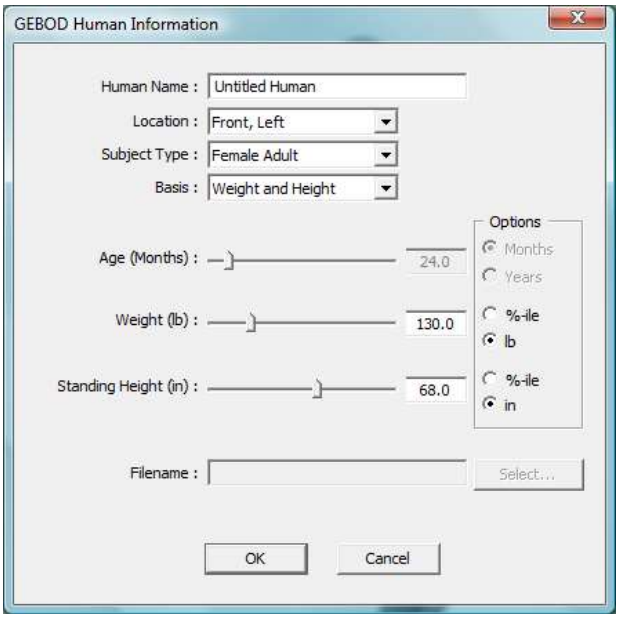
HVE Version 10 Now Shipping

HVE Version 10 was released on February 3rd, 2014, and was shipped automatically to supported *HVE* and *HVE-2D* users. A large number of new features and capabilities are found in Version 10, including:

- New Environment Information Dialog
- *DyMESH* Wheel Impact Model
- Vehicle Light System
- Vehicle Textures
- GEBOD Human Information Dialog
- Environment Sky Dome
- Updated Texture Editor

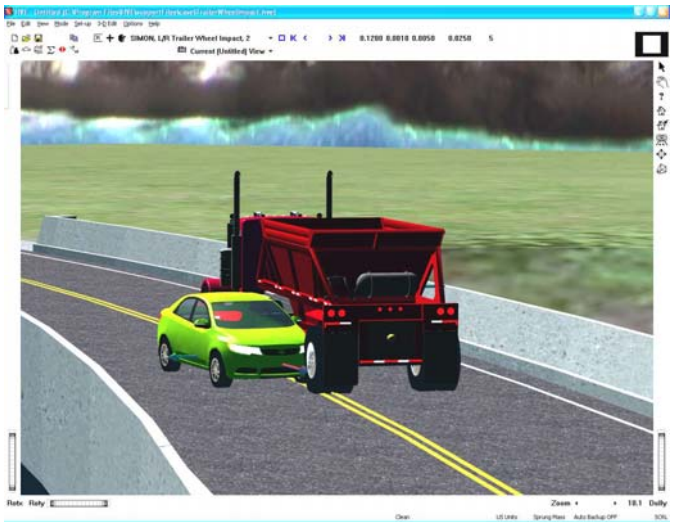
… and *much* more!

More information about these and other new features and capabilities included in *HVE*, *HVE-2D* and *HVE-CSI* may be found online at www.edccorp.com/Version10, as well as the Release Notes included with the software. The new *HVE* Vehicle Light System is the subject of the Technical Session in this editon of the Newsletter (article starts on page 2).

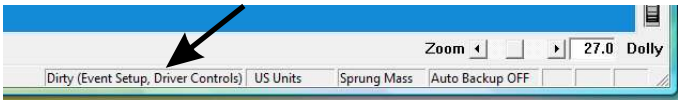


Humans are now created using a custom version of GEBOD integrated directly into HVE's Human Editor.

Vehicles may now have textures. Visualizing the undercarriage is a great example.



The DyMESH Wheel Impact model rigorously calculates the forces and moments produced when a (spinning) wheel impacts another object.



A new member in HVE's status bar tells the user about any data changes made since an event was last executed. In this example, the user has changed the driver controls since the event was last executed.

Technical Session

This Technical Session is a backgrounder for the new *HVE* Vehicle Light System model introduced with *HVE* Version 10. We describe the underlying technology as well as the user interface.

