

GROVE CITY COLLEGE
MECHANICAL ENGINEERING
PROSPECTIVE STUDENT INFORMATION
2020 – 2021

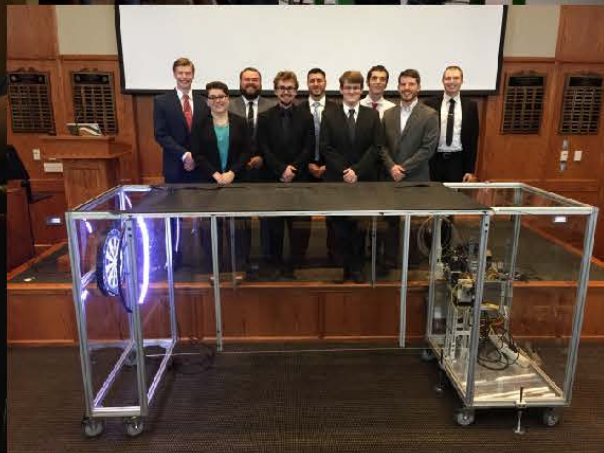
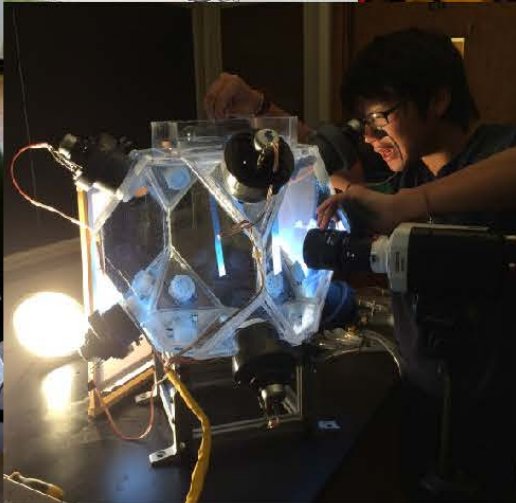


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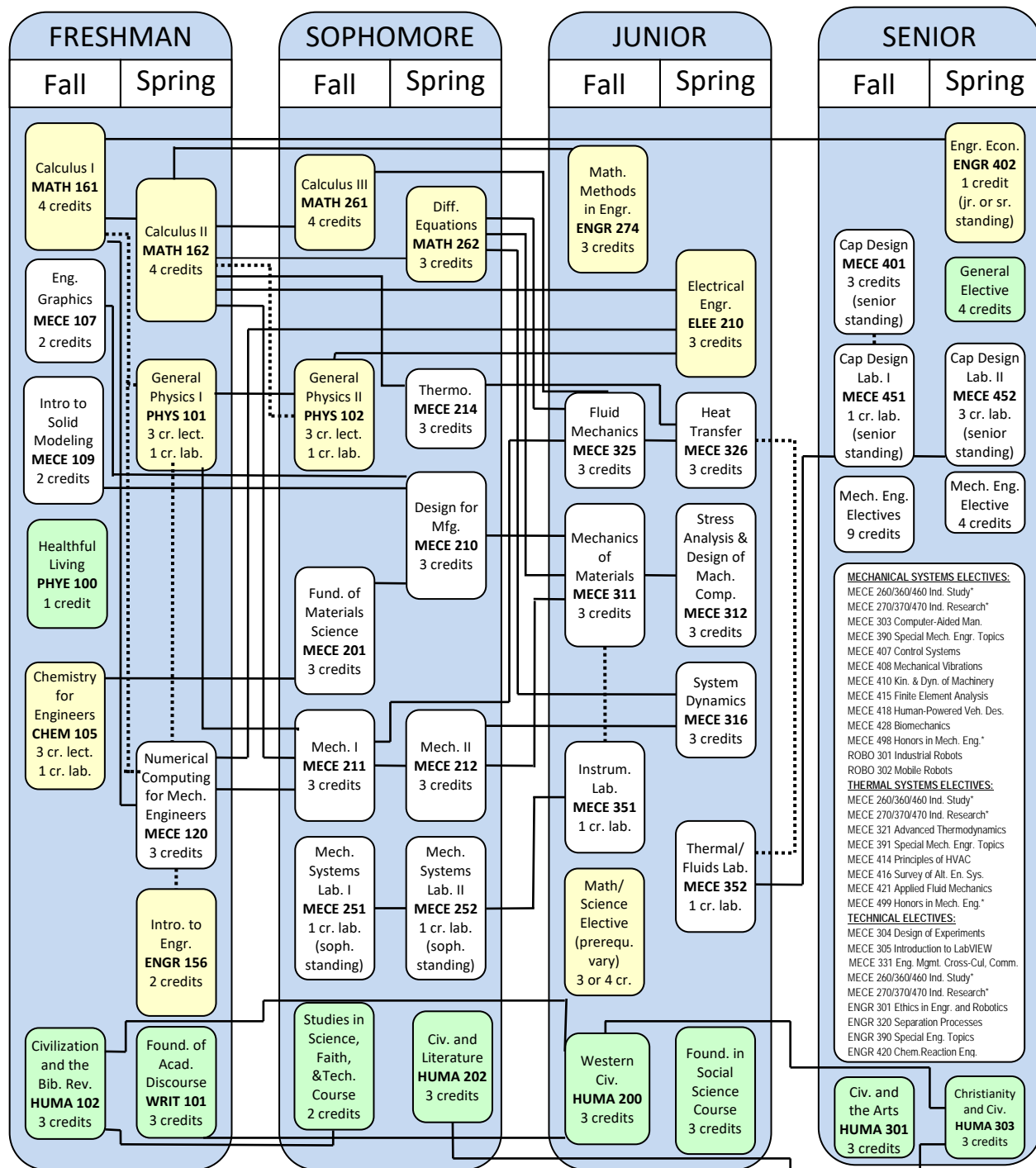
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Course Flow Chart with Prerequisites



MECHANICAL ENGINEERING

Curriculum and Prerequisites for the B.S.M.E Degree



— Prerequisite on left

..... Corequisite course

TOTAL CREDIT HRS. REQU. = 128

Revised 09-10-2017

General Education Requirements
(28 credits)

Major Related Requirements
(minimum of 39 credits)

Mechanical Engineering Requirements
(61 credits)

*Students must take a total of 13 credits, selecting a minimum of 3 credits from each area. Six credit hours must be 400 level classes and a maximum of 4 credits from 1 and 2 credit courses. Prerequisites vary.

