There has been a recent uptick in interest in the FIRST Tech Challenge from the community due to recent circumstances, most notably from FRC teams turning their attention to FTC after the recent IFI controversy. There have been many posts on the problems of FTC, from the program feeling like a JV feeder to it being the forgotten child of FIRST's programs. I wanted to take time during this to draw the community's attention to a problem that I think goes overlooked but has very consequential impacts on the program and its future.

I want to talk about vendors in the FIRST Tech Challenge and how FIRST HQ treats companies attempting to enter this market. More broadly, I want to shed light on what I believe is behavior that should change in order to better the program. **The current way that FIRST treats vendors in FTC is a detriment to the program overall and has to be improved**.

I am writing this chiefly as an alumni of the program, secondly as a mentor of the program, and third as a vendor in the program. I recognize that my perspective and experiences have been biased by my own financial interests in this program, but this writing is far more than my own voice. This is something I would have made regardless of if I was a vendor or just an alumni, although I would not have had as much first person experience to put in this document. Regardless, while this is a known issue to FTC circles, this has never quite been talked about much publicly for a variety of reasons.

A handful of the thoughts/conclusions in this document are not originally my own, and are included here with permission. Secondary authors are anonymous at their request.

The History of Parts Legality in FTC

To understand the current state of vendors, you have to first understand how this program started. (Note: A very useful resource to have open alongside this document is the amazing website https://ftchistory.dogbuilt.net/ made by a student of the program. It has quick links to past game manuals, one pagers, game reveals, and is split up by year and era.)

As some of you may know, FIRST Tech Challenge started off as the FIRST Vex Challenge back in 2005, with the game "Half Pipe Hustle". FIRST had recognized a growing need for a program between their two existing programs, FRC and FLL, aimed at schools and areas that couldn't support the relatively massive resources needed for an FRC team.

Their answer to this was the RadioShack and IFI sponsored FIRST Vex Challenge (FVC). FVC was very similar to the modern day VEX Robotics Competition. Teams purchased a VEX Starter kit, batteries, and programming kit from RadioShack, and, critically, **these were the only legal parts allowed in the competition**. Rule <R5> in the Game Manual was the first material construction rule in FVC/FTC, simply stating that official VEX Components were allowed, some VEXLabs components were allowed, and other than that "No additional components may be used!".

Teams were required to keep a Bill Of Materials (BOM) to verify that only VEX components were used in the construction of their bot, as well as documentation and receipts for every single used part to prove they were official VEX parts. This was basically the beginning of **Closed COTS**, a concept where only allowed parts from approved vendors would be allowed. However, it is still known to teams as the beginning of the FIRST Vex Challenge era.

Broadly speaking, FVC was a mild success for FIRST. It didn't immediately achieve all of its goals, but it did provide a relatively level playing field for its players because of the limitations of the VEX Kit. FIRST took the successes and failures of the first year of FVC and turned it into its second year, "Hangin'-A-Round". This time, we saw a slight reduction in the totality of Closed COTS, with the first exceptions. Rule R5 introduced two such exceptions. <R5.c> and <R5.d> stated "Any parts which are identical to legal Vex parts may be used" and "Teams may add non-functional decorations from parts not on the above list, provided that these parts do not affect the outcome of the match, and must be in the spirit of 'Gracious Professionalism'" respectively. These loosened restrictions saw some use, mainly with teams making fancy individualized decorations and sideplates (see: paper sideplates and cardboard decorations), but the core of the rules was still Closed COTS to one vendor. This idea of Mostly Closed COTS, where decorative parts and some clones were allowed, was a trend that would continue for a long time, particularly in the Vex Robotics Competition created by "The Divorce".

The IFI/FIRST Divorce

The separation of FIRST and Vex into two programs, unofficially otherwise known as "The Divorce" in FIRST Tech Challenge, is something that most people know very little about. Regardless, it brought some questions into the 2007-2008 season. What would vendors and materials look like in this new "FIRST Tech Challenge" (FTC). Would FIRST still be using VEX parts after they removed "VEX" from their name? The answer from FIRST, in the game "Quad Quandary", is that nothing would change. The robot rules ("R" rules) remained virtually identical, with only official VEX parts (or identical clones) being allowed. The same exceptions remained, the same BOM and receipts requirement remained, nothing changed.