Technology

The *HVE* Vehicle Light System model uses the vehicle geometry file to supply a complete light system for any type of vehicle. This light system is controlled by *HVE* program functions and user inputs.

The light system may include any light type found on modern highway vehicles:

- Headlights (high and low beam)
- Driving Lights
- Fog Lights
- Running Lights
- Taillights
- Brake Lights
- Backup Lights
- Turn Signals
- Emergency Flashers

Lights are identified in the geometry file by a series of descriptive "light tags" that define the type of light, the light's geometry and location, and the light's attributes. The details for adding lights to a geometry file are provided in a separate document. (Please contact EDC Technical Support if you would like to obtain a copy of this document.)

Headlights, driving lights and fog lights cast a beam of light onto surfaces in the environment as well as onto humans and other vehicles. The resulting surface illumination quality is affected by the size of the polygons: Smaller polygons are required for an accurate depiction of the illuminated surface.

Most computer graphics cards place a limit of 8 to 10 individual light sources for the computer system. This limits the number of headlights, driving lights and fog lights that may be displayed simultaneously by the *HVE* light system model.

Light types other than headlights, driving lights and fog lights are made visible by increasing their emissive color attribute. They do not cast light onto surfaces. This is reasonable given that these types of lights produce very little surface illumination, yet are quite visible when activated. Because these light types are not included as light sources by the graphics card, they are not considered in the limitation on headlights, driving lights and fog lights, described above.

In the Vehicle Editor, when the user adds a vehicle and *HVE* reads the vehicle's geometry file, the file is scanned for light system tags. These tags and their associated attributes are used to create a list of lights for the vehicle. Once a vehicle has been added to a case, a list of these lights and their associated attributes may be displayed by clicking on the vehicle's CG and selecting Lights… from the Sprung Mass menu. A typical Vehicle Light System dialog is displayed in Figure 1.

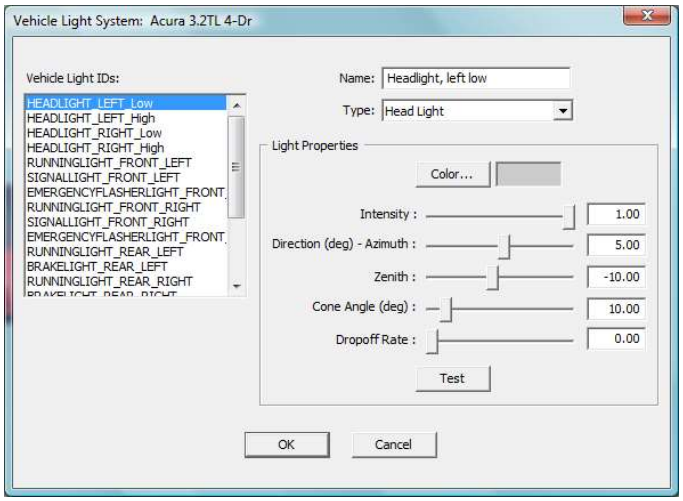


Figure 1 - Vehicle Light System dialog

Light System Dialog

Vehicle light properties are displayed and edited in the Vehicle Editor's Light System dialog. The components of the Vehicle Light System dialog are:

- **Vehicle Light ID List –** A listbox that displays all of the lights found in the geometry file
- **Name –** User-editable name for the light currently selected in the Light ID listbox. A default name is automatically assigned according to the light tag.
- **Type –** The light type (see above for a list of the available light types) for the selected light

The Light Properties group box includes all of the user-editable properties for the currently selected light:

- **Color –** The light color. The light color may be edited using a standard HVE color editor dialog.
- **Intensity –** The brightness of the light. 0 is the same as off; 1 is maximum brightness. Some lights have multiple intensities, e.g., when a taillight is on, the Intensity may be about 0.40; when the brakes are on, the light's Intensity increases to, say, 0.90.

