

# Running an FRC Team

FRC1114 – Simbotics  
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# Karthik Kanagsabapathy

- 17 years of *FIRST* experience
- Lead Mentor for Team 1114, 2004-present
  - 23 Regional Championships
  - 2008 World Champions, 2010 & 2014 World Finalists
  - 2012 Championship Chairman's Award
- 2005 Waterloo Regional Woodie Flowers Finalist Award
- TEDx Speaker - <http://youtu.be/MfC3JdkEVgQ>
- Regional Manager, Innovation First International, Canada
- Chairman of the VEX Robotics Game Design Committees



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# Outline

- Team Organization
- Managing the Build Season
- Drive Team Selection



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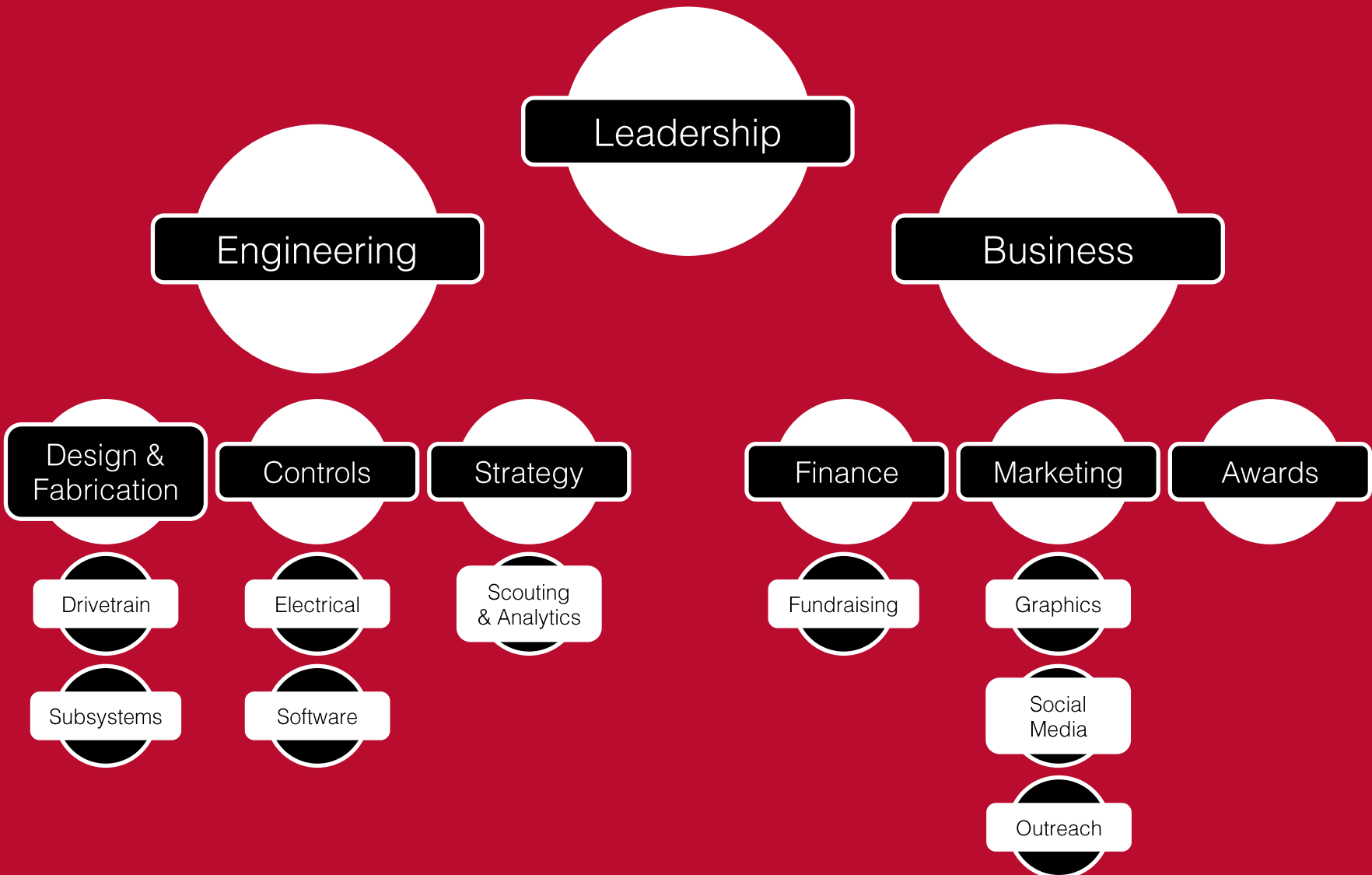
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# Team Organization

- An FRC team is much like a business
  - Work needs to be filtered through a hierarchy
  - Too much for one person to do on their own
- A strong partnership is needed between students and mentors
  - *FIRST* is not a science fair, students are not expected to, nor should they, do everything on their own
- Assign leaders to each sub-team
  - Creates a sense of ownership and responsibility
  - Student leaders or mentor leaders?
    - Both is ideal!