Spiritually, the 2008-2009 game didn't have any changes to the idea of Mostly Closed Cots. However, almost everything changed. Suddenly, VEX was not the only, or even primary, vendor in FTC. Two new companies stepped in, Lego and PITSCO. The control system was designed to move away from the antiquated VEX controllers to a modern NXT based system (using a custom network controller called the Samantha Module, made by a FIRST employee). New sensors, motors, servos, and construction material from Lego/Hitechnic and Pitsco (Tetrix brand) were added. These parts were put into an "Official FTC Competition Kit" teams could buy. Essentially, if a part was sold by LEGO NXT, or Pitsco Tetrix, it was competition legal. In addition, for the first time, limited raw materials (polycarbonate and aluminum) were allowed. Although limited in volume, it was another slight loosening in restrictions. However, external vendor parts were still illegal for competition unless they were purely decorative.

From 2009-2014, the same trend continued. Year after year, more and more parts were made legal by the rules as exceptions, but the core idea still remained Mostly Closed COTS. However, the exceptions list grew longer and more specific with time. We went from 24 exceptions in 2009 to a ridiculous 34 exceptions in 2011, ranging from rope to a limited quantity of aluminum square tube. Now a large number of exceptions doesn't matter per se, but they were so specific that it legitimately made it very hard to figure out what materials could be used to build robots.

Another consequence is it made materials rules near impossible to enforce; imagine needing to measure that the surface area of a non-slip pad did not exceed 576 in² with no dimension over 24 in, and then needing to check similar constraints for at least 12 other similar limits. One head robot inspector I talked to from that era commented:

> "We gave up on enforcing specifics in [the 2010 game, Getting Over It]. We gave it a glance over to see if it roughly looked like it followed then passed it through…if we took time to enforce things properly robot inspection would have to be a whole separate day".
> -Anonymous Head Robot Inspector, 2022

This was not an isolated attitude; the large number of exceptions and strict and specific wording made many regional inspectors adopt a loose attitude with the rules, which teams would exploit from time to time.

From Mostly Closed to Opening

I'd like to think some time around 2012, someone on the GDC sat down and said "These exceptions are starting to get absolutely insane! What if we just…simplified it all". In truth, I doubt it was that simple and it probably involved a lot more back and forth and complexity. What matters however, is that the rules did significantly open up. Raw materials became blanket legal (with no volume limits) and we saw the introduction of the first non-vendor locked processed parts: assemblies.

General assemblies were still illegal with the exception of 5 specific things: Linear slides, turntables, leadscrews, servo blocks, and #25 chain. These could be purchased from any vendor (a very new concept for FTC) and would be blanket legal. Of course, the first vendors to take advantage of this were the ones closest to FIRST, as they were the first to know. Teams bought parts from non-FIRST related vendors, but none of them were advertising to FTC yet. The market was new and wasn't big enough for it to even be a thought. However, this was the first possibility of an open market.

It's important to look at the exact intent for this slight opening of the market, as it becomes important later in Open COTS. The specific line used is

> “The intent of <R02> is to augment the TETRIX, LEGO and MATRIX robot system kits with a few select assemblies/mechanisms that might be useful for this years[sic] game challenge. For the purpose of this rule, assemblies are considered to be component parts that have been fitted together.”
> - Game Design Committee (Game Manual Part 1), 2012

This moment is very important in COTS history, as it's the first time the GDC publicly recognized there was a need for parts beyond what Pitsco/Lego could provide. The “few select assemblies” wording is key as well — this wasn’t supposed to be an open license for COTS assemblies. The GDC recognized a need for some level of outside vendor involvement, but they were very clear to retain the right to draw the line exactly where they wanted to. One more key line is a limitation, that

> “Prefabricated and/or Preformed COTS plastics or metal are not permitted (i.e. buckets, cups, **grippers**, gears, etc.)”.
> - Game Design Committee (Game Manual Part 1), 2012

This line about grippers will become important later during the Open COTS era.

