THE HELICOPTER: A MODEL FOR KEEN ACROSS THE ENGINEERING CURRICULUM

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KEEN
KERN ENTREPRENEURIAL ENGINEERING NETWORK

Overview

A team of engineering faculty at UNH created and implemented six planned new modules related to a consistent engineering example: the helicopter, as part of this KEEN topical grant.

- Implemented across the first three years of engineering curriculum.
- Special emphasis on second year engineering analysis courses and three KEEN Student Outcomes (KSOs).

Foundation for Curriculum Integration

We chose the helicopter because of its multidisciplinary nature:

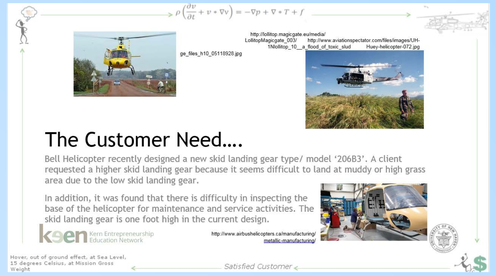
- requires structural, mechanical, chemical, electrical, computer and system engineering for it to function.
- complex system with interesting cost, value, risk and design features across its development life cycle.

We could leverage our strong relationship with Sikorsky Aircraft.

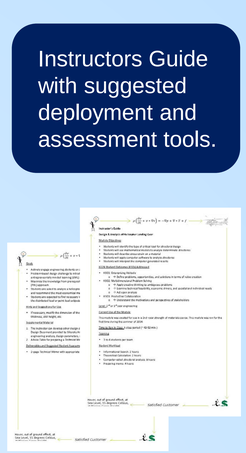
There is significant research that demonstrates students work best when applying concepts to an interesting example.

The use of a complex system example, such as a helicopter, allows students to investigate approaches and techniques for innovation and creativity in the large, complex corporate development organization.

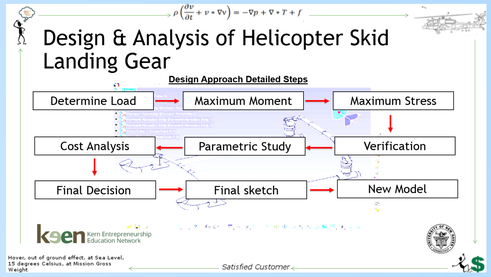
Module Examples



Detailed presentations with embedded in-class activities and places for student engagement.

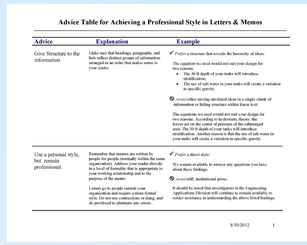


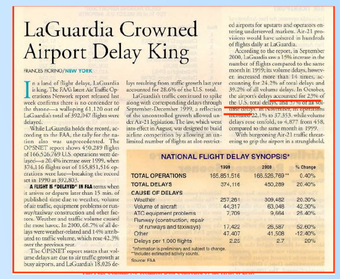
Instructors Guide with suggested deployment and assessment tools.



The modules were created using different systems in a helicopter as an example. Modules range from overall general design criteria to redesigns of small key components using formulated hand calculations and analytical computer simulations.

Supporting and Supplemental materials





Modules Developed

Module	Description	KEEN Student Outcomes	Relevant Classes
The Value Proposition in Engineering Design: Making Valuable Design Choices	Uses KT (Kepner-Tregoe) Design Analysis method and includes the concept of 'value proposition', i.e., how design choices and methods impact the value of the final product or service for customers. Start with everyday examples and move to helicopter example, based upon key helicopter design aspects, provided by Sikorsky.	• Enterprising Attitude • Multidimensional Problem Solving • Collaboration • Communication	Introduction to Engineering and Design (1st Year)
Distributed Design of a Helicopter Assembly Line	The Value Proposition in the Design of Assembly and Automation: Goal Setting and Persistence, System Integration, Automation, and Team Communication. Students apply these concepts to a multi-week automation student team project. Emphasizes development of technical writing communications.	• Enterprising Attitude • Multidimensional Problem Solving • Collaboration • Communication • Resolute Integrity	Introduction to Logic & Programming, Introduction to CAD, Technical Writing, Team Presentations, & Team Work (1st & 2nd year)
Design & Analysis of Helicopter Skid Landing Gear: Mechanics of Materials	This module is a guide through designing the skid landing gear of a helicopter. Engages students to link mechanics of material calculations to choices of materials, processes, and to customer value/need.	• Enterprising Attitude • Multidimensional Problem Solving • Collaboration	Mechanics of Materials, Materials Engineering (2nd & 3rd Year)
Applying Value Engineering and DfMA in the Design of a Helicopter Tub Beam	Students are introduced to the concept of Value Engineering and Design for Manufacturing and Assembly (DfMA) Methods. Demonstrates how to apply these concepts and methods for the design of a Helicopter Tub Beam.	• Enterprising Attitude • Multidimensional Problem Solving • Collaboration • Communication	Statics, Strength of Materials, Materials Engineering, Manufacturing Processes (2nd & 3rd Year)
Analysis of Fluid Coupling & Hydraulic Clutch Devices	Students compare an automatic vs. a manual transmission and discuss the role of cost in selection and use of technology, in terms of value creation. Presents an opportunity to discuss the impact stakeholders can have on a technology being successful.	• Enterprising Attitude • Multidimensional Problem Solving • Collaboration • Communication	Fluid Analysis Courses (2nd & 3rd Year)
Using Statistical Methods to Improve the Carburization Process of a Helicopter Gear	This module demonstrates how to define and measure value to the customer using good testing methodologies and statistical analysis. Demonstrates how to apply calculations of tolerance limits and specification limits in the design of a Helicopter Gear carburization process and its link to creating customer value.	• Enterprising Attitude • Multidimensional Problem Solving • Collaboration • Communication	Engineering Probability and Statistics (2nd & 3rd Year)

Contributors

- Sam Daniels, Professor, Mechanical Engineering
- Nadiye Erdil, Assistant Professor, Industrial Engineering
- Byungik Chang, Associate Professor, Civil Engineering
- Eric Brisart, Engineering Lecturer
- Parker Mathis & Mike Montanari, UNH Engineering Students
- Larry Levine, Manager, Advanced Engineering Applications, Sikorsky
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