# Sample Organization Chart



# Engineering

- “The Robot Team”
- The engineering leader is the overall authority when it comes to all robot related decisions
- Co-ordinates between the three engineering subteams, and ensures areas of overlap are taken care of (crucial)
  - It’s hard to split the robot up perfectly into distinct areas
  - e.g. Autonomous Mode
    - Strategy sets the priority
    - Design and Fabrication makes room for and mounts the sensors
    - Controls integrates, programs, and tests



# Design and Fabrication

- Responsible for the mechanical design and build of the robot
- “Makes the robot do what it’s supposed to do”
- Usually broken down into two areas
  - Drivetrain
  - Subsystems – The mechanisms
- Takes design directives from the strategy team
- At competition, responsible for maintenance and upkeep of the robot



# Strategy

- Responsible for the strategic design
- “What should the robot do”
- Analyzes the game and determines the game strategy
- At competition, they are responsible for match planning and execution
  - The drivers & coach should be a part of this team
- Scouting & Analytics
  - Gathering information about opponents to help decide on match plans and alliance selection
  - Analysis of gathered scouting data
- Great for students who might not seem like “robot people”
  - Sports fans!!!



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# Controls

- Responsible for making a mechanically sound robot work
- Electronics
  - Wiring the robot and installation and design of all sensors
- Software
  - Writing the code that allows the drivers to interface with the robot.
    - (or in the case of autonomous mode, the code that allows the driver not to interface..)
- Must be able to communicate well with the other engineering subteams!



# Business

- A high functioning FRC team needs to run like a business
- Often overlooked and neglected
- This section of the team, allows the engineering side to function
- Brings funding, recognition and distinctions to the team
- A great opportunity to expose students to science and technology



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# Finance

- Responsible for creating and managing the team budget and business plan
- Entrepreneurship Award
- Fundraising
  - FRC is a very expensive program
  - Work with the Marketing team to spread the word about the team and contact potential donors



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# Marketing

- Responsible for getting the team publicity in the community and at competitions
- Graphics
  - Establishes team branding; logos, apparel, banners & signage, promotional materials
- Social Media
  - Responsible for establishing and maintaining a web presence
    - Website, Facebook, Twitter, Instagram, etc.
- Outreach
  - Spreads the word of *FIRST* in the community
  - Gives back to the community



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# Awards

- Responsible for the preparations of submissions and accompanying documentation for awards
- Most *FIRST* awards do not require a submission
  - Having a handout or display, with strong team branding for the judges never hurts!
- The Chairman's Award
  - The highest honour in *FIRST*
  - Requires a written submission and a presentation
    - Full seminar on this Award on October 29<sup>th</sup>!
- Woodie Flowers Award (mentorship)
- Dean's List Award (student leadership and excellence)
- Entrepreneurship Award



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# Team Organization Tips

- You don't need to have subteams for each area
  - There's lots of duplication. Choose based on the amount of students and mentors you have available
- The same goes for the award submissions
  - Don't bite off more than you can chew
- Try to have a mentor for each subteam
  - Recruit parents, industry professionals, anyone who might be interested.
- Don't restrict your team to "techies"
  - Lots of different skill sets are required for a successful team
  - Seriously, this is really important



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# Managing the Build Season

- Now that you have a team structure in place, it's time to get started
- For most of you, this is the largest project you have undertaken
- There is a hard deadline – Ship Date
- The only way to succeed is to manage your time effectively
- 6 weeks and 3 days
- And extremely small amount of time for a very big project



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# Timeline – The Beginning

- Week 1
  - Brainstorming – Days 1-4
  - Design Freeze begins – Day 5
    - Established robot design
    - Mobility system frozen
      - Frozen means no more changes!!
    - General ideas for all mechanisms
  - Mechanism Prototyping – Days 5-8
  - Build Drive System – Days 5-14
  - Design Freezes
    - The more experienced you are, the later you can leave your design freeze
    - Prototyping determines a lot
    - The later you freeze, the less time you have to recover



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# Timeline – The Middle

- Week 2
  - Mechanism Build – Days 8-21
  - Programmers Begin Coding – Day 8
    - Can & should start pseudo-coding earlier
    - Build a test board!
  - Robot Controls – Days 8-14
  - Drive System Complete – Day 14
    - Having the robot moving early is crucial!! An emotional lift
- Week 3
  - Begin Autonomous Testing – Day 15
    - Most *FIRST* autonomy only involve the chassis



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# Timeline – The End

- Week 4
  - Mechanism Integration – Days 22-28
    - Wiring is not a quick job
- Weeks 5-6
  - Robot Done – Day 29
  - Testing & Perfecting – Days 29-40
    - Not as easy as it sounds
    - Weight Reduction
    - Design is an iterative process
    - The sooner you fail, the sooner you can improve
  - Driver Training – Days 29-40
    - “Practiced drivers make bad robots win, and unpracticed drivers make good robots lose”



# Timeline – Tips

- Perfectionism can kill the schedule
  - “Never let perfectionism get in the way of getting a good job done”
  - This robot doesn’t need to last for 10 years!
- Your real lives are more important than *FIRST*!
  - Your family and marks come *FIRST*!
    - “All robots and no sleep make Johnny go crazy”
- The given schedule is a sample, like everything in *FIRST* it depends on your team’s resources
  - Time, experience, manpower, funding, etc.
  - A practice robot changes things drastically!



