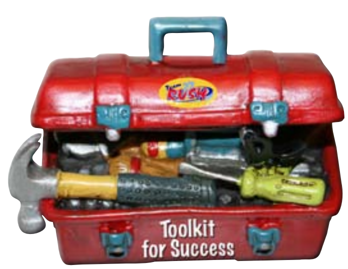
BUILD SEASON – THOSE CRAZY SIX WEEKS



KICK OFF AND IMMEDIATELY THEREAFTER

With Kick Off the first Saturday after New Years Day – be ready to meet immediately after the web cast as a full team to discuss what you heard, begin to plan your strategic direction and prepare a list of materials for constructing the practice field you just learned about. We suggest having any parent “handymen” and rough carpenters ready to go for construction very shortly after Kick Off. **Team RUSH** actually buys materials and begins construction on their field the **Sunday immediately following Kick Off.**

This past season **Team RUSH** attempted an “Accelerated Build Schedule.” Our idea was to have the robot done at least 10 days before it was to ship. **We tried – but we couldn’t do it –** and we are a team with over a decade of experience! For your use we have included ***Addendum 6.I*** *“Sample Build Schedule” in the back of this section.*

The best memories are created during the late nights in the shop.”
Jason Markesino, mentor

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STRATEGY — KEEP IT SIMPLE

"If you can buy something to solve your problem, do so. Many teams make the mistake of trying too much, over-engineering or making overly-complex mechanisms that are not robust enough to compete on the big stage."

Anthony Lapp, mentor

Although "Keep It Simple" is an overly used cliché – it works! If you are just starting out realize that many of the people you're competing against have many, many years of experience building *FIRST* robots. Teams with advanced drive train technology most likely have three or more years of development on said system. It is tempting to try to emulate what you've seen on the internet or at previous competitions….but in the end, fielding a working competitive robot is more inspirational to your students than building a piece of engineering artwork.

"Every season I hear complaints from new teams who show up at competition and are blown away by the level of complexity and polish on some robots and make statements like, 'I bet the kids didn't even touch that machine!'

This is almost always NOT the case. The likely culprit…that team has been competing for years, has carry-over technology, a large group of dedicated mentors and a clear focus on engineering excellence, presentation and craftsmanship."

Anthony Lapp, mentor

An essential first step of the build season is planning your strategy. In other words: **what do you want your robot to do?** Many beginning teams make a mistake in trying to build a robot that will do everything the game entails. We have found that the best strategy is to pick two or three tasks that you want the robot to do and base your design and construction on these aspects. Building a robot that is the best at accomplishing those two or three objectives will usually give you better results than trying to do everything.

"We've found it to be beneficial when brainstorming our strategy to actually have team members act like robots and "play the game" out on the playing field. Many times this will give insight as to what's really important in the game and help the team narrow its strategy. Remember, it's not always good to be a jack-of-all-trades but master of none."

Shannon Moegling, mentor

Once you have those two or three tasks identified, let them drive how you design and construct your robot. If you cannot identify which of your two or three initial tasks a component is trying to accomplish, chances are you don't need it.

"Brain storming is always a good practice. Don't be afraid to suggest off-the-wall ideas. Sometimes even the craziest idea can morph into a great one"

Tim Flickenger, mentor.

Build it Tough! The on-field play is way rougher than you think. Even though contact is limited and regulated, your robot will take hits and probably run into a wall or game object. If you can't ram your robot into a wall with complete confidence during build season practice – then it is not strong enough.

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WORKING IN SUB-TEAMS

When it comes time to build robots, **Team RUSH** works as a team to develop unique strategies of play. We then make broad design choices as a group and proceed into smaller sub-groups. It is that individual mentor's responsibility to work with their student's concepts to design a machine that will perform the required tasks.

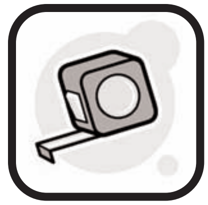
Have a Leader. Many teams learn quickly that allowing just anybody to help with their robot is a recipe for disaster. Your students are the focus of this challenge, not their parents or the engineering mentors who want to help. Start the build season with a plan and understand the adult help you will need. Address any conflict among the adults immediately and away from the students. This is politically sensitive, but unavoidable – it happens to every team.

Sub-teams allow for maximum student involvement. In these smaller groups, students can focus clearly on a few tasks, work closely with their mentor and refine the details of their design. Poorly designed and constructed systems are often the result of not paying close attention to details!

Our students usually do not posses precision machining skills at this age, yours are probably no exception. Because of this, **Team RUSH** enlists the help of a few adults to help us fabricate and machine certain precision components. Other parts are sent to outside shops sympathetic to our cause. The remaining, less precise, hand-made parts are built in our shop by students under mentor supervision.

This model ensures that student ideas are well represented in the final product. Their work in a sub-group lead to detailed drawings and concepts that were used to make the final components. Most real-world engineers never enjoy the opportunity to fabricate what they've designed, so even at this level of involvement, your students are gaining more experience that most engineers get in a lifetime.

The final step of this process is to meet for weekly design reviews. This allows each sub-group to communicate their plans and progress with the whole group. Other build groups can help identify solutions to unresolved problems or suggest improvements, and those students who were involved in overall strategy but chose non-build responsibility can get caught up with where the team is headed.



"Building prototypes is a great way to prove out if an idea works. Don't be afraid to build proof-of-concept models with wood or cardboard or any other easy to shape materials. Chances are, if it won't work with wood or cardboard, it won't work with metal or PVC pipe either."

Tim Flickenger, mentor

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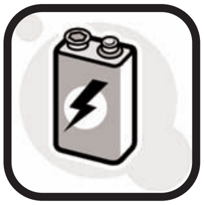
Electrical



The electrical parts of your robot should not take a "back-seat" to the mechanical parts. Although many teams wait until the mechanical parts are finished before routing wiring, this can be counter productive. As you build the mechanical systems or sub-assemblies, wire them up and see if the actuators (either motors or pneumatic) move and perform as you anticipated and test them out.

Wire routing and power distribution are important to get right on the final product. A poorly routed wiring can cause pinched or severed wires, or in some cases electro-magnetic interference from motors. Obviously, you want to have your wires as short as possible without stretching wires when the parts of your robot move.

If you have the experience and knowledge in your mentor base, try custom electronics or non-standard sensors on your robot. The control system given in the robot kit can be greatly augmented if you try some of those. Sensors can be found at Digikey.com or doing a search on the Internet can help. If you want to create a custom electronics board, Sunstone electronics can make them for you, but you have to create the board layout yourself.

- Keep your wiring…neat…organized and labeled…this will save you time in the heat of competition.
- Do it right the first time…it doesn't save time to rush it and then have to fix it later.
- Every connection has to pass what we call the "jimmy" test. Pull on it to see if it comes loose. The robot will see a lot of vibration and impacts.
- Strain relief as much as you can.
- The electronics have size, weight and cost…this is often overlooked by the build team…always account for it early in the build season.
- Get the robot done and wired before the deadline…it is much harder to do the work at the competitions
- **REMEMBER – NEAT and LABELED!**

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"Ask other teams for help! Talking to members of another team has helped tremendously in understanding FIRST basics including the robot design process, build and competition."

Steve Hyde, mentor

Programming

- Make use of free training from other teams and *FIRST* corporate sponsors such as NI that offers LabView training.

- Visit veteran *FIRST* teams' web sites.

- Determine tasks to be performed by the robot per function such as chassis directional movement, mechanical arms, camera, etc.

- Split tasks among groups to concentrate on one function.   If limited in resources, make sure the basic tasks are completed.   For programming, split the tasks and assign one person to combine & compile the separate program functions onto one PC for programming the robot controller.

- Do not sweat it if you only have one programmer as many veteran teams, including ours, have in the past, had only one programmer.

- Prior to cutting metal or programming code make sure the proposed design is on paper. For programming, use common methods such as state charts or flow-charting. Always have documentation so when something goes wrong you'll have a heard start at fixing it.

"The end result is a group of students with expert knowledge and a machine that looks like art."

Anthony Lapp, mentor

Addendum 6.I

SAMPLE BUILD SCHEDULE

APPROXIMATE WORK HOURS
Various sub teams: Monday through Friday 5pm to 9pm – Weekends 9am to 3pm

Kickoff Weekend:
- Kickoff Meeting – Game and rules announced - Saturday
- Team game and rules review - Saturday or Sunday
- Team meeting to plan game strategy / form sub teams - Sunday

Week One: Formulate Design Ideas
- Sub teams develop design ideas
- Complete design ideas - Determine the “what to do” before the “how to do” aspects of the robot

Week Two: Design / Integrate Systems and Components
- Order Parts
- Sub teams - Design systems and components
- Complete system designs, component drawings, and parts list

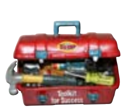
Week Three: Fabricate / Procure Components
- Fabricate components
- Complete component fabrication and procurement

Week Four: Assemble Robot and Shipping Crate
- Sub teams assemble robot
- Complete robot

Week Five: Develop and Test Robot
- Test, refine, and develop robot
- Complete testing and development
- Start the Drive Team practice process

Week Six: Game Practice and Revisions
- Drive team practices and team makes final robot/play revisions
- Prepare robot for completetion

Week Seven:
- Ship Robot by Deadline
- Team meeting for review of:
- Robot final design
- Competition sub teams’ rules knowledge
- Competition needs
- Collect completed Consent & Release Forms for registration at initial competition
- Safety – Ensure enough ANSI Z87-approved safety glasses for team at competition
- Travel safety, venue safety, buddy system, etc.
- Provide contact information



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