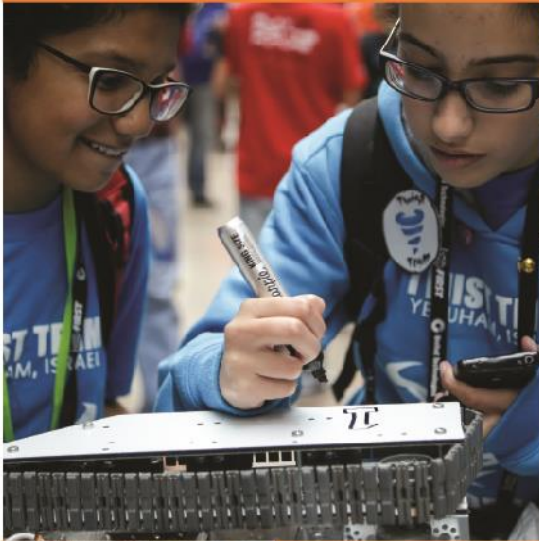


Training and  
Support



**FIRST  
TECH  
CHALLENGE**



# 2016-2017 *FIRST*<sup>®</sup> Tech Challenge Engineering Notebook Guidelines

[www.firstinspires.org](http://www.firstinspires.org)

200 BEDFORD STREET ■ MANCHESTER, NH 03101



FOR INSPIRATION & RECOGNITION OF SCIENCE & TECHNOLOGY

## Volunteer Thank You

Thank you for taking the time to volunteer for a *FIRST*® Tech Challenge event. *FIRST*® and *FIRST*® Tech Challenge rely heavily on Volunteers to ensure events run smoothly and are a fun experience for Teams and their families, which could not happen without people like you. With over 4,600 Teams competing annually, your dedication and commitment are paramount to the success of each event and the *FIRST* Tech Challenge program. Thank you for your time and effort in supporting the mission of *FIRST*!



## Sponsor Thank You

Thank you to our generous sponsors for your continued support of the *FIRST* Tech Challenge!

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Revision History		
Revision	Date	Description
1.1	07/01/2016	Initial Release
1.2	08/01/2016	<ul style="list-style-type: none"> <li>• Formatting update</li> <li>• Updated Sponsor Thank You Image</li> </ul>

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## Introduction

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### **What is FIRST® Tech Challenge?**

FIRST Tech Challenge is a student-centered activity that focuses on giving students a unique and stimulating experience. Each year, Teams participate in a new Game that requires them to design, build, test, and program autonomous and driver-operated robots that must perform a series of tasks.

The playing field for the Game consists of the FIRST Tech Challenge game pieces set up on a foam-mat surface, surrounded by a metal and Lexan Field frame. Each Tournament features Alliances, which are comprised of two Teams, competing against one another on the playing field. Teams work to overcome obstacles and meet challenges, while learning from, and interacting with their peers and adult Mentors. Students develop a greater appreciation of science and technology and how they might use that knowledge to impact the world around them in a positive manner. They also cultivate life skills such as:

- Planning, brainstorming, and creative problem-solving.
- Research and technical skills.
- Collaboration and teamwork.
- Appreciation of differences and respect for the ideas and contributions of others.

**FIRST Tech Challenge is MORE THAN ROBOTS<sup>SM</sup>! While competing, students develop personal and professional skills they will be able to rely on throughout their life.**

To learn more about FIRST Tech Challenge and other FIRST Programs, visit [www.firstinspires.org](http://www.firstinspires.org).

### **FIRST Tech Challenge Core Values**

Volunteers are integral to the FIRST community. FIRST Tech Challenge relies on Volunteers to run the program at many levels, from managing a region to Mentoring an individual Team. Our Affiliate Partners coordinate the program in each region or state. These Affiliate Partners fundraise, run Tournaments, hold workshops and demonstrations, market FIRST Tech Challenge locally, handle public relations, and recruit Volunteers and Teams. They are a tremendous resource for Mentors and FIRST would not exist without them.

