

Game Design Challenge Finalist Team 1318

Team Name: Issaquah Robotics Society

Location: Issaquah, Washington USA

Game Name: Operation Outpost

Game Overview:

There is often adversity in the FIRST Universe, and the scientists at FIRST Outpost are concerned. Because of this, in OPERATION OUTPOST, two research teams are working to gather supplies in preparation for an approaching storm. Playing in two alliances of three robots each, the match starts with a 15 second autonomous period where both alliances try to reach their Perimeter Line, the center of their Lab Sector, and store spherical Provisions, the game piece, in either the tall Treehouse goals or the shorter goal on the Hollow. If robots, also known as transport vehicles, can complete one cycle with their first Provision (that can be pre-loaded), they may attempt to locate and store other Provisions that are found on the field along the width of the Jungle.

In the teleoperated segment of the match, transport vehicles venture past the center of the Jungle and onto the opposite side of the field in order to collect as many Provisions as they can. The field is populated with the Jungle and two Treehouses and Hollows—one Treehouse and Hollow per alliance. The Jungle is an obstacle course that spans the center of the field. It is configured in a lattice shape with six stalks of Bamboo (upright poles) dispersed on its centerline and three hanging Vines (cylinders hanging from chains) along the perimeter of the Jungle, alternating with two stalks of Bamboo. During teleop, robots continue to collect and store Provisions by either shooting them into their Treehouse goal (two circular goals at the top of a tall structure) or rolling them into their Hollow goal (a ramp with two faces leading up to a circular goal). The Hollow goal has chains hanging down, connected to the upper outside, in order to prevent teams from shooting into it.

After Provisions are scored, they end up in either the Rope Bridge, which is attached to the Treehouse, or in the Basket outside the Hollow, which is located on the Trail. There are two human players per alliance. They interact with Provisions on the Trail by collecting scored game pieces and putting them back into play or storing them in the Ladder near the alliance wall. Human players are allowed to roll Provisions, throwing is not allowed. If all four rungs on the Ladder are filled with Provisions, an alliance earns one climb.

During the last 30 seconds, transport vehicles must navigate the Jungle and climb a Vine (no part of the robot touching the ground) to see how far out the storm is. Because the Ladder can substitute one climb, only two robots need to climb off the ground onto hanging Vines; the other must park on the Tree Base to qualify for a ranking point. The alliance with the highest score at the end of the match wins.

Describe Notable Field Elements:

There are four notable field elements in OPERATION OUTPOST. The first is the Jungle, which serves as a series of obstacles for robots during gameplay. The Jungle is a combination of hanging Vines and Bamboo rods. The Vine element consists of chains suspended from a truss that travel through rubber tubes to a supporting base plate. The Bamboo rods are made of vertical posts that attach to the floor. Robots can either move diagonally to cross the Jungle or horizontally along the field, navigating around the Bamboo rods between the Vines. Endgame involves robots climbing on hanging Vines, introducing a new climbing concept.

A method to substitute a Vine climb is to fill the Ladder with Provisions. The Ladder, a container that stores four Provisions on the Trail, provides a way for rookie teams to contribute to a ranking point, creating a more accessible game. The Ladder is a more complex strategic element, where teams must balance provisions available and the potential for a climb.



The Hollow provides a low-scoring goal that allows robots to roll a game piece up a ramp into a chain-draped goal. The chain was included to prevent teams from shooting into the goal, and the Hollow gives teams, who may not possess the expertise to score with the second option, a chance to contribute to the game.

The second method of scoring is through the Treehouse, a higher-scoring goal that requires robots to launch Provisions up to a target. The Rope Bridge, between the Treehouse and the Trail, redistributes Provisions to the human players in an efficient manner, to be placed in the Ladder or back into game play.

What are robots expected to do?

In OPERATION OUTPOST, robots complete three game stages: autonomous, teleop, and endgame. In autonomous, robots start against their alliance wall and will receive points for crossing the Perimeter Line. There is a bonus if every robot on the alliance crosses, and more advanced teams could complete multiple auto cycles, with the other Provisions originating from the Jungle.

In teleop, teams can score in two places, the Hollow and the Treehouse. It is expected that less experienced teams will focus on the Hollow because of the ramp component. More experienced teams will likely focus on the Treehouse, where defense will be less of an issue than the Hollow. Teams will have to get around defense to focus on their cycle times, so we expect defense in the Jungle to become more important as the season continues. Because the Loading Station is where Provisions recycle into the game, defense in that zone results in a penalty.

In endgame, Vines provide a novel challenge. Less experienced teams could complete the Ladder to substitute a climb, using the Hollow to efficiently transport Provisions to human players. As the season continues, we expect more experienced teams to focus on the climb, as at least two robots on the Vines, one parked on the Tree Base, and a completed Ladder are necessary for a Ranking Point. This game will likely start as an offense game, but as teams progress throughout the season, we expect significant increase in strategy and defense from all levels of teams.

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

Yes

If yes, how?

In OPERATION OUTPOST, chains are used to hold up the Vines by attaching them to the Canopy (truss). The Vines are a novel field feature for FRC, consisting of six swinging elements hanging from the Canopy in the center section of the field. They are made of durable hollow rubber cylinders through which the high-strength chain is threaded. The Vines serve as a weighted obstacle that may be moved by the robots, as well as the field elements for the robots to climb during the endgame. The typical endgame approach would be for one robot to climb each Vine, but the chains supporting the Vines are Grade 30 straight chains with a 1200 lb. load limit, which can support the weight of up to 3 climbing robots with a 2.5x factor of safety. The chain also adds weight to the Vines, which creates interesting dynamics involving navigation throughout the Jungle.

Chains are also used on the field for each Hollow (low scoring structure). Three chains are strategically placed to hinder teams from directly shooting Provisions into the Hollow, with the preferred method being a pushing action instead. Teams that utilize the Hollow for scoring would focus on their driving abilities, providing non-shooting teams with a valuable scoring option. Since the chain used for the Hollow is only a barrier (not supporting other structures), it may use a medium-duty straight chain as a cost-effective option.