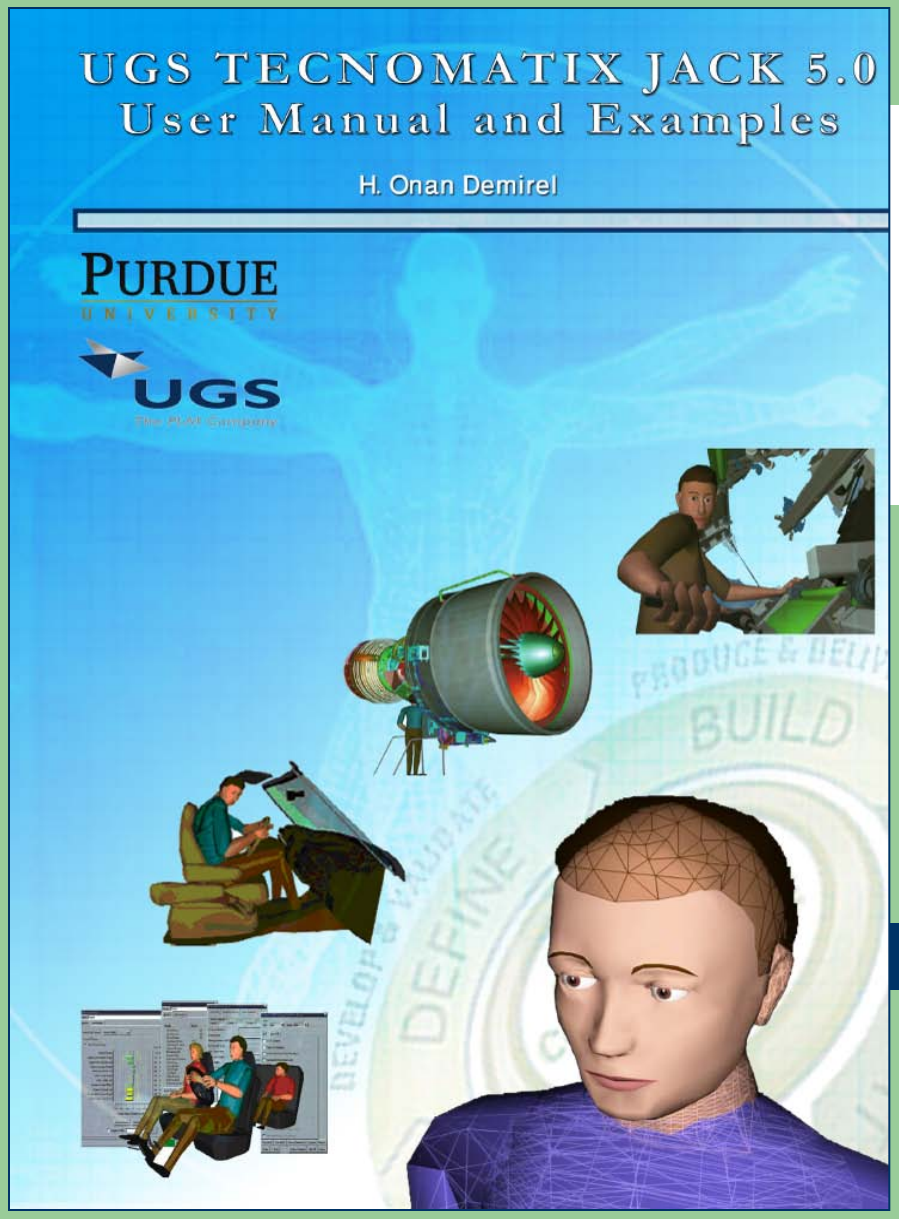


# Jack 5.0 User Manual and Examples

## Digital Human Modeling (DHM) FOR Product Lifecycle Management (PLM)

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# Overview

- Introduction/Background
- DHM for PLM
- Jack 5.0 User Manual in Details
  - How to create human body?
  - Lower Back Analysis
  - How to Import/Export CAD files?
- Sample DHM+PLM Design Practice
- Future Work

