Georgia Institute of Technology | University of Maryland | Bentley | University of Illinois at Urbana-Champaign | UMassAmherst | John Deere Southeast Engineering Center | PTC The Product Development Company

Facilitating Distributed Collaborative Product Development in an Undergraduate Curriculum

Tord Dennis
Georgia Institute of Technology
tord.dennis@coe.gatech.edu
404.894.7752

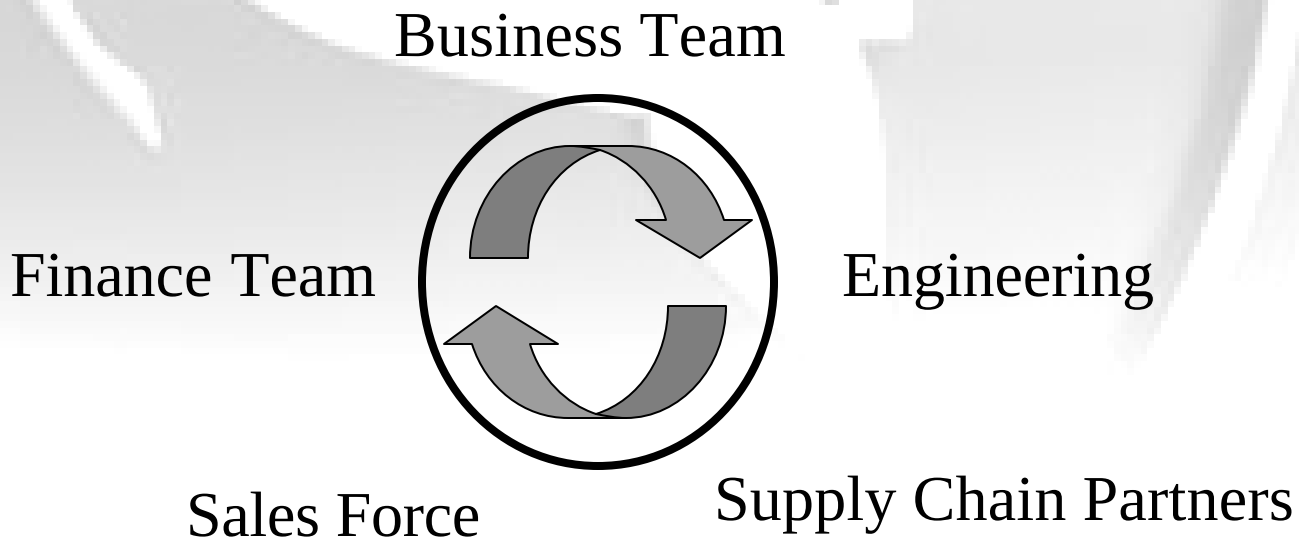
Overview

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

 tord.dennis@coe.gatech.edu

Collaboration in Industry

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



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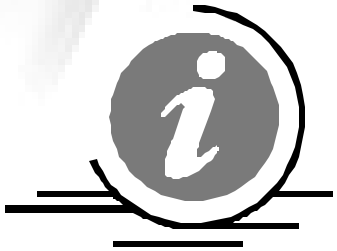
Collaboration in Industry

Why?

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



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Collaboration in Industry

How?

- Web based conferencing
- Product Lifecycle Management Software
  - Windchill -
  - Teamcenter -
  - Enovia -

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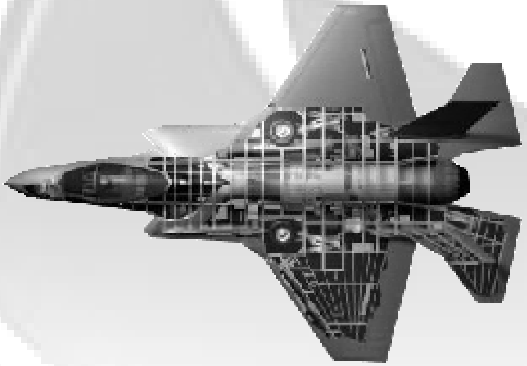
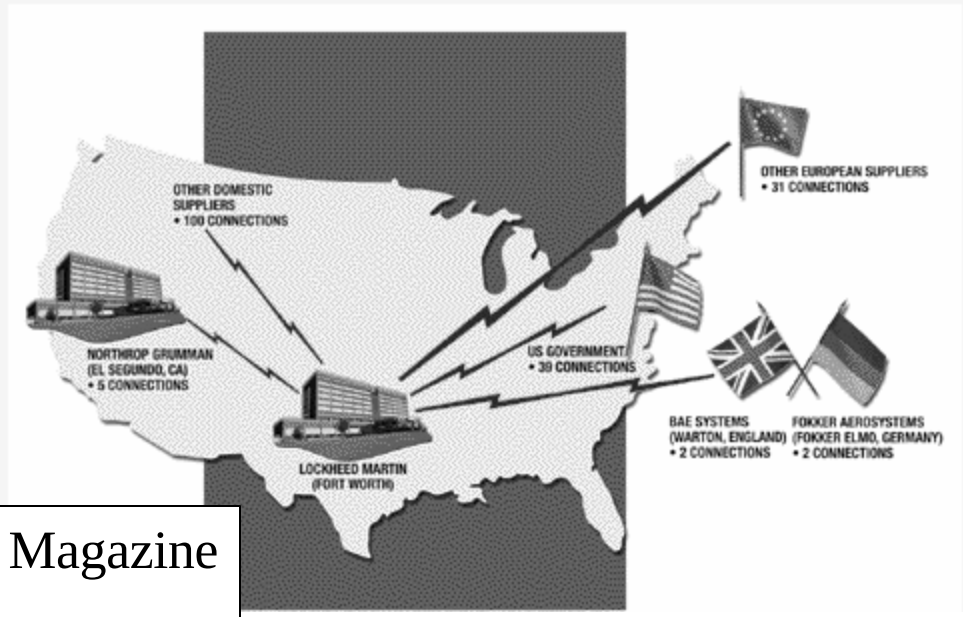
Collaborative Product Development in Industry

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

tord.dennis@coe.gatech.edu

What is PLM?