The remaining properties affect only light types that cast light on surfaces: Headlights, Driving Lights and Fog Lights. These properties are:

- **Direction, Azimuth –** The angle of the light beam in the vehicle-fixed x,y plane; the default for low beams is + 5 degrees for vehicles with left-side drivers; -5 degrees for vehicles with drivers on the right side. The default for high beams is 0 degrees.
- **Direction, Zenith –** The angle of the light beam in the vehicle-fixed vertical plane; the default for low beams is -10 degrees (downward). The default for high beams is 0 degrees.
- **Cone Angle –** The included angle of the cone of light; the default is 10 degrees.
- **Dropoff Rate –** The light intensity is brightest in the direction of the light beam as defined by the Azimuth and Zenith angles, and may decrease towards the limit defined by the cone angle. A Dropoff rate of 0 (default) defines a sudden change from maximum intensity to zero intensity at the border defined by the cone angle. A dropoff rate greater than 0 defines a gradual decrease in intensity.

The Test button allows the user to see the brightness effect of each light.

Vehicle Light Set-up Dialog

The lights are activated during the event set-up process using the Set-up, Driver Controls dialog. This makes sense because individual lights are controlled by the driver, just like a steering wheel input or brake pedal application. In fact, as we'll see below, these driver controls are also part of the light activation process.

To set up the vehicle's light system, perform the following steps:

- Add an event using a vehicle that has a light system
- Select the vehicle and choose Driver Controls from the Set-up menu. The Driver Controls tabbed dialog is displayed.
- Click the Lights tab. The Lights Set-up page is displayed (see Figure 2).

The Lights Set-up page has the following components:

- **Light Name List –** A list of all the vehicle lights

You will recognize the Light Name List; you prepared this list of lights in the Vehicle Editor.

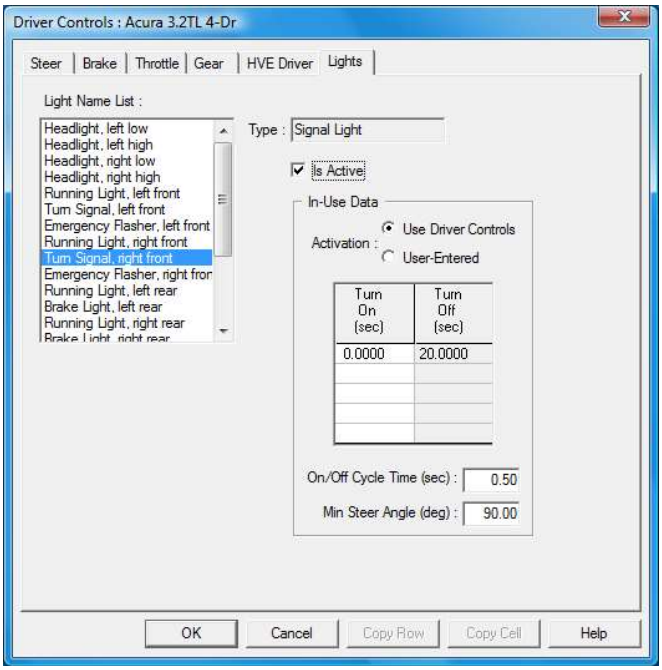


Figure 2 - Vehicle Lights Set-up dialog, showing the activation of the right front turn signal

NOTE: This listbox allows multiple selection using both Shift + Select (the first light, the last light and all those in between are included in the selection), and Ctrl + Select (only the selected lights are included). These multiple selection methods allow the user to set up