FIRST asks everyone who participates in FIRST Tech Challenge to uphold the following values:

- We display *Gracious Professionalism*<sup>®</sup> with everyone we engage with and in everything we do.
- We act with integrity.
- We have fun.
- We are a welcoming community of students, Mentors, and Volunteers.
- What we learn is more important than what we win.
- We respect each other and celebrate our diversity.
- Students and adults work together to find solutions to challenges.
- We honor the spirit of friendly competition.
- We behave with courtesy and compassion for others at all times.
- We act as ambassadors for FIRST and FIRST Tech Challenge.
- We inspire others to adopt these values.

## Gracious Professionalism®

FIRST uses this term to describe our programs' intent. This is one of the most important concepts that can be taught to a young person who is learning to get along in the work world. At FIRST, Team members help other team members, but they also help other Teams.

*Gracious Professionalism®* is not clearly defined for a reason. It can and should mean different things to everyone.

Some possible meanings of *Gracious Professionalism®* include:

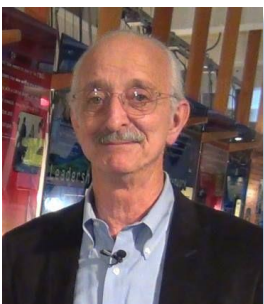
- Gracious attitudes and behaviors are win-win.
- Gracious folks respect others and let that respect show in their actions.
- Professionals possess special knowledge and are trusted by society to use that knowledge responsibly.
- Gracious Professionals make a valued contribution in a manner pleasing to others and to themselves.

In the context of FIRST, this means that all Teams and participants should:

- Learn to be strong competitors, but also treat one another with respect and kindness in the process.
- Avoid leaving anyone feeling as if they are excluded or unappreciated.
- Knowledge, pride and empathy should be comfortably and genuinely blended.

In the end, *Gracious Professionalism®* is part of pursuing a meaningful life. When professionals use knowledge in a gracious manner and individuals act with integrity and sensitivity, everyone wins, and society benefits.

Watch Dr. Woodie Flowers explain *Gracious Professionalism®* in this [short video](#).



*“The FIRST spirit encourages doing high-quality, well-informed work in a manner that leaves everyone feeling valued. Gracious Professionalism seems to be a good descriptor for part of the ethos of FIRST. It is part of what makes FIRST different and wonderful.”*

- Dr. Woodie Flowers, National Advisor for **FIRST**

### **Gracious Professionalism® for Volunteers**

It is a good idea to spend time going over this concept with Volunteers. Provide Volunteers with real-life examples of *Gracious Professionalism* in practice before, during, and after the event and recognize great *Gracious Professionalism* when you see it in action!

**An example of *Gracious Professionalism®* is patiently listening to a Team's question and providing support despite having several pressing things to do on the day of the event.**

## Youth Protection Program

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The purpose of the *FIRST*® Youth Protection Program (*FIRST* YPP) is to provide Coaches, Mentors, Volunteers, employees, others working in *FIRST* programs, team members, parents, and guardians of team members with information, guidelines, and procedures to create safe environments for everyone participating in *FIRST* programs.

The *FIRST* YPP sets minimum standards recommended for all *FIRST* activities. Adults working in *FIRST* programs must be knowledgeable of the standards set by the *FIRST* YPP, as well as those set by the school or organization hosting their team.

### **Youth Protection Expectations and Guidelines**

Coaches and Mentors are expected to read and follow elements in the [FIRST Youth Protection Program guide](#) that are labeled as required are mandatory in the United States and Canada, and may not be waived without the approval of the *FIRST* Youth Protection Department.

*FIRST* recommends that the standards set forth in the [FIRST Youth Protection Program guide](#) be applied outside of the United States and Canada to the extent possible. At a minimum, local regulations regarding youth protection must be complied with.

