# 4607 STRATEGY REQUIREMENTS

**2019 Deep Space Season Goal:**

* Win the Northern Lights Regional and improve throughout the season to be competitive at the World Championship

**Overall Strategic Objectives:**

* Finish 1 Rocket alone in Teleop to acquire Ranking Point
  + 6 Hatch cycles
  + 6 Cargo Pod cycles
* Deliver Hatch Panel to top level of Rocket during Sandstorm
  + Stretch Goal: Return to Human Player Loading Station and retrieve another Hatch Panel during the Sandstorm
* Consistently Acquire the Hab Zone (End Game) Ranking Point
  + Accomplished by scoring 15 points during the end game
  + Can be done by actively enabling a teammate to get on the 3rd Level of the Platform or by getting to the 3rd Level on our own

**Drivetrain requirements:**

* Drive anywhere on the field without getting stuck (¾” hump, Platform LVL 1, etc.)
* Have precision when scoring the Cargo Pod and placing the Hatch Panel
* The ability to climb/ lift ourselves or an alliance partner to the 3rd LVL platform
  + Not necessarily a drivetrain function, mechanism could be used instead
* Fast enough to be capable of running 12 cycles from the Loading Bay to the Rocket

**Game Piece Acquisition (Intake) Requirements:**

* Touch it, Own it, Hold it (the Cargo Pod and Hatch Panel)
* Accurately discharge the Cargo Pod at least 18” out of the intake device
* Acquire both game pieces from floor and Loading Bay
* Propel the Hatch Panel less than 2 feet out of our robot
  + This is a robot rule
* (Want) Intake Hatch Panels and Cargo Pods fully within frame perimeter
  + Allows us to steal game pieces from the other side of the field
* (Want) Full width Cargo Pod intake to maximize margin for error
  + Generally full width over-the-bumper intakes were the most effective in 2016

**Game Scoring Objectives:**

* Finish the Rocket solo with enough time to end on LVL 3
  + Earn ranking point when Rocket is complete

**End Game Obj.**

* Consistently earn 15 points during end game to gain the ranking point
  + Can be accomplished by getting to Level 3 ourselves or by actively placing an alliance partner on Level 3
    - Actively placing is defined as being capable of placing a dead alliance partner on top of Level 3

**Robot Archetypes**

Here are all the different types of robots we expect to see broken down by cycling capabilities. End game capabilities are mostly irrelevant for our teleop strategic breakdown. Within each robot archetype there will be varying degrees of proficiency which is covered by the range of expectations in the descriptions.

* Low Hatch Panel Specialist
  + Robot that only scores first level Hatch Panels
  + We expect this to be the most common specialist we play with
  + Expectations
    - 2 Hatch Panels on the Low end of the spectrum, 12 Hatch Panels on the elite end of the spectrum with an estimated average of 4 Hatch Panels
* Low Cargo Pod Specialist
  + Robot that only scores first level Cargo Pods
  + We expect this to be a rare robot since Hatch Panels must be scored first in order for Cargo to be scored
    - This robot doesn’t make a lot of sense to build
  + Expectations
    - 2 Cargo Pods on the Low end of the spectrum, 12 Cargo Pods on the elite end of the spectrum with an estimated average of 4 Cargo Pods
* Low Versatile Bot
  + Robot that scores both Hatch Panels and Cargo Pods on the first level
  + This is the ultimate 3rd robot design - Think ‘Snow Problem’s Ri3D robot
  + Expectations
    - 2 Game Pieces on the Low end of the spectrum, 12 Game Pieces on the elite end of the spectrum with an estimated average of 4 Game Pieces
* Mid Hatch Panel Specialist, and Mid Cargo Pod Specialist, Mid Versatile Bot
  + “Mid” level robots are capable of scoring in all of the 1st level Cargo Bays as well as the 2nd level Cargo Bays on the Rocket
  + We don’t think this really gives teams a huge advantage over “Low” teams since it only opens up 4 Cargo Bays/8 scoring opportunities
    - It is unlikely, in a majority of matches, that all 24 1st level Cargo Bays are filled
    - We are expecting most “Mid” tier teams to be teams that attempted to score high but ran into difficulties that limited their capabilities
  + Essentially this all boils down to: if you’re already putting engineering time and effort into a lift, why not lift all the way to the top and unlock the ability to earn a Rocket RP
    - The exception to this rule is robots that shoot the Cargo Pods to the 2nd/3rd level with no lift - there are probably teams that do this effectively, but with how bouncy the Cargo Pods are, we are skeptical of what kind of success shooters will have
* Elite Hatch Panel Specialist, Elite Cargo Pod Specialist, Elite Versatile Bot
  + Non-versatile “Elite” robots (meaning they can score at any level) will be somewhat rare
    - Elite Cargo Pod Specialists will likely come in the form of shooter bots, which we are skeptical of
    - Elite Hatch Panel Specialists will be more common and extremely valuable partners
  + Elite, Versatile Robots are the only style of Robot that is capable of soloing a Rocket RP which is why we expect it to be the dominant archetype among elite level teams
    - On the flip side, this archetype will also be the most pursued style of robot among all teams, even though most would be better served by specializing