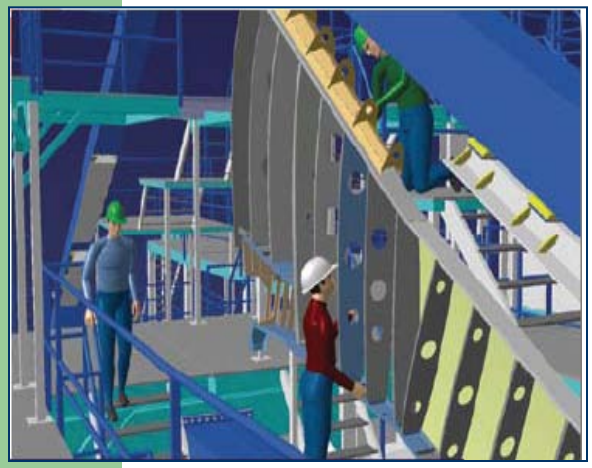
# What is DHM?

- Digital human models (DHM)
  - A digital representation of the human inserted into a simulation or virtual environment to facilitate prediction of safety and/or performance
  - Includes a visualization & math/science in background (Sundin, 2006)

- Has potential to enable engineers
  - incorporate ergonomics & human factors engineering principles earlier in the design process (Duffy, 2004; Chaffin, 2005)

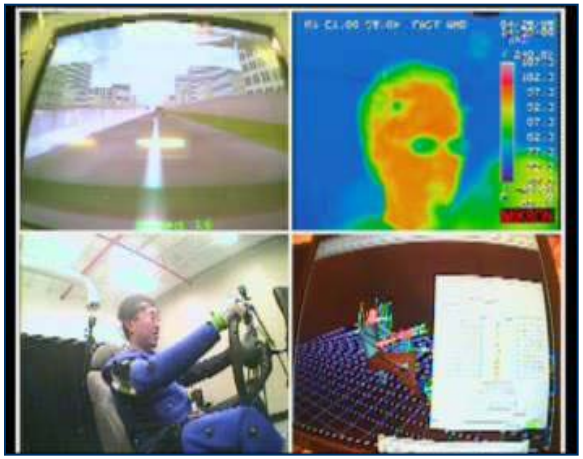
# DHM for PLM

- Integration of PLM and DHM
  - Increases the engineering design and analysis capabilities
  - Improves the product ergonomics
  - Provides cost and time savings