Requirements for the B.S.M.E. for students entering in the fall of

2020

Mechanical Engineering Status Sheet

Grove City College Status Sheet

Status Sheets are provided as a convenience for the student and may be helpful for recording completed courses. However, the College Bulletin is the controlling authority on all requirements. Questions should be directed to your academic advisor or the Registrar.

(WI)=Writing Intensive, (SI)=Speaking Intensive, (IL)=Information Literacy courses.

B.S. in Mechanical Engineering Entering in 2020

(REVISED 03-01-2020)

Name: _____

ID#: _____

Year of Anticipated Graduation: _____

Date: _____

Advisor: _____

TOTAL HOURS REQUIRED FOR THIS DEGREE----- 128 HOURS

General Education + Elective Requirements----- 28 HOURS

GENERAL EDUCATION REQUIREMENTS----- 24 HOURS

	Cr.	Sem. Taken	Grade
HUMANITIES CORE----- 15 HOURS			
HUMA 102 Civ and the Biblical Revelation (IL)*	3		
HUMA 200 Western Civilization	3		
HUMA 202 Civilization and Literature	3		
HUMA 301 Civilization and the Arts	3		
HUMA 303 Christianity and Civilization	3		

*The year-long sequence of RELI 211 and 212 may substitute for this course.

WRITING REQUIREMENT----- 3 HOURS

WRIT 101 Found. of Academic Discourse (IL)	3		
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STUDIES IN SCIENCE, FAITH, & TECHNOLOGY (SSFT)----- 2 HOURS

Choose one course from the following:

COMP 205/SSFT 205 Ethics, Faith, and the Conscious Mind			
PHIL 243 Science and the Human: Inquiry, Design, & the Person			
SSFT 210 Science & Religion			
SSFT 212 Science, Faith, Technology, & Origins			

2

FOUNDATIONS OF THE SOCIAL SCIENCES----- 3 HOURS

Choose one course from the following:

ECON 120 Foundations of Economics	PSYC 101 Foundations of Psychology		
HIST 120 Foundations of History	PSYC 200 Cross-Cultural Psychology		
HIST 141 World Geography	SOCI 101 Foundations of Sociology		
HIST 204 Hist/Phil Foundations of Education	SOCI 103 Found. of Cultural Anthr.		
POLS 101 Foundations of Political Science	SOCW 101 Found. of Social Work		

3

QUANTITATIVE/LOGICAL REASONING----- 0 HOURS

Satisfied by major-related requirements.

NATURAL SCIENCES (with labs)----- 0 HOURS

Satisfied by major-related requirements.

PHYSICAL EDUCATION----- 1 HOURS

PHYE 100 Healthful Living	1		
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GENERAL ELECTIVES----- 4 HOURS

MAJOR-RELATED REQUIREMENTS----- 39-40 HOURS

CHEM 105 Chemistry for Engineers	4		
ELEE 210 Electrical Engineering	3		
ENGR 156 Introduction to Engineering	2		
ENGR 274 Math Methods in Engineering	3		
ENGR 402 Engineering Economy	1		

Math/Science Elective: Choose one course from ASTR 206, 207; BIOL 101, 102; CHEM 112 and 114, 227, 241, 345; MATH 210, 213, 222, 331; PHYS 234, or 402.

3 or 4

MATH 161 Calculus I	4		
MATH 162 Calculus II	4		
MATH 261 Calculus III	4		
MATH 262 Differential Equations	3		
PHYS 101 General Physics I	4		
PHYS 102 General Physics II	4		

Minimum CQPA and MQPA required for graduation-----2.00

MQPA Courses---MECE; ROBO; ELEE 210; ENGR 156, 320, 390, 391, 392, and 402

Major Requirements-----100 HOURS

MECHANICAL ENGINEERING REQUIREMENTS----- 48 HOURS

	Cr.	Sem. Taken	Grade
MECE 107 Engineering Graphics	2		
MECE 109 Intro to Solid Modeling	2		
MECE 120 Numerical Comp. for Mech. Engr.	3		
MECE 201 Fundamentals of Material Science	3		
MECE 210 Design for Manufacturing	3		
MECE 211 Mechanics I	3		
MECE 212 Mechanics II	3		
MECE 214 Thermodynamics	3		
MECE 251 Mechanical Systems Lab I (IL)	1		
MECE 252 Mechanical Systems Lab II	1		
MECE 311 Mechanics of Materials	3		
MECE 312 Stress Analysis/Design of Mach. Comp.	3		
MECE 316 System Dynamics	3		
MECE 325 Fluid Mechanics	3		
MECE 326 Heat Transfer	3		
MECE 351 Instrumentation Lab (WI)	1		
MECE 352 Thermal / Fluids Lab	1		
MECE 401 Capstone Design I	3		
MECE/ROBO 451 Capstone Design Lab I	1		
MECE/ROBO 452 Capstone Design Lab II (SI)	3		

MECHANICAL ENGINEERING ELECTIVES:----- 13 HOURS

Select a minimum of 3 credit hours from each area. At least 6 credit hours must be 400-level courses with a maximum of 4 hours from one and two credit courses.

MECHANICAL SYSTEMS ELECTIVES:

MECE 260/360/460** Independent Study	1-3		
MECE 270/370/470** Independent Research	1-3		
MECE 303 Computer-Aided Manufacturing	3		
MECE 390 Special Mechanical Engineering Topics	1-4		
MECE 407 Control Systems	3		
MECE 408 Mechanical Vibrations	3		
MECE 410 Kinematics & Dynamics of Mach.	3		
MECE 415 Finite Element Analysis	3		
MECE 418 Human-Powered Vehicle Design	3		
MECE 428 Biomechanics	3		
MECE 498 Honors in Mechanical Engineering	1-3		
ROBO 301 Industrial Robotics	3		
ROBO 302 Mobile Robots	3		

THERMAL SYSTEMS ELECTIVES:

MECE 260/360/460** Independent Study	1-3		
MECE 270/370/470** Independent Research	1-3		
MECE 321 Advanced Thermodynamics	3		
MECE 391 Special Mechanical Engineering Topics	1-4		
MECE 414 Principles of HVAC	3		
MECE 416 Survey of Renewable Energy Systems	3		
MECE 421 Applied Fluid Mechanics	3		
MECE 499 Honors in Mechanical Engineering	1-3		

TECHNICAL ELECTIVES:

MECE 260/360/460** Independent Study	1-3		
MECE 270/370/470** Independent Research	1-3		
MECE 304 Design of Experiments	1		
MECE 305 Introduction to LabVIEW	1		
MECE 331 Engr. Mgt. & Cross-Cultural Comm	3		
ENGR 301 Ethics in Engineering and Robotics	1		
ENGR 320 Separation Processes	3		
ENGR 420 Chemical Reaction Engineering	3		

** A combined total of up to three credit hours for independent study, independent research, faculty-mentored research, and honors courses can be applied towards the Engineering Electives requirement.

