Natural, Mathematical & Physical Sciences

14/2/2022

Prof Barbara Shollock
Department of Engineering

Dr Francesco Ciriello
Department of Engineering

4CCE1MCP: Design, Making a Connection

Week 26

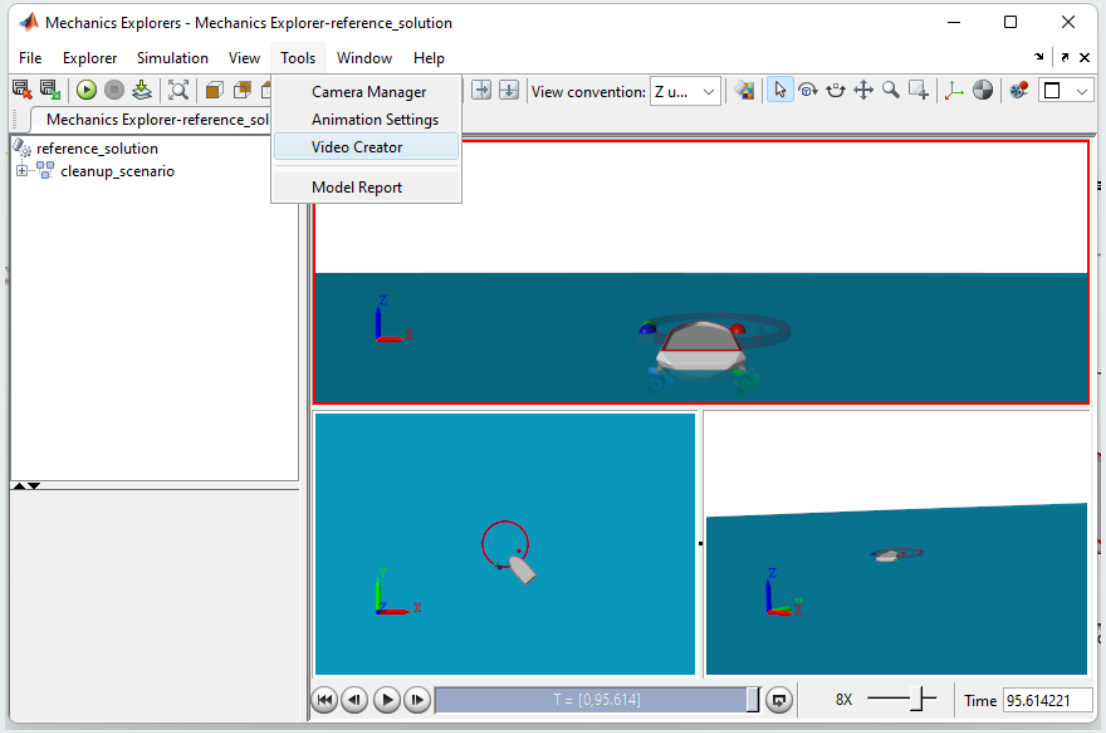
Introduction to Group Project

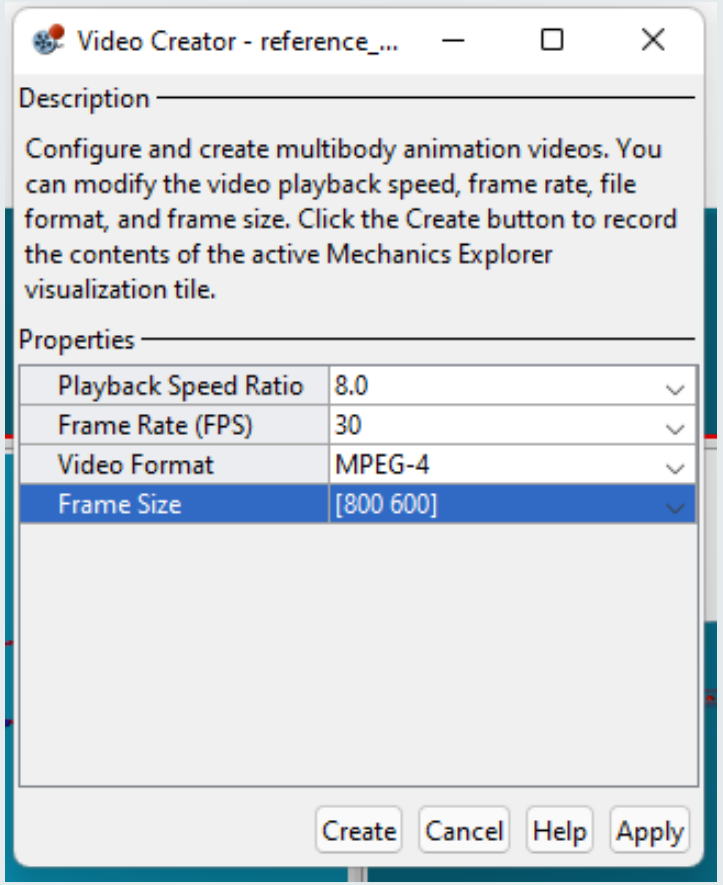
Image Source: The Ocean Clean-up

Housekeeping

Submitting your individual coursework, due February 21, 16:00

1. Save Simulink model as ship_k1234566.slx
2. Record video of collection attempt at x8 playback speed
3. Save video as ship_k123456.mp4 file
4. Upload to KEATS





Housekeeping

Verify your simulation before submission using the function in KEATs

Check your solution for the individual coursework submission

Use the attached MATLAB function, **checkMCPSolution**, to check your performance in the individual coursework simulation exercise.

You can save the function in the same folder as that of your Simulink model .

To test your solution, run the following command in the MATLAB Command Window:

```
[numberObjs, timeCollected, marksAwarded] = checkMCPSolution("ship_k123456")
```

The input to the function is the name of your model, e.g. "ship_k123456". Please remember to use the naming convention outlined in the coursework brief.

The outputs of the function are:

- numberObjs - the number of floating objects that you have collected and transported back to the home collection point
- timeCollected - the maximum collection time for all objects
- marksAwarded - your grade on the coursework exercise

The function also automatically records a video of your solution, saving in the current folder as "ship_k123456.mp4", that you can upload to KEATs.