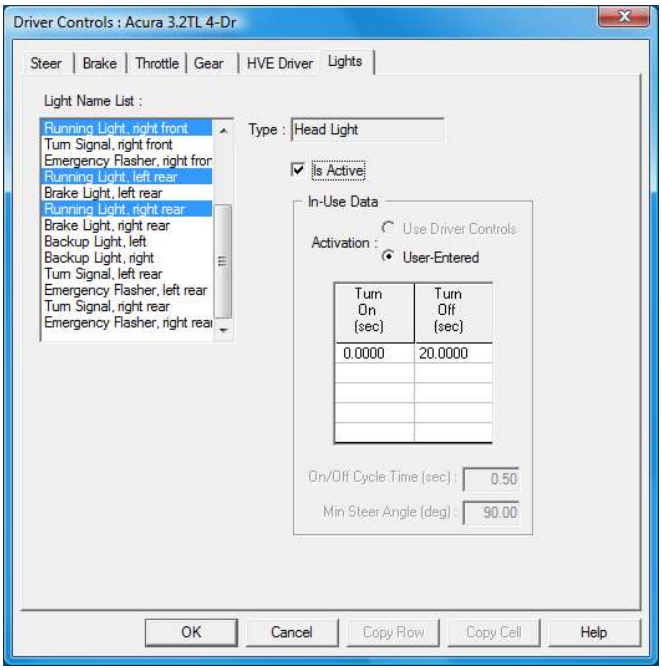


Figure 3 - Vehicle Lights Set-up dialog, showing multiple selection of headlights and running lights

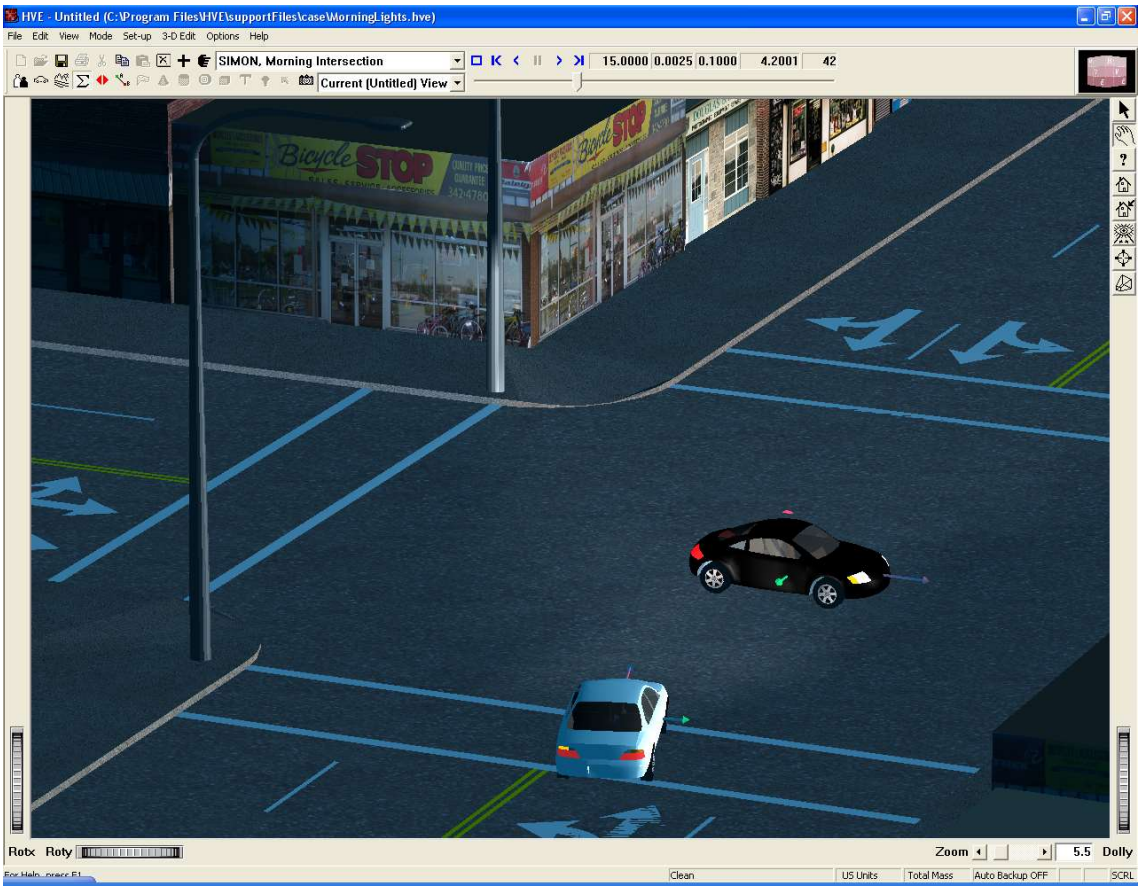


Figure 4 - An example of vehicle lights and morning sunlight

several lights at once. For example, if the user wishes to simultaneously activate the headlights and running lights, pressing Ctrl while selecting all the low beam headlights and all the running lights can activate all these lights at once. The Turn On/Turn Off times will apply to all the lights, as shown in Figure 3. The same is true for front and rear turn signals and/or brake lights. This is a huge time-saver!