SAMPLE FOUR-YEAR PLAN for the BACHELOR OF SCIENCE IN MECHANICAL ENGINEERING

<u>Fall</u>	<u>Credits</u>
Chemistry 105.....	4
Mathematics 161.....	4
Mechanical Engineering 107.....	2
Mechanical Engineering 109.....	2
Humanities 102.....	3
Physical Education 100.....	<u>1</u>
	16

<u>Fall</u>	<u>Credits</u>
Mathematics 261.....	4
Mechanical Engineering 201.....	3
Mechanical Engineering 211.....	3
Mechanical Engineering 251.....	1
Physics 102.....	4
SSFT course*.....	<u>2</u>
	17

<u>Fall</u>	<u>Credits</u>
Mechanical Engineering 311.....	3
Mechanical Engineering 325.....	3
Mechanical Engineering 351.....	1
Math/Science Elective*.....	3
Engineering 274.....	3
Humanities 200*.....	<u>3</u>
	16

<u>Fall</u>	<u>Credits</u>
Mechanical Engineering 401.....	3
Mechanical Engineering or Robotics 451.....	1
Mechanical Engineering Electives*.....	9
Humanities 301*.....	<u>3</u>
	16

Freshman Year	
<u>Spring</u>	<u>Credits</u>
Engineering 156.....	2
Mathematics 162.....	4
Mechanical Engineering 120.....	3
Physics 101.....	4
Writing 101.....	<u>3</u>
	16

Sophomore Year	
<u>Spring</u>	<u>Credits</u>
Mathematics 262.....	3
Mechanical Engineering 210.....	3
Mechanical Engineering 212.....	3
Mechanical Engineering 214.....	3
Mechanical Engineering 252.....	1
Humanities 202*.....	<u>3</u>
	16

Junior Year	
<u>Spring</u>	<u>Credits</u>
Mechanical Engineering 312.....	3
Mechanical Engineering 316.....	3
Mechanical Engineering 326.....	3
Mechanical Engineering 352.....	1
Electrical Engineering 210.....	3
Foundations of Social Science course*.....	<u>3</u>
	16

Senior Year	
<u>Spring</u>	<u>Credits</u>
Mechanical Engineering or Robotics 452.....	3
Mechanical Engineering Electives*.....	4
Engineering 402.....	1
Humanities 303*.....	3
General Elective*.....	<u>4</u>
	15

*Marked courses are not restricted to the time slots as shown in this suggested schedule.

NOTE: Scheduling time conflicts may occur for students who deviate from the above plan. Any exception to the classes listed on the other side of the page must have prior written approval of the department chairman.

TOTAL CREDIT HOURS REQUIRED = 128

Special GCC ME Department Offerings

MINORS

Robotics

The field of robotics is developing rapidly and Grove City is excited to be devoting important resources to the development of this discipline. Students complete 19-20 hours of course requirements (no additional credits are required; students take specific classes to fulfill mechanical engineering requirements). Courses feature hands-on learning experiences, practical design and programming courses.

Chemical Engineering

Students complete 19-20 hours of course requirements from the fundamental level through separation processes in chemical engineering applications (no additional credits are required; students take specific classes to fulfill mechanical engineering requirements).

STUDY ABROAD

Mechanical Engineering majors can partake in several study abroad opportunities ranging from short term faculty led travel courses to various summer programs.

Note: Previously offered semester abroad program for engineering is currently being re-evaluated.

UNDERGRADUATE RESEARCH OPPORTUNITIES

Opportunities exist for students to become involved in research during the school year and summer. Current research areas include alternative energies, biomimetic propulsion, experimental fluid dynamics, light alternative vehicles, biomedical instrumentation, control systems, electro-statics applied in the food drying industry, and more.



GCC ME Department Employment Information

Over the past 5 years, an average of **98% of our graduates found employment or attended graduate school within 6 months of graduation.** Starting salaries for 2019 graduates averaged \$61,247 with a maximum offer of \$70K. The median salary was \$55K. Our placement rate at graduation this year was 72%. This includes those graduates with full-time jobs or those with plans to attend graduate school full-time.

Year	% students employed 6 months after graduation*
2019	97%
2018	98%
2017	98%
2016	97%
2015	100%

*Includes a small percentage of students (typically about 10% or less) who chose to attend graduate school full time. Results based on a typical response rate close to 100%.

