

# DATA CHAIN

Designed by Galileo Robotics (FRC 4669) for the 2021 Game Design Challenge

## Game Overview

In DATA CHAIN, FIRST® City has been destroyed by an asteroid. Two alliances of three robots work together to recover sensitive data from FIRST® City in an underground data center. Each alliance has to extract valuable data capsules from server racks in the data center and deliver them into the transfer station to transport them to another secure facility. Throughout the scoring period, alliances can activate bonuses that will aid them in their task. Robots have a limited amount of time to extract the data before they have to climb to safety. Whoever recovers the most data from FIRST® City wins the match!

Each alliance can retrieve DATA CAPSULES from the SERVER RACK or the FIELD and score them by pushing or placing them side-first horizontally into the low TRANSFER PORT, side-first vertically into the middle TRANSFER PORT, or headfirst into the high TRANSFER PORT.

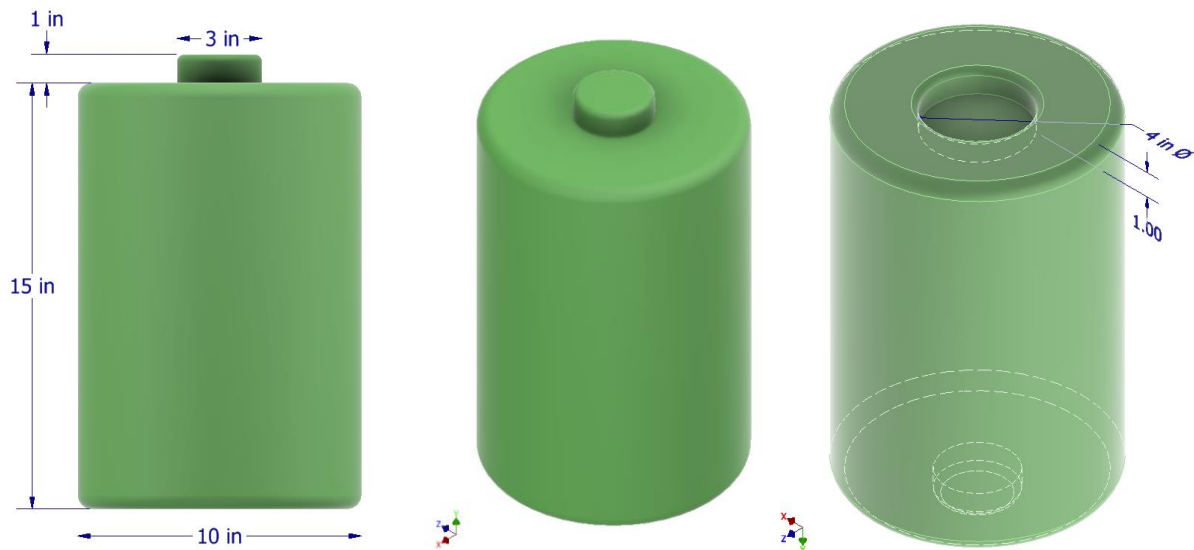


Figure 1 DATA CAPSULE

Each TRANSFER PORT has a PORT DOOR to protect HUMAN PLAYERS from scoring ROBOTS. HUMAN PLAYERS will operate each PORT DOOR to remove the scored DATA CAPSULE in a TRANSFER PORT in order for ROBOTS to score another DATA CAPSULE in the same PORT.

