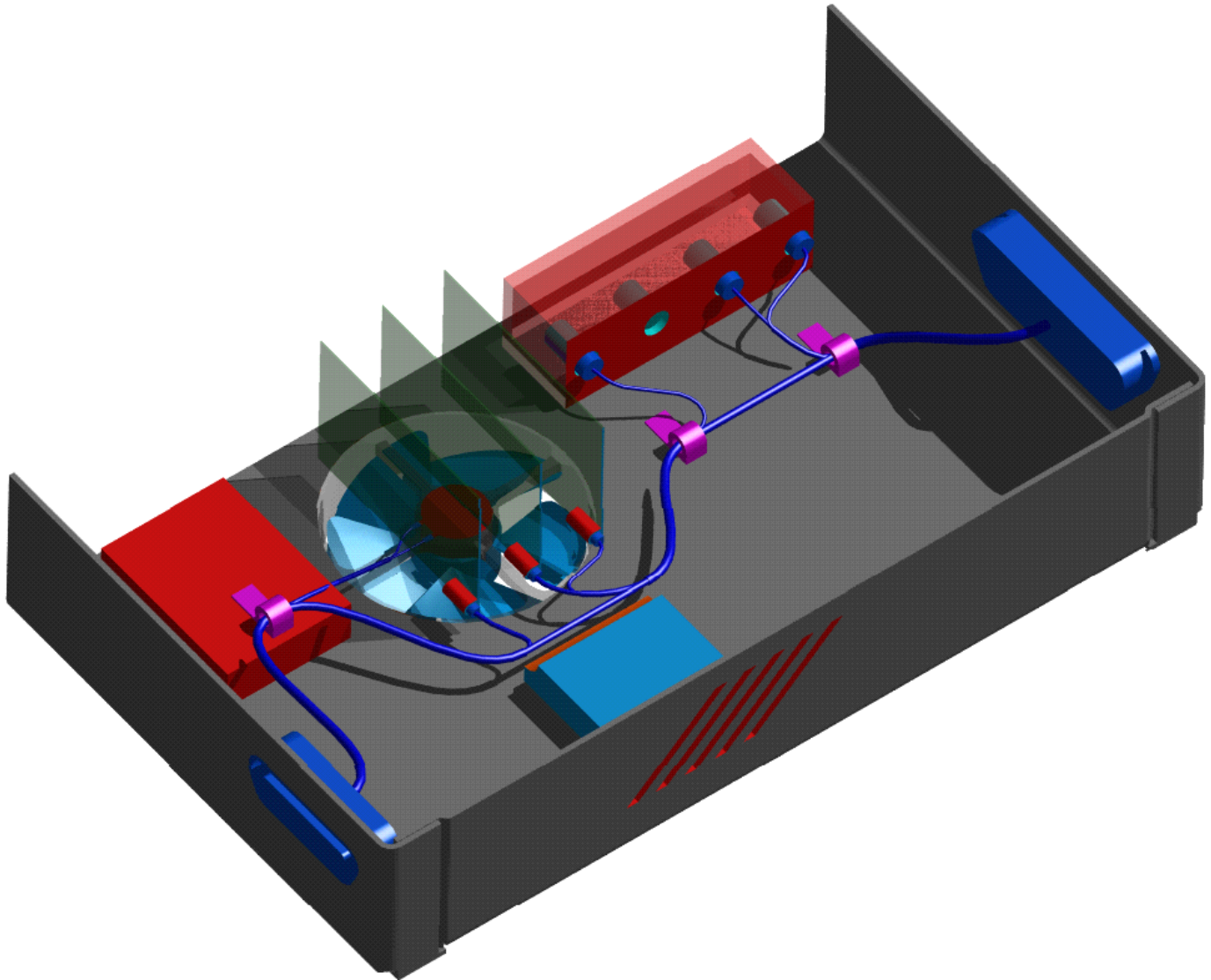


I-DEAS MASTER SERIES HARNESS DEMONSTRATION I-DEAS MS6



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Technical Marketing

Getting Started

The files for the harness presentation:

Start model file (unix)	(gzipped)	HD.mf1.gz
Start model file (unix)	(gzipped)	HD.mf2.gz
Schematic drafting file		HD.asc
Start model file (nt)		HD_nt.mf2
Start model fine (nt)		HD_nt.mf1
Documentation in SGI Showcase	(gzipped)	HD.sc.gz
Documentation in PDF format		HD.pdf
Documentation in Postscript (page range)	(gzipped)	HDxx_xx.ps.gz
Flattened harness picture		Harness.pff
Formatted wirelist file		wire_list.txt
Original wirelist file		HD.dat
Start picture file		HD.pff
Modified wirelist file		HD_mod.dat

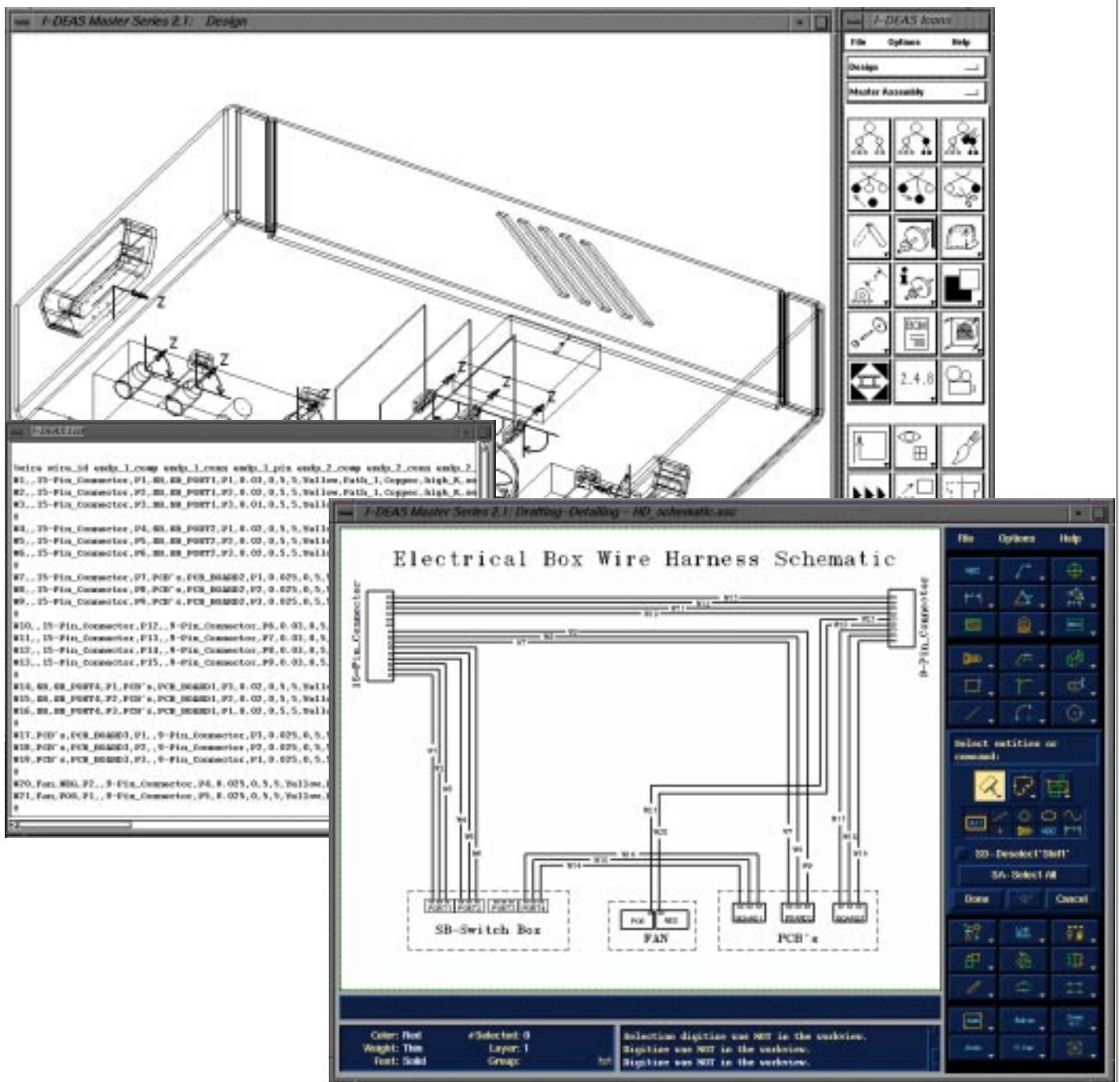
The following global symbols are defined and are available for use in the presentation:

ADD	Autoscales preselected dimensions
ADO	Toggles the autodraw switch
ARR	Flips the arrow on preselected dimensions
CFF	Changes the font and color of preselected curves
CLL	Toggles centerline/centerpoint visibility
CVV	Toggles constraint visibility
EHH	Hides preselected entities
ETT	performs an orient, move
LLL	Places the leader off of the left side of the dimension
LOO	Toggles the visibility of local origins
LRR	Places the leader off of the right side of the dimension
VVC	Sets the dynamic rotation center to a user picked point
CSS	Toggles the visibility of reference designators (coordinate systems)
SSA	Section appearance modification by label

NOTES:

1. The formatted wire list file "wire_list.txt" (yes that is a "one" not an "l") is placed on the drawing rather than the one actually written. The formatting makes the file more readable.

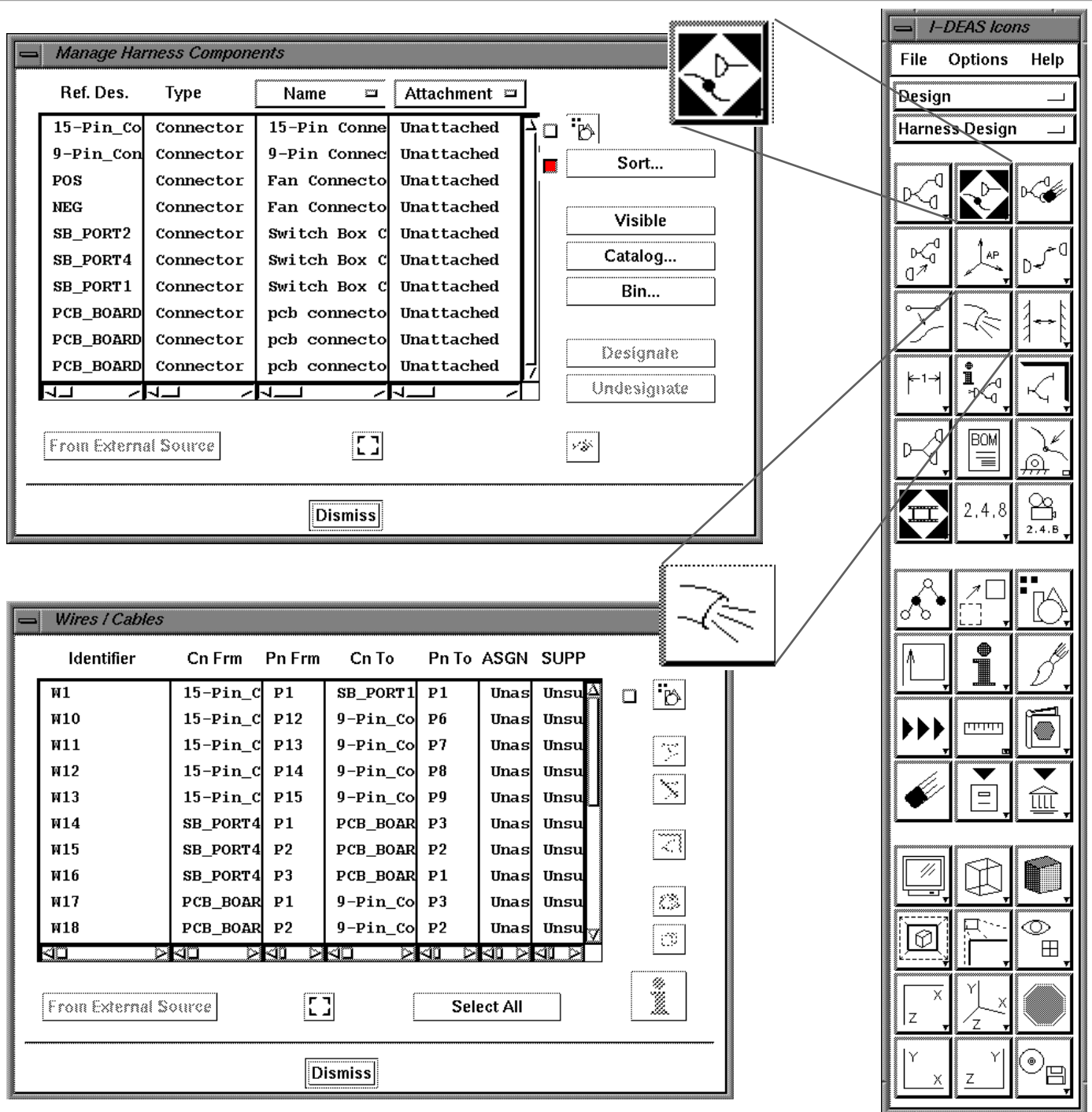
2. MB3-mouse button 3



Before the presentation, open HD.mfl in I-DEAS and display the HD.pff picture file; open HD.asc in Drafting (use drafting -m). 'Cat' the file HD.dat in a unix window (or type "xq" in the ideas prompt window and pick "HD.dat"-the text file will be printed in the I-DEAS list window).

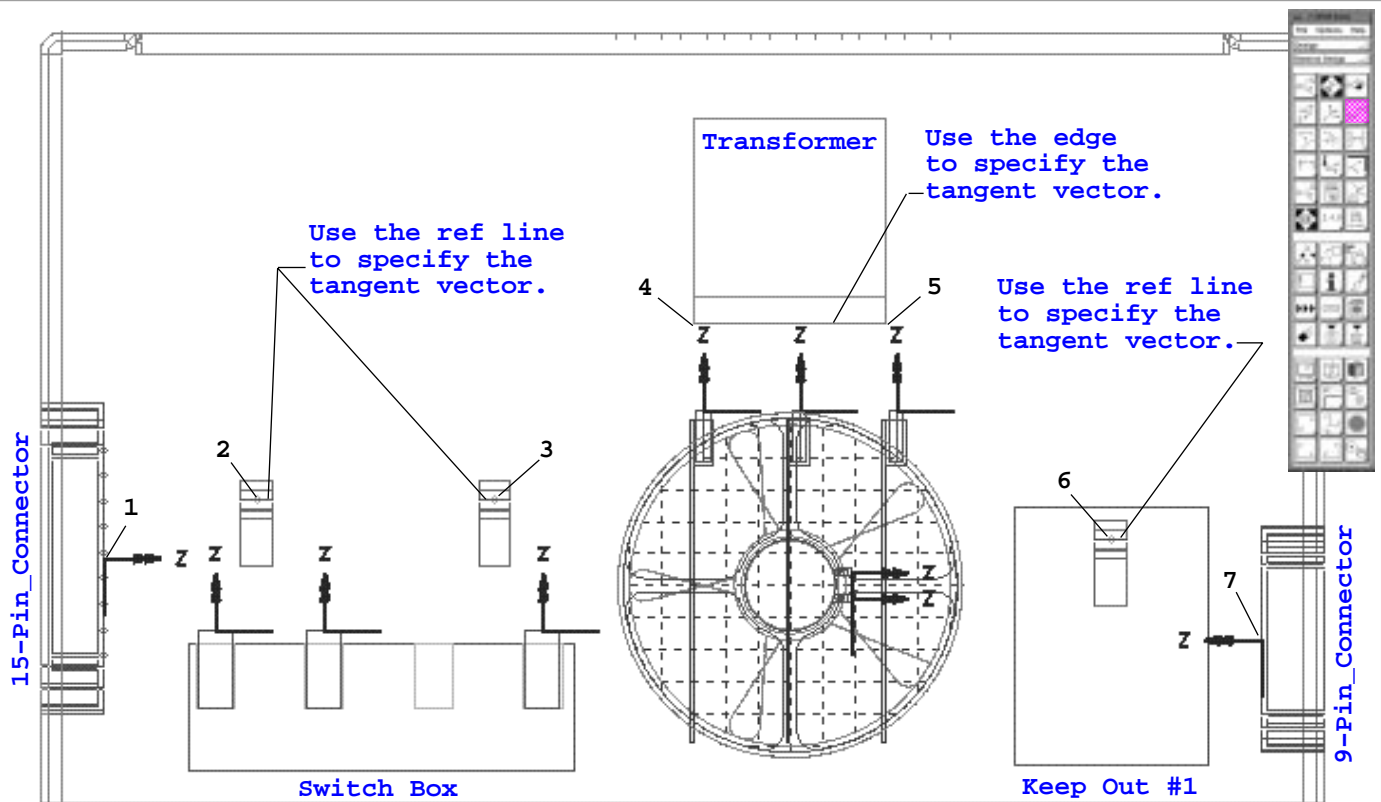
The demonstration starts with a shaded image of the final harness in its assembly. Give a 1 minute overview of the harness design procedure and why it is important in your customer's design process.

Refresh the I-DEAS screen back to the assemblyless harness. Pop-up the Drafting window of the harness schematic. Discuss how logical harness design is performed in the customer's ECAD package (emulated with Drafting for this presentation); discuss the wirelist (HD.dat) being the messenger of bi-directional associativity between the schematic capture package (the ECAD package) and I-DEAS Harness Design.

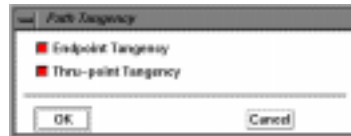


The wire list has already been read into the start model file and all of the connectors have been assigned. (My experience was that people were not too interested in seeing me assign and place connectors. However, if someone shows interest in this step simply delete the harness instance from the assembly and do these few steps live). All the data on these two forms, except for the 'Part names', comes directly from the 'HD.dat' file. This demonstration starts from a wirelist, however, **I-DEAS does not require a wirelist to create a harness.**

Show that picking names off of the Wires/Cables form or the Connectors form highlights the corresponding connector(s) on the screen.



Pop to a top view of the assembly. Using the create path icon, create paths from (verify path tangency is 'on' using MB3):



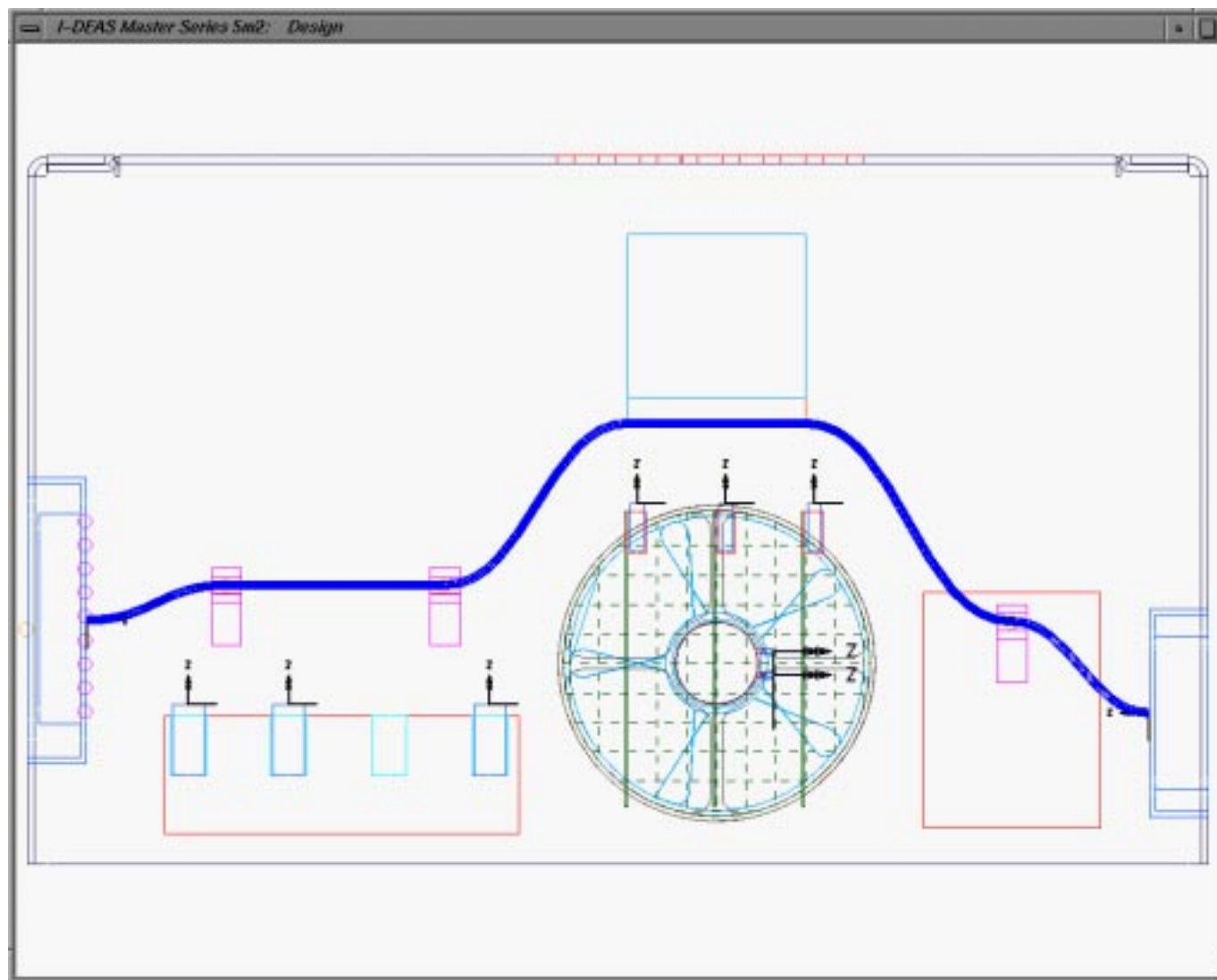
Path segment 1-2> pick at attach point 1 and ref point at 2, since path tangency is on (MB3) pick the path tangent vector left to right along the ref line at 2. After confirming the tangent direction at 2, hit one return and then one extra return to segment the path. The exact prompting goes like this:

- Pick point for path definition (pick attach point at 1)
- Pick point for path definition (pick ref point at 2)
- Pick vector for tangent definition (pick ref line at 2 and confirm arrow pointing to right)
- Pick point for path definition (hit a return-MB2)
- Pick point for path definition (hit one more return-MB2) <- this is the important step

Path segment 2-3> pick again the point at 2 (this time you will get the curve connector (cc##) rather than the reference point that you did above-this is okay) and at 3. Again establish the path tangency running along the ref line at 3 from left to right. After confirming the tangent direction at 3, hit one return and then one extra return to segment the path.

Path segment 3-4> pick the curve connector at 3 and the centerpoint at 4. Make the tangent vector point to the right by picking an edge on the transformer. Flip tangent direction if necessary. Don't forget the extra return to segment each path.