NOTE: The selection process is smart enough to know that some light types cannot be paired with other light types. For example, it probably doesn't make sense to use multiple selection for headlights and brake lights. When incompatible light types are multi-selected, the first light selected determines the compatibility of other lights.

Continue setting up the lights:

- Select one or more lights from the Light Name List. The light Type is displayed.
- Click on the Is Active check box. This enables the In-Use Data for the selected light.

Depending on the light type, some or all of the following attributes are enabled:

- **Activation –** This radio button allows the user to choose how the light is turned on and off. The options are:
  - **Use Driver Controls –** For brake lights and backup lights, activation is controlled by applying the brakes and shifting into reverse gear, respectively. For turn signals, the light is turned on according to the user-entered table; it is turned off when the steering is returned towards the straight-ahead position (i.e., de-activated by the steering wheel angle).
  - **User-entered –** All other light types are manually activated by the Turn On/Turn Off times assigned in the user-entered table (brake lights, backup lights and turn signals may also use this manual option).
  - **On/Off Cycle Time –** For lights that flash on and off (turn signals and emergency flashers), this value sets the on/off frequency.

- **Minimum Steer Angle –** For turn signals, the steering wheel must be steered more than this amount to activate the behavior that turns the signal off when the steering wheel is returned towards straight ahead. Note that this is exactly the same behavior as an actual vehicle.

Implementation

The Light System Model is included in *HVE* and *HVE-2D*. To achieve the greatest benefit, *HVE-2D* users will need to have the 3-D Viewers option.

The Light System model is implemented for selected *HVE*-compatible simulation models, currently *SIMON* and *EDSMAC4.* Note that the Light System model cannot be implemented for reconstruction-type models, such as *EDCRASH,* because these models do not operate in the time domain (lights turn on and off as a function of time).

Each *HVE*-compatible simulation model that supports lights has a routine that activates each light according to the event set-up information described above.

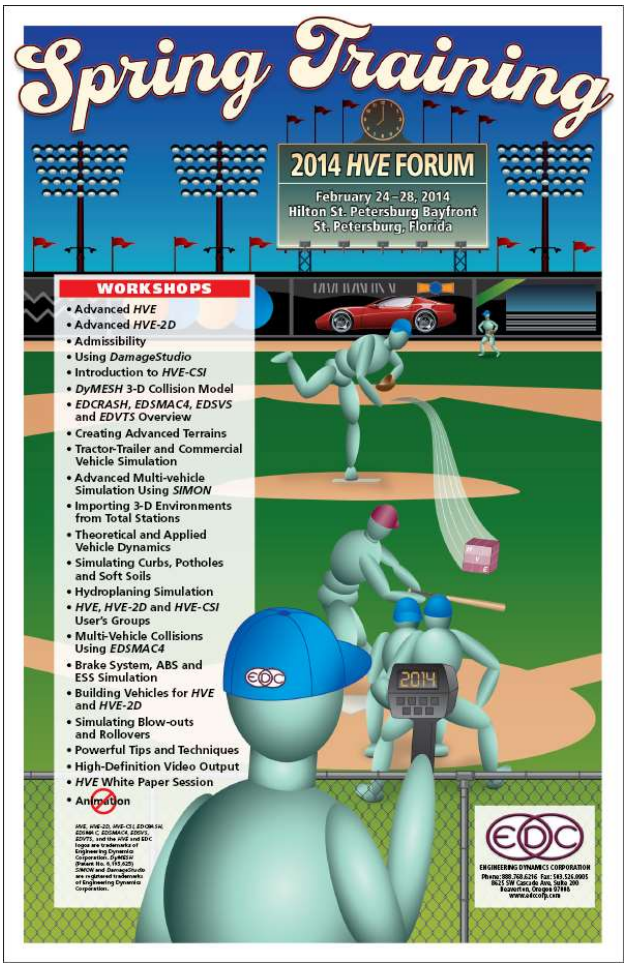
Individual lights are controlled (turned on and off) by results stored in the event's output tracks. Therefore, the output time interval plays a role: If the event's output interval is set to 1.0 second and the cycle time for a turn signal is set to 0.2 seconds, the light will fail to blink or, perhaps, blink sporadically. The default cycle time of 0.5 seconds and output interval of 0.1 seconds provides sufficient resolution, although the output interval can be reduced if desired.