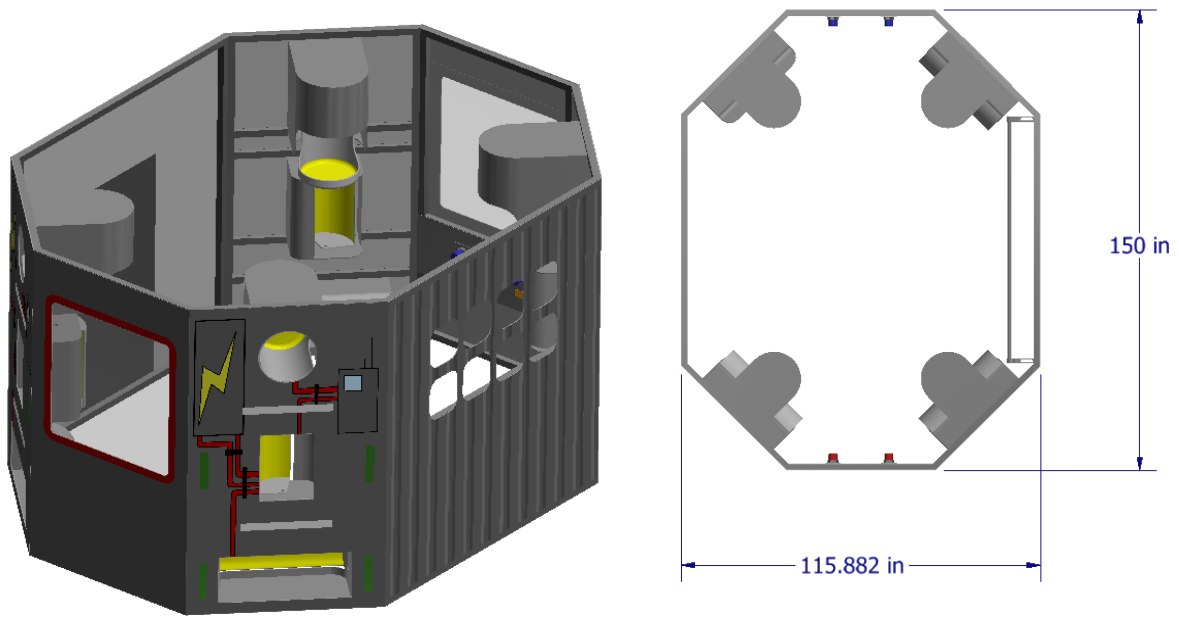


Figure 2 TRANSFER STATION (orthographic view), Figure 3 TRANSFER STATION (top view)

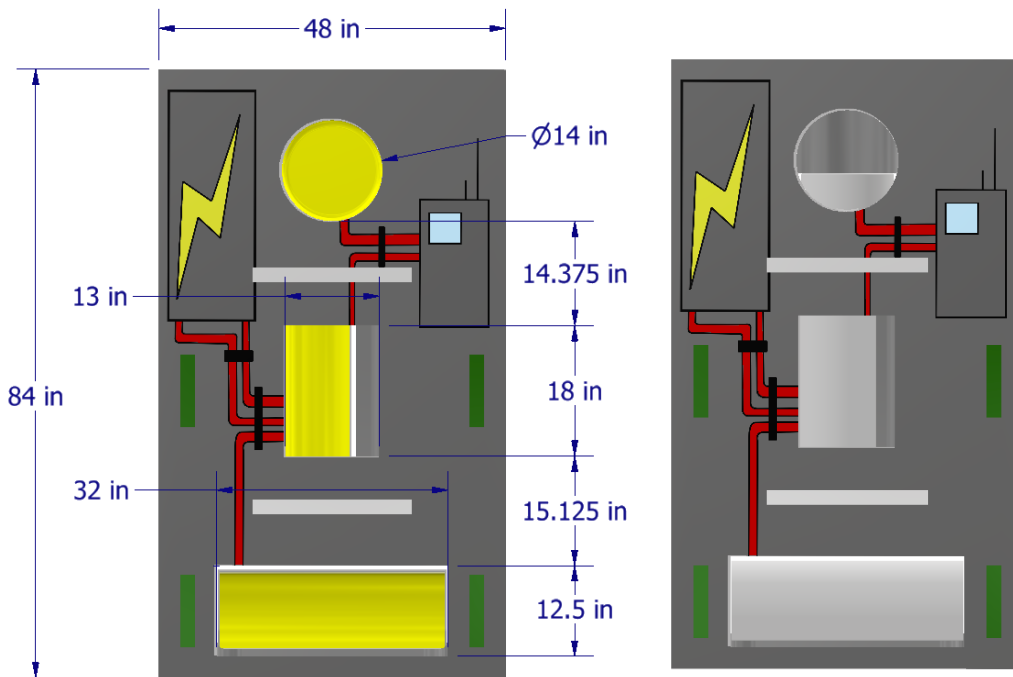


Figure 4 TRANSFER PORTS (open, field side), Figure 5 TRANSFER PORTS (closed, field side)

Each match begins with a 15 second autonomous period in which ROBOTS, operating on pre-programmed instructions, cross the AUTO LINE, pick up DATA CAPSULES from the field, and deliver them to the TRANSFER PORTS. DATA CAPSULES scored in this period are worth twice as many points as they are in the teleoperated period. One middle and one low TRANSFER PORT per alliance will be designated as RAPID TRANSFER PORTS for the match; scoring DATA CAPSULES in the RAPID TRANSFER PORTS during the autonomous period in addition to the crossing of the AUTO LINE by all 3 ROBOTS will reward a bonus.

