Team #33 –Killer Bees FIRST Robotics Build Season Journal

Jim Zondag – Team Leader

FIRST Season #16 - 2011

This is my daily log of the 2011 FIRST Robotics Season for Team 33 - the Killer Bees.
This document is basically a stream of consciousness, written in real time with daily entries as we move through the season. Most of this is from my own selfish perspective, according to my personal set of priorities as the team leader, chief engineer and coach. These notes are focused on the Robot design, build, strategy, and competition; not the Chairman's award, Website, PR or other supporting activities. These other items are very important, but I am not involved with them enough to attempt to document their progress.

Jan 7, 2011 – Are You Ready?

Only one day to go. Hold on!
I think we are as ready as we are going to get. The shop is stocked with materials, the software packages are installed, our fall prototyping efforts have been very successful, the students are buzzing with excitement, and I am more or less caught up at work. I have been working all through Christmas break and every day since New Year's to get ready for this season. Tomorrow we will be hosting a big kickoff event at the Chrysler Museum for all our students, families, sponsors and supporters. So far we are expecting nearly 100 people, but it may be even more. We have 18 new sponsors this year, which is unbelievable considering where we were 6 months ago. I have a few items to gather up after work and then I am going to be done preparing until everything hits the fan tomorrow.
This year, after several years of uncertainty, I think we have the right formula for success. We have the right leaders, we have the right students, we are properly prepared, and we have the cash. I am not going to pull any punches or make any excuses this year. I know what it takes to do this right, and I am going to demand nothing less this time. Everyone keeps saying they want to win, this year we will find out for sure how bad they really want it. No holds barred; knobs to 11! We are going to adhere to our ideal build process as tightly as possible, which requires a fully functional robot with all systems at 30 days, with two complete machines at 40 days. We have been getting closer to meeting these goals each year, this year I know we can do it. We have a great group of students and a couple of new mentors this year, so I think we will be able to turn it up another notch. Time will tell.

Jan 8, 2010 – Kickoff – Day 0

LogoMotion!, Good Game! I expect it to be a blast to play.
The team outdid themselves with the kickoff event! Very impressive! Over 100 people in attendance at the Chrysler Museum Theater. There was huge enthusiasm and support with lots of sponsors, alumni and parents present. The parent group put on a great party. Initial Game Impressions: FAST. Every scoring action may require a full field traversal and return. This means that we will need high top speed and very fast acquisition and release times. The premium for scoring on the top row is big enough to make this a first priority every-time. Managing traffic flow and tube sequencing will be the keys to getting a high score with tubes. The minibot end game will decide a lot of matches: If your alliance can

get 50, and the other alliance gets 25; that will swing most matches. The championship will be won by a team with a lighting fast Minibot and well-timed release. I want a robot which does not have to turn around to score. I am very happy that our fall chassis development project can be used almost verbatim in this game, which gives us a huge head start. I do not believe that the ability to translate will be a huge deal, but it might be a minor advantage. This game will be won on minor advantage and well planned execution. Big open questions from this afternoon:

Can you score two pieces on one peg?

Can you score two logos on top of one another?

Does the Minibot have to be self propelled or can you launch it? -- This is huge.

Our process requires: Strategic Targets -> Functional Objectives -> Machine Attributes -> Component Design. We use a standard V-model process for both design and verification. We must have a complete understanding of all strategic options before we can take the first steps toward setting our objectives. Now I am off to read, sketch and plan for a few hours. Objectives will be set tomorrow.

Jan 9, 2010 – Day 1 - Sunday Strategy Session at my house:

Yes it is Day 1. The Killer Bees always start with kickoff being Day 0…why? Because our team leader (me) is a Software Engineer and old school 8 bit guys like me always start counting at zero. ☺

This meeting at my house is an annual tradition and it helps me figure out who, out of students (and adults), will really be driving the process this year. The students who show early leadership now that the "real deal" is here will usually turn out to be the front runners for the Pit Crew, Comp Team, & Scouts.

We had a great discussion tonight. About a dozen team members came out and worked thru a lot of points. Our offensive strategic target is **to be able to score a minimum of 78 points by ourselves,**

with a stretch goal of 90 points. There are 158 possible points available, but the scoring function yields serious diminishing returns after 122. Our defensive strategic target is less specific (we don't really intend on playing much D, but we always set this anyway): **Be able to push aside or hold any robot with which is not specifically designed to be a defense specialist.** Our list of design objectives, in no particular order are as follows.

1. **Must** be able to Score tubes on all 3 levels. We all agree that the top level is the only one which really matters but protecting for all 3 can be easily done given other requirements.
2. **Must** be able to handle all 3 types of tubes with the same end effector without active selection.
3. **Must** be able to score tubes on any top peg in automode. This means that line following will likely not be our course of action.
4. **Want** to be able to attempt 2 Ubertubes in Auton. This is a stretch, but it offers a 12 point advantage and will likely be an open opportunity in many matches.
5. **Must** have at least 2 drive gears.
6. **Must** have solid high traction stance AND easy turning ability. The game clearly will involve high speed running, rapid zero point turns, holding ground, and pushing through defense.
7. **Must** be able to pick up tubes from the ground of all 3 types, regardless of tube orientation.
8. **Want** to be able to take tubes from the wall slot
9. **Must** be able to hang any type of tube, in any orientation.
10. **Want** to be able to take tubes over the player station wall.
11. **Must** be able to collect tubes from floor even if line of sight is blocked.
12. **Want** to be able to take tubes from over wall or slot from 'over the back'. The approach area is too narrow to do a zero point turn with a standard size machine. Should we cut the corners?
13. **Want** to be able to pick up tubes from floor from both ends.
14. **Want** be able to indicate to driver if robot is aligned to scoring pegs.
15. **Must** have indicator device on robot to indicate desired tube type to human player.
16. **Must** be able to self-center to pole base for mini bot deployment with indication to driver.
17. **Want** to have automated mini-bot deployment at exactly 10 seconds if aligned and armed.
18. **Want** to be able to score from both ends without turning around.
19. **Must** have a superfast mini bot!!!

From these design objectives we proceeded to set number of functional targets on some robot tasks:

1. Robot must be able to complete a 'scoring run' in 15 seconds or less. A scoring run is defined as departing from HP station wall, traversing field, scoring and returning to ready position for another tube, with no opposition or traffic obstruction. Power/weight calculations indicate that times as low as 10 seconds are possible.
2. Robot must be able to lift an obtained tube from the floor to the height to score on the highest peg in 1.5 seconds or less.
3. Robot must be able to perform a 180 degree zero-point turn in 0.5 seconds or less.
4. Robot must be able to push a 150lb robot with a kit chassis/wheel design sideways on carpet.
5. Mini-bot deployment device must engage pole in 0.5 seconds or less.
6. Mini-bot must ascend pole in 0.5 seconds or less. (This assumes a 'projectile type' mini-bot. I suspect that this may be outlawed in update 1, but for now, this will be the target).

The team agreed that pursuing a multipath mini-bot development plan would be best. We will probably make a motorized Tetrix bot and a projectile. We should plan to build multiple Tetrix bots and make it an internal competition for the students involved.
The 60" circle rule in the rule book looks like a big limiter on design options. There is a contradiction in this rule already noted on ChiefDelphi. We will have to wait till update #1 to know for sure. 84" would make it much easier. Every year FIRST restricts design flexibility more and more…I don't understand why. Time to start the serious CAD work, but much of the Chassis is pretty much already done!!!

Jan 10, 2010, Monday Day 2. Strategy & roleplaying

Today went very well. All the students were very engaged and we had a great strategy discussion.
A number of things we suspected turned out to be supported by the roleplaying exercises.

1. The Auto-mode is big. If there is a way to do multiple tubes, we should go after this.
2. Traffic flow is difficult to manage. If anyone decides to mess with you, it will seriously limit how many runs you will do.
3. It is easy to hem others into the laneways and in their own scoring zone if you try.
4. Many chokehold strategies work fairly well.
5. Communication with the Feeders, and advanced planning of game play with the other 2 alliance members is more important than in any game we have every played.
6. Far fewer tubes will be scored in the main part of the game than many suspected.
7. Tube throwing ability is very important, and completely changes the game dynamic.
8. Once the 6 top tubes are scored, there is little motivation to keep scoring; instead, priority switches to insuring that the mini-bot bonus is secured.

Thus the best strategy appears to be to score as many Ubers as possible in Auton, then very quickly score 3 tubes on the top row. If your partners can help with completing the other top logo, then take it if you have time. Do not continue scoring too long! As soon as possible you must get past mid field to be in position for the end game while at the same time preventing them from doing the same. All 3 team members working in concert can lock in a win as long as 2 teams have mini-bots.

After the strategy session, the student leaders and mentors stayed on to talk about design. Chassis decisions are made, objectives for other devices are agreed upon. Materials will be ordered tonight.

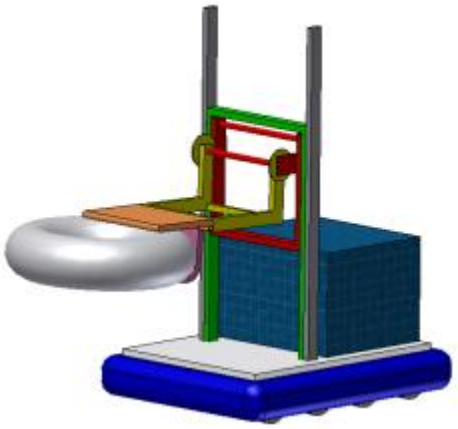
Jan 11, 2011 Tues Day 3: From Strategy to Design:

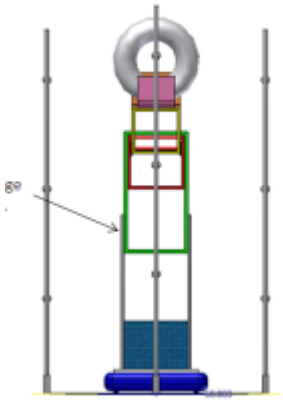
Great Design discussions tonight. We reviewed results of roleplaying and then broke the team into 4 groups. Each group had 45 min to develop a robot design concept, then each presented to the team. We had 2 teams bring back concept which are basically what I have drawn up, but not shown them yet. Each group put a lot of thought into their concept.

We took a break mid-evening and inventoried the kit and then deployed a group to help Dr. Deporre with field assembly. This is awesome. The Deporre Family worked over the weekend and built all of the field elements. Some Items had to be assembled on site, so the group put these things together. We have most of a field and the carpet is laid down. A few more small details and we could practice (if we only had a robot).

Update #1 came out…No Rocket Mini Bots, they must be self-powered, bummer! We revised our ascent time target to be 3.0 seconds or less. We will have to study the power/weight equations and build rules of the Minibot more to see if a more aggressive target is possible. The 60" rule expanded to 84". This will make it easier for the rookies, but we probably wouldn't have needed this change for our design. I expect this change to encourage more teams to build "Barricade Bots". Too many of these and the game could devolve pretty badly. I hope FIRST sees this weakness in the game design, but I suspect that they do not (yet).

I did a lot more CAD work late at night to refine the details of my overall design. I think what I currently have sketched this is the way we will end up deciding to go tomorrow, so why not. Ideas are cheap at this point.





Jan 12, 2011 Wed Day 4: Design Selection/ mockups begin

Today we did a group exercise on a weighted decision matrix on the overall design selection. 5 design concepts were rated and we had a clear winner (as expected) with the hybrid elevator/short arm/roller collector design. This design rated nearly 50% higher than the others. Now that this decision is made, we broke into groups and did some real work: The end effector group started on a mockup to determine design requirements for roller diameter, roller RPM, pinch, width and depth. Chet has a simple design for a wooden property to quickly define the targets for these. The Minibot team did a lot of math to determine climb time, deployment time and vehicle mass. Isaac estimates that sub 3 second climb times are possible, but we have a lot of estimation on these numbers. As soon as we get the Tetrix kit we can determine if these estimates are realistic. My team spent some time defining the total list of

vehicle systems and desired software features. Then we went over a bunch of design details on the chassis, elevator, and arm. The goal is to get EVERYTHING except the collector and minibot system COMPLETELY designed by Monday. We want to go at warp speed this year. The key to this game is to very quickly post a solid score on the pegs and then be prepared to own the towers by being the first ready. Skills training with the drivers is of upmost importance, so I want to be done building in 30 days as originally planned. I obsessively restate this goal to the team very often.

Day 5: Thursday Jan 13, 2011 – Mockups

We summarized the decision results from last night and then reviewed the CAD models. Everyone likes it, so away we go. Now we built mockups of the collector and some minibot deployment concepts. The hope is that we can do a collector with a single powered roller and a slip roller deck (simpler and lighter) but I am a skeptic on this. I suspect that a dual powered over/under roller will be what we ultimately choose, but I like to try to start simple and add complexity rather than the other way around.

We selected motors for all the machine functions and began calculations for ratio selections and gearbox purchases. Andrew has refit the practice chassis with a CRIO and rewritten the initial control code in LV. Work is now beginning of setting up the software architecture for the complete feature list and communication requirements between the various domains. This is great that we can do production Feature development in Week 1.

Day 6: Friday Jan 14, 2011 – CAD, CAD, CAD

No team meeting tonight so I spent several hours doing CAD models of the elevator and chassis details while watching TOY STORY3 with my kids. Models are going great and so far no major surprises. It looks like it will be a straightforward build, with the exception of the Mini-bot system which I expect to see iterated several times.

Main machine feature detail summary so far:

Chassis System: 8 wheel drive with independent pneumatic articulation on rear wheel set.

Drive line: custom 3-motor, 2-speed gearboxes, Super-Shifter derived innards.

Elevator: dual stage, Bi directional 2" Drum winch with 2 20:1 Rs550 Banebot motors, 3:1 FDR.
Arm: 12" shortarm with 90 degree elbow & 150 degree swing, dual Denso motors with 2:1 reduction.
Collector: 16"W x 8"D dual roller design with pneumatic release. Single FP motor with 16:1 gearbox.
Docking plate: 16" wide aperture with pneumatic release, spring deployed w/ locking end stop.
Minibot Sled: 22"sliding extension, spring deployed with pneumatic release, locking out stop.
Indicator lights: 5 color indicators for 3 tube types, active end indicator, and chassis mode.
Minibot: specs unknown, but will likely be little but a battery, two motors, two wheels, and a switch.
All designs, motor selections and gear ratios have individual spreadsheets outlining the supporting design assumptions, power calculations and safety factors.

Day 7: Saturday Jan 15, 2011 – Construction begins.

Full day of work on Saturday #1. By the end of the day, we had a Gen2 Collector mockup done, and 3 variants of Minibot deployment systems. The Tetrix stuff came on Friday, so the Minibot group tried to make a minibot with some success. More work is needed on design side of this once some key principles can be determined. Palardy got the Labview version of our closed loop velocity controller working on the robot along with all the active ride management stuff……awesome. Chassis and Elevator teams were able to cut stock for the entire frame and elevator system and machine all the features and have it ready to weld by the time we left. This is a record for us to have structural components for full custom design of 2 major systems done in the first week. I want to hold this pace, I suspect component availability will be a limiter in week 2, since AndyMark, BaneBots, and OnlineMetals often have delays of several days. I will try to plan the workload to focus on what we can do without some of these materials now.

The field is built, we have 2 complete racks, a loading station and 2 poles. It is awesome to have great parents like Mike D and Jim S who will just come and take care of this for us.

Day 8: Sunday Jan 16, 2011 – Detailing

I feel terrible today; I think I picked up the flu or something from someone. This happens to me every year in week 2 or 3. Oh well…nothing to do but power through. I did a couple of hours of design work on my own in the afternoon, mainly on transmissions – customized 2 speed 3 motor adaptation of an AM SuperShifter. The math says it will make a noticeable difference on vehicle acceleration. I still find it amazing how our selection of great off the shelf items improves every year and how much this streamlines many of the decisions on design details compared to 10 years ago. Way to go Andy! Today is the first day for my 2011 Church Cadet program, so I spent a couple of hours preparing stock for a woodworking project for my group of young boys.