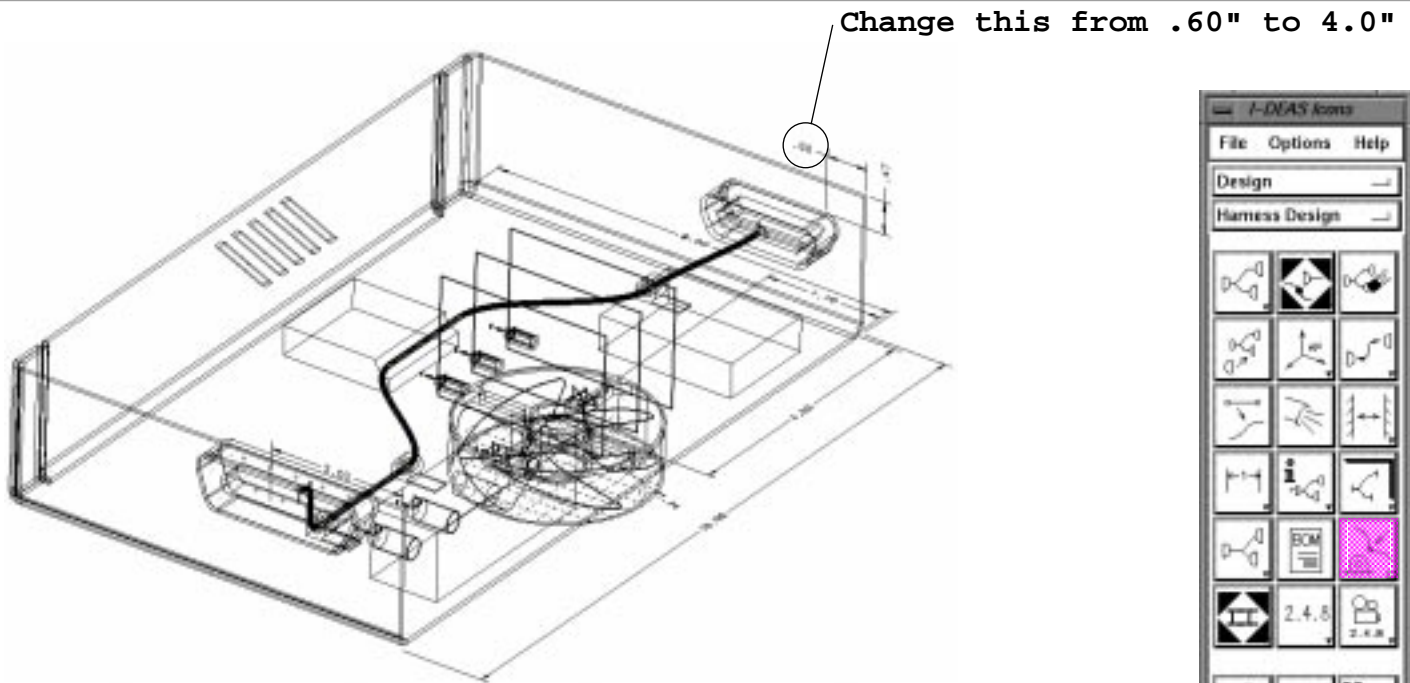
Path segments 4-7> continue the above methodology.



After the paths have been created, turn off all checking and assign the wires. Your picture should look like this if you created paths as described on the previous page. The 4 wires that are common to the 15-Pin and 9-Pin connectors are now assigned.

Save.

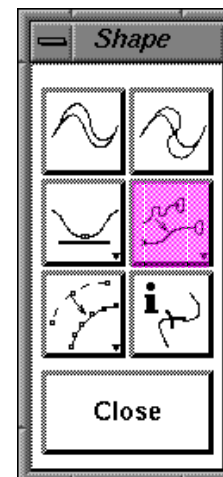
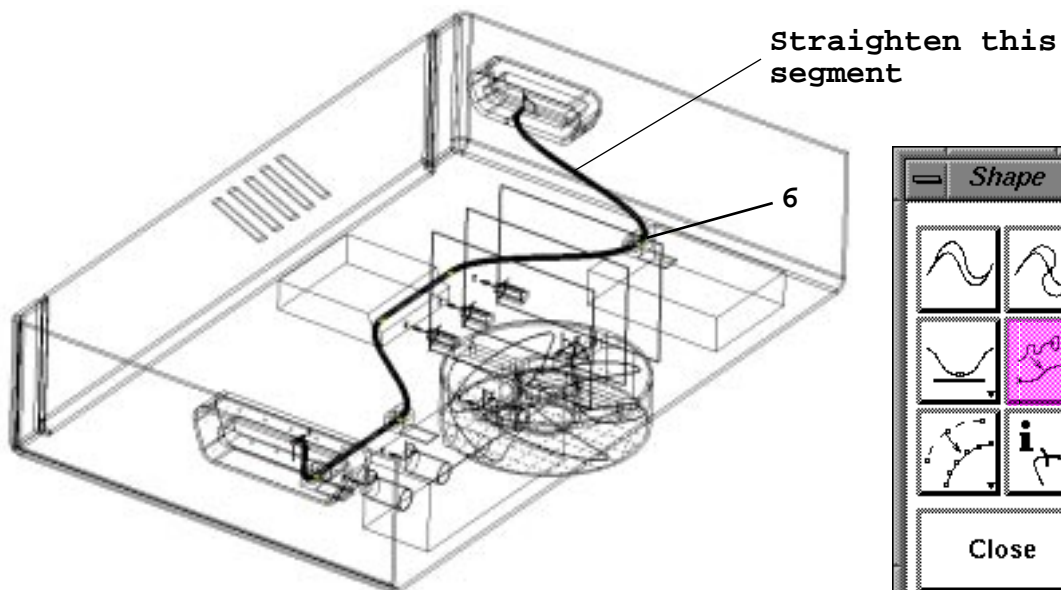




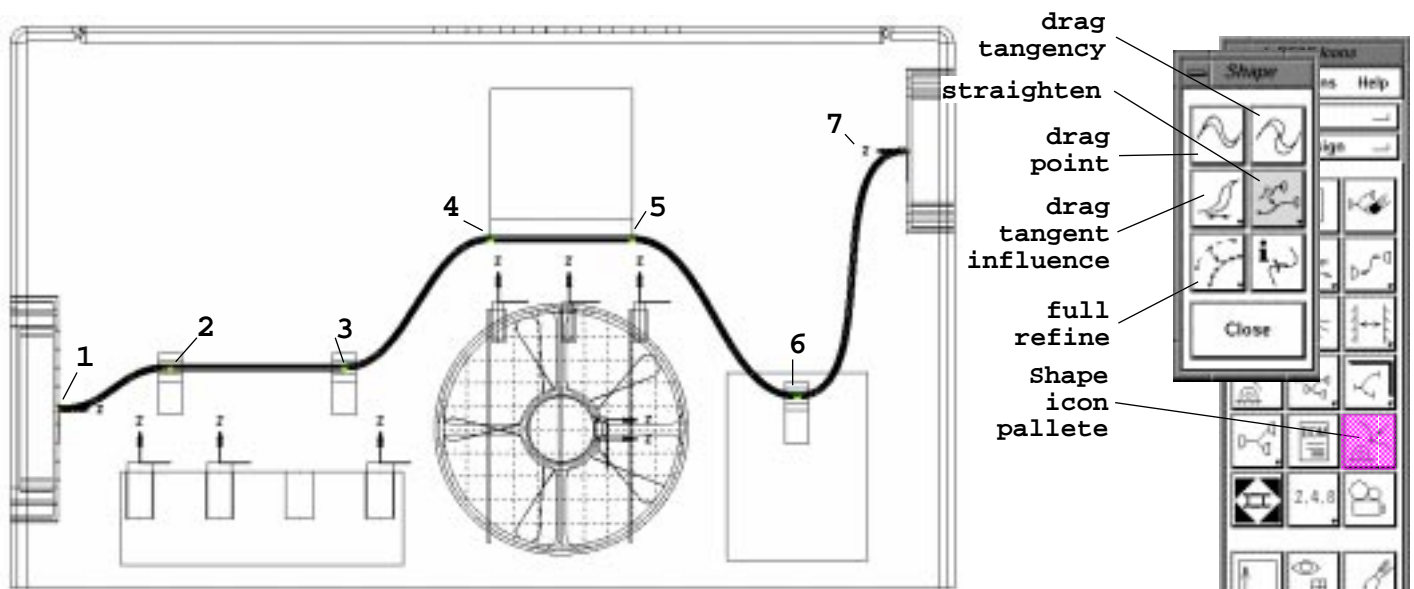
Use the modify icon to make visible the sheetmetal base part dimensions. Change the "FromEdge_6" dimension locating the 9-pin connector cutout from .06" to 4.0".

Update the part. Notice that the part updates, the connector realigns itself and the harness moves and grows to accommodate the dimension change.

After the update is complete, use the "Straighten-Smooth Path" icon from the tear-off icon palette to relax the harness path just modified. Notice that none of the shape modifications propagate past location 6. This is the benefit of segmenting the paths, the technique used on page 5.



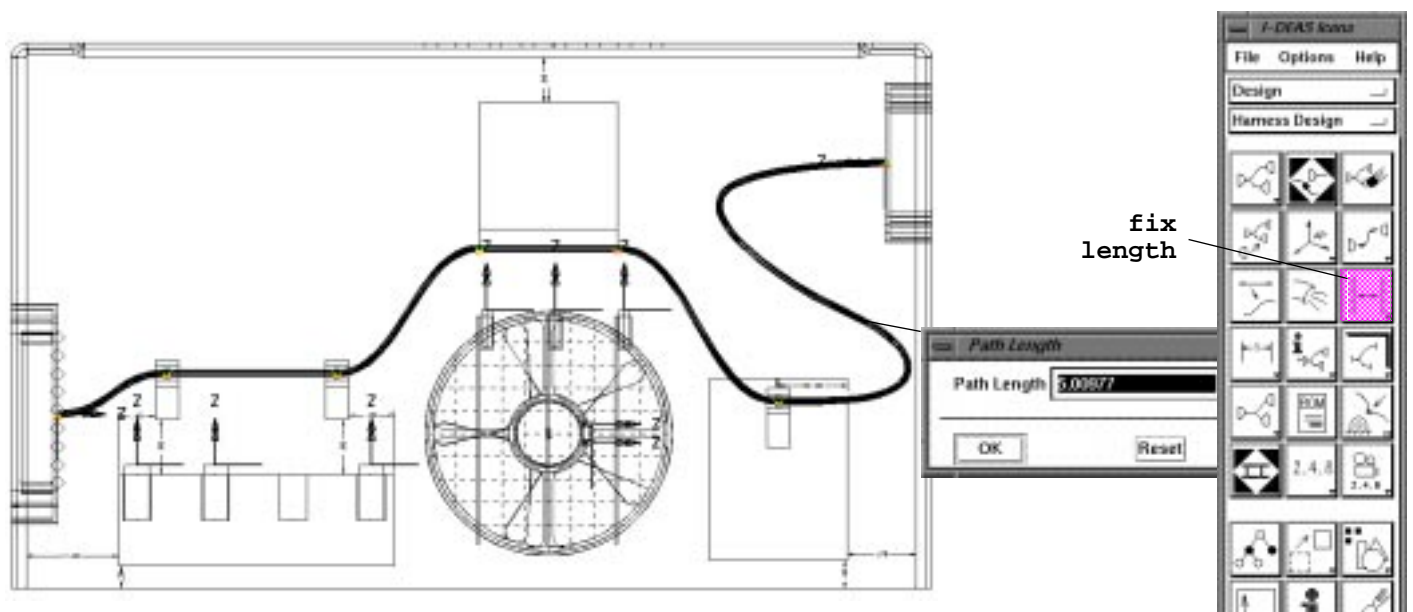
Straighten Icon

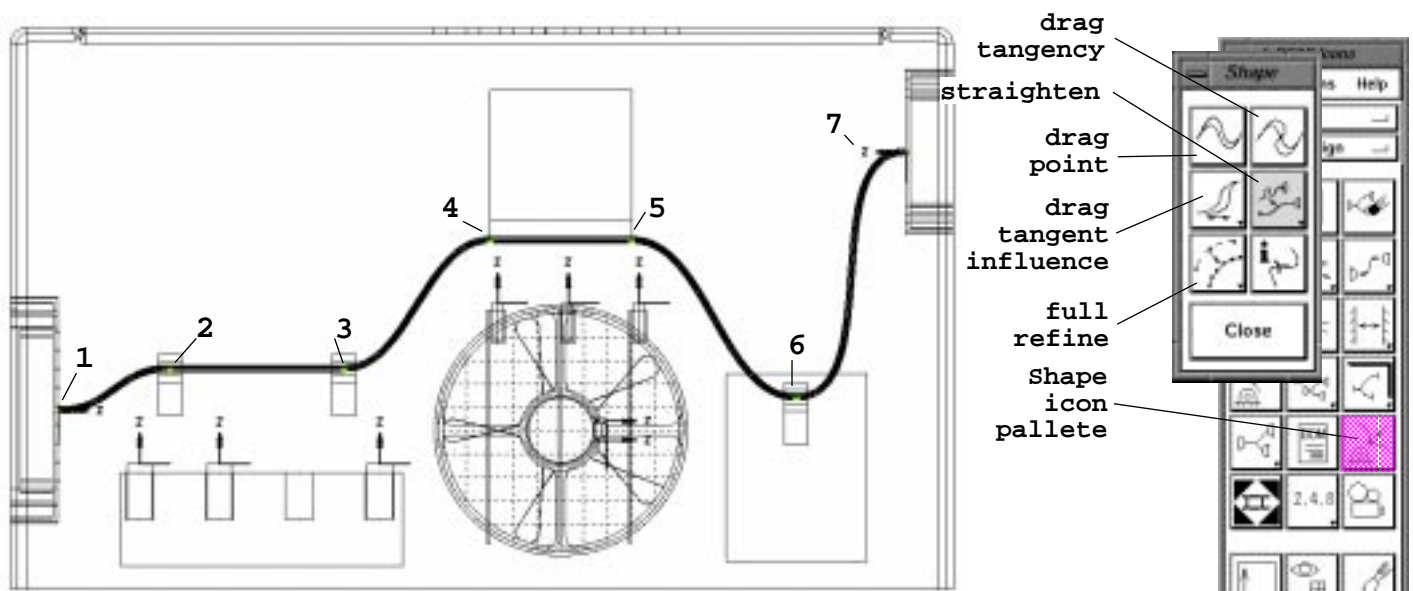


Pop to a top view. **Save the work thus far.** Now is a good time to play with the tools on the shape icon palette.

Use the drag point icon to stretch the path segment between points 6&7. Make sure to set the shape plane to be the view plane by typing "og pl vp" (you can also dig in the pop-up menu (MB3) three successive times to set this mode-the command is On_Geometry, PLane, View_Plane). This needs to be set only once per path segment.

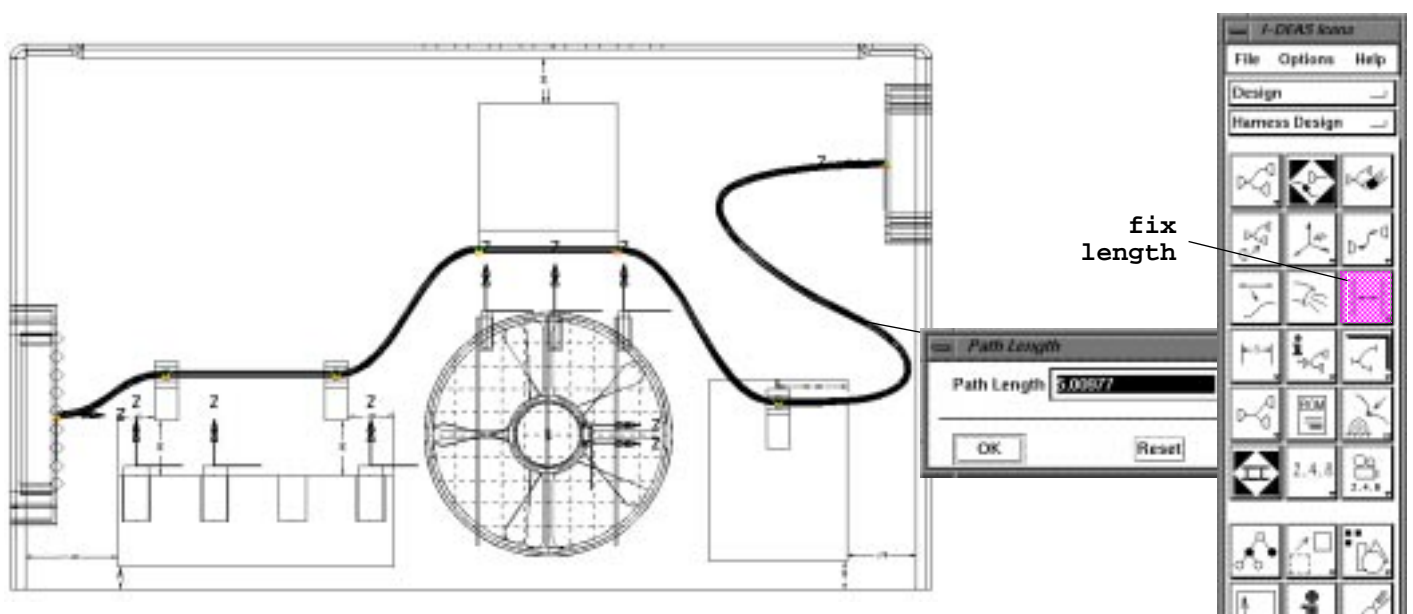
Illustrate the "drag tangent influence" command. Pick at 7 and grow the tangent influence (make sure that the wireframe constraint symbols are visible).

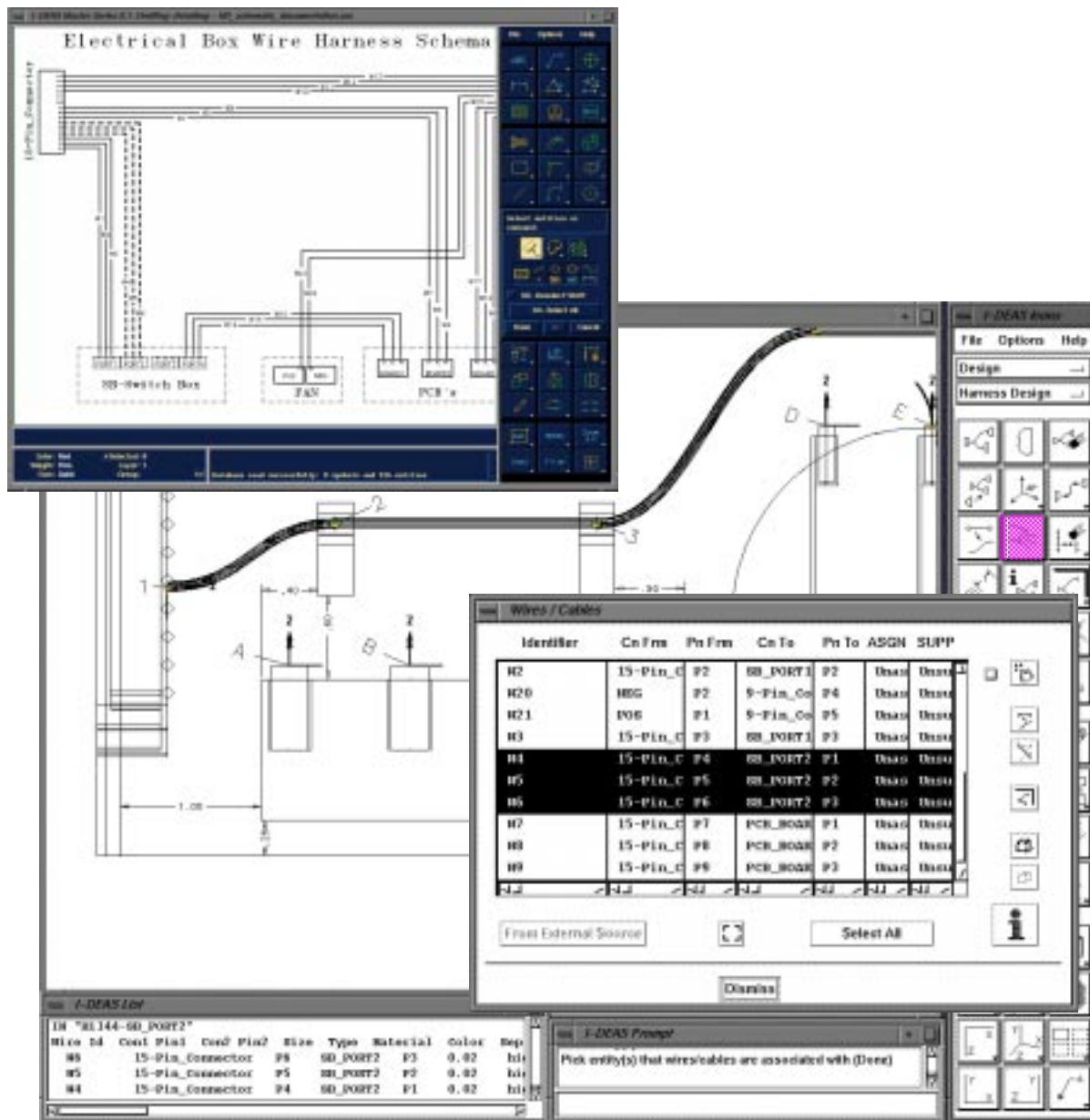





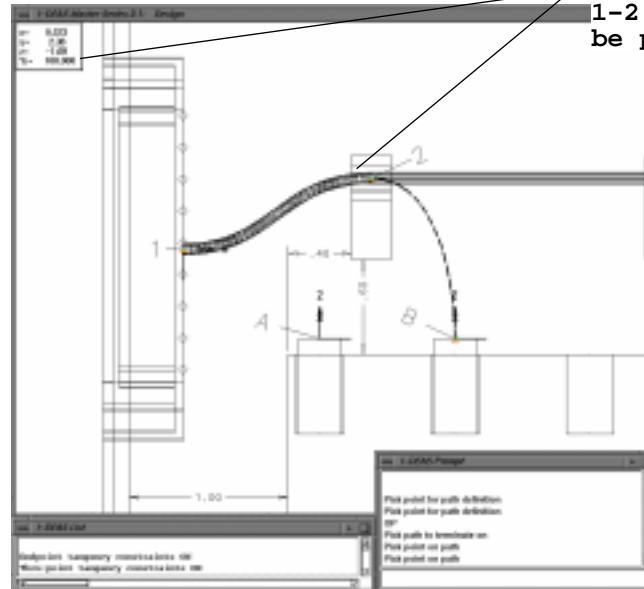
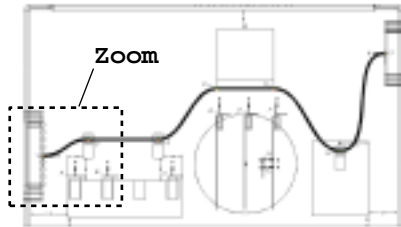
Use the full refine icon to add two dof (the default) to the path segment 6-7. Using drag tangency, pick 6-7 at roughly the mid point to add slack for a service loop. Fix the length of segment 6-7 using the fix length icon. Alter slightly the default value that is presented on the path length form. For example, if the value is 5.00977, change it to 6.0 and watch the path length change.

Continue altering the shape of the path using the tools from the shape icon pallet. Point out that fixed length design rules are not violated as the path is shaped or straightened. Unfix the length of segment 6-7 (pull down under 'fix length' icon). Use the "Straighten-Smooth Path" icon to smooth the path that has just been perturbed. (if you get things really hosed, "control-Z" to reopen the model file).