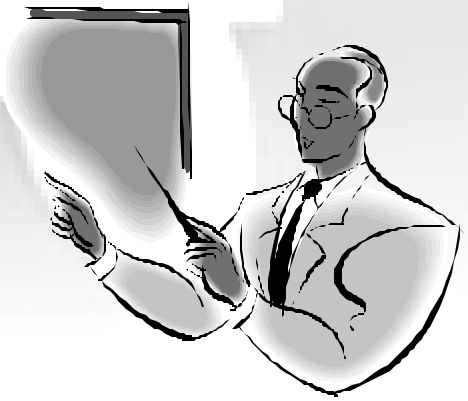
"PLM requires the ability to create high fidelity digital products, collaborate cross-functionally in an organization and throughout the digital product value chain, and control and manage product information and product development processes throughout the product's lifecycle.

In other words, it's about building great products. To build great products you need a PLM solution that enables you to seamlessly create, collaborate and control."

http://www.ptc.com/products/plm/

Why PLM in Academia?

- Business is utilizing PLM
- Students need practical experience
  - Co-op
  - Internships
  - Projects



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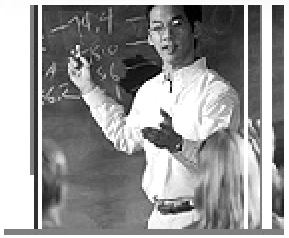
Collaboration in Universities

Accreditation Board for Engineering and Technology (ABET)

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



ABET ACCREDITATION

tord.dennis@coe.gatech.edu

Collaboration in Universities

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

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

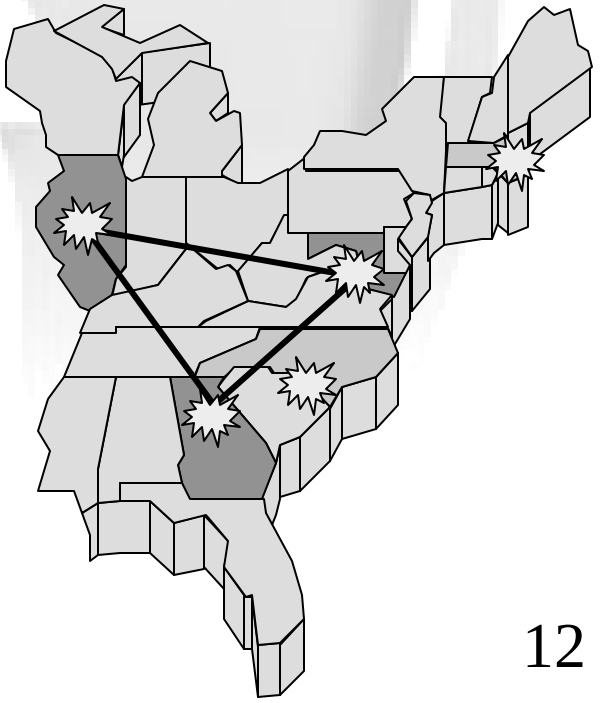
- Georgia Institute of Technology
- University of Maryland-College Park
- University of Illinois Champaign-Urbana
- Bentley College

tord.dennis@coe.gatech.edu

DCPD John Deere Project

Division of Responsibilities

- Georgia Tech
  - Primary Mechanical Design Team
  - Industrial and Systems Design Team
  - Industrial Design Team
- University of Maryland
  - Mechanical Design Team
- University of Illinois
  - Mechanical Design Team
- Bentley College
  - Operations Research Team



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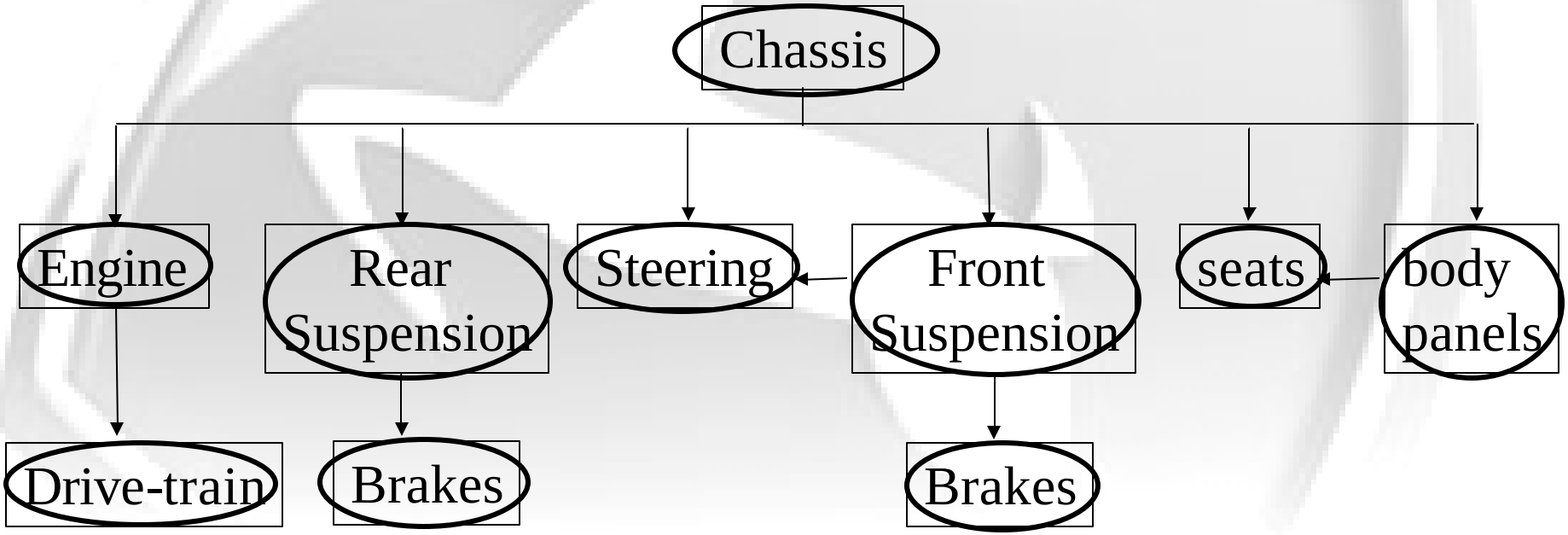
DCPD Mechanical Design Objective

