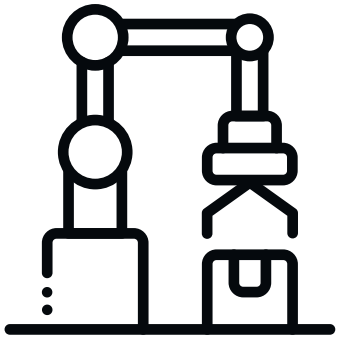


# Tides of Efficiency



What role does automation and the use of robotic arms play in the maritime industry?

**Suggested Equipment Skill Level**

Advanced User

**Equipment Skills**

Design and Coding

Port Automation Specialist

**Career & Skillset Connections**

- Systems Integration
- Technical Skills
- Decision Making

**Project Guiding Themes**

- Engineering design process
- Operating robotic arm, mobile robot, and 3D printer collaboratively to complete a task

**Suggested Software & Materials**

- DobotLab Software
- Sphero App
- 3D Modeling Software
- Paper/Cardboard
- Tape

**Aligned VDOE CTE Course(s) and Competencies**

**Engineering Studies**

36-Weeks

**Engineering Drawing and Design**

36-Weeks

**Technology Assessment**

36-Weeks

# Tides of Efficiency

Robotic Arm Advanced Skill Level



What role does automation and the use of robotic arms play in the maritime industry?

## Project Problem & Career Prompt

In the bustling world of shipping, your team has been entrusted with an extraordinary mission: to revolutionize container movement at the renowned Port of Virginia. The task at hand is to design and implement an innovative solution that combines mobile robots, robotic arms, and 3D printing technology, aiming to enhance efficiency and speed in handling shipping containers throughout the port. As the project unfolds, your team becomes the driving force behind a remarkable transformation. Together, you embark on a journey of ingenuity and collaboration, seeking to design and 3D print a custom attachment that will revolutionize the movement of containers. This attachment will be securely fastened to the mobile robots, enabling them to handle containers of various shapes and sizes with precision and ease. But your innovation extends beyond the physical attachment. The team will also reimagine the layout of the entire Port, meticulously planning each step of the operation. Your expertise will be put to the test as you strategize and optimize the positioning and movement of the robotic arms, seamlessly integrating them into the container loading process. Each member of the team brings a unique set of skills and perspectives, working together to overcome challenges and unlock the full potential of this groundbreaking project. As you navigate through the design phase, you'll collaborate, brainstorm, and prototype, leveraging the power of 3D printing, robotic arm, and mobile robot technology to bring your visions to life.

## Project Background & Resources

- understanding of port operations and shipping logistics
- research of automation technologies

## Suggested Pacing

1-2 Days of research and sketching ideas

3-4 Days of Implementation (3D printing parts, coding, etc.)

1-2 Days of Final Install and Testing

## Investigative Questions

What are the potential cost savings and productivity gains that can be achieved through automation?

What are issues that may arise due to automation?

## Project Criteria

- 10-12 shipping containers are designed varying in shape and size
- Attachment is created for the RVR and 3D printed that holds the shipping containers
- Port layout must have an entrance and exit (for RVR), location for crane (Dobot), and locations for shipping containers ("offshore" and "onshore")
- Final program and prototypes must be completed prior to project deadline

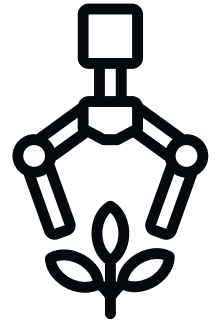
## Project Constraints

- All parts and programs must be designed by your team
- Size on port layout is dependent on teacher

# Tides of Efficiency



## Robotic Arm



### Career & Skill Set Connections

## Port Automation Specialist

A Port Automation Specialist focuses on enhancing efficiency in container movement by utilizing advanced technologies. They design and implement solutions using additive manufacturing, robotic arms, and mobile robots.

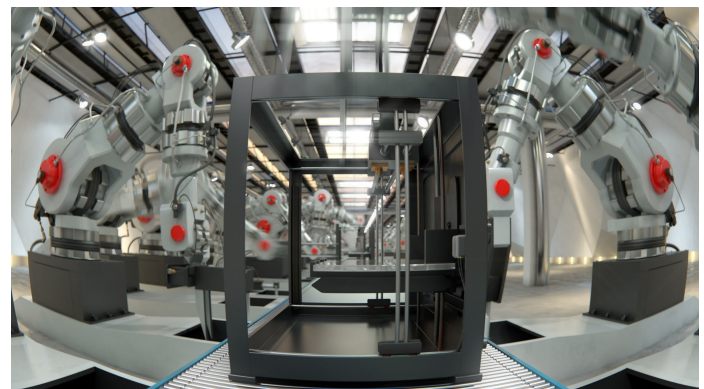
### Essential Skills

- \*Port Operations Knowledge
- \*Project Management
- \*Communication
- \*Adaptability