Class of 2019 – Employment at Graduation

AMM Incorporated Aerotech, Inc. Armstrong World Industries Chromalox Epic Metals Corporation Farason Corporation Havtech Honda R&D Americas Honda R&D Americas, Inc. Honda RD Americas Johnson Controls	Johnson Controls, Inc. Johnson Controls International PAE Consulting Engineers Qortek, Inc. Raymond Co Southeastern Pennsylvania Transportation Timken (2) US Navy Weldon Solutions
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<i>Class of 2018</i>	<i>Class of 2017</i>
Aerotech Affiliated Engineers, Inc. Agco Alion Science and Technology Bechtel Plant Machinery, Inc. Billco Manufacturing, Inc. Bossa Nova Robotics CamCraft CertainTeed Co. Curtiss-Wright DEKA Research and Development Corp. DesignTech Inc. DNP Imagingcomm America Corporation Eaton Corporation FHG Inc. GlobalFoundries GT Advanced Technologies Hamilton Tanks HB McClure Heyl and Patterson II-IV, Inc. Johnson Controls (York, PA) Karpinski Engineering Lanco Integrated Liberty Electronics Inc. Micro Tool Company Modjeski and Masters, Inc. Reading Bakery Systems Saint-Gobain Sechan Electronics, Inc. Stantec The Timken Company Thermaltech, Inc. TURBOCAM International Turner Construction Company UC Synergetic, LLC USAARL (US Army Aeromedical Research Laboratory) Vactaulic Vortex Optics Youngblood Automation, LLC	A. Stucki Company ABB, Inc. Aerotech Aire Technologies, Inc. Allied Machine and Engineering Alyan Pump Co. ATI Atlas Surveying, Inc. BAE Systems BPMI Braho Machinery Electric Boat Genesis Medical Associates Graybill Machines Great Hearts Academies Greene Tweed Honda R&D Americas Integrated Automation Systems Johnson Controls (2) Karpinski Engineering Lockheed Martin McCarl's Mechanical Contracting Orbital ATK Pittsburgh Fellows/Mylan Pharmaceuticals ProAutomated (Washington, MO) S P McCarl & Company, Inc. (Altoona, PA) Select Group Stanley Black & Decker Stantec Stone Machine Inc. Suburban Manufacturing The Timken Company (3) Towers Engineering Uromedica Inc. Viatran Weil-McLain (Michigan, IN) Westinghouse Electric Company

<i>Class of 2016</i> Aerotech, Inc. Alcoa Technical Center Alcoa Howmet Bechtel Marine Propulsion Corporation (2) Bechtel Plant Machinery, Inc. (2) CHL Systems Ellwood Specialty Steel Ford Motor Company General Dynamic Electric Boat (2) General Electric Transportation Grove City College Honda R&D Americas, Powersport Division Johnson Controls, Inc. Karpinski Engineering (2) National Fuel Gas National Institutes of Health Sepro America Siemens Building Technologies Stantec Supfina Machine Corporation TES Engineering The Timken Company Truefit Solutions Westinghouse Electric Co.	<i>Class of 2015</i> Aerotech, Inc. Alcoa Technical Center Alcoa Howmet Bechtel Marine Propulsion Corporation (2) Bechtel Plant Machinery, Inc. (2) CHL Systems Ellwood Specialty Steel Ford Motor Company General Dynamic Electric Boat (2) General Electric Transportation Grove City College Honda R&D Americas, Powersport Division Johnson Controls, Inc. Karpinski Engineering (2) National Fuel Gas National Institutes of Health Sepro America Siemens Building Technologies Stantec Supfina Machine Corporation TES Engineering The Timken Company Truefit Solutions Westinghouse Electric Co.
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GCC ME Department Graduate School Information

Graduate Schools Attended Full-Time Immediately After Graduation Classes of 2007-2020

(enrolled in M.S. or Ph.D. programs)

Carnegie Mellon University
Colorado State University
Florida State University
Gannon University
Georgia Tech
Johns Hopkins University
Massachusetts Institute of Technology/Woods Hole
Oceanographic Institution
Oregon State University
Pennsylvania State University
Princeton University
Purdue University
Texas A&M
Temple University
University of Alabama
University of Delaware
University of Florida
University of Kentucky
University of Maryland
University of Pennsylvania
University of Pittsburgh
University of Virginia
University of Wisconsin - Madison
Vancouver Film School
Virginia Tech

GCC ME Department Internship Information

Over the past 5 years an average of **77% of our graduates participated in summer engineering internship work experiences.**

Graduation Year	% Students Participating in Internships*
2020	85%
2019	78%
2018	77%
2017	63%
2016	81%
Average	77%

*Students usually participate in engineering internships during the summer between the junior and senior years. Some students find internships after the freshman and/or sophomore years. Internships are work experiences formally designated as such by the employer or work experiences with significant engineering content, but lacking a formal designation.

A listing of employers that hired our students for these summer internships is shown below and on the following two pages.

<p>Class of '20 Summer Internships</p> <p>A. Stucki Company Aerotech, Inc. Affiliated Engineers Allied Machine and Engineering American Expedition Vehicles (AEV) Andritz Metals AUMA Actuators BAE Systems Ball Metalpack Beckett Gas Cadence Inc. (2) ChemCut Corp. Crayola Custom Valve Repair Dairy Farmers of America (3) Dart Container (3) Deist Industries Department of Defense DesignTech Inc. DuCo Ceramics Company Earth Engineering, Inc. Eby Trailer The Electrode Store Elliott Group Engineered Design Group Equipment and Controls Inc. First Quality Enterprises, Inc. General Carbide GrayMatter Hovis Auto & Truck Supply Ibis Tek, Inc. Instrumentation Industries, Inc.</p>	<p>Karpinski Engineering (2) Komatsu Mining Corp. LAN Associates Lancaster County Timber Frames, Inc. LII Engineering Lockheed Martin M&T Bank Michelin Miller Industries New Pig Inc. NLMK Pennsylvania Northrop Grumman (2) Nova Technology NZK Plastics Penn State University PennDOT Pentair Precisionmatics Co. Premier Custom Built Robinson Fans Ruger Firearms Stanley Black and Decker Superior Plastic Products, Inc. Thorson Baker & Associates ThermalTech Inc. The Timken Company TJD Energy Services Inc. Turbocam International (4) University of Denver US Electrofused Minerals Inc. Walter Reed Medical Center Westinghouse Electric Company The Young Industries, Inc.</p>
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In addition, students have also had summer research experience through REUs (Research Experience for Undergraduates) and similar programs. Approximately 3% of the students participated in some type of research program. They included working at Penn State, and Grove City College.