Office Hours

Module Teaching Support

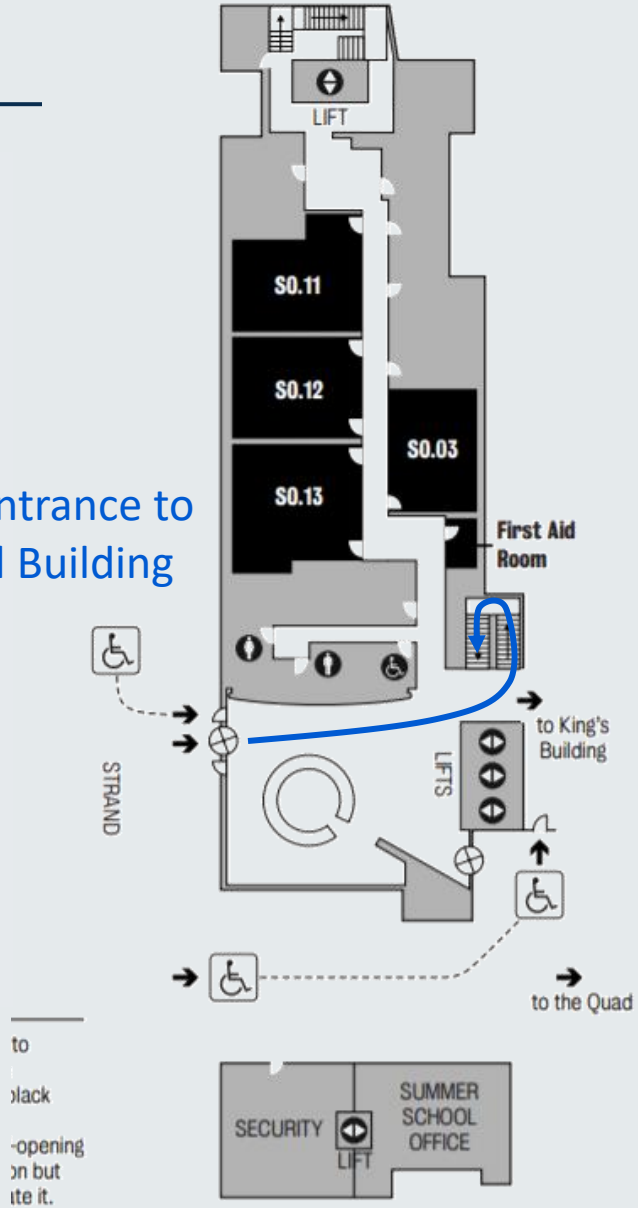
Dr Francesco Ciriello

Email: francesco.ciriello@kcl.ac.uk

Office Hours: Monday 11:00-12:00 (on campus), Room 1.24 Strand Building

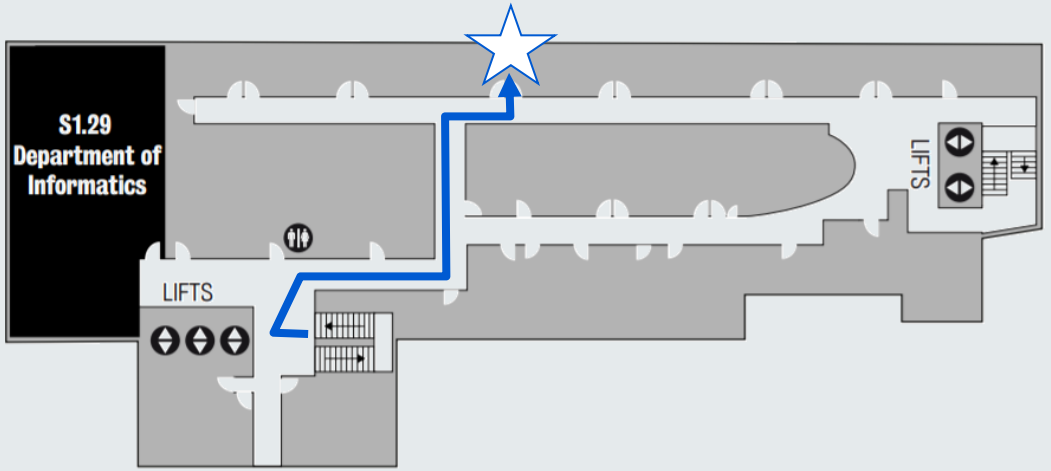
Wednesday 10:00-11:00 (virtual), MS Teams link

Main Entrance to Strand Building



Ground Floor

Office 1.24



Message me in MS Teams if you get lost or cannot access the area

Learning Outcomes

- List the deliverables and dates required to successfully complete the module
- List the criteria used for assessment
- List the activities that will design development for the module
- Assign team roles & responsibilities for group work

Agenda

Design, Build & Test Group Project

- Final Demonstration Brief

Assessment Criteria

- Video log
- Final Report

Organisation & Housekeeping

- Makerspace sessions
- Expert Design Consultations
- Formative Design Reviews

Group project

Design, build & test an RC ship model and demonstrate operation in water tank

Teams of 8-9 members with sub-teams for

- System Design, Project Management and Integration
- Control Design & Teleoperation
- Mechatronics, Drivetrain & Embedded Programming
- Ship and Collector design

Demonstration Day

Compete in the final days of term by running your RC Ship system in a water tank

Dimensions of tank and objects

- Tank is ~ 1.2 x 1.2 m^2
- Collect spherical objects, 20 mm diameter
- 15 min total demo time (5 setup + 10 collection)
- Fastest collection time wins

