Robots and Field Information

The Field
Hive Mind is played on a 26’ x 54’ field with 2 alliances of three teams. Each alliance has 2 hives to score nectar and honey in during autonomous and teleoperated, and one endgame flower per alliance.

Robot Rules
Robots must have a frame perimeter equal or less than 120” and weigh no more than 125 lbs (not including batteries and bumpers).

Robot Bumpers
Robots must have bumpers that start no lower than 2 inches from the floor and do not exceed 8 inches to the top. Bumper construction and specifics will follow previous years rules to maintain a safe and fun experience for teams.

Game Design Element
This year’s game design element is zinc plated straight link coil chain from Fehr Bros Industries, Inc. Loops of these chain are hanging just below the flowers, and must be spun (note: pulling on the chain will not score, the loop must be spun to rotate the wheels and activate the encoder). This is an exceptionally unique use of the chain and unlike any endgame in FRC history.
The Hive - Scoring Locations
There are four hives on the field, 2 per alliance. The game pieces nectar and honey are placed into the hexagonal scoring holes. There are distance sensors in each hole that are used to automatically score the match. To earn a rank point, teams must completely fill a hive. Additionally, LED lighting would signify which holes are filled and which are empty. These elements are easy for teams to build at home out of plywood and are unique.

Nectar - Simple Scoring
Nectar game pieces are 10” foam balls placed around the field with additional pieces available at the loading stations. They can be rolled or carried by team (but not launched) and either scored into hives or traded at the exchange for honey. These game pieces are readily available and most rookie teams would be able to manipulate them easily, either scoring or feeding them to teammates.

Honey - Advanced Scoring
Honey pieces are the other game pieces used for scoring in teleop. They are more difficult to manipulate and score, so they are worth considerably more points than nectar, though they are scored in the hives as well. These are rigid injection molded hexagonal tubes with a side to side measurement of 8 inches.

The Hive - Scoring Locations
Endgame - The Flower
The endgame consists of 3 different tasks, escalating in difficulty. For each completed task, an alliance will open one petal on the flower and score 20, 30, or 40 points. To earn a rank point in qualifier matches, teams must score 60 endgame points. Teams that “bloom” the flower with all three petals opening will have a significant point reward, but the tasks are quite different and may require separate mechanisms. Team members may opt to perform more than one task to assist the alliance.
How to Play Hive Mind

**Autonomous Period**

The first 15 seconds of the match is the autonomous period, where robots may score pre-loaded nectar into the hives without driver control. Robots start behind the initiation line, and receive points for crossing the line as well as for each nectar scored. They may also pick up nectar on the field and attempt to place them into scoring hives as well. During this time, robots may not cross the mid-field line.

*We felt it was important to have a consistent time with previous years, and to let teams start with a game piece to score as soon as possible. It is important to keep autonomous robots on separate alliances away from each other, so we created protected ends of the field. By having game pieces available on the field during autonomous, high level teams would have the option to create complex routines to score additional points.*

**Teleoperated Period**

The next 135 seconds of the match is the teleoperated period. Teams collect nectar from the field or through loading stations located on the opposite side of the field. Teams may score the nectar into the hives, or choose to exchange the nectar for honey at exchange stations on their side of the field. Human players would accept nectar and use the exchange station to eject honey game pieces onto the field. Honey is also scored by placing it into the hives, but would be worth more points due to its difficult shape and need for an exchange. If a team fills all 13 slots in a hive, they receive a ranking point. The trapezoids marked with tape by each hive are protected zones, where teams may score unimpeded. Teams may also elect to score from the midfield, but are not protected from defense when doing so.

*We felt it was critical to have an easy game piece for some teams, and a more complex and difficult to handle piece for the advanced teams. We considered cycle times, and decided an exchange would help make the 13 slot hive achievable, but not easy to fill in a match. We wanted a good role for human players to be involved in the match, and wanted some defense, but not for defense to be too overpowered of a strategy.*

**Endgame**

In the last 30 seconds of teleop, the endgame is triggered. During this time, there are three tasks that may be completed to "bloom" the flower. The easiest is the push bumper, which must be held in for 5 seconds to open a petal and earn 20 points. The second task is a spinning disc that must be rotated five times to earn 30 points and open another petal. The third task is the spinning loop of chain, which must be rotated once around. This will earn 40 points and open a petal as well. To earn an endgame rank point, alliances must score at least 50 points in engame. Teams may complete more than one endgame task, but there are only 30 seconds so it will be very difficult to do them without help.

*We felt having various complexities in the endgame tasks would allow all levels of teams to partake. Opening large petals on a flower was integral to our theme, and provided the audience and teams with a clear idea of the progress of the endgame tasks. We were careful to balance endgame scoring so that it was important to do, but would not completely flip a match unless on alliance did nothing. We wanted an exciting endgame that built suspense as teams rushed to score at the last minute, and was able to be scored real time electronically. Finally, all the task elements would not require a field reset, only the flower would need the petals returned and that would be a simple mechanism. This would help the event flow quickly and be easier on the volunteers.*
Scoring and Rank Points
We spent a great deal of time exploring how to balance scoring in Hive Mind. We designed and built an physical and online board game that team members could use to simulate matches, which helped us determine point values for each game piece and end game. As we continued to play more and more simulated matches, we adjusted point values accordingly to keep the game engaging and make sure no one action was overpowered.

Team receive one rank point for completely filling a hive - a challenge that requires alliance collaboration and strategy. Teams may also earn a rank point in endgame by scoring 60 points. There are three endgame mechanisms worth 20, 30, and 40 points respectively.

This makes it essential to be have at least one alliance partner be able to complete the most complex of the three tasks, while still allowing other teams to have mechanisms that complete the others. Again, working together is essential for the success of the alliance. The complex endgame scoring mechanism also uses the Game Design Challenge Element.

The Story behind Hive Mind
Bees are known for their ability for an entire hive to work together, solve problems, and complete many goals efficiently. Unfortunately, bees are threatened by many hazards, including climate change, pesticides, hive collapse, and other environmental challenges.

Our FIRST scientists have developed a brand new prototype that can save the many different types of bees: Bee-Bots! They are tasked with going out into the wild, joining a beehive, and assisting the living bees. The scientists programmed them to do many tasks, such as putting nectar into the hive, converting it to honey (no vomiting required), and pollinating flowers. Without bees, our economic infrastructure would collapse, and people would not be able to grow many types of crops. The scientists have run out of funding for this experiment, and they need YOU to ensure the Bee-Bots can withstand the intricacies of a bee’s life!

Many aspects of the game we have created, “Hive Mind,” reflects this story’s basics. For example, we have a flower as the focus during the endgame to represent pollination. To show that pollination takes more than one bee, we split the end game up into three different tasks. A similar concept occurs in the teleop and autonomous segments when the bees work together to fill their hives. That aspect of the game represents coopertition™ because the robots have to be mindful of the opposing alliance and treat them with the respect bees treat bees from another hive. Finally, the game has a real-world lesson, too; the game makes people think like bees by doing tasks that ensure they know how to work as a team. This has many applications in everyday life, like working with other people in group projects or at work.