Work Environment Simulation

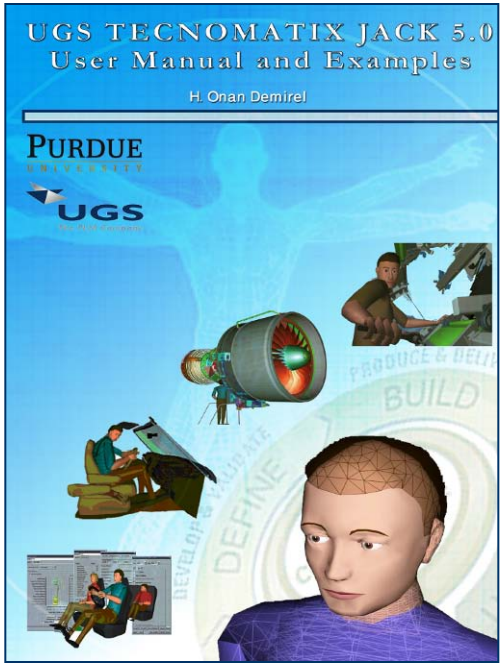
Automotive Design

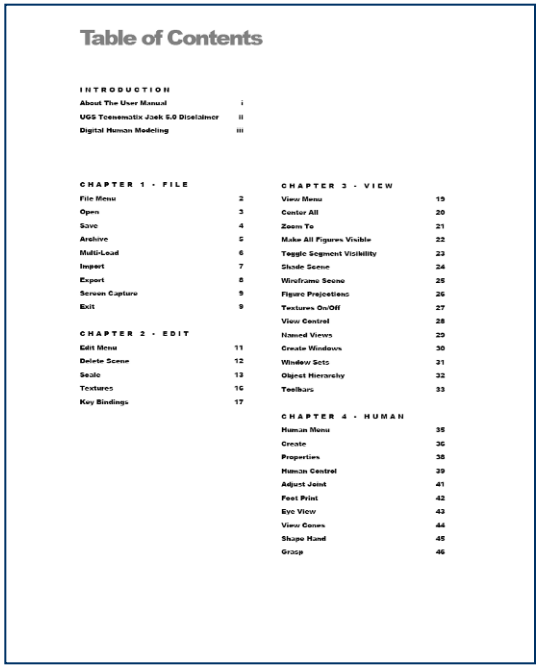


Cognitive Models

# Purdue University
## *DHM in Engineering Curriculum*

- Comprehensive tutorial for the UGS Jack software package
- Integrate classical ergonomics and human factor curriculum with interdisciplinary design engineering tools



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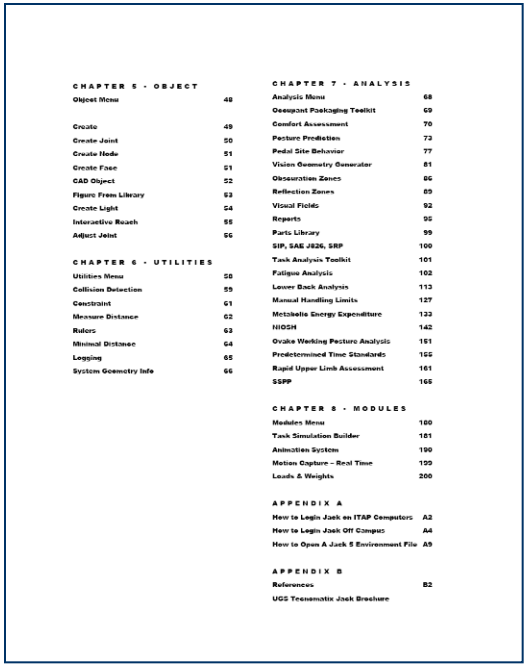


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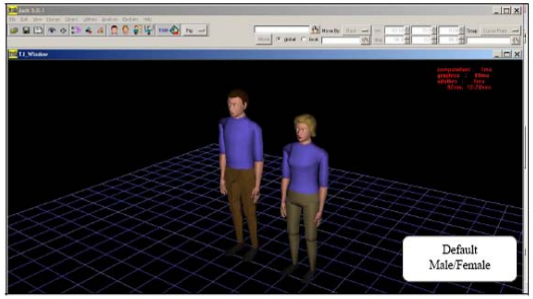
# Jack Manual in Details – User Guide

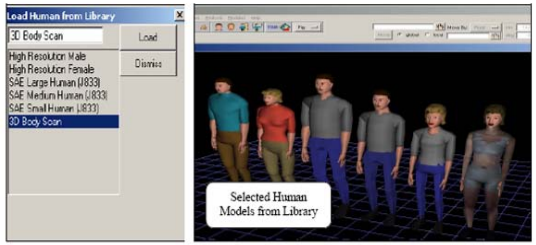
## *How to create human body? (pg. 36,37)*

### Create

Create command is used for launching human bodies (male/female) to Jack 5 view screen.

You can launch default bodies, or bodies from library. In addition, you can create custom bodies with specific measurements and properties.

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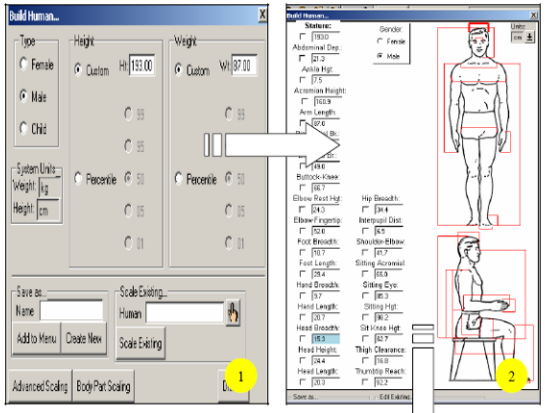
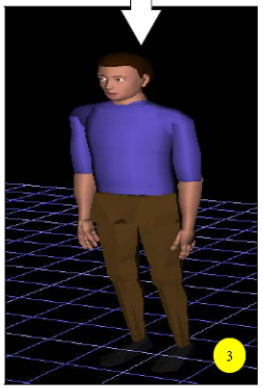



Step by Step Custom Human Creation

1) Enter type, weight, height and name your human.
2) Go, "Advance Scaling" to modify desired body dimensions.
3) The custom human will appear automatically.