The 2013 game didn’t bring much new in the way of COTS parts, but did open the door to timing belts and pulleys, once again showing a “softening” of the Closed COTS rules.

Open COTS and 1 Degree of Freedom

It isn’t known what exactly led to the fall of Closed COTS. However, the 2014-2015 game, Cascade Effect, brought with it a very interesting new rule, <**R04**>. Simply put, R04 made any and all COTS parts and assemblies legal so long as it was “readily available”, and had up to one degree of freedom. This singular degree of freedom rule (nicknamed “2DoF” in FTC due to most of the initial bans being 2 degrees of freedom assemblies) formed the core of COTS rules in FTC and shaped its development with external vendors. The only exceptions were omni wheels and mecanum wheels. This is commonly referred to as the start of the “Open COTS" era because of this rule.

However, this wasn’t free of vendor rules yet. The previous three rules between R04 made almost all LEGO parts legal, almost all TETRIX parts legal, and **all** MATRIX parts legal. These parts were not subject to degree of freedom limitations—so long as they were sold under those brands they were completely legal. Any other vendor’s parts were subject to the rest of the mechanical rules to determine legality. **This is, frankly, explicit vendor favoritism.** However, it's easy to see where it came from, with those brands being **the** FTC vendors in the past.

The 2015-2016 season didn't bring any major changes to the Open COTS rules, but did bring one new addition, the first definition of "one degree of freedom": "a system whose motion is defined just by a single independent co-ordinate (or function)", along with a presentation on degrees of freedom with examples and definitions (the paper has since been taken down, but is still archived here). On the surface, this doesn't mean much since it is the actual definition of a degree of freedom, but is confirmation that FIRST meant the typical definition of degree of freedom.

The definitions remained pretty constant until 2017-2018, when an intent behind the degree of freedom rule was added:

> "It is the intent of FIRST is to encourage Teams to design their own mechanisms rather than purchasing pre-designed and pre-manufactured solutions to achieve the game challenge. Purchased mechanism kits (for example, grippers) that violate the single degree of freedom rule, either assembled or requiring assembly, are not allowed. COTS drive chassis (for example, AndyMark TileRunner, REV Robotics Build Kit) are allowed provided none of the individual parts violate any other rules."
> - Game Design Committee (Game Manual Part 1), 2017

This exception introduced one of the largest loopholes in the 1 degree of freedom rule. The exception that all drive chassis kits, a term never defined by the GDC, were allowed led to the creation of several kits from vendors such as REV or Andymark that were, at best, questionably drive chassis kits but were deemed legal for containing drive chassis. However, it did define pretty clearly why the one degree of freedom rule existed. This rule, <RM02>, still exists in that exact form today, nearly identical to how it was in 2017-2018 (though the definition of a degree of freedom was removed in 2020-2021).

A Closer Look at 1DoF

While externally, FIRST's attitude towards COTS and other vendors changed, internally it seems to be fairly constant. During the Closed COTS era, FIRST very explicitly stated that their intent "is to augment the TETRIX, LEGO and MATRIX robot system kits with **a few select assemblies/mechanisms that might be useful** for this years[sic] game". However, the core intent of this rule doesn't differ that greatly from the first line of the 1 degree of freedom rule, which states

> "It is the intent of FIRST is to encourage Teams to design their own mechanisms rather than purchasing pre-designed and pre-manufactured solutions to achieve the game challenge."
> - Game Design Committee (Game Manual Part 1), 2022

This line comes **before the actual rule**, which says assemblies with more than one degree of freedom are banned. Very clearly, this line is the intent behind the rule.

Except, in practice, the 1DoF rule isn't used this way. It exists to blanket ban parts the FIRST GDC does not want to be sold in the FIRST Tech Challenge…

Which leads us to the following thesis:

The 1 degree of freedom rule doesn't exist to ban assemblies with more than 1 degree of freedom. It exists to blanket ban parts FIRST does not want to be sold in the FIRST Tech Challenge without them explicitly saying so, for whatever reason that may be.

This is a bold claim, but let's examine some specific cases.

