2023 U13 iSTEM 4 - Motors, Robotics, and Controllers

Content Area: **CTE**
Course(s): **iSTEM**
Time Period: **March**
Length: **12 - 13 weeks**
Status: **Published**

Unit Overview:

In this unit, students will explore the application of motors and controllers used in remotely operated vehicles (ROV). The SeaPerch program and Drone operating challenge focuses on the interaction of structure building, motors placement / operation, and controller configuration that incorporates multiple disciplines of engineering. Through a variety of hands-on activities, using problem-based learning, students learn the science behind an ROV, the configuring of motors, assembly of electrical wires, and will investigate air and fluid mechanics.

Essential Questions:

- What is the difference between atmosphere & aerospace?
- What is Daniel Bernoulli's contribution to understanding the relationship between air speed and air pressure?
- How do marine transportation power sources & subsystems work?
- Why are mechanical, structural, power, and transportation systems are designed to work the way they do?
- What is Archimedes contribution to understanding the relationship between water and bouyancy?

Enduring Understandings:

- Identify various types of simple and complex structures in the world
- The positive and negative effects technology can impart on a community, region, and society as a whole.
- Learn the science principles necessary to construct an ROV, such as Newton’s Laws of Motion, buoyancy, and properties of air
- Design and build an ROV for competition
- Describe how ROVs are used in the marine science
- Compare the technology of an ROV to other technologies
- Conduct on-going self-assessments and research in the face of evolving educational and workplace environments.
- Investigate the challenges of working in an airless environment
- Design and implement an electrical system for their ROV
- Test underwater ROVs for buoyancy, control, guidance, speed, and friction
- Compare and Contrast the rotational movements of pitch, yaw, and roll.
- Explain the opposing forces of gravity versus lift, and of thrust versus drag.
- Explain the components of air foils and how they assist in generating lift.

Lesson Titles:

- Presentation of Information: Sea Perch Videos, Sea Perch Packet Assembly, Drone Building Packet

- Sea Perch Project

- Drone Building and Flying

- Design Challenge: Life Size Cardboard Boats

- Life Size Cardboard Boat Project Presentations

Instructional Strategies, Learning Activities, and Levels of Blooms/DOK:

- Direct Instruction: Daily Overviews (Promethean Board, Chromebooks, White Board)
- Direct Instruction: Open Discussion on Projects, Group discussion into teacher and group discussion
- Instruction: Videos / Links to step by step building instruction
- Indirect Instruction: Reflective Discussion, Evaluation of Data and Technical Writing - ENB Write Ups, Self Evaluations, Presentation of Projects
- Experiential: Project - Life Size Cardboard Boat
- Experiential: Project - Sea Perch
- Experiential: Project - Drone Flying
- Cooperative: Partner classwork, short projects, projects and ENB entries

Summative Assessment:

- Mini - Project: Drone Building
- Mini - Project: Drone Course
- Mini - Project: Sea Perch Project
- Project: Life - Size Cardboard Boat Project
- Quiz: Life - Size Cardboard Boat Project ENB
- Quiz: Life - Size Cardboard Boat Project Presentation

Formative Assessment:

- Anticipatory Set - Overview of items for the day, future activities of the unit, and/or review of previous information from the unit

- Classroom / Student Observation - check in on student work during in-class activities / projects
- Closure of Projects - students provide results of their projects, self-evaluate projects for possible improvements that could be made, and evaluate instruction that could be improved
- Closure of Units - students complete a design project that pertains to the unit at hand as well as prior units
- Conferences between the instructor and student at various points in the semester.
- ENB (engineering notebooks) - reviewed periodically during the school year
- In-class activities where students informally present their results.
- Presentation Sample Slides - Students participate in classroom discussion on topic that is being introduced and reviewed
- Q & A session - Student led question and answer session at the start of class for project information as needed
- Question and answer sessions, formal, planned and informal, spontaneous.
- Warm-Up - review information from current topic or previous topics, preview time for current activity, and/or opportunity for clarity on the previous day's work

Benchmark Assessments

Skills-based assessment

Reading response

Writing prompt

Lab practical

Alternative Assessments

Performance tasks

Project-based assignments

Problem-based assignments

Presentations

Reflective pieces

Concept maps

Case-based scenarios

Portfolios

Standards/Indicators/Student Learning Objectives (SLOs):

