Introduction
This document presents an overview of the proposed tasks for the 2018 Maritime RobotX Challenge. Our objective for RobotX is to engage, challenge, and educate students in the development of maritime autonomy through the principles of systems engineering. The competition will be conducted 08-15 December 2018 at Sand Island on Oahu, Hawaii. The term Autonomous Maritime System (AMS) will be used throughout this document to refer to the entire maritime system, including the WAM-V and any offboard systems deployed from the surface platform.

A more detailed RobotX Challenge Task Description and specifications document will be published on 31 January 2018. In the interim, teams interested in participating in 2018 RobotX Challenge should reference 2016 RobotX Challenge documents currently listed under the Rules & Requirements section of the RobotX website (RobotX.org).

In-water Tasks

Demonstrate Navigation Control
The Demonstrate Navigation and Control challenge is a mandatory task. The Autonomous Maritime System (AMS) must autonomously navigate through two sets of buoys, placed approximately 30m apart. This task is mandatory prior to teams being permitted entry to the courses for practice, qualifying, semifinals and finals. Teams must demonstrate that their Autonomous Maritime System is able to autonomously and safely transit through the navigation channel.

Entrance and Exit Gates
A set of three gates will be located in the course area with a beacon placed underwater within each gate. The AMS must detect the active underwater beacon and transit through the gate in which the active beacon is located.

After transiting through the active gate, the AMS must detect and circle one of two buoys in the field beyond the gates. One of the buoys to be circled will be an instance of the light buoy used in the Scan the Code task, while the other will be a marker buoy similar to the one used in the 2016 Maritime RobotX Challenge. The AMS must circle the light buoy if it actively displays a light pattern. If the light buoy is off, then the AMS must circle the marker buoy.

After the AMS has circled the correct buoy, it must return through the gate with an active underwater beacon. The gate with the active beacon may change between entry and exit.

Station Keeping
Autonomous station keeping is a core capability that enables successful completion of several tasks in the 2018 Maritime RobotX Challenge. Autonomous station keeping can be demonstrated either by holding position adjacent to the Underwater Ring Recovery marker buoy or within the docking bay of the Identify Symbols and Dock task.
Avoid Obstacles
For the 2018 Maritime RobotX Challenge, this task has been modified to provide a more representative real world challenge. Rather than being grouped as a separate task, as has been done in previous years, obstacle buoys will be placed throughout the operating areas. Obstacle buoys will be of the same shape, size, and color as were used in RobotX 2016.

During practice and qualifying days an obstacle field will be available for team practice. Totems from the Find the Totems challenge may be placed in the obstacle field.

During semifinals and finals, the obstacle buoys will be placed near other challenges and scattered throughout the course in varying densities.

Find Totems
The Find Totems task will be very similar to the 2016 RobotX Challenge task. For practice and qualifying days the totems may be placed within a field of obstacles. On these days, the TD will announce the assigned totem sequence and direction.

For the semifinals and finals courses the totems will be placed at random locations around the competition course. The AMS will be required to find and circle totems based on information gathered from other tasks.

Scan the Code
The AMS is required to observe a light sequence displayed by an RGB buoy and report the color pattern. This is similar to the 2016 RobotX light buoy task. During practice and qualifying days the teams will report the detected light sequence using a Scan the Code reporting message to be detailed in the 2018 RobotX Communications Protocol, to be published at a later date.

During semifinals and finals, the AMS will demonstrate that it has successfully observed the light buoy by using the sequence to inform completion of other tasks. The AMS should also report the observed light sequence using the Scan the Code reporting method.

Identify Symbols and Dock
The docking task will be configured as shown in Figure 6 with colored shapes similar to those used in the 2016 RobotX Challenge. Dock materials will be the same as those used in 2016.

The AMS may demonstrate its autonomous station keeping ability by holding position within the docking bay of this task.
Detect and Deliver
A floating platform will be tethered in an open area. A colored shape and a pair of square holes, one small and one large, will be visible on two opposite faces of the platform. The AMS must propel or insert objects through the target holes on the face. During practice and qualifying days the TD will designate the correct color and shape.

For the semifinals and finals, this task will be paired with the Identify Symbols and Dock task as depicted in Figure 7. The correct shape and color may be determined by the AMS successfully completing other tasks.

Underwater Ring Recovery
The AMS must recover rings suspended underwater in the competition field. The final implementation method for this task is still under development, however, the current plan is to attach rings at varying depths underneath a marker buoy on the water’s surface. The rings will be of various colors, sizes, and weights. Rings will be positively buoyant and may range from six to 14 inches in diameter. Details of the rings will be included in the Detailed Task Descriptions and Specifications document. The AMS will demonstrate completion of this task by recovering a ring to the surface platform and returning it to judges.

The AMS may also demonstrate station keeping by holding position next to the marker buoy.

Other Considerations

Autonomous Maritime System Heartbeat
In addition to the Visual Feedback system required at RobotX 2016, teams will be required to implement a heartbeat broadcast system similar to that required in RobotX 2014. The heartbeat is used to provide information to judges.

Teams will be provided with a hard-wired link to the Technical Director (TD) network to connect to their ground station. Teams are responsible for getting data from the AMS to their ground station, then to the TD network. Details of the heartbeat will be modeled from the 2014 RobotX Communications Protocol, and will be published by 31 January 2018 in an updated document titled 2018 RobotX Communications Protocol.

Offboard System Launch and Recovery
Many teams are intending to use offboard Autonomous Underwater Vehicles (AUVs) to attempt the underwater challenge in 2018. Requirements for the AUV and its associated launch and recovery system will be included in the 2018 Maritime RobotX Challenge Rules document, along with other safety requirements. AUVs will be required to remain tethered to the WAM-V for the 2018 Maritime RobotX Challenge due to safety and legal considerations.

Rules
Design documents from RobotX 2016 will serve as the basis for RobotX 2018 rules, safety and design documents. This documentation can be downloaded from the Rules and Requirements section of the RobotX website (robotX.org). Updates to the 2016 documents should be posted by 31 January 2018.

Competition Pre-requisites
Teams will be requested to submit video and technical documentation that they have implemented the mandatory buoyancy pods and that both the remote and on-board kill switches are functional several months before the 2018 RobotX Challenge in Hawaii. This is to ensure that these systems are ready for use and streamline the process of getting teams in the water when they arrive on site. Schedule and method for these submissions will be published.