Redesign the John Deere Gator Utility Vehicle for amphibious function



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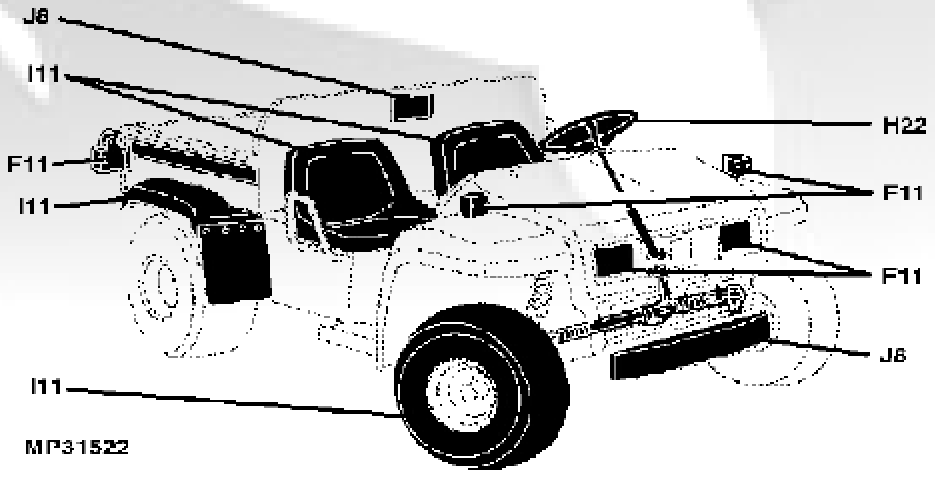
DCPD Industrial Systems Design Objective

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



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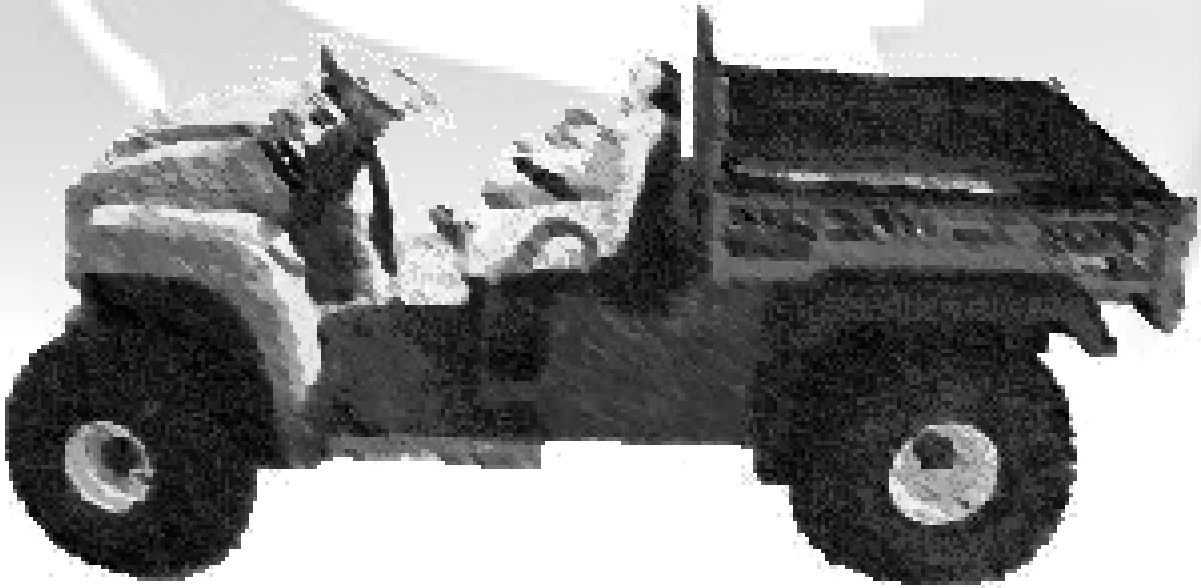
DCPD Industrial Design Objective

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



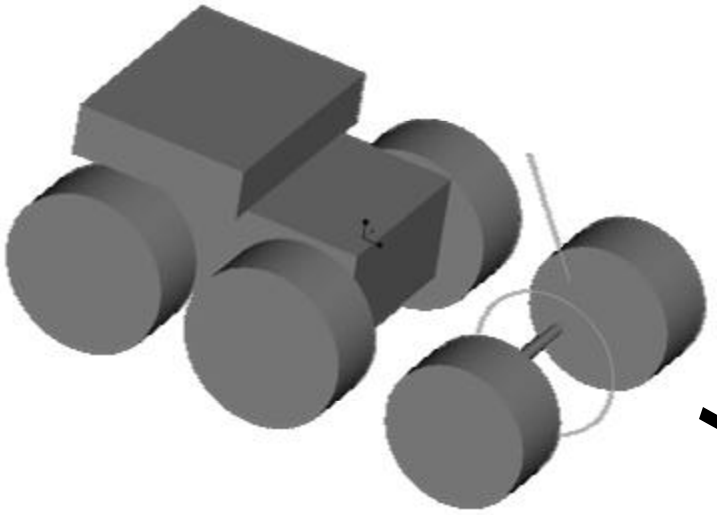
DCPD System Requirements for Collaboration