During the remaining 2 minutes and 15 seconds of the match, the teleoperated period, humans control the ROBOTS. Teams on an alliance work together to extract DATA CAPSULES from the SERVER RACKS across the field and deliver them to one of their six goals. During the teleoperated period, alliances can score a DATA CAPSULE in each of their RAPID TRANSFER PORTS (or use DATA CAPSULES scored in the RAPID TRANSFER PORTS during the autonomous period) to activate their ROBOT CONSOLES. The ROBOT CONSOLE buttons can then be manipulated by ROBOTS to create a 2 times scoring bonus, which human players can activate on their HUMAN CONSOLE inside the TRANSFER STATION. In addition, alliances and their human players can earn a COOPERTITION® TIME BOOST of 15 seconds added to the match. ROBOTS from both alliances must first toggle a specific button on their ROBOT CONSOLES to start this process. The COOPERTITION® TIME BOOST will be rewarded after human players from both alliances also toggle their designated button on their respective HUMAN CONSOLES. During the final 30 seconds of the match, ROBOTS will need to exit the data center. Teams return to the EVACUATION AREA and can work together to climb CHAINS to exit the area before the end of the match.

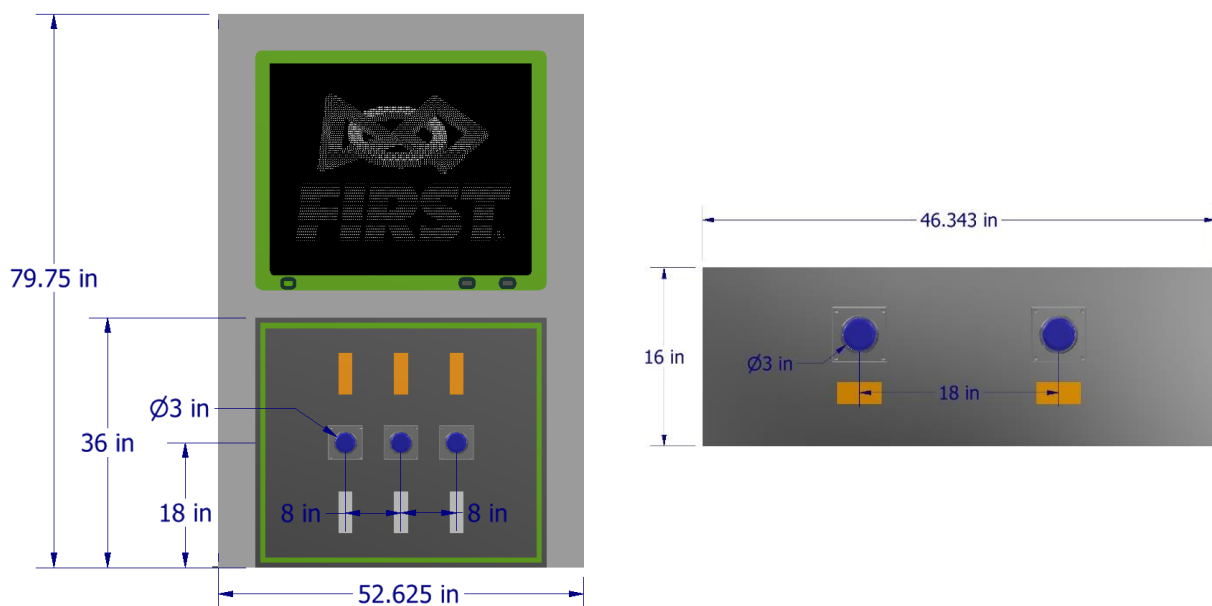


Figure 6 ROBOT CONSOLE, Figure 7 HUMAN CONSOLE

## Notable Field Elements

Notable field elements include the octagonal TRANSFER STATION, the DATA PIPELINE, the ESCAPE LIFT, the CONSOLES, and the SERVER RACKS. The TRANSFER STATION is where ROBOTS score DATA CAPSULES. Each ALLIANCE STATION has 3 sides of the TRANSFER STATION facing their side of the field, with 2 of those 3 sides used for scoring. The remaining two sides, facing the sides of the field, will be walls, with one side containing a door for human players to enter/exit. The DATA PIPELINE is an optional obstacle for teams who want to access the SERVER RACKS faster, passing it offers a shorter path. The ESCAPE LIFT, located in the EVACUATION AREA, offers 3 options for climbing: one form is a loose chain connected at two points forming a concave parabolic curve, called the U CLIMB; another form is a free-hanging chain appended with a large circular ring, called the O CLIMB; the third form is just a free-hanging chain, called the I CLIMB. The ROBOT CONSOLE, located on the side farthest from the DATA PIPELINE on each alliance wall, will allow for ROBOTS to activate a scoring boost for their alliance and a COOPERTITION® TIME BOOST for the match. It has 3 toggle buttons that ROBOTS can operate, and different combinations of toggles will activate different bonuses in the game. But, human players inside the TRANSFER STATION will have to activate these bonuses using a HUMAN CONSOLE containing two buttons. One button activates the 2 times scoring bonus for their alliance's RAPID TRANSFER PORTS for 30 seconds, and the COOPERTITION TIME BOOST is activated when the remaining button on both alliances are activated. The SERVER RACK is a feeder station that has a slot to allow human players to pass DATA CAPSULES from the human player station to the FIELD.