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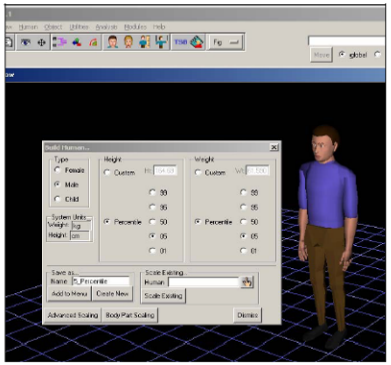
# Jack Manual in Details – Exercise
## *Lower Back Analysis (pg. 113,125)*

**Step 1: Build Human -** ***Anthropometry Information***

We need to know the worker's sex, weight, and height. This information is entered into The **Build Human** dialog box holds the related input variables and helps us to build our digital worker. Our sample digital worker will be a 5% percentile male (164.69 cm tall and 61.590 kg).

1) Go Human → Create →Custom
2) When the dialog box appear choose;
   a. Type = Male
   b. Height → Percentile = 05
   c. Weight → Percentile = 05
3) Save as... → Name = *give any name you want, ex. 5_Percentile*
4) Create New

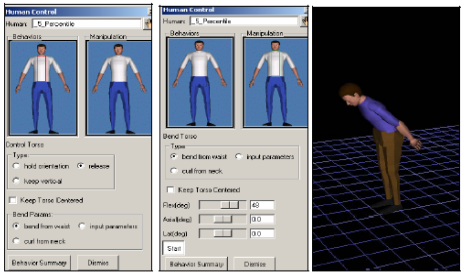


**Note** = In future, you can edit your human figure by using Scale Existing command in above dialog box by changing the anthropometry variables.

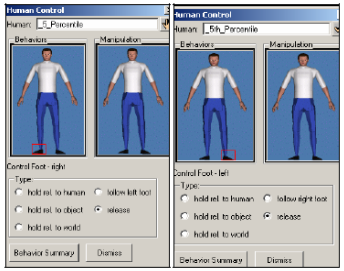


**Step 2: Posture –** ***Joint angles***

1) Control Torso



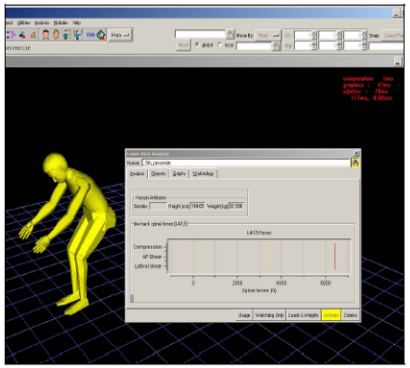
2) Balance Control



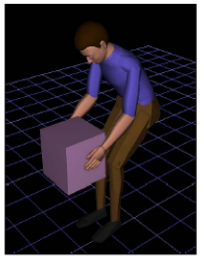


**Step 3: Lower Back Analysis Setup –** ***Loads***

1) After you build the desired posture go to Analysis → Lower Back Analysis. From the Lower Back Analysis window click on the hand tool and select your already built human.



2) OPTIONAL! *Next step is the Load & Weights selection. You don't need to create a solid load or a CAD object. You can assign the loads as vector forces to a specific point on the human body. However, it may be useful to show a box load for presentation purposes, but is optional.*



*You can create a box type object in several different ways. One way is;*

Object → Create → Rectangular Solid

Enter values, height, width and depth.