<p><i>Class of '19 Summer Internships</i></p> <p>Arconic Avalon Precision Metalsmiths Billco Manufacturing Bristol Metals Cardone Industries Duane Bosman (Logging) Epic Metals Corporation FHG, Inc. Flowserve, Inc. Fluence Automation GE Transportation Hardwire LLC Harmony Castings Jacobs Technology Lincoln Electric MCD Machine MTD Products, Inc.</p>	<p>Oberg Omega Engineering OPEX Corporation Paul Reed Smith Guitars Phoenix Energy Supply Phoenix Mecano PKF Mark III, Inc. Qortec, Inc. RMF Engineering Saab Sensis Corporation Sonset Solutions Tektronix Component Solutions Testing Solutions, Inc. Trumbull Corp. (PJ Dick) US Navy Voestalpine Roll Forming Company Werner Co.</p>
<p><i>Class of '18 Summer Internships</i></p> <p>A. Stucki Company (2) Aire Technologies AK Steel Holdings Corporation BAE Systems I&S, Hill AFB, Utah Bechtel Plant Machinery Billco Manufacturing (2) Camcraft CertainTeed (2) CJL Engineering Columbus Steel Castings (out of business now) Dahlgren Naval Base DEKA R&D Corp. DiMec Rail Services Diversified Mounting Solutions DNP Imagingcomm America Corporation Eaton Corporation (2) Encap Plastic Injection Moulding Exelon GE Transportation (4) Global Foundries Green Bank National Radio Astronomy Observatory Greenville Metals, Inc. Harmony Castings, LLC Herrick Technology Labs Honda R&D Inc. Intersystems, Inc. Intervala ITW Deltar Fasteners</p>	<p>JV Manufacturing Karpinski Engineering Kirlin Design Build Kubota Industrial Equipment Longview Power Maximatec MEI Total Elevator Solutions Micro Tool Company Mitsubishi Electric Power Products Modjeski and Masters Naval Facilities Engineering Command Northrop Grumman NYC Department of Environmental Protection Parlee Cycles Pentair Philadelphia Energy Solutions Plascore, Inc. Safkan Incorporated Sechan Electronics SMS USA, Inc. SonSet Solutions TE Connectivity Tower Engineering Turbocam Turbocam International (2) Victaulic Volvo Group Trucks Westinghouse Electric Company (2) Whirlpool Corporation Zurn Industries, Inc.</p>

<i>Class of '17 Summer Internships</i> A. Stucki Company (2) Aire Technologies, Inc. Alcoa Wheels and Transportation Allied Machine and Engineering Altaflo, Rudolph Research Analytical Andy McCoy Race Cars Baier und Koppel Chromalox Compaction Technologies, Inc. Delta Systems, Inc. First Solar GE Lighting Harmony Castings Holstein White Engineers Honda R&D Americas	Integer/Breat Batch Jennings Heating and Cooling Co. JLG Industries (2) Joy Global Karpinski Engineering Kleinschmidt NASA Langley Orbital OTK Paramount Die Company Reach Beyond (2) Stone Machine Inc. Tendye Medical, a subsidiary of Abbott Labs The Timken Company TurboCam International Volvo Group Trucks Westinghouse Electric Co. (2) Whirlpool Corporation
<i>Class of '16 Summer Internships</i> A. Schulman, Inc. Beck Manufacturing Beckett Gas, Inc. (2) Billco Manufacturing BPMI Camcraft Inc. (2) Cardone Industries Claitman Engineering Associates Connection Technology Center Cummins Inc. Custom Control Concepts, LLC DesignTech Dewatering Services EQT Corporation Essential Medical, Inc. FHG Inc. FMC Technologies	GE Transportation (3) Harmony Castings International Electronic Machine Corporation Johnson Controls Joy Global Kurt J. Lesker LORD Corporation Medart Metso Mitsubishi Electric Power Products, Inc. PAE Engineering PennDOT PSEG (2) RoPRO Design Sikorsky Aircraft Corporation US Joiner LLC Westinghouse Electric Co. (3)

GCC ME Department FE Data (Fundamentals of Engineering Exam – the first step towards licensing as a Registered Professional Engineer)

Over the past 5 years an average of **97% of those students who took the FE exam passed the exam**. We strongly urge all graduating students to take this exam.

Year	GCC ME Student Pass Rate	National Pass Rate
2018	80%	72%
2017	100%	78%
2016	94%	78%
2015	100%	83%
2014	91%	85%
Average	93%	79%

Mechanical Engineering Faculty and Staff

Rich Savage

Dean of Hopeman School of Science, Engineering, and Mathematics
Professor of Engineering
Ph.D., Indian University, Analytical Chemistry/Materials Science
B.S. Juniata College, Chemistry
Specialty: Micro-Nano scale system design, fabrication & characterization

Dr. Savage spent 16-years at Cal Poly, San Luis Obispo, CA and served as Dean of Graduate Education, Chair of Biomedical Engineering and Chair of Materials Engineering. His industrial experience includes being Chief Technology Officer of Olympus and VP of research and product development for several corporations involved in manufacturing semiconductor processing equipment. He also was President of two start-up companies: SC Technology and PT Analytical. Most of his work involved the fabrication of semiconductor devices and the development of bio-mems devices for surgical endoscopy.

Stephanie Adams

Staff Assistant, Hopeman School of Science and Engineering
ABET Coordinator
B.S., Grove City College

Stephanie came to Grove City College in February 2010. She is the staff assistant for the Hopeman School of Science, Engineering, and Mathematics. Before joining GCC, she worked at Franklin Insurance Agency as Operations Manager and at On Bank as a mortgage servicing supervisor.

Blair T. Allison

Professor of Mechanical Engineering
Ph.D., Massachusetts Institute of Technology
M.S., Massachusetts Institute of Technology
B.S., Carnegie Mellon University
Registered Professional Engineer in Pennsylvania

Mechanical Systems Faculty
Specialty: Mechanics of Materials, Control Systems.

Dr. Allison joined GCC in 1999, transitioning from a highly-successful 15-year career at Alcoa, where he was a nationally-recognized expert in the industrial applications of metal forming. He is fluent in German and managed the pilot manufacturing of key parts for the all-aluminum Audi A8 in Soest, Germany. Dr. Allison holds four patents in the metal forming area and is a recipient of the Arthur Vining Davis Award for Technical Excellence. He teaches sophomore, junior, and senior lab and lecture classes.

Erik Anderson

Professor of Mechanical Engineering
Ph.D., Massachusetts Institute of Technology
M.S., St. Francis Xavier University
B.S., Gordon College

Thermal Systems Faculty

Specialized Areas – Fluid Mechanics, Biomechanics, Philosophy of Science
Key Courses Taught – Applied Fluid Mechanics; Mathematical Methods in Engineering; Science, Faith, Technology & Origins

Additional Items of Note – William J. Fulbright Scholar in the area of experimental biofluid dynamics, postdoctoral fellow at Harvard University in the Department of Organismic and Evolutionary Biology

Mark Archibald

Professor of Mechanical Engineering
Ph.D., Virginia Polytechnic Inst.
M.S.M.E., Virginia Polytechnic Inst.
B.S.M.E., Univ. of Alabama at Huntsville

Mechanical Systems Faculty; Sophomore Laboratory Coordinator

Specialty: Computer-Aided Design and Manufacturing, Design of Human Powered Vehicles.