9-12.HS-ETS1	Engineering Design
9-12.HS-ETS1-1.1	Asking Questions and Defining Problems
9-12.HS-ETS1-1.1.1	Analyze complex real-world problems by specifying criteria and constraints for successful solutions.
9-12.HS-ETS1-4.4.1	Models (e.g., physical, mathematical, computer models) can be used to simulate systems and interactions— including energy, matter, and information flows— within and between systems at different scales.
9-12.HS-ETS1-3.6	Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles and theories.
9-12.HS-ETS1-1.ETS1.A	Defining and Delimiting Engineering Problems
9-12.HS-ETS1-1.ETS1.A.1	Criteria and constraints also include satisfying any requirements set by society, such as taking issues of risk mitigation into account, and they should be quantified to the extent possible and stated in such a way that one can tell if a given design meets them.
9-12.HS-ETS1-1.ETS1.A.2	Humanity faces major global challenges today, such as the need for supplies of clean water and food or for energy sources that minimize pollution, which can be addressed through engineering. These global challenges also may have manifestations in local communities.
9-12.HS-ETS1-3.ETS1.B.1	When evaluating solutions, it is important to take into account a range of constraints, including cost, safety, reliability, and aesthetics, and to consider social, cultural, and environmental impacts.

Career Readiness, Life Literacies, & Key Skills:

WRK.K-12.P.1	Act as a responsible and contributing community members and employee.
WRK.K-12.P.4	Demonstrate creativity and innovation.
WRK.K-12.P.5	Utilize critical thinking to make sense of problems and persevere in solving them.
WRK.K-12.P.7	Plan education and career paths aligned to personal goals.
WRK.K-12.P.8	Use technology to enhance productivity increase collaboration and communicate effectively.
WRK.K-12.P.9	Work productively in teams while using cultural/global competence.

Inter-Disciplinary Connections:

LA.SL.11-12.1	Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with peers on grades 11–12 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.
LA.SL.11-12.1.A	Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well reasoned exchange of ideas.
LA.SL.11-12.1.B	Collaborate with peers to promote civil, democratic discussions and decision-making, set clear goals and assessments (e.g., student developed rubrics), and establish individual

	roles as needed.
LA.SL.11-12.4	Present information, findings and supporting evidence clearly, concisely, and logically. The content, organization, development, and style are appropriate to task, purpose, and audience.
LA.SL.11-12.5	Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest.
LA.SL.11-12.6	Adapt speech to a variety of contexts and tasks, demonstrating a command of formal English when indicated or appropriate.
SOC.9-12.1.4.1	Take a position on a current public policy issue and support it with historical evidence, reasoning, and constitutional analysis in a written and/or oral format.
SOC.9-12.1.4.2	Demonstrate effective presentation skills by presenting information in a clear, concise, and well-organized manner taking into consider appropriate use of language for task and audience.

Technology Materials and Standards

- SmartBoard Presentations
- Chromebooks, Google Drive, Google Applications
- MS Office Software as needed
- Smartphones
- Construction Hand Tools and Safety Equipment

TECH.8.1.12	Educational Technology: All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.
TECH.8.1.12.B	Creativity and Innovation: Students demonstrate creative thinking, construct knowledge and develop innovative products and process using technology.
TECH.8.1.12.C	Communication and Collaboration: Students use digital media and environments to communicate and work collaboratively, including at a distance, to support individual learning and contribute to the learning of others.
TECH.8.1.12.F	Critical thinking, problem solving, and decision making: Students use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources.
TECH.8.2.12	Technology Education, Engineering, Design, and Computational Thinking - Programming: All students will develop an understanding of the nature and impact of technology, engineering, technological design, computational thinking and the designed world as they relate to the individual, global society, and the environment.
TECH.8.2.12.B	Technology and Society: Knowledge and understanding of human, cultural and society values are fundamental when designing technology systems and products in the global society.
TECH.8.2.12.C	Design: The design process is a systematic approach to solving problems.
TECH.8.2.12.E	Computational Thinking: Programming: Computational thinking builds and enhances problem solving, allowing students to move beyond using knowledge to creating knowledge.