Demonstration Day

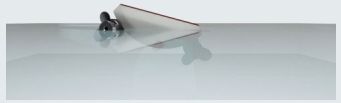
collect 9 floating objects

start from corner

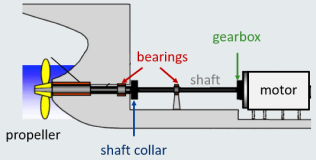
1220 x 1220 x 300 mm

Demonstrations will be held outside the building

Expected Design Components - Minimum Viable Build

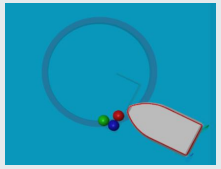


- a **ship** that can float in a stable configuration and manoeuvre



- a **propulsion mechanism**, *e.g.* DC motor with gearbox and / or propeller drivetrain

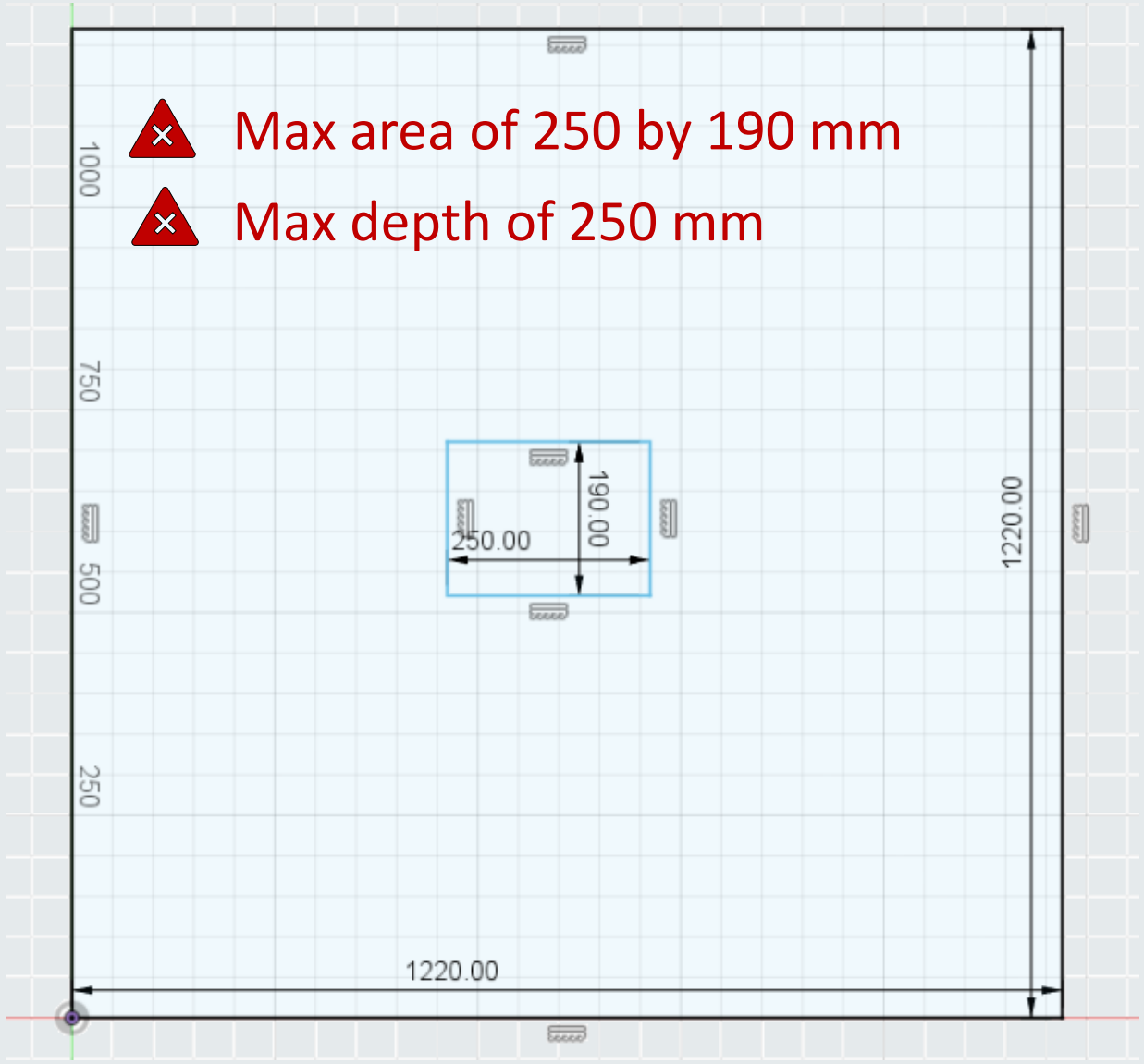
- as **steering mechanism**, *e.g.* a rudder or a two-propeller system