Dr. Archibald's industrial experience includes work as a design engineer for the Volvo-GM Heavy Truck Corporation, shape-memory alloy research for Sandia National Labs, and extensive training as a small- aircraft pilot/instructor and airframe mechanic. He directs the CAD lab and is the author of *Design for Manufacturing with Pro/MANUFACTURING*, *Mechanical Engineering Design with Pro/Engineer* and *Design of Human-Powered Vehicles*.

Erik Bardy

Professor and Assistant Chair of Mechanical Engineering
Associate Director - European Study Center Program
Ph.D., Univ. at Buffalo, SUNY
M.S., Univ. at Buffalo, SUNY
B.S., Univ. at Buffalo, SUNY

Thermal Systems Faculty

Specialty: HVAC and Thermodynamics

Key Courses Taught – Thermodynamics, HVAC, Instrumentation Laboratory, Survey of Renewable Energy Systems

Dr. Bardy is a dual French-American national. He is very involved in the European Study Center program in Nantes and directs all short term travel courses associated with the program as well as summer research at our activity partner school (Oniris, associated with the University of Nantes, Nantes France). Dr. Bardy is the faculty advisor for ASHRAE and the GCC swing club.

Michelle A. Clauss

Professor and Chair of Mechanical Engineering
Ph.D., Carnegie Mellon University
B.S., Grove City College

Thermal Systems Faculty; SWE Advisor

Specialty: Fluid Mechanics

Dr. Clauss is a recipient of the NSPE Roger Clark Dawes Award and has been recognized as an “Outstanding Young Woman of America.” She currently serves as advisor to the Society of Women of Engineers Student Chapter. Dr. Clauss teaches the mechanics classes and fluid mechanics.

John Dixon

Assistant Professor of Mechanical Engineering
Ph.D., University of Minnesota
M.S.M.E., University of Minnesota
B.S.M.E., Grove City College

Thermal Systems Faculty

Specialty: Heat Transfer, Thermodynamics, Engines/Emissions

Key Courses Taught – Thermodynamics, Measurement lab, Matlab programming, computational methods, Internal Combustion Engines

Dr. Dixon's industrial experience includes work as an engineer for Cummins Power Generation, developing fuel systems and improving emissions for new products.

Mark Fair

Professor of Mechanical Engineering and Physics
Ph.D., Carnegie Mellon University
B.S., Grove City College

Thermal Systems Faculty

Specialty: Transport phenomena, Mechanics, Thermodynamics, Scientific Computing
Key Courses Taught - Fundamentals of Materials Science, Heat Transfer, Advanced Thermodynamics, Mechanics

Dr. Fair joined the faculty at GCC in 2004 after working in industry at Aristech Chemical Corporation and Aristech Acrylics, LLC. His industrial experience includes research and development for acrylic polymerization and related processes; design and process engineering for the design, construction, and startup of a continuous casting machine to produce acrylic sheet and of a reactor system to produce acrylic syrup; process engineering for various systems including an automated chemical addition system; and control systems engineering. He also performed research in polymer physics as postdoctoral fellow at Stanford University. Dr. Fair has taught a variety of physics courses in addition to mechanical engineering courses.

Kara Henley

Machine Shop and Laboratory Support Engineer
B.S., Grove City College

Kara is a 2015 graduate in Mechanical Engineering from Grove City College. Graduating from our program gives her a great working knowledge of the needs and expectations of our students. She assists with the sophomore machine shop laboratory sessions and supervises the evening hours the shop is available for student use. Each spring, Kara arranges plant tours to a variety of manufacturing facilities, exposing the students to many different aspects of this important component of engineering. In addition, Kara accompanies students and faculty to key competitions and provides onsite support as needed.

Jim Paich

Department Machinist and Machine Shop Supervisor
Certified CNC and Precision Machining Instructor

Jim is an expert machinist with more than 30 years of experience and full knowledge of CNC programming and general machining. Before joining GCC, he worked as a machining supervisor and programmer at Syst-A-Matic Tool & Design and Joy Manufacturing, as well as an instructor at the Precision Manufacturing Institute in Meadville, PA.

Mark Reuber

Field Director of the Office of International Education
Professor of Mechanical Engineering, Registered Professional Engineer in Pennsylvania
Ph.D., University of Illinois at Chicago
M.E., Carleton University, Ottawa, Canada
B.E., Carleton University, Ottawa, Canada

Mechanical Systems Faculty
Specialty: Design, International Engineering

A recipient of the Ralph R. Teetor Education Award and the National SAE Faculty Advisor's Award, Dr. Reuber has been a member of the GCC faculty since 1989. His research in design has been featured in Popular Mechanics and Popular Science and has generated over two dozen technical papers and briefs, including one patent. He has served as a consultant to the U.S. Olympic Committee, the U.S. Olympic Baseball Team, and the PGA Tour. He currently serves as liaison to our sister department at Oniris in Nantes, France (associated with the University of Nantes). In the fall of 2004, Dr. Reuber was appointed as the Director of International Education at Grove City College and currently serves as the Field Director of International Education. He is responsible for significantly expanding the opportunities for all GCC students to study abroad.

George ("Geo") A. Richards

Associate Professor of Mechanical Engineering
Ph.D., Purdue University
M.S.M.E., B.S.M.E., Clarkson University

Thermal Systems Faculty
Specialty: Energy Conversion, Propulsion, and Power

Dr. Richards joined the GCC faculty in 2019 after a research career with the National Energy Technology Laboratory. He has lead dozens of research projects on clean energy technology for the U.S. Department of Energy, as well as conducting inter-agency research (NASA, Dept. of Defense, Energy) related to advanced propulsion and power. Dr. Richards has authored or co-authored seven book chapters, multiple articles, and seven patents, all related to energy technology. He currently serves as an associate editor for the Journal of Propulsion and Power, American Institute of Astronautics and Aeronautics (AIAA).