The shining example of this is a type of part that is often the poster child of the 1 degree of freedom rule in FTC, grippers. There are currently two grippers ruled illegal in the Legal/Illegal parts list, the TETRIX® Prime Gripper Arm Kit and TETRIX® MAX Gripper Arm Kit. In addition, the VEX Claw Kit, which is similar to both, has been ruled illegal in the FTC Q&A. These claws use gears to actuate both sides of the mechanism, and hard mount to the robot frame. By any reasonable examination of this mechanism, it had 1 degree of freedom. The two sides were not independently actuatable, and by FIRST's own definition its motion was defined by one single co-ordinate, the rotational angle of the input gear. However, year after year, this part has been ruled illegal under <RM02>, the 1 degree of freedom rule.

This is not the only part to have fallen under <RM02>. Another interesting one is the leadscrew kit ban in 2018-2019. This ban is particularly interesting, because the Game Manual specifically lists "Lead screws" as an example of a **legal** COTS item. However, FIRST banned the use of leadscrew kits in that year, using the fact that the kit both contains a leadscrew that rotates, and a leadscrew nut that linearly moves, as proof of two degrees of freedom. This is a case, once again, where the part meets the definition of the motion being described by a single variable/function, but once again was banned. What was also particularly interesting about this ban was that it was eventually reversed. In their decision, they stated

> "Normally we encourage teams to design and build their own mechanisms to solve the game challenges but on occasion we have allowed the use of COTS kits that provide additional capability to teams without ruining the robot design experience (for example: the TileRunner kit). **Due to the overwhelming response from the FIRST Tech Challenge community**, the GDC has re-evaluated the use of linear actuator systems with regard to Rule <RM02>."
> - Game Design Committee Member (FTC Forums), 2018

(Emphasis mine)

They also stated in this ruling that “This is a one-time exemption”. The wording of this response is very clear, the GDC only reversed this decision because of the massive backlash it had on the FTC community. For reference, at the time, more than 60% of competing FTC teams used leadscrews on their robot. It was, by far, the most popular method of completing the “hanging” objective of the game. Note that the most popular kit used was not an all in one kit like you see in FRC. The kit was just a motor, a leadscrew, a leadscrew nut, a guiding rail, a piece of structural channel, and gears to connect the motor to the leadscrew.

(Note from the author: There has been a lot of debate over whether the GDC was trying to ban “X/Y and rotational” lead screws (notably, no FTC targeted lead screws matching this description existed before or after the ban) or all leadscrews. The enforcement done in wake of the ban was to ban **all** leadscrew kits, so this is what people concluded the intent to be.)

Parts that clearly have multiple degrees of freedom are also regularly ruled legal; the obvious example of this is universal joints. While already two degrees of freedom on their own, they *have* to be used in a way that contains a third degree of freedom as well. Year after year, they are ruled legal by the GDC. However, there are even more egregious examples. Perhaps the most fascinating case study is the REV Robotics Fidget Spinner. (https://ftc-qa.firstinspires.org/qa/174 (archived))

Many parts that are allowed by the GDC despite having multiple degrees of freedom can be argued to have a crucial use that means they have to be ruled legal. The REV Robotics Fidget Spinner is not that. It is a fidget spinner. A central bearing with 3 more axial bearings around it. By any definition, this part absolutely has more than one degree of freedom. There isn’t a specific use for a fidget spinner on an FTC robot, and it doesn’t fill a need that would otherwise go unfilled. There is absolutely no reason for the GDC to rule such a part legal for competition.

However, on November 24th, 2022, the Game Design Committee legalized the fidget spinner in response to a question about its legality due to the 1 degree of freedom rule. The answer given instantly sparked massive confusion amongst the community.

> “This spinner can be considered a bearing mount, it is legal.”
> - Game Design Committee (FTC Q&A), 2022

There are a few things to dissect in this answer. The most notable is it very clearly ignores part of the asked question (“If [the spinner has more than 1 degree of freedom], are the isolated outer bearings adding degrees of freedom to the central pivots?”). Whether this is intentional or not is up to speculation, as the GDC has not clarified its answer. The second notable thing is the phrase “bearing mount”. This is a term that is neither defined by the GDC in any way nor a listed exception to the 1 degree of freedom rule. This also throws into question previous parts ruled illegal by the GDC. If bearing mounts are legal, then what counts as a bearing mount? What other hardware is an exception to the 2 degree of freedom rule?