"Source View illustration". Hit the wires/cables icon  to pop the wires/cables form. Hit the pick button on the form and pick the connector at B. Using the scroll bar, pull down in the Wire/Cables form until the three highlighted wires (W4, W5, W6) are visible on the form. These are the three wires that run into the 'SB_PORT2 connector. Hit the Info button on the form to generate wirelist information in the list region. This information tells you that the wires here run from the switch box, port2, pins 1-3 to the 15 pin connector pins 4-6. Discuss how the "From External Source" button would be active if Source View were running. The value of Source View is best illustrated if you pop the drafting window. Navigate near wires 4-6 in drafting (they have been converted to a symbol so all three will highlight). If the Mentor Graphics Source View™ application were running, these three wires would automatically be highlighted because they were selected from I-DEAS. Alternatively, you can pick wires in the Source View schematic and have them highlight in the wires/cables form (and on the I-DEAS graphics screen if the wires had been assigned). The schematic is the road map by which you can figure out how to do the physical routing in I-DEAS.



Continue creating paths. Zoom into the area illustrated from a top view. Using the create path icon, create the paths shown. Create the path B-2 by selecting the attach point at B, select "on path" (MB3) and pick the path segment

1-2. The exact prompting goes like this:

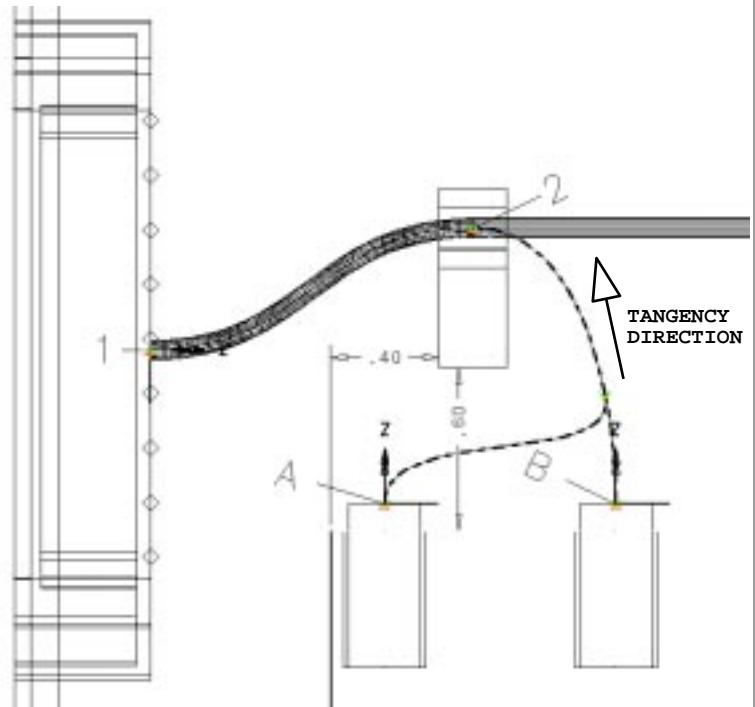
- >  (make sure end point and thru point tangency are on-MB3)
- >"pick point for path definition"-pick the attach point at B
- >"pick point for path definition"-MB3, pick "on path"
- >"pick path to terminate on"-pick the path segment 1-2
- >"pick point on path"-slide along path segment 1-2 past location 2 and pick when the odometer is at 100% (picking off the end of the path at 2 is an easy way to ensure this)

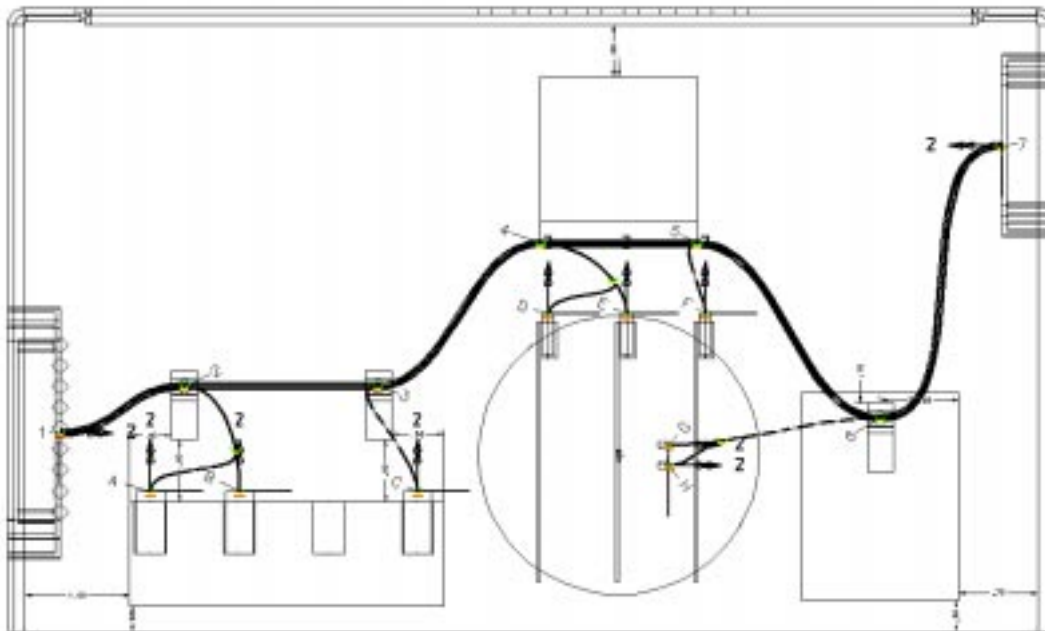
A nice path will be drawn

Create a path from the attach point at A to "on path" 2-B using the same methodology. Splice into path 2-B about 1/3 of the way from B to 2. Make sure the path tangent vector points from B to 2.

Finish creating all of the remaining paths. Pop-up the Drafting "Source View" window to understand the schematic connectivity and to illustrate the functionality of source view.

Exit the Drafting session.



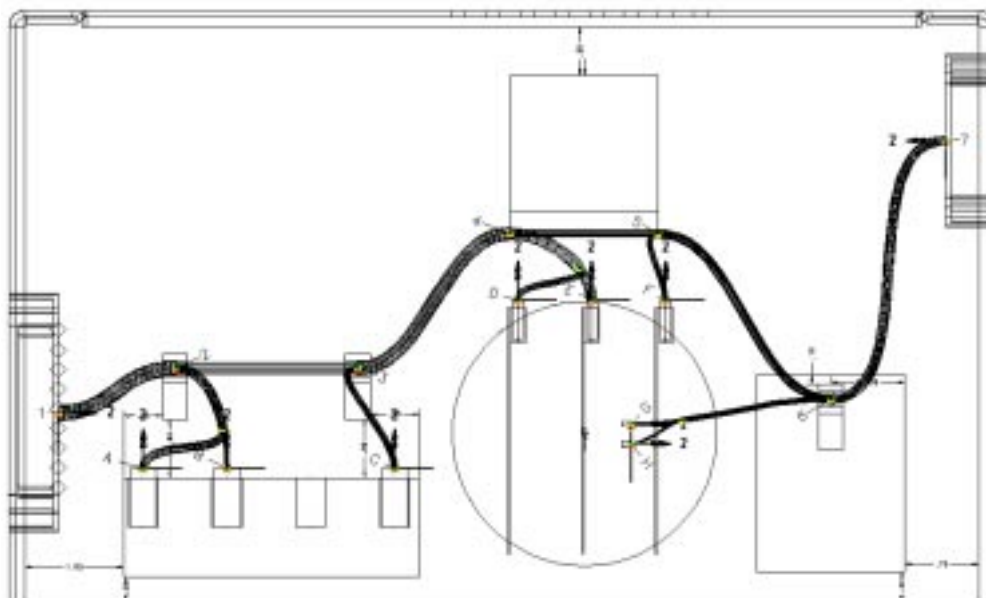


Create path 3-C by picking the ref triad at C then pick "on path" 3-4 with the "point on path" selection at 3.

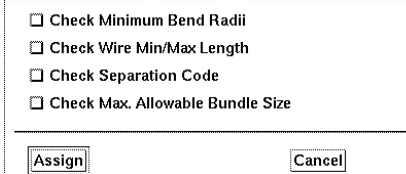
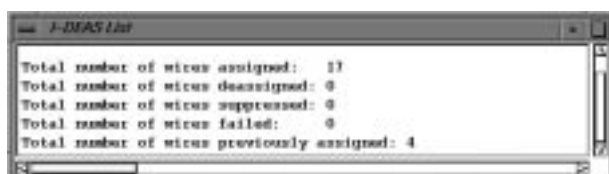
Create path 4-E by picking the ref triad at E then pick "on path" 3-4 with the "point on path" selection at 4.

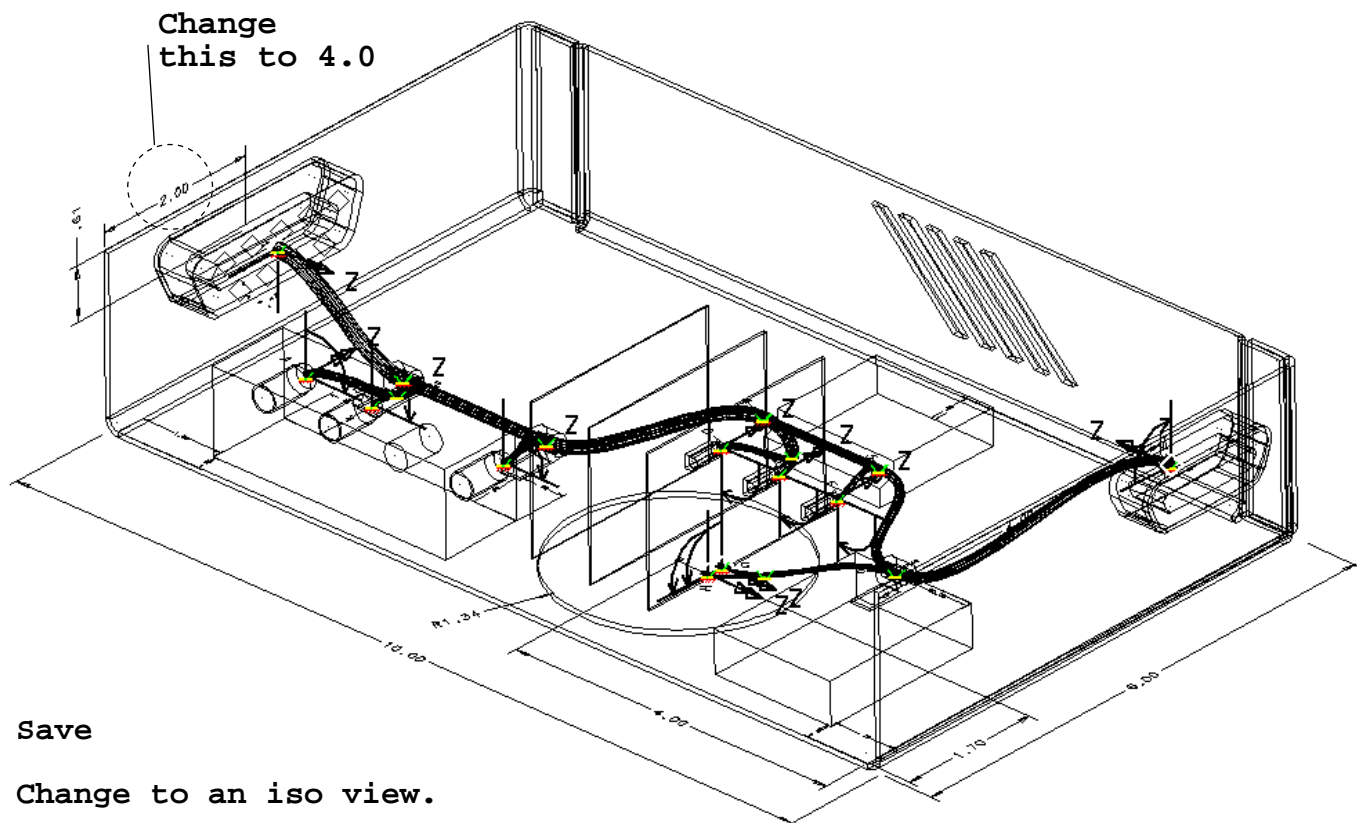
Create path 5-F by picking the ref triad at F then pick "on path" 5-6 with the "point on path" selection at 5, etc.

Your screen should look like after all the paths have been created.



Assign  all of the wires. Turn off all of the checks.






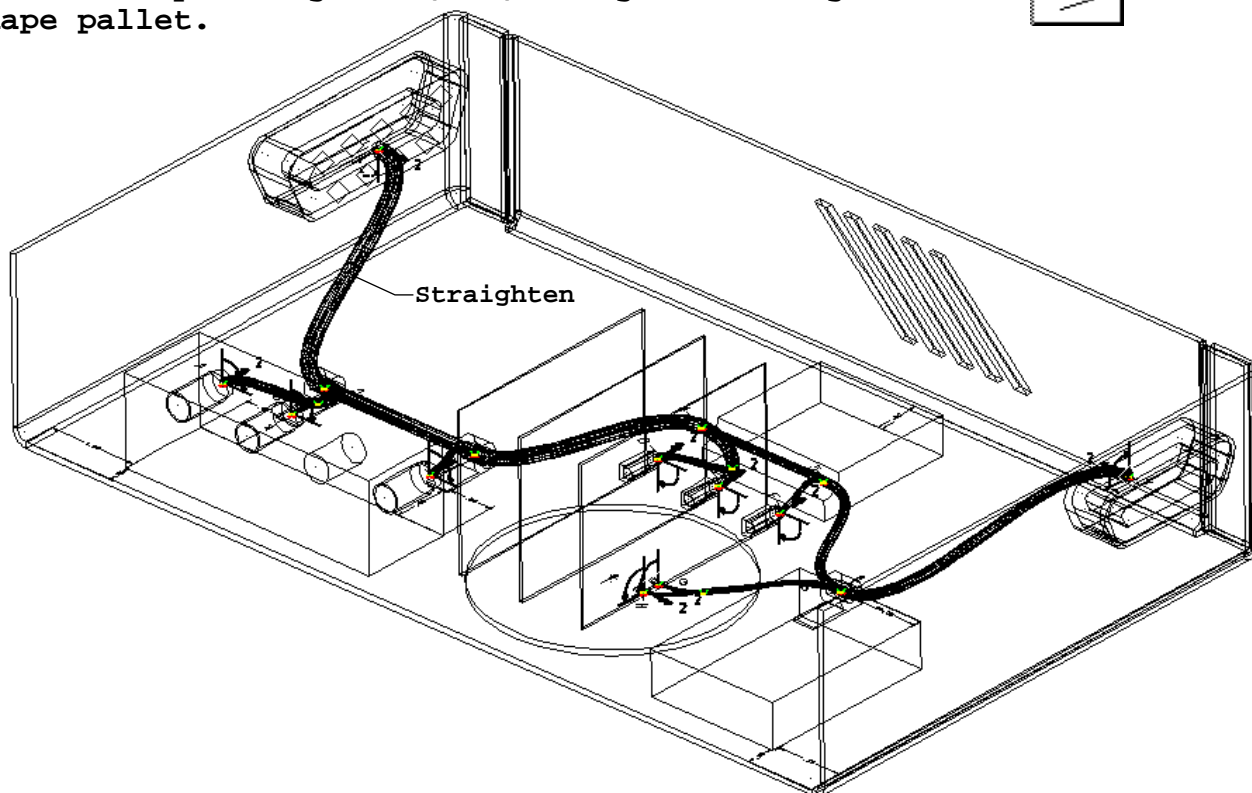
Save

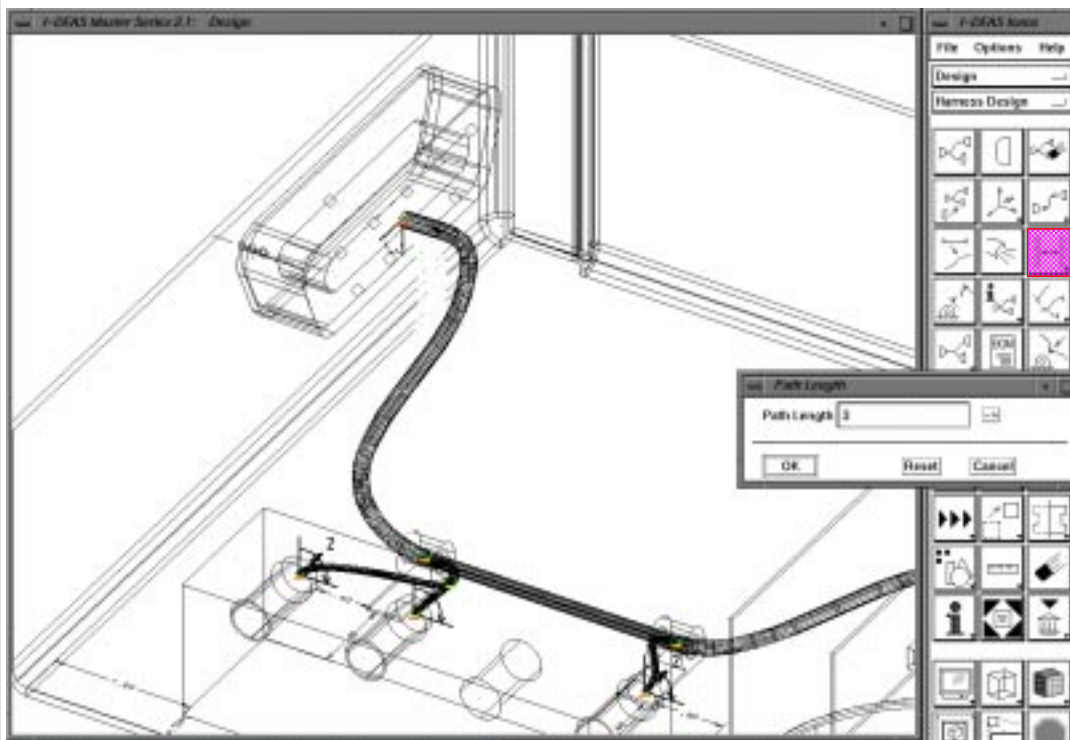
Change to an iso view.

Modify the dimension that locates the 15 pin connector from 2.00" to 4.00".

Update the assembly

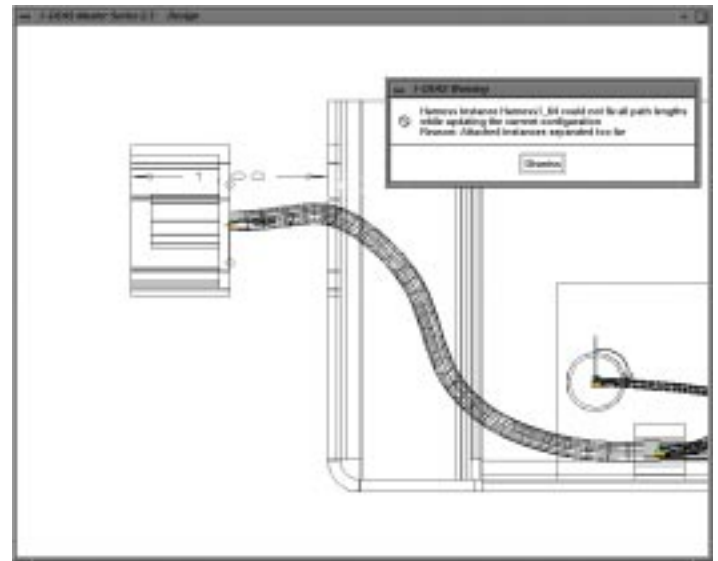
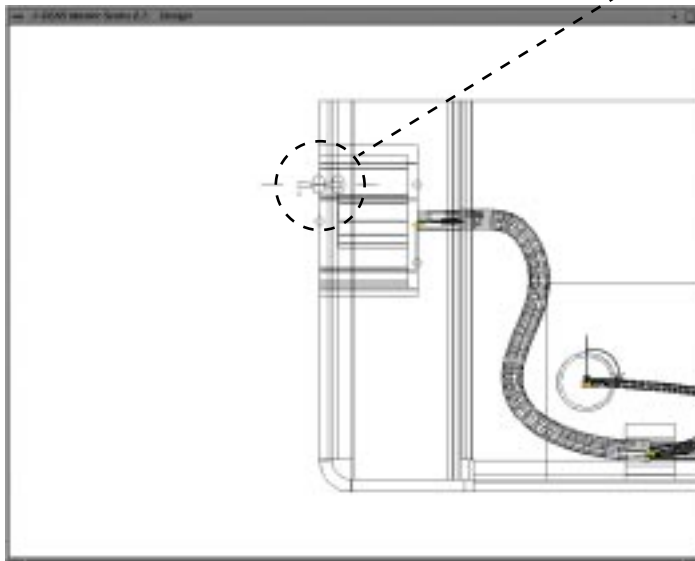
Relax this path segment (1-2) using the straighten icon  from the shape pallet.

