



# Distributed Collaborative Product Development in Academia

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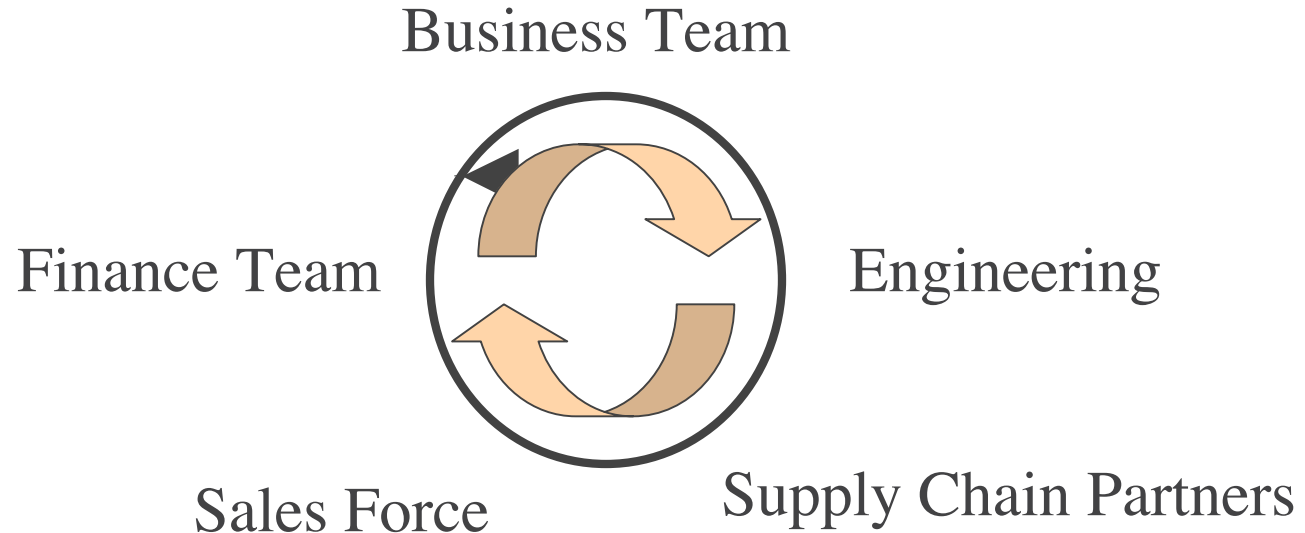


# Overview

- β Introduction
- β Collaboration in Business
- β Collaboration in Universities
- β Requirements for Collaboration
- β DCPD John Deere Project
- β Benefits of Collaboration

# Collaboration in Business

The organizational structure of today's businesses require close relationships between interdisciplinary teams for optimal efficiency



# Collaboration in Business

Why?

- β Increased focus to meet customer needs
- β Faster time-to-market
- β Increase quality
- β Lower costs
- β Reduce rework
- β Reuse accumulated knowledge
- β Share risks



# Collaboration in Business

How?

- β Web based conferencing
- β Product Lifecycle Management Software

- TeamCenter -  UGS PLM SOLUTIONS  
an EDS company
- Enovia -  DASSAULT  
SYSTEMES
- Windchill -  PTC  
The Product Development Company

# Collaborative Product Development in Industry

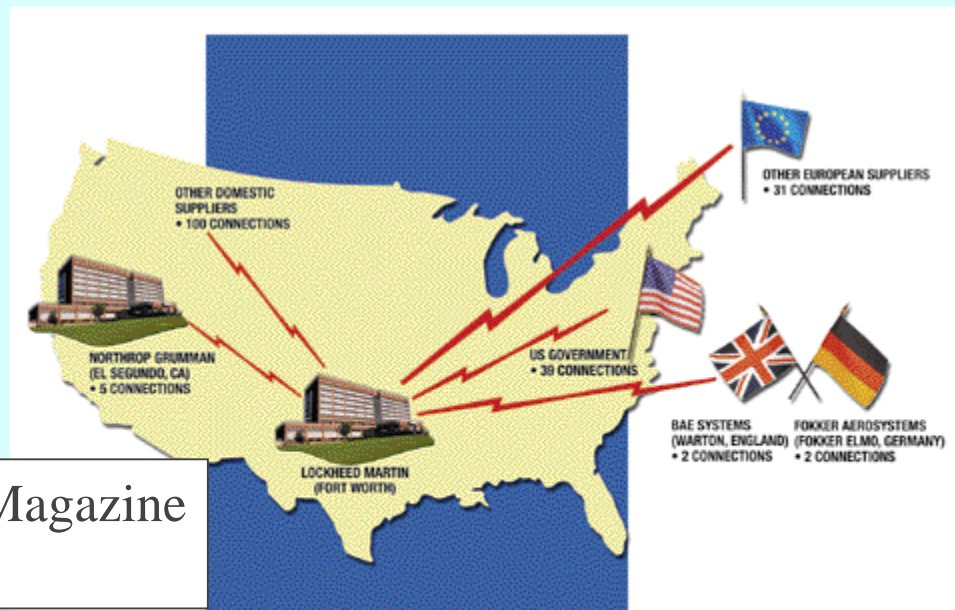
## X-35 Joint Strike Fighter



### COLLABORATIVE DEVELOPMENT ACROSS 11 TIME ZONES

Uniform tools give Lockheed, its partners,  
and suppliers the same view of product development

- PDM software • CATIA for 3D design
- 1 master database, mirrored at partners, synchronized in real time



Source: Desktop Engineering Magazine  
Dec 2002

# What is PLM?

“Product Lifecycle Management enables you to marshal the skills, expertise, knowledge, and experience of your entire extended enterprise and apply them to every major stage in your product lifecycle to achieve competitive excellence.”