Vern Ulrich

Professor of Mechanical Engineering, Registered Professional Engineering in New York

Ph.D., University of Virginia

M.S., University of Virginia

B.S., Bridgewater College

Mechanical Systems Faculty

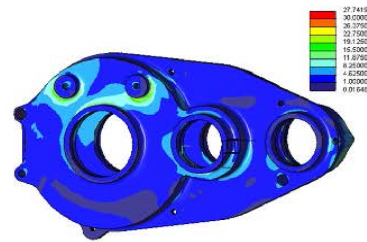
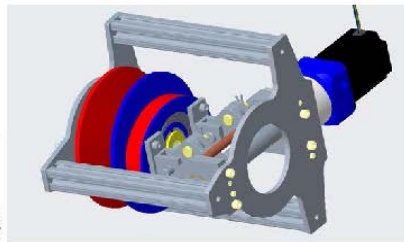
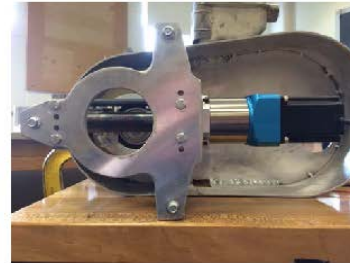
Specialty: Machine Design, Design of Experiments, Vibrations, Finite Elements.

Dr. Ulrich joined us in 2005 and comes to us after 6 years with Lexmark. He also has 13 years of experience with Xerox Corporation. Dr. Ulrich is an expert in electrophotography, printer design, and manufacture, and holds 3 U.S. patents.

Past Two Year Senior Design Projects

Gear Ratio Optimization Via Electronic Response (2019)

- The purpose of this project is to develop a New Drivetrain for the primary competition car of the Grove City College Baja SAE Team. The drivetrain consists of an Electronic Computer-Controlled Continuously Variable Transmission (e-CVT) that selects an optimum gear ratio based on various engine and vehicle conditions, and a Single-Speed Gearbox that acts as a final gear reduction before power reaches the rear wheels.



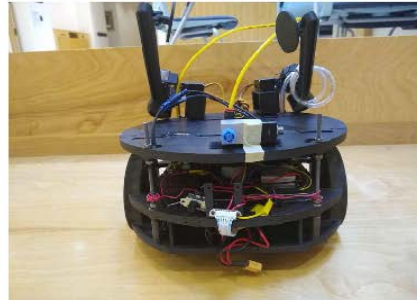
Automated TGMS Mount (2019)

- ENSCO Rail has contracted a Grove City College (GCC) Senior Design Team with developing a Hi-Rail Chevy truck mount that will mechanically relocate their Track Geometry Measurement System (TGMS) to specific locked locations.
- These positions are specified to not impede the vision of the driver during travel as well as lowering the system to a specific location for scanning use.
- The design was created to minimize the physical effort needed by ENSCO's workers considering their past design required employees to move the TGMS with brute force.



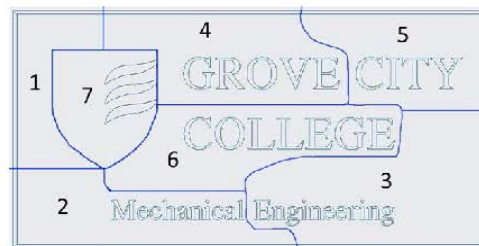
Fire Fighting Robot Team (2019)

- The main goal for the project was to design and produce a functional autonomous robot capable of entering the the Trinity College Fire Fighting Home Robot Contest in 2019.
- Projects objectives included
 - Autonomously navigate the arena
 - Detect and extinguish all candles
 - Run in under 5 mins
 - Start from an unknown location
 - Navigate around furniture
 - Navigate a reconfigurable arena
 - Locate a baby crib
 - Pick up and relocate crib to a safe zone
- This design team consisted to both mechanical and electrical engineering majors.



Robotic Arm Modular Assembly Cell (2019)

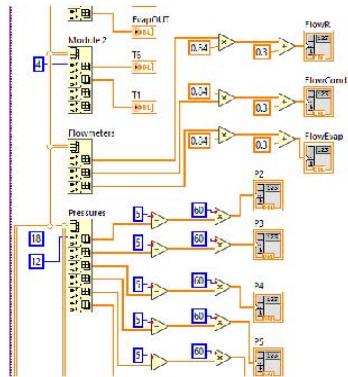
- The goal of this project was to develop a modular assembly cell built around the mechanical engineering department's FANUC robot which will use a vision system to identify and assemble pieces into a souvenir for potential students interested in mechanical engineering.
 - Robot scans each piece using vision system
 - Computes correct order and orientation for pieces to be placed
 - Pieces are placed in order into the puzzle box by robot
 - The robot returns to the home position and the rotary feeder is spun. The puzzle is removed.





Refrigeration Board Spring Design Report (2019)

- The purpose of this project was to design and build a display board to exhibit the full vapor-compression refrigeration cycle and its properties.
- The board measures temperature, pressure and flowrate at several points via national instrument DAQ modules interfaced with LabVIEW.



Turbulence Tank (2019)

- The turbulence tank project was originally founded in 2013 to aid Dr. Erik Anderson in his research with the National Science Foundation at the Woods Hole Oceanographic Institute.
- The goal of the turbulence tank is to implement a controlled system to promote a consistent and measured volume output of flow for repeatable experiments.
 - Bellows were chosen to be the system to displace the fluid and create turbulence in the tank.
 - With the use of the control program, the volume output of the bellows is uniform and precise from eight actuators.