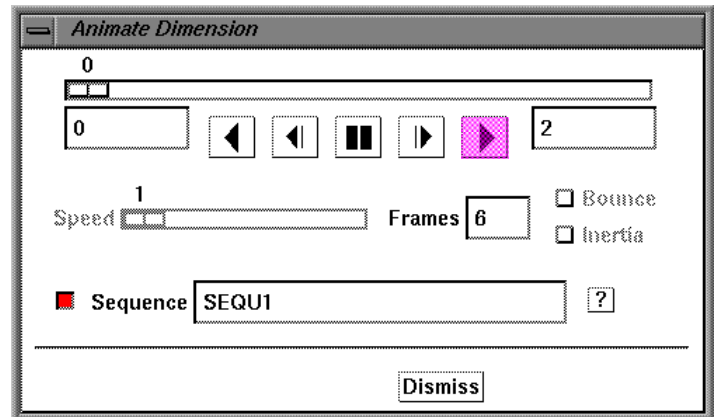
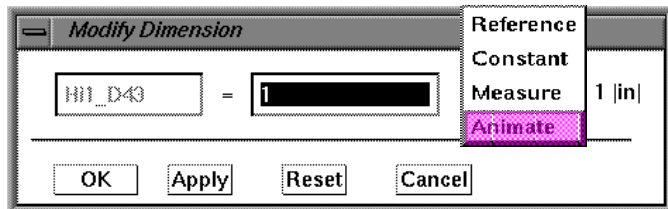
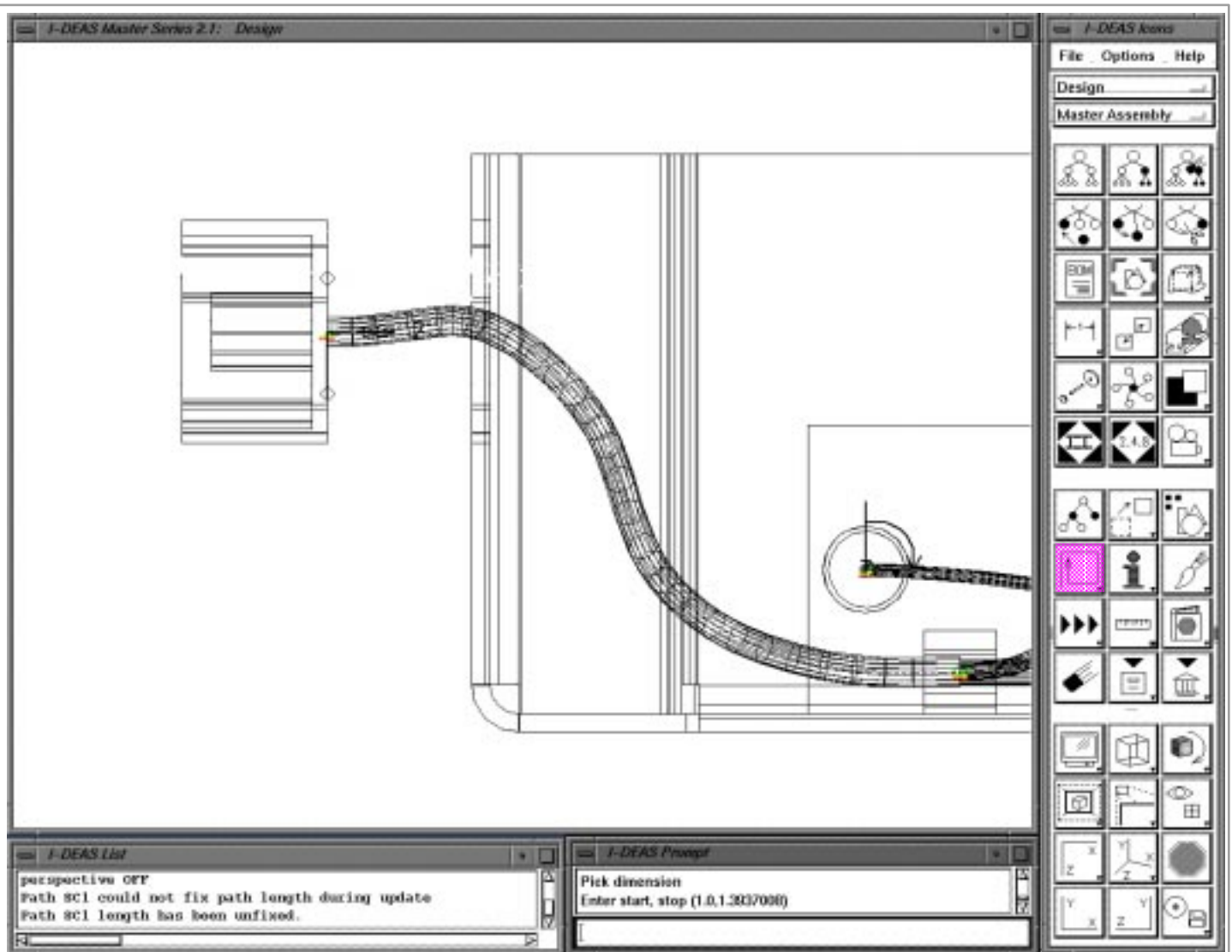




Fix the length of path 1-2 to some number other than the default. The default will be about 2.6" use something like 3.0".

Snap to a front view and zoom in around the area of the 15-pin connector. Change the surface offset dimension that locates the face of the 15-pin connector relative to the sheetmetal base (Hil_D43) from 0.0" to 1.0" to simulate pulling the connector out of the box. Point out that the fixed length design rule would be violated by the dimension change.

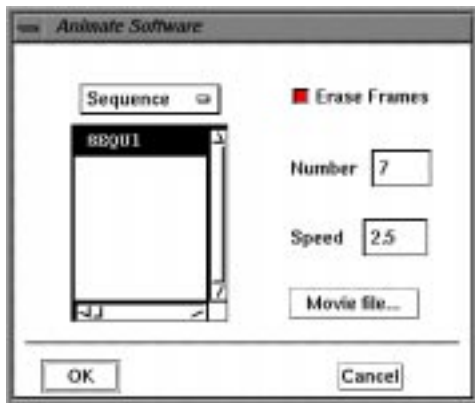
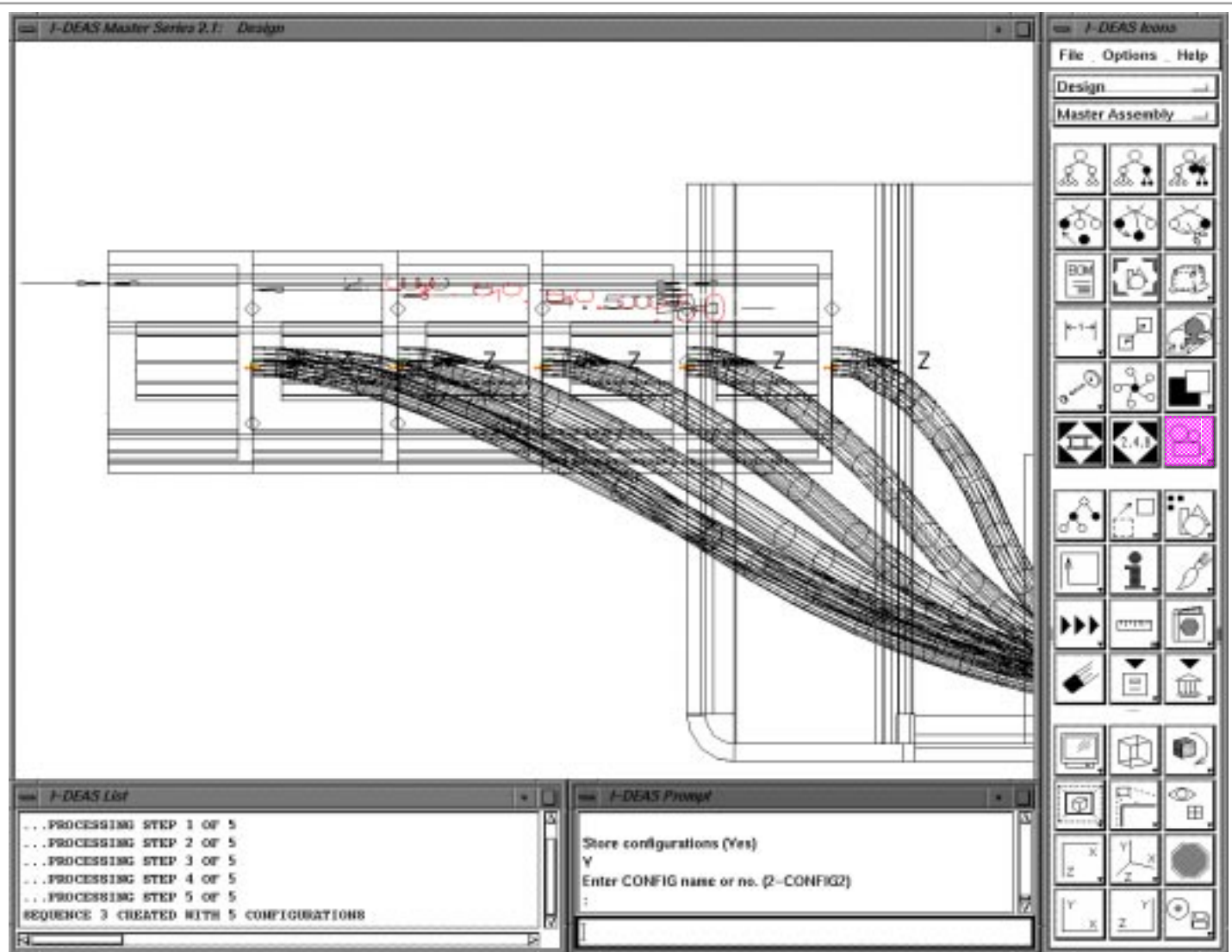




Unfix the length of section 1-2 and update the assembly. Turn on the assembly icons.

Modify the surface offset dimension. Pull down to Animate. Set the form as shown. Hit the play button (the right hand arrow).

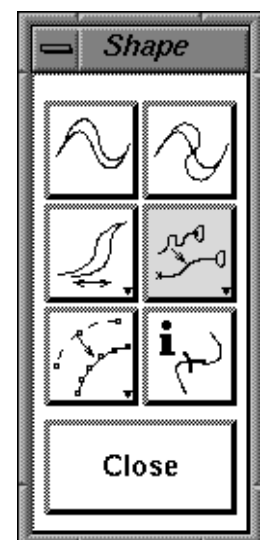
After frames are calculated, dismiss and cancel the 2 forms.

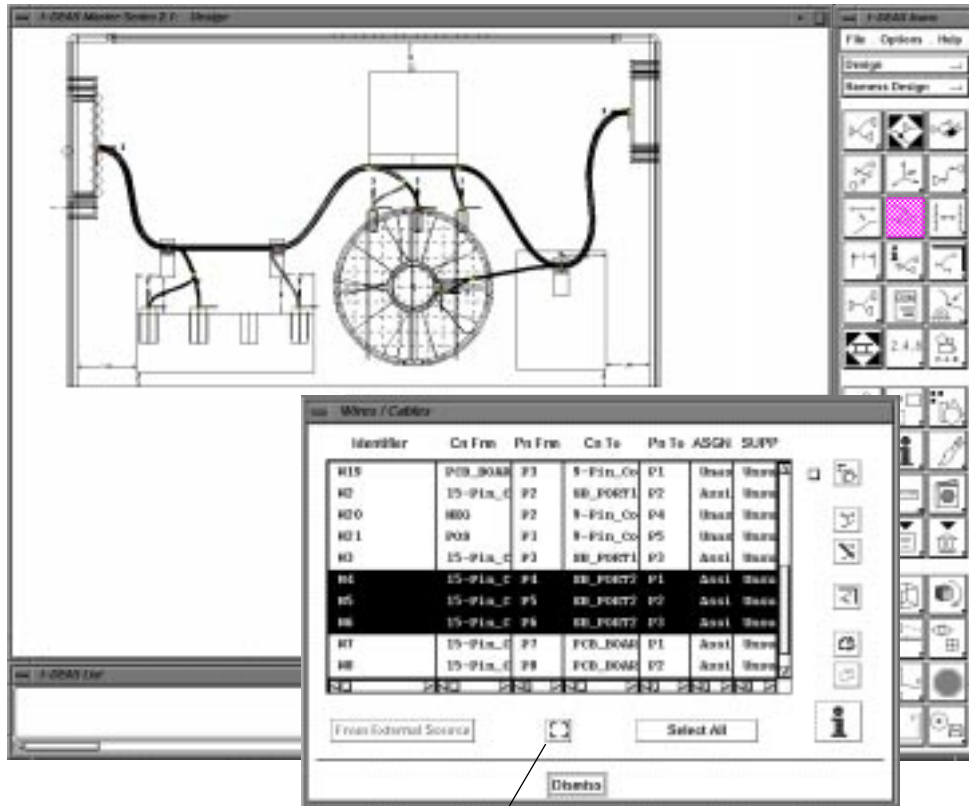


Shade the assembly and 'Animate Software...' the sequence ('SEQU1') that was created on the previous page. Don't forget to dynamically rotate the display.

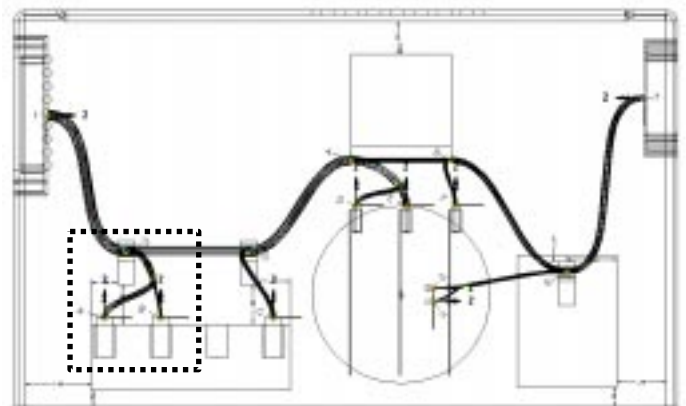
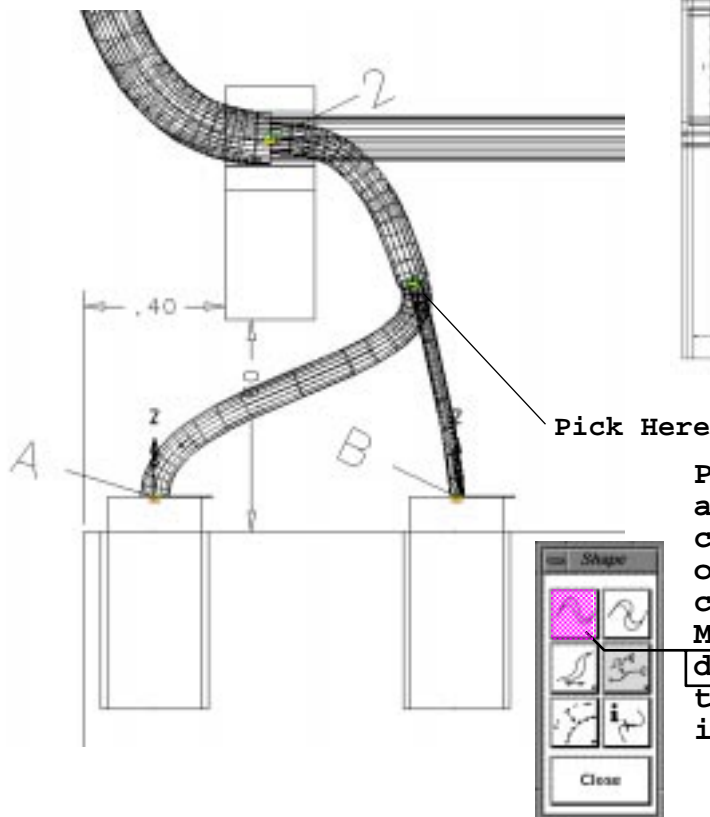
End the animation (MB3) and turn on the Harness icons. Set the surface offset dimension back to 0.0".

Straighten path segment 1-2.

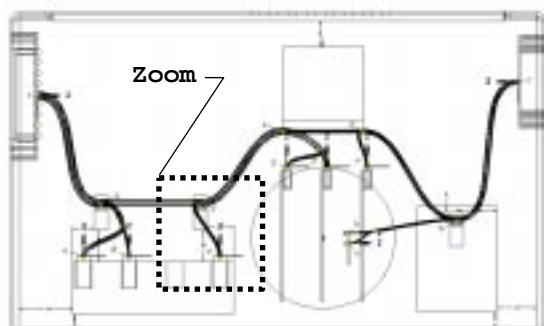




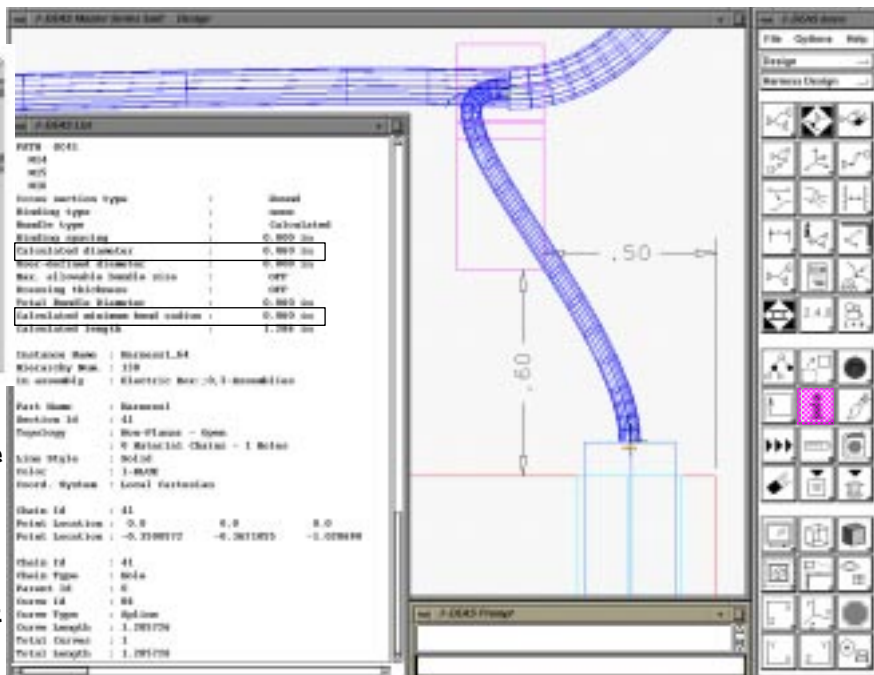
As you go through the presentation, don't forget to illustrate the intelligence built into the harness. Pop the Wire/Cables form. Pick on one of the wires in the list and show how it highlights graphically. Using the pick icon (on the form), pick one of the wires (graphically) and show that it highlights in the list. Use the pick icon and graphically pick two different connectors. Show how the wires COMMON to both connectors get highlighted. Have fun, be happy.

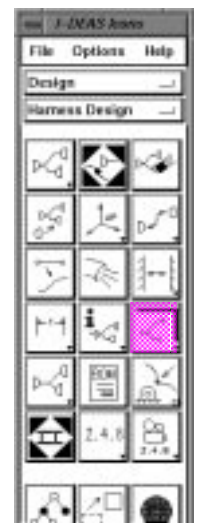
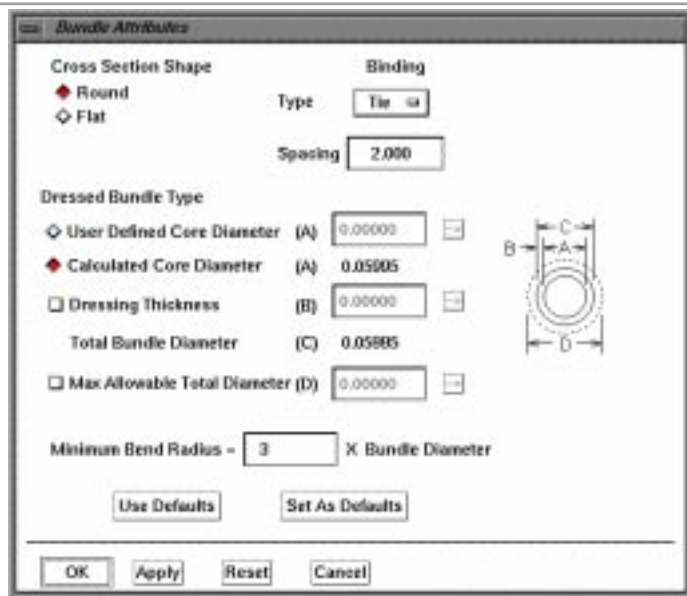




Pop to a top view. Zoom into the area shown. Illustrate how you can interact with three paths at once by picking the curve connector at the junction shown. Move the three paths using the drag point icon. Show-off more of the shape tools that have been illustrated thus far.

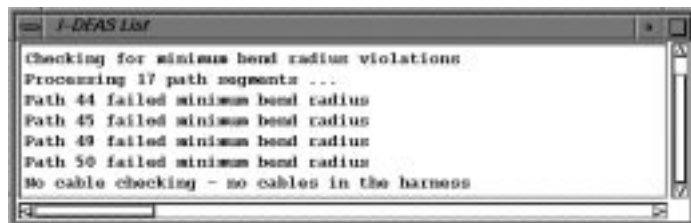


Pan over slightly to the right and zoom-in around the area of path 3-C. Pop and grow the list window. Info the path 3-C. The information about this path segment is shown in the list region. Boxed are the two lines pertinent to the minimum bend radius checks—the calculated minimum diameter and the minimum bend radius along the path.





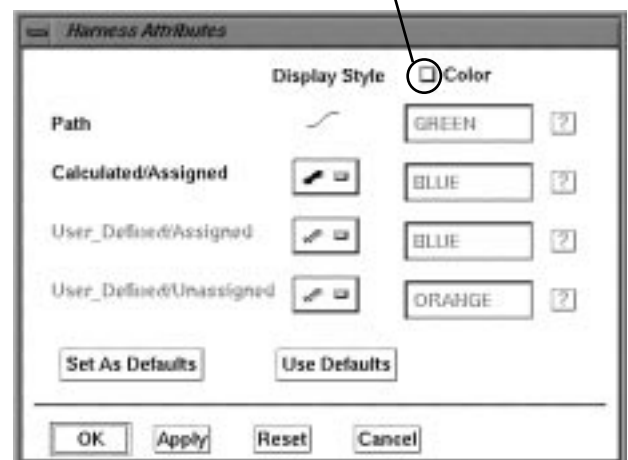
Hit the bundle attributes icon , pick one bundle then "all" using MB3 to pop the bundle attributes form. Set the minimum bend radius to be 3 times the bundle diameter. Returning to the I-DEAS list window, notice that the "Total Bundle Diameter" is .060". This means that the minimum bend radius allowed on this path segment is .18 (.060x3). Also notice that the "calculated minimum bend radius" is .060". This means that somewhere on this path, the minimum bend radius is .060". Since .060" is less than .18", the path segment in question will fail the minimum bend radius check. Hit the "check bundles" icon.  Turn on the minimum bend radius check. The offending paths are listed.



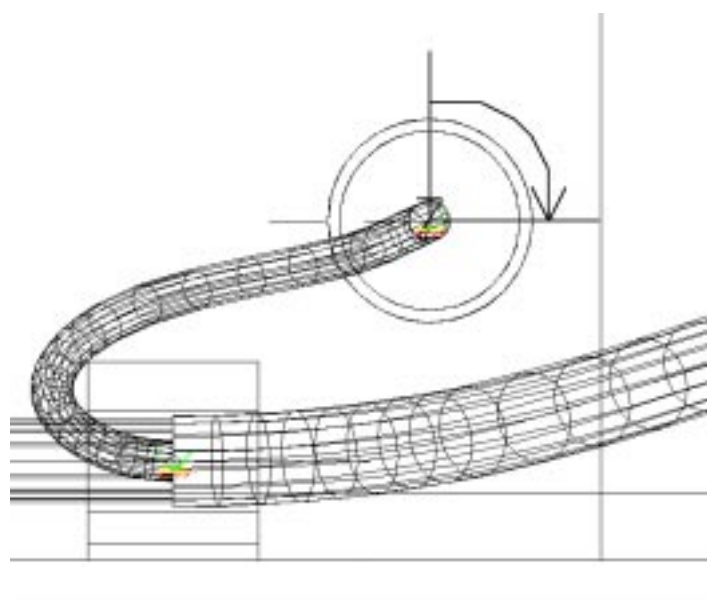
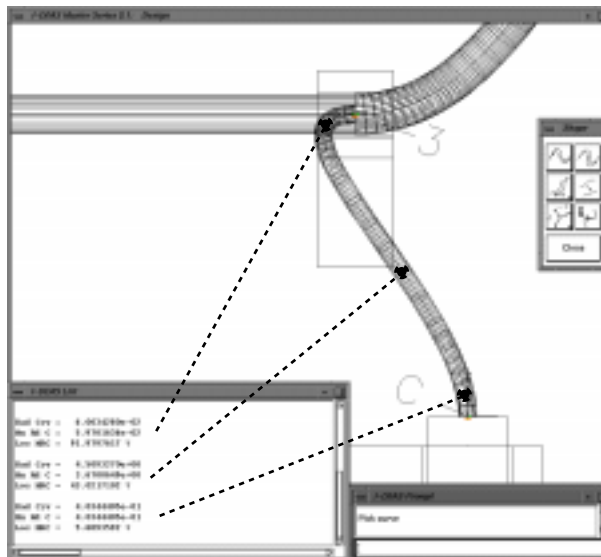
Toggle Off

Using the appearance icon, double click on one of the paths to bring up the 'Harness Attributes' form. Toggle off the 'Color' button next to the 'Display Style' text. This will allow you to override the default colors I-DEAS is using to display the harness.

