Davaus – SE Center Collaboration

Current and Future Relationships

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ETCS Industry Advisory Council
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Introduction

About the Systems Engineering (SE) Center

About Davaus and Peridot

Creating the Davaus – SE Center Partnership

Building the Knowledge Base

Benefits of our Partnership

Next Steps
1. Convert knowledge gained from Industry research to PFW Academic Programs:
MSE - Systems Engineering, MBA, Leadership, Anthropology, Senior Design, First Year Engineering, ...

2. Develop a methodology and knowledge base for both the design of products and systems that are sustainable.
   Davaus Products
   Davaus Manufacturing System
   Davaus Enterprise System

3. Create partnerships with industry
Davaus is a Strategic Partner with the SE Center and is influencing the direction of the SE Center in several areas:

Product Development
- Ferret
- Soilyzer
- Hemp Lifecycle

Design Process and Structure

Enhancement of PFW Research and Education
History – It Starts With Peridot

Established in 1997

- 3D Printing & ADDV MFG
- Polymer Molding
- Metal Castings
- CNC Machining
- Contract MFG & Supply Chain Mgmt
Ideas + Peridot = Davaus
Davaus: Present and Future

Soilyzer

+ New Products

FERRET

SEEDRIGHT™
Davaus - SE Center Collaboration

Quickturn & In-house Projects
- stalkroll
- fertilizer
- brush kits

Sustainable education model for student talent development

Externships/GRA
- Ferret
- vision systems
- materials

Mules & Test Beds
- planter
- graincart
- varibine
- tending

Purdue IP SE Center

Research & Multi-phase projects
Contributions being made in Spite of the Rules

What we wanted to do...
Share sales revenue:
Gross revenue sharing
Portion of IP to SE Center
Talent development

What we did:
TAA
IEDC Grant
TAP
Senior Design Projects
SE Center Self Funding Development Tools
Balance theory and practice
Talent development
Hemp Research Highlights

Systems Engineering builds on the concept of a Viewpoint and a View of systems...

The challenge is to understand together how to see a system to be most effective...

Building a knowledge base that applies to Hemp, Ferret, Combine, Enterprise...

...using same methodology that is scalable

Growing insights through different views of the same system
SE Research Contributions through Collaboration

SYSTEM ARCHITECTURE OF HEMP LIFECYCLE AND VALUE STREAM
The Product Lifecycle is treated as a series of Desired Functions...

Each Function is a Process Step for the desired sequence of Normal Processing

Output of functions measured as Vector Functional Requirements (FRs):

Maximize X

Minimize Y
A Physical Solution (PS) achieves a Functional Requirement (FR).

The design is less effective when a set of PSs works at cross-purposes to achieving a set of FRs.

Benefits:
1. Identify gaps in design solutions
2. Identify where design trade-offs exist
3. Identify sequence of PS implementation
SE Research Contributions through Collaboration

STRUCTURING THE COLLECTIVE SYSTEM DESIGN METHODOLOGY

Enhancements to Collective System Design Methodology:

- Taxonomy
- Information Model
- Structure of MBSE toolset
- Design Decisions made explicit

Improving the structure of design...
Explicit Design Decisions enable Davaus to Prioritize Next Steps and Resource Allocation

<table>
<thead>
<tr>
<th>Decision Context</th>
<th>Induced by Alternative/PS</th>
<th>Tradeoff Number</th>
<th>Tradeoff Name</th>
<th>Tradeoff Description</th>
<th>couples FRs/Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hemp Growth Cycle (Application-specific?)</td>
<td>Hemp 4-phase growth cycle: Composites #1 (default)</td>
<td>TR.1</td>
<td>Yield competition</td>
<td>Different hemp applications seek to maximize the yield of the various plant components: fiber, hurds and seeds. But plant biology implies that these yields are in competition in any individual plant.</td>
<td>Functional Requirement FR.3.A Maximize fiber yield. Functional Requirement FR.3.D Maximize hurd yield and quality.</td>
</tr>
</tbody>
</table>

Low planting densities have a positive effect on hemp seed yield at the expense of fiber yields and hurd yield and quality.
Benefits

THE KNOWLEDGE BASE ADDS VALUE IN SEVERAL WAYS:

Davaus

Confluence of many systems...

- Specifications
- Design Decisions
- DFMEA
- “Know How”
- Validation & Verification

Essential architecture for design process

Systems Engineering Center

Enhanced system design methodology...

- Reusable Knowledge Base
- Explicit and Traceable Design Decisions
- Multiple viewpoints of Hemp Lifecycle
- Shortens time to Create Value
- Future Project Identification and Priorities

Harvest lessons learned for academic programs
Next Steps

Develop knowledge base for Ferret product

Different subsystems for VariBINE

Apply to future products

Further refine Hemp Model through future research

Use model to identify business opportunities for Davaus