

Game Design Challenge Finalist Team 4488

Team Name: Shockwave

Location: Hillsboro, Oregon USA

Game Name: CHAIN REACTION

Game Overview:

GAME OVERVIEW

CHAIN REACTION celebrates scientists who show the perseverance and ingenuity to solve the world's biggest challenges. Our goal in designing this game is to encourage the love and exploration of science and honor those scientists.

In CHAIN REACTION, a natural disaster in FIRST® City has caused the release of a dangerous toxic hazard. Two Alliances of three Robots work frantically in the FIRST Chemistry Lab to create a cure and save the citizens of FIRST City. To do this, Alliances, with their Robots, collect and analyze Chemicals in their corresponding Beakers. Different sequences of Chemicals may be combined by Robots in their Mixers to trigger different reactions. Reactions may provide additional Chemicals in the Lab or increase the potency of Chemicals in the Beakers. Chemicals used in the Mixer will be dispensed into the Crucible by pulling the Mixer Chain. Additionally, Robots may place Chemicals directly into the Crucible. At the end of the match, Robots rush to the Decontamination Zone to pull the Distribution Chain and save the day.

The game has 15 seconds of autonomous period, then 2 minutes and 15 seconds of teleoperated period, of which the final 30 seconds are the Endgame period.

CHAIN REACTION highlights:

- BEAKERS allow for scoring from all sides.
- INCLUSION FOR LESS COMPLEX ROBOTS:
 - + This game was designed to enable effective contributions from every robot.
 - + The CRUCIBLE offers low and easy scoring for the simplest of robots.
 - + The CABINET opening, MIXER opening, and the side opening on the BEAKER are all at the same height, facilitating robot design and inclusion.
 - + The BEAKER side openings only allow the first four CHEMICALS to be scored, but allows lower complexity robots to score at the same points per cycle.
 - + The DECONTAMINATION platforms are wide enough to fit three ROBOTS.
 - + The LOWER DECONTAMINATION platform is low to encourage all robots to participate in ENDGAME.
- CHALLENGES FOR MORE COMPLEX ROBOTS:
 - + Multi colored CHEMICALS help promote sorting by color, which has never been seen in an FRC game before.
 - + Reaching the UPPER DECONTAMINATION ZONE while only using the chains to lift the robot from the floor.
 - + Many possible actions can be taken during the autonomous period, providing many options for strategies to maximize scoring.



- + Assist other ROBOTS during the end-game to reach the UPPER DECONTAMINATION ZONE.
- + BEAKERS in near proximity to each other pose vision processing challenges for teams.
- STRATEGIC POTENTIAL:
 - + Teams will have to make strategic decisions regarding CHEMICAL allocation between BEAKER, MIXER, and CRUCIBLE.
 - + Different color combinations of CHEMICALS placed in the MIXER provide different strategic outcomes, increasing the point value of CHEMICALS in the corresponding BEAKER or releasing additional CHEMICALS onto the field.
 - + Match strategies will change dynamically based on ALLIANCE compositions.
 - + CHEMICALS must be dispensed from the CABINET in repeating red, white, blue order, so teams need to plan cycles carefully.
- EXCITEMENT FOR SPECTATORS:
 - + Visually appealing CHEMICAL buildup in the beakers.
 - + Field is easy to view from any side.
- CHEMICALS are globally available, easy to ship, and inexpensive.

Describe Notable Field Elements:

Description of Notable Field Elements

FIELD

- A 30' by 74' playable area.

CHEMICAL

- The core game piece of CHAIN REACTION.
- Red, white, or blue inflatable rubber ball with an 8.5-inch diameter.

INITIATION LINE

- A tape line on each half of the field where robots start the match.

BEAKER

- An open-topped cylinder with an internal helix ramp, a chain net on the top, and a low opening on the side.
- + Three BEAKERS per alliance, capable of holding sixteen CHEMICALS each.
- + The top includes LED lights to indicate the potency (extra points) of the CHEMICALS that are scored in the BEAKER, as well as retroreflective tape to assist targeting from all sides.
- Top opening: allows scoring CHEMICALS from all sides.
- Side opening: lower option to score the first four CHEMICALS.

BURETTE

-- A controlled release mechanism preloaded with nine CHEMICALS, three of each color, to be released in sets of three.

-- Three BURETTES are located above the DECONTAMINATION ZONE structure for each ALLIANCE.

MIXER

-- A cylinder capable of containing three CHEMICALS, accessible through a hole in the field wall beside the CRUCIBLE.

-- Allows CHEMICAL sequences to be scored at the same height as the CABINET and lower BEAKER opening.