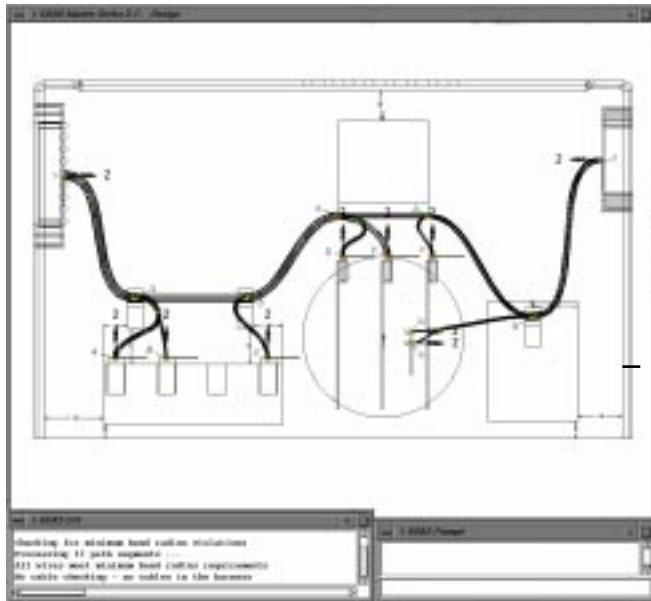
Use the "SSA" global symbol to manually change the color of the offending paths to yellow. Specify the paths by the label listed in the List region. Change the color to yellow.



A diagram showing a particle being attracted to a surface. A curved line represents a surface, and a small circle represents a particle. An arrow points from the particle towards the surface, indicating the direction of the attractive force. The surface is represented by a horizontal line with diagonal hatching underneath it.



Front View

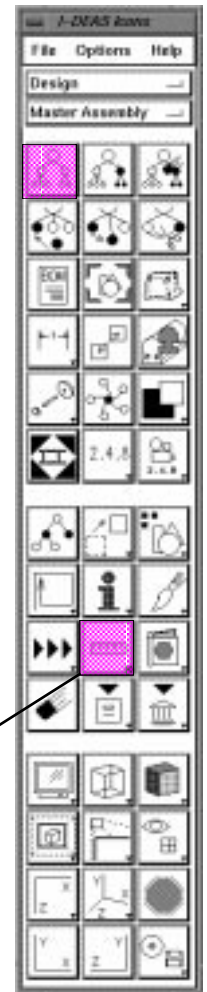


When you are done shaping all paths that violate the minimum bend radius check, your harness will look something like this.

Turn on the assembly modeling icons (switch tasks). On the Hierarchy form, suppress the 'Fan Assy'.

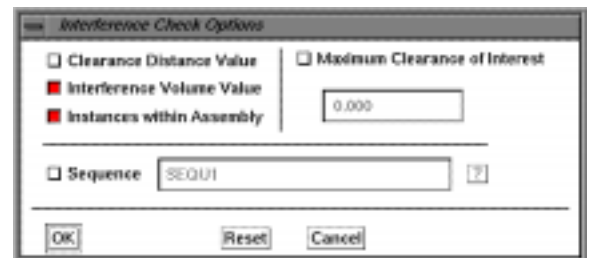
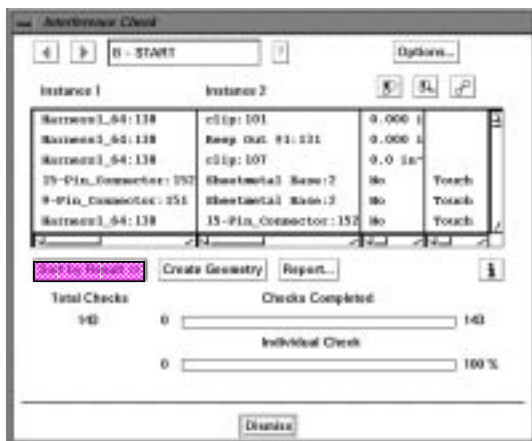
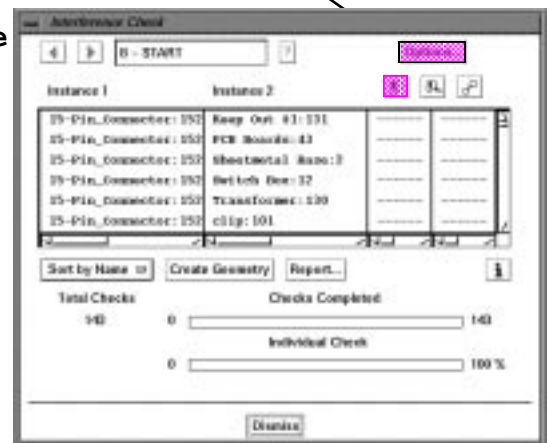


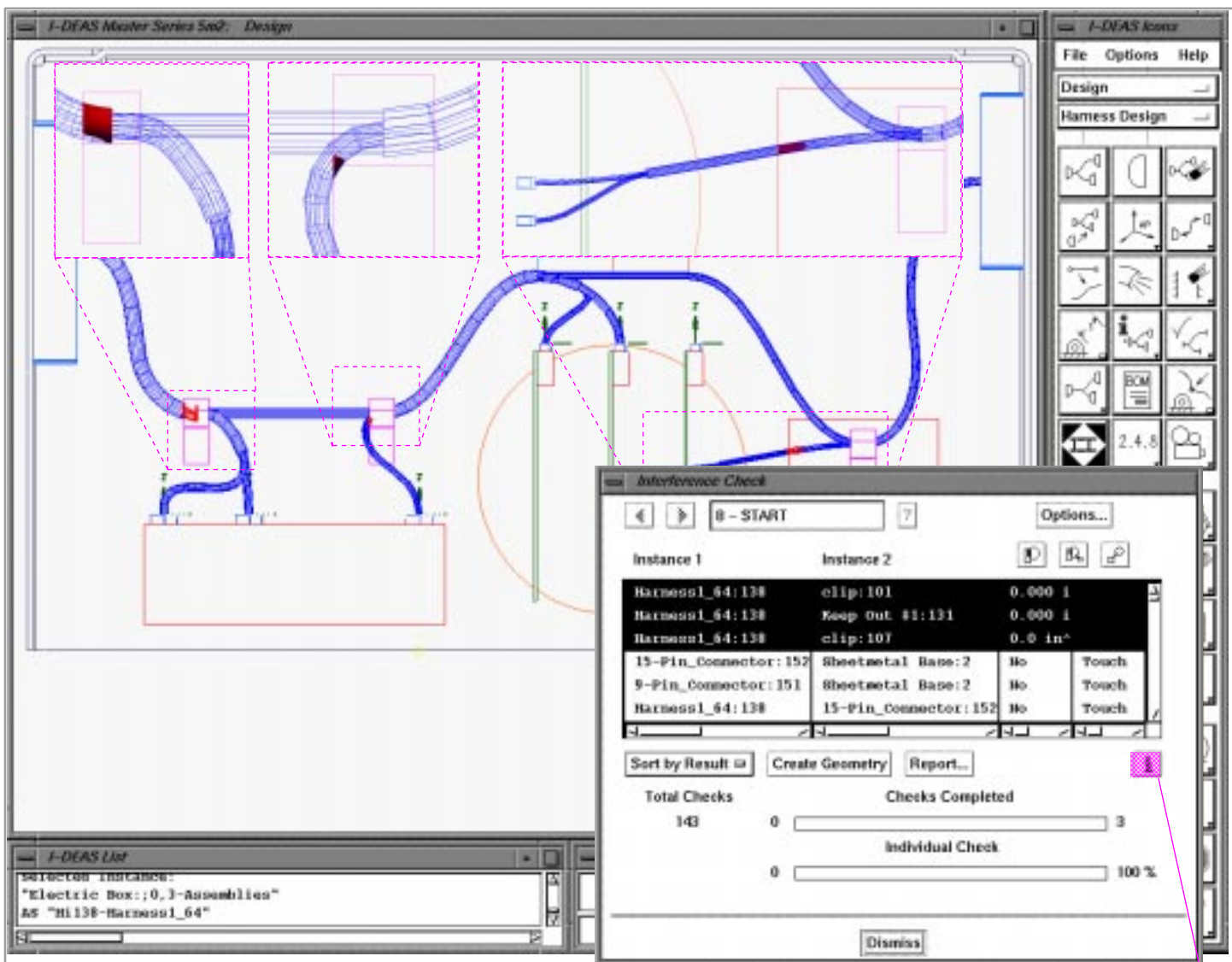
Perform an interference check on the harness against the assembly (143 interference checks are calculated). Hit the interference icon. For the 1st set, pick one of the harness bundles, MB3 'all', hit done. For the 2nd set, use MB3 and pick all. Pick done and okay to the prompts about wireframe and suppressed instances.



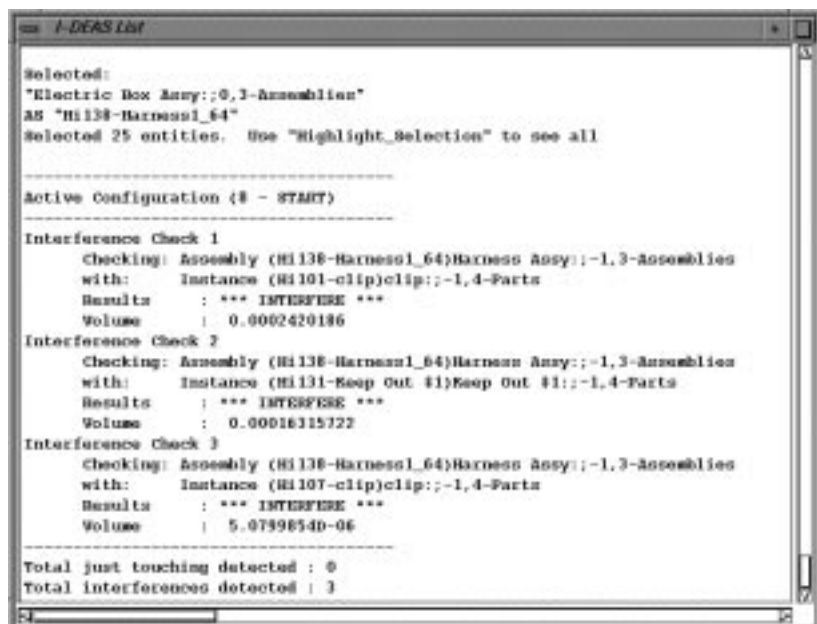
Under the interference check 'Options' button, turn off 'Clearance Distance Value' and turn on 'Instances within Assy'.

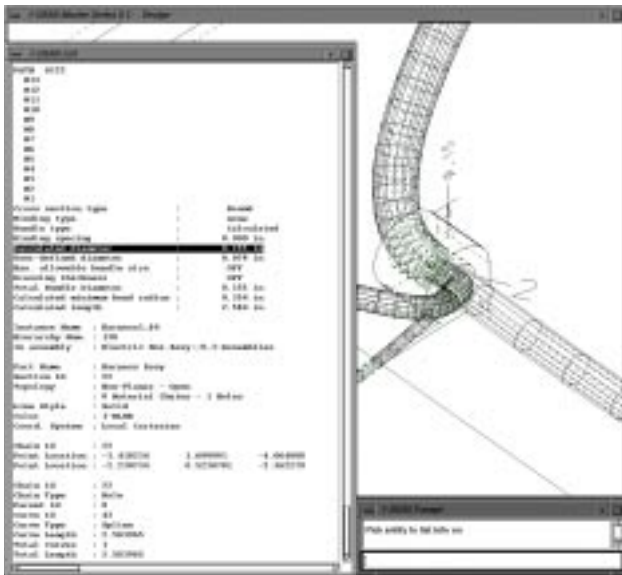
When the interference check is completed (about 50 sec on an SGI R10K), change 'Sort by Name' to 'Sort by Result'. The first 3 listings are the interferences. Highlight all three.



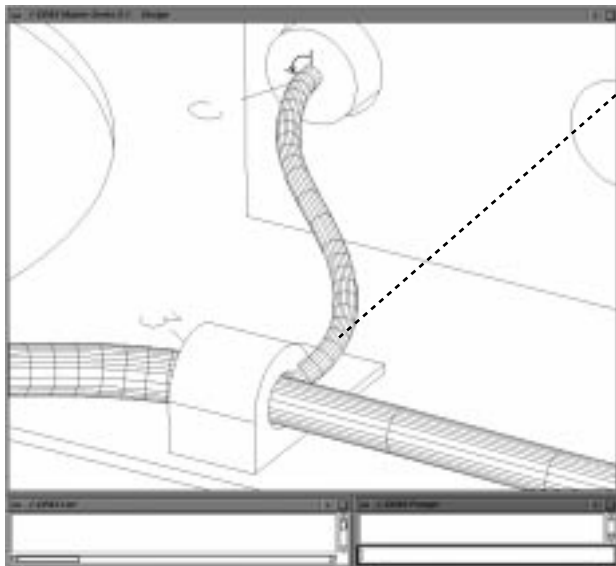


The picking the 3 interferences off of the form will graphically show the interferences in a red wireframe display. Also note the other information in the form, the 'Touch' conditions.

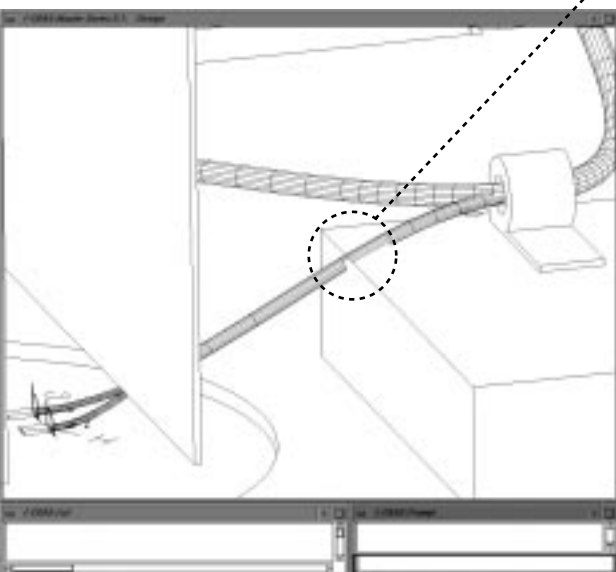




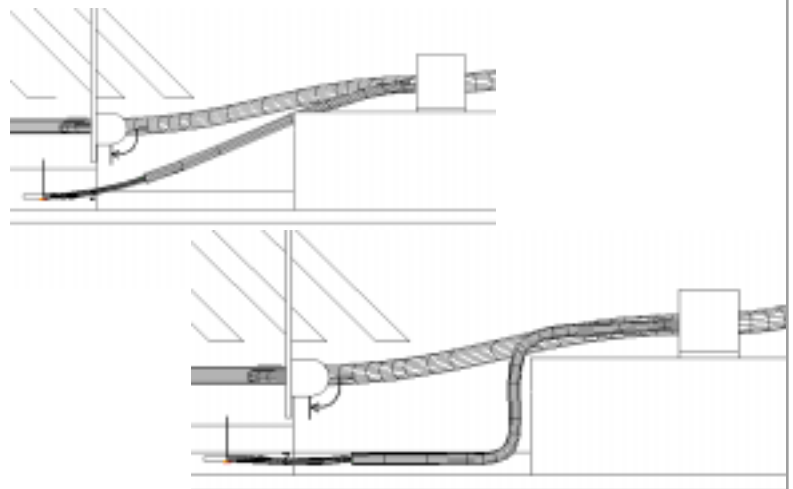
The interference check lists three interferences. The first interference occurs because path segment 1-2, which has a bundle diameter of .155", interferes with a hold down clip of thru hole diameter .150". Info path 1-2. Fix the interference by modifying the clip thru hole diameter from .150" to .200". It might be helpful to turn on the part instance names from the assembly filters form to see exactly which clip is hierarchy #101 vs. hierarchy #107.

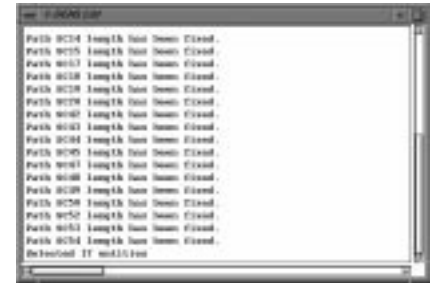
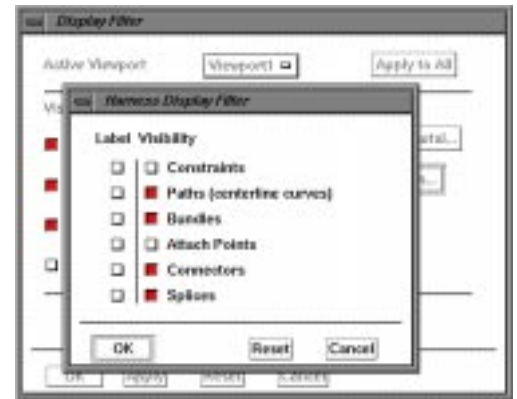
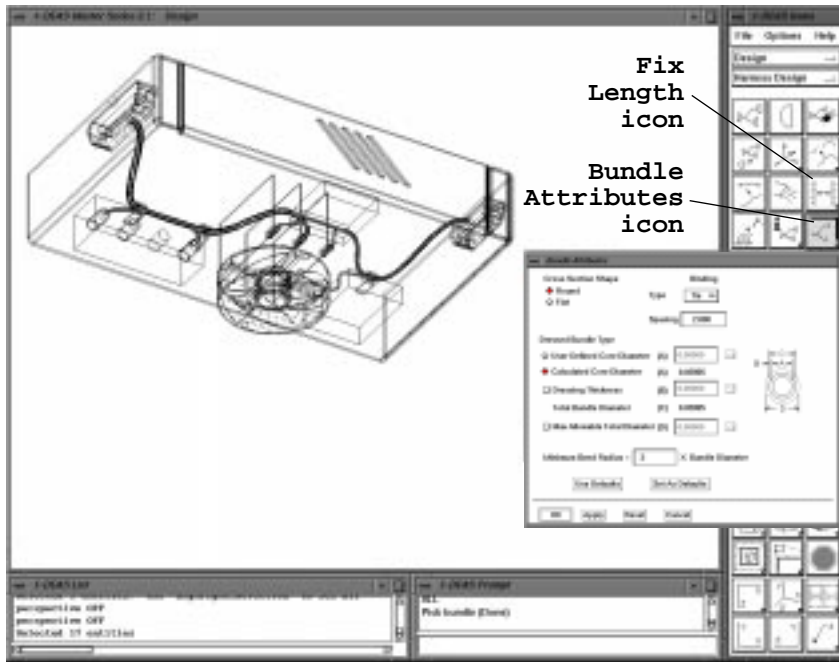


The second interference occurs because path 3-C intersects the wall of the clip. The resolution here is to pop into a top view and drag the path clear of the clip without violating the minimum radius of curvature.



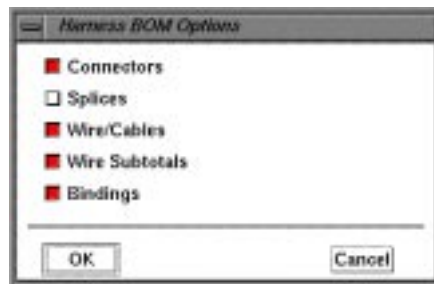
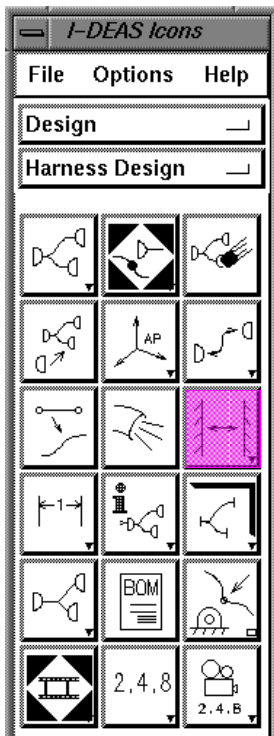
The third interference happens because the path 6-G hits the side of keep out #1. Fix this by popping to a front view, "full refine" the path segment and drag it path clear of the keep out area. Illustrate how the path can be shaped to run along the bottom of the sheetmetal enclosure and along the side of keep out #1

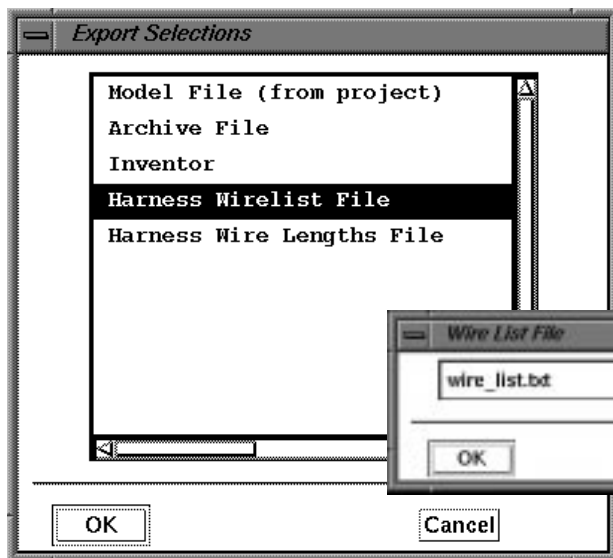




Pop to an iso view and autoscale. Use 'Display Filters, Harness' and toggle off constraints and reference designator display. Hit the bundle attributes icon, pick a path, MB3, All. On the bundle attributes form, change the tie wrap binding type from "none" to tie and set the spacing to 2". These attributes will results in the calculation of the number of tie wraps the harness requires at a 2" spacing.

Using the fix length icon, "fix" the lengths of all path segments (pick one , MB3, all). Select the BOM icon. On the "Harness BOM Options" form, turn on all of the buttons except 'Splices' and hit ok. Show the harness BOM information regarding the number of connectors, total wirelength, material usage, etc.