An Example

An example of an event that includes vehicle lights, as well as morning sunlight, is shown in Figure 4. In this example, the white Acura is turning left as the black Audi crosses its path. The event occurs at 9 AM. Morning sunlight (coming from the right) is reflecting on the east side of the buildings and on the right side of the Acura. The Acura's headlights and running lights are on, as well as its left blinker. Its headlights are illuminating the side of the Audi, as well as the road surface and the pole and building across the street.

Rate This Tech Session

Please go to www.edccorp.com/TechSessionRating to tell us if you liked this Technical Session and to suggest other topics you'd like to see in future technical sessions. Thank you!



2014 *HVE* Forum
February 24 - 28, 2014
St Petersburg, FL

The 2014 *HVE* Forum offers a wide selection of training workshops for beginning, intermediate and advanced users, along with User's Group Meetings, *HVE* White Paper Session and more. Attend this excellent opportunity to learn how to use the full features and capabilities of your *HVE*, *HVE-2D* or *HVE-CSI* software, while expanding your network of resources at the same time! Another great benefit is pre-approval for 20 - 35 ACTAR CEUs depending upon your workshop selection over a 3 or 5 day period.

A Beautiful Venue Location!

Check out this perfect location for the 2014 *HVE* Forum:

Hilton St. Petersburg Bayfront
333 1st St South
St. Petersburg, FL 33701

Special Topic For 2014: Admissibility

A new Forum workshop is being developed to provide a clear framework for *HVE* users wishing to have their *HVE* results admitted in state and federal courts. The focus of this workshop is on admissibility of *HVE* results, not on the more general subject of giving expert testimony.

The material covered in the workshop will include:

- Qualifying the Expert
- Education of Attorneys and Judges
- Daubert Challenge of Witness Expertise
- Useful References

This session will be held on Wednesday during the lunch break to allow everyone at the 2014 *HVE* Forum the opportunity to attend. A box lunch will be provided.

HVE White Paper Session

Three new White Papers are scheduled for the 2014 *HVE* Forum:

- *Observational Validation of the SIMON Steer Degree-of-Freedom Model: A Case Study* - *SIMON*'s Steer Degree of Freedom model was used to study the path of a vehicle that had traveled down an embankment over irregular terrain after leaving the road. The goal was to help determine the vehicle's direction of travel when it left the road (in particular, was the event staged in a fraudulent attempt to mislead others?).
- *Comparison of HVE simulations to NHTSA Full Frontal Barrier Testing: An Analysis of 3D and 2D Stiffness Coefficients in SIMON and EDSMAC4* - This paper compares HVE's stiffness coefficients for selected vehicles with results from actual crash tests.
- *Using Barrier Load Cell Data to Generate Stiffness Coefficients* - This paper provides a modeling approach for calculating 3rd-order, 3-dimensional stiffness coefficients from NHTSA crash test data.

HVE Advanced Workshop Overview

- *HVE* Light System Details - An in-depth look at the new *HVE* Vehicle Light System, workshop attendees will learn the technical details and get hands-on experience working with vehicle light systems. In addition, each attendee will add a light system to an existing vehicle.
- Power Debugging - For the real *HVE* power user, learn the tried-and-true method for identifying the cause and the solution for an ill-behaving simulation.
- *SIMON* Steer Degree-of-Freedom - Workshop attendees will get an in-depth look at the mechanical model employed in the SIMON Steer DOF model. Attendees will also set up and execute various simulations that illustrate and take full advantage of the Steer DOF model.
- *HVE DyMESH* Wheel Impact Model - Attendees will see the mechanical model employed by the *DyMESH* Wheel Impact model, as well as learn how to choose input values. Attendees will also learn about debugging *DyMESH* Wheel Impact results.
- *HVE* Electronic Sability Systems - The workshop provides an in-depth look at the Yaw Stability System (YSS) and Traction Control System (TCS) model employed by *HVE*. Because these systems are encountered more and more often, their understanding and use is becoming essential.