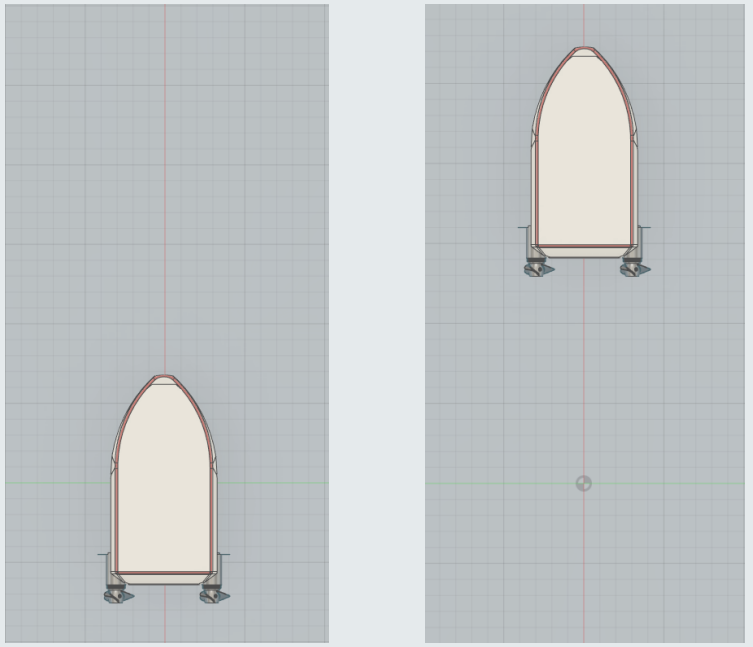


- a debris **collection system**, *e.g.* net, basket or gripper

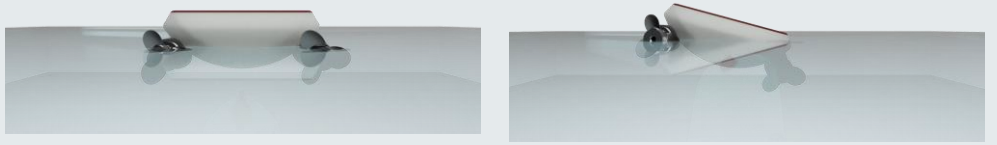
- a **remote control**

Expected Design Components: Ship



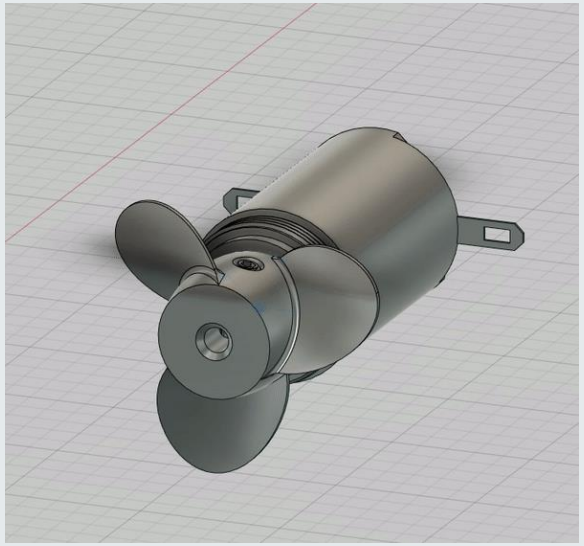


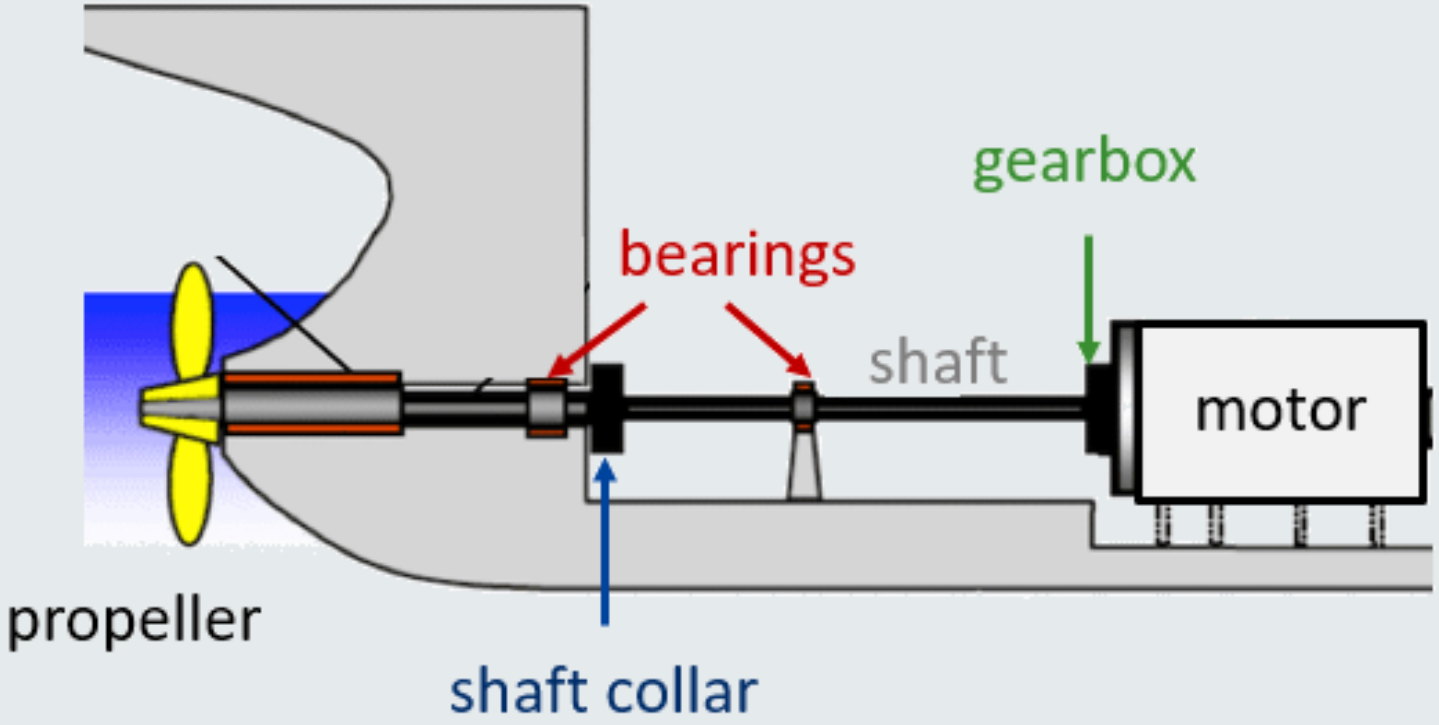
