

# MATE ROV Competition

## Technical Bulletin: Image Recognition

What will it take for teams to be successful at the image recognition of benthic species task?

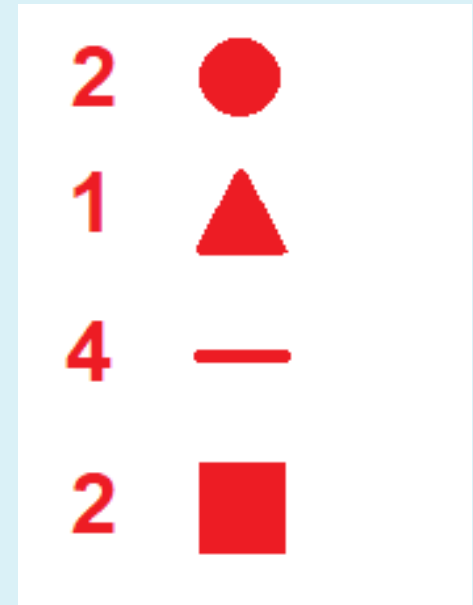
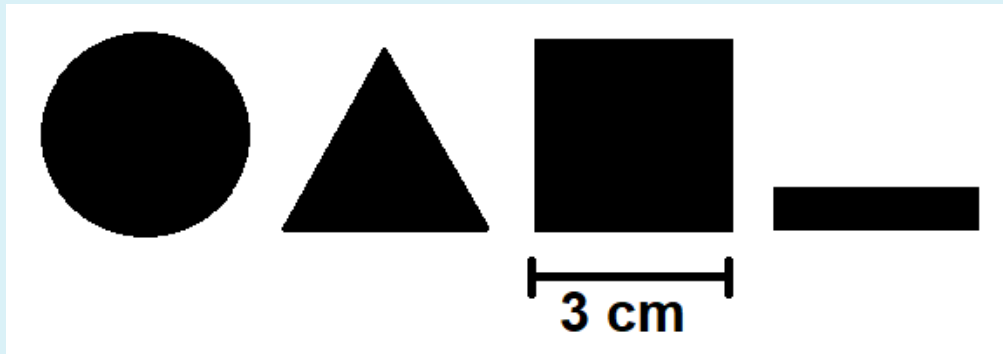


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# Image Recognition Goals

The goal of this task is to challenge companies to design and program software that can recognize the four black shapes and display information about the number of each shape within the sample. The information should be displayed on a screen for the station judge(s) to see.



# Documentation

Companies that choose to use image recognition software must provide documentation on their image recognition software. This must include a description of the algorithm used and a flow chart of how the software works. The software program code must also be included. The description of the algorithm should be clear and logical so that even ‘non-programmers’ can understand the process.

- Prior to the competition, MATE officials will examine this documentation and verify the ROV’s ability to recognize images without user input. Companies that provide sufficient documentation are eligible to attempt verification, if necessary, at the competition.

# Verification

Companies **may** be required to demonstrate the capabilities of their image recognition system in air prior to a regional competition.

- Your regional coordinator will inform you if this in-air verification is required and when and where this verification will take place.
- All companies advancing to the international competition and wishing to use image recognition software will be required to demonstrate the capabilities of their vehicle in air.

# Verification process

During this verification, companies will set up their system as needed. The company will then be required to move away from all controls. A benthic species sample will be set up in front of the ROV cameras. Companies may help to position the image in front of the proper camera at a proper angle, but companies should not touch the controls as they do so. The image recognition program must display the number of each of the four shapes on a video screen without any input from the company team members.

Companies that do not succeed may try again, but if a company cannot succeed at the verification, they will not be permitted to use image recognition during the product demonstration run.

# No human input

The image recognition software should take input from the video system and determine the number of each shape. No input from company team members is allowed.

The image recognition program should be ready to execute when the ROV removes the “rock” from the benthic species. Once the ROV has the benthic species in view of the proper camera, the image recognition program can execute. Companies **MUST** go hands-free from any computer or control system. If companies need to hold or reposition the ROV for a better view, they should ask/inform the station judge. At that time, company members may go hands-on the joystick, but no buttons on the control station should be used.

# Output

The output must be displayed on a screen for the station judge to evaluate. If the image recognition software does not immediately display the proper information, companies may wait to see if the proper information is eventually displayed.

Companies are responsible for determining how long to wait for the proper information to be displayed.

It is the responsibility of the company to inform the station judge where to look for the output.

# MATE resources

The MATE ROV Competition has provided a number of resources for companies wishing to attempt image recognition of the benthic species. See the competition manual for a list of these resources.

See section **6.1.2** of the Competition manual.



# EXPLORER CLASS LINE FOLLOWING

## EXPLORER CLASS ONLY

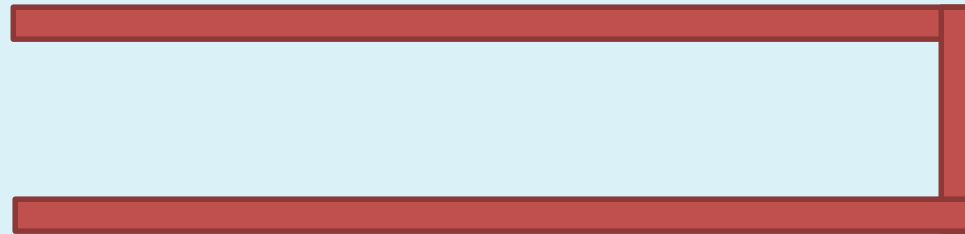
SLIDES 10 - 14 ARE ONLY FOR EXPLORER CLASS COMPANIES AND REFER TO AUTONOMOUS LINE FOLLOWING, LENGTH OF CRACK DETERMINATION, AND AUTONOMOUS MAPPING OF THE CRACK.

# Goals

EXPLORER ONLY

The EXPLORER class is tasked with autonomous line following, determining of the length of the crack, and mapping the crack.

The goal of this task is to challenge EXPLORER class companies to design software that allows their ROV to autonomously follow a red line, identify and measure a crack, and display information for the station judges to see.



# Documentation

EXPLORER ONLY

EXPLORER class companies planning to autonomously complete the dam inspection task, must provide documentation on their line following, length determination, and mapping software. This must include a description of the algorithm used and a flow chart of how the software works. The software program code must also be included. The description of the algorithm should be clear and logical so that even 'non-programmers' can understand the process.

See section 6.1 of the Competition Manual for more information on submission and required documentation.

# Verification

EXPLORER ONLY

EXPLORER class companies that pass their benthic species identification do not need to verify their length determination of the crack. Companies that plan to autonomously follow the line and determine the length of the crack, but do not plan to undertake the benthic species identification task, should make special arrangements to verify their length determination software.

Contact the [Competition Technical Manager](#) once your company has advanced to the international competition.

# No human input

EXPLORER ONLY

To receive full points, EXPLORER class companies go completely hands-free when autonomously following the red line, autonomously determining the length of the crack, and autonomously mapping the foundation of the dam. Unless a company is repositioning their vehicle at the starting point for another attempt at an autonomous run, companies should not have their hands on any part of their control system.

# Output

EXPLORER ONLY

The output must be displayed on a screen for the station judge to evaluate. If the software does not immediately display the proper information, companies may continue to wait to see if the proper information is displayed, manually display or relay the information for fewer points, or maneuver to the beginning of the red line to attempt the run again.

Foundation of the dam map: The output must show all twelve squares. The length of the crack must be displayed in the proper grid square.

Length of the crack: The output must display the length of the crack with the units displayed afterwards. Companies may use the output length in the autonomous mapping to fulfill autonomously determining the length of the crack.