Day 9: Monday Jan 17, 2011 – Mentors and Leaders meeting

Today was a school and work holiday. I worked on CAD models for several hours during the day. I got the entire frame, lift, string paths, shoulder and forearm all completely designed. I ordered parts in the afternoon before I went to CTC. I am still dragging, but I feel like I am getting better already.

At CTC, the Leadership team met and reviewed the design and a number of management items. Our financials are great and we just got another sponsor. We did a detailed review of many of the design hardpoints and everyone is on board with the plan of record. Biggest open issue is how to apply the minibot to the pole, which will take more experimentation this week. Isaac and Tim hold the keys to our success. We will have a kick-butt scoring machine, but it all comes down to the minibot. They have more mockups to do before we can lock in any hardpoints on the minibot or the deployment system. Student Sub-team assignments were determined and I think the groups look good. Eric will run the Chassis team this year, which is a big change, but it will free up a lot of my time to make sure we do everything else right. Culver finished the powered collector mockup tonight and already has a list of ideas for another one. Andrew put a gyro on the robot and started working on some fusion code to do orientation control along with the encoders. Auto alignment with Camera is next .

Isaac and I got the frame welded and first stage lift carrier welded up tonight. If we had the rest of the metal I have on order, we could be done with both. Sent files for first batch of parts to the waterjet room before I went to bed so I can be at the front of the line tomorrow.

Day 10: Tuesday Jan 18, 2011 - Small parts

As suspected, we are waiting for some parts to come in, so I put the team on making a bunch of small items we need: Roller mounts, pulley mounts, hub adapters, etc. Lots of machining going on, everyone is working hard. Some of the students need some serious skills training, but we have great student leaders this year, so I think the inspiration is properly in place to make this happen.

Tim did more work on the deployer, and is closing in on a solution. A big A-HA moment occurred when we realized that we can grab the pole whenever we want, not just during the end game, so we can have a 2 stage system if we wish. This will make the ability to be pre-align much easier. Tim's team is proceeding with development of a 2 stage device; Stage 1 deploys to grab the pole, Stage 2 applies minibot to the pole.

I had to leave early tonight to go to a Church Council meeting. The rest of the team continued to work.

Day 11: Wednesday Jan 19, 2011 - Development

Design attributes for the collector are done! 6" pinch with movable lower jaw for fast release. As expected, dual roller design was required to get the floor pickup action we liked. Production design detailing will commence tomorrow. Rollers are mounted on the elevator stage, Pulley brackets are made. Material for second chassis arrived today so we will cut and detail these tomorrow. I want both frames and elevators done by Saturday. Electronics layout started, and sensors have been ordered.

Second set of Minibot parts arrived, so Minibot team can start doing parallel development.

Tim is closing in on defining the attachments for the minibot deployer. Palardy got the Camera working in greyscale to find the retro-reflectors, so we should be able to auto-align to the target if needed, although it is rather high bandwidth, even in grey-scale. I want to attempt a full ded-reckoning system again, just because I take pride in begin able to do awesome things without high-technology.

I have a huge work assignment which I need to do now, and it is already 11:30pm; it's going to be a long night.

Day 12: Thursday Jan 20, 2011 Framing Done

Frame elevator is welded to frame and first stage is installed! The complete set of parts for the second frame and lift are cut and ready to weld. If we had the waterjet parts, we could be driving the thing in a few hours. We still have to make the winch and pulley mounts to get the lift going. All the kids are working pretty hard. I think we are a little behind on the Minibot, but this is a good project to develop building skills on, so we can catch up quickly and easily make standalone upgrades. Chris's group worked out many of the production design details on the collector, made a partial CAD model. They are planning to get what they need to build a production version. That should start Saturday.

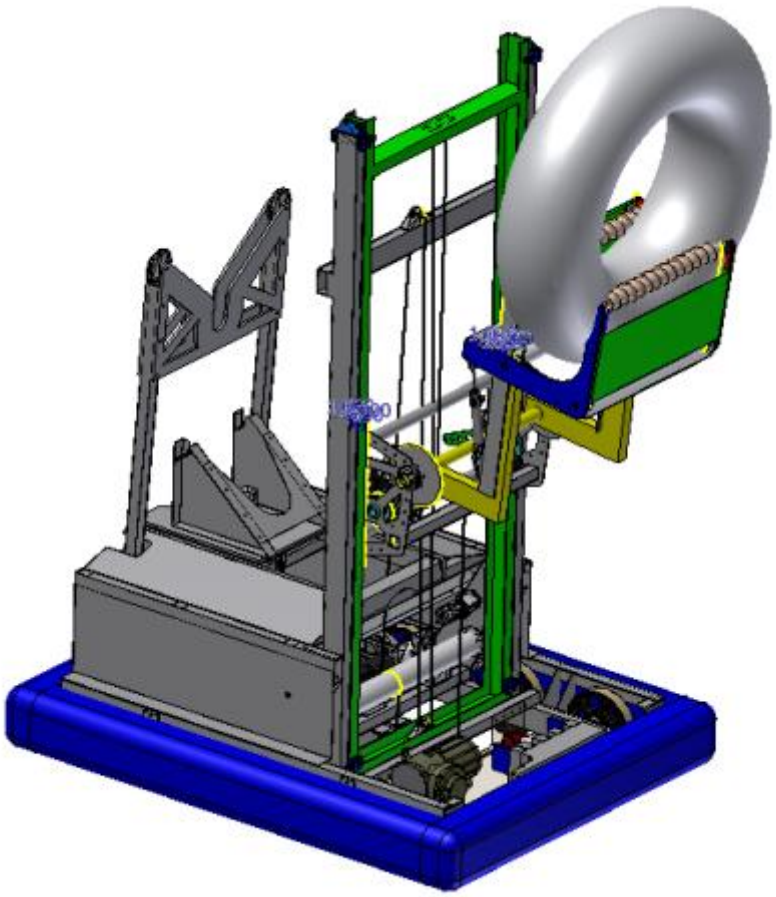
Palardy got the CMUCAM working on the test vehicle, we have some work to do to get it to properly talk to the Crio, but there is some promise of offloading the image processing. Even in low-res grey-scale, the Crio bogs down noticeably when you try to do any real-time image processing. The CMUCAM is a last chance at trying vision; but I am still a skeptic.

Tim's team looks like they have settled on the flip-down pole aligner, and a slide-out minibot action. I will now begin designing the mounting brackets for this so we can kickoff production of the remaining perimeter frame pieces.

Day 13: Friday Jan 21, 2011 – No meeting, CAD Work

Our parts are delayed for a couple of days on the Waterjet machine due to a big backlog of real work that showed up. We expect the parts to get cut Saturday, which means we likely won't have them till Monday. This means I will have to get more organized for tomorrow and make all the little stuff. No worries, plenty to do. I reviewed the mini-bot deployment system with Tim this afternoon, I think we have enough defined now to finish detailing out the hook, release, and the supporting framework.

I made a bunch of shop drawings of parts tonight so we can kick out some parts tomorrow.



Day 14: Saturday Jan 22, 2011 – The Best Laid Plans….

Well, Kyle called me at 8:00 am and said that the Waterjet machine went down and must be repaired. He will let me know Monday on an ETA for parts. This is the downside of using automation; you become more subject to technical difficulties. If there is any serious delay, we will start making some of the simpler parts by hand on Monday.

Eric also will not be coming today due to car issues. It is about zero degrees F outside today, so I don't envy him. I guess I will run both his crew and mine today.

We got a lot of work done today. We started out with an overall design review with the whole team and then started fabbing a bunch of small parts for the chassis and elevator. Isaac's team got a Minibot working…about 4 second climb time, we have a target of 3 or less based on the math, but this is a good start. Tim's team got the relationship between the pole alignment device and the minibot sled all worked out and build a wood mockup representing both systems and demonstrated it on the tower…looks great. I think we will have to work hard to get the inlet aperture as big as possible. Based on last year, I want this to be 18" wide or so; the distance between the driver and the target is almost twice what it was in Breakaway, and we can't afford to miss. Chris's team has a solid design for the collector and started making the production rollers. Palardy had some success figuring out how to get the CMUCAM to properly find the reflectors and then automatically align the robot to the rack...this is pretty good. There is some sort of bug in the new Encoder VI that keeps messing with the driveline

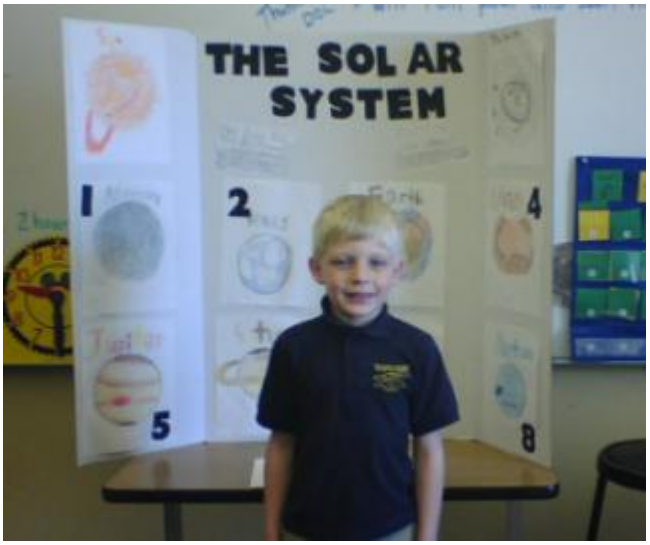
controls. I think we will just code around this rather than wait for NI to fix it. Both Chassis and Elevators sets are now welded, belly pan and rollers are installed on one of them.

Day 15: Sunday Jan 23, 2011 – 1/3 of the way through.

No meetings on Sundays. I did a bunch of CAD work today on pop out alignment arms on the pole dock, it might work. My parts are all designed, so I may as well apply spare mental bandwidth to any remaining issues. I will review this with Tim tomorrow. He will likely have similar ideas.

I did a lot of research on parts and components we might be able to use, I am getting close to having a final parts list. Everything we need is in the mail. I think we are done with ordering parts except Pneumatics and some sensors.

I worked on my son Isaac's science project: the Solar System. He is pretty scientific for a 7 year old and wants to go to space when he grows up (I will have to talk to Lavery about this).



Day 16: Monday Jan 24, 2011 – Misc Small sheet metal parts

Still no water-jet parts, Backlog of real work took priority (as it should). The machine is back up but it will take a couple of days to work through the logjam. Tonight we were pretty light on leadership. Despite having lots of mentors this year, I seem to be having more issues than usual on having leaders show up when expected and on time. There is always some unpredictability on this, but it seems more noticeable this year.

Tonight we got a lot of the sheet metal brackets for the chassis structure made and attached to the first frame. Parts will be assembled to the second frame after we get wheels on Unit 1.

Neither Chris nor Chet were here so Bryan headed up making production rollers and axles for the collector. Tim is ready for final design and we will start making parts for the frame to support his hardware tomorrow. Minibot is still at 4 seconds, I think we are at a point where we need to start making a "good" one properly.

Day 17: Tuesday Jan 25, 2011 – no meeting in more ways then one.

Well, tonight is more or less a bust. The intention of the Tuesday-off was that we would get together and meet as adults so that we could make sure that we were all on the same page. This worked last year, but this year, already on the second meeting, no one feels the need to actually show up, which basically negates the whole intention. This further reinforces my belief that the moment you make anything optional, you get much lower turnout. I think I will terminate this practice and go back to the way we used to do it.

Tim stopped in and we went over a couple of details on the interfaces to his parts. This stuff all looks like it should go smoothly. We will make the structural parts tomorrow. I spent an hour reviewing the design, made a few small parts, and then went home and worked up complete detailed design on the collector. If Chris shows up with a design on Wednesday we will make his, else we will make mine. We must keep pushing forward as fast as we can.

Availability of Banebots parts will likely be one of the limiters on the full vehicle test timing.

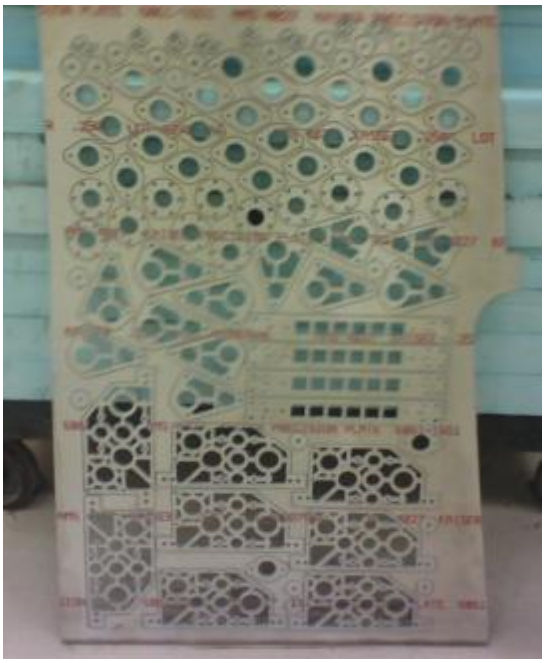
Day 18: Wednesday Jan 26, 2011 – Parts are here!

I am getting crushed with real work this week, making any planning for Robotics very hard. Also our new Chrysler IT policy keeps expanding its evil influence, and now I cannot order parts from several of my preferred vendors because I can no longer access their sites from work. Oh well, one more thing to do in the middle of the night.

Waterjetted parts are done! We got a big batch of parts and are good to go! Release the minions! The students spent a bunch of time deburring and polishing. We set all the bearings and axles, and then built up the wheel assemblies. Eric is still out so I ran the Chassis and Elevator and Collector groups again. We got the lift carriage built up and installed, and the winch drum. We can finally start working through the big pile of parts that have been burying my workbench while waiting to be assembled.

We discovered that there was a dimension error on one of the transmission plates, so I will have to get them remade. Bummer, but this will not hold up progress, because I set up the frame to take both our custom gearbox and a stock AM gearbox, Just in case…..this is the case. We will swap transmissions when I get new plates. Tim's group is now cranking out the production pole grabber. Mini-bot is creeping along, their team seems to like making parts, which seems contrary to the whole concept, but I trust that they will get it right soon.

I had an 11:00pm conference call with the FIRST in Michigan staff to go over some policy items. No rest in the build season!

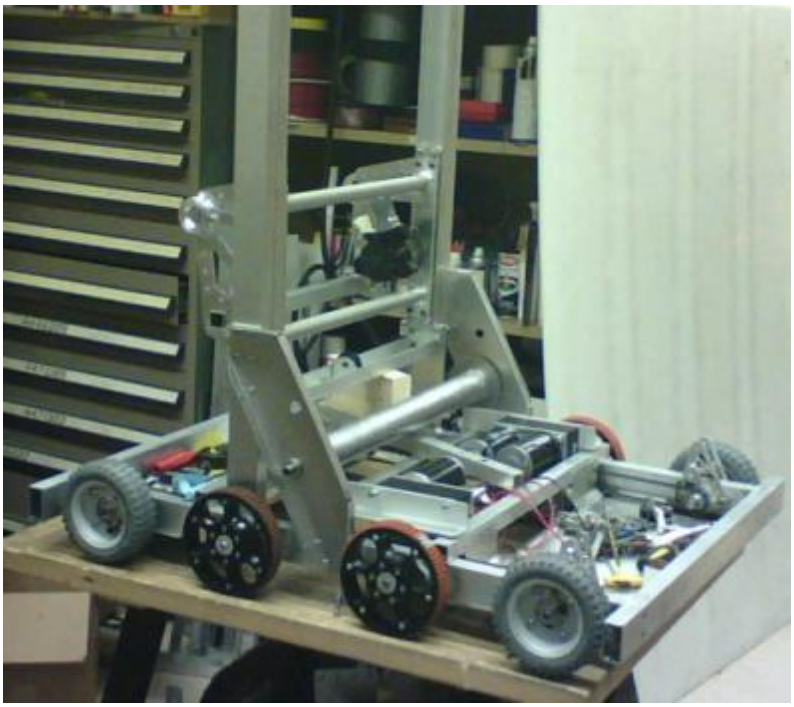


Day 19: Thursday - Jan 27 2011 – Rockin and Rolling

Great night….everyone was on fire today. We started the evening with a Talent show. This started off as joke a week ago and then somehow took on a life of its own. Matt did a Karaoke, Joe played Sax, Erin played violin, Elizabeth and Ashley did a skit, Lazlo played trumpet and Demi tossed swords…..awesome. We have such an energetic bunch this year. Then we got down to work. I have seldom seen so many Bees working in the shop at the same time. Wheels are on! Chained up and gearboxes are in. Lift carriage is welded and installed. If we had electronics on board, we could drive it, and if I had my Banebots order, I could make the lift work. The lift is awesome; smooth as glass!. Chris' team made the plates for the collector jaws so we should be able to assemble the production collector very soon. Team Tim made the rear frame and the docking plates and are working fast. So far, everything looks like it is going to work out and there are no looming disasters. I haven't made any design changes in about 24 hours, so we must be close to done, or blind to reality…..time will tell. The Minibot effort still concerns me, but it is small enough that sweeping changes can be made in little time. I have to work on some of the electronics/pneumatic packaging tonight to make sure that everything will fit. I want to maintain the ability to put the battery in front, middle, or rear for CG and balancing, so this means I need 3 variants of these packaging studies.