Forms are available here: <http://www.firstinspires.org/sites/default/files/uploads/about/FORMS.zip>

Information on the US Screening process is available here:

<http://www.firstinspires.org/sites/default/files/uploads/about/US-Screening-Screen-Shots.pdf>

Information on the Canadian Screening process is available here:

<http://vimeo.com/30137373>

You can find FAQ and additional information about the *FIRST* Youth Protection Program on the *FIRST* website at:

<http://www.firstinspires.org/resource-library/youth-protection-policy>

**Everyone working with  
FIRST Teams should be  
familiar with the FIRST  
YPP policies.**

### **NOTICE OF NON-DISCRIMINATION**

United States Foundation for Inspiration and Recognition of Science and Technology (*FIRST*®) does not discriminate on the basis of race, color, national origin, sex, disability, or age in its programs and activities. The following person has been designated to handle inquiries regarding the non-discrimination policies: Lee Doucette, Youth Protection Program Manager, 200 Bedford Street, Manchester, NH 03101, 603-666-3906, Ext. 250.

## What are the *FIRST*® Tech Challenge Engineering Notebook Guidelines?

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The purpose of the *FIRST* Tech Challenge Engineering Notebook Guidelines is to:

- Provide an additional resource for Teams to create successful and effective Engineering Notebooks to be used throughout the *FIRST* Tech Challenge Season.
- Expand on the guidelines provided in Game Manual Part I.
- Providing Award Winning Examples.

The Guide focuses on the skills and concepts needed for the development of the following general goals:

- Creating a successful and effective Engineering Notebook
- Provide tips for Mentors/Coaches to guide students to best utilize the Engineering Notebook.

This Guide would not be possible without the contributions of time, ideas, and resources provided by the following people:

- Jill Wilker, *FIRST* Tech Challenge Judge Advisor
- Dee Tomczak, *FIRST* Tech Challenge 2015 World Championship Think Award Judge
- Gigi Johnson, *FIRST* Tech Challenge 2015 World Championship Think Award Judge
- Marlene Lynn, *FIRST* Tech Challenge 2015 World Championship Think Award Judge
- Team 365, *FIRST* Tech Challenge 2015 World Championship Think Award Finalist
- Team 4250, *FIRST* Tech Challenge 2015 World Championship Think Award Finalist
- Team 5037, *FIRST* Tech Challenge 2015 World Championship Think Award Finalist
- Team 6134, *FIRST* Tech Challenge 2015 World Championship Think Award Finalist

## Engineering Notebook Overview

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### *What is an Engineering Notebook?*

One of the goals of *FIRST* and *FIRST* Tech Challenge is to recognize the engineering design process and the journey that a Team makes during the phases of the problem definition, concept design, system-level design, detailed design, test and verification, and production of the robot.

Throughout the process of designing and building a Robot, Teams will come across obstacles, lessons learned, and the need to draw things out on paper. This is where Teams will use an Engineering Notebook. These notebooks track the Team from the beginning of the season in May throughout the Competition season. Judges review a Team's Engineering Notebook to better understand the journey, design, and Team as a whole.

The Engineering Notebook is a complete documentation of the Team's Robot design as well as chronicles the time spent doing research, outreach, Team meetings, and plans for growth. This documentation should include:

- Sketches
- Discussions and Team meetings
- Design evolution
- Software development
- Processes, obstacles
- Each Team member's thoughts throughout the journey for the entire season

**A new notebook should be created for each new season.**



### **Engineering Notebook Questions**

This journey goes beyond recording the day to day “here’s what we did” or just listing “we met today”. It explores questions like:

- What is the agenda for today and what are the goals?
- Why are you meeting?
- What decisions did your Team make in forming the Team, creating the robot, writing the program, the outreach projects, etc.?
- Why did you make that choice when building your robot, coded the software that way, chose that group of individuals to outreach to, etc.?
- What was the impact on your Team, robot, or community when you made that decision?
- What is the next step?

## Engineering Notebook Formats

Teams may choose to record their season with either handwritten, electronic, or online documents. There is no distinction made between handwritten and electronic Engineering Notebooks during Judging; each format is equally acceptable. Only one copy is required per Team.