Being that 4607 is attempting to be an Elite Versatile Robot (yeah, yeah, I know I’m not listening to my own advice), we can develop strategies around theoretical alliances with and against our defined robot archetypes above. Rather than set up a table of all possible alliance combinations however, we think it makes sense to develop general strategies that are chosen based on pre-match expected outcome.

Everybody is essentially just cycling. Your optimal places to cycle will largely depend on your field of view (which is determined by what driver station you’re in), and the sensors on your robot that assist your field of view/ability to score with an obstructed field of view. In theory, everybody will be able to score low to some degree. So where you score is entirely a function of maximizing everybody’s visibility, and of whether you’re going for the Rocket RP or not. How to handle the latter is outlined below.

**How to Handle the Rocket Ranking Point (RRP)**

Your RRP strategy should be a function of the summation of your alliance’s cycling output compared to the expected summation of the opposing alliances cycling output, with the objective of maximizing your ranking points for each match. In general, end game scores are assumed to be similar between both alliances, but it should be factored in if there is a large end game advantage on either side. Ultimately there are five different situations you will face:

* Your alliance is **significantly faster** at cycling than your opponent
  + If you have a strong advantage, you should prioritize getting the Rocket RP (RRP), even if it is defended
    - The idea is that even though they’re defending the RP, you’re still going to win even if they’re slowing you down
* Your alliance is **slightly faster** at cycling than your opponent
  + If you have a small advantage, you need to prioritize winning until it is assured, at which point you can try to finish the RRP
    - Smart opponents will defend your Rocket as you get close to finishing it - you must not go for the bait (“Baiting the Rocket” strategy described later on) and continue fighting through defense to try to finish the Rocket
    - If your Rocket is being defended, go to another scoring objective
      * This forces the opposing alliance to waste a bunch of time as one of their robots is defending nothing
    - When the opposing alliance either gives up defending nothing, or falls way behind you due to wasted time, go back to loading your Rocket to go for the RRP
* Both alliances are **evenly matched** at cycling
  + If both alliances are evenly matched, your top priority needs to be winning, rather than getting the RRP (2 Ranking Points is bigger than 1)
  + In this scenario, you’re fine to try for the RRP if the opponent chooses not to defend you (and going high doesn’t slow you down too much)
    - If going high slows you down significantly, stay low, go for the win and forgo the RRP
    - If the opponent chooses to defend at all, you should avoid their defense completely and focus on maximizing cycle points at any scoring location
* Your alliance is **slightly slower** at cycling than your opponent
  + When you are at a cycling disadvantage, you need to do something to interfere with the opponent to make up the difference (assuming you don’t have a large end game advantage)
    - The most effective form of defense (assuming your opponent is going for their RRP) is to “Bait the Rocket” and let the opposing alliance get close to finishing their Rocket, only to start heavily defending their Rocket late in the match
      * They will have strong incentive to continue going after the RRP which gives you the opportunity to out cycle them if they take the bait, and are slowed down by your alliances defense
      * In general, you want to send your weakest cycler to defend so that your best cyclers can attempt to make up the difference
      * This strategy can backfire if the opponent doesn’t take the bait - leaving your defensive robot to waste a bunch of time defending nothing, however, you were expected to lose anyways so it’s always worth trying
* Your alliance is **significantly slower** at cycling than your opponent
  + If you are expecting to lose, and no amount of defense can get you back in the game, your best option is to ignore trying to win, and go for the RRP
    - You always want to maximize your Ranking Points, in this scenario, 1 Ranking Point is better than 0
  + All three alliance members should focus all their effort on a single Rocket until it’s complete
    - If no alliance member is capable of scoring on the high Cargo Bays on the Rocket, this strategy doesn’t work
  + Additionally, once the RRP is earned, if it’s possible for the alliance to earn the end game RP, the alliance should give themselves additional time to get on whatever Platform Level they are capable of
    - You should continue cycling until you feel like you’re at the point where you may need more time to climb (for scouting purposes)
      * People are scouting how many cycles you do, and quitting cycling early can hurt your numbers - so if you can only get to Platform Level 1, cycle until late in the match