We are now on the hook; Louise and John have decided to do a "Ship day event" and invite all the sponsors. So I guess we have to deliver now….it's not like we weren't going to, but now we gotta make it look good. I think this is good, because now I have an even bigger lever to crank to insist on getting stuff done.

We are probably going to lose Dana for a while, her son was diagnosed with cancer and she is going to leave town for a while. This puts our website development plan in jeopardy, but we will be ok. We are all praying for her and her son.



Day 20: Friday Jan 28, 2011 – Ready to Roll

Morning meeting with FIRST NH and FiM Board…ugh... It is hard to rationally discuss anything with people who treat this sport like some sort of religion. I am always amazed at the NH leaderships' apparent lack of true awareness of the motivations of the teams. Maybe I can see this better being the only person involved who actually runs a team and builds robots. It seems that a few small statements backed up by a wealth of data is the only way to effect any changes with this group. Slowly but surely we do actually make incremental progress.

We had a small group meeting today to try to get some stuff done with a small group before the big push tomorrow. We got the forearm motors in, and the winch is now ready to be strung. It appears that we may have a slight issue if we decide to go with the varying wheel types, the diameters are not all exactly the same, so the ride height adjustment is not quite right. I can fix this by making new pivot forks, but I will wait till at least Monday to kick this off. We will do a weight rollup tomorrow and see if we think we can just use 8 pneumatic wheels. If I make new forks, I will make them adjustable as I should have done in the first place. We are going to drive it tomorrow!

Still waiting for Banebots parts, but so is every other team I know.

Day 21: Saturday Jan 29, 2011 - **First Drive!**

Awesome Saturday, we all were cranking out major work all day! This year's team continues to impress me. They can stay on task better than many groups we have had in the past. We drove the machine before lunch, performance is as designed…fast and nimble, I love it. We got the elevator strung and powered. It can almost meet the functional targets with only one motor; it will have two when we get the BaneBot parts. The forearm is welded and installed. Fast. We tested the lift on the field to make sure it met the reach high scoring targets and it does. Tim's team got the first set of all their deployment hardware done. Chris got the first collector fully assembled. Pole dock and Minibot slide

are done and should work. Production electronics, pneumatics, bumpers and body work are still needed, but everything else on the main bot is built. 95lbs so far, which is within 2 lbs of the estimate for this stuff. Much of the hardware for the second robot is also made, but it is still just a pile of parts: we have a lot of welding and assembly still to do. Palardy, Chris and I went over the electronics/pneumatics packaging plan this evening. It looks like there is a place for everything.

The Minibot continues to trouble me. I have seen 4 second minibots built entirely out of Tetrix, yet our group seems to insist on spending many hours machining custom parts only to result in an inferior solution. Isaac does not exactly have the best machinists on his crew; we will likely have to re-deploy some people in week 4 to move this forward. Small things can often be devilishly complicated.

Day 22: Sunday Jan 30, 2011 - No Meeting

I spent about 2 hours mocking up a Minibot and deployment sled with Lego to get a handle on what Isaac is dealing with. This is an unusual situation and I feel partly to blame for this. This is the first time I have made no attempt to design a portion of the robot since 1999. Usually, I do design and ideation on all robot systems with a decent level of detail in week one. Typically, we use a lot of content from the rest of the team, but I always set a personal design base line for all features every year, until now. I think because the Minibot is a separate vehicle, I kind of mentally ignored it. This was a mistake, and no surprise, it is the item which is lagging. Time to end this. The Lego mockup gives me a good idea on where we need to go. We will discuss tomorrow.

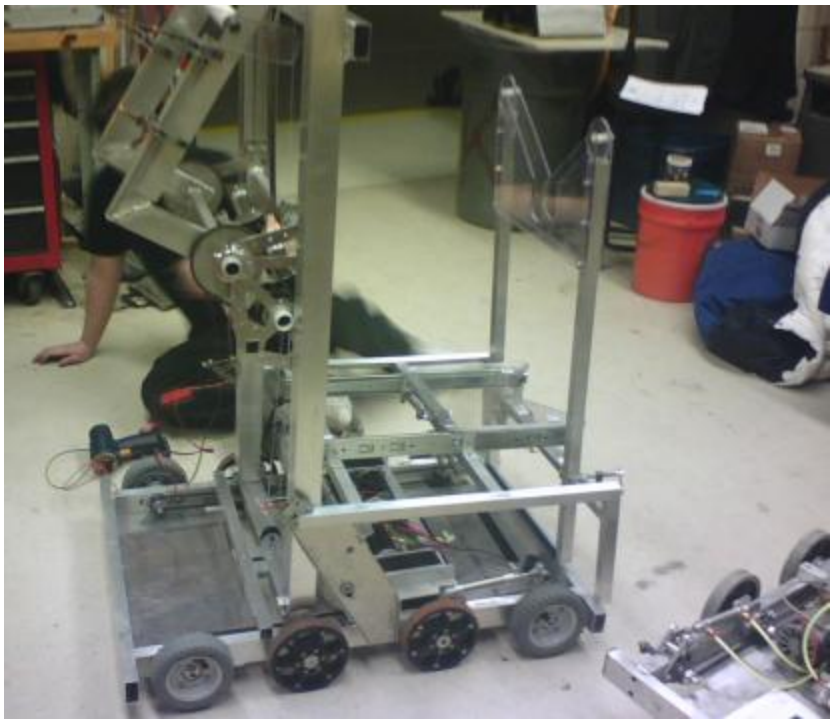
I did a bunch of Labview work on overall framework so that Andrew and I can push everything out quickly. I will try to let everything be entirely his work this year, but I want to make sure I have tighter understanding of exactly what we are actually implementing. Last year was a little loose.

Woodworking class with the Church Cadet crew tonight….awesome. I had 15 kids tonight. We used the bandsaw, drill press, and router table. We cranked out 15 DVD racks in 1.5 hours: not bad for 7-10 year old little kids. Some of them are getting pretty good at shop skills for 2nd graders. Maybe I should have all my FIRST kids do woodworking for a few months before jumping to metal…just a thought.

Day 23: Monday Jan 31, 2011 - Half way point:

Today marks the mid-point of the build season. I think we are more or less on track. First robot is mostly complete. Still no Banebots parts, but once we have those, we should be able to play the game with robot 1 within a few hours. Second machine is coming nicely, it is still a pile, but most of the welded assemblies are now done so it should go together quickly. I did a review with Isaac on Minibot principles and I feel better about their design direction. We did a little work to re-gear the Tetrix motors to get a better output speed the more closely matches a realistic wheel speed. With this design, a ~2.0 second ascent should be possible. Collector team got the collector more or less put together, we should be able to test it tomorrow.

The team was pretty locked on today and everyone was making lots of parts. I need to get the second bot going so that I can cut down on the robot Campfire that now starting to happen.



Day 24: Tuesday Feb 1, 2011 – Light meeting

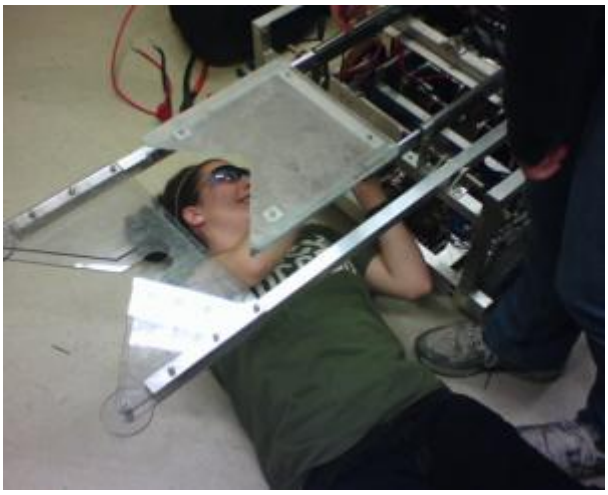
Again, the whole Tuesday thing does not work. I tried making this back into a regular meeting today, but because it was already on the official calendar, pretty much nobody came: I guess paper trumps reality. Even though this is supposed to be adult coordination time, only a couple adults showed. I was hoping to go over the collector with Chris, but he is not here. I hope we don't regret this later (but I already do). Matt and Bryan showed up at my request and we make some parts and got the some of the production electronics in. We will wire it tomorrow.

Day 25: Wed Feb 2, 2011 – Snow-pocalypse!

Death Storm 2011 is upon us! Actually, despite 3 days of hype, it was pretty lame as I expected! Usually when they predict a major snow event in Detroit, I divide the predicted amount of snow by 2 and that is usually what we get. The "Worst Storm in Years" turned out to be only about 6-8 inches. I had to take the day off because my kids had no school. I did a lot of real work from home….I swear I am more productive if I don't go to the office sometimes.

Turnout at the meeting was light as expected with no school at NDP. Still, we got a lot done; sometimes less is more, especially in the Bot-cave. Robot is wired up; Andrew did a great job and most of the electronics are in. Isaac got the V-style Minibot working and it is a fantastic start. It tests at about 2 seconds and there is still a lot of optimization which can be done. This is a winning concept, and I am very happy to see some solid progress here! Tim's team kept working on the second set of parts. The latches/catches are the only major development items left on Tim's stuff. Bryan demo' d the collector, nice work so far. They need to tweak the pinch a little and increase the overbite a bit, but it can easily pick up all 3 types of tube. It is currently about 9 lbs which is way too much, so we will

have some work to do to lighten it up. There is a lot of opportunity for weight reduction on the current design, so this should be easy.



Day 26: Thursday Feb 3, 2011 – Let it Snow, let it Snow, Let it Snow

NDP had no school again today, but we had a good turnout anyway. Electronics and detailing on robot #1 continues. Tim's docking plate and Minibot sled are now integrated onto the first machine. The Second frame now being built up with chassis and elevator hardware; so far so good. Bryan continued work to finalize the collector. I think all of the details are now set. It can pick up all three types of tubes on the fly at any orientation, so it meets the functional objectives we have set. We will work this weekend on a lightening plan. The Minibot team continues on lighter weight versions of two different designs. My Banebots order has finally shipped, so we will finally be able to build up the rest of the systems. There is a big business opportunity in FRC if anyone can make a competing product in the small planetary gearbox area. Hmmm.

The shop is degenerating quickly when we are working every day. We need to do a big cleanup effort on Saturday or risk being buried in junk.

Day 27: Friday Feb 4, 2011 – Someone call Security!

Well, it finally happened. Every year, we wonder when CTC building security will start questioning us and what the heck we are doing in the building at all hours; that time has come. Tim and I met with the security director this morning and discussed imposing new entry/exit policy for all students and parents. At least the tone was good, security wants to work with us, but we will probably have more bureaucracy coming and going every day. Oh well, just one more thing to manage.

No meeting tonight, so I spent some time at lunch working on bodywork and styling. We need to figure this out to avoid any redundant panels for bodywork vs. electronics. This should be a cool looking robot. It looks like Tim had the same idea because he had some foam-core body panels duct-taped onto the machine when I stopped in the shop at the end of the day. His thoughts appear to pretty much match my sketches. I spent an hour after work going over some shop inventory and putting the carrier stage in the elevator in robot #2. Tomorrow we will put in the belly pans and lift drum assembly. I was happy to see my first Banebots shipment sitting on my doorstep when I got home. CIMulators, but no P60s yet. I expect them Monday according to UPS. I may decide to build Robot #2 with a CIMple Box and CIMulator instead of a P60 for the lift, depending on how tomorrow goes.

Day 28: Saturday Feb 5, 2011 - Finishing Robot #1

We did a lot of work today. Not as much as I had hoped, but still pretty good. Campfire effect (everyone huddling in a circle around the robot) was very obvious today. I spent most of the day working with Eric and the kids on the second machine to try to eliminate this problem. Palardy finished up most of the last wiring details and on Robot #1, and it is now drivable with all the production content. Chet showed up today after an extended illness and gave some advice to the collector team. They played around a lot with the exact pinch geometry to see if any further optimization can be done. I think we are about done with collector development and this is about as good as it can get. Isaac's team got a revised version of the V-style Minibot to clock at 1.75 seconds! This is great. Now his team and Tim's are starting to finalize the details on the carrier/deployment sled which applies the Minibot to the pole. We went to the EE lab so the kids could solder dip all the 6 gauge power cables. Kids always love to stick things in a huge vat of liquid molten metal. We took a brief tour of the Waterjet room and Kyle showed them the machine and explained a lot about how it works and what it can do; great stuff. I had to leave about 2:00pm to drive up to Canada tonight for my Father's birthday. Eric, Isaac, and Tim were still working with a group of kids when I left. Eric was working towards getting the 3 motor Gearboxes built up now that we have the parts. I was happy to find a box with my P60s waiting for me when I got home. Now we have everything we need to finish both machines. Major white-out blizzard was beginning just as I was leaving….great!

Isaac just texted me as we are slogging our way through the Canadian Snow: Robot is at 117 pounds! There are a couple of easy pounds of opportunity, but we have some pneumatic valves and some other misc. stuff, plus body panels to go. We will have our work cut out for us tryinbg to make weight once again! Oh well, this is more or less normal for the Killer Bees. Every machine we ever make is 119.9 lbs, so I guess this one will be too. The 10-15 lbs. of wiring, electronics and pneumatics have a way of creeping up fast. After this season, I am going to do a teardown/weigh-in project on the

practice bot so that we can get realistic weights in our database for all of the KOP and standard COTS parts we use.

Day 29: Sunday Feb 6, 2011 - Snowbound in Canada.

Yet another Superbowl where I did not see a single second of the game. I stopped paying attention to NFL football over a decade ago, so no big loss. We were in Canada all day and my family are really not football fans. Hockey yes, football no. My kids all had a blast playing with all their cousins. I did a little pen and paper work to make a list of "still to do" items and possible weight savings avenues, but that was pretty much it. This was the first day since kickoff where I didn't put in several hours of work on the robot project. Tomorrow is Day 30, and we are supposed to be done on day 30. We are pretty much there, but a small amount of assembly is still required. We are a couple of days behind my ideal schedule, but most of the gap has been due to Banebots lead times and Waterjet downtime, which are difficult to anticipate. The amount of welding, while not a lot in this design; is still a process bottleneck, especially when making 2 machines. These are some things to consider for next year. Maybe I can learn to TIG aluminum over the summer to allow some more options and speed up some of this. I can do it in a pinch, but not very well with my rusty skills.

Day 30: Monday Feb 7, 2011 - OMG it is Day 30!

We are supposed to be done today, and we are almost there: I impressed on the team that being done making parts for one robot does not mean that we are done and that making parts is not the same as making robots. Robots require iteration and vehicle development. I want everyone to work hard now so we do not have to in week 6 (or week 7,8,9,10…..)! Weight reduction efforts will continue, we should be ok, but I like to impart a little bit of low level fear of doom to really get people motivated.