HVE-2D Advanced Workshop Overview

The Advanced *HVE-2D* Workshops are for the experienced user who already has a fundamental knowledge of the user interface and is looking to go beyond the software basics. These sessions will cover the enhancements introduced in the latest versions of *HVE-2D*. Including:

- Vehicle Light Systems - Workshop attendees will learn the technical details and get hands-on experience working with vehicle light systems.
- Damage Studio - Attendees will use DamageStudio to analyze vehicle damage and associated colision dynamics.
- Path Follower - Attendees will learn how to apply the *HVE* Driver Model's Path Follower option.
- Hydroplane Model - Students will set up and execute simulations involving vehicle hydroplaning.
- Case Study - Attendees will reconstruct real world case studies with special emphasis placed on simulations using *EDSMAC4* and the advanced features of that program. Building a custom *HVE* vehicle and editing the geometry file to permit use of the Vehicle Light Systems will also be covered.
- Playback Editor - Users will combine the trajectory simulations from multiple events in the Playback Editor and edit the timing to create a single coherent sequence. The Video Creator will be used to produce a video file of the simulation.

Workshop Registration

There is still time to sign up! Workshop schedules, descriptions and registration forms are available to download from the 2014 *HVE* Forum pages at www.edccorp.com/2014HVEForum.

HVE and *HVE-2D* F.A.Q.

This section contains answers to frequently asked questions submitted to EDC Technical Support staff by *HVE* and *HVE-2D* users.

Q: Why do I receive the following message when I attempt to close the Video Creator window, "Closing the Video Creator Window will reset the current Active Trajectory Simulation table"?

A: The Video Creator window now resets the Active Trajectory Simulation table if the user closes the window. This change was made because closing the Video Creator and then deleting a Trajectory Simulation and re-opening the Video Creator resulted in corrupt data (the Video Creator relied upon the Trajectory Simulation which no longer existed). Saving the case file would result in a corrupt file.

Q: Why am I receiving the following message when attempting to launch HVE, "Publisher Could Not Be Verified"?

A: Right-click on the file you are launching and select Properties. Look at the bottom of the General tab, just below the checkboxes for Read-only and Hidden attributes. If you see this message: "Security: This file came from another computer and might be blocked to help protect this computer." Click the Unblock button next to the message; the problem should be resolved. (This frequently occurs when you download a file from the internet. Windows sets a flag on the file to mark it as suspicious, which results in the message.)

Q: Why do I receive the following error message, "Error copying temp file to case file. The reported error was: Not enough storage is available to process the command"?

A: The error message is informing you that you have run out of disk space. This message is triggered while either saving your case file or when *HVE* performs an Auto-Backup. The only solution is to free up some disk space on your computer. Also be aware that *HVE*'s Auto-Backup feature saves the previous ten case file images. Since an *HVE* case file can be quite large, you can very quickly use up a lot of disk storage.

Q: Some of my HVE dialogs won't open. Two examples are the Help, Tech Support dialog and the Event Set-up, Driver Control tables. What's up?

A: These dialogs contain an Excel-style table. Any dialog that includes a table requires a Microsoft system file, named "Msflxgrd.ocx". On a 32-bit machine, the file should be in the C:\WINDOWS\SYSTEM32 folder. On a 64-bit machine, the file should be in the C:\WINDOWS\SysWOW64 folder. If this file is missing, you can download it from Microsoft. (NOTE: This file may be missing if you built your own computer.)

Q: While setting up a SIMON collision event with a wheel impact, I am unable to select the DyMESH Wheel Impact option (it is disabled). What's wrong?

A: The *DyMESH* Wheel Impact option is enabled only when the *DyMESH* collision option is enabled. Choose Options, *DyMESH* to display the *DYMESH* options dialog and turn on *DyMESH*. Then, set up the *DyMESH* wheel impact model.