Computer Science and Design Thinking Standards

CS.K-12.2.a	Cultivate working relationships with individuals possessing diverse perspectives, skills, and personalities.
CS.K-12.2.b	Create team norms, expectations, and equitable workloads to increase efficiency and effectiveness.
CS.K-12.2.c	Solicit and incorporate feedback from, and provide constructive feedback to, team members and other stakeholders.
CS.K-12.2.d	Evaluate and select technological tools that can be used to collaborate on a project.
CS.K-12.6.a	Systematically test computational artifacts by considering all scenarios and using test cases.
CS.K-12.6.b	Identify and fix errors using a systematic process.
CS.K-12.6.c	Evaluate and refine a computational artifact, multiple times, to enhance its performance, reliability, usability, and accessibility.
CS.K-12.7.b	Describe, justify, and document computational and/or design processes and solutions using appropriate terminology consistent with the intended audience and purpose.

Equity Considerations

Climate Change

Topics: Activities to help students understand Climate Change

Materials Used: https://www.weareteachers.com/climate-change-activities/

Addresses the Following Component of the Mandate:

- Economic
- Political
- Social

Asian American Pacific Islander Mandate

Topic: Asian American STEM classrooms

Materials Used: https://www.pbs.org/wgbh/nova/article/asian-american-scientists-stem-classrooms-increasing-inclusion-and-visibility/

Addresses the Following Component of the Mandate:

- Economic
- Political
- Social

LGBTQ+ and Disabilities

Topic: What topics can have an impact on individuals in LGBTQ

Materials Used: https://prideinstem.org/lgbtstemday/

Topic: What topics can have an impact on individuals with Disabilities

Materials Used: https://alexandertutoring.com/supporting-stem-education-students-disabilities/

Addresses the Following Component of the Mandate:

- Economic
- Political
- Social

Modifications

G&T Modifications:

- Alternate assignments/enrichment assignments
- Enrichment projects
- Extension activities

- Higher-level cooperative learning activities
- Pairing direct instruction with coaching to promote self-directed learning
- Provide higher-order questioning and discussion opportunities
- Provide texts at a higher reading level
- Tiered assignments
- Tiered centers

ELL Modifications:

- Choice of test format (multiple-choice, essay, true-false)
- Continue practicing vocabulary
- Provide study guides prior to tests
- Read directions to the student
- Read test passages aloud (for comprehension assessment)
- Vary test formats

At Risk Modifications

The possible list of modifications/accommodations identified for Special Education students can be utilized for At-Risk students. Teachers should utilize ongoing methods to provide instruction, assess student needs, and utilize modifications specific to the needs of individual students. In addition, the following may be considered:

- Additional time for assignments
- Adjusted assignment timelines
- Agenda book and checklists
- Answers to be dictated
- Assistance in maintaining uncluttered space
- Books on tape
- Concrete examples
- Extra visual and verbal cues and prompts
- Follow a routine/schedule
- Graphic organizers
- Have students restate information
- No penalty for spelling errors or sloppy handwriting
- Peer or scribe note-taking
- Personalized examples
- Preferential seating
- Provision of notes or outlines
- Reduction of distractions

- Review of directions
- Review sessions
- Space for movement or breaks
- Support auditory presentations with visuals
- Teach time management skills
- Use of a study carrel
- Use of mnemonics
- Varied reinforcement procedures
- Work in progress check

IEP & 504 Modifications:

*All teachers of students with special needs must review each student's IEP. Teachers must then select the appropriate modifications and/or accommodations necessary to enable the student to appropriately progress in the general curriculum.

Possible Modifications/Accommodations: (See listed items below):

- Allow for redos/retakes
- Assign fewer problems at one time (e.g., assign only odds or evens)
- Differentiated center-based small group instruction
- Extra time on assessments
- Highlight key directions
- If a manipulative is used during instruction, allow its use on a test
- Opportunities for cooperative partner work
- Provide reteach pages if necessary
- Provide several ways to solve a problem if possible
- Provide visual aids and anchor charts
- Test in alternative site
- Tiered lessons and assignments
- Use of a graphic organizer
- Use of concrete materials and objects (manipulatives)
- Use of word processor

Resources & Materials:

- Project Lead the Way, Introduction to Engineering Design Information
- Walker, Exploring Drafting, II: Goodhart-Wilcox, 1996
- Gradwell & Wekch. Technology, Engineering Our World, IL: Goodhart-Wilcox, 2012