Today's build meeting went pretty well. We got chains, wheels, and transmissions in Robot #2. Banebot Motors are in on the lift, 3 motor gearboxes are in on Robot #1, and all of the pneumatics are

installed except for the valve manifold which I am still waiting for from Motion Industries. Chairman's award submission is currently under review, and both WFA submissions are also pretty much done. Carolyn has done a great job timesharing the team and getting most of the core documentation is done in 30 days as planned. There are still a lot of reviews to do, but the submissions are excellent already. The Minibot team continued to forge ahead. The revised magnetically coupled V bot keeps getting faster. They finished the first version of the carrier for it, and demonstrated the application of the Minibot to the pole…awesome. Tim's group now has 2 full sets of hardware completed for the docking arm and deployment sled. Everything appears to be done except for one latch which is being redesigned, and continued lightening efforts on these parts. Chet worked with the collector team to kick off production of 2 copies of a lightweight collector based on the finished one. I spend most of the evening working on the second machine with Matt, Kitty, Eric, Andrew and Steve. The progress is a little slower than I had hoped, but Robot 2 is almost ready to drive. I think tomorrow we will steal the Crio out of last year's robot. I hate the fact that the NI control system is so expensive. Even with a lot of sponsors, it is hard to justify spending $1000 to keep an old robot alive. I will probably refit the 2010 bot with a Vex Cortex system at some point after shipday.

Day 31: Tuesday Feb 8, 2011 - Two weeks to go!

Lunchtime phone conference today with the mentors. Good discussion. We will start making Competition Phase assignments soon. We did a lot of review on the key points of the design and everyone seems to be on the same page. Brutal amounts of "real work" this week. This is good in the big picture, because it means that the company is getting busier, but I will have to lose some sleep tonight to keep from getting buried.

Again we had a light turnout on a Tuesday, but most of the people we really needed were there. We did a lot of routing cleanup on Robot #1, and put on all the bumper brackets and other sheet metal work on robot #2. Lightweight Collector #1 is done and works great. I intended to get it permanently bolted on to Robot #1 today, but we didn't quite get there. My son has a big science project he is working on, so I went home so I could review his work with him. His presentation is on Thursday, and he is very exicted. We heard back that Dana's son is doing better than originally projected, so that is a big relief to the team.

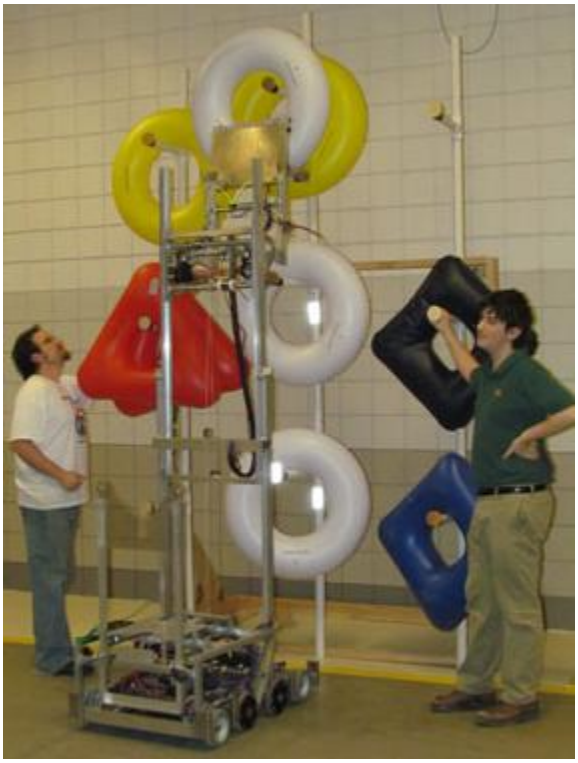
Day 32: Wednesday Feb 9, 2011 – Birthday in the Botcave!

Yes, today is my birthday. I don't advertise it, but everybody always finds out anyway. Matt got me a cake and it was pretty cool. My best present?....Pneumatics are here! These are the last remaining parts we need. Robot #1 is basically done except for body work and weight reduction. Lots still to do, but the "making" is more or less done. We spent a lot of time doing sensor and calibration work tonight. I think this is important to get right before we spend much time practicing, since it will help prevent any bad habits from developing in the drivers. If the robot is going to be semi_autonomous, then I need it this way before we start any hardcore drills. I spent most of the night working on Robot #2 again; trying to make sure it is on time and done right. I decided that I would save my precious Banebots transmissions for spare comp bot parts and I made a winch motor pack out of 2 CIMulators and a CIMple box for Robot #2. . The kids dubbed it the "InCIMerator". Lift system on #2 is now done, and if I had a second collector, we could play with robot #2 with only some wiring and plumbing cleanup

left to finish. We spent some more time working on lift counterbalancing with constant force springs on #1, and it now goes up faster than it comes down. More to come on this. Isaac managed to blow up a Minibot by getting a safety string caught in the wheels…no big deal, but the Tetrix parts are rather unforgiving. We will have to be careful at the events and have spares ready. I think that a lot of the team is getting tired, everyone seemed a little slow tonight, myself included.

Day 33: Thursday Feb 10, 2011 – Day 33, this is when the magic happens!

How cool is it that on Day 33 we have 100% complete machine integration and can now drive, score, and play! The machine continues to develop as we calibrate the sensors and systems. So far I am happy with it but I want to aggressively pursue adding all the automation now. We added more content to the second bot and it is now ready to be wired up. We have some details to work out on the controls but we are underway. We geared down the forearm by 30% to accommodate the heavier than expected collector. It still meets the performance requirements with the lower ratio, and we hope to have a second collector built on Saturday; all the materials showed up today. We confirmed that we can pick up tubes at full speed every time. I still need to design another counter spring for the elevator to make it stay put without brakes. It is close, but needs a little more assist. Isaac proved that the Minibot delivery system can successfully apply a Minibot to the tower with very high speed. Nice! We still need to adjust the ride height stops before we can really dial in the dynamic chassis systems.
So far, I love this machine. I am getting geared up to play, and so are Matt and Kitty.



Day 34: Friday Feb 11, 2011 – In the balance.

No team meeting today. We had a mentor phone conference at lunch which was very productive. We set priorities for Saturday with the intention of cleaning up a lot of loose ends and making sure our ducks are all in a row. Everyone seems to be on the same page. I need to send one last small batch of parts to the waterjet for spares and upgrades.

After work I went to the shop and figured out the right spring balancing ratio to get the elevator to hold at any position and arm angle without needing any power to hold it. I mocked this up on Robot 2, and then made a quick design of the parts to productionize it for Robot 1. We will make these parts tomorrow, but I need to order more springs for the second robot.

Day 35: Saturday Feb 12, 2011 – Hang 'em high!

Big day today! Had students officially sign up for CA presenters, Scouts, Pit Crew and Comp Team. I think we already know who we will give most of these assignments based on how everyone has been demonstrating ability so far, but it is good to get confirmation of interest. We actually made bumpers and brackets today, which are a first in week 5, usually bumpers are on ship weekend. Robot one is done and the electronics team calibrated the sensors and started on tuning the systems. It collects great, scores quickly and the geometry and speed of all the actions is good. The team spent a couple of hours on the practice field working techniques for hanging tubes and getting the set-points defined for all the automate positioning. I think we will have to work on the tuning of the chassis articulators a lot more to get the thrashing out, but this is mainly to improve how it looks and sounds; it works very well even without these improvements. I am not sold on the pneumatic tires, I was a skeptic from the beginning but some of the students really wanted them. I don't like how much bounce we see on an 8

foot tall machine. It is workable, but it looks inferior to a firmer stance. I think we will try it with higher tire PSI and also put it back to 8 plactions on Monday and do some A/B testing. We save about 2 lbs with this change too, so it may end up being an easy choice since we will likely need the weight. The collector team now has two complete lightweight collectors being assembled, with the first one weighing in a nearly 5 lbs less than the mark 1 design…nice. We started putting final electronics in Robot #2, but kind of stalled out because we were so distracted by the awesomeness of Robot #1 being tested. If we had to ship in 3 days, we could be ready, but I am very grateful for a full week of time to iterate. I am very glad we had the money and desire to push the process faster than ever this year. We still have some weight reductions to pursue, but it looks very do-able that we can make the target without major reworks. Tim's group started on final body work and Team Isaac has most of a second V style Minibot completed. The actual mini-bot seems a little slower than some of the original tests indicated, but certainly sub 2.25 second times are realistic with this design, provided the tires are good. The CA team had some great new ideas for the Chairman's video. A bit late, but it doesn't really take too long to put together a 3 minute video. It should be very cool if they go this way.

I had to leave at 6:00pm to go play pinochle with my church group. I had a great night playing cards and got a big score by taking some rather large calculated risks; again proving that "chance favors the bold".

Day 36: Sunday Feb 13, 2011 – Final to-do lists:

No meeting today. I spent about 2 hours going over the models, software, specs, lists, charts, etc, and compiling a week 6 To-Do list. Everyone on the team knows what they are doing but it is good to make sure that I am not assuming anything on testing or other activities when we get this close to the finish. I will distribute these assignments tomorrow.

I want to see if it is possible to do the R-W-B indicator light controls via I2C to avoid putting all the spikes on to do this the old fashioned way. I have to re-read all the rules on this to see if it is legal, I suspect it is not; again the FRC build rules stifle creativity for no apparent reason.

Church Cadet woodworking class tonight. I had 16 little kids tonight, and we did a scroll saw project. Lots of fun and everyone got their project completed with minimal chaos.

Day 37: Monday Feb 14, 2011 – Valentine's Day, Feel the Love:

The dreaded Week 6 is here!! Actually, in all our history, this is probably the most comfortable I have ever felt on this day. Maybe I am delusional or just numb. Actually, I think we are in pretty good shape, plus we had heart shaped chocolate cookies today. Andrew wrote up a to-do list on Saturday night which matched mine fairly well, and we started working towards implanting many of these software items. The robot scores great, and we now have semi- representative driver interfaces to start training on. All of the collect, scoring and release automation is in place. We spent a solid couple of hours on the practice field testing and practicing. Matt and Kitty are getting pretty good at scoring already. We all agree that we need to try out some tire swaps tomorrow to find the right combination of traction to dial in the dynamics. Right now there is too much lateral traction on the 3rd set of wheels and we get a lot of hop on zero point turns when elevated. In the shop Tim's team built a new Minibot holster for Isaac's group. We finished the bumper mounts and we should be able to play with bumpers

tomorrow. I now have a killer head cold going, but I refuse to admit that I am sick at this point in the season.

Day 38: Tuesday Feb 15, 2011 – One week to go!

This is it, the final week. Still going strong. The robots keep getting better and better. We changed out all the wheels on Robot 1 and I like the performance much better. I still want to try 4 KOP wheels on the center 4, but for now we are set. We added a spring assist cam to the forearm, and the performance is now to spec…> 90 degrees /second. This is awesome! There is a little bit of lateral slop in the elevator that I want to shim out, but this can wait. We did a test on Iron-on transfer for bumper logos; this will work great and look great, so we will make bumper covers tomorrow. We tested the Minibot a couple of times and the variability due to tire wear scares me. It is very important that the Minibot successfully climbs the pole every time, regardless of the speed. Even in last place, it is always worth 10. The new Minibot holster looks good and I think we will keep this design. Robot #2 didn't change much today, the Minibot team was using it as a fixture so no one else could really get at it. We will start final wiring for it tomorrow. All the awards submissions for WFA, CA and Dean's List went out tonight, which is excellent. Full field robot testing shows we can consistently score tubes on a 15 second loop: Score, go to human, return, score again. Obviously this will not be possible in a real game with defense and traffic, but this meets all the functional targets. We will start on Auton tomorrow. Now I must lie down because this cold is killing me.

Day 39: Wednesday Feb 16, 2011 – Calibrate good times! Come on! Let's Calibrate!

Today was a pretty good day. The programming team spent a several hours making incremental improvements to all the systems, tuning and calibrating. Autonomous can now score one tube very reliably, and seems to be 100% or very close. Now we will start working on doing 2 tubes. The goal is to do this with no camera and no field referencing sensors. The odometry routines are now very accurate and very repeatable. We can make this robot drive straight as a bullet, even without a gyro. Probably the biggest thing here is Andrew's new scripting setup. We can now update auton by sending a text file via FTP to the CRio without any reprogramming. Amazing! I love it! This allows us to make sequencing updates in seconds instead of minutes, which is HUGE for iterative development, and competition environments. Work continues on second bot, and most of the wiring is now complete. Bumper graphics are on and bumpers will be finished tomorrow. Isaac's team managed to pop a Minibot off the tower and proved that the 10 foot drop test is actually survivable. Steve H is helping with Minibot fabrication now, which makes me pretty happy. The Minibot still seems to be our weak spot as a team, which is worrisome since it is the key to winning in our strategy. We have demonstrated mini-bots that can climb in 2 seconds, but have not yet verified that the complete system works. We NEED to do this tomorrow.

Car trouble in week six, of course! This kind of thing always happens when I have the least time. I went home at 11:00pm after Robotics and put a new fuel pump in our vintage minivan… Yuck! Nothing like laying on a freezing cement floor in a pool of gasoline in the winter. But once again, man triumphs over machine: van is fixed, wife is happy!

Day 40: Thursday Feb 17, 2011 – Design Changes

Major real work today, I hate it when my career interferes with Robotics ☺. After work, we did lots more development tonight and keep dialing things in. We practiced again for several hours and came to a couple of conclusions: A. We need better control strategy on the Chassis pivots, or we will run out of air pressure, certainly fixable. B. We can move the upper crossbar of the middle elevator stage up and get a couple of benefits; Extended reach, reduced offset for arm, better stability ,lighter weight, and still will be able to reach over the back to get the tube from the loading station. The current extension of the forearm kind of scares me, if it takes a hard hit, it will bend. With this change we will be able to reduce the overall weight of the robot, and make the forearm more robust. We discussed this in week 1, but decided to wait and see. Now we will see. We are going to try to crank this change out tomorrow. I think we can safely gear the machine up a bit, I will work on a plan for this. Andy does not sell the gears I want so I will be stuck with making them. Honestly, it may not be worth the trip, with 6 robots on the field higher top speeds will likely not be reachable due to traffic. Bumper covers are all on and robot is starting to look good. Now I must rest, last night was way too late.

Day 41: Friday Feb 18, 2011 - Making the change.

Small group tonight, only a few kids since no official meeting on Friday. This was great because we knocked out the design change for the lift. We fabricated and welded the whole new middle stage, tore the whole elevator apart, put the new stage in, re-did all the string paths, shimmed out the carrier, and then put the whole thing back together. This took several hours, but it went much faster than it would have with the whole group present. The changes make a big difference and the overall quality of the new assembly is much better than the original. It is tight and very smooth and now has 8 inches more

vertical reach, allowing us to safely cut 5" out of the forearm, ,making it lighter and stronger. Tomorrow we will re-qualify all the calibrations and practice with the changes. Steve and Matt worked on a new Minibot design, it seems like this will be an incremental reliability improvement over the current one. Iteration continues. The team is doing great, and everyone is very excited by our progress so far.

Day 42: Saturday Feb 19, 2011 – Final Push.

This is the last full work day for the team before Ship Day. The big stuff is done but there are a million small details left. The whole team was pretty locked on, and the students have no school next week so no one has homework or any other conflicts, so lots of kids put in overtime today. The team re-calibrated all the lift set-points and we got some good solid practice time in. Drive team is getting pretty good. We did human player tryouts and I think we know who we want. We have a list of student members now for all the key roles. We will announce these on Monday. Team presented Carolyn's WFA submission at lunch, great work. We reviewed the new website, which is a major improvement over the old one. We had a major Chinese food feast for dinner tonight. Tim has all bodywork done except for stickers. Layouts for decals look great. Best news of the day: Final weigh-in at 119.5 with everything!!!. This is awesome. I still want to get a pound or so out to do some more things with panels/ graphics but we have no "need to do" things left on the weight deck before ship. Second Robot is done except for attaching the collector. Collector team took forever to get this assembled today, but it was ready to go on when we left tonight. We will calibrate it tomorrow. It is official that Robot #1 will be the competition bot. It has a few advantages over #2 and I am not sure we will even bother to make the lift upgrades to #2 anyway. New Steve/Matt Minibot is consistently at 2.5 seconds or less for entire release/deploy/climb action. We did this dozens of times and it is great. I love having a ship weekend with no crisis (knock wood).