Standard configuration for all participants:

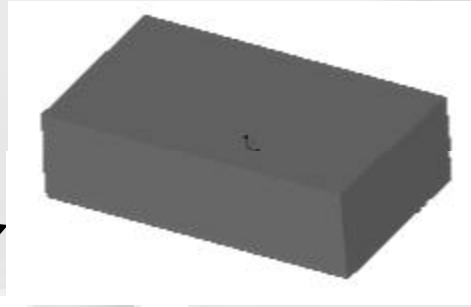
- Master Model Approach
- Part Number Generator
- “New Part” Labeling Standard
- CAD Start Parts
- Software configuration files
- Same version of CAD software

System Requirements for Collaboration

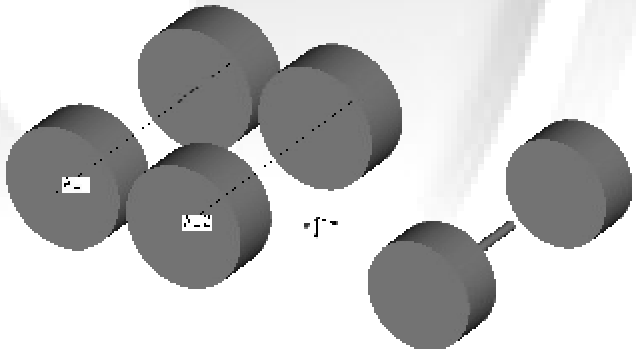
Master Model Approach



Master Skeleton



Chassis Skeleton (GT)



Suspension Skeleton (UIUC)

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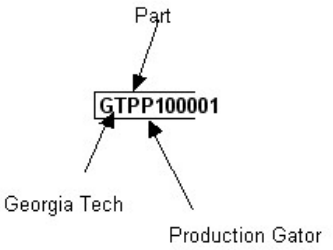
System Requirements for Collaboration

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



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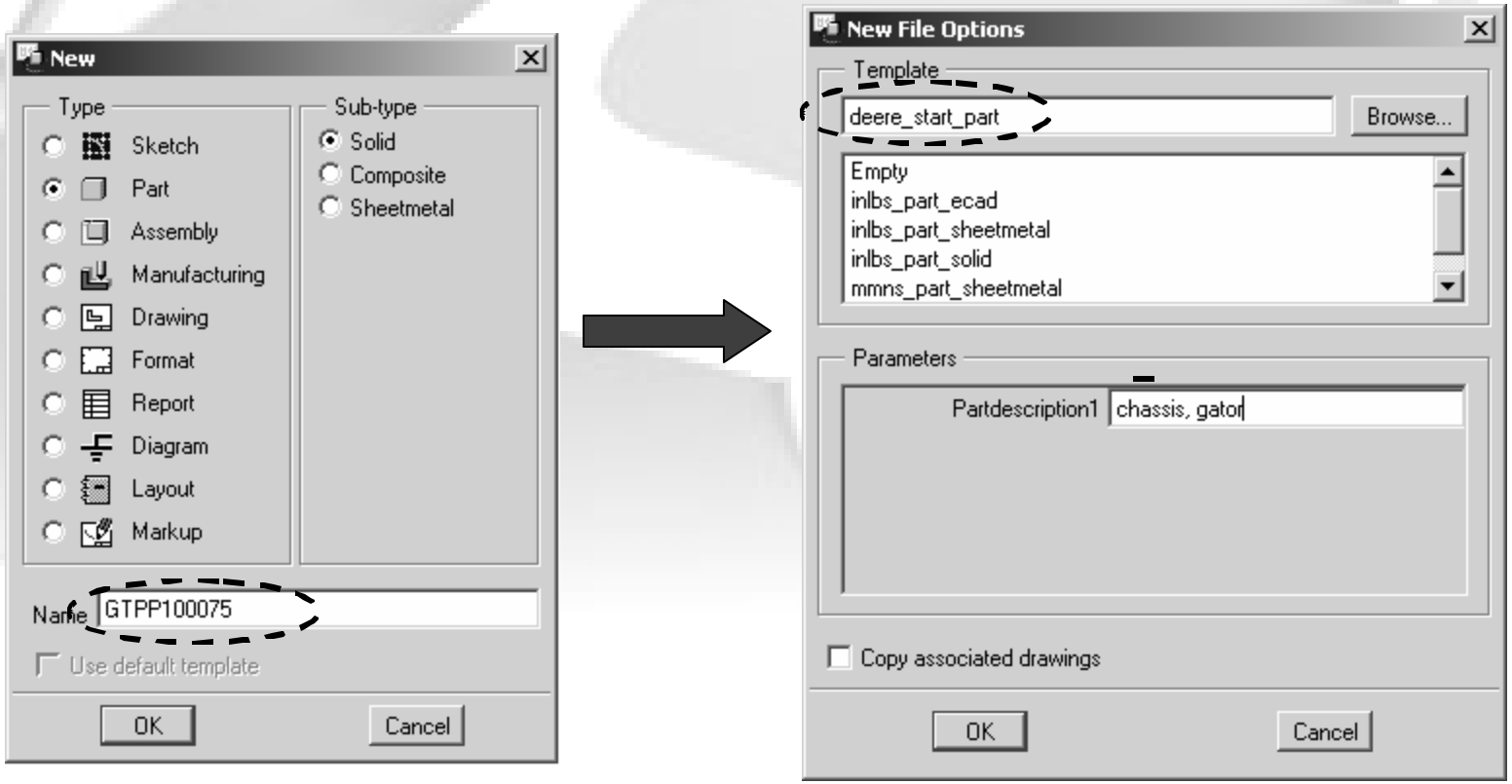
System Requirements for Collaboration