-- The MIXER CHAIN hangs above the MIXER and, when pulled, empties the CHEMICALS into the CRUCIBLE for scoring.

CRUCIBLE

-- A low, slanted scoring ramp that directs CHEMICALS into a bin behind the ALLIANCE WALL for retrieval by a HUMAN PLAYER.

-- Also collects the MIXER CHEMICALS.

DECONTAMINATION ZONE & DISTRIBUTION CHAINS

-- Three DISTRIBUTION CHAINS hang in front of the UPPER DECONTAMINATION ZONE, allowing ROBOTS to climb to the UPPER DECONTAMINATION ZONE.

-- The platform underneath the DISTRIBUTION CHAINS is the LOWER DECONTAMINATION ZONE.

CABINET

-- HUMAN PLAYER station that allows for CHEMICALS to be entered into the LAB in a specific, repeating order: red, white, then blue.

What are robots expected to do?

Description of Expected Robot Actions

BEFORE THE MATCH, ROBOTS MAY:

-- Pre-load up to one CHEMICAL of each color.

DURING THE 2-MINUTE AND 30-SECOND MATCH, ROBOTS MAY:

-- Pick up CHEMICALS.

-- Use cameras or onboard targeting systems to recognize the retroreflective tape at the tops of the BEAKERS and MIXER to assist with aiming.

-- Shoot CHEMICALS into the tops of the BEAKERS from anywhere on the field that is not a designated SAFE ZONE.

-- Score CHEMICALS into CRUCIBLE to score points.

-- Score CHEMICALS of specific colors into the MIXER.

-- Pull the MIXER CHAIN to activate and empty the MIXER into the CRUCIBLE.

+ If there is one of each color of CHEMICAL in the MIXER, activating the MIXER causes the release of CHEMICALS from the BURETTE into the LAB, giving ROBOTS access to an additional three CHEMICALS of each color.

+ If there are three matching CHEMICALS in the MIXER, activating the MIXER will affect the BEAKER of that color. Each correctly sorted CHEMICAL in that BEAKER will be granted additional points (potency) regardless of when the CHEMICAL was scored. The effect can be applied multiple times during the match.

-- Collect CHEMICALS from the CABINET via the Human Player introducing balls into the LAB. The zone around the CABINET is a SAFE ZONE.

DURING THE 15-SECOND AUTONOMOUS PERIOD AT THE START OF THE MATCH, ROBOTS MAY:

-- Drive off the INITIATION LINE.

-- Complete the aforementioned actions.

-- Not cross the MIDLINE.

DURING THE FINAL 30-SECOND ENDGAME PERIOD, ROBOTS MAY:

-- Not enter opponents' DECONTAMINATION ZONE.

-- Park in the LOWER DECONTAMINATION ZONE.

-- Hang on the DISTRIBUTION CHAIN(S) for additional points.

-- Climb the DISTRIBUTION CHAIN(S) to park in the UPPER DECONTAMINATION ZONE for maximum ENDGAME points.

Did you use the Game Design Challenge Element in your concept?

Yes

If yes, how?

How the ELEMENT is used

In CHAIN REACTION the chain ELEMENT is used in three different ways: (1) activating the MIXER, (2) BEAKER back stop, and (3) ENDGAME challenge.

1. During the match, ROBOTS interact with the MIXER CHAIN. When ROBOTS pull the MIXER CHAIN, the CHEMICALS in the MIXER are released, triggering bonuses and opening up space for the MIXER to be reused. Pulling the MIXER CHAIN would not require a large amount of force.

2. Near the top of the BEAKERS, chains are used to create a net similar to that on a disc golf goal. The main intention for this net is to stop the motion of a CHEMICAL shot at it. This makes it possible to shoot CHEMICALS from farther away, and from different angles and still be able to score the CHEMICAL in the BEAKER. Because of the physical properties of this chain, ROBOTS are not forced to place the CHEMICALS on top of the BEAKERS, instead, they can shoot CHEMICALS into them.

3. Three chains hanging from the DECONTAMINATION ZONE superstructure are used in the ENDGAME as the method ROBOTS will use to climb to the UPPER DECONTAMINATION ZONE. ROBOTS may climb and hang from at least one of these three chains, then, if they choose to continue for additional points, ROBOTS may maneuver themselves such that they are supported on the adjacent UPPER DECONTAMINATION ZONE.

TYPE OF CHAIN



Both the MIXER CHAIN and chains used in the DECONTAMINATION ZONE for climbing could use the provided chain with product code EGSLC2-0. This chain is capable of holding 500 pounds of weight, ensuring safety and promoting ALLIANCE cooperation in climbing. Since all chains ROBOTS interact with are identical, teams have the ability to use a single subsystem for all chain interaction.