<http://www.eds.com/products/plm/>

# Why PLM in Academia?

Business is utilizing PLM

Students need practical experience

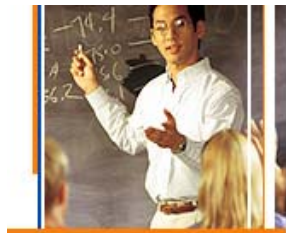
- Co-op
- Internships
- Projects



# Collaboration in Universities

## Accreditation Board for Engineering and Technology (ABET)

β Outlines 8 Criterion for Accredited Engineering Programs, including ***Criteria 3 - Outcomes and Assessments***, that each graduate must accomplish



# ABET

ACCREDITATION

CAPSTONE DESIGN fulfills three of the eleven ABET ***Program Outcomes and Assessments (Criteria 3)*** including

- β an ability to apply knowledge of mathematics, science and engineering
- β an ability to design a system, component or process to meet desired needs
- β an ability to identify, formulate and solve engineering problems

# DCPD John Deere Project

Phase 2 of the Distributed Collaborative Product Development (DCPD) project involves the following Universities

β Georgia Institute of Technology

β University of Maryland-College Park

β University of Illinois Champaign-Urbana

β Bentley College



# DCPD John Deere Project

## Division of Responsibilities

### β Georgia Tech

Primary Mechanical Design Team

Industrial and Systems Design Team

Industrial Design Team

### β University of Maryland

Mechanical Design Team

### β University of Illinois

Mechanical Design Team

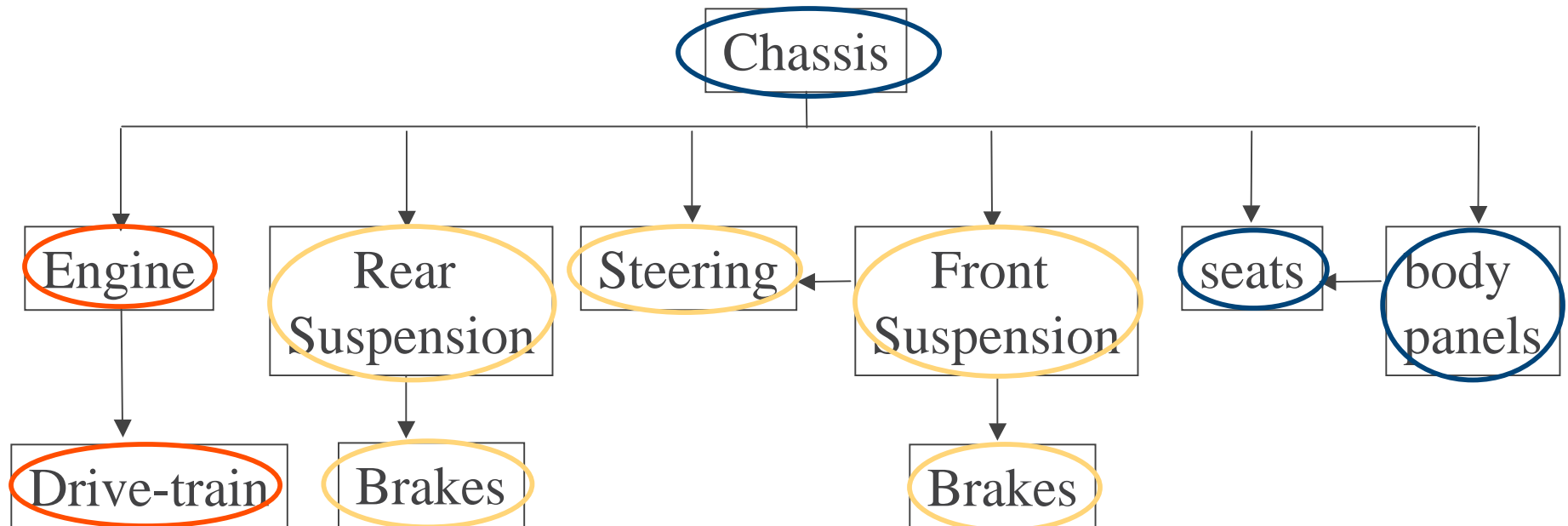
### β Bentley College

Operations Research Team



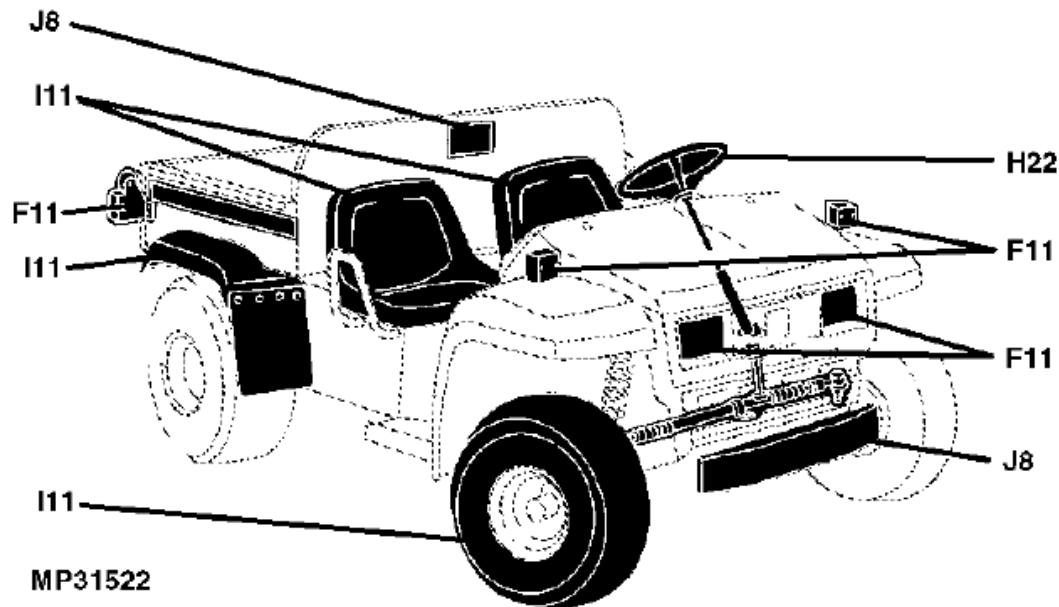
# DCPD Mechanical Design Objective

Redesign the John Deere Gator Utility Vehicle for amphibious function



# DCPD Industrial Systems Design Objective

Perform cost analysis on the existing system to optimize the efficiency of the manufacturing process



# DCPD Industrial Design Objective

- β Optimize the placement of consumer related features on the Amphibious Utility Vehicle
- β Make the vehicle aesthetically pleasing





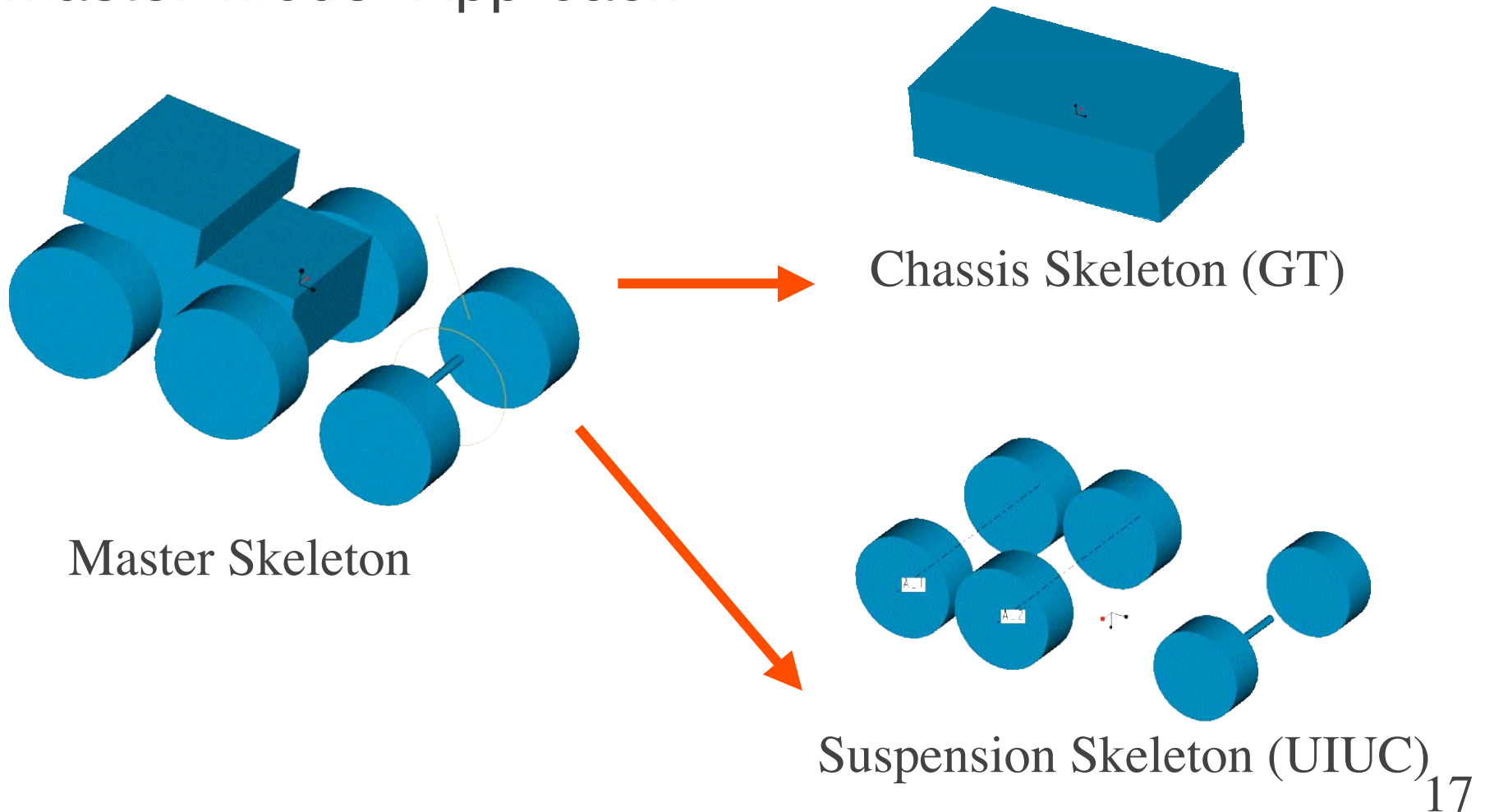
# DCPD System Requirements for Collaboration

Standard configuration for all participants:

- β Master Model Approach
- β Part Number Generator
- β “New Part” Labeling Standard
- β CAD Start Parts
- β Software configuration files
- β Same version of CAD software