CAD Start Part and "New Part" Labeling Standard



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Issues with Traditional Collaboration Methods

- E-mail item revisions
  - Must contact appropriate team member(s)
  - File size limitation
  - Tracking latest version
- Phone conferences
  - Difficult to illustrate some concepts verbally
  - A poor phone connection for one party may adversely affect the entire call
- Face to face Meetings
  - May be constrained by location (costs time and money)

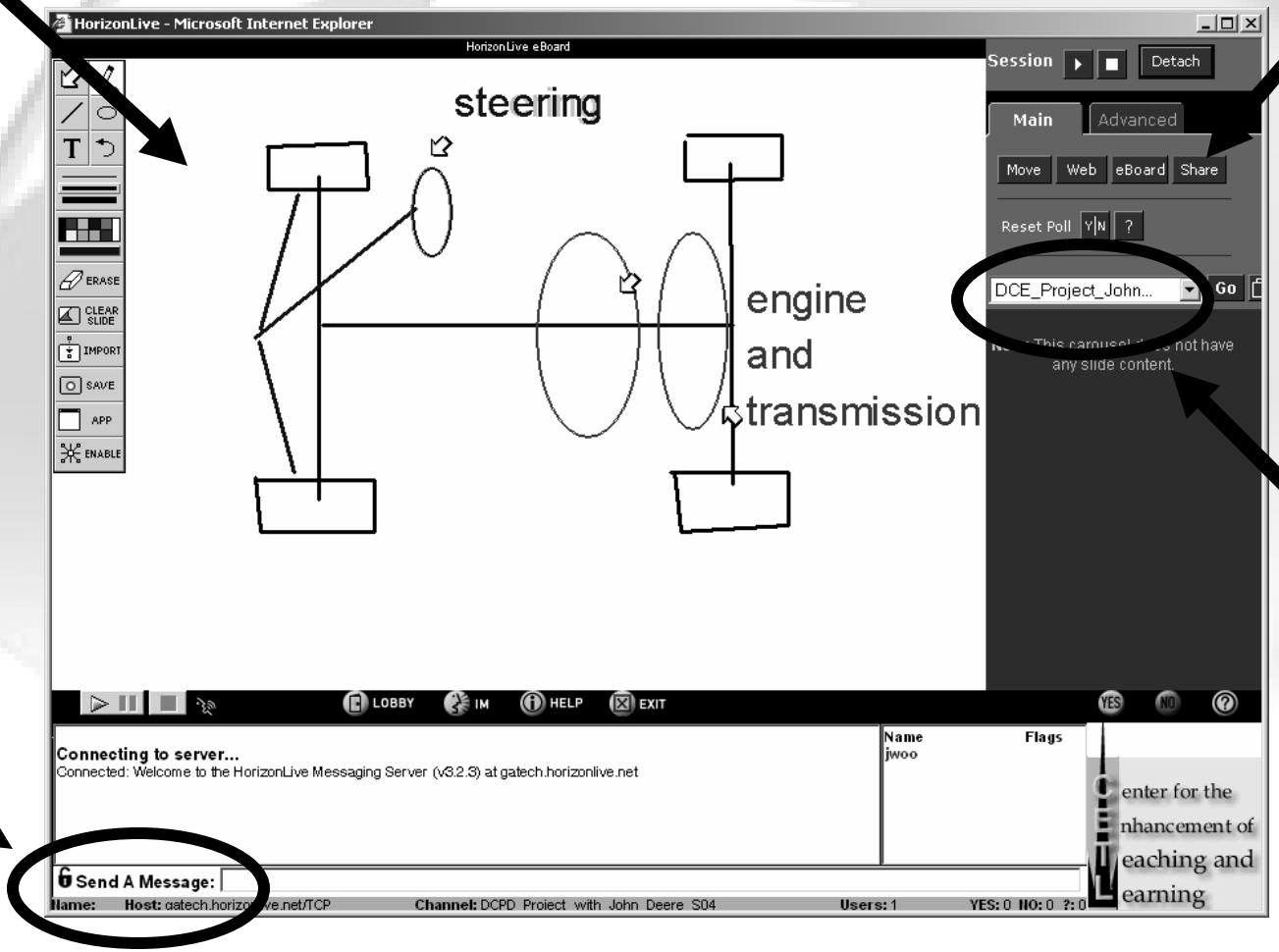
DCPD Collaboration Method