Day 43: Sunday Feb 20, 2011 – Incremental Improvements.

We met with a small group this afternoon. We did a lot of continuous improvement and improved the handling of the robot a lot with improved filters and speed dependent algorithms on the chassis controls. We had a lot of debate on driver controls, and what we do and do not need. Less is more in my opinion on driver controls. We also proved that we can now score in both directions with the new elevator geometry. We will work on an inverted autonomous mode next, with the objective to be better situated to possibly hang 2. It is great that we have several hours of stick time in already and have broken nothing. This is a very well-built machine. Good work by all today and the drivers continue to improve. Minibot system needs more surgical tube, but other than that, everything looks good. Huge snow storm tonight, school tomorrow is closed already so we will see if this messes up any of our final plans.

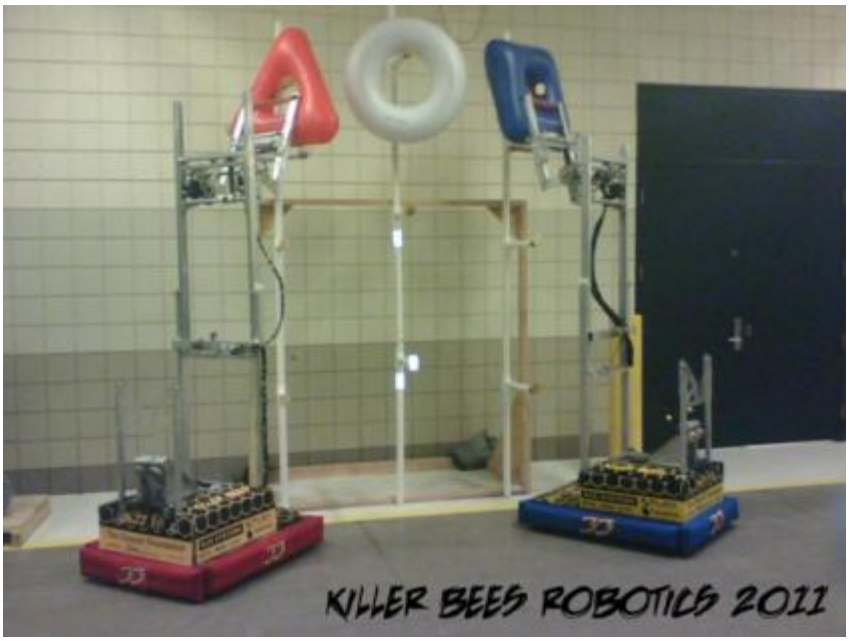
Day 44: Monday, Feb 21, 2011 – Last real meeting.

Tomorrow is Ship day, so this is it. We did a lot today. I took the day off of work due to the storm, and then I got a babysitter in the morning and I went in to build robots. A bunch of kids came in at 10:00; they don't have school all week: winter break. We finished up a lot of loose ends on wiring and other little stuff on both robots. All systems on Robot 2 are now fully operational and calibrated. I basically

cleaned up a lot of stuff in the shop, and worked on a display unit for the pits while the kids got stuff done. The rest of the team showed up at 4:30pm. Comp Team, Scout Leaders, Chairman's Presenters and Pit Crew were all announced today. The students were happy. We will have a great group on all of these fronts this year. We went over some details on a plan for tomorrow's Ship day event. 60+ people are coming. I am hoping I can work it out with building security tomorrow morning. Tim laid up all the graphics for the body work tonight; it is going be another sweet looking Killer Bees Bot. We will probably add some paint later. The collector team had some concerns about overinflated tubes based on some of the scrimmages this weekend, so we adjusted the pinch out ½" and confirmed that we are good with overinflated tubes. I realized today that I never bought a second set of game controllers so we can't drive both robots at the same time. Andrew said he would get them tomorrow morning. We worked on autonomous some more in an attempt to work our way up to 2 tubes. We still have a way to go here, but 1 tube is solid. Minibot team was kicking butt today! They now have 2 units which can both consistently perform at under 2 seconds for the full deployment + Climb cycle. This is awesome! All of the Minibot retention catches, pull pins, and related features are now done. It is a great thing when my ship day to-do list has only software and stickers on it. Great effort by the whole team! Only things left to do is keep making it prettier, tune autonomous, work on driver skills, and of course, make more minibots.

Day 45: Tuesday Feb 22, 2011 – Ship Day Celebration!!

Great Event, Great day! The Ship Day event at CTC was awesome. We had probably about 80 people there, plus we had a lot of Chrysler people pop in, including a bunch of top executives. Louise, Janet and the other parents put on a great snack spread. We demonstrated the robots, thanked all our many supporters and generally made the whole program look great. The students were phenomenal, and proved once again that they are definitely getting the things we are trying to teach them.
Final prep on the robot concluded very well. The sponsor logos went on right before the big show so all the beautification is done, and it looks great. The Minibot team confirmed repeated drive-in deployments on the practice field and can consistently get 2 second cycles. We finalized autonomous tuning and got the 2 tube sequence dialed in. We did it successfully many times. It still has a little dependency on battery voltage, we will work on this. The Drive team can now deliver tubes on a 12 second loop time. So at this point, we have essentially met every strategic and design objective we set in week 1. We will see if this holds true in combat. There was a brief scare when we slammed into the player station and everything quit working. Upon investigation we found a tiny metal chip in the Digital sidecar…even with protective covers, frags can get anywhere. Problem solved quickly. We shot some video for the team movie short that Bryan is working on, then did a short photo shoot at 11:30pm, and then put it in the bag. Build season #16 is now at an end, and it was a good one, perhaps the sanest one ever! I am looking forward to playing at Kettering next week.



Day 46 - Wednesday Feb 23, 2011 – Reflections

So how did it go? After a night of rest and a half a day of contemplation, here are my thoughts:

Overall I would give us an A- for the build season. Not quite perfect, but we are definitely getting there.

We were certainly a step up from the past number of years in a number of areas:

- Strategic objectives were set properly (I hope) ,
- All required functional objectives are met, as well as many on the wish list.
- Documentation was all done on time,
- Student engagement was very good,
- Parent group support was outstanding!
- New team website is a big improvement
- Robot CAD design was completed on time,
- All devices designs were supported with solid math data and analysis.
- We utilized many items from our “design shelf”, which sped up development greatly.
- Prototyping efforts were timely and successful in defining key attributes of system designs.
- Most of the parts were built to print and worked successfully on the first iteration,
- Scrap ratio was about as expected,
- Final robot assembly was completed only 3 days behind ideal schedule,
- Pre-ship software work including an advanced autonomous mode and was completed on time,
- Pre-ship driver and HP training objectives were met,
- Robot as shipped meets all function targets, including weight.
- No extremely late night or panicked rework sessions.
- Future improvement list is very short.

I think we benefitted greatly from a game which facilitated concept re-use from prior games. We had less raw invention required this year than we have sometimes had in the past.
That said; we have some areas where we can improve our process and our team operations:

1. There were a number of parts which were never actually designed. Instead they were "cobbled up" on the spot. Not surprising, almost all of these were among the last parts to be completed. The lesson here; Take the time to complete the ENTIRE design! It will save time in the end. What we really need is more skilled CAD users . This will take planning and training.
2. There were a couple of occasions this year where I hesitated when ordering parts. In every case of this, I regretted it later and ended up waiting for the parts in question, which ultimately wasted time. I am still a little cautious about accidental overspending after so many years of thin margin budgets. The lesson here; buy what you need as soon as think you need it. Unless it is something really exotic, it will probably end up as part of a future machine anyway, so today's overspending is tomorrow's savings.
3. Shop stocking: I should have bought more raw materials in the pre-season. Again, I was conservative due to previous lack of funds, but building 2 full machines can consume a lot of material. We need to make sure we have ample supplies prior to Kickoff to avoid any delays. The lesson here: make sure we are properly stocked and plan accordingly.
4. We still had too many things undone at the start of the build season. We got everything done, but many things in the website, video, uniform, business planning, and documentation areas can be moved forward on the calendar. The lesson here: Set target completion goals for non-robot items earlier in the year, even if the goal is just for partial completion of these items.
5. We had a lot of students sort of drift between groups this year. I am generally ok with this but in the end we had a few groups which had nearly been abandoned by all but the student leaders. In the future I will put the student group leaders in charge of policing their people more strictly, and we will make large print signs over each workstation with the members lists.
6. We did not properly distribute the skilled students throughout the build groups; we had a bit of clumping, resulting in the one group not having any strong builders, causing it to languish a bit. We need to watch this closer in the future when we make assignments.
7. I still have priority issues with the practice bot. Some people simply do not want to work on it once they know which is which. I think the only way to fix this is to truly build two identical machines, or to force the issue by telling people they cannot continue until both robots are at the same level.

These are all fixable issues, but we will need to commit to fixing them early if we expect them to ever go away.

Day 47 - Thursday Feb 24, 2011 – Practice Bot.

A couple of us got together this afternoon and did a little work. The main goal was to make sure we were all on the same page as far as the driver controls interfaces and the current state of the practice robot. There were a few late term changes that still needed to be made to the practice robot which we did, and then we went over the practice machine a bit to make sure it is ready to play. All good now. The biggest thing is that we never made the elevator design change on this machine. This prevents the

robot from reaching the center high peg with the shorten claw. So we have 3 choices: **1.** Put an extension in the claw mountings, **2.** Modify the elevator stage. **3.** Modify the rack for now.
In the interest of time, we will go with option 1 for now, and implement option 2 after Kettering.

Day 48 – Friday Feb 25, 2011 – Speed it up
After watching some video of the robot over and over, I think the single biggest thing we could do to improve the machine quickly would be to speed up the elevator. I deliberately designed it on the conservative side of the power curve (in 2008 we had a lot of unexpected binding in the lift). This one is much better made and has more spring assist. I can almost double the speed with a simple ratio change. This will be item #1 for unbag time. We had the drive team come in and practice for a while today. They get better all the time. We identified a couple of improvements we can make in the software which we will implement tomorrow.

Day 49 – Saturday Feb 26,2011 – Small crew Saturday
This was the first Saturday since kickoff where we did not have the whole team out. Basically, it was the Comp Team, Palardy, and a few mentors. We improved a few things on the practice bot, and I packed up a bunch of stuff to get ready for the competition next weekend. We made the parts for the lift upgrade. Andrew went through a lot of scenarios and made sure the software was properly interlocked in all cases to prevent the arm from crashing into the tower. The drive team drove for a bit. I think we are ready to start active defense training on Monday. We can use Buzz13 for this. I had to leave at 2:00 to go to a birthday party up in Canada.

Day 50 – Sunday Feb 27, 2011 – Bumpers & Lists
We got back late this afternoon from Canada. My wife, Lorianne, laid out all of the snap on fitted bumper covers and made one of them up as a test piece. It looks very good. This will be great; I hated dragging around two sets of bumpers last year. I worked up a "to-do" list for this week and a "to-pack" list for the events, as well as a final Bill of Materials for all the systems. I spent a couple of hours in the evening reviewing all of the LV software constructs so that I can more effectively give input on future improvements. Andrew is a very good programmer for an 11th grader.

Day 51 – Monday Feb 28, 2011 – Out of the bag.
Last full meeting before we play. Isaac did a big overview of goals and process with the scouts. We packed tools, parts, pit and spirit stuff. At 6:30, most of the students left and then we took the robot out of the bag with the core group for 2 hours. We pulled the elevator motors, made new chains, fitted new sprockets, redid some other small things, put it back together and then did some testing. Awesome! Elevator now does a full lift in about 1.0 second! Definitely worth the time. We retuned the calibrations for the lift, and then we put it back in the bag. Tomorrow we drive to retrain with the new actuation time.

Day 52 – Tuesday Mar 1, 2011 – Practice time.

We drove for a full 2 hours with the comp bot, which if you think about it, this is about a full FRC season worth of field time in one night. We have about 10+ hours on this machine so far which is a record for us at this point. Drivers are getting very good and the coordination between the two of them keeps getting better. We did final review on the team video. We will put this up on YouTube tomorrow night. Bryan did a fantastic job on this, and it is really cool. The Wolfmother soundtrack is great! Robot went back in the bag and we were home by 7:30.

Day 53 – Wednesday Mar 2, 2011 – You break it, you bought it.

We spent our last out of bag session tonight. We drove it like crazy and made sure that we were happy with Auton yet again. Ran 2 tube many times, never missed. We did defense training today with 2 machines and the team got pretty good at pushing through D to get in to score. We will see how much this matters soon. With about 30 minutes to go on our last out of bag session, the robot started making the classic chain jumping sound on forward to reverse slams. We haven't even checked the chain tensions all week and the 2 rear loops were visibly a little slack. Aluminum sprockets tend to run in a bit with use. I told them "keep driving, we will tighten all the chains at Kettering". Bad move. With about 5 minutes left to go, the machine jumped one of the rear chains and mangled it. Then we had to put it in the bag broken. Oops, my fault! I made a couple of new chains, we will fix it when we arrive tomorrow night.

Day 54 – Thursday Mar 3, 2011 – Load up, load in.

Kettering University: Event # 1 2011. We loaded everything up quickly and were on the road by 5:30, at KU by 6:30pm. There are a good mix of Rookies and veteran at this event. I love this one. Between real events and off season, I think I have played here at KU 15 times so far. As soon as we took it out of the bag, I replaced the two chains, tightened the rest up, and then let the pit crew check the whole thing over. They then went through inspection easily. We are undersize by a hair, underweight by 0.7lbs, and all legal. I always let Tim and the students handle the whole inspection process, so I spent a while helping some other teams with software and wiring issues. Isaac and Chris were both inspecting at this event, and they hooked me up with some teams who needed a lot of help. No surprise that with the re-tensioned chains, that we found that Auton needed some adjustments since the P gains were now a little off. Andrew and the pit crew worked through this on the practice field and got it right after a number of quick iterations. The FTAs did not get the field working before we had to leave when the pits closed, so no one got to do any real practice before we had to leave.

Day 55 - Friday Mar 4, 2011 – Let the games begin!

What a great day! Certainly the best starting day of an FRC season I have ever had, despite having to drive to Flint in a killer ice storm in the morning. All our hard work the past 2 months is paying off. We had a few little details to deal with in the morning, but by match #2, we were golden. We went 7-0 today, and pretty much walked through all of the matches. Machine is solid, and we are already getting major kudos from everyone. The team was very energetic we had lots of good spirit. Scouts got me all the data I need and our pick list is already pretty solid. Matt and Kitty are working very well together and very quickly found the right rhythm for this game. Peter is putting the tubes out in the right places

with the right timing. We hit the double tube Auton a couple of times, which is a huge crowd pleaser. I am a little surprised how many tubes are on the floor during gameplay, and also how bad everyone is at throwing them. Half the time, we are being fed tubes by our opponents. Penalties are stupidly over-applied again (no surprise), and the Minibot is way overvalued. I am kind of surprised by how few mini-bots there actually are, given its value, and also by the fact that many teams have what appear to be working minis with no good way to put them on the pole. Ours works great, and has won all its climbs so far. It is also the best looking. We are #1 seed at the end of Friday with a big lead going into tomorrow, and I think this is finally our time. Our OPR is 51 at the end of the day. A couple of other teams, 67, 2137, 2337, 51, look pretty good, but I don't think they can catch us.

Day 56 - Saturday Mar 5, 2011 – Victorious!!!!