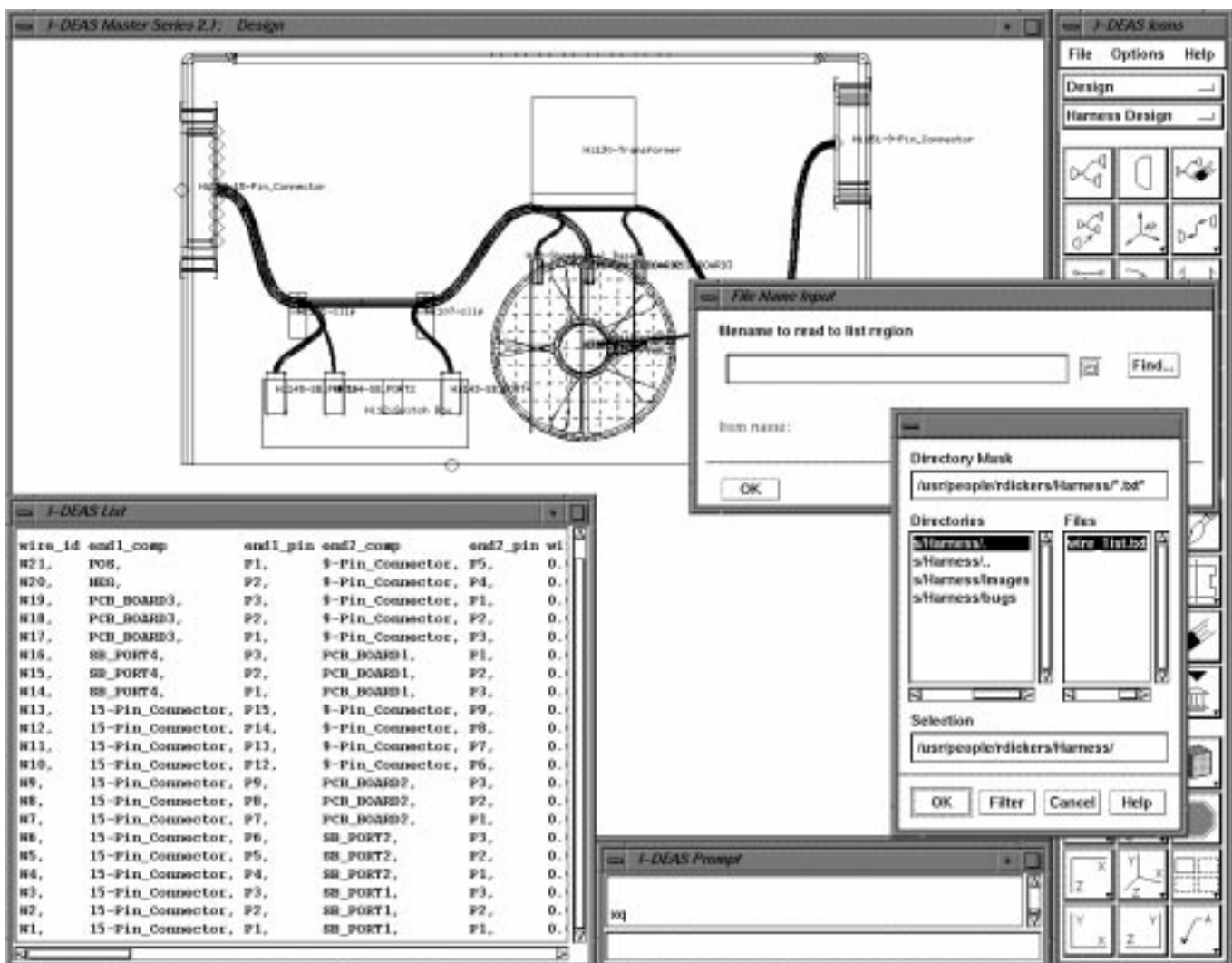




Pull down from the file menu to the "Export..." pick. On the export selections form, pick "Harness Wirelist File" and write a file named "wire_list.txt".



Type "xq", set the file filter to look for "*.txt*" files and pick "wire_list.txt" from the listing. This will show the formatted wirelist file in the I-DEAS list region. This is the file that we will apply on the flattened harness drawing. This file is also the means of bi-directionality back to the schematic capture program.



Look at a top view of the harness assembly. Hit the auto straighten icon. Pick the paths 1-2, 2-3, 3-4, 5-6, 5-6, and 6,7 as the "bundle for main truck". Flatten the harness in a plane defined by the top of the switch box (parallel to view plane)



Fill-out the form as shown. Put the flattened configuration of the harness in an empty assembly named "Flattened Harness" in the Assemblies bin. After the harness gets flattened, it will be red. You must hit the update icon to finish flattening the harness.

Name

Bin: 3-Assembli ?

Name	Part #	Type
Flattened Harness		Assembly

OK Reset Cancel

Auto Straighten Options

- ☒ Straighten all bundles, place straightened harness in empty assembly
- ☐ Straighten all bundles, keep straightened harness in active assembly
- ☐ Straighten individual bundles, place straightened harness in empty assembly

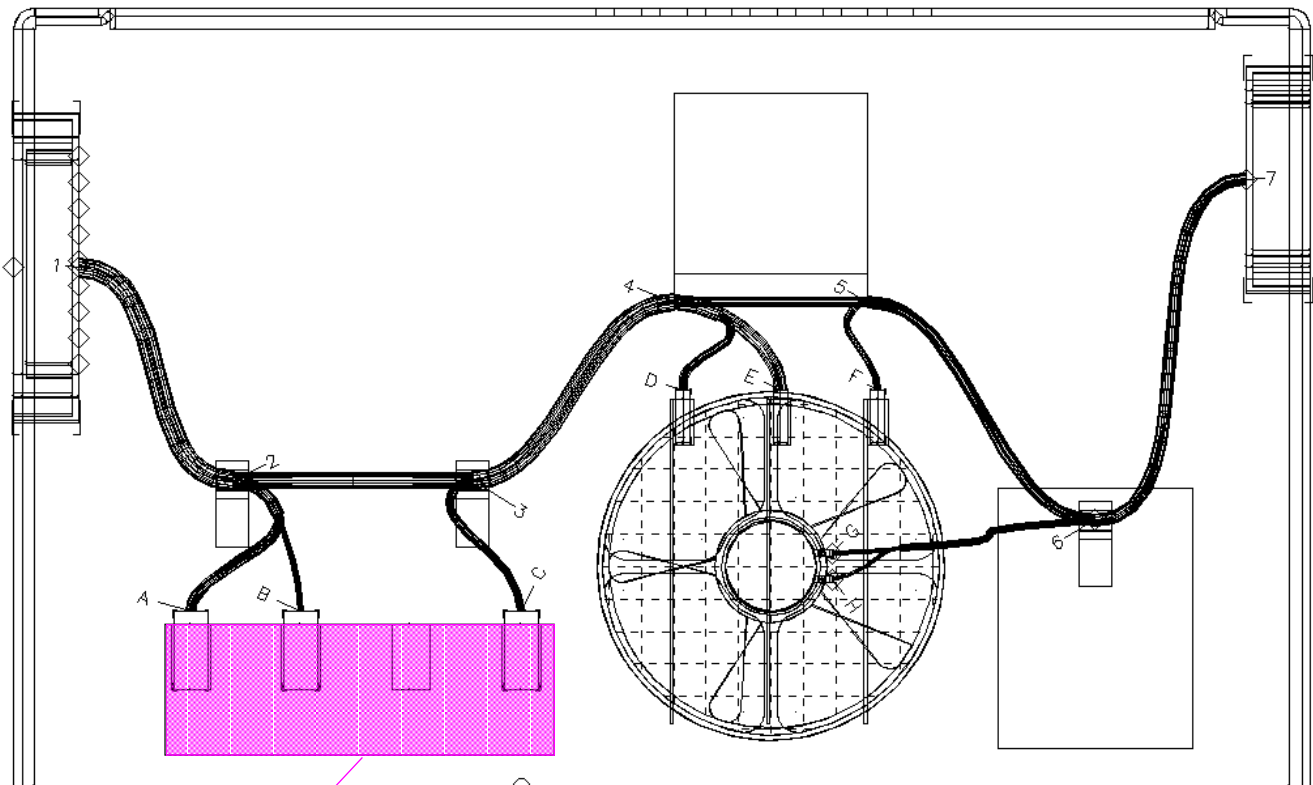
Branch: When 2 or more paths meet

Angle: 45

Tangency: ☒ On ☐ Off

Use Defaults Set As Defaults

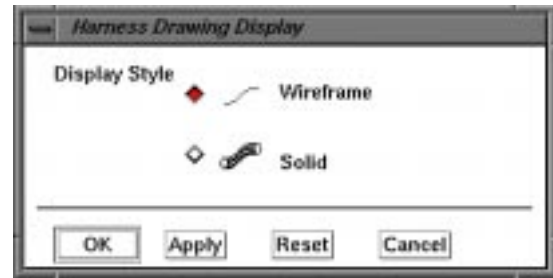
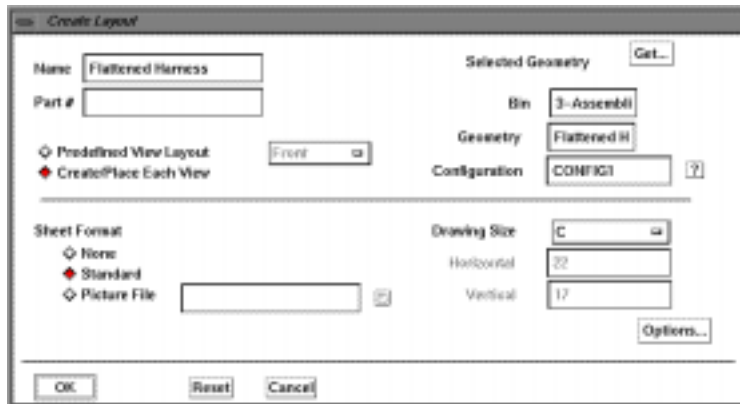
OK Reset Cancel



flatten on
this plane

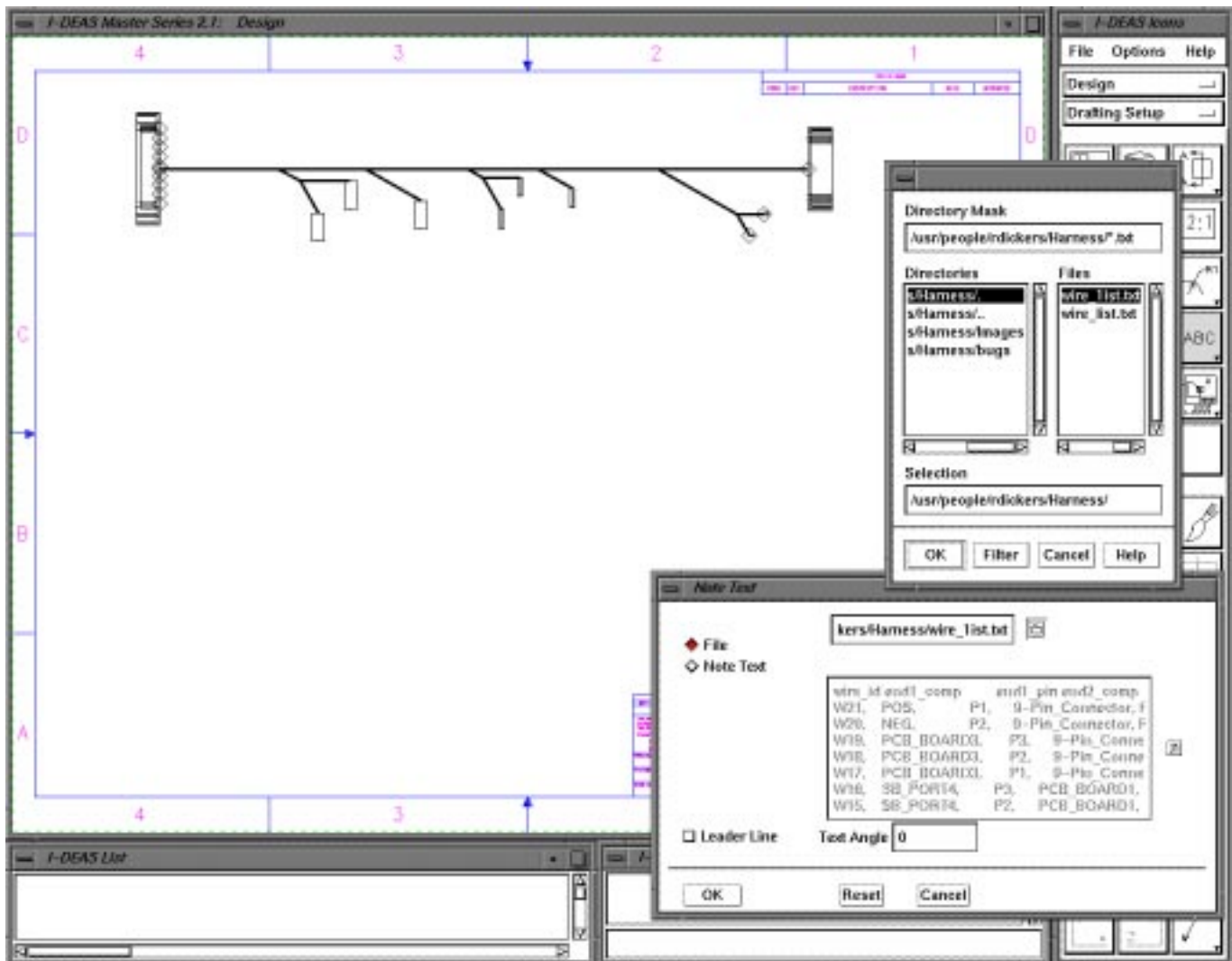


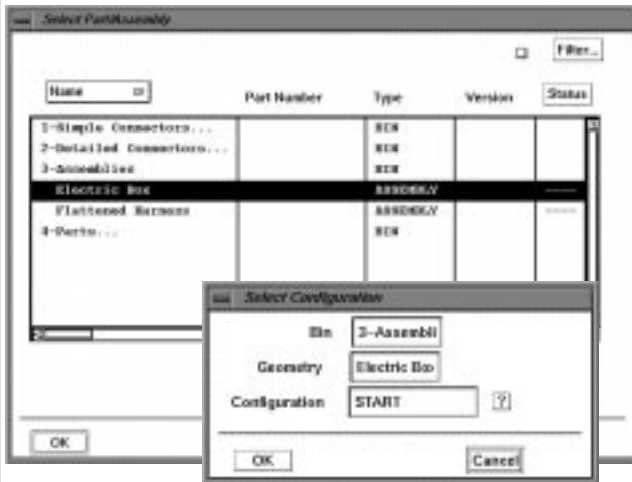
Turn on the Drafting Setup icons and create a layout of the flattened harness on a C-size drawing. Set the display style of the harness to wireframe. Place the top view of the harness toward the top of the drawing as illustrated.



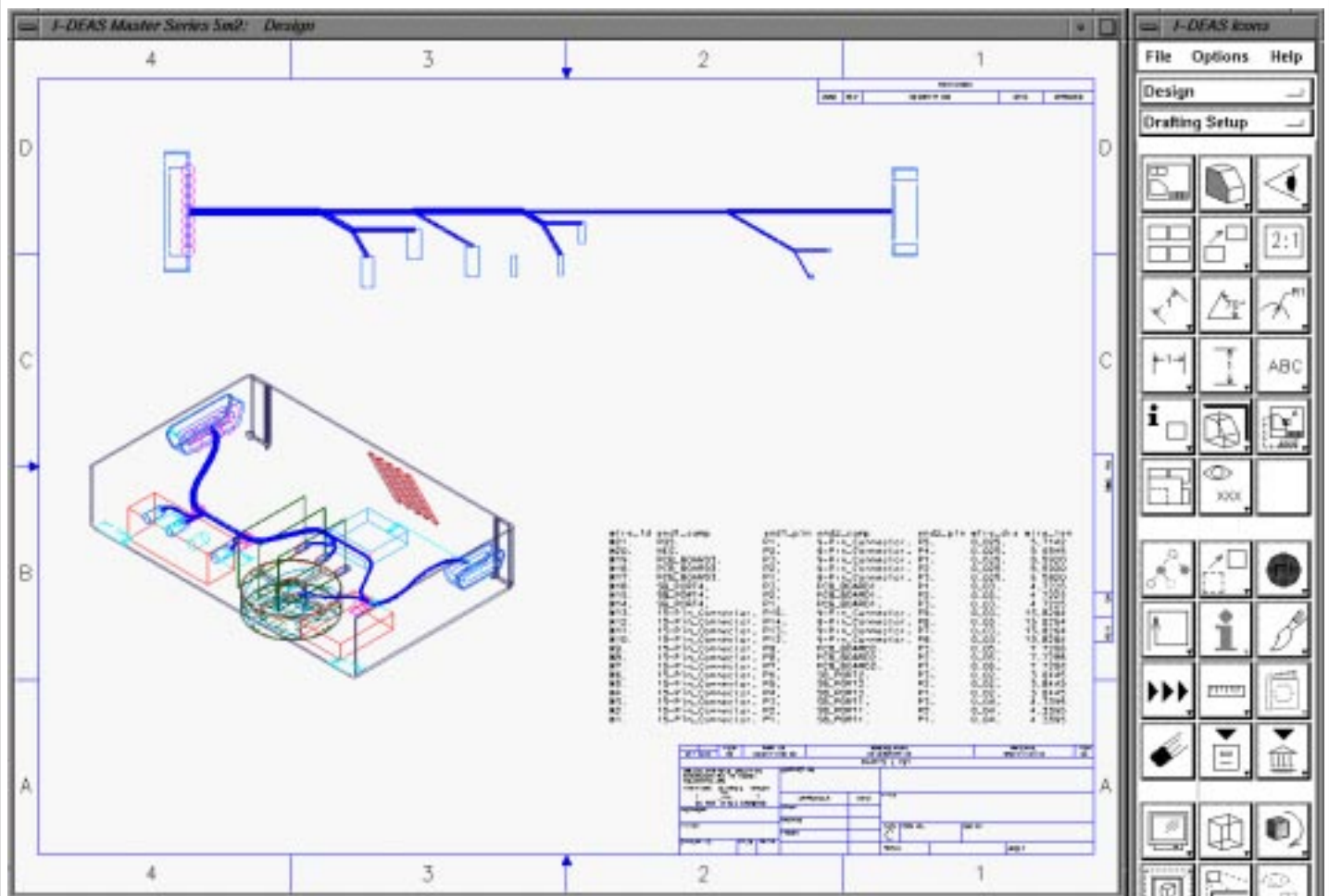
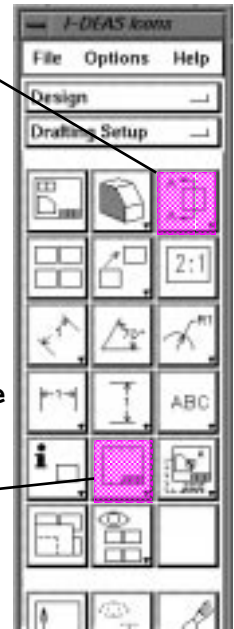
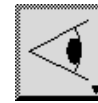
Next, put the (formatted) wirelist file on the drawing using the note icon (make sure that the active view is the 'DRAWING' view). The file name is "wire_list.txt". Place the text above the title box.

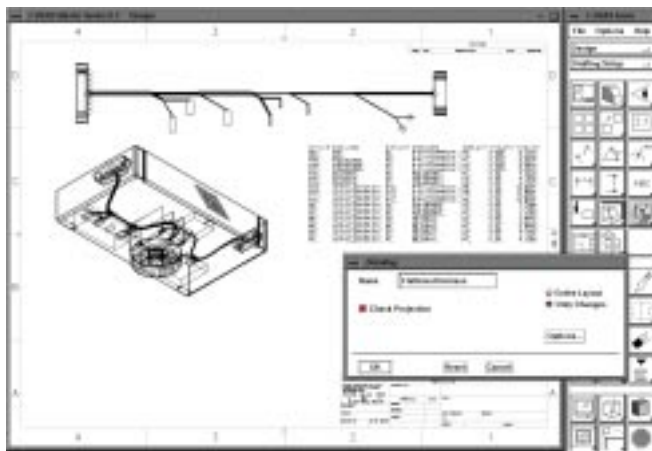
ABC





Place a user defined view of the "as-designed" harness on the drawing. Do this by using the change geometry icon and pick the "electric box" assembly from the form. Place an iso view of this assembly on the left of the drawing (manually set the eye direction as 1,1,1).



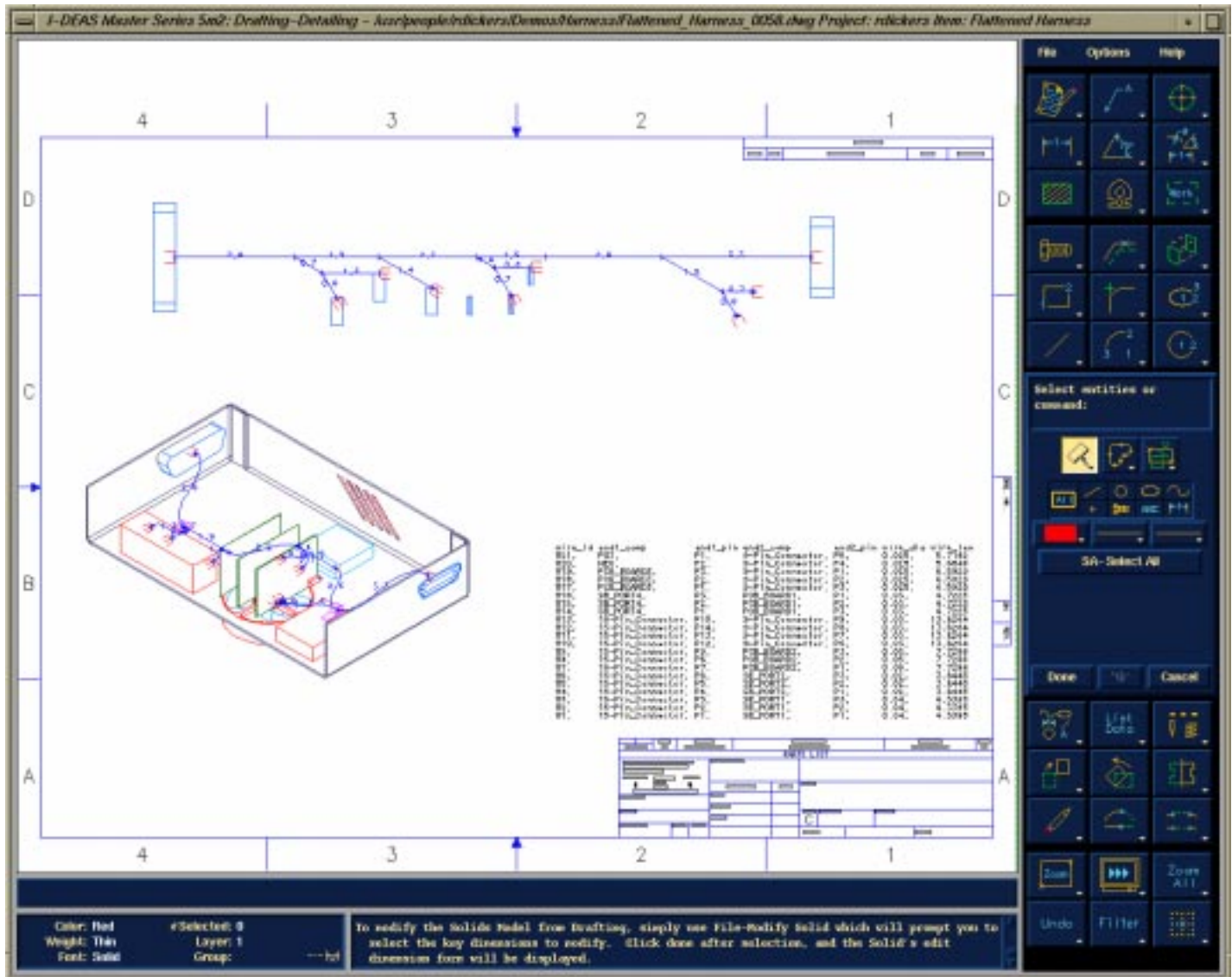
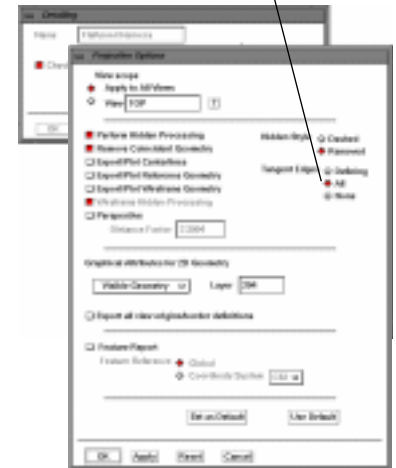


Hit the "Detailing" icon.