# System Requirements for Collaboration

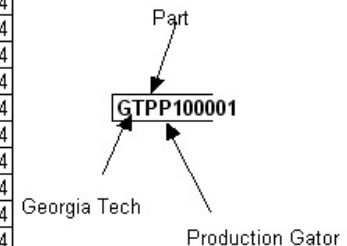
## Master Model Approach



# System Requirements for Collaboration

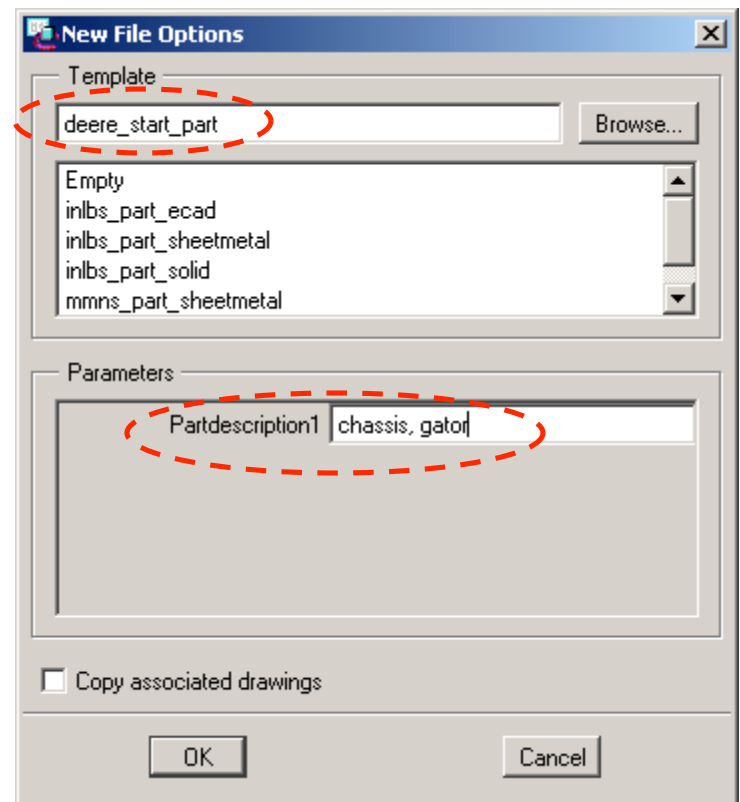
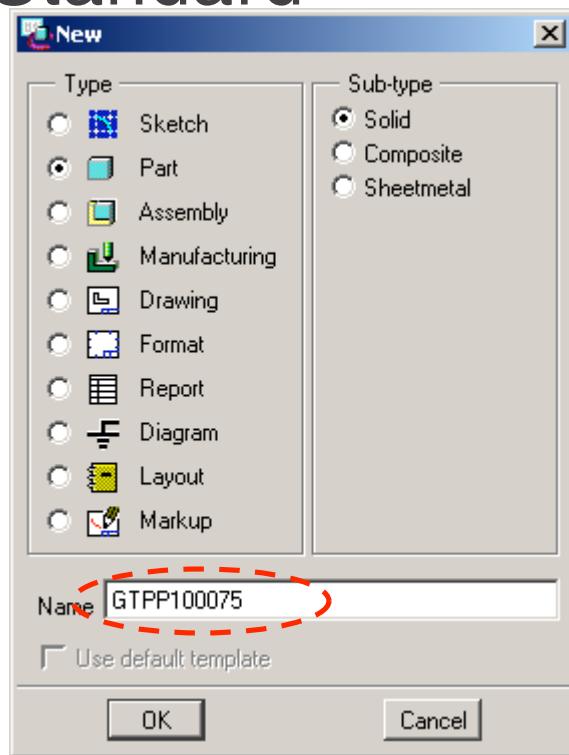
## Part Number Generator

Part Number	Part Name	Part Description	Creator	Date Created
GTPP100001	BED	TRUCK	J. Woo	01/05/04
GTPP100002	PANEL, BODY	BENT WING	J. Woo	01/05/04
GTPP100003	PANEL, BODY	BENT WING DRIVER	J. Woo	01/05/04
GTPP100004	Part Name List	BOOT	J. Woo	01/05/04
GTPP100005	PANEL, BODY	BOTTOM SHELL CURVES	J. Woo	01/05/04
GTPP100006	HUB	FRONT	J. Woo	01/05/04
GTPP100007	TIRE	FRONT	J. Woo	01/05/04
GTPP100008	ARM	FRONT PONTOON MOUNTING	J. Woo	01/05/04
GTPP100009	TANK	FUEL	J. Woo	01/05/04
GTPP100010	FENDER	FRONT	J. Woo	01/05/04
GTPP100011	HOOD	FRONT	J. Woo	01/05/04
GTPP100012	PANEL, BODY	INSTRUMENT	J. Woo	01/05/04
GTPP100013	NUT	LOCK	J. Woo	01/05/04
GTPP100014	NUT	REGULAR	J. Woo	01/05/04
GTPP100015	HUB	PASSENGER SHELL	J. Woo	01/05/04
GTPP100016	Part Name List	PASSENGER SHELL SIDE	J. Woo	01/05/04
GTPP100017	PONTOON	BOTTOM	J. Woo	01/05/04
GTPP100018	PONTOON	angle	J. Woo	01/07/04
GTPP100019	PONTOON	angle 2	J. Woo	01/07/04
GTPP100020	PONTOON	BACK	J. Woo	01/07/04
GTPP100021	PONTOON	FRONT	J. Woo	01/07/04
GTPP100022	PONTOON	SHELL	J. Woo	01/07/04
GTPP100023	PONTOON	TUBE	J. Woo	01/07/04
GTPP100024	PONTOON	MOUNTING ARM	J. Woo	01/07/04
GTPP100025	PONTOON	MOUNTING ARM, FRONT	J. Woo	01/07/04
GTPP100026	RACK	ROD	J. Woo	01/07/04
GTPP100027	PANEL, BODY	REAR	J. Woo	01/07/04
GTPP100028	RACK		J. Woo	01/07/04
GTPP100029	TIRE	REAR	J. Woo	01/07/04
GTPP100030	Part Name List	RING	J. Woo	01/07/04
GTPP100031	PONTOON	SOLID	J. Woo	01/07/04