**How to most Effectively Play Defense**

Characteristics of the ideal Defensive Robot:

* Capable of intaking Cargo Pods and Hatch Panels from the opposite side of the field
  + Must do so from inside the frame perimeter
* Strong drivetrain with smart driving

**Defending the Loading Bay**

Remember that robots must be fully in their HAB in order for you to incur a penalty from touching them. The HAB is around 7 feet long and the opponent would need to push you deep into their HAB in order for you to incur a 3 point common foul. Defending the Loading Bay is certainly plausible for a smart team with a strong drivetrain, but you’re at a visibility disadvantage and you’re also in a penalty-prone situation. I would argue defending the loading zone is the 2nd or 3rd best place on the field to defend.

**Defending the Cargo Ship**

Arguably a better place to defend is around the Cargo Ship. The tolerances for scoring are very tight for Hatch Panels on the Cargo Ship which are necessary for Cargo Pods to score. These tight tolerances will cause teams to miss, and drop, Hatch Panels. The number of drops will increase when defense is introduced. Defending around the Cargo Ship opens up many opportunities to slow your opponent down while also creating short cycle times for yourself if you’re capable of stealing Cargo Pods/Hatch Disks.

**Bait the Rocket Strategy**

My favorite place to defend is the Rocket… but only if you’re smart about it. Baiting the Rocket is a strategy that involves allowing your opponents to fill the Rocket undefended up to a certain threshold (which will depend on the skill of your opponents) at which point you send a defender to lock it down. The opposing alliance has a massive incentive to fight through your defense (and waste time) to go for their full Rocket rather than go to an undefended Cargo Ship or the other Rocket. The Ranking Point is your bait, and if the opposing alliance goes for your bait, you’re giving your alliance a chance to make up ground, or build a lead. If they don’t take the bait, you’ll have a harder time winning the match playing 2 vs 3. It’s a risk reward strategy, but you have to know when to use it, and how to avoid being tricked by it.

**How Things Change in the Playoffs**

* Ranking Points don’t matter = Scoring High doesn’t matter
  + At least until all the 1st level Scoring objectives are either full or defended
* Baiting the Rocket does nothing for you as there is no incentive to finish the Rocket
* The most valuable place to defend becomes the Cargo Ship or Loading Bay
  + Hard to say which at this point but I’m leaning towards the Cargo Ship if you’re capable of stealing Hatch Panels or Cargo Pods
* The fastest cyclers, regardless of ability to score high, become the most valuable
  + If there is a Low Hatch Panel Specialist capable of doing 12 cycles compared to a Elite Versatile Robot that is only capable of 8 similar cycles, the Low Robot will be more valuable in the Playoffs
    - The value of going high isn’t zero… but it is significantly devalued (especially at early and low level events) - the most value comes from versatility in that it’s harder to defend a robot that has more scoring options
* While cycles are the leading sort for most pick lists, end game ability is the next most important factor
  + End game capabilities can essentially be added to the number of cycles a team can do to roughly determine their value in the playoffs (of course other factors like how they handle defense and things like that will also be important)
    - A level 1 end game is essentially equal to 1.5 cycles
      * But really it’s worthless since everybody who will play in the Playoffs will be capable of it
    - A level 2 end game adds 1.5 cycles of value vs a level 1 end game robot
    - A level 3 end game adds 6 cycles of value vs a level 1 end game robot and 4 cycles to a level 2 end game robot