ship motion



ship stability

Expected Design Components: Propulsion System



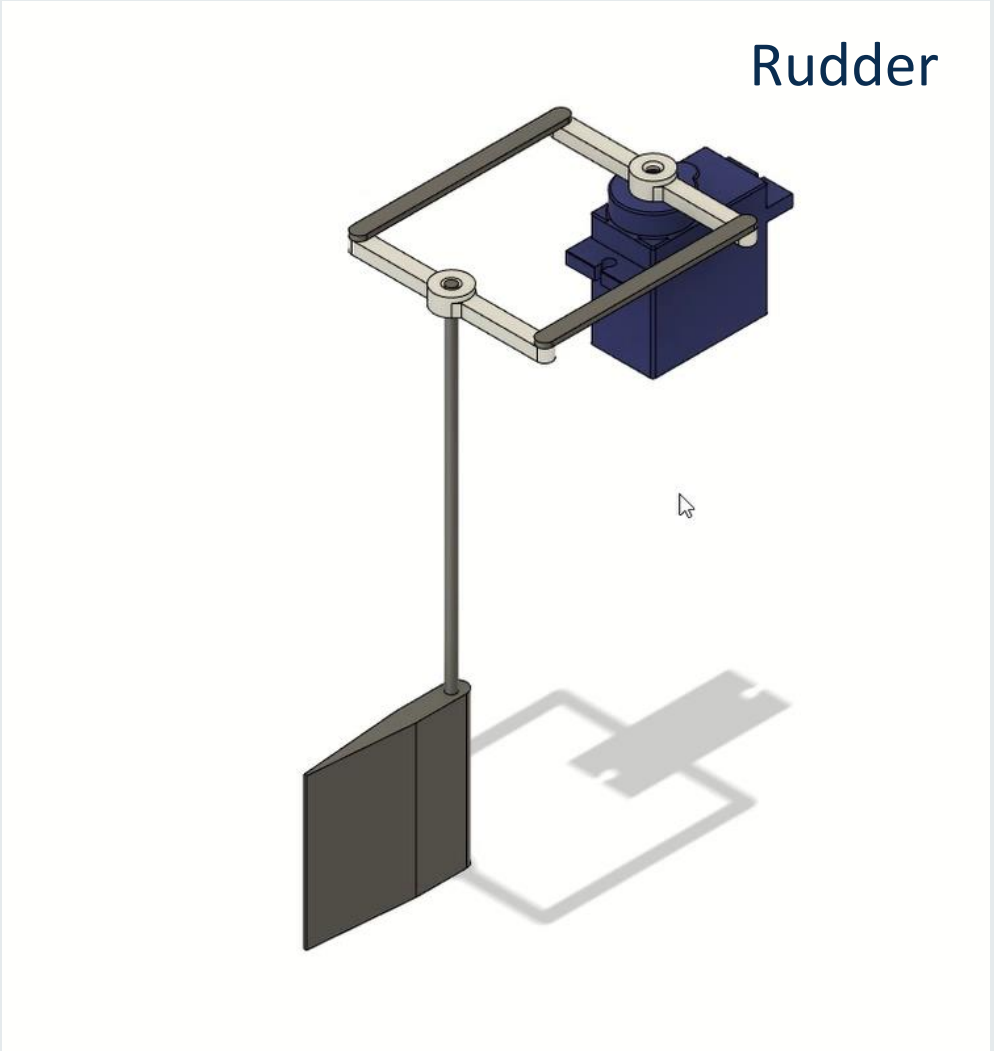


make sure motor assemblies are safe from water ingress

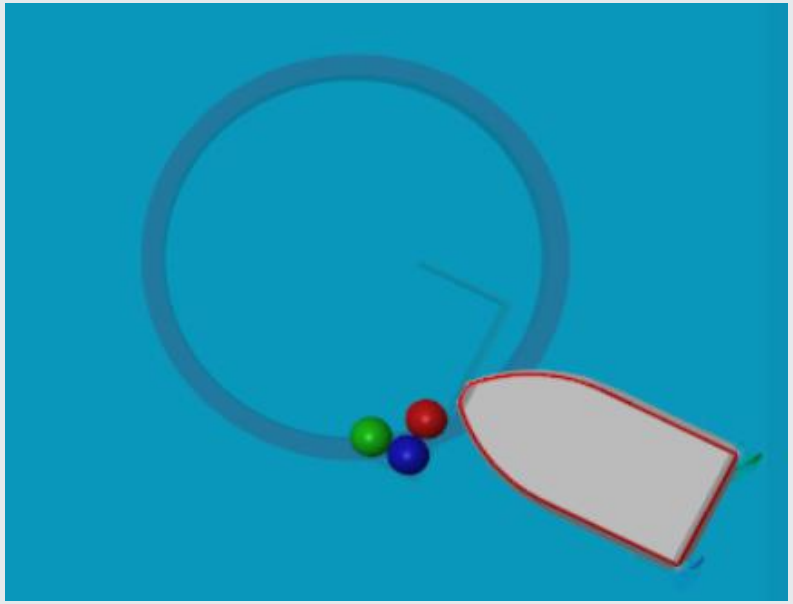
Expected Design Components: Steering Mechanism