We finally did it! After a whole bunch of silvers over the past 5 years, we finally took home gold! It was another great day! The team was on fire today. We had at least 100 team members, parents and fans in audience, and we were the loudest team in the room. We ended up 11-1 in quals (as always, we seem to blow the first one on Saturday), and we were #1 seed. Robot was nearly flawless. The tough part came when it was clear that HOT was having some serious reliability issues and we had to decide we could not pick them. This was a bummer because we have not been on an Elim Alliance with HOT since 1999, despite often being at the same events. We have never been able to pick them due to declines when the chance has arisen in the past. Oh well, maybe next time. We went with 2137(TORC), who are great; and #1 (Juggernauts) who were a sleeper. Great alliance! 2137 was best robot there and they really know how to play. We had a great strategy, and all 3 teams executed well. We had 6 wins and 1 tie through Elims. We played almost no D, and instead had #1 deliver tubes to us from the backfield. This worked great since it is just too crowded to have 3 machines scoring. The D against us was pretty ineffective. This was a great day for our team. We won the coveted "Quality Award" with is my 2nd favorite judged award. We now have 73 Michigan Ranking points which puts us second in the state after week 1 and already gives us a lock on going to EMU. Awesome, Just

Awesome!!! We will celebrate a little and then get to work making our team even better….I already have a list.

Day 57 – Sunday Mar 6, 2011 – A Day Off? Not yet.

Even though this is really my first day off from robotics since New Year's, I still spent a couple of hours arranging data for the FIRST in Michigan Ranking database, and also reviewing results from the rest of the events. I am the "numbers guy" for the State, and I produce all the official ranking data for all 10 events. I was a little behind on organization so I wrote a bunch of new VB programs to automate some of the report-out functions I need for the coming weeks. I also worked on some new analysis programs that I am not ready to discuss just yet. No surprise that 217, 2056, 16, 148, 1918, 175 and a few other usual suspects also won yesterday. Scores were similar at many venues, since exceeding about 110 becomes diminishing returns pretty fast. We can do 110s easily with a good partner. It will be interesting to see how this game evolves. Logomotion is pretty shallow as far as strategic depth goes, and after playing it, it seems even more so than I thought previously. It seems obvious that later in the season the only real thing you may be able to do to win against a great alliance is to try to block out their minis. But most of the good teams can already come close to maxing the rack game out in week one, so turning up the D may be the only way to move forward. Time will tell.

Day 58 – Monday Mar 7, 2011 – Reflections and Opportunities.

Today we had a full team meeting, everyone was very happy and had good things to say about the weekend. We did a Things Gone Right/Things Gone Wrong discussion with the whole team and got a good list compiled about what to work on for future improvements in all areas: scouting, spirit, image, comp team, robot, etc. Lots of opportunity for incremental improvements.

I already ordered a few parts yesterday, so we are going to wait till some stuff comes in before we do any real work. After the bulk of the team left, the core kids and I discussed specific skills training and robot improvement which would make us better. Key areas are tube placement, communication,

and Minibot deployment. We have a good list of stuff to work on. Much of it is software improvements for improved control and training drills. I will write these up as feature requests to Andrew so he can code them up before we meet again. They are fairly simple but will require some tuning. Tomorrow I may actually take a day off from Robotics, for the first time this calendar year. I think I have earned it.

Day 59 – Tuesday Mar 8, 2011 – Day off.

We had a phone conference at lunch with the mentors and outlined the workplan for the coming weeks. We have a pretty good plan, and the work is certainly do-able in the time we have. After reviewing all the video from this past weekend from our events and others, we have identified all the strengths and weaknesses relative to the other leaders. Areas for improvement:

Minibot Reliability – it is good, but must be perfect, new minis will be built.

Minibot Speed – It could be a touch faster (-0.4sec or so) but only if reliability is not compromised.

Autonoumous – We need this to also be 100%. It is close, but we should be able to make it near perfect. We also need a mirrored version of the double tube which works on the left side of the field.

Scoring: We need to improve scoring on the top row. Sometimes we waste a lot of time due to blocked line of sight. I think we can add a sequenced move to allow us to align with the middle row visually then autoscore on the top. Training with deliberately blocked view will help too.

Wheels: lighter traction would help in a number of areas. We will experiment.

Human Player: Peter is good, but must become better.

Driver training: Duh. We need to drive, drive, drive.

Day 60 – Wednesday Mar 9, 2011 – Wheels.

Short session after work. Tim added new springs to Minibot sled on practice bot: big improvement. We ordered some more springs of different types to try to further optimize this.

I built up 2 different sets of wheels for A/B/C testing tomorrow.

Today, the FiM FTAs and I discovered an error which occurred with the FMS ranking data last weekend. I spend about 2 hours recomputing all the W/L/T data from the raw match results in order to double check everything from the Kettering event. I found several small errors and reposted the data back to the FiM webmaster. We have never had an FMS data error before in over 2 years. I wrote a small VB program to cross check this in the future so that this can never happen again without being noticed.

Day 61 – Thursday Mar 10, 2011 – Upgrades.

We had comp team and pit crew in for several hours. We spend some time fixing up the practice bot and then we went to the field to test the upgrades. Big improvements. Andrew wrote a new feature to sequence a tube from mid to high peg with one press. This will help a lot when we are trying to place tubes on the blind pegs. We also tested several combinations of tires, and the rover wheels on wheel set #3 seem to be the best. We drove quite a bit to get Matt and Kitty to communicate better. They continue to improve.

Day 62 – Friday Mar 11, 2011 – Waterford District

I volunteered to be MC at Waterford this weekend. I am sharing this assignment with Grant Cox, who is also a great energetic MC. I started the morning being a supplemental CSA, reprogramming CRios and driver stations, fixing wiring issues, helping with inspections, etc. By 11:00 we had everyone through inspection. Once the event got rolling, we got on schedule fairly quickly, considering that we had 18 rookies, I thought this was pretty good. Rob Jenkins was FTA and was awesome as always. The day went pretty smooth and I did my best to pump up the crowd. Being MC can be a lot of work, but it is a lot of fun.

Day 63 – Saturday Mar 12, 2011 - Waterford Finals

Fun day! The conclusion of the Waterford event was a lot of fun, and the competition was remarkably good. Grant and I did a lot of fun dual mike back and forth announcing, and we really got the crowd going. The finals went to three and ended with the #5 seed winning, which is a rarity in the FRC. The minibots were the key as expected, with a 0.5 second advantage winning the event. 548 won both the tournament and the Chairman's Award. 548 has the fastest mini I have seen yet, at about 1 second climb time. We can benchmark some things from this design. Team 2834 managed to take enough points with their 2nd place finish to give them a lock on getting into States, which is great. We do a lot with their team and it is good to see them succeed after their rough start at Kettering. Carolyn was there both days and she is really getting into the whole "FIRST insider" thing. We have a tight core group of volunteers here in SE Michigan, and it is fun to be a part of such a great group. I compiled all the results from the event as soon as I got home,(I would have done it at the event, but I left my laptop at home), computed the updated statewide rankings and forwarded it to the FiM webmaster, Ed Law, to put on the official website.

Day 64 – Sunday Mar 13, 2011 – Pinewood Derbies

My in-laws were over this weekend, so I didn't do much FRC stuff on Sunday. I reviewed the weekend results from the rest of the events. No surprise that 111, 1114, 1503, 254, 987, 179, 233 and a few other historically strong teams were all winners this weekend. This game gives experienced teams a bit more of an edge than usual. I spent a couple of hours summarizing the penalty results from Waterford into a

report. 161 Penalties in one weekend, what a travesty! I really don't understand why the GDC designs games this way! Can't they see what a downer this is for the fans? I summarized all the results into a report I sent to the FiM board and hopefully they will send it on to FIRST. Maybe we can influence some incremental improvement in this regard.
Tonight my church cadet group, and the girls group all did session #1 of our annual pinewood derby build event. About 30 kids cut out cars tonight. It was lots of fun, and all the kids are excited. Everyone thinks their car will be the fastest. My sons have ambitions plans to build Star Wars ships yet again this year. If it motivates them into learning how to build, then this is great.

Day 65 – Monday Mar 14, 2011 – Prep work
The team presented the Chairman's presentation and the video script. Needs a little work yet, but they are on the right track and I am sure it will be great. After 2 weeks of Logomotion, I am convinced that the two areas we can gain the most from are Minibot speed and deployment, and Human player skills. We spent the evening reviewing Minibot design options and working on tube throwing methods. Good progress on both. Pete is getting better and the Minibot design looks very promising that we can really punch it onto the pole. Tomorrow we will work on driveline tuning.

Day 66 – Tuesday Mar 15, 2011 – Tuning
Good work with a small crew tonight. We did a 2 hour training session. We put a multistage driveline software filter in place which really cut down the trashiness when trying to score on the high peg . Matt says it is a big improvement, and once we had this in place and tuned, I saw a noticeable improvement in fine control while elevated. I think this feature will allow us at least one more tube per match. Every little bit helps!

Day 67 – Wednesday Mar 16, 2011 – Driving the wheels off
Another 2 hour training session tonight. I think we may want to speed up the elevator on the practice robot this weekend. It is still slower than the comp bot. The drivers' timing is sort of built around this delay, so I think this is worth doing. These machines are amazingly robust, and we have not really had to maintain them at all. This has allowed us to get a little lazy with maintenance and spot checking. At one point tonight, we literally launched a wheel right off the machine because the screw worked all the way out. No worries, but we will do a daily spot check on some key maintenance points before each practice session from now on. Late at night, the week 2 FRC top 25 vote occurred, and we are still in the top 5 on both the public and expert polls. It is cool to be noticed, we must be doing something right.

Day 68 – Thursday Mar 17, 2011 – Incremental Improvement
More driver training. We finished development on some new driver controls which allow for faster grab and release actions when performing tube delivery action. If tube starving becomes a common tactic, then fast gathering will enable higher scores. Isaac believes this will happen, and he is often right on strategic things. With the control changes, the drive team got much faster with a collect-then-score sequence. Incremental improvement is the key to continuing success. We started work on a new Minibot tonight. The one we have is good, but it will not be good enough to win at States. I am not really sure if Steve H is making one, so I am kicking off a new one direct drive one, with a combination of

all the best attributes we have seen so far. We made the motor shafts and completed the frame detailing tonight. I will send parts to the Waterjet tomorrow.
Bryan worked for a while tonight on a tube alignment device to center the tube in the collector. This looks somewhat promising, and we will try to get this on the practice machine next week. It will require a little automation to work seamlessly, but if it works it will cut down on the difficulty of trying to hang a very off center tube. Today Ed Law published the worldwide CCWM and OPR calculations, which is impressive because it requires a matrix inversion of a 2076x2076 Matrix and solve 2076 equations for 2076 unknowns in order to compute the results. Also impressive are out results: We are #2 on CCWM and #4 on OPR worldwide so far. If we had not had the unexpected air depletion issue in qualifying which cost us 2 minibot scores, we would actually be #1 right now. So close! So close!

Day 69 –Friday Mar 18, 2011 – Mini-botting
I spent about an hour at lunch finishing up the Minibot details and then sent the parts to Kyle to be cut on the waterjet. It is actually a simple design, but we have already proven that the devil is in the details with these minibots. The sooner we get this thing made, the sooner we will figure out how to make it better. After work, a rookie team called me in a panic and I stepped them through debugging a whole series of mis-wiring, software errors and other related blunders and eventually got their robot to work for the first time. I did all this over the phone, whew! This is like talking down a plane. It is very exhausting to debug by remote. This is, however, one of the great things about FiM and bag-n-tag: at least this team does not have to wait till their first event to drive their robot. In the past, they would have been doomed, and powerless to help themselves. They have a much better chance at some level of success because of the open time in their shop. Image if they had no access restrictions!?!

Day 70 – Saturday Mar 19, 2011 – Detroit District
We went down to Wayne State U to watch the Detroit district today. Good event. There was a bit of strategy evolution, but it pretty much played out as expected. Chickens were #1, and went with 51 and won the event. 469/245 alliance made them earn it in the finals, but is really came down to auton and minbots in the end. 469's lift is insanely fast! I was surprised at the level of inconsistency on many of the minibots, the deployments were less than stellar on many. It was good to watch an event for a change. 1918/27 won in West Michigan. 27 looked like they upped their game quite a bit and are now a serious contender. It is good to see that they, like us, have ended a long streak of seconds and finally took a gold. States should be awesome!!

Day 71 – Sunday Mar 20, 2011 – Chassis lift
I published all the FiM State wide standings this morning after church. 1918 will be #1 going in to States, no one will catch them due to the double win and 4 awards. I worked for a few hours this afternoon on a redesign of the chassis lift cams. The new design will be a nice upgrade if we decide to do it: Locking overcenter mechanism with over 1000lbs of max force. This only adds 3 extra small parts over the current design but makes for a big functional improvement. This might be a next year thing, but we will have the design on the shelf if we need it.

Day 72 – Monday Mar 21, 2011 – Team Meeting

Full team meeting tonight. We geared up the elevator on the practice bot, now it is the same speed as the comp bot: much better. We also worked more on the tube aligner concept. We almost got this done. It has taken a lot of trial and error to get this to work, but it is promising. Steve H showed up with a new direct drive minibot that he put together. It is faster than the current one and clocks at under 1.5 seconds. It is all polycarbonate construction, so it looks very cool. We tested it for a while and then immediately started in on making the next one.

I worked on getting the original test chassis back up and running; we stole some part from it in week 6, but I want to have another defense bot to work on game play with later this week. The Chairman's team is doing final prep for Troy, they look pretty much ready. The movie is a little behind but they will get it done…it sounds like it will be pretty cool if they can make it the way they want it.

Day 73 – Tuesday Mar 22, 2011 – Tube Aligners.

After hours of trial and error, I think we got the tube aligners working. Bryan, Eric and Andrew worked on this for several hours to get it right. Now we can pick up a tube in any orientation, and even with the grip severely off-center, the aligner pegs will force the tube to a more or less centered position. Continuous improvement continues. Our Goal is eventually to be able to hang 9 tubes in the playing portion of the game. We shall see if this is achievable. Much of this depends on Peter being able to throw the tubes far and accurate.

I got the test chassis up and running. It needs bumpers and weights, but other than that, it is good to go again, so we have a defense blockade machine to train with.

Day 74 – Wednesday Mar 23, 2011 – Defensive driving school.

Driving West coast style robots with no bumpers is like racing open wheel cars…It is easy to run up over another vehicle and go airborne. We were battling in the basement for a while tonight and ended up almost rolling each of the machines a couple of times. We were doing defense training with Eric driving the test chassis. Matt is getting pretty good at working through hard D. It slows down the scoring a lot, but does not stop him. We got the rest of the parts for what I hope is the final Minibot today, so we should have it built soon. I can't believe how much money we have spent on Tetrix parts, it is ridiculous that we have to buy $30 motors when in reality I can buy a motor with this type of performance on the open market for under $3. This whole thing is just too much of a cash grab for me.

After much testing, I have concerns about the tube aligner concept. 3 times tonight it caused us to drop a tube. I think we can make it better, but it needs to be perfect and it is not there yet. Part of the problem is too much lash in the KOP Denso hub couplers. I think I need to replace these as we did on the comp bot with metal ones. More improvements to come. We cleaned up the practice machine for the Chairman's video shoot tomorrow.

Day 75 – Thursday Mar 24, 2011 – Video Shoot

We went to NDP and shot final footage for the Chairman's video after school. This went pretty smoothly and the video should be cool if the editing goes well. After the shoot we went back to CTC for a while. We worked on new software for better autonomous control for a few hours. We also tested

Steve's new minibot. It looks great and is faster than anything we have built so far. We still need a complete deployable system, but the hardest part is done.

Day 76 – Friday Mar 25, 2011 – Ann Arbor District

I was the MC at the Ann Arbor District today. Big Fun!! 40 teams, and a very nice facility. There was great competition today and I did my best to work up the crowd. The majority of the teams here have played at least once so far, so the tournament has run pretty smoothly so far. Rob Jenkins is the FTA, and has done an awesome job so far, quickly fixing any and all issues quickly. The towers still seem flakey, and I was glad to see the refs overriding update 18 a couple to times to keep things fair. Big day tomorrow, Dean is coming.