(Note, before this continues, I want to give a bit of a disclaimer warning. I work for Axon Robotics, and the CODEX Odometry bundle mentioned was a personal project of mine. The presented information is trying to be as objective as I can, and has been a topic written about by other students in FTC.)

However, there is another answer worth mentioning as well. An item that has gained infamy is a dead-wheel odometry bundle sold by Axon Robotics. Essentially, dead-wheel odometry is an unpowered omni wheel attached to an encoder that is used to track the robot's position over time. Generally, these wheels are on a pivoting pod with a spring to maintain ground contact and pressure. In FTC, these pods usually use specific parts from multiple different vendors. In order to centralize and save the team's shipping cost, Axon Robotics started selling a bundle of common odometry parts (specific bearings, a very popular omni wheel, screws, spacers, nuts, 3d printed parts, plates, etc). The point of the bundle, as stated on their website, was for teams to use the parts in a variety of different designs. Three example configurations are shown on their website, each requiring a different list of parts that need to be purchased or manufactured by the end consumer.

The bundle was initially sold as a "kit". This "kit" did not contain *all* the parts needed to make an odometry pod. Some components, such as the encoder, a side plate, a pivot, and springing still needed to be manufactured or purchased by the end consumer. This was ruled illegal under the 1 degree of freedom rule. As a result, Axon Robotics updated their website to include two changes. The first was a name change, from the "kit" to "bundle", and the second was a clarification that the parts were not a functioning odometry pod on their own, rather a set of common parts that could be used in a variety of designs, and the fact that additional products had to be manufactured or purchased for the odometry bundle to be usable in any meaningful way.

Therefore, a second question was asked by a team stating

> "Following Q19 & Q21, Axon changed their product offering to just be a bundle of odometry-related parts (bearings, springs, housing for encoders, etc) from which a number of open-source odometry pods can be built. **Part A) Is it legal to buy this bundle and build one of the open-source pods with it?** Part B) is it legal to buy this bundle and build Axon's original odometry pod design (which is also open-source)? Thank you!"
> - FTC 21376 (FTC Q&A), 2022

The answer was the following

> "**QA: Not (sic) this is not legal** QB: No this is not legal."
> - Game Design Committee (FTC Q&A), 2022

(Emphasis mine)

With no rule number given, we are left to speculate exactly what rule this bundle broke. However, the most reasonable assumption is that this was ruled illegal under RM02, which bans “Purchased mechanism kits (for example, grippers) that violate the single degree of freedom rule, either assembled or requiring assembly”. The ruling of particular concern is that buying a bundle of parts and using it to assemble a general open source design is **illegal** according to the FTC GDC. Like previous questions, this immediately caused widespread confusion. Since the bundle required user fabrication to make an open source design, then what were the limits. Questions such as “does this ban all open source odometry designs?” and “what counts as an open source design? Do custom closed source designs not count?” went unanswered for a long period of time. Even now, questions about how authorship of open source models affects legality (it appears open source models being promoted by a vendor makes that design illegal) are still in play.

(Biased opinion from the author, but I personally don’t see much of a difference between the two bearings in an odometry pod (see pictures on Axon’s website for reference) and the bearings in a fidget spinner. If those are a “bearing mount”, the CODEX bundle seems to be a bearing mount, an omni, and some screws and related hardware. However, I can see that some distinctions can be made.)

These are just three in depth examples, but there are lots more that have been ruled in previous forums and Q&A answers. Unfortunately, some of them have been lost to time (the entirety of the 2021-2022 Q&A was erased by FIRST as the beginning of this season for one example), but there has always been consistent inconsistency in how parts are ruled legal and illegal under the 1 degree of freedom rule. However, it does start to become a lot more clear when you approach <RM02> as a rule banning parts that FIRST doesn’t believe fits with the idea of FIRST Tech Challenge, rather than a blanket rule banning more than 1 degree of freedom parts.