**End Game Ideas/Strategies**

* The end game Ranking Point should be the primary objective for all end game strategies
  + You need 15 points
    - The easiest way to get there for an elite team is to either get 12 points from Level 3 themselves and trust an alliance partner to get 3 points from Level 1 or to actively lift/place an alliance partner on Level 3 and get 3+ Points from Level 1+ themselves
    - The other way to get the End Game RP is for two robots to get to Level 2 and the third to score on Level 1
  + The points earned during the end game seem to be more efficient (more points per time) than cycling, so scoring on the Platform during the end game is likely a better option for closing a deficit than cycling
* After the End Game RP has either been secured (or deemed impossible due to alliance structure) the next most important end game objective should be securing the RRP
  + Assuming the RRP isn’t already secured, you have the entire end game, undefended, to fill the remaining slots on the Rocket
* If the match is close, and your end game point efficiency is worse than your cycling point efficiency (i.e. you don’t have more than a Level 1 Platform ability) you should be running the most efficient, undefended cycles you can to the closest open scoring objective

**Pre-match Pre-Loading Strategies**

**Null Hatch Panel vs Bonus Cargo Pod for the Cargo Ship?**

* The Null Hatch Panels are almost always a good idea since it’s unlikely that you’ll reach the low game piece cap in most matches
  + Playing all 6 Null Hatch Panels allows you to do 6 cycles of Cargo Pods each worth 3 points which is more efficient than doing 6 cycles of each game pieces for 5 points each
    - 18 points in 6 cycles (3 pts/cycle) vs 30 points in 12 cycles (2.5 points/cycle)
* Loading the Cargo Ship with Cargo Pods and intentionally letting them fall so you can intake them from the ground and quickly score them in your Rocket is a valid reason to choose to pre-load Cargo Pods
  + The Cargo Pods will fall and roll towards your Rocket which makes for short cycles assuming you’ve already placed Hatch Panels over 1-2 Cargo Bays

**Pre-Load a Hatch Panel vs Cargo Pod on your robot?**

* In most cases it makes sense to load a Hatch Panel on your robot
  + The only time you can score a Cargo Pod is when you have chosen to pre-load a Null Hatch Panel
  + Scoring Hatch Panels early makes your cycles more efficient later
  + Scoring a Hatch Panel on a pre-loaded Bonus Cargo Pod nets you 5 points which can be a significant lead early in the match
* We believe placing a Hatch Panel (or two) on the top level of the Rocket will be the Sandstorm strategy most often employed by elite teams
* If you choose to use all 6 Null Hatch Panels, and aren’t confident about your ability to get to the Rocket during the Sand Storm, you may be better off pre-loading a Cargo Pod

**Miscellaneous Notes**

* When going for the RRP, start by going high early in the match
  + This makes it easier to score in the Rocket when it’s more heavily defended later in the match
  + It also “unlocks” the Rocket and allows lower skilled alliance partners to finish it off while you’re possibly doing other things (vs leaving the top Cargo Bay empty with your robot being the only “Elite” robot on your alliance)
* It might make sense to disguise what Rocket you’re going after early in the match to make it more difficult for the opposing alliance to lock down the one you’re really going for
  + Maybe fill in the lower levels on both Rockets (same number of points, similar difficulty, and similar cycle time as the Cargo Ship anyways) early to make it less obvious what you’re going after
* Drive coaches are going to need to keep track of where both alliances have been scoring in order to make informed decisions
  + This is going to be a significant challenge as there is a lot to keep track of
  + The poor visibility on your own Cargo Ship could mean a lot of wasted time trying to score in a full Cargo Bay if you’re not keeping track of what’s full
* During alliance selections, it will be common to see 3rd level climbers choosing the best cyclers with a 3rd level climb so that they aren’t forced to compete against them
* This is a rare FRC game where an alliance of specialists can be significantly better than an alliance of versatile robots