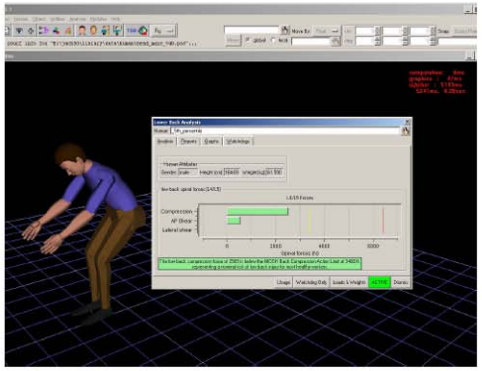
*After you create the solid box, manually drag the box to the position respect to the human posture.*

# Jack Manual in Details – Exercise
## *Lower Back Analysis (pg. 113,125)*

**Step 4: Activate** - ***Run the Static Strength Prediction***

After you finish the Step 3, click the Activate tab on the Lower Back Analysis main window. This will simulate the applied loads and the relative posture by using Lower Back Analysis algorithm.

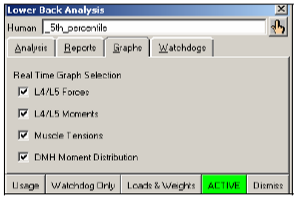
When you click Activate, first thing you should notice is the Low Back Spinal Forces (L4/L5) chart.

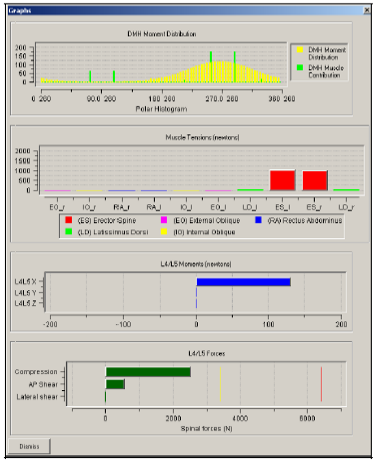




**Step 5: Analysis** – ***Graphs***

Jack's Lower Back Analysis module will develop DHM Moment Distribution, Muscle Tension, L4/L5 Moments, and L4/L5 Forces graphs for further analysis. In order to view the graphs, click the Graphs tab and select the graph types you want.



# Jack Manual in Details – User Guide

## *How to Import/Export CAD files? (pg. 7,8)*

### Import

Import command helps users to load files from external sources. You can import CAD files, Images, Textures, VR files...etc from other software by using common file share extensions available in Import menu. **Figure 3** shows available Import file extensions in Jack software.

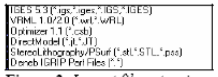
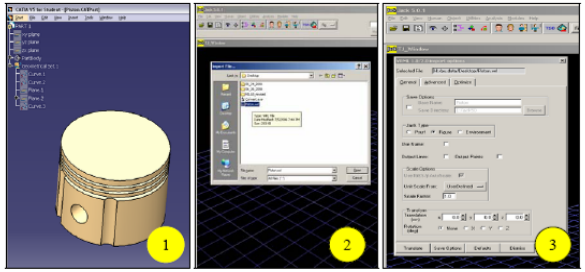
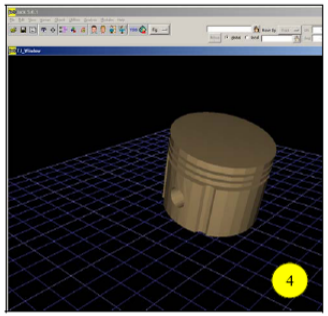



**Figure 3**: *Import file extension*




**Step by step Import file (-igs)**

1) CAD part (This part was created in CATIA V5. Also, any 3D CAD program can be used.)

2) Save CAD part as –igs, -stl or –wrl. (-wrl extension is used in this example.)

3) Go to Jack 5, click Import and select the file you have already saved in Step 2. When VRML pop-up window appears, click Translate.

4) Ignore the process pop-up windows. Your CAD file should be visible in Jack screen

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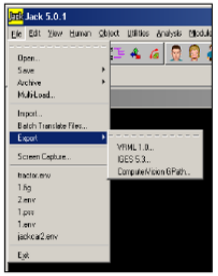
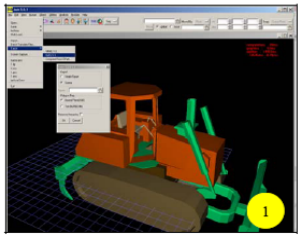
### Export




Export command allows users to export files to an external source. You can export Jack files to CAD softwares, VR softwares, Image editing softwares…etc. by using common file share extensions found in Export tool. You can either use VRML, IGES or ComputerVision Gpath to export Jack files.