The intent of the rule seems to pretty closely resemble <I101> in the FRC manual, which deals with MAJOR MECHANISMS. The FTC GDC seemingly wants to ban COTS MAJOR MECHANISMS (except drive chassis), but is attempting to justify this under a 1 degree of freedom rule instead of introducing a rule that says this. An interesting consequence of this is that Game Challenges are not clearly defined, leading to debates over whether secondary objectives like robot localization or movement count as a Game Challenge. In FRC, with a dedicated rule, this is clear—“Examples of MAJOR MECHANISMS include mov[ing] the ROBOT around the field”, while in FTC we (including vendors, this is an important detail that is expanded upon in the next section) are left to guess about what is and is not a game challenge. Driving seemingly is not, while localization seemingly is.

Since this has been written, the GDC has actually posted a new answer, which confirms suspicion that autonomous localization is a game challenge. The answer, in Q171, states the following.

> The Axon odometry module is a COTS solution to the POWERPLAY Autonomous Period tasks that benefit from accurate Robot movement along the Playing Field Floor (e.x., Navigation, Cone Scoring, and Signal Bonus tasks) and is therefore an illegal COTS mechanism as stated in 19. The universal Robot construction parts contained in the odometry module kit are allowed (e.x., bearings, screws, nuts, omni wheel) when they are used in a Team designed part or general construction part (e.x., extruded aluminum structural element). Custom COTS parts in the Axon odometry module (e.x., side plates) are not legal for Robot construction.
> - Game Design Committee (FTC Q&A), 2022

This is derived from the line “It is the intent of FIRST to encourage Teams to design their own mechanisms rather than buying pre-designed and pre-manufactured [Commercial Off-The-Shelf (COTS)] solutions to achieve the game challenge.” However, this bar of providing support for localization tasks is defined nowhere in the game manual, has never been stated or defined before, and has only been stated by the GDC nearly 3 full months post kickoff, and almost 2 months after the initial ruling of “this part is not legal” with no explanation. It took numerous follow up questions in order to get this explanation.

In addition, this is seemingly contradictory considering sensors that promise complete all in one localization, such as the Intel T265, are completely FTC legal.

(Note from the author: There might be a super old and obscure forum ruling somewhere that references something like this, but in my opinion something as important as this should be put in the game manual and defined a little more explicitly. What constitutes an Autonomous Period Task? Why is the T265 legal? Why aren’t parts designed to make tasks like intaking elements easier illegal?)

So What am I trying to say here?

Warning: This section is where we switch from trying to inform to trying to persuade. It's going to contain personal opinions. You may disagree with them, this is fine. The intent of this is to start a discussion, and that includes telling me that I am wrong

So why does this matter? FTC has vendors. From REV and Andymark, who work directly with FIRST on some things, to unconnected vendors like Studica and goBILDA, there are companies in this program. So why am I complaining? Why do I care about this? Does this really matter?

I think the answer is a solid yes, this does matter. The existence of companies not connected to FIRST but solidly in the FTC sphere is not proof that the system works. Rather these exist almost in spite of FIRST’s attempts to create an atmosphere toxic to business. There are many barriers that exist to making a company in FTC, one of the biggest ones being the inherent low volume, revenue, and therefore margin environment of FTC. This absolutely constrains how

companies can develop in this space. There still is space for companies to exist in this program. Many of us are alumni or people who know very personally how much FTC has changed our lives for the better, recognize its potential, and want to give back to the program. But that doesn't mean we should let FIRST hold that over our heads.

However, what there aren't the right conditions for, is innovation. New products are developed and released all the time by the major non-FIRST vendors, but they are pretty exclusively either different versions of older parts or extremely safe mechanical parts that are analogs of other, older parts. It's understandable why this happens, the entirety of product R&D is dependent on the whims of a GDC that seems to change its mind from month to month. The constant guillotine of the Q&A hangs over the head of anybody daring to actually put time and money into R&D. They don't answer hypotheticals, nor is a ruling on a hypothetical definitive.