Day 77 – Saturday Mar 26, 2011 – Ann Arbor District

Great day. Dean Kamen and John Dudas came to AA for opening ceremonies. I got Dean to put on a tube skirt ☺. Dean and John Dudas were both very positive about what we have done in Michigan to promote growth and sustainability and gave us a lot of great feedback. The tournament ran great and the competition and crowd energy were very good. The finals went to 3. Enginends and Martians and Flyers ended up winning and Nerds also won Chairman's. They used some great strategy at the end, the game is starting to evolve as we expected. Good times were had by all. I am very tired after two days of running around pumping up the crowd.

Day 78 – Sunday Mar 27, 2011 – Stats

I ran all the standings for the FIRST in Michigan Standings after church and forwarded them to the webmaster for posting. I did a little design work on an improved chassis cam system and worked on a Labview VI for an improvement I am thinking of; pretty simple but I need to work through the math before going over this with Andrew. I am a bit upset that no one came in to CTC this weekend in my absence, even though we talked about this on Thursday. I think the team is getting a little complacent due to the long gap between events.

Day 79 – Monday Mar 28, 2011 – Mini-botting yet again

We packed tools and started to get ready for Troy. The Chairman's team gave their presentation and it looks pretty good. Video production is still in process. I lit some fires under the team to work harder to get ready. We made the protector plate for the collector, and got everything ready for our unbag time. The team kept working on a direct drive lexan mini, and it was looking pretty good, but under repeat testing it started breaking off pieces. Then it started getting slower with each test, indicating it was starting to change shape. We need to do more work here. Only a few days to go and we need a new mini. After a month of time, this is still not solved.

Day 80 – Tuesday Mar 29, 2011 – Practice with 217/469

We went over to Android Industries tonight to practice on the full size field with team 469. Team 217 was also there. This was a good experience, and the drivers got back in the groove of driving on a full field. Both of the other teams looked great as expected. They have very different designs with very similar capabilities. Peter showed noticeable improvement throwing tubes after a few hours of practice. We used 2 hours of out of bag time with the comp bot on just driving. Then we rebagged the comp bot and they started practicing with the practice bot. I had to leave for an hour; before I got back I got a text that they had managed to break the practice robot. Should I really be surprised? I went back to AI, fixed the practice robot (simple), and took the comp bot back to CTC.

Day 81 – Wednesday Mar 30, 2011 – Upgrades

We used the rest of our out of bag time tonight to make all the planned mechanical upgrades and to re-qualify autonomous mode. With the lighter traction 3rd wheel set, the gyro angle controls are not as repeatable as they used to be. We got it to work after a number of iterations. Matt and Steve got the direct drive mini mostly done on a new single axle design. I think this will work, but we rebagged the robot with the intent of putting the old mini back on for Troy unless they can prove the new one is superior.

Day 82 – Thursday Mar 31, 2011 – Going to Troy, not quite together.

We loaded up and were at Troy by 6:30pm. It is great to have an event in our back yard. We got set up quickly and then got to work. As I expected, we were less ready than we wanted to be. The whole evening was a big cluster, and I was getting rather aggravated by the end of the night. We NEED to be more prepared than this, and there is no excuse for not being ready after having 4 weeks off. We spent hours messing with the minibot deployment with limited success. We were almost a pound overweight, and we had to take a bunch of little stuff off just to get certified. We never went out to

practice and we left without ever testing Autonomous, and with fears of a possible non-functional minibot. Hopefully tomorrow is better, because some of this looks a bit grim right now.

Day 83 – Friday April 1, 2011 – Troy, Ghost in the Machine

In the morning, Matt and Steve got the Direct Drive Mini to work on the deployment stand. We decided to go ahead and put it on the machine. This was good because this one is faster and more reliable. At 11:00 we started playing. Then the gremlins came out. The firing mechanism for the minibot sometimes refuses to fire. It only happens on the competition playing field, making it impossible to debug. We tested it hundreds of times in the pits under every imaginable condition and it never fails, then we go out on the field and it sticks…what the heck? I have changed literally every part of the system and reviewed all the software, and it still does it. It takes a lot to stump me but this had done it. We ended up losing two matches today because of this, and that pretty much kills our chances at #1 seed. This is a drag. Still, we look really good out there, and Matt, Kitty and Pete really have been doing well out there, so I have no doubt that we will be a top pick. ThunderChickens, Guerrillas, or Enginerds will be #1, so I figure we will be in the #2 alliance at worst. We need to keep digging tomorrow to get to the bottom of this problem (it is killing our OPR).

Day 84 – Saturday April 2, 2011 – Troy Finals: Chairman's Threepeat!

We ended up 9 and 3 after qualifying. Not great; and this was all due to the stinking minibot launch problem. All the losses were wins until the end game. We would have been #1 if not for this bug. We got drafted by the ThunderChickens; breaking the 12 year cycle of us NEVER being on the same alliance with 217. We would have picked them if we were #1, so in the end, it changed nothing. It was fun to work with Mike and Paul Copioli. We crushed in the Quarters, putting up a 128 – 0 win in match #2. We took the Semis to 3 round but lost, again due to the endgame. We had both of those matches won, but 217 failed to launch both times. Stinking minibots! We had a few repeatability issues with autonomous too. We seem to have the knack for stopping Paul at the Semifinals. We did it last year in ATL with team 148, and now today with 217. The Enginerd/Guerilla alliance won it all in an epic finish. Still, it was a great event and the team was great and energy was very high. Everyone was very loud and lots of parents, friends, alumni and fans came out to cheer us on. Matt and Kitty were in the Oakland press and also were honored as Dean's list candidates. Carolyn got honored as a WFFA candidate. At the end, we won the Chairman's award for the 3rd year in a row! The KB33 video was very cool. Overall, a very good day for the Bees, but there is certainly still room for improvement. We are 7th overall in the State at the end of the district season. Not bad, but my 2011 goal was top 3 (we would have been 3rd with a win today). We have some work to do for States next weekend if we expect to be able to win.

Day 85 – Sunday April 3, 2011 – Ski-jump.

Today, a small group went in to CTC to work on the new minibot and launcher. The new launcher is something we started on last Thursday, but couldn't quite get it done on the weekend. It is a Ski-jump style (thanks to team 233) and something that several teams have been developing including 217, and 469. It is awesome, and is more reliable and faster than anything we have tried. By the end of the session tonight we had a fully completed system on the practice bot which cleanly launches the mini every time. We need to finish the new, faster mini to go with this but we are well on our way to a bulletproof solution. This change takes almost 5 lbs. off of the machine, opening the door for a few more desired upgrades. Bryan also made new collector jaws, and lower covers, so we are covered for repair parts. We have a lot to do before Wednesday, but I am very hopeful that these changes will move us back up to the top of the pack. As JVN says; "Life is iterative", and we will keep iterating until we meet our goals.

Day 86 – Monday April 4, 2011 – Don't blink, you might miss it.

Tonight we did a review of the weekend with the whole team. We got lots of great input for improvements from all the team members. Everyone was thrilled to have won Chairman's on Saturday. We reviewed travel plans for States next weekend, and discussed the pre-event scouting needs with the scouting team. We then demonstrated the ski-jump minibot launch we built yesterday. Everyone was very impressed, and this success motivated the minibot team to really start cranking out the new dual shaft mini which will go on for States. The math done yesterday showed us that we can gear the new mini faster than ever before due to the lower launch torque required for horizontal launch orientation. By 9:30pm Matt, Keith and Steve had the complete system ready to test. Wow! It is faster than anything I have ever seen on any other robot, and also more reliable. Measurement with the high speed camera shows that the ENTIRE deploy/climb cycle is under 1.2 seconds, with a 0.88 time from the 18" line to the top as measured with the high speed camera. We have a little work left on the retention feature to make it competition ready, and we will build a second one next, but this is fantastic!

Day 87 – Tuesday April 5, 2011 – Dotting the i's

Tonight we mopped up some of the final details before States. It was pretty clear from the post event analysis from Troy that Auton and Minibots were our key opportunities for continuous improvement, at least as far as the actual machine goes. Andrew and I spent a couple of hours in the basement with the practice machine developing a new Labview turning controller VI. Error in the rotation accuracy has been identified as the source of most of our error on the second Uber tube. We now have a routine which is repeatable to +- 1.5 degrees or so, which seems to be good enough. This will be a good research topic for the post season: develop a process to tune a PID controller to improve upon this. The new auton will take some time at States to calibrate it on the Comp bot, but all the basics are in place.

Matt and Steve worked late and got all the final details on the new mini worked out: Ski jump is done, and reliability and repeatability are both very good. Everything is ready to go on the comp bot. We have 2 minis which work on this system, and they have most of a 3rd done which they will finish making tomorrow.

Day 88 – Wednesday April 6, 2011 – Goin' to States.

After work the pit crew and comp team came to CTC and we loaded up and shipped out to EMU for the Michigan State Championship. Anticipation is high. Chris, Ed and I went out with the trailer. We hauled everything into the venue and then set up the pit (Love the Wednesday night load-in!). I chatted with the leaders of many to the teams. Everyone is very geared up for this event. We were done setting up in about an hour, then we grabbed some dinner in Ypsi and headed home. I rewrote my to-do list for tomorrow and printed out my pre-event scouting sheets when I got home. We are ready, and I think we may be able to win this year. The big dogs at this event will be 67, 217,469, 27, 1918, and 2054. There are at least a dozen others who will be right up there too. The elims are going to be awesome!

Day 89 – Thursday April 7, 2011 – EMU practice day.

We knocked out all of our changes in the morning: Ski jump is on, steel collector shafts are in, software updates are done. We checked over the whole machine, got inspected easily and are good to go. Now that everyone is here, the true reality of this event becomes clear; there are so many good teams packed into one venue! This is going to be great! We went out to practice a couple of times; We put up 5 logos once with a little help from 217. New mini is awesome and may just be the fastest one here. The comp team is very tight, with smooth execution so far. Qualifications began at 3pm Lots of 'super matches' in our schedule, with 6 good teams all on the field at once. We won all 3 of our matches today. A good strong start to what looks like a good weekend. I love the State Championship!

Day 90 – Friday April 8 , 2011 – EMU Qualifying

What a great day! The competition here is amazing! Super Alliances and tons of scores well over 100 points. After 10 matches we are 9 and 1 and are sitting at #1 seed overall. This is fantastic. We have one tough match tomorrow against 217, but it is winnable. We stand a strong chance of being #1 overall. The Minibot release bug was still present, even with a completely different deployment system, and cost us our one loss today. After tons of trial and error, speculation, and video review, we finally figured it out: It is a power supply voltage issue. When the robot docks to the pole, the drive

train automatic hold feature kicks in. Because it is the end of the match, the battery is already somewhat depleted. The hold feature stalls the drive into the tower due to initial compression of the bumper and deflection of the pole. This stall condition causes the system voltage to sag to below 9VDC in the final seconds of the game. At this voltage, the ability to fire the solenoids becomes marginal, hence the intermittent nature of the problem. This had been a systemic problem at all 3 events but now we finally know the root cause. We made some simple software changes to prevent this condition, so we should be good now. We spend a couple of hours after the event debating our pick lists, we are ready for tomorrow. Can't hardly wait.

Day 91 – Saturday April 9, 2011 – State Champions!!!!!!!!!!!!!!

I can't believe we actually did it! We won the 2011 Michigan State Championship!. This was probably the most competitive tournament I have ever played. What a great day.

We finished quals in the #2 spot, right behind the Thunderchickens. We had to play them in our last qualifier, and we lost on the minibot, allowing them to pass us. We picked Team #67 the HOT team as our first pick, ending yet another 12 year cycle of not playing with them in Eliminations. Team #70, the More Martians, were our 3rd. Together we had a fantastic combination of skills. HOT was amazing, clearly the best team for us, and they were simply great to work with. They have great strategy and great scouting, and an awesome machine. The More Martians were great and landed us a couple of 30s in the Mini-races. All 8 alliances were stacked, this level of competition simply cannot be found anywhere else in the regular season. We swept the Quarters and Semis against some amazing trios, but the Finals against 27, 245, 1023 were very close; going to 3 rounds, with one of them going our way with a 112-111 victory. Amazing! The event was very high energy and our team was excellent. The Robot was great the whole day, with only a few minor impact related issue coming up for repairs all weekend. In a major upset, the #1 alliance of 217,469,201 were eliminated in the first round, which was unbelievable; only at the MSC can the #8 alliance score a 143! We also won the Industrial Design

Award, which is my personal favorite. We did not win State Chairman's Award, but we were close. At the end of it all, we are ranked #1 in the State overall on ranking points! This exceeded even my lofty preseason goals. Awesome day, Awesome event, Awesome Alliance, Awesome Team!!!!

Day 92 – Sunday April 10, 2011 –A little R & R.

I'm taking a bit of a break today. The weather is nice and sunny and I am just enjoying the afterglow of the weekend. I made a TGR/TGW list from the weekend, and summarized of all the things we need to fix and purchase before St Louis. I sent out thank you notes to the team and our supporters. I communicated with a few of the teams who qualified for STL yesterday and gave some advice on trip planning. I crosschecked all of the state standings including all the tie breakers and made sure the FiM website data was correct. I am going to the VEX World Championship in Orlando next weekend, so I confirmed all my travel arrangements.

Day 93 – Monday April 11, 2011 – MSC Recap:

We met with the whole team at 4:30. Enthusiasm was very high. We reviewed a bunch of media published over the weekend from several newspapers, Internet and TV. Awesome! It is so great that

there is so much attention from the public now compared to in the past. Everyone is excited to see the ABC special on Saturday. We did a recap and rundown of the weekend and made a to-do list for St Louis. There are lots of small items on the to-do list; the major ones, as always are Minibot and Autonomous. We made a plan for these with specific goals. The minibot team worked to build most of yet another new mini. Kitty repacked all the pit tubs for the upcoming event.
NDP is going to organize a pep rally for the team later this week. I will be out of town, but Matt agreed to make sure it will be a success.

Day 94 – Tuesday April 12, 2011 – Autonomous Development
We got together with a small group and did autonomous development tonight. The new routine does tighter course correction with the gyro. We got this to where it can hold an absolute heading to within 1.5 degrees. This is good, and should be accurate enough to prevent any of the issues we saw on Saturday afternoon at EMU. Steve and Matt got the new mini more or less done, but I did not stay long enough to see the timed test.

Day 95 – Wednesday April 13, 2011 – Going to Orlando
Busy day: I was downtown at COBO hall for the SAE Conference all day. Then I went straight to the airport and to Orlando. Thunderchicken VRC teams were on the same plane, heading to the VEX Championship. Tim handled shipping of the FRC robot at CTC. Apparently the forklift driver dropped the crate when loading it!… I hope everything is OK. We will know in 2 weeks when we open the box. I got into the hotel at about 10:00pm, ate a late dinner and went to bed early. I expect this will be a busy weekend.

Day 96 – Thursday April 14, 2011 – VRC Championship 1.
This is a very cool event! I have not been to Disney since we came here for FRC back in 2002. I didn't know how many FRC teams have VRC teams. Lots of overlap and there are a ton of FRC veterans I know here. The ESPN venue is pretty well suited to an event this size and everything looks pretty professional. I helped with some setup, went over proper protocols with the event coordinators and other MCs. I am MC of the Science Division with Jack Kentfield. At 3:00pm, Qualifications started. Vex events are much higher paced than FRC, with matches running on a 4 minute loop. The afternoon was a blur of play-by-play and robots. We ended up about a half hour behind, due to technical issues, but it went very well. For a simple game, "Roundup" has a lot of strategy and some of the robots are very good. Good game. This whole thing has much of the look and feel of an FRC event, but I think the VRC field tech is better. There are far fewer field issues and much faster initialization times than FRC. Some of us went out for dinner afterwards at ESPN on the Disney boardwalk and it was a lot of fun.