**Electronic/Online:** Teams may choose to use electronic or online programs to create their Engineering Notebook. For the purposes of Judging, Teams must print out their Engineering Notebooks and place them in a binder, no larger than 3” and no more than 2 binders.

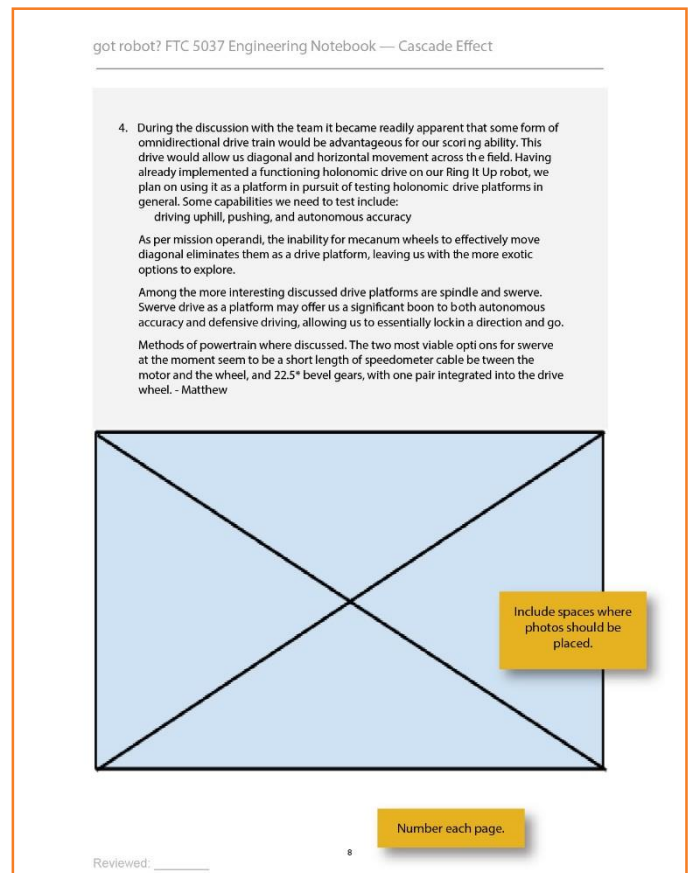
**Handwritten:** Teams can choose from spiral-bound, laboratory, or documentation notebooks available through their school or local stationary supply store. Teams can also use the binder supplied by Rockwell Collins delivered in the Registration and Welcome Kit. No more than 2 binders/notebooks.

### Engineering Notebook Requirements

1. The Team Number and Team Name must appear on the outside of the Engineering Notebook.

**Engineering Notebooks will not be considered without this information.**

2. Attach a summary page to the front cover of the Engineering Notebook. The summary should be one page and include a summary narrative about the Team, school, or organization with bulleted highlights of the Team’s season. The Team summary page should also include the Team number and a list of pages in the Engineering Notebook that the Team would most like the Judges to consider.
3. The Engineering Notebook must be divided into multiple sections, including:
  - a. An Engineering Section that includes the Robot design processes (required).
  - b. A Team Section that includes information about the Team and outreach activities (required).
  - c. And include one or more of the following (not required).
    - i. A Business plan
    - ii. A Strategic plan
    - iii. A Sustainability plan



## Engineering Notebook Tips to Help your Team Stand Out

- Every Notebook is a work in progress, forever changing and developing. Judges do not want to see a “final” copy notebook; they want the real thing complete with misspellings, stains, worn edges and wrinkled pages. Just remember to keep it real!
- Document EVERYTHING.
  - Include the time after you finish your build and all the way up to Competition, as well as between Competitions. If your Team plans on competing in multiple events for the season, what are you doing to improve your performance? How are your outreach efforts? How is your Team investing its time in between the Competitions? *Do not stop using the Engineering Notebook once the robot is completed.*
  - Ask yourself questions like:
    - What worked, what didn't? Do not be afraid to include your failures. This is about your journey to success. When something didn't work, how did you problem-solve?
    - What modifications are you planning on making?
    - How has your robot changed over the course of the season?
    - How do you plan to fund your way to each event?
  - The documentation should be detailed enough that somebody could look at your notebook and be able to build your robot from it.
- Summary Narrative Page should be used as a way to impress the Judges without the Team being in the room.
  - When crafting your summary narrative, make sure you highlight what makes your Team stand out. Remember to keep this short, as you would want Judges to have more time diving into the pages of your notebook that you have tabbed for them.
  - Remember, Judges only have a limited amount of time with each notebook. When tagging the pages you would like them to review, keep in mind that more tabs means that they will have less time to spend on each page. Think, *quality over quantity*.
- Engineering Notebooks should be organized enough that an outsider (e.g. a potential sponsor) can understand the Team and their journey.
  - Be clear when dividing the notebook into sections.
- Start the Team Section of the notebook by introducing each Team member and Mentor with a brief biography of their name, age (or school year), role on the Team, interests, and reasons for joining an FIRST Tech Challenge Team.
  - The Team Section is also a good place to discuss and show Team activities that are done throughout the Team's season. These can include what your Team outreach efforts include, **Gracious Professionalism®** - “Doing your best work while treating others with respect and kindness - It's what makes FIRST, first.”

got robot? FTC 5037 Engineering Notebook — Cascade Effect


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9.16.14 PROTO-STORM!! Duration 6:00 pm - 8:00 pm

**Attendance:**  
Bo, Chris, Matthew, Aidan, PJ, Kristen, Marcos, Coach, Programming Coach Stephen, Mrs. Laker, Mrs. McKellar, Mr. Solomon

Tasks:	Reflections:
1. Plan ideas for a practice “sparring” robot that we would use as an “opponent” for the rest of the season.	1. Aidan was tasked with developing the sparring bot, a robot which we will use for training during driving practice. (See details.)
2. Brainstorm ideas for ways of picking up and scoring balls	2. Matt, Marcos, Kristen, PJ, Coach, and Mr. Stephen spent time generating ideas for ways that our competition robot could pick up balls and deploy them. (See details.)
3. Put the ideas presented into CAD so they can be tested virtually.	3. Bo and Chris would work on getting the ideas that are presented into CAD. (See details.)
4. Brainstorm new ideas for our robot.	4. The two major discussion points involved the construction and requirements of the drivetrain, and ball transfer devices. Possible drivetrains included the likes of swerve and holonomic, while the ball mechanisms discussion included inertial kickers, slides, and conveyors. (See details.)

Clearly states tasks and team reflections



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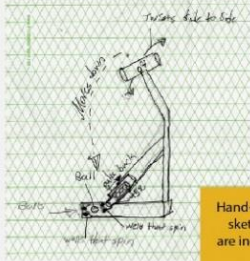
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- Team building activities, or more.
- b. Pictures along with the bios would serve as a great visual for the Judges to get to know each member of the Team.
6. Start a fresh page in the Engineering Section at every meeting. The date, and start/stop times should be recorded when starting a new page.
    - a. Include highlights from the meeting. What was talked about? What did you do? What was planned and/or accomplished during your time together?
  7. All designs and changes to the Robot should be recorded directly into the Engineering Section of the Engineering Notebook. The inclusion of all details and sketches are preferable. Notes and calculations should be done in the notebook, NOT on loose paper.
    - a. A Judging panel is always interested to see a unique design or playing strategy. On the other hand, a design without the substance to support its reasoning is not viewed as highly. Remember to explain the *underlying science, math, and strategies your Team is using as well as why you are doing what you are doing.*
    - b. Pictures or sketches of the Robot designs, electrical wiring diagrams, or even software development are recommended as part of a thorough documentation.
  8. Think about including your software development. This does not mean including the entire code, rather we encourage you to describe your code.
  9. Written entries must be in permanent ink – not pencil.
  10. Entries should be made by every Team member, initialed, and dated. Judges like to see entries from more than one Team member. While it is not prohibited for one student to own the Engineering Notebook process, showing that your Team has multiple members sharing the responsibility showcases how your Team is proactively thinking about the sustainability of your Team.
  11. Use both sides of a page. Never leave any white space: “X” out or crosshatch all unused space, and initial and date. For electronic Engineering Notebooks, consider printing on both sides of the paper.
  12. To insert pictures or outside information into the notebook, tape the picture into the notebook and outline with permanent ink, to note that it was there in case it falls out. Put the corresponding page number on that inserted page
  13. In the case of an error, draw a single line through the incorrect data. Do NOT erase or use correction fluid. All corrections should be initialed and dated.

got robot? FTC 5037 Engineering Notebook — Cascade Effect

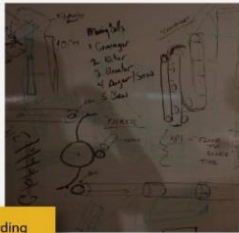
Details:

1. My current idea is to make a sparring bot with a telescoping lift that has a scoop/tube attached at the top. This tube will have a pivot in the middle. There will be a scoop with a zip-tie intake in the front and behind the scoop at the opposite side of the tube will be an opening hatch. In order to pickup balls the lift will lower all the way while the tube moves on its pivot to become parallel with the ground, allowing balls to enter through the zip-tie intake. Once the pipe is full the lift would raise and the pipe would become vertical. To score, the robot would move its lift/tube to roll the balls into a rolling goal we would have attached on the back. This goal would not be released so we could continue scoring easily. --AMP



Hand-drawn sketches are included

2. During our brainstorming section for the robot's intake/delivery multiple ideas were presented.
  - a. I thought of a 2 part delivery mechanism.



Recording ideas for possible design

Delivery Mechanism:  
My idea entails a pipe and an arm with 2-3 claws mounted at the end. The illustration to the left shows how these components go together. At the bottom is a square frame/base, which the drawer slide is mounted to, on the front. The top of the slide has two straight bars that make up an arm connecting the slide system to a horizontal 'pipe' at the very top. This 'pipe' will be able to hold 5 balls total. Through the slide changing elevation the arm and thus the pipe will move as desired. This mechanism will have 4 preset movement capabilities:

- Pipe end facing ground at 45° from vertical
- Wrist will rotate left/right
- Arm shoulder rotates up/down so that the arm rises
- Pipe end facing ground at 45° from vertical on either side

Reviewed: \_\_\_\_\_ 6

## Business/Strategic Plan

Identify the Purpose for a Business Plan for your Team. This is unique for every Team and may touch on one or more of the following needs:

- Direction the Team wants to take.
- Outlining Team Goals.
- Type of outreach Team wants to focus on.
- Creating a Team budget.
- Fundraising needs.
- Seeking out Sponsors.

The Business Plan can act as the backbone and guiding force for your Team. By mapping out where you plan to go during the season (starting with who and what your Team is all about), the goals you want to achieve and what you need to do in order to reach them, your Team will be able to stay on track throughout the season. This is a living document and may change based on challenges that may arise through the season, lessons learned, or new opportunities. Plan on revisiting this document a few times throughout the season to see if your Team is on track of if a new direction is being taken, and modify your Business Plan accordingly.

Your Strategic Plan may also include milestones. These may they be short term (i.e. competing in at least two events this season) to one year plan (i.e. making it to a Regional Championship and fundraising the costs) or even further (i.e. plans to create and foster additional *FIRST* Tech Challenge Teams).

Ask yourself:

- What are your Team Goals?
- Are you planning to use the Business Plan to plan your funding strategies?
  - How much money does your Team need to get started and for what? (ie: a budget)
  - How much money does your Team need to sustain it for multiple years?
  - How much money does your Team plan to raise through fundraising efforts?
  - How much money does your Team anticipate raising through grant opportunities?
  - How much money/in-kind donations does your Team plan to raise through sponsorship?
  - How will you promote a business/organization if you receive a sponsorship? (Logo on Team t-shirts and flare, etc.)
- Are you planning to use the Business Plan to seek out Sponsors?

A Strategic Plan or Business Plan is documentation of the process through which an organization defines priorities and develops the process they will undergo to achieve their goals. It helps the organization (in this case, your Team) determine a course of action and a measure by which to make decisions about how they will gather and use resources. That information can then be shared within the Team to keep everyone focused, as well as outside of the Team, such as with parents, school administrators, Sponsors, and other groups to articulate the Team's purpose and impact.

Make sure to identify what must be purchased, such as tools and major components, not only simple categories like parts, travel lodging, etc. It should include the budget, the fundraising plan, contingencies if the Team does not reach their fund raising plan, and what they will do if they have excess. For multiple Team organizations, show who is doing what and how the money raised is divided.

See an example in our Appendix D: [Sample Business/Strategic Plan](#).

### ***A Sustainability Plan***

This plan can be integrated into the Business/Strategic plan. This plan explains how the Team plans to grow and stay competitive when students graduate from the program. This may include plans to recruit sponsors, new Mentors, or Team members.

When considering including a Sustainability Plan, ask yourself:

- How does your Team plan on continuing past this season?
- Are you training younger Team members in key roles as members graduate out?
- Are there plans for recruiting new members? What are they?
- Does your Team have plans on recruiting additional Mentors?

- How are you fundraising the costs of next season? Registration? New parts?
- How are you and your Team leaving a legacy that will last beyond just this season?

See an example in our Appendix D: [Sample Business/Strategic Plan – Sustainability](#).

## Notebook Examples


Scanned copies of award-winning Engineering Notebook (both electronic and handwritten) examples are posted on the *FIRST* Tech Challenge [Team Management Resources](#) website under Engineering Notebook Resources. It is strongly encouraged for Teams to look over these great examples of what the Judges will be looking for when reading through the Engineering Notebooks. Please remember, each Engineering Notebook is a reflection of the Team creating it. Although these samples are great references, the methodology and format used for these Teams may not fit your Team. These are examples that may *inspire* your Team when starting your Engineering Notebook, but should not be used as the sole template for your Notebook.

got robot? FTC 5037 Engineering Notebook — Cascade Effect

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**Intake System:**

In my design the pipe is connected at 45° to the base. This pipe has three slits in it. Overall there are two pipes: an intake system/pipe, which is smaller, and the delivery system/pipe, which is larger. The downward position will be at a 45 degree angle. When grabbing balls the delivery pipe will interlock with the intake pipe. Once locked the delivery system will retract the attached claws and will connect with the slots in the intake system. Interlocked the delivery system will pull back. When all is done the systems will release and the intake will rise to the delivery positions. -MM Ms




Marco's intake and delivery system

Initial entries.

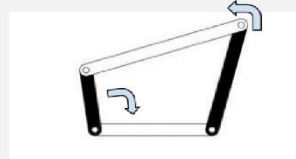
Include photos of prototypes as well as detailed explanations.

b. While prototyping ideas I developed a closeable scoop to drive up to the balls then close the top half of the scoop bucket to trap a ball. The scoop would be mounted on a longer jointed arm to reach up, then open the upper scoop to drop the balls in the rolling goal. I used Tetrix parts, cardboard, and masking tape to create a prototype to show my idea to the team. -K McK



Kristen's Ball Scoring Device V1

3. Chris and I worked on making a 4 bar linkage that we could combine with Kristen's pipe and arm idea so the tube could easily be lifted off the floor. We tested out our idea in SolidWorks and it worked quite well! -Bo



Reviewed: \_\_\_\_\_

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## Award Categories that Require the Engineering Notebook

The chart below provides a quick overview of the Engineering Notebook requirements by Award:

<b>Engineering Notebook Requirements by Award</b>	
<b>Inspire Award</b>	<ul style="list-style-type: none"> <li>Engineering Notebook must be submitted, and must include an Engineering Section, a Team Section and a Business or Strategic Plan. The entire Engineering Notebook must be high quality, thoughtful, thorough, detailed and well organized.</li> </ul>
<b>Think Award</b>	<ul style="list-style-type: none"> <li>Engineering Notebook must demonstrate that the Team has a clear understanding of the engineering design process, with pictures or drawings and details documenting all stages of Robot design.</li> <li>Notebook must recount the Team's journey, experience and lessons learned throughout the season.</li> <li>Engineering Notebook must include entries describing underlying science, mathematics, and game strategies.</li> </ul>
<b>Connect Award</b>	<ul style="list-style-type: none"> <li>An Engineering Notebook must be submitted and must include a Business or Strategic plan that identifies their future goals and the steps they will take to reach those goals. The plan could include fundraising goals, sustainability goals, timelines, outreach, and community service goals.</li> </ul>
<b>Rockwell Collins Innovate Award</b>	<ul style="list-style-type: none"> <li>Team must submit an Engineering Notebook with an Engineering Section that documents the design process and how the Team arrived at their design solution.</li> </ul>
<b>PTC Design Award</b>	<ul style="list-style-type: none"> <li>Team must submit an Engineering Notebook with an Engineering Section that includes detailed robot design drawings.</li> </ul>
<b>Control Award</b>	<ul style="list-style-type: none"> <li>The Engineering Notebook must include an Engineering Section that documents the control components.</li> </ul>

Read the [Full Awards Descriptions](#) here.

## Additional Engineering Notebook Resources

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For more information and suggestions, check out the following resources:

[Mentor Manual](#) – there is a section on the Engineering Notebook, as well as Appendices that include: Engineering Notebook samples (with tips on why they were successful), information on writing a Business/Strategic Plan, and more.

[FIRST Tech Challenge Example Engineering Notebooks](#) – under the Training Resources section of the *FIRST* Tech Challenge Team Resources webpage there are four full Engineering Notebooks from Teams. Check them out for ideas.

[FIRST Tech Challenge Fundraising Resources](#) – Fundraising Guide, Budgets, Sponsor Presentations, etc.

[Fundraising Toolkit](#) – lots of information and example Business, Strategic, and Sustainability plans, including sample budgets.

[Judges Manual](#) – review for information on how Judges will be evaluating the Engineering Notebook.



# 2016-2017 *FIRST*® Tech Challenge Engineering Notebook Guidelines

## Appendices

## Appendix A: Resources

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### **Game Forum Q&A**

<http://ftcforum.usfirst.org/forum.php>

Anyone may view questions and answers within the *FIRST*® Tech Challenge Game Q&A forum without a password. In order to submit a new question, you must have a unique Q&A System User Name and Password for your team.

### **FIRST Tech Challenge Game Manuals**

Part I and II - <http://www.firstinspires.org/node/4271>

### **FIRST® Headquarters Pre-Event Support**

Phone: 603-666-3906

Mon – Fri

8:30am – 5:00pm

Email: [FTCTeams@firstinspires.org](mailto:FTCTeams@firstinspires.org)

### **FIRST Website: [firstinspires.org](http://firstinspires.org)**

[FIRST Tech Challenge Page](#) – For everything *FIRST* Tech Challenge.

[FIRST Tech Challenge Volunteer Resources](#) – To access public Volunteer Manuals.

[FIRST Tech Challenge Event Schedule](#) – Find *FIRST* Tech Challenge events in your area.

### **FIRST Tech Challenge Social Media**

[FIRST Tech Challenge Twitter Feed](#) - If you are on Twitter, follow the *FIRST* Tech Challenge twitter feed for news updates.

[FIRST Tech Challenge Facebook page](#) - If you are on Facebook, follow the *FIRST* Tech Challenge page for news updates.

[FIRST Tech Challenge YouTube Channel](#) – Contains training videos, Game animations, news clips, and more.

[FIRST Tech Challenge Blog](#) – Weekly articles for the *FIRST* Tech Challenge community, including Outstanding Volunteer Recognition!

[FIRST Tech Challenge Team Email Blasts](#) – contain the most recent *FIRST* Tech Challenge news for Teams.

[FIRST Tech Challenge Google+](#) community - If you are