You can only get a ruling on your product *after* you have finished your long development expenses, and only nearly a month after the season has already started. This leaves vendors with the following options. Either pre-producing a new product and praying it is legal, with an illegality ruling meaning massive expenses, or waiting a full year to again release the product at kickoff, giving anybody else time to clone or come up with their own competing products.

Unless, of course, you are a FIRST partnered company. In which case you are still spending the prototyping expenses, but with none of the risky options considering you can simply talk with FIRST to ensure your product's legality. And hey, in the process FIRST might grant you an exclusive monopoly too.

I understand that these monopolies are always going to exist, and to an extent I am fine with this. I also understand that FIRST doesn't have the bandwidth or employees to respond to emails with legality questions.

However the combination of the Q&A opening so far late into the season, the game manuals being written in an extremely vague way with rules that aren't even written down until they are broken, and all the other barriers in place, create an environment nearly *perfectly* designed to prevent thinking out of the box. Perhaps this was the intent, after all I get the feeling COTS rules are designed with non-FTC specific vendors in mind. Maybe the possibility of a company deciding to plant itself into the program and wanting to interact with FTC in a major way never occurred to them.

However, when a company offers to pay your extremely high fees for a booth at worlds and you cancel on them last minute with basically no reasoning (other than vague words about not allowing competition), when a vendor tries to work with you repeatedly and you just ignore their emails outright, when you create contradictory legality rulings based on rules that barely exist, you paint a pretty clear message that I don't know if you are intending to paint. You are choosing to be hostile and say abandon hope to all who enter.

So what do I want to see changed? I think the surface level change that will probably have the biggest impact is a rule similar to I101, MAJOR MECHANISMS in FRC. Spell out that you want MAJOR MECHANISMS banned with a list of exceptions, and stick to it. This is certainly the option most likely to happen, but I don't think it addresses or solves the fundamental issue here.

I think communication needs to be massively improved between vendors and FIRST. Not necessarily emails, I understand the challenges there. However, at the very least, there should be a Q&A open before the season starts, when Game Manual part 1 releases, to ask about product legality questions. This is still very late in the product development cycle but at the very least allows some flexibility and breathing room rather than a month after kickoff (sales data indicates that there is a massive spike in orders right after kickoff, which starts leveling off almost perfectly as the Q&A starts answering questions).

And when I say open before, I don't mean a week before kickoff. I mean when Game Manual part 1 releases. **And let vendors have Q&A accounts so we can actually ask questions rather than hoping teams ask them and not mess them up** (the exact wording of a question tends to lead to very different answers)**.**

The absolute best scenario would be for FIRST to allow vendors to email them and work privately to explain the intentions behind rules. This will absolutely never happen, but would be above and beyond for figuring out where you can concentrate R&D efforts. It can also open dialogues with vendors which I think would be useful for FIRST.

As an alumni of this program, a mentor of this program, and a vendor of this program, I am asking FIRST to recognize that its current course of action with vendors has issues. The current state of the program is bright, it's promising, but it can be better. There are changes that can be made to introduce more vendors to the program, who are able to bring costs down and increase accessibility for everyone. I recognize that my perception may be biased, being a vendor with a financial stake in the program, but this is an opinion that is held by many members of the program, many alumni who have left, and many mentors continuing. This is a viewpoint that has been talked about behind closed doors outside of public view for years. I want to bring it forward for more to see and discuss, in the hopes that change is made.

Eeshwar Krishnan
Alumni of FTC 7244 OUT of the BOX Robotics

CHIEF DELPHI POST (Archived)

There has been a recent uptick in interest in the FIRST Tech Challenge from the community due to recent circumstances, most notably from FRC teams turning their attention to FTC after the recent IFI controversy. There have been many posts on the problems of FTC, from the program feeling like a JV feeder to it being the forgotten child of FIRST's programs. I wanted to take time during this to draw the community's attention to a problem that I think goes overlooked but has very consequential impacts on the program and its future.

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I am writing this chiefly as an alumni of the program, secondly as a mentor of the program, and third as a vendor in the program. I recognize that my perspective and experiences have been biased by my own financial interests in this program, but this writing is far more than my own voice. This is something I would have made regardless of if I was a vendor or just an alumni, although I would not have had as much first person experience to put in this document.