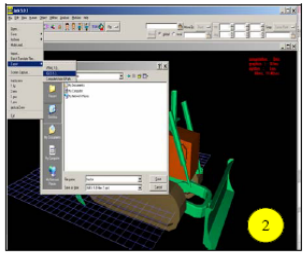


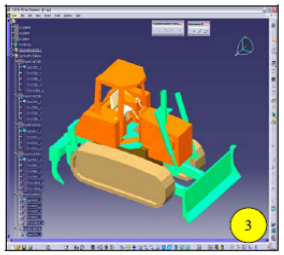

**Step by Step Export File (-IGES)**

1) Open a Jack 5 environment. Click Export > IGES> OK

2) Give a new name to the file you want to export and click Save.

3) Open the external software and open the file that you have already saved in Step 2. (In this example, CATIA V5 software was used to upload the file.)

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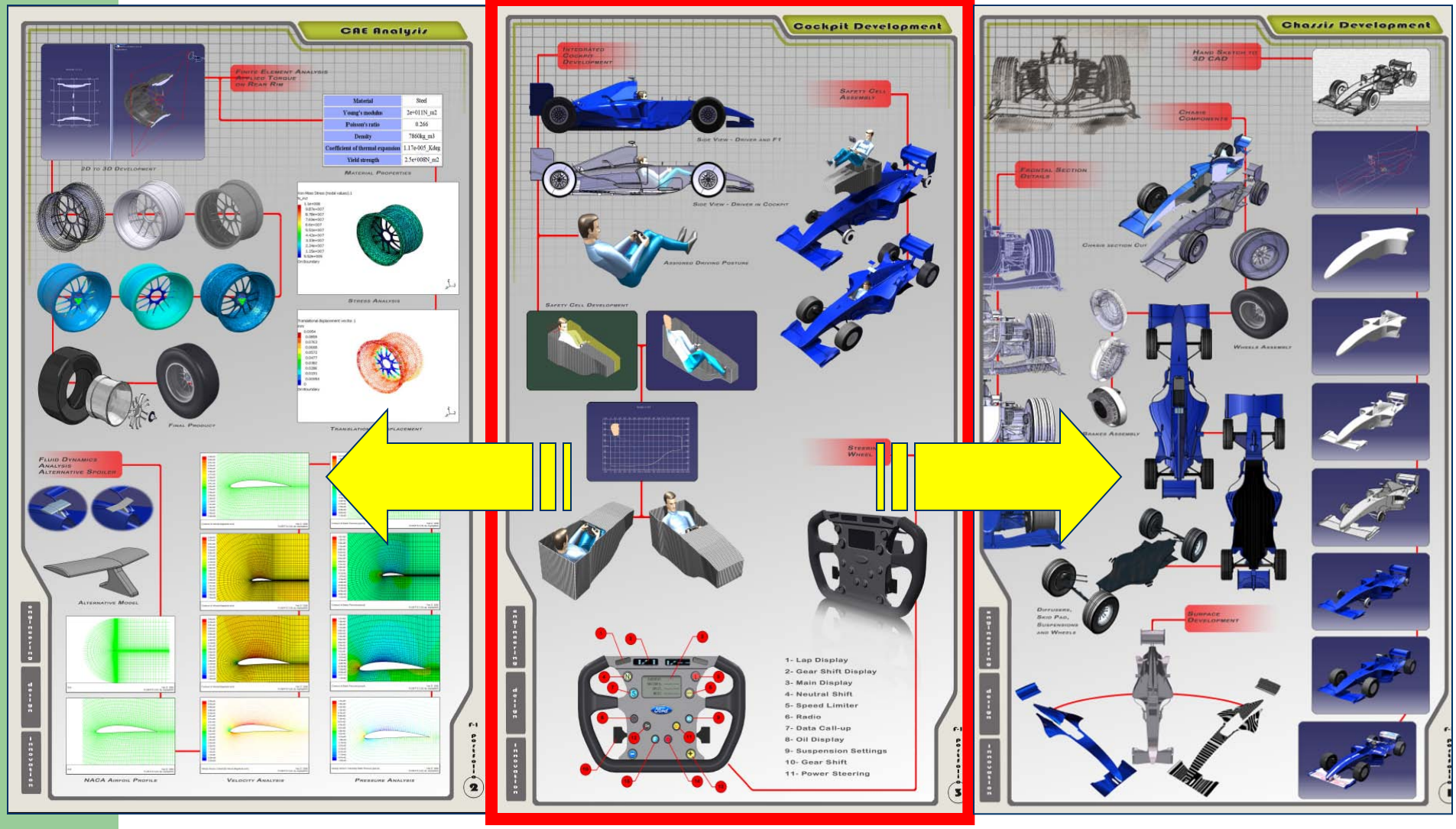
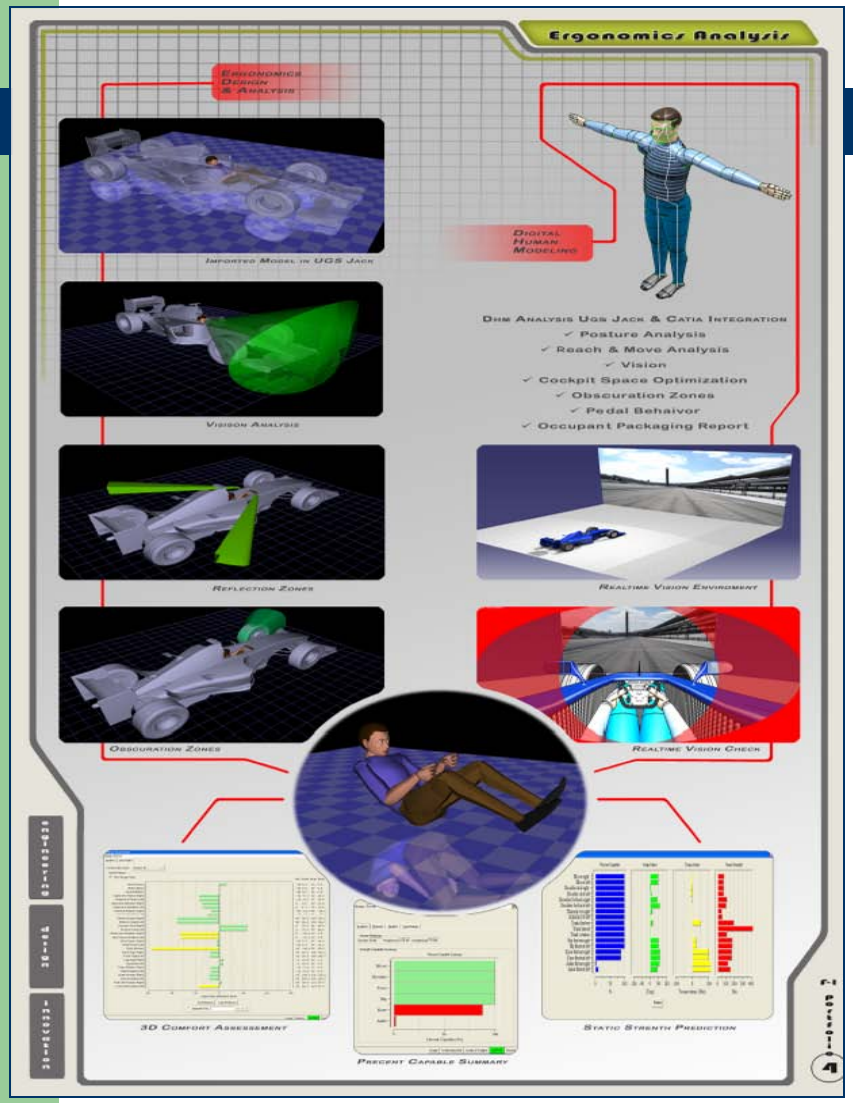
# Jack Manual in Details – Design Practice