# System Requirements for Collaboration

## CAD Start Part and “New Part” Labeling Standard



# Issues with Traditional Collaboration Methods

## β E-mail item revisions

- Must contact appropriate team member(s)
- File size limitation
- Tracking latest version

## β Phone conferences

- Difficult to illustrate some concepts verbally
- A poor phone connection for one party may adversely affect the entire call

## β Face to face Meetings

- May be constrained by location (costs time and money)

# DCPD Collaboration Method

Weekly meetings conducted using Web Conferencing software



- β Individuals illustrate ideas on a virtual whiteboard for all team members to visualize
- β Individuals at different locations conduct presentations over the web
- β Meetings recorded for future reference
- β Share applications
- β Voice over IP (VOIP)

# HorizonLive Interface

“Live” e-board for collaboration

The screenshot shows the HorizonLive interface within a Microsoft Internet Explorer browser window. The interface is divided into several sections:

- Left Panel:** A vertical toolbar containing various drawing and editing tools such as a selection tool, line tool, text tool, color palette, and buttons for ERASE, CLEAR SLIDE, IMPORT, SAVE, APP, and ENABLE.
- Main Canvas:** A large central area displaying a technical diagram. The diagram features a horizontal line with two vertical lines extending from it, each ending in a rectangular box. A blue oval is drawn around the left vertical line, with the word "steering" written in blue above it. Two red ovals are drawn around the horizontal line, with the words "engine and transmission" written in red to their right. Small green arrows point to the blue and red ovals.
- Right Panel:** A vertical sidebar with a blue background. It includes a "Session" section with "Main" and "Advanced" tabs, and buttons for "Move", "Web", "eBoard", and "Share". Below these are "Reset Poll" and "Y/N ?" buttons. A dropdown menu is set to "DCE\_Project\_John..." with a "Go" button next to it. A message below the dropdown reads: "This carousel does not have any slide content".
- Bottom Panel:** A black bar with icons for "LOBBY", "IM", "HELP", and "EXIT". Below this is a white area for chat. It shows a status "Connecting to server..." and "Connected: Welcome to the HorizonLive Messaging Server (v3.2.3) at galech.horizonlive.net". A "Name" field displays "jwoo". A "Send A Message:" input field is circled in orange. At the bottom, a status bar shows "Name: Host: oatech.horizonlive.net/TCP", "Channel: DCPD Project with John Deere S04", "Users: 1", and "YES: 0 NO: 0 ? : 0".

Annotations with orange arrows point to specific features:

- An arrow points from the text "“Live” e-board for collaboration" to the drawing toolbar on the left.
- An arrow points from the text "Share desktop" to the "Share" button in the right panel.
- An arrow points from the text "Import PowerPoint" to the "DCE\_Project\_John..." dropdown menu in the right panel.
- An arrow points from the text "Chat" to the "Send A Message:" input field in the bottom panel.

# Product Lifecycle Management

## Information shared via Product Lifecycle Management (PLM) solution from PTC

- β “Standard” web interface
- β Centralized web location where all information is organized
- β Cross-Functional teams have access to all project information
- β Limit access to sensitive information
- β Lightweight CAD visualizer
- β Share multi-CAD and non-CAD data
- β Change management

# ProjectLink Portal at GT

Georgia Institute of Technology

Home Project

Files Team Resources Details Plan Deliverables Tasks Forum Meetings BOM Reports Change Log