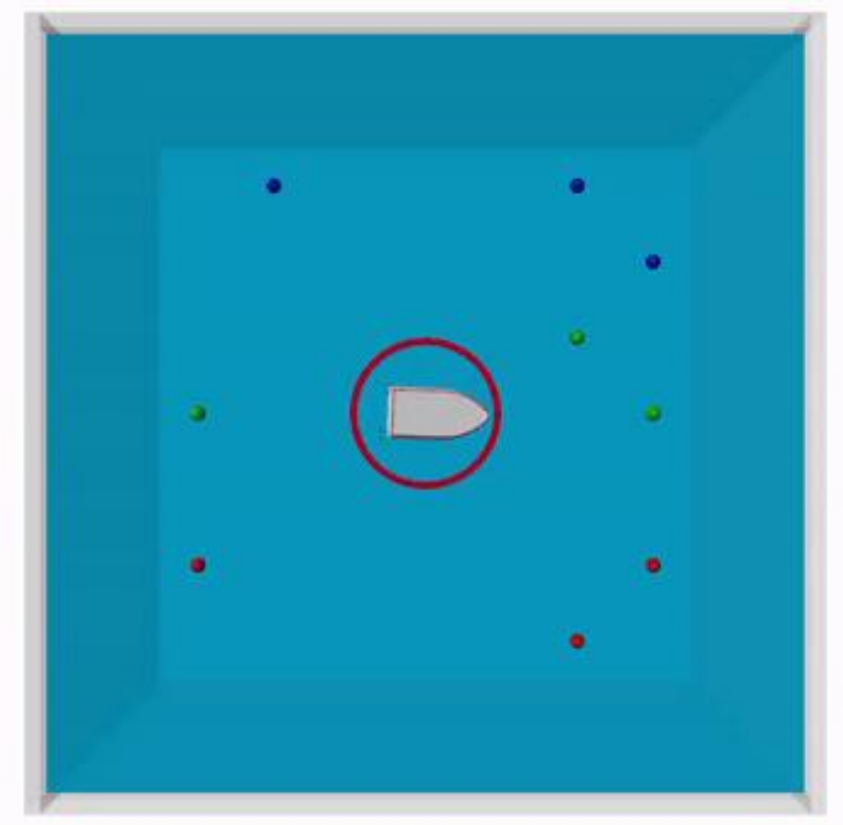
Two propeller system

Rudder



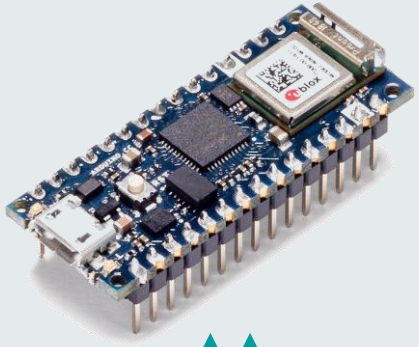
Expected Design Components: Collection System

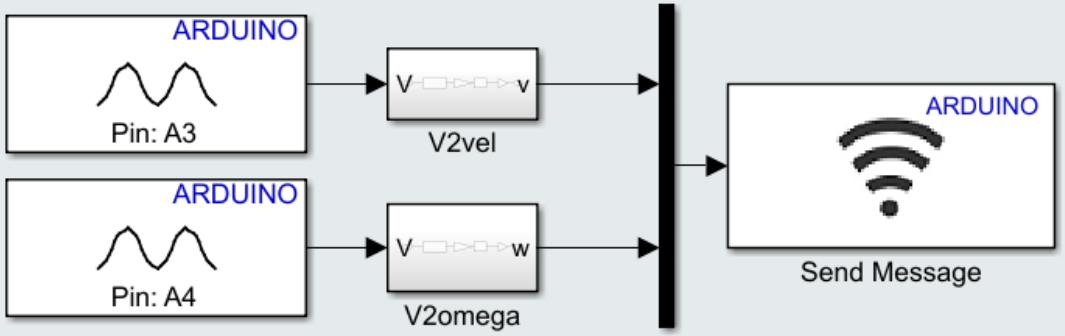


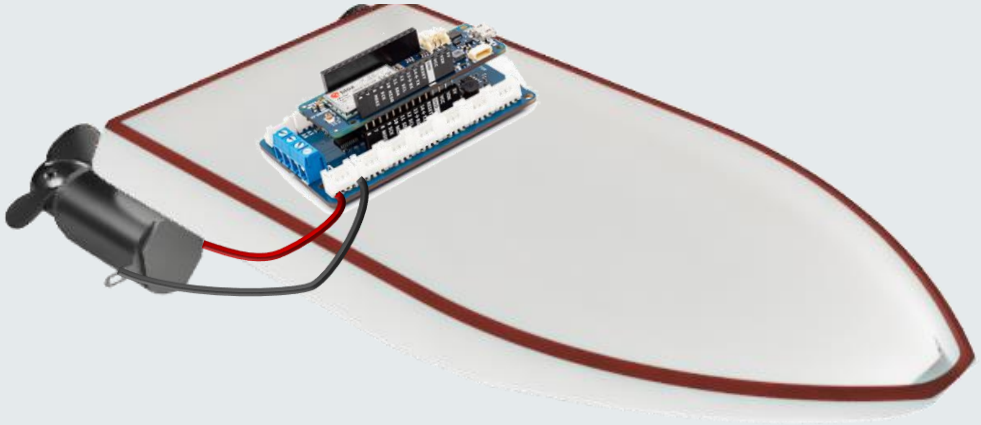


Collection defined as capture of objects so that they do not get released back in tank

Expected Design Components: Remote Control







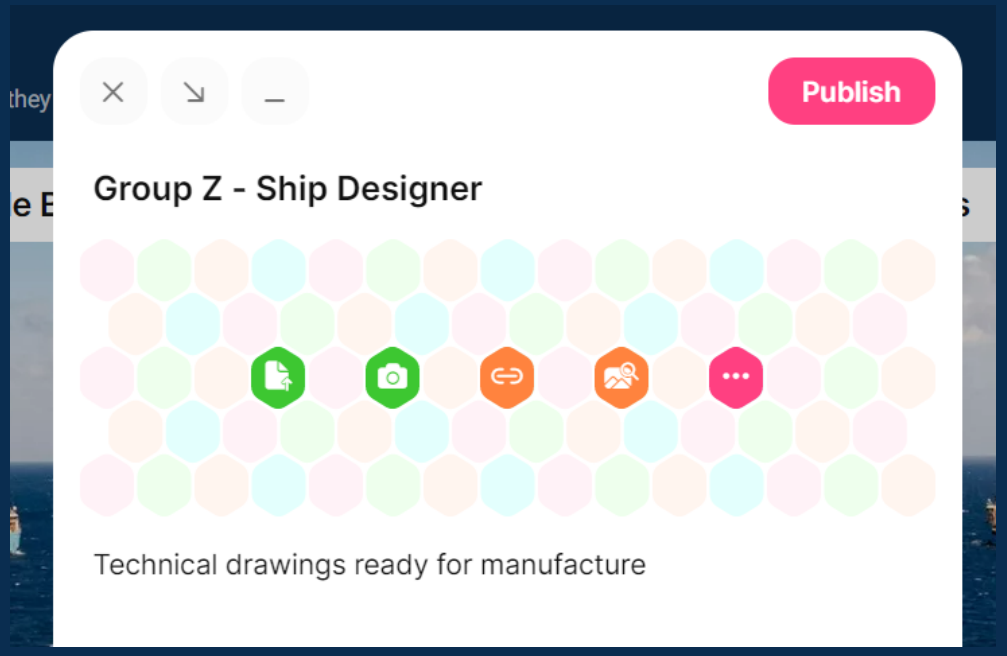
Local Area Network provided (same as labs)