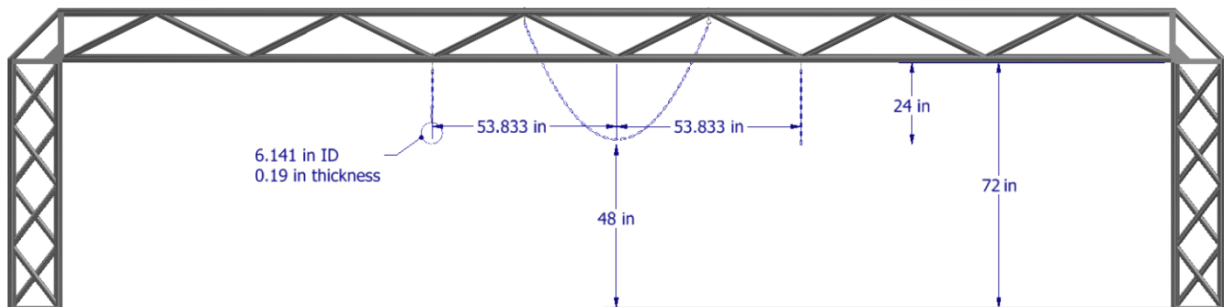


Figure 9 ESCAPE LIFT

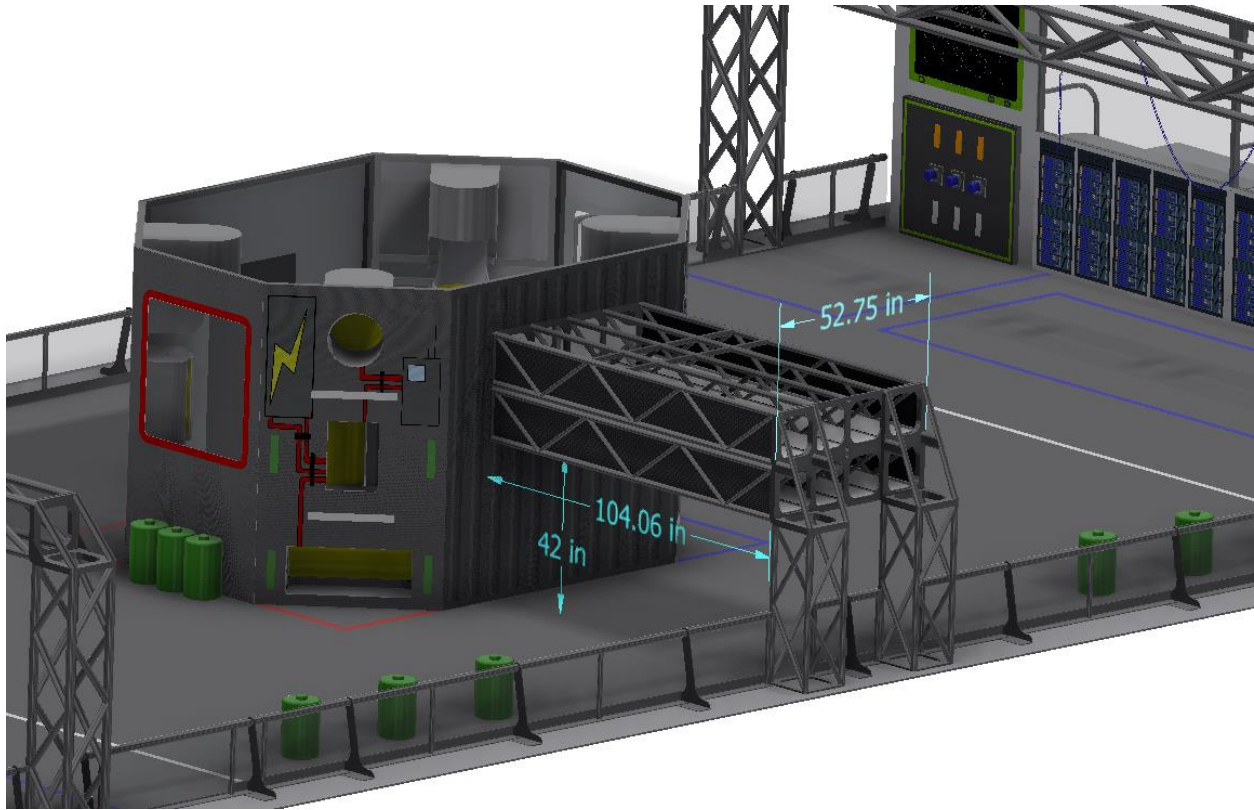


Figure 10 DATA PIPELINE

## Expected Robot Actions

Before the match starts, ROBOTS can be preloaded with one DATA CAPSULE each. At the beginning of the match, a 15 second autonomous period occurs. In this time, ROBOTS will be expected to manipulate DATA CAPSULES by either pushing, grabbing, or rotating them, and inserting them into any of the six available TRANSFER PORTS. Prior to the start of the match, the FMS will assign a random middle TRANSFER PORT and a random low TRANSFER PORT on different TRANSFER PORT walls on each alliance side as RAPID TRANSFER PORTS, which will be used for the auto bonus and throughout the match when activated. After the autonomous period ends, a 2 minute and 15 second teleoperated period begins. ROBOTS will be expected to manipulate the cylindrical DATA CAPSULES by either pushing and rotating them into a specific orientation and inserting them into the TRANSFER PORT that corresponds to the specific orientation. ROBOTS can carry a maximum of 2 DATA CAPSULES at a time. If the alliances choose to use the ROBOT CONSOLE button board, then ROBOTS are also expected to include a mechanism that is able to press buttons on the ROBOT CONSOLE. During the final 30 seconds of the match, the endgame will start. During the endgame, ROBOTS are expected to climb one of the three chains or park in the EVACUATION AREA for points.

## Use of Chain (Design Element Challenge)

The CHAIN is being used for differing types of climbs at the end of the match. The first form, named the U climb, is a CHAIN attached at two points on the ESCAPE LIFT. In this form, the CHAIN droops down to form a convex parabolic shape, forming a U. The attachment points of the CHAIN are 53.83 inches apart, with the lowest point of the chain 4 feet off the ground. The second form, named the O climb, is a CHAIN attached at one point on the ESCAPE LIFT, with a 6.14 inch diameter circular loop welded to the CHAIN. In this form, ROBOTS can use the loop to help them attach to the chain in order to climb. The bottom of the loop will be 4 feet off the ground. The third form, named the I CLIMB, is a CHAIN attached at one end to the ESCAPE LIFT that hangs freely. It is similar to the O climb, but there is no loop. The lowest point of the chain hangs 4 feet off the ground. All 3 forms are robust enough to support double or triple ROBOT climbs, where one ROBOT supports another ROBOT during the climb.