Weekly meetings conducted using Web Conferencing software

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

HorizonLive Interface

"Live" e-board for collaboration



Share desktop

Import PowerPoint

Chat

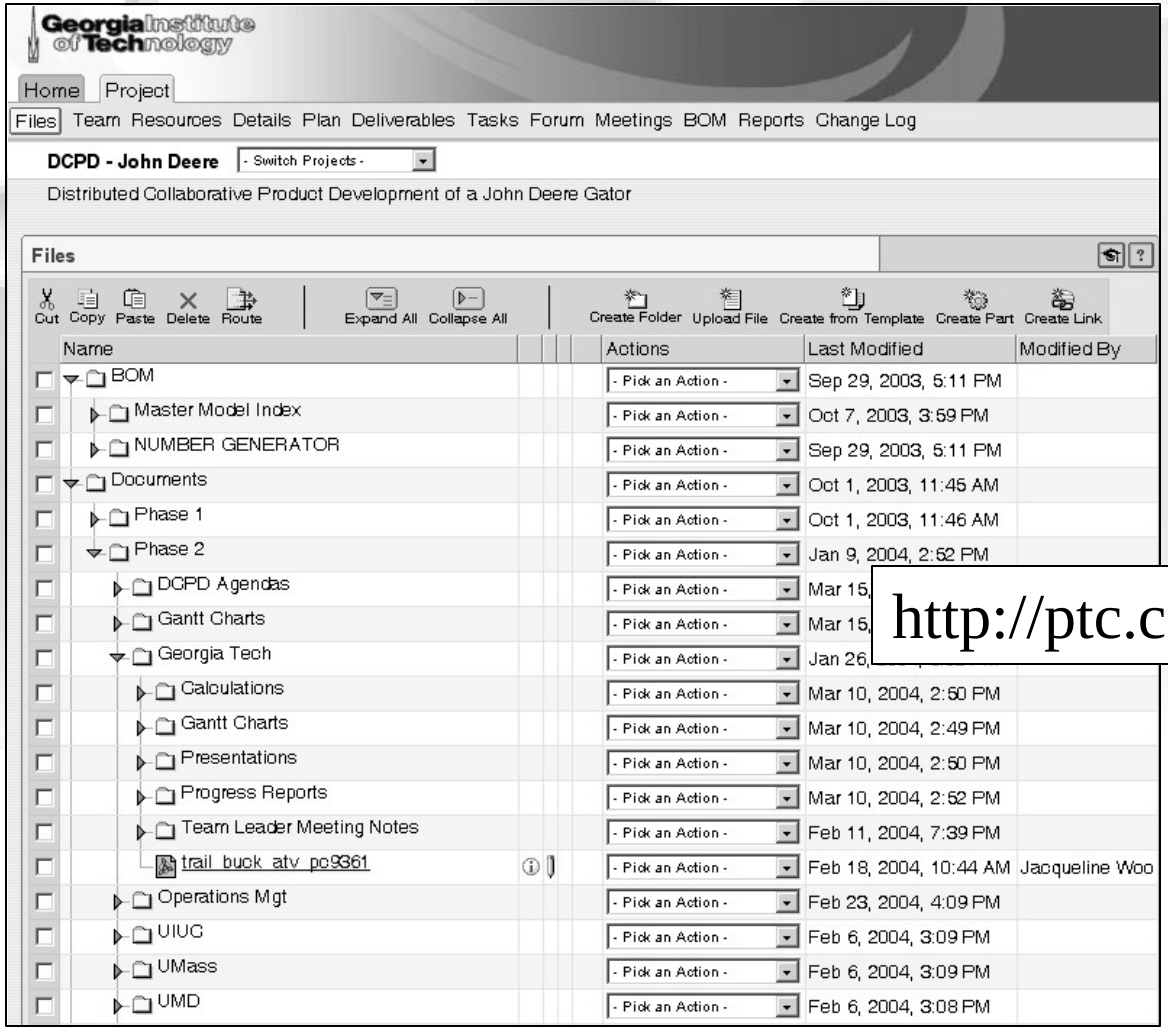
tord.dennis@coe.gatech.edu

Product Lifecycle Management

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

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

ProjectLink Portal at GT

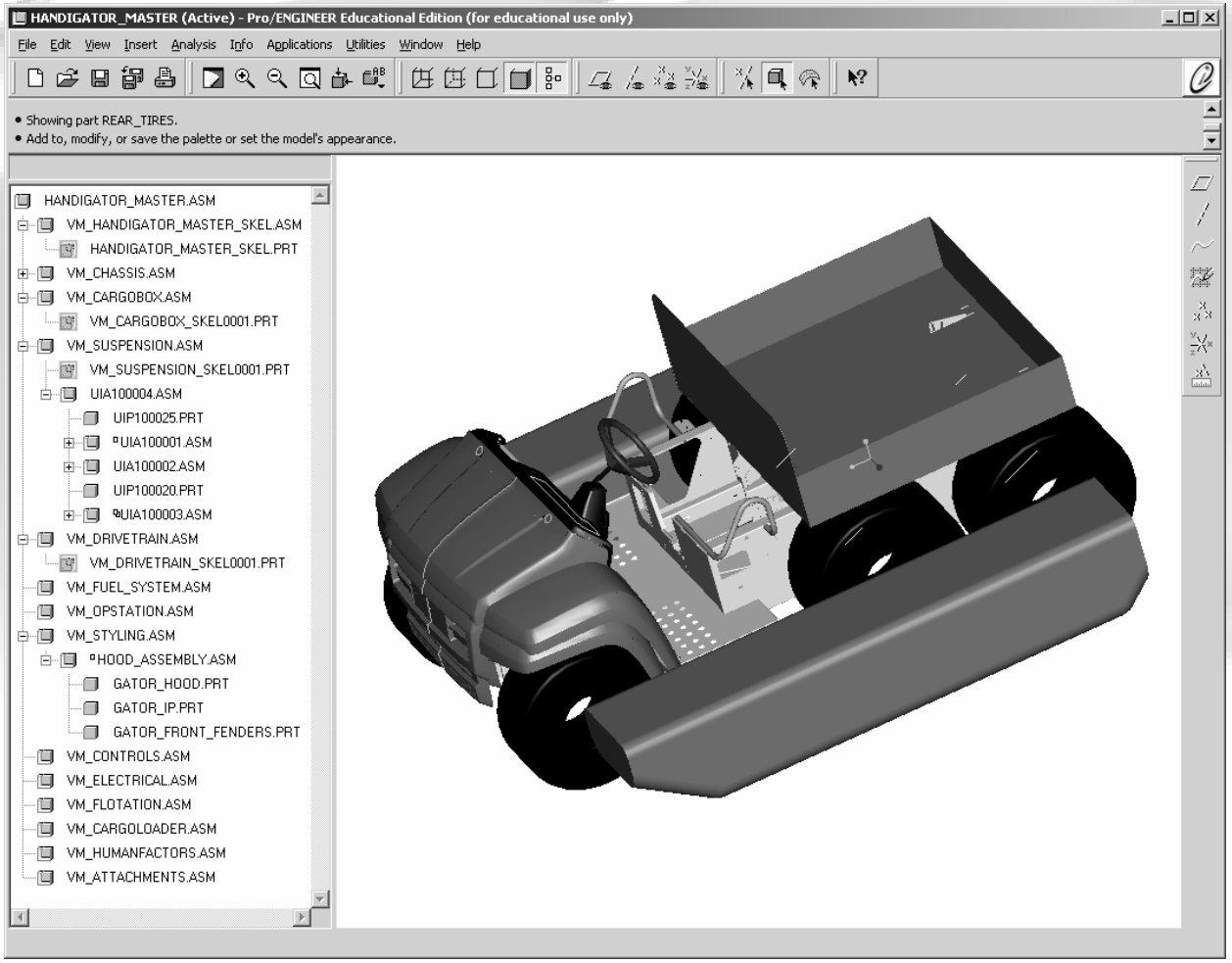


http://ptc.cad.gatech.edu

tord.dennis@coe.gatech.edu

DCPD Mechanical Design Status (Phase 1)