Progress Update

Each member provides progress update on group-project design

Use this Padlet to share your update

Title Post: Group < Letter >: < Role >
Text: < my update >



Assessment

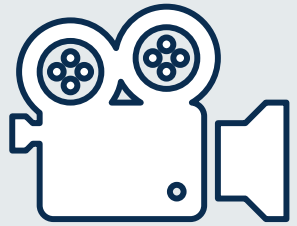
Deadline	Assessment	Deliverable(s)	Weight	Marking
Week 26	**Individual Coursework Submission**	Simulation Submission	**25%**	Individual
Week 28	**Mid-term Communication KEATS Quiz**	Quiz Completed	**10%**	Individual
Week 29	**1st Design Review**	Completed Prototype *10 min presentation + 5 min Q&A*	**Formative**	Sub-team
Week 31	**2nd Design Review**	Completed Build *10 min presentation + 5 min Q&A*	**Formative**	Sub-team
Week 32	**Group Project Demonstration**	Completed System Integration *15 min Live Demonstration*	**25%**	Group
Week 32	**Video log**	*5 min video summarising project*	**10%**	Group
Week 32	**Final Report**	*Group report*	**30%**	Group

Group Project Marking Criteria

Assessment 65% of module

Demonstration 25%

Final report 30%

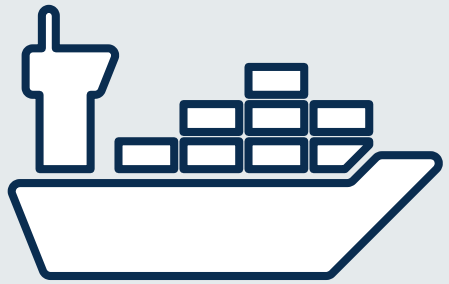


Video log 10%

Six areas of learning in engineering

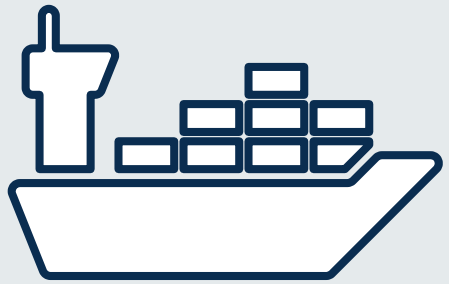
Science & Mathematics	Interpret design using mathematical techniques
Engineering Analysis	Conduct critical analysis to describe system performance
Engineering Practice	Work effectively as a member of an engineering team
Engineering Design	Identify and work with design constraints and unknowns
Engineer Context	Identify and mitigate areas of risk
Transferable Skills	Demonstrate effectiveness and clarity of communication

Demonstration



Marks	Requirement
Total 20	**Project & Systems**
5	Group attends session and project ready for demonstration
5	Ship system successfully collects at least one object in allocated time
5	Ship system successfully collects at least three objects in allocated time
5	Ship system successfully collects all objects in allocated time
Total 20	**Ship design & manufacture**
5	Ship is intact / does not miss components
5	Ship floats
5	Ship is stable
5	Electronic components safe from splashing or water ingress

Demonstration



Marks	Requirement
Total 20	**Control & Communication System**
5	Ship can move forward
5	Ship can steer
5	Remote control works
5	Ship can approach floating objects
Total 20	**Mechatronics**
5	Ship propellers spin
5	Propulsion system drives ship
5	Collector system catches objects
5	Collector system keeps collected objects
Total 20	**Competition**
	Marks awarded as a distribution of performance with respect to other teams*

Final Report

Deliver an 8-page team technical report

Team members contribute to specific sections by role

Assessed with a combination of individual and group markings

Provide supporting appendix with proof & analysis of design

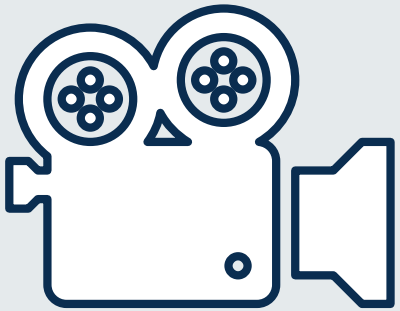
Final Report

Sections

1. Scope of report and list of deliverables
2. System Architecture & Quality Control Process
3. Ship Hull Design & Analysis
4. Ship Manufacturing & Build
5. Ship Collector Design & Analysis
6. Ship Propulsion & Steering Design & Analysis
7. Remote Control System Design & Analysis
8. Reflection on new technology development and implications for Oceanic Clean-up
9. Reflection on group project delivery and new lessons learnt from MCP

Contributor	Section Headings	Length
Project Manager, **System Architect & Quality Control**	Scope of report and list of deliverables	max ½ page
	System Architecture & Quality Control Process	max ½ page
Ship Design & Build	Ship Hull Design & Analysis	max ½ page
	Ship Manufacturing & Build	max ½ page
Mechanical Engineer, Control & Quality Engineer	Ship Collector Design & Analysis	max 1 page
Propulsion Engineer, Control & Quality Engineer	Ship Propulsion & Steering Design & Analysis	max 1 page
Communication, Control & Quality Engineer	Remote Control System Design & Analysis	max 1 page
All	Reflection on new technology development and implications for Oceanic Clean-up	max ½ page
All	Reflection on group project delivery and new lessons learnt from MCP	max ½ page

Final Report



Deliver a 5 min video log of design, build and test

Area	Actions	Marks
Engineering Design	Communicate to a technical audience	• Use appropriate technical language to describe design
Engineering Practice	Demonstrate design effectiveness in the context in which the system is applied	• Demonstrate how the ship works
Additional General skills	Demonstrate effectiveness, clarity and originality of communication	• Use media and graphics effectively to communicate your design • Clear and concise voiceover • Original presentation

Are the assessment criteria clear?