BPMI - Valve Testing Rig (2020)

* All projects were ended in March 2020 due to COVID-19

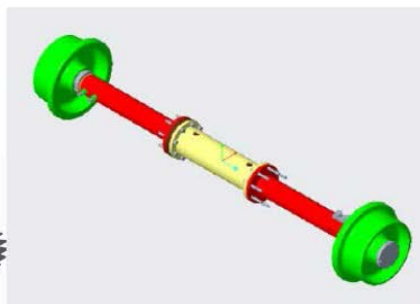
- The goal of the project was to develop a system to test the durability of a valve by autonomously opening and closing it up to 10,000 times.
- At the conclusion of the project students were able to develop a system on a movable cart consisting of a motor, gearbox, and the following interfaces to control the system:
 - Programmable Logic Controller (PLC) used to control the operation of the system, which includes initiating programs saved to the motor controller, counting test cycles, and recording torque over time.
 - Human Machine Interface for initiating tests and for monitoring system operation.
 - Safety features such as emergency stops and a safety cage.
- This project was supported by Bechtel Plant Machinery Inc. (BPMI)



Ensco Rail Project (2020)

* All projects were ended in March 2020 due to COVID-19

- The goal of the project was to use a modified hi-rail axle in conjunction with ENSCO TGMA to determine weak areas of track that may lead to derailments.
- Features of the design included:
 - DMF RW-1015 hi-rail system modified for specific use.
 - Internal mounted hydraulic cylinder.
 - Circular flange mounting for easy maintenance and repair.
 - Guide rod through axle tube to provide axial force producing less stress on the system.
- This project was sponsored by ENSCO Rail.



Designing an HVAC System for Hoyt Hall (2020)

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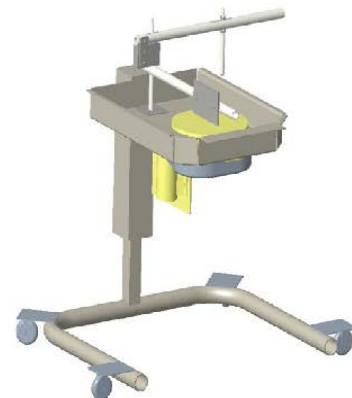
- The goal of the project was to design an efficient and economical HVAC system to implement in Hoyt Hall of Engineering.
- At the conclusion of the project students were able to:
 - Complete a comprehensive survey of Hoyt Hall
 - Gained an understanding of AutoCAD, Trane Trace, and Revit software.
 - Researched and selected control systems needed in an HVAC system with the assistance of Siemens following ASHRAE standards.
 - Created AutoCAD backgrounds for all three floors of Hoyt Hall.
 - Produced an accurate and complete model of Hoyt Hall.



Accessible Pottery Wheel (2020)

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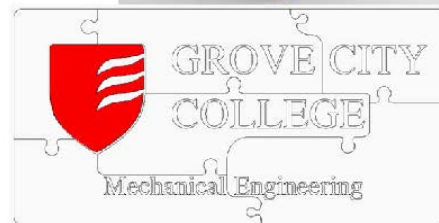
- The goal of the project was to design, build, and test a wheelchair-accessible pottery wheel that is competitive with AMACO Brent's Model #16 Adaptive Wheel, incorporating modifications specifically for students at the local Grove City High School.
- The student design consisted of the following:
 - A motorized lift to allow students and teachers to easily adjust the table height, a comfortable armrest for the students
 - A detachable wheel head for ease of cleaning
 - A large power button accompanied by an emergency stop
 - A hand-accessible speed control
 - An accessory to aid the students in centering and opening the clay
 - A sturdy frame to support the load.
 - These systems were designed and analyzed in PTC Creo Parametric.



Puzzle Assembling Robot (2020)

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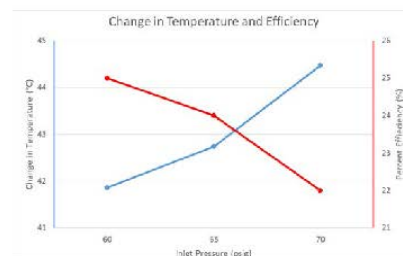
- The goal of the project was to assemble a puzzle using a FANUC industrial robot and an integrated vision system. This was a continuation of a project from 2019.
- At the conclusion of the project students accomplished the following:
 - Implementation of a High luminosity contoured backlight to aid in part recognition and decrease the negative effects of ambient light.
 - More accurate calibration and puzzle part placement to achieve a higher percentage of successful runs.
 - Increased the reliability of the puzzle assembling process through optimization of the gripping system.
 - A Programmable Logic Controller (PLC) was used to monitor safety sensors mounted on robot cage, stopping robot motion if someone enters cage.
 - A Human Machine Interface (HMI) design.
 - Data sharing through EtherNet/IP software between PLC, HMI, and FANUC controller.



Determining the Efficiency of a Scroll Expander (2020)

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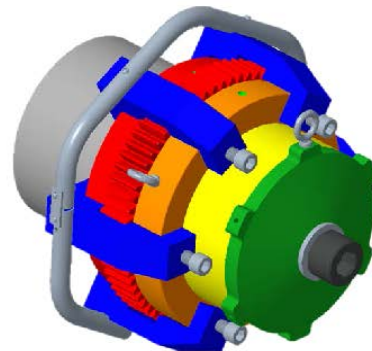
- The goal of the project was to evaluate the efficiency and business case for a reversible scroll compressor/expander as a new method to recover waste heat, store renewable energy, and shift electric power grid demand.
- At the conclusion of the project students accomplished the following:
 - Recorded data that shows that the scroll expander effectively generates power with a power output increasing directly as inlet pressure increases.
 - Despite obtaining lower efficiency values than originally predicted, the system proved that waste heat energy can effectively be transformed into energy via a scroll expander system.
 - More testing would be required in order to determine if the efficiency and power output of the expander would increase by increasing the temperature of the inlet air, like what would be available in latent waste heat recovery applications



Wabtec Gear Removal (2020)

* All projects were ended in March 2020 due to COVID-19

- A press-fit gear (red) is floated onto a 10-inch diameter EVO crankshaft by pumping hydraulic fluid into an inlet and an internal groove. If the internal groove slides over the initial edge of the crankshaft, the hydraulic pressure is lost and the gear locks in place. The goal of the project was to design, manufacture, and test an apparatus that will remove the gear without damage.
- At the conclusion of the project students proposed a design that can maintain hydraulic pressure as the gear slides over the initial edge of the crankshaft, enabling the gear to be completely removed from the crankshaft.



Water Tunnel (2020)

* All projects were ended in March 2020 due to COVID-19

- The goal of the project was to design a water tunnel to aid in research carried by Dr. Erik Anderson. The water tunnel will be used to analyze the biomechanics of fish swimming through a fluid field. Understanding the energetics of fish swimming has applications to the design of novel propulsion systems.
- At the conclusion of the project students completed a design that will be used to construct the water tunnel at Grove City College.