# Driver Selection

- *FIRST* is like auto racing, events are not always won by the best robots; it's often the best drivers
- Too important to be left to the last minute
  - Drivers need time to practice, and adjust to the pressure of the role
  - Prefer to have drivers picked before kickoff, but never any later than day 14
    - I prefer a lot of things in life that don't always end up happening...



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# Driveteam Roles

- Driver (x2?)
  - Responsible for all robot operation
  - Roles are usually divided with a Pilot and a Operator (Controls arms, pickup systems, etc)
  - Overlap can exist
- Field Coach
  - Responsible for planning match strategy, and communicating the strategy during the match
  - The overall decision maker on the field
  - Needs to understand the game inside and out



# One Driver or Two?

- Robot specific decision
- Simple robots can easily be done with one driver
  - A simple robot with two drivers can result in redundancy that leads to slowness
- Complex robots typically necessitate a second driver
- Communication between drivers is critical!



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# Driver Qualities

- Maturity
- Communication Skills
- Passion/Enthusiasm/Dedication
- Driving Skill



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# Driver Qualities

- Maturity
  - *FIRST* competitions are stressful events; your driver must be able to handle pressure!
  - Dependability comes with maturity. You cannot afford to have a driver who will bail on you at the last minute
  - Consider students who've been through high level competitions – e.g. varsity athletes
  - Remember, maturity cannot be taught





# Driver Qualities

- Communication Skills
  - Must be able to listen to instructions from the co-driver, and more importantly the coach
  - The inability to follow pre and in match strategies will result in losses
  - This is another skill that can't be instantly taught in a season



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# Driver Qualities

- Dedication/Passion/Enthusiasm
  - *“Nothing great was ever achieved without enthusiasm”*
  - The drivers need to be fully invested in the team
  - They have to be willing to make the team the priority
    - Become a top driver takes hundreds of hours of practice
- An intense competitive spirit
  - Hey look, another skill that can’t be easily taught in a season...



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# Driver Qualities

- Skill
  - Driving a FIRST robot requires top flight hand-eye coordination
  - A good understanding of spatial relations
    - The ability to see lanes; vision
  - Aggression – you cannot be afraid to mix it up
  - Notice how skill comes after the other three?
    - With enough practice, anyone can develop driver skill
    - With the prevalence of video games, lots of people know how to manipulate a joystick...



# Drive Coach Qualities

- Fast Thinking
  - Drivers have to be watching the robot at all times, they can't watch the whole field
  - Up to the coach to be aware of everything happening on the field
  - Like the offensive coordinator of a football team, the coach calls the plays
  - Needs to be aware of and calculate the score quickly
    - Can't always rely on the real-time scoring
  - Many matches have been won and lost by good and bad coaching



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# Drive Coach Qualities

- Authoritative
  - Drive coach must have the respect of his/her drivers
  - Drivers have to listen to the field coach without question
    - Crucial in short 2-minute matches
  - Drive coach must be able to get the team's point across in the pre-match strategy sessions
    - Teams can be pushy in these sessions, without a strong field coach, you'll end up with a plan that does not suit your team
- I highly recommend that you choose an adult as a field coach
  - The only alternative is your most mature, strong willed and intelligent high school student, who has the respect of his teammates
  - Just my opinion, a lot of people disagree



# Driveteam Decision

- How do we decide who makes the driveteam?
  - Choose your drive coach first
    - This person needs to be involved in the choice of the drivers
  - Base your decision on the aforementioned criteria
    - Also, chemistry matters; they need to get along
- Should we have tryouts?
  - Of the four major qualities, how many of them can be evaluated via a tryout?
- These people will be the faces of your team, for better or for worse
  - An understand of gracious professionalism in critical



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# Resources

- [www.facebook.com/frc1114](http://www.facebook.com/frc1114)
- Twitter: @frc1114
- [YouTube.com/Simbotics](http://YouTube.com/Simbotics)
- [www.simbotics.org/workshops](http://www.simbotics.org/workshops)
- [www.simbotics.org/scouting](http://www.simbotics.org/scouting)
- [www.simbotics.org/app](http://www.simbotics.org/app)
- [www.simbotics.org/kitbot](http://www.simbotics.org/kitbot)
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  - Feel free to ask questions, I actually enjoy this stuff!