- ❑ Yes, I know what I need to do to pass the assessment.
- ❑ Yes, but I do not know how I will be able to meet them.
- ❑ No, I do not understand what is expected of me.
- ❑ No, give me time to read them again

Support Structure

You will be mentored through term with:

- Lectures
- Computer-based Laboratories
- Workshop & Making Sessions
- Design Consultations & Reviews

Lecture Schedule

Lectures are delivered Live Online, access by MS Teams link in KEATS

Date	Topic	Lecturer	Duration
Week 22	Introduction to MCP	Prof Barbara Shollock	1hr
Week 23	Modelling Engineering Components	Dr Francesco Ciriello	1hr
Week 24	Control System Design	Dr Francesco Ciriello	1hr
Week 25	Hardware Interfacing	Dr Francesco Ciriello	1hr
Week 26	Aerodynamics of Vehicles	Dr Julia Li	1hr
Week 26	Group Project Introduction	Prof Barbara Shollock	1hr
Week 28	Communication Technologies	Prof Vasilis Friderikos	2hr

Workshop Sessions

Workshop sessions are scheduled for each team to build the ship and collection system

Date	Topic	Lecturer	Duration
Week 26	Group Planning Meeting	Self-organised	1hr
Week 27, 30	Expert Design Consultation Breakouts	Mixed academic staff	15 min
Week 27, 28, 29, 30, 31	Making Session	Dr Kamalanathan Kajan	3hr

Make sure to reach making sessions, starting on Week 27, with a clear plan on how to manufacture your system

Expert Design Consultations

Parallel consultation sessions for each sub-team:

Project & Systems Team	Barbara Shollock, Harris Makatsoris, Ernest Kamavuako
Control Team	Kajan Kamalnathan & Francesco Ciriello
Mechanical team	Shan Luo, Jon West
Design Team	Antonio Elia Forte, Charlotte Palmer, Konstantina Vogiatzaki, Juan Li

Format

- Sub-teams submit questions in advance of session
- Session chairs introduce themselves and their area of expertise, 10-15 min
- Breakout rooms in which students meet with other team members in their same role, 30 min
- Extended Q&A, up to 1 hr

Design Reviews

Present Design to Academic Staff

You are expected to produce a maximum of 5 slides per review, including

- Engineering Drawings and Diagrams
- Model & Simulation Analysis
- Pictures of Build

Each sub-team receives a pass or fail mark and verbal feedback

Next Steps

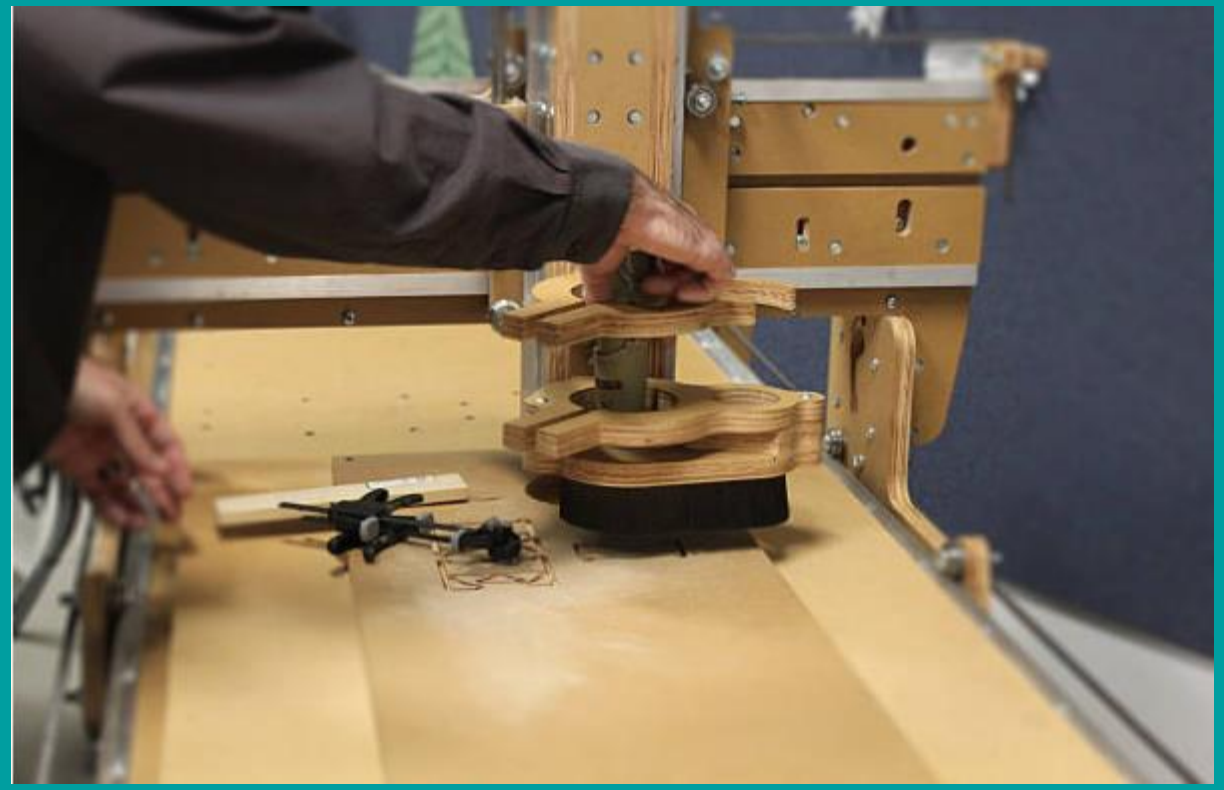
- Plan your build activities, you have limited time in the makerspace
- Attend all support sessions (consultations, design reviews)
- Maintain **regular team meeting times** in your calendar, including
  - 1 hr **group project delivery meeting** to be held before this Friday
  - 15 min **stand-up meeting** at beginning of each week
  - 30 min **sub-team planning** meeting each week
  - 30 min **full team planning** meeting each week
- Maintain up to date confluence pages
- Keep recording videos during design, build & test activities for the video log submission

Group Project Meeting – Week 26

No lab sessions this week

It is mandatory that you meet with your team and plan for the making sessions

Maker space sessions – Week 27 onwards



Attend all maker space sessions to build the ship and assemble system components