## GLOSSARY

PHRASE	DEFINITION
<b>CHAIN</b>	a zinc plated, trade size 2/0 chain that allows ROBOTS to climb on the ESCAPE LIFT
<b>COOPERTITION® TIME BOOST</b>	a 15 second time bonus added to the end of the TELEOP period before the ENDGAME; activated when ROBOTS and human players on both alliances toggle their designated Coopertition buttons on their CONSOLES; can only be activated during the aforementioned period.
<b>DATA CAPSULE</b>	a light green 16-inch tall, 10-inch diameter cylindrical object that acts as the game piece in DATA CHAIN. It has a dimple on one end and a depression on the other
<b>DATA PIPELINE</b>	a 3 ½ feet tall truss that spans from one wall of the TRANSFER STATION to the same side of the field; acts as a DATA CAPSULE storage for human players and as an obstacle to a direct path to the SERVER RACKS
<b>ESCAPE LIFT</b>	a field-wide, 6 ¾ feet tall truss that supports climbing via the CHAIN
<b>EVACUATION AREA</b>	the EVACUATION AREA is a 5 foot by 14 foot area bounded by tape
<b>HUMAN CONSOLE</b>	a button board containing 2 toggle buttons that each corresponds to the activation of a bonus: one activates the ALLIANCE BOOST, and the other one activates the COOPERTITION® TIME BOOST
<b>I CLIMB</b>	a CHAIN attached at one end to the ESCAPE LIFT that hangs freely 4 feet off the ground
<b>O CLIMB</b>	a CHAIN attached at one point on the ESCAPE LIFT, with a [PLACEHOLDER] inch diameter loop welded to the CHAIN; the lowest point of the loop is 4 feet off the ground
<b>PORT DOOR</b>	the safety mechanism installed into each of the TRANSFER PORTS to protect HUMAN PLAYERS from injury by scoring ROBOTS. It blocks ROBOT scoring while HUMAN PLAYERS are extracting the DATA CAPSULES.
<b>RAPID TRANSFER PORT</b>	one of two TRANSFER PORTS on four sides of the TRANSFER STATION designated for 2 times scoring when the correct configuration is activated during the TELEOP period and for the AUTO BONUS; they are randomly paired in configurations where they cannot be on the same column of TRANSFER PORTS, and there must be one low and one middle RAPID TRANSFER PORT
<b>ROBOT CONSOLE</b>	a button board containing 3 toggle buttons; two of them corresponds to the alliance bonus and the other corresponds to the COOPERTITION® TIME BOOST
<b>SERVER RACK</b>	the feeder station on the opposite side of an alliance wall where ROBOTS can obtain DATA CAPSULES
<b>TRANSFER PORT</b>	one of three goals (one low, one middle, one high) on four sides of the TRANSFER STATION that allows for the scoring of DATA CAPSULES with a different orientation that the DATA CAPSULE can be inserted into for each goal. The DATA CAPSULE can be inserted horizontally in the low TRANSFER PORTS, vertically in the middle TRANSFER PORTS, and headfirst in the high TRANSFER PORTS.
<b>TRANSFER STATION</b>	the center octagonal structure where ROBOTS can score DATA CAPSULES, which are then stored by human players inside the TRANSFER STATION and DATA PIPELINE
<b>U CLIMB</b>	a CHAIN attached at two points on the ESCAPE LIFT; assumes a parabolic form; the lowest point is 4 feet off the ground

## MATCH TIMING

<b>AUTO</b>	<b>TELEOP</b>		
<b>15 seconds</b>	<b>1 minute 45 seconds</b>	<b>COOPERTITION- TIME BONUS</b>	<b>ENDGAME</b>
		<b>15 seconds</b>	<b>30 seconds</b>

## SCORING

Award	Awarded for...	AUTO	TELEOP	Qual.
<b>AUTO LINE</b>	each ROBOT that fully crosses the auto line	2	-	-
<b>AUTO BONUS</b>	all 3 ROBOTS crossing the auto line and scoring 1 DATA CAPSULE in each rapid TRANSFER PORT goals	6	-	1 RP
<b>DATA CAPSULES</b>	each DATA CAPSULE scored in low TRANSFER PORT	2	1	-
	each DATA CAPSULE scored in middle TRANSFER PORT	4	2	-
	each DATA CAPSULE scored in high TRANSFER PORT	6	3	-
<b>ALLIANCE BOOST</b>	the toggling of the correct buttons on ROBOT and human CONSOLES of the same alliance	-	2x score for 30 sec in rapid TRANSFER PORTS	-
<b>COOPERTITION® TIME BOOST</b>	the toggling of the correct buttons on ROBOT and human CONSOLES of both alliances	-	15 second time bonus to end of TELEOP before ENDGAME	1 RP, for each alliance
<b>CLIMB BONUS</b>	each ROBOT that is in the EVACUATION ZONE	-	3	-
	each ROBOT that is suspended by the U climb and not supported by the carpet	-	6	-
	each ROBOT that is suspended by the O climb and not supported by the carpet	-	9	-
	each ROBOT that is suspended by the I climb and not supported by the carpet	-	12	-
	earning at least (21) climb bonus points	-	-	1 RP
<b>Tie</b>	completing a match with the same number of points as your opponent	-	-	1 RP
<b>Win</b>	completing a match with more points than your opponent	-	-	2 RP