CAD model



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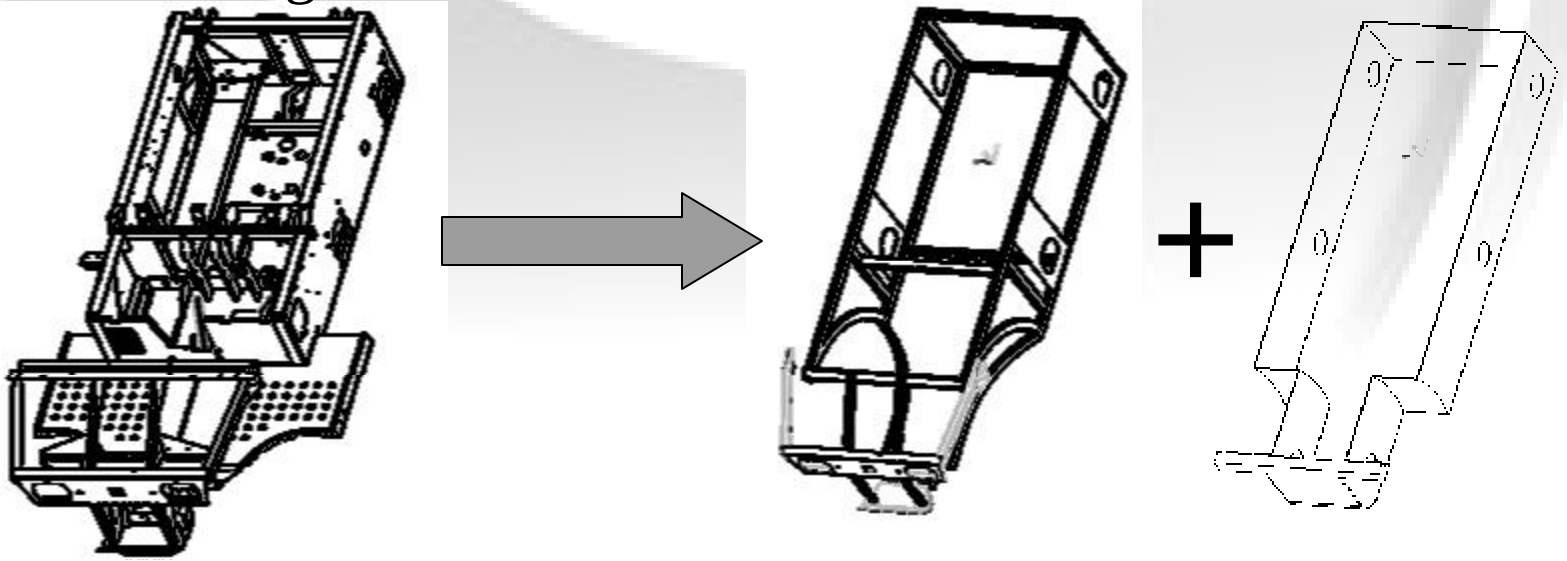
DCPD Mechanical Design Status (Phase 2)

Vehicle analysis:

- Reduce weight
- Waterproofing
- Flotation
- Propulsion
- Steering



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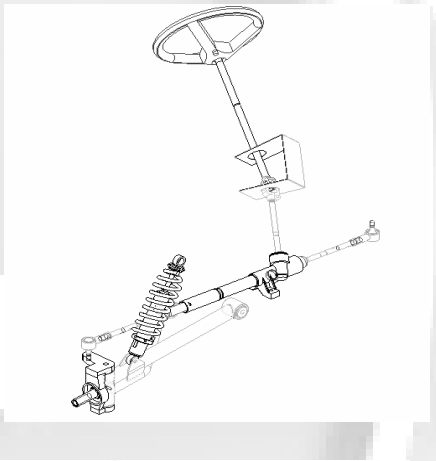
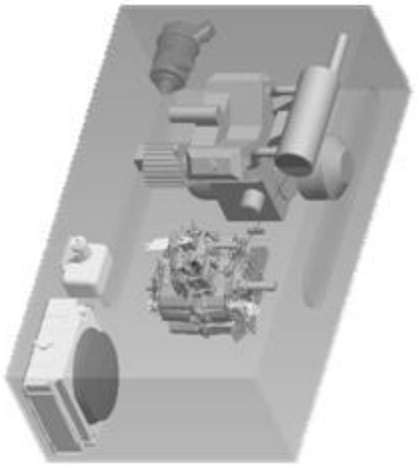
DCPD Mechanical Design Status (Phase 2)