### Academic Pathway

High School Diploma  
and  
Community College/Certification  
or  
Bachelor's Degree  
or  
Master's Degree



### Aligned VDOE CTE Course(s) and Competencies

Workplace Readiness Skills & Work-Based Learning Opportunities & Examine All Aspects of an Industry

#### Engineering Studies

Practicing Engineering Fundamentals

Demonstrate research techniques/strategies used by engineers  
Explain rapid prototyping to develop models

Create a model or simulation for an engineering product, process, or idea

Exploring the Physics Concepts of Selected Energy Systems

Identify the primary concepts and components of mechanical systems

Explore electrical systems

Demonstrating College Readiness Skills

Demonstrate teamwork skills necessary for success when working in a technological team

#### Engineering Drawing and Design

Introducing the Design Process

Describe the Engineering Design Process

Apply the Engineering Design Process

Producing Illustrations

Create parts of the assembly using a 3D printer

Present a design solution to explain an engineered system

#### Technology Assessment

Analyzing Technological Impacts

Describe replacements of outdated technologies

Innovating a Technical Product or System

Innovate a product or system to solve a problem or satisfy a need

Use 3D modeling and analysis

Producing a Technical Product or System as a Team

Produce a model or prototype that represents improvement in a product or system

Use tools, machines, materials, and processes

Present the product or system as a team

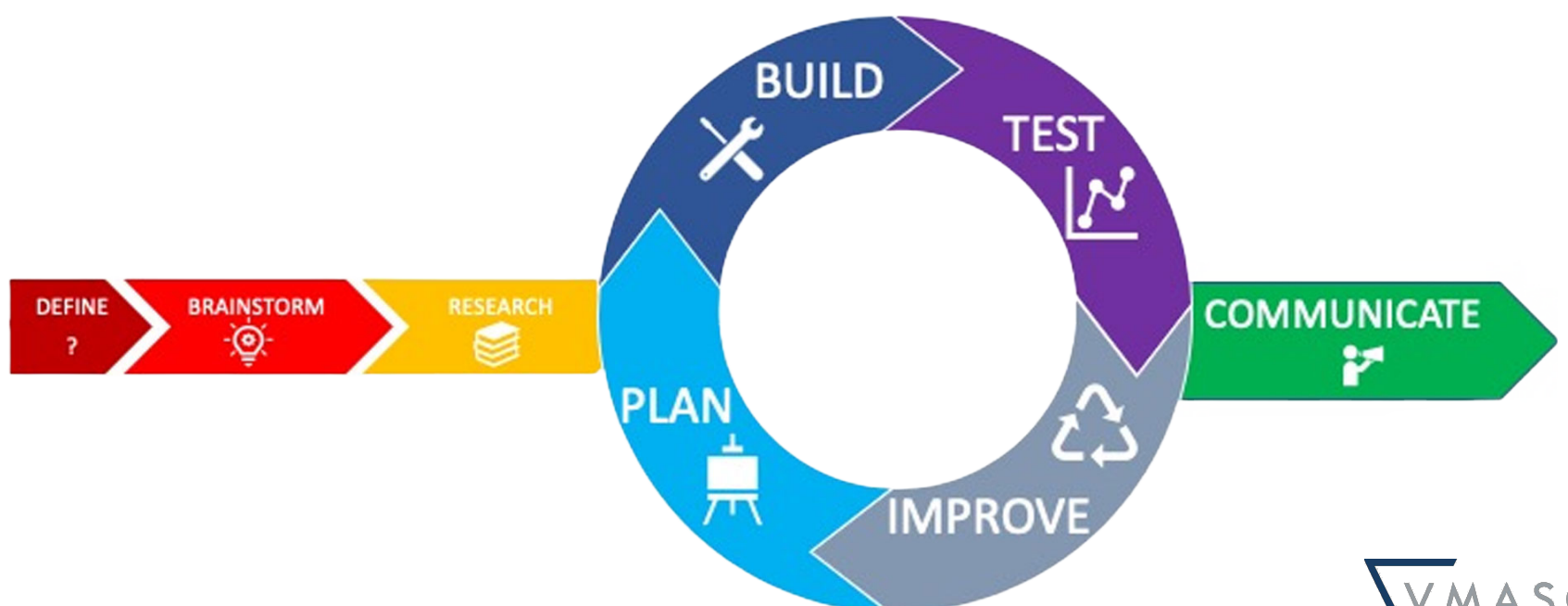
# Project Management Plan

Team  
Member  
Roles

Team  
Goals &  
Timelines

Team  
Member  
Tasking

# Sketches & Design Planning



# Notes

# Notes