Day 97 – Friday April 15, 2011 – VRC Championship Day 2
Big Opening with speeches, fireworks, a parade, and dancing Mickey Mouse. Very well done! Then matches began: The day went by in a blur: We did about 150 matches today. The pace is pretty crazy with matches coming every 3:20 today. All the teams were great and we had only a few small technical issues today. After the event, we did a wrap meeting with the event managers, and then went to Planet

Hollywood for dinner with a big group. Later we went for drinks on the Boardwalk and I got to meet some more of the VEX staff and marketing people I had not met before. Lots of fun; this is a great group to work with: they have a very passionate, young and technically competent crew. FIRST could learn some things from these guys.

Day 98 – Saturday April 16, 2011 – VRC Finals

Great finish to a great event. I ended up moving over to MC the college division. The finals were very cool with lasers and flash bombs for effect. Kari Byron from Mythbusters was the MC of the finals. She is pretty cool and seems to genuinely like this robot stuff. Teams from Science Division were champions of the High School division. Team 44, the Green Eggs were very, very good, as was team 1103. Very exciting event overall; better than I would have expected for table top robots. The biggest negative is that Vex is harder to see than the big FRC or OCCRA bots. The cameras and big screens help a lot but sometimes it is still really hard to get the whole picture of the action/strategy on the field. Still, the VEX teams and fans loved it and it was a very high quality event. I really think there is some definite value in a challenge like this, especially for the underclassmen to learn basic assembly skills and critical thinking. Now that there is VRC in Michigan, we will have to discuss possibilities on this and/or FTC with the team leaders in our area.

Afterward the event was over, I went out to dinner with Mike Martus, Andy Baker and Mike Walker. We talked a lot about business opportunities in the competition robotics field, and also some theories on how to maybe bridge the gap between FRC and VRC. Later we went to Jelly Rolls piano bar on the boardwalk. The whole VEX/IFI crew were there, including Kari Byron. We had a rockin' good time. Karthik got up on stage and danced to the Fresh Prince at one point. Hilarious. Since I have a very early flight, I decided to simply forgo sleep and party all night. It was the right choice.

Day 99 – Sunday April 17, 2011 – Derby Race

Action packed day: Stayed up all night, flew back to Detroit with a 5:15am departure. Got in at about 10:00, drove straight to my church and got there right at 11:00. Immediately started setting up for our annual church Pinewood Derby race. I am the head counselor and I run this event. It was major fun, but there were no pyrotechnics at this event ☺. All the kids were super excited and there were lots of really cool cars as always. We had some great races, and my sons took home two trophies, Calvin for 3rd place in speed and Isaac for 3rd place in style. They were thrilled. When I finally got home, I took a much needed 2 hour nap. Then I got down to business on scouting for St Louis. The division breakdowns came out yesterday. We are in Archimedes division again. Some say it is weak, but on paper only. There are plenty of good teams with which we can build a winning alliance, the strength is about 30 teams deep. It will be like an MSC reunion…many of the good teams in Archimedes are from Michigan. I am sure that Isaac and Tim will have lots of analysis done tomorrow.

Day 100 – Monday April 18, 2011 – Is it really Day 100 already?

Usually the season is over at about Day 100, but the Championship is late this year. We had a full team meeting, but many kids were gone because it is spring break at NDP this week. We got a lot of stuff ready for STL, and worked on minibots and autonomous for a few more hours. We also reviewed the finances with the leadership team. We are in good shape, and just got more money from one our sponsors for winning States. Andrew showcased the work they did on auton while I was gone. It is pretty good and will now do more robust course correction using gyro heading on the straightaways, but we spent another 2 hours making it even better. At this point, I don't think we can do much more on the practice machine on auton, we simply have to wait to adapt these calibrations to the comp bot in St. Louis.

Day 101 – Tuesday April 19, 2011 – No meeting - Spring Break.

We had our weekly mentor phone conference at lunch and discussed logistics for St Louis. We reviewed the to-do list for the robot as well as our pit load-in plan. Isaac's team has some scouting improvements planned and we went over the team breakdown for our division. It should be great: 118, 177, 330, 1918, 1718, 2016, 2054, 3539…wow! We also approved the plan for a year end party at the Chrysler Museum to honor the sponsors and parents. I went down to the shop after work and organized some of the gear to get ready for next week. Both the our drivers are on vacation this week, so no driver training right now. We need to spend some time Easter Weekend to be ready.

Day 102 – Wednesday April 20 – 2011 – FIRSTcast

Lots of scouting analysis on all of the STL divisions today. Some of this was prompted by the fact that we are doing a live FIRSTcast tonight. The decision to do this was formulated on the shuttle bus at Disney last weekend, when Greg, Andy, Karthik, and I all decided that something needed to be done. Great ideas come when you put the right people together. We had a great 2 hour FIRSTcast discussion and it was cool to talk strategy, rules, growth and lots of other FRC stuff with this panel of experts.
Lots of people were online. This discussion got me pretty cranked up for next weekend.
We found out today that Steve Hatfield's wife was hit by a car and is in the hospital. We don't know the seriousness of this, but the whole team is concerned about her and their family. Steve has done a lot of work on the minibots lately, so we will probably need to have someone else run with this until we know what Steve's status is. Matt, Keith and Peter have all been very involved, so I think they will know what to do.

Day 103 – Thursday April 21, 2011 – Supercharging
A few of us did some work tonight testing various ways to charge minibot batteries to see if we can improve the deployment time by overcharging the battery with different types of battery chargers instead of the Tetrix Charger. After a running through series of tests and scenarios, we developed a charge cycle which can improve the minibot climb time by about 10% without risking the battery durability using an RC car charger. Great stuff! Incremental improvement is the key to success.

Day 104 – Friday April 22, 2011 – Good Friday
No work today, so a few of us went in this afternoon. We packed some stuff and worked on completing the second minibot. It is now pretty much done, which was our last to-do building item before St Louis. All we need is a second set of magnets, which are in the mail. We tested it with the magnets from unit #1. We still have some open questions on some of Steve's work, based on his notes. We have not heard directly from him, so we don't really know his status. We understand that is wife has had several surgeries to repair the bones in her leg. That sounds pretty serious.

Day 105 – Saturday April 23, 2011 – Spring time in Detroit.
This is my first free Saturday since New Year's. I feel a little guilty that we probably should be doing driver training today, but both my drivers are out of town this weekend. It is OK, since I think they are good enough at the main part of the game, they have 2 full seasons of FIRST and 2 full season of OCCRA under their belts, so they have probably played something like 200+ actual matches in real robot games, plus probably 20-30 hours stick time on the practice machine this year. They can do 8+ tubes in a practice match, so our big opportunities lie in autonomous and minibot. We have a good plan for these 2 areas and I think we have done pretty much all we can do at this point. After a long wait, it is finally Spring here! I spent some time outside with my kids, did some yard work, and cleaned up my garage, my truck, and my basement workshop. I have robot parts and debris everywhere at this point in the season. It is good to start to get this cleaned up and organized. In the evening, I did some more scouting research for St Louis, as well as reviewing the travel package, event schedule, conferences and packing list.

Day 106 – Sunday April 24, 2011 – Easter Sunday

After church, we went to Canada for Easter dinner at my In-Law's. Major food for Easter! No one can crank out the chow like old Dutch ladies ☺. It is really cool that lots of my extended family now follow FIRST online and know all about how we are doing. Everyone liked the ABC State Championship program, many people have seen it online. Apparently Simbotics were on the news up here and my family knows who they are…that is very cool. This sport continues to grow every year. It is so different now than when we began so long ago. At night, after we got back home, I spent a little time working on a paper for a proposal to Chrysler and also a proposal to the FiM board for our meeting next month.

Day 107 – Monday April 25, 2011 – Packing for St Louis

This is our last team meeting before we go to the Championship. We went over the travel schedule with the whole team to make sure everyone know where to be and when to be there. Magnets are in so we finished out the second minibot, and confirmed operation is within about 0.05s of Unit 1. Perhaps we are finally done with minibots after 107 days! I can only hope so. We worked on packing some up all the gear and the pit stuff. We also took all the needed spare parts off of the practice robot and packed them up. I think we are good to go.

Day 108 – Tuesday April 26, 2011 – Get on the bus!

St Louis here we come! We had a phone conference at lunch to confirm final details. I staged all the stuff for load out after work. At 9:30pm the bus showed up. The team quickly loaded all the gear and luggage. We are travelling with team 51 again this year so they were at CTC with the 2nd bus too. Their team is pretty pumped up too. We were all loaded up and ready to go in about 45 minutes. The whole team is very excited. I gave a few words of encouragement, sent them off and went home. I am flying down with Lorianne in the morning.

Day 109 – Wednesday April 27, 2011 – Welcome to St Louis

Flew to STL, were in by 9:00am, we met the bus downtown just as they pulled in. We went up the Gateway Arch with the whole team; very cool, awesome Engineering. At 3:30,we went to the Dome for Karthik's Strategy Seminar. It was great as always, Karthik is hilarious and brilliant. We loaded in in the pouring rain at 5:00pm and unpacked the crate. Why does FIRST insist on having such complex load in procedures instead of just letting people in when they show up? I don't get it. When we took out the robot, we found to our dismay that the frame was seriously bent when the crate was dropped. Hammer Time! With some focused pounding, we got it back straight again. We pushed though all our other to-do items, and were done with a little time to spare before pits closed. We had a late dinner with the comp team and pit crew and went back to the hotel by 11:30.

Day 110 – Thursday April 28, 2011 – STL Practice and Quals!

We got on the practice field early and reconfirmed autonomous. We had one practice match in the morning in the dome and it went fine; the robot is in top form. I did a lot of cruising through the pits and checking out a lot of robots, taking pictures, and talking with other mentors. Our schedule is a little tough: 2 matches that will be very hard to win due to very weak partners, and we have to play against several of the top teams in the division. We ended the day 3-1 after 4 matches. The one we lost was basically unwinnable: 3 good teams against us and 2 derelicts and we still almost won. Matt, Kitty and Pete were really on today, scoring 6-9 tubes in all 4 matches, driving well, throwing well, and generally looking awesome doing it. We went for pizza dinner with the whole team and then went back to the hotel for some preliminary sorting on the division. We pulled out 44 potential picks from our division of 88 teams. Tomorrow the scouts will be able to focus their attention more tightly on this top 50%.

Day 111 – Friday April 29, 2011 – #$^&@#$ Field Electronics!

Well, we won all 4 of our matches today, except the field electronics robbed us of a win by not registering our minibot, costing us 30 points and the win in our 3rd match of the day. If the systems we design at work had the reliability of FIRST's systems, I would be fired and we would go out business. The tower design is a bunch of amateur junk. FIRST needs better engineers if they are going to try to implement mission critical elements like automated scoring. They have never successfully implemented any field automation that even comes close to the reliability levels required for something like this. 99% reliability is simply not good enough for something as critical as this.

We ended the day 6-2 overall. We would be #1 seed if that stolen win had counted. Oh well, nothing to be done about it. The robot, minibot and comp team are still totally solid. So far, so good. If we keep this up, we should have a very good chance of going far this year.

We had a great scouting meeting while all the kids went to the Black Eyed Peas concert. They all said it was awesome. We got our top 44 teams (50% of division) sorted and ranked. Our chances look good for being a captain or top pick. Tim's predictor software shows a couple of weaker teams will seed in the top 8, so the alliances might get jacked up if this happens. We had a lot of fun with the adult crew tonight. Tomorrow will be a big day.

Day 112 – Saturday April 30, 2011 – World Championship

We lost our first match of the day today (Saturday morning curse). It was a tough one but it should have been winnable; we screwed up. This dropped us to 12th, so picking is no longer an option. It looks like several other top teams in other divisions got hosed by tough schedules too. We got drafted by 1477, Texas Torque in the #5 spot, which was good, they are a strong team. We picked up #191, X-cats for our third partner. This was a great alliance and both teams were excellent to work with. The team was very pumped up and energy was very high. We crushed the #4 alliance in 2 in the Quarters. Then we had to face the #1 alliance 2016, 177, & 781 in the Semis. We took them to 3 rounds, but lost in a close decision in the 3rd match. So close! They went on to win the Archimedes division and end as World Finalist in the big show. It seems to be a law of nature that 177 will go to Einstein☺; this is 6 times in a row for them!

The Finals on Einstein were great. The 254, 111, & 973 Galileo Alliance was simply stunning: they were like poetry in motion. 254 and 111 have probably the finest 2 robots I have ever seen in 15 years. A well-deserved win by all 3 teams! The Poofs finally win it, and Wildstang now has 3 Championship wins. Outstanding!

After the event we packed up the pits quickly, crated the root, and got the bus loaded. A group of mentors went out to a spot that 111 had reserved ahead of time, and about 100+ FIRST people showed up to party. It was great to hang out with so many great people, and I met a number of new people. We stayed out till almost 4am. St Louis is a fun town. There ain't no party like a Wildstang party, especially when they win the World Championship! Good times, Great Season!!!

Day 113 – Sunday May 1, 2011 – That's All Folks!!

That's it: Another FRC season completed, making it 16 for our team. We have an afternoon flight back to Detroit and will meet the bus for unload this evening. As we fly back, I can reflect on how the whole season went and where we stand as a team. Overall I would give us an A- this year. Very good, but as always, there is still room for improvement in several areas.

- Student involvement was very good this year, but I think we need to do work more on skills training prior to the build season start.
- Sponsorship support was excellent, but we can do more. We must develop more student sales team members and further toward our sustainability goals.
- Parental support was very good. We need to work to define roles and responsibilities so we can best utilize this invaluable resource.
- We need to find ways to continue to embed our team in school culture. We saw big strides this year, but other top teams still show that we can do much more to become institutionalized.
- We need to work more on event preparedness. We tended to be a little scattered on packing and load-out at several of the events. "Be Prepared" as the Boy Scouts say.
- This was the most robust machine we have ever built, and it was almost completely maintenance free the whole season. Still, we will continue development on new fabrication capability, new process and methods so we can continue to improve our machines.
- The season experience can be summed up as "Good Hard Fun". We work very hard, but always have fun doing it. Whatever we do to improve, we must always maintain this balance.

My stats put us at 32nd overall at the championship. or 98.5th percentile for 2011 season….not too bad. We finish in 13th place on my "All Time Championship History Rank", just shy of my goal of top 10 this year. OPR World Ranking spreadsheet puts us at 12th overall. With two event wins this year, only a very select few have a better competitive success record. All in all, it was a very good year for the Killer Bees: one of our best ever.

Conclusion:
Logomotion was a fun game to play and the Buzz16 was a very thrilling robot to build and play with. I had a very enjoyable year once again. This is the greatest sport in the world, and the hardest fun possible. I am very proud to be a Killer Bee and to be a member of such a great team of people.

The official 2011 FRC season may be done, but we are far from done working. FLL registration opens tomorrow. OCCRA GDC planning meetings will start next week. Recruiting for next year's FRC team starts soon, exit interviews need to be done, and our year end party has yet to be planned. We have more sponsors to pursue, and facilities planning to take care of. Four robot demonstrations are already scheduled, with more to come. We have a full summer schedule of off-season FRC events including MARC, IGVC, IRI and KK. Our off-season prototyping and development plan already looks pretty ambitious. Greatness comes from the relentless pursuit of perfection.

Already looking forward to Season 17!

Jim Zondag

Special Thanks to all the Students, Parents, Mentors, Sponsors, Supporters and Fans who made season #16 of Killer Bees Robotics possible.

GO BEES!!!!

Cast of Characters:
There are 29 students, 10 mentors and many parents on the 2011 Killer Bees Robotics team.
The members below have been mentioned in this journal. Some names have been omitted to protect the innocent.
Jim Zondag – Mentor and Team Leader
Tim Grogan – Founding Mentor
Chet Fleming –Founding Mentor
Isaac Rife – Mentor and Scouting Leader
Chris Hunt –Mentor
Steve Hatfield –Mentor
Eric Yahrmatter – Mentor
Carolyn Beyer – Mentor – NEMO - Team Mom
Matt Deporre – Student Team Leader – Robot Driver
Katherine "Kitty" Fitzpatrick – Robot Operator
Peter Dondanville – Human Player
Bryan Culver – Pit Crew / Video production
Andrew Palardy – Pit Crew / Lead programmer