DCPD - John Deere - Switch Projects -

Distributed Collaborative Product Development of a John Deere Gator

Files

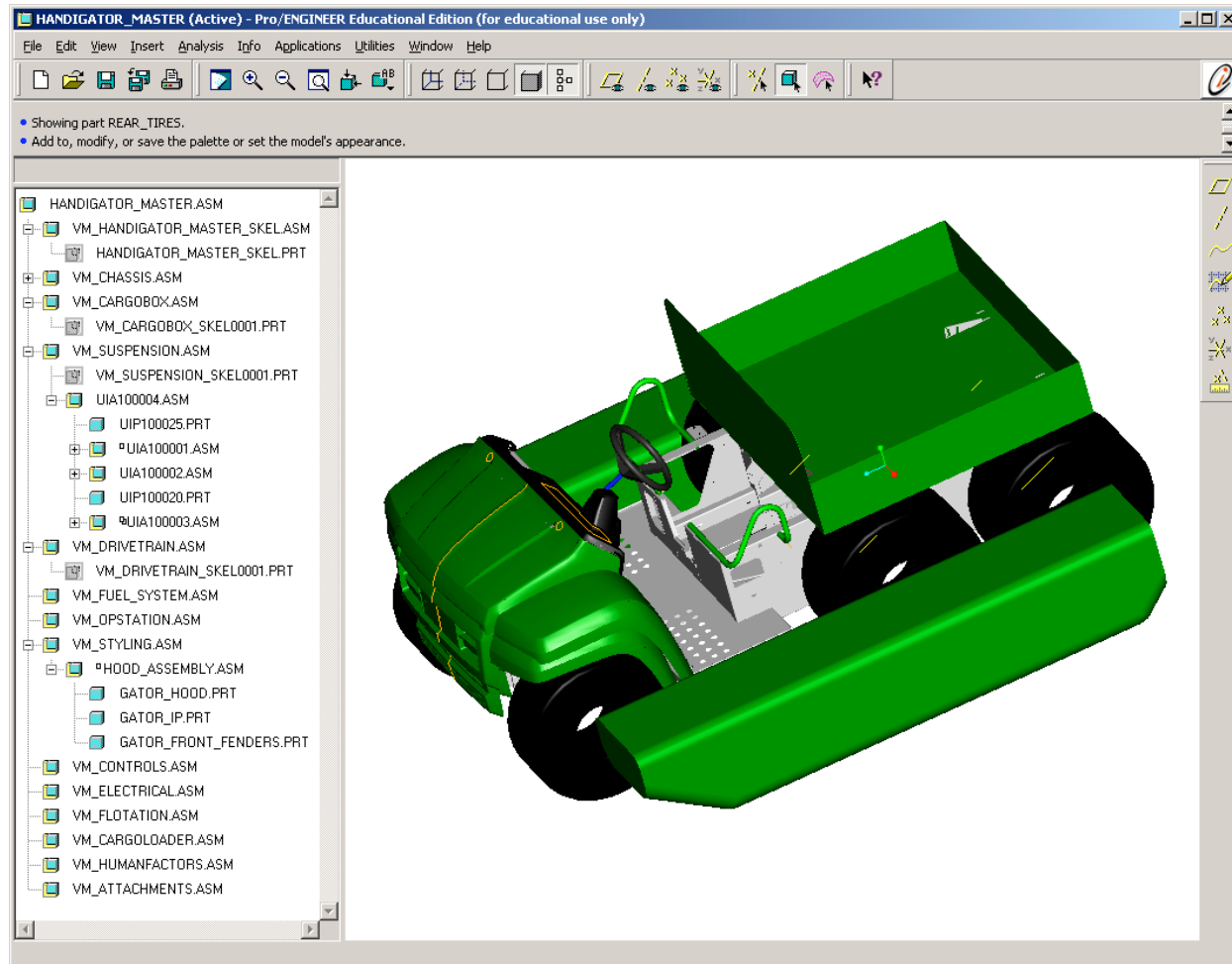
Cut Copy Paste Delete Route Expand All Collapse All Create Folder Upload File Create from Template Create Part Create Link

Name	Actions	Last Modified	Modified By
<input type="checkbox"/> BOM	- Pick an Action -	Sep 29, 2003, 5:11 PM	
<input type="checkbox"/> ▶ Master Model Index	- Pick an Action -	Oct 7, 2003, 3:59 PM	
<input type="checkbox"/> ▶ NUMBER GENERATOR	- Pick an Action -	Sep 29, 2003, 5:11 PM	
<input type="checkbox"/> Documents	- Pick an Action -	Oct 1, 2003, 11:45 AM	
<input type="checkbox"/> ▶ Phase 1	- Pick an Action -	Oct 1, 2003, 11:46 AM	
<input type="checkbox"/> ▶ Phase 2	- Pick an Action -	Jan 9, 2004, 2:52 PM	
<input type="checkbox"/> ▶ DCPD Agendas	- Pick an Action -	Mar 15, 2004, 3:40 PM	
<input type="checkbox"/> ▶ Gantt Charts	- Pick an Action -	Mar 15, 2004, 3:41 PM	
<input type="checkbox"/> ▶ Georgia Tech	- Pick an Action -	Jan 26, 2004, 6:02 PM	
<input type="checkbox"/> ▶ Calculations	- Pick an Action -	Mar 10, 2004, 2:50 PM	
<input type="checkbox"/> ▶ Gantt Charts	- Pick an Action -	Mar 10, 2004, 2:49 PM	
<input type="checkbox"/> ▶ Presentations	- Pick an Action -	Mar 10, 2004, 2:50 PM	
<input type="checkbox"/> ▶ Progress Reports	- Pick an Action -	Mar 10, 2004, 2:52 PM	
<input type="checkbox"/> ▶ Team Leader Meeting Notes	- Pick an Action -	Feb 11, 2004, 7:39 PM	
<input type="checkbox"/> ▶ <a href="#">trail buck atv pc9361</a>	- Pick an Action -	Feb 18, 2004, 10:44 AM	Jacqueline Woo
<input type="checkbox"/> ▶ Operations Mgt	- Pick an Action -	Feb 23, 2004, 4:09 PM	
<input type="checkbox"/> ▶ UIUC	- Pick an Action -	Feb 6, 2004, 3:09 PM	
<input type="checkbox"/> ▶ UMass	- Pick an Action -	Feb 6, 2004, 3:09 PM	
<input type="checkbox"/> ▶ UMD	- Pick an Action -	Feb 6, 2004, 3:08 PM	