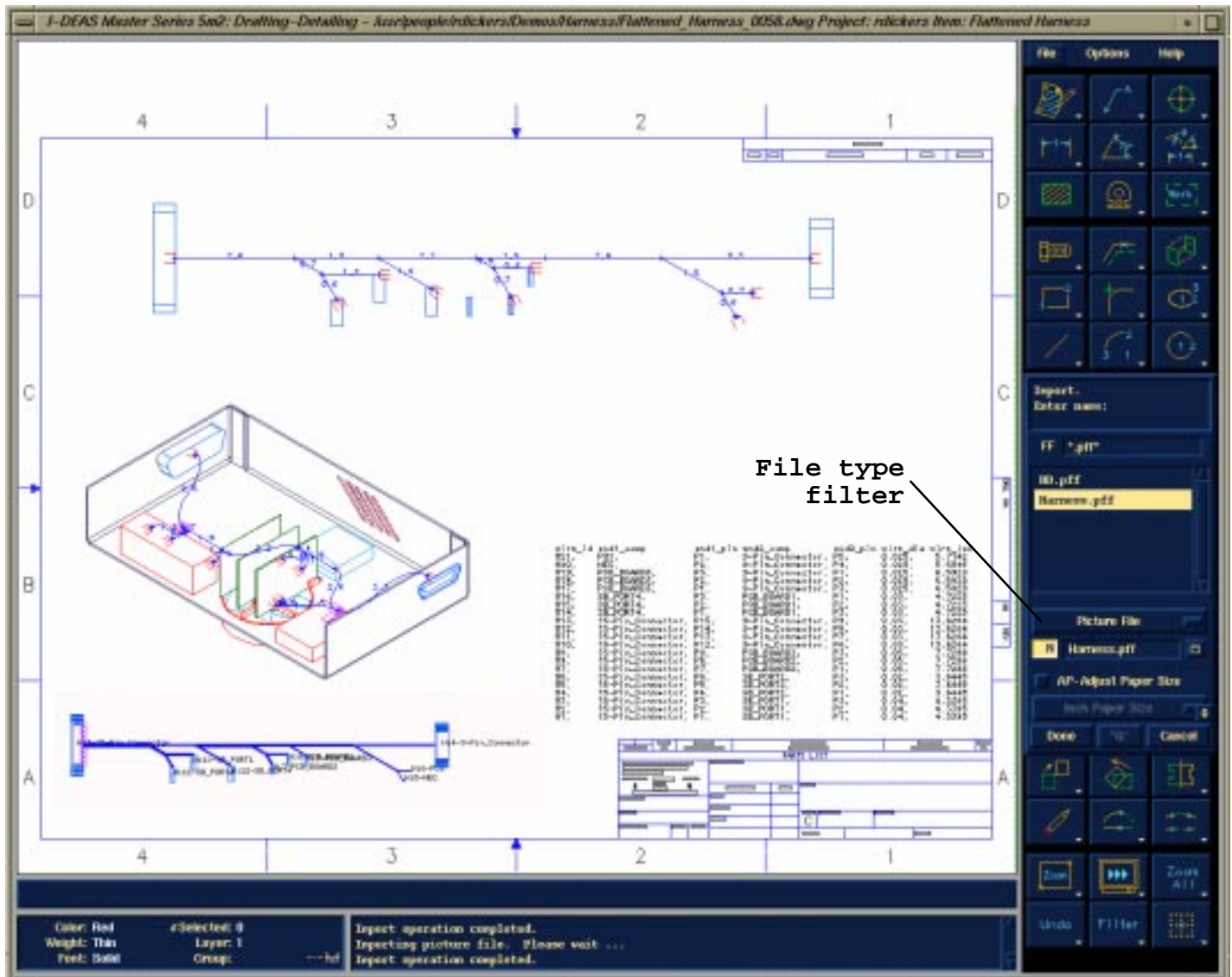
On the Projection Options form, set the "Tangent Edges" to "all".

Process the layout.

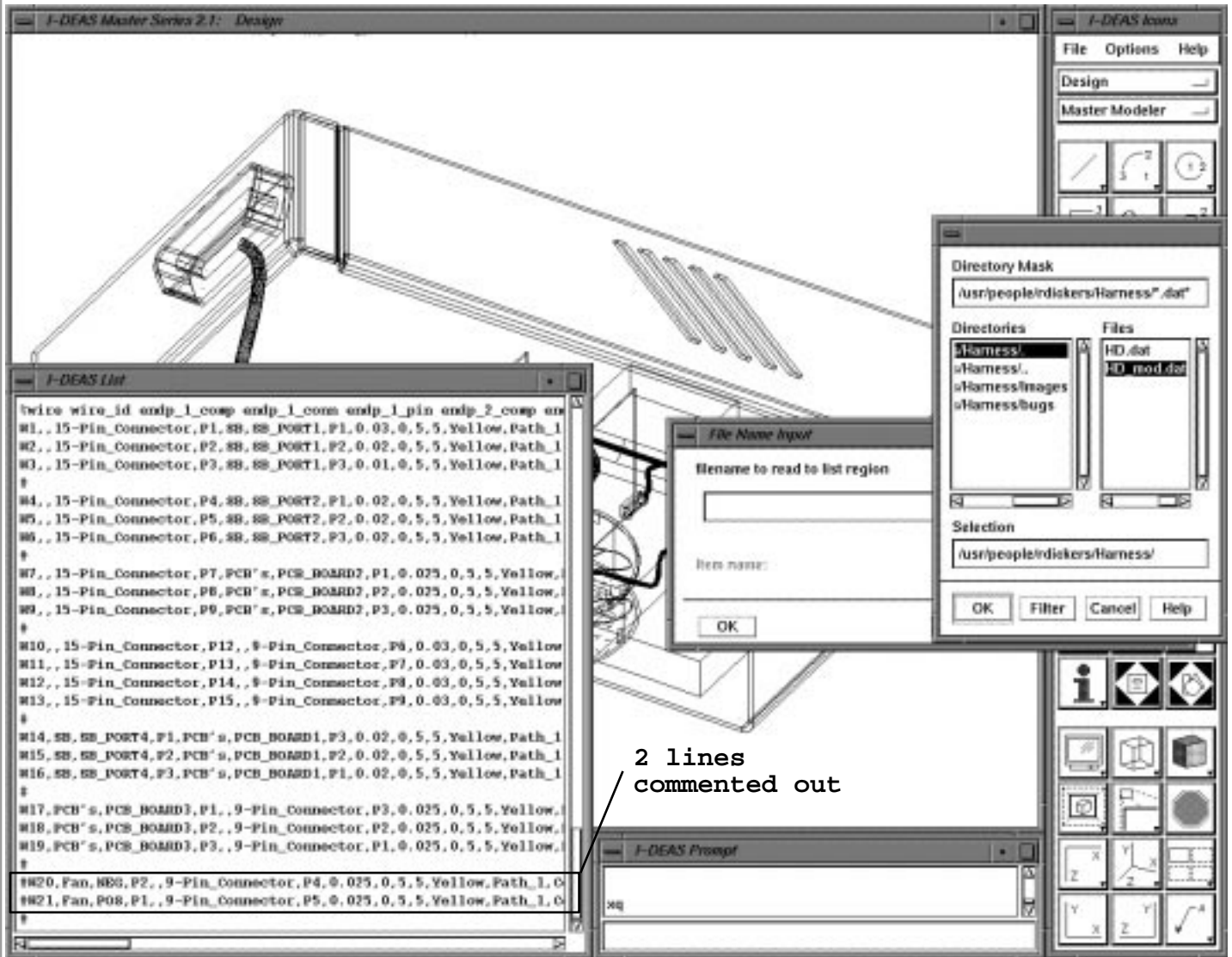


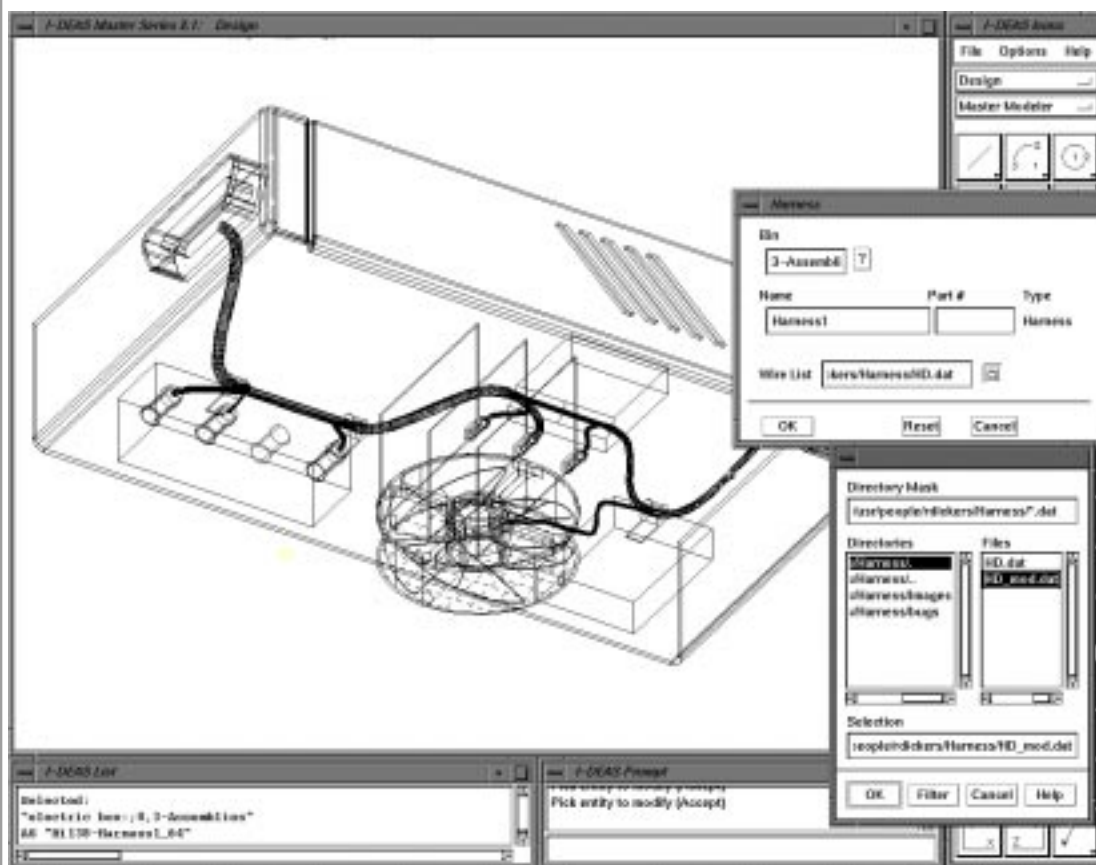
Place a formatted picture file on the drawing by using the "file, import" command. Set the file type filter to "Picture File". Select "Harness.pff" from the selection region. The picture file will appear at the bottom left of the drawing. The purpose is to show the connector names that are listed in the wirelist.

This drawing now has the information it takes to fabricate the harness.



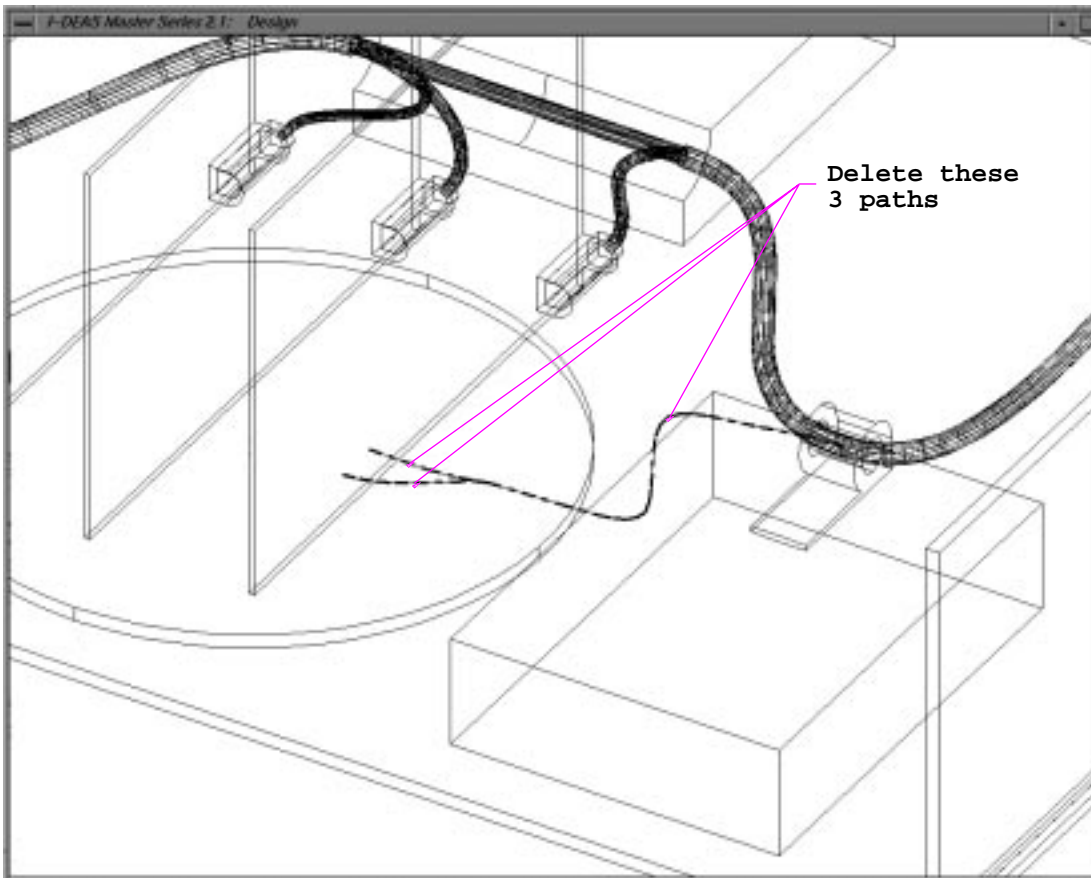
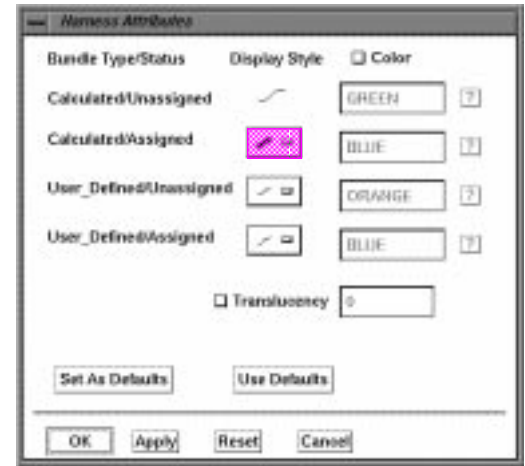
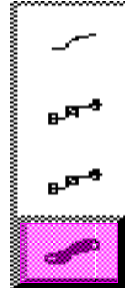
Exit the drawing back to the Harness Design task. Get the "electric box" assembly. Switch to an iso view and autoscale. Use the "xq" command to bring up a file name input form. Pick "HD_mod.dat" from the list. This is a modified wire list that has the positive and negative fan leads commented out. The purpose is to show associativity of the wirelist to the 3-D design and the manufacturing drawing. Show the customer that the two bottom lines are edited.





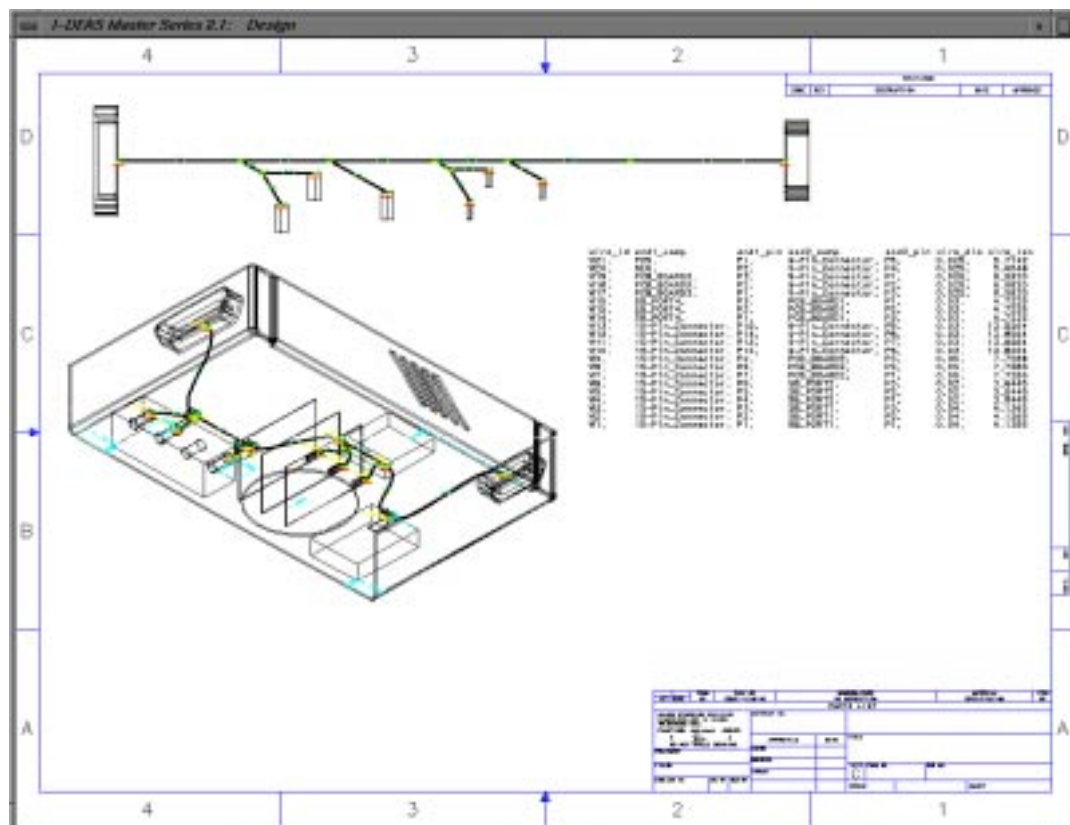
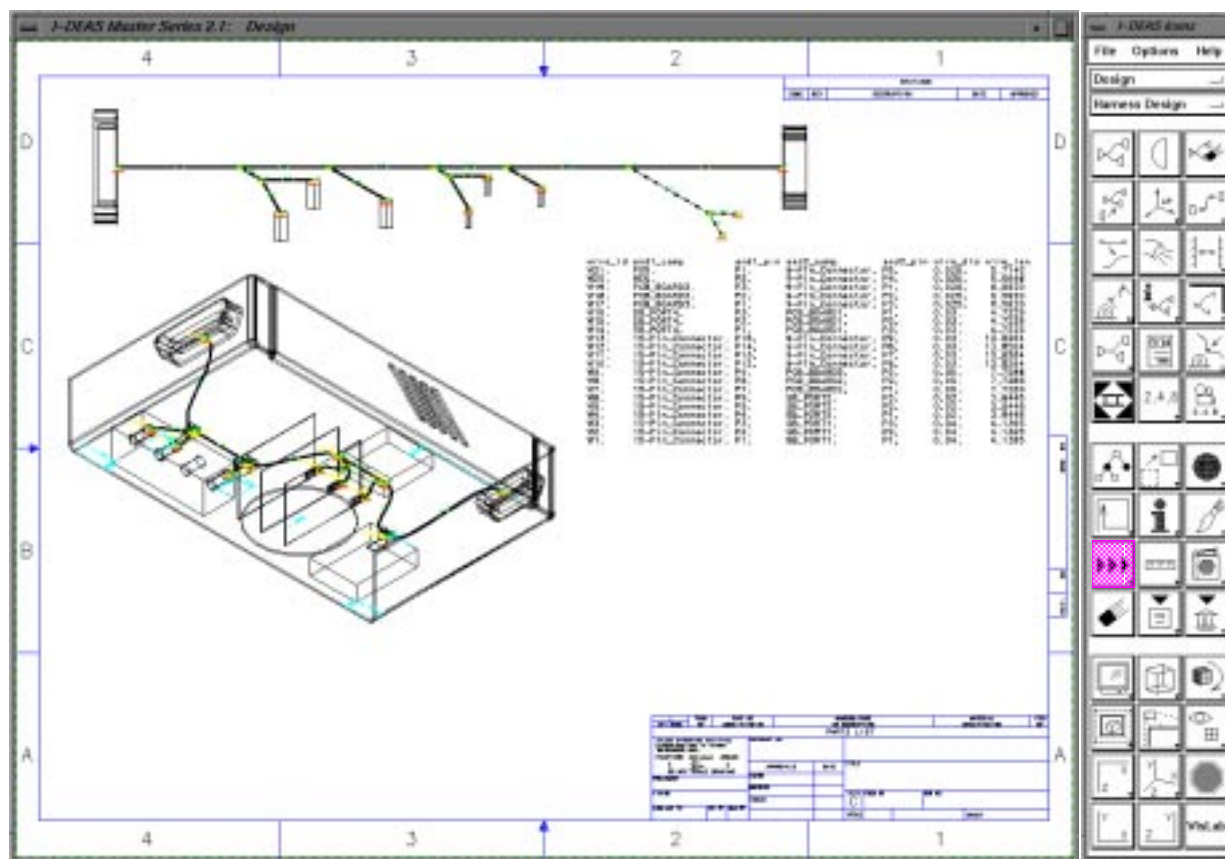
Modify the harness by hitting the modify icon, MB3, Hierarchy, 'Harness Assy...'. Select the "HD_mod.dat" wirelist as the new wirelist.

Using the Appearance icon, double click on one of the path segments to bring up the 'Harness Attributes' form. Change the 'Calculated/Assigned' display back to a solid display (it changed when we selected wireframe display in Drafting Setup).