CAD model

UIUC



UMD



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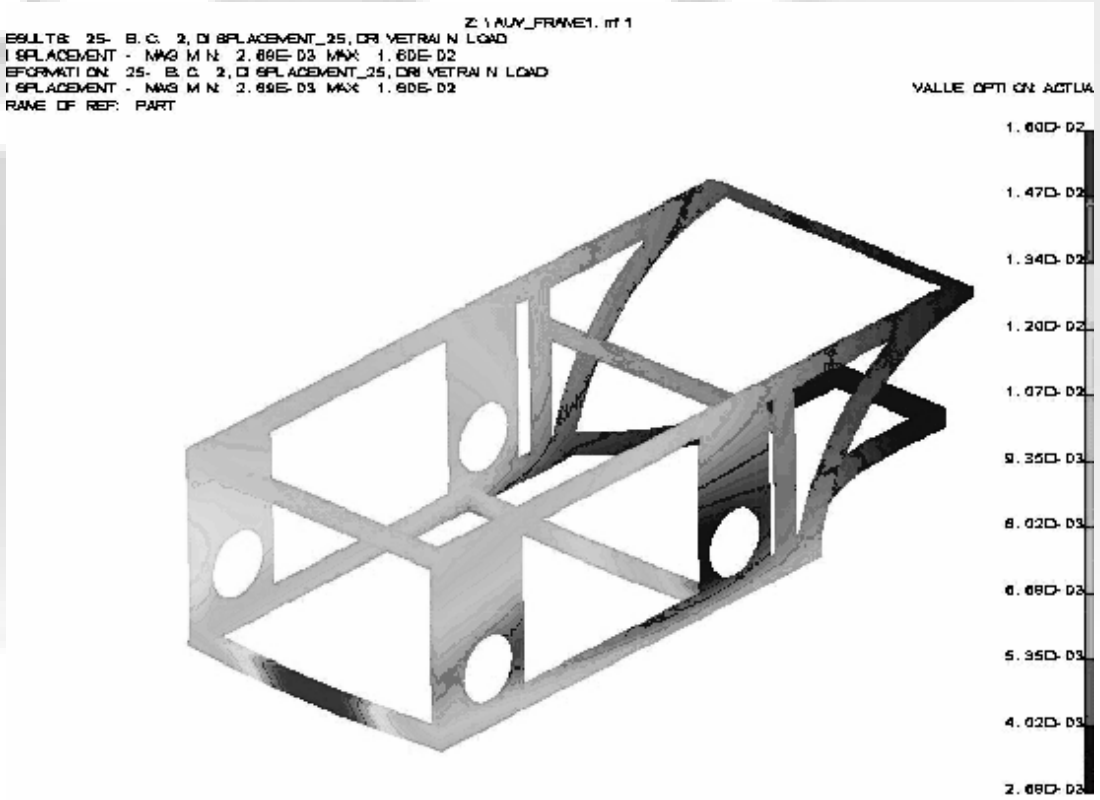
DCPD Mechanical Design Status (Phase 2)

Finite Element Analysis



tord.dennis@coe.gatech.edu

Benefits of DCPD

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

Traditional Academic Projects

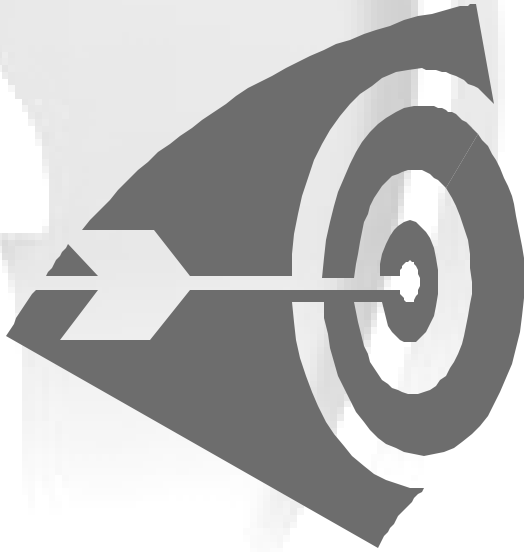
- Schools usually compete rather than collaborate
- Students teams lack multi-disciplinary experience
- Typically, class projects are limited to a max of 5 people
- Most projects have a duration of one semester

tord.dennis@coe.gatech.edu

Lessons Learned

How to make a successful project

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



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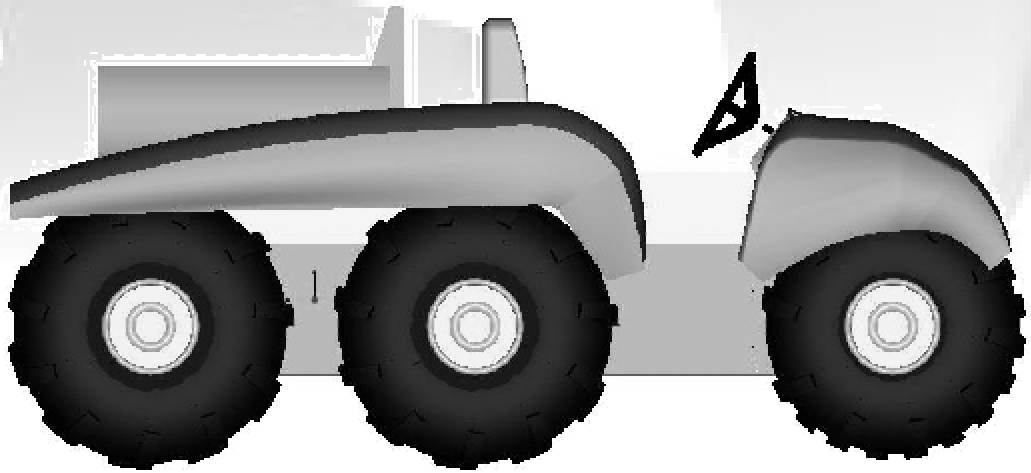
Future Plans

To complete product development process by 2005

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



tord.dennis@coe.gatech.edu

Questions

JOHN DEERE

Southeast Engineering Center

PTC
The Product Development Company

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

Tord Dennis
tord.dennis@coe.gatech.edu
Georgia Institute of Technology

In memory of Dr. Robert E. Fulton

Special thanks to: Jacqueline Woo