Q: I can't find the Add Playback Window option in the Options menu. How do I add a Playback Window?

A: As of Version 9, the Playback Window has been replaced by the Video Creator. The Video Creator is selected from the Files menu.

Q: I am using EDSMAC4 and trying to decelerate a vehicle at 0.5 Gs. When I enter a % Available Friction of 0.5 for each wheel in the Brake Table, the deceleration is less that I'm expecting. What's wrong?

A: The value you enter in the Brake Table is *not* the deceleration rate, it is (as its name suggests) the percentage of the available tire-road friction that is used by that tire. To achieve the desired vehicle deceleration rate, divide the desired deceleration rate by the (slide) coefficient of friction (i.e., decel / μ) for each tire and enter that result into the table for each tire.

Q: Why are some of my data columns within the Driver Control tables missing or cut off?

A: The data cell size in *HVE*'s tables is pre-defined. If you increase the computer's default text size, the text will occupy more space than the table's data cell provides, causing the value to be cut off. A quick fix is to manually adjusts the column width each time you enter tabular data. The only permanent solution is to set your computers text size back to the default size.

Visit the Support section of www.edccorp.com to download software updates and to view more FAQ's from the Knowledge Base.

EDC Training Courses

EDC Reconstruction & Simulations

EDC offers excellent one-week courses on the use of the *EDCRASH* reconstruction program and the *EDSMAC*, *EDSMAC4*, *EDSVS* and *EDVTS* simulation programs. The **EDC Reconstruction** and the **EDC Simulations** courses are designed to fully investigate the inner workings of the physics programs. Lectures are full of helpful hints gained from years of experience. During the course, students will use the physics programs to complete several workshops highlighting the capabilities of each program discussed in the course.

All users of *HVE* and *HVE-2D* agree that these courses are extremely beneficial and challenging. It's the fastest way to learn what you really need to know – how to effectively use the physics programs and get the right results. *Note: These courses focus on the physics programs, not on the user interface. For courses on using HVE, HVE-2D or HVE-CSI, check out the HVE Forum.*

HVE Forum

The ***HVE* Forum** offers numerous workshops designed to help *HVE, HVE-2D* and *HVE-CSI* users improve their modeling and application skills. By participating in workshops, attendees learn new techniques and also how to use the latest advancements in the software. The *HVE* Forum is also a great opportunity to meet other users and expand your network of resources.

Engineering Dynamics Corporation
Training Course Schedule

EDC Reconstruction

Miami, FL . . . . . November 10 - 14, 2014
Los Angeles, CA . . . . . January 2016

EDC Simulations

Los Angeles, CA . . . . . January 19 - 23, 2015
Miami, FL . . . . . November 2015

Theoretical & Applied Vehicle Dynamics

Upon Request

2014 *HVE* FORUM

St. Petersburg, FL . . . . . February 24 - 28, 2014

Vehicle Dynamics

The **Theoretical & Applied Vehicle Dynamics** course extends the scope of a general vehicle dynamics discussion by including several direct applications using the *SIMON* vehicle dynamics simulation program within *HVE* and providing a solid theoretical background for such simulations. The course is focused towards engineers and safety researchers with an interest in an understanding of vehicle dynamics and automotive chassis systems development.

Course Registration

To register for a course, download a registration form from the Training page at edccorp.com or contact EDC Customer Service at 888-768-6216 or by email to training@edccorp.com. All courses are eligible for Continuing Education Units and ACTAR credits.

HVE Training Partners

HVE, *HVE-2D* and *HVE-CSI* users looking to improve their skills, but unable to attend one of EDC's regularly scheduled courses, can contact an *HVE* Training Partner for assistance. *HVE* Training Partners are experienced *HVE* and *HVE-2D* users who offer introductory and custom training courses on the use of *HVE*, *HVE-2D*, *HVE-CSI* and compatible physics programs.

HVE Discussion Groups

Websites hosted by experienced *HVE* Users offer information about using *HVE* as well as moderated online discussions with other users. Be sure to visit:

AccidentReconOnline.com - Online training courses and also the DiscoverHVE video tutorials and discussion group hosted by Wes Grimes of Collision Engineering Associates.

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