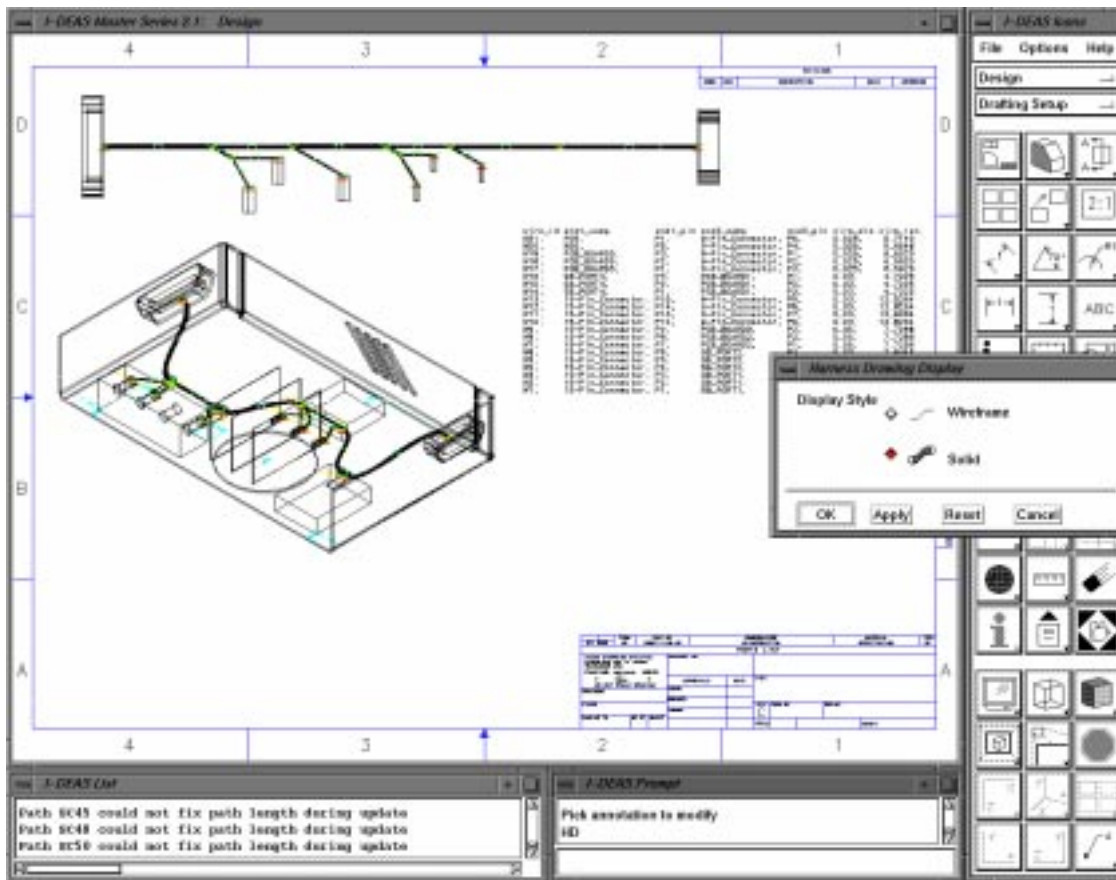
Notice that the two fan paths now have unassigned wires (the fan assy has been hidden for clarity). Delete these paths using the "delete" icon.

Turn-on the Drafting Setup icons. Notice that the fan wires paths are removed from the 3-D harness (shown in the iso view) and dashed in the flattened view. Also, the flattened harness configuration is red meaning that it is not up to date.

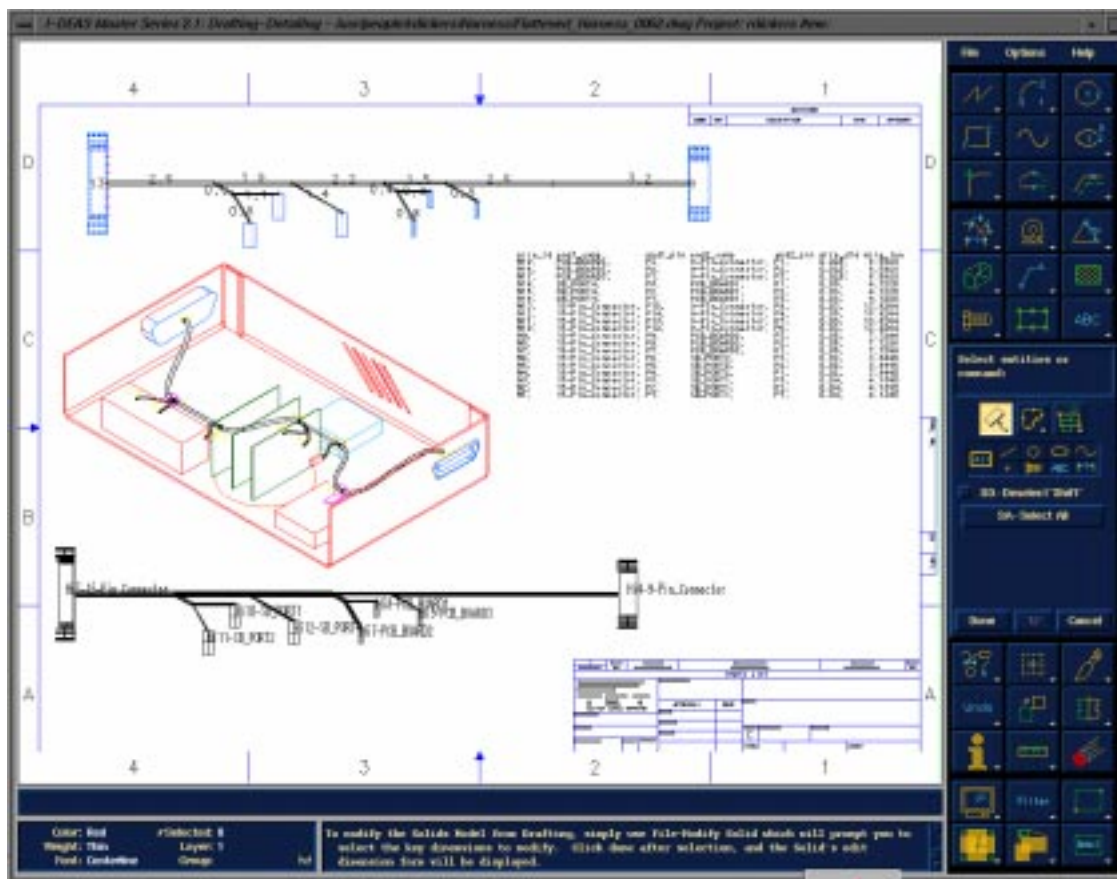


Hit the update icon. The fan pos and neg wire paths are removed as the harness is updated.

OPTIONAL

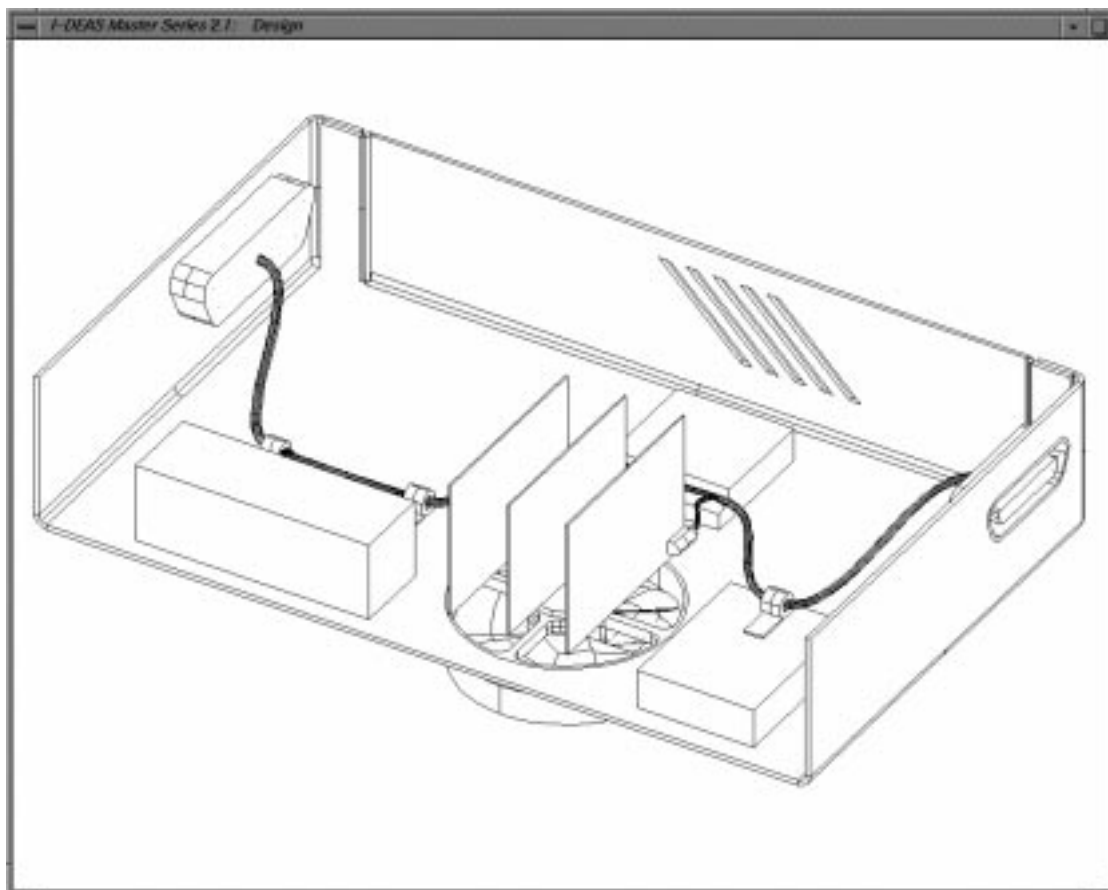


Hit the "Appearance" icon, MB3, 'Harness Display', change the display of the harness from wireframe to solid and reprocess the setup using the 'Detailing icon'.

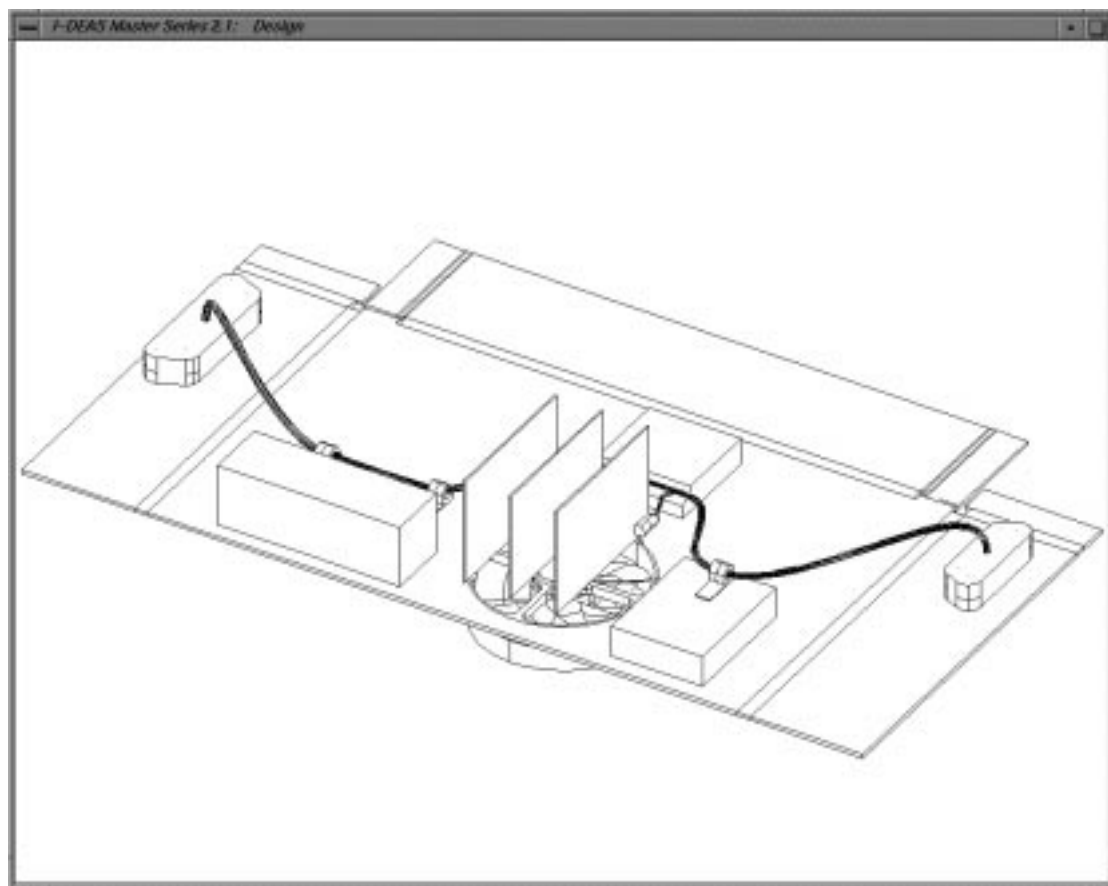


Notice how the flattened harness configuration now reflects the changes to the harness wirelist (the wirelist and geometry from the picture file were edited manually). Also, the display of the harness shows the thickened bundle diameter.

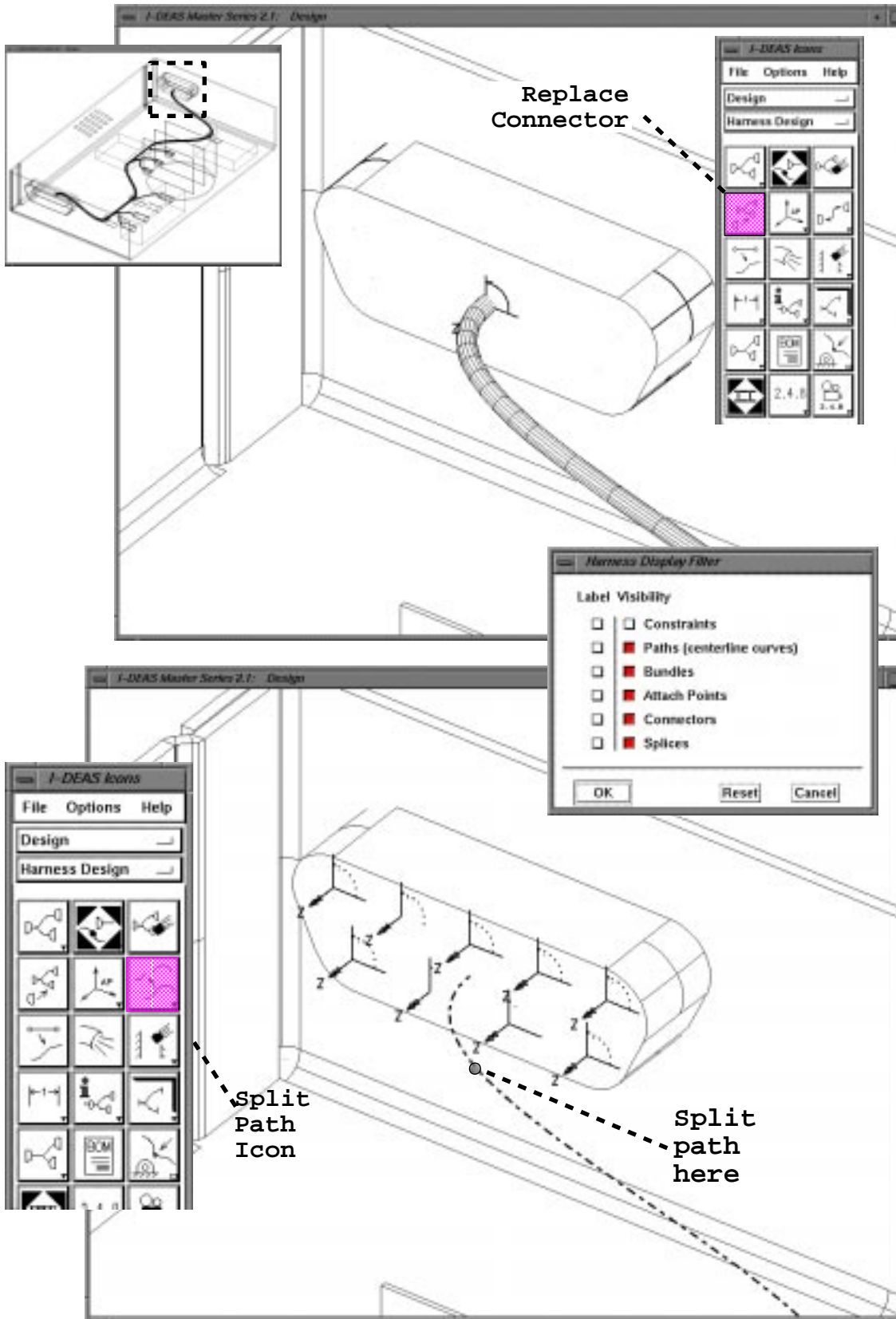
FUN #1



Turn on the harness design icons and get the "electric box assembly". "Unfix" the lengths of all the paths. Pick the modify icon and double click on the sheetmetal base. Pick "unfold all" from the menu and update the assembly. The sheetmetal base will flatten, the connector cutouts will move, the connectors will move and the harness paths will update. You might "straighten" the two affected segments if necessary.

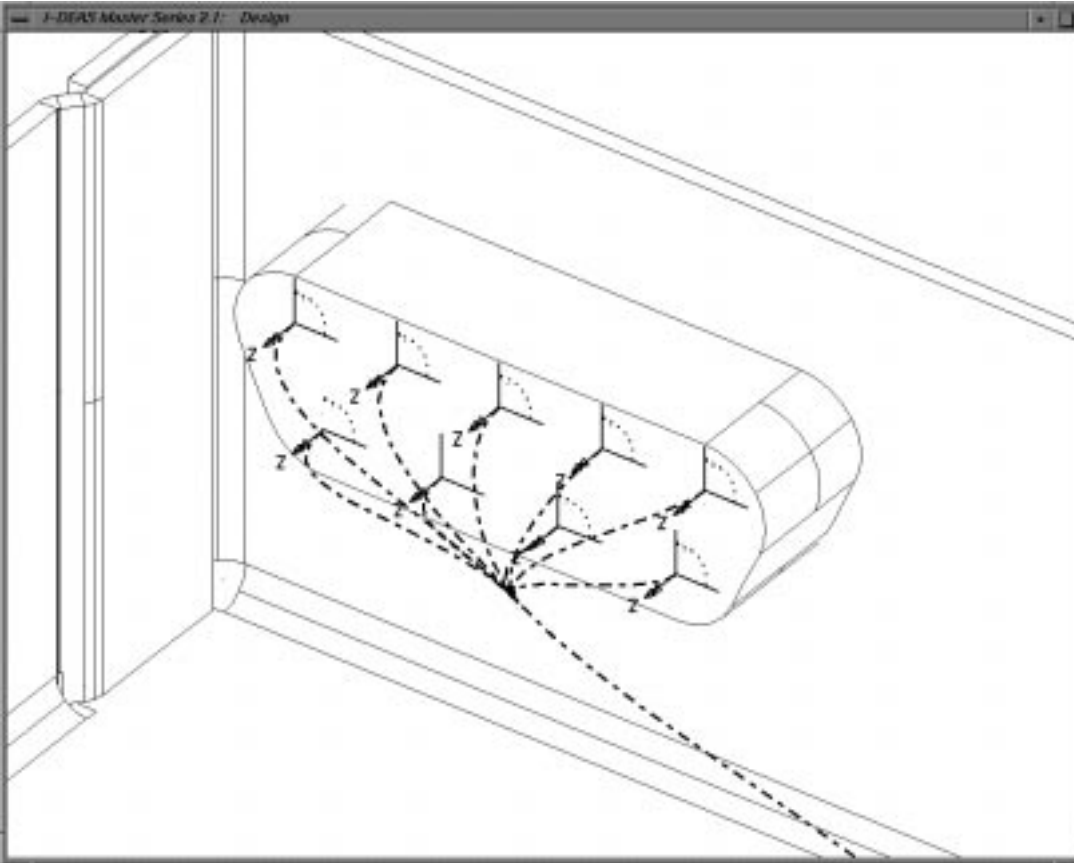


FUN #2



Re-open the model file with "control-Z". Switch to an iso view looking into the right side of the box as shown and zoom-in on the 9-Pin Connector. Use the "Replace Connector" icon to switch the "9-Pin Connector" with the "9-Pin Fanout Connector" from the "Detailed Connectors" bin. (Make sure the 'Attach Point' visibility is on). Notice that the wires become unassigned at the new connector (also, the face-to-face mating relationship between the old connector and the sheetmetal base gets discarded). Use the "split path" icon and split the path at the location shown.

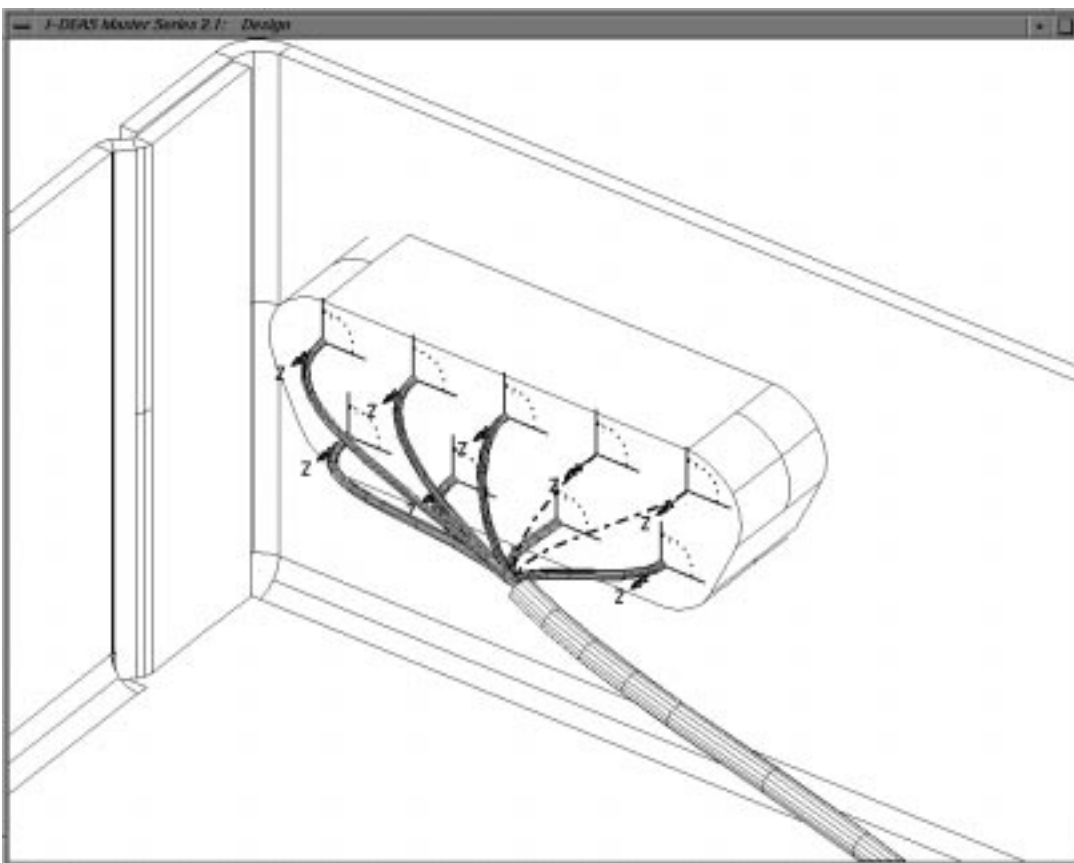
FUN #2...



Delete the path segment from the split point to the detailed connector. Use the "create path" icon to connect each attach point on the connector to the path. The exact prompting sequence goes like this:

Pick point for path definition (pick one of the attach points). Pick point for path definition (use MB3, slide down to "On Path" and pick at the end of the segmented path).

Repeat this process for each reference triad.



After all the paths are created assign the wires (turn all the checks off). Notice that two paths will not have wire assignments-these pins used to be connected to the fan (pin 4 and pin5-see the wirelist for verification).

End