## *DHM & PLM Integration for Digital Prototyping*



# Jack Manual in Details – Design Practice

## *DHM & PLM Integration for Digital Prototyping*



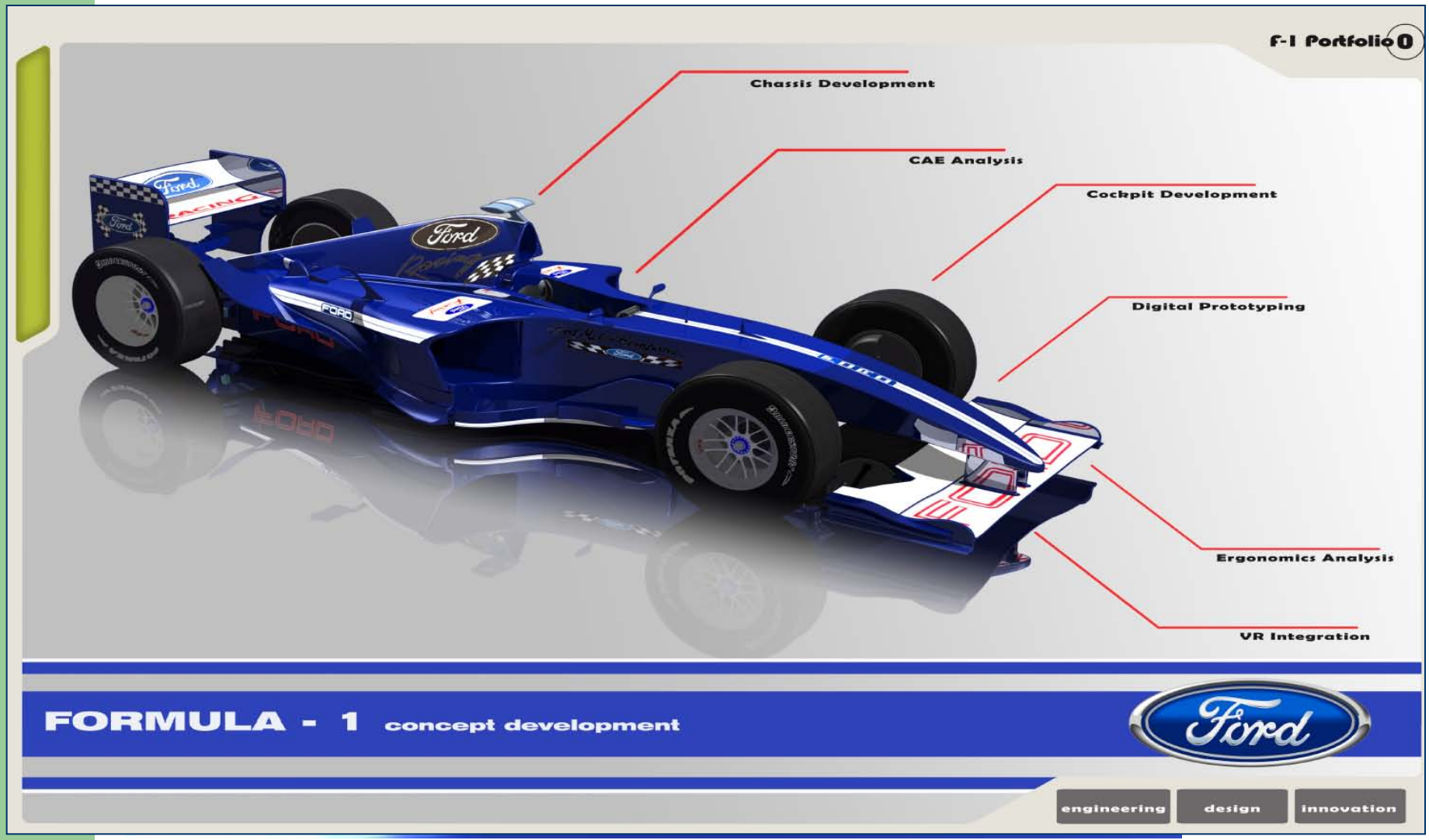

**Results;**

- Vision Analysis
- Reflection Zones
- Obscuration Zones
- 3D Comfort Assessment
- Percent Capable Summary
- Static Strength Prediction

# Future Work

## *DHM + PLM + Virtual Reality (VR)*

**Virtual Reality;**

- **Interaction with product in immersive environment**
- **Replicate the real geometry through stereoscopic projection**
- **High fidelity;**
  - **Identical volume, positioning, and depth**

# QUESTIONS & COMMENTS?