The conditions in FTC are ripe for vendors to enter the market. However, what there aren't the right conditions for, is innovation, growth, and development. New products are developed and released all the time by the major non-FIRST partnered vendors, but they are pretty exclusively either different versions of older parts or extremely safe mechanical parts that are analogs of other, older parts. It's understandable why this happens, the entirety of product R&D is dependent on the whims of a GDC that seems to change its mind from month to month. The constant guillotine of the Q&A hangs over the head of anybody daring to actually put time and money into R&D. They don't answer hypotheticals, nor is a ruling on a hypothetical definitive.

The combination of the Q&A opening so late into the season (effectively a month *after* kickoff), **the game manuals being written in an extremely vague way, rules being made up on the Q&A** (universal joints being legal despite clearly having multiple degrees of freedom, as well as products being banned for rules not present anywhere), **randomly banning parts, including mid-season** (1 degree of freedom lead screws and 1 degree of freedom claws being banned for having "2 degrees of freedom"), **and all the other barriers in place, create an environment nearly *perfectly* designed to prevent thinking out of the box.** (There are more examples in the document linked at the end, there is too much to talk about in this short CD post).

Perhaps this was the intent, after all I get the feeling COTS rules are designed with non-FTC specific vendors in mind. Maybe the possibility of a company deciding to plant itself into the program and wanting to interact with FTC in a major way never occurred to them. However, it makes figuring out what the GDC actually intends incredibly difficult and dangerous. For

example, while the concept of game challenges is mentioned in the Game Manual, it is not defined there nor in previous Q&A answers, and, to my knowledge, autonomous localization being a game challenge is not mentioned anywhere nor would this be expected given the Intel T265 (a camera promising all in one complete localization) is legal. This did not stop the GDC from ruling it as such on the Q&A, banning a mechanical part that aims to accomplish a subset of what a camera sets out to, while, on the same year's Q&A, declaring the camera legal.

So what do I want to see changed? I think the surface level change that will probably have the biggest impact is a rule similar to I101, MAJOR MECHANISMS in FRC. Spell out that you want MAJOR MECHANISMS banned with a list of exceptions, and stick to it. This is certainly the option most likely to happen, but I don't think it addresses or solves the fundamental issue here.

I think communication needs to be massively improved between vendors and FIRST. Not necessarily emails, I understand the challenges there. However, at the very least, there should be a Q&A open before the season starts, when Game Manual part 1 releases, to ask about product legality questions. This is still very late in the product development cycle but at the very least allows some flexibility and breathing room, as opposed to when legality is decided at earliest a month after kickoff. (Sales data indicates that there is a massive spike in orders right after kickoff, which starts leveling off almost exactly when the Q&A starts answering questions).

And when I say open before, I don't mean a week before kickoff. I mean when Game Manual part 1 releases. **And let vendors have Q&A accounts so we can actually ask questions rather than hoping teams ask them and not mess them up** (the exact wording of questions has led to very different answers in the past)**.**

The absolute best scenario would be for FIRST to allow vendors to email them and work privately to explain the intentions behind rules. This will absolutely never happen, but would be above and beyond for figuring out where you can concentrate R&D efforts. It can also open dialogues with vendors which I think would be useful for FIRST.

If this feels like a summary, that is because it is one. There is so much I want to discuss here, so many pieces of history and evidence and context I want to say, but this post is already insanely long as it is. I have a pretty substantial breakdown of the history of FTC, Vendors, COTS, and "How we got here" as well as many more modern examples of the GDC's opinions. It is quite long, but it is there if you want to read more..

As an alumni of this program, a mentor of this program, and a vendor of this program, I am asking FIRST to recognize that its current course of action with vendors has issues. The current state of the program is bright, it's promising, but it can be better. There are changes that can be made to introduce more vendors to the program, who are able to bring costs down and increase accessibility for everyone.

I recognize that my perception may be biased, being a vendor with a financial stake in the program, but this is an opinion that is held by many members of the program, many alumni who

have left, and many mentors continuing. This is a viewpoint that has been talked about behind closed doors outside of public view for years. I want to bring it forward for more to see and discuss, in the hopes that change is made.

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