<http://ptc.cad.gatech.edu>

# DCPD Mechanical Design Status (Phase 1)

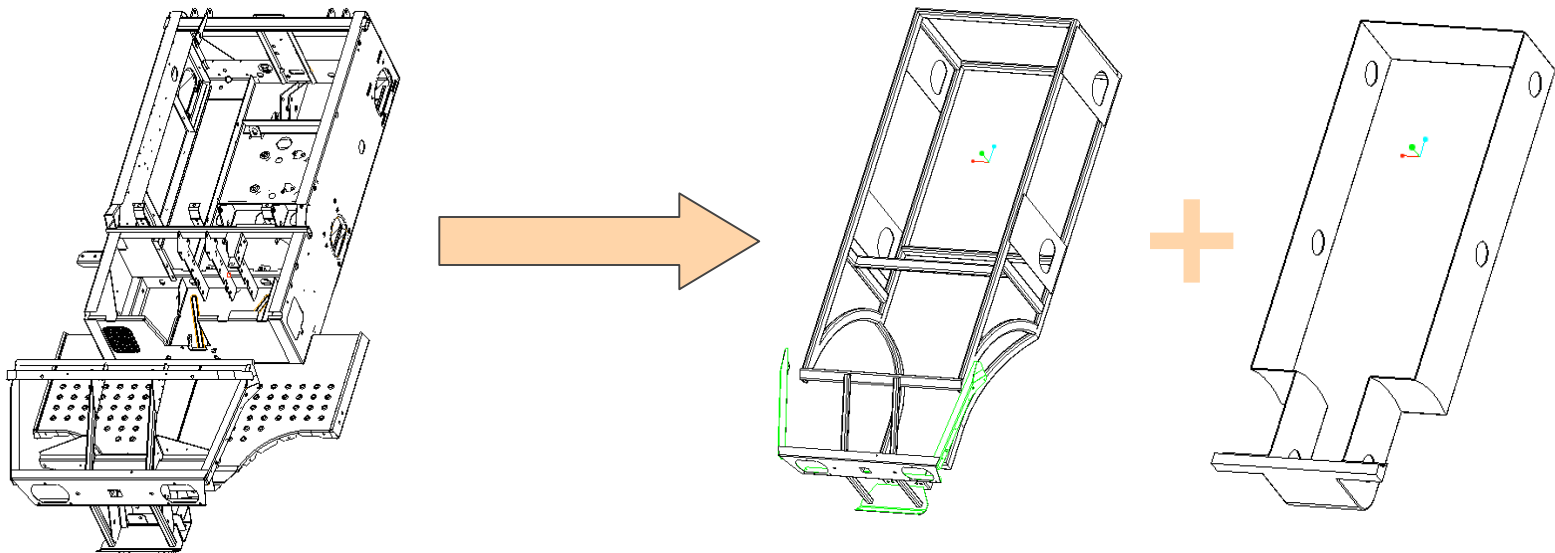
## CAD model



# DCPD Mechanical Design Status (transition to Phase 2)

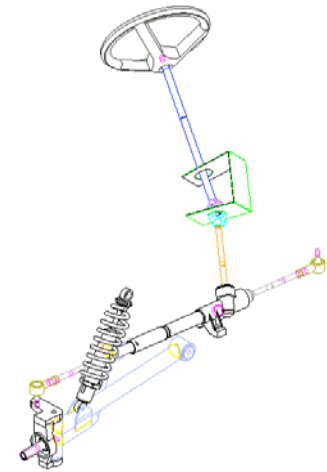
Vehicle analysis:

- Reduce weight
- Waterproofing
- Flotation
- Propulsion
- Steering

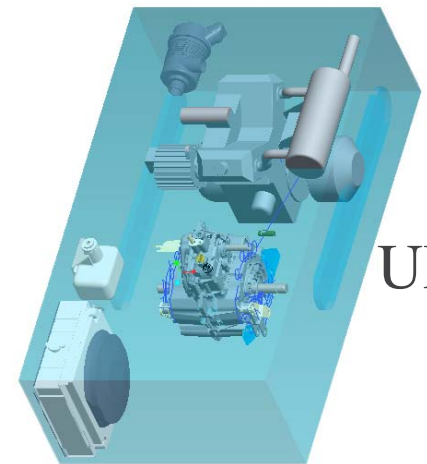


# DCPD Mechanical Design Status (Phase 2)

CAD model



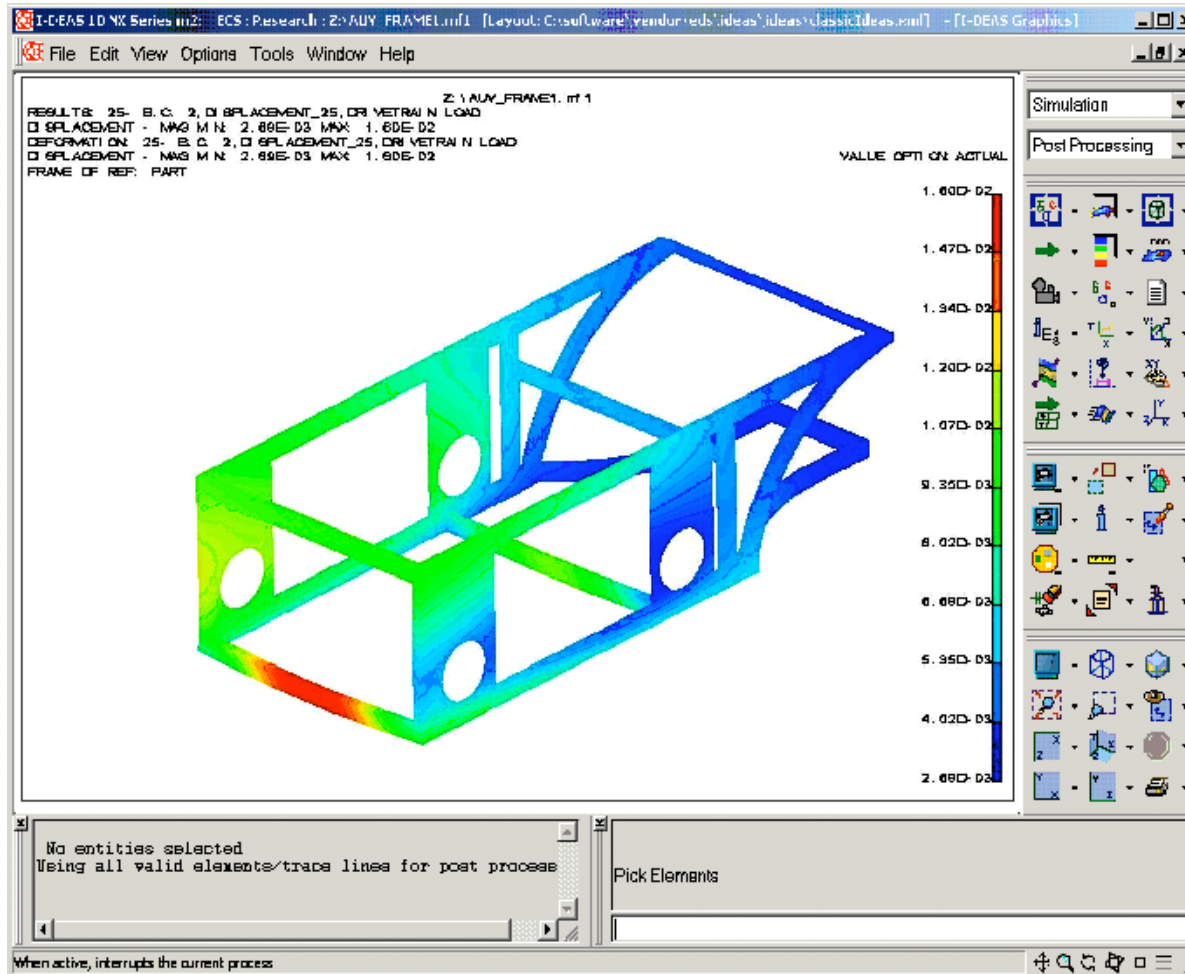
UIUC



UMD

# DCPD Mechanical Design Status (Phase 2)

## Finite Element Analysis



# Benefits of DCPD

- β Students of different disciplines collaborate towards a common goal
- β Situations comparable to those encountered in business environments
- β Students can collaborate without relocating
- β Students become familiar with multiple aspects of product development
- β Participants can leverage resources not available locally

# Traditional Academic Projects

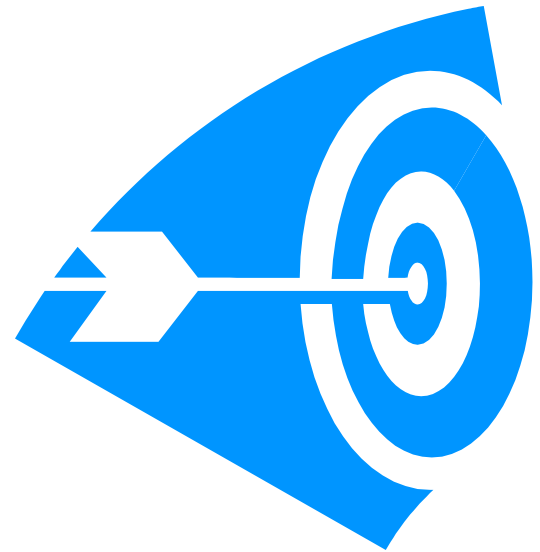
- β Schools usually compete rather than collaborate
- β Students teams lack multi-disciplinary experience
- β Typically, class projects are limited to a max of 5 people
- β Most projects have a duration of one semester



# Lessons Learned

## How to make a successful project

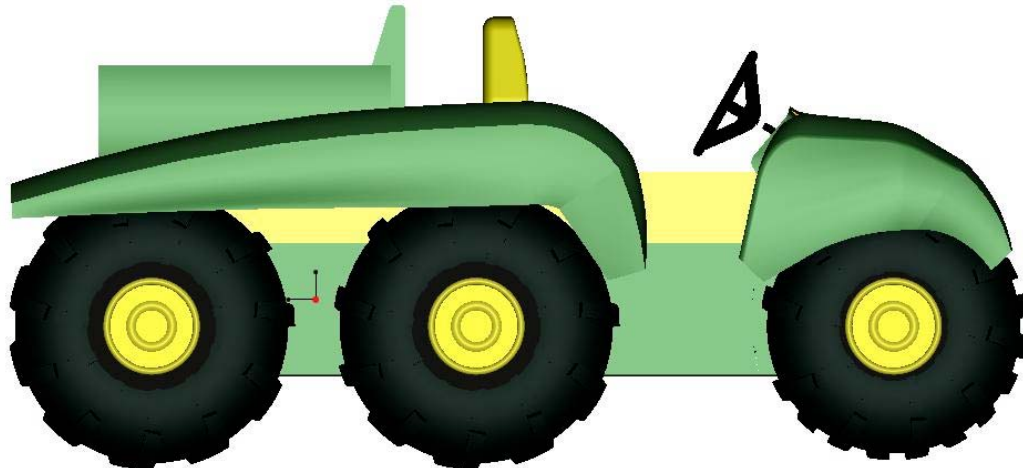
- β Active professor involvement
- β Environment standardization
- β Standardized training
- β Weekly meetings
- β Shared goals
- β Definite project objectives
- β Effective project management
- β Industry participation



# Future Plans

To complete product development process by 2005

- β Manufacturing simulation
- β Assembly simulation
- β Fabricate prototype
- β Prepare business case



# Questions

More details at <http://ptc.cad.gatech.edu>



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