6 Week Build Schedule – General Guidelines

Aside from materials and finances, one of the most critical and limited resources of the FRC build season is time. To manage the 6-week build, it is important to establish milestones and deadlines for the design, build and test processes. The general schedule described below is an option to use to keep your team moving and one track to improve your ability to have a driving, functional robot when you arrive for day 1 of your competition.

Below is a high level overview and a more detailed summary of a build season.

Day 1
A.) Kick-off

Day 2 - 7
B.) Understanding the new game
C.) Team strategy
D.) Preliminary design process
E.) Prototypes and design development
F.) Material procurement

Day 8
G.) Final Design Concept Decision

Day 9 - 16
E.) Continued Prototypes for Final / Best Options

Day 17 - 38
H.) System fabrication and assembly

Day 39 - 46
I.) Robot testing and improvement

Final Day
J.) Bag & tag

Ongoing
K.) Spare parts

A.) Kick-off

1.) Download the encrypted game files posted by FIRST prior to the day of kick-off
2.) Game files are typically posted here: www.frc-manual.usfirst.org
3.) Attend your local kick-off (if possible) to network with neighboring teams and pick up your kit of parts
4.) Be sure to inventory your kit of parts on the day of receipt and report any missing/defective parts using the contact info provided by FIRST
---> Your KOP will contain large bags and ties that will be required to seal your robot at the conclusion of the build season. Be sure to store these in a safe place so they won't be damaged or lost.

B.) Understanding the new game

1.) Read through all of the game documents and list any questions that may arise

2.) Determine what aspects of the game may need to be recreated to be thoroughly understood

a.) Some components of the field may be critical to the strategy or function of your robot

b.) Past examples of such components include scoring structures, goals, bridges/ramps, and ball chutes

c.) FIRST releases technical drawings for field elements including low-cost versions for team use <LINK> http://www.usfirst.org/roboticsprograms/frc/game-and-season-info

d.) Complete the procurement and construction of these elements within the first few days for use during the design process

3.) FIRST will also maintain a list of official Question & Answers, typically located here: <LINK> http://www.usfirst.org/roboticsprograms/frc/game-q-and-a

a.) Q&A will be updated periodically and is considered an official addendum to the game rules

b.) If you feel that your team's question has not been specifically addressed, your lead mentor may submit questions for FIRST review by: <INSERT KNOWLEDGE HERE>

C.) Team strategy

1.) After the game and rules are thoroughly understood, begin developing team strategy

2.) Some points of consideration include:

a.) Point-weighting of various tasks/challenges...what takes priority?

b.) When is a win more than a win? Consider ranking points vs. match points.

3.) Create a timeline for your team's "Perfect Match"

a.) What would your team's best match look like - broken down by AUTO, next 30 seconds, next 30 seconds, ending of match?

b.) Consider all levels of partner participation, from immobile to awesome

4.) Once your strategy is developed, create a priority list for each of the robot functions from most important to least (this list could be critical during construction of your robot)

D.) Preliminary design process

1.) Select the type of drivetrain that is best suited to your team's capabilities and desired match strategy (6WD, 8WD, crab/swerve drive, omni wheels, etc.)

a.) Many teams intentionally undersize their robot chassis in all directions to mitigate risk of being oversized (example, design 1" smaller than max width, length and height to avoid issues at inspection.)

b.) Consider boltheads, axles, etc. that may protrude beyond your frame and understand the specific rules about them.

2.) Create preliminary sketches and conceptual designs of appendages or manipulators

a.) Be sure to consider size constraints for extensions

b.) Keep bumper zones in mind and anticipate how they might interfere with your design

c.) Review past robots and documentation from other teams for inspiration (previous shooters, manipulators, drive systems - FIRST "Behind the Design" books are an excellent resource.)

3.) Consider what feedback and controls might be needed during a match and what sensors could be used.

4.) Allow space for major control components (cRio, Radio, breaker panel) and begin to consider placement of other smaller components.

5.) Document your work and decision process for later review

E1.) Prototypes and design development

1.) Build mock-ups of key elements/design features of your robot for testing and experimentation
   a.) Building a mock-up can help prove (or disprove) a design
   b.) Mock-ups can also be a useful testing platform for design modifications without affecting your competition robot
2.) Use feedback and experience gained through prototypes to improve (or discard) system designs
3.) Begin to develop code to operate the robot functions. You can create code to work with prototype parts, and then make final adjustments once the finished pieces are ready.

F.) Material procurement

1.) Evaluate your most likely design options for long-lead items that will need to be ordered quickly
2.) Use the list of long-lead components to prioritize the final design process (i.e. focus design efforts on finalizing items that need to be ordered)
3.) Some items that have historically taken extended time to receive include:
   a.) Pneumatic cylinders
   b.) BaneBot motors/transmissions
   c.) New batteries
4.) Plan and utilize any FIRST Choice vouchers as some items are offered in limited quantities and may run out

G.) Final Design Concept Decision

1.) Make the decision on the final design.
   a.) Consider the team priority matrix from section C, Input from the prototype work, availability of resources and time constraints.
   b.) Complete the level of computer design you have the resources and skills to do.
   c.) It is much better to work out the design details and resolve interferences, fits and system integration in "electrons" if you have the team skills to do this.
2.) Someone has to be the team leader to make the "final decision" on the design and trade-offs.
   a.) Decisions may be made by team vote, design matrix "data", or by a small group or single leader - but you must come to A decision and then focus the teams resources on that design.

E2.) Prototypes and design development

1.) Continued prototype work to finalize detailed design decisions and create the best possible sub-systems
2.) Use feedback and experience gained through prototypes to improve the final system designs.
3.) Continue to refine programming as prototypes and sensor requirements progress.

<u>NOTE</u>: Step E has two segments. Early prototyping will prove a general concept so you can begin design work. Later prototyping is to continually improve and refine the design decision to make it the best you can.

H.) System fabrication and assembly

1.) Begin and maintain a Bill of Materials that tracks and summarizes all raw materials and parts that are installed on your robot
   a.) FIRST offers a template for teams to follow: <LINK>
   b.) A complete BOM is a requirement for all teams at each FIRST competition
2.) Weigh each system independently and during assembly to project final robot weight

a.) As the weight limit is reached (or exceeded), refer back to the strategy priority list to determine what systems will be sacrificed to make weight

b.) Consider weight-saving opportunities during each phase of assembly including material reduction (thinner material, holes), smaller fasteners, smaller chain, etc.

3.) Include attachment hardware for bumpers

4.) Think about the location and routing of wires and pneumatic tubing. Be sure it avoids pinch points and is not susceptible to damage from general robot contact. Consider wrapping wires in protective coils.

I.) Robot testing and improvement

1.) One of the top priorities for any team is the ability to drive across the field (if you can move, you can help your alliance)

a.) Completing and testing your team's chassis and drivetrain should be top priority

b.) Wiring should be safely protected and stored within the robot, and should be accessible for repair

2.) Remember that a robot without legal bumpers and field communication systems will not be allowed onto the field (no exceptions)

3.) During code/controls development, keep regular file back-ups in case of memory loss, etc.

J.) Bag & tag

1.) For most events, you need to “Bag and Tag” your robot on the stop work day. Use the large bags provided by FIRST and work to ensure that you do not rip or tear the bag.

a. Think about how you will move and transport your robot when it is in the bag. Do you need to make any special provisions to the robot prior to placing it in the bag? For example, do you need an eye bolt to connect a tiedown strap to? If you put your bumpers in the bag, will they stay in place?

b. Zip Tie the bag and record the tag number and signatures on the FIRST form. Don’t lose the paper! Consider placing it in a zip-lock bag and taping it to the robot bag, or placing it in a tool cart that you know will be at the event.

c. Make sure the signature form is easily available at the time you take your robot into the venue. The inspector will need to see if before giving you the “OK” to open your robot bag.

d. If you are going to another event, or qualify for the CHP event, you will need to re-bag your robot. Be sure you save the bag or take the spare one, and that you have the additional zip-ties with you.

K.) Spare parts

1.) Consider what spare parts are needed. FIRST has a limited supply of spare parts at the competition, but don’t count on them having the specific part you need if it is critical to your robot.

2.) Make or purchase unique parts for your robot.

3.) Many teams take spare parts, nuts and bolts and raw materials to the competition and are willing to share. HOWEVER – if you have a specialized part (unique bolt size, thread,), pneumatic cylinder, special fitting, etc. don’t count on another team to have a spare. Be sure to have spares with you.

4. If you borrow a part, return it to the team you borrowed it from - Especially if it is a unique or expensive part. Motors, gears, pneumatics, electronic components, wheels and other parts are expensive and the team that helped you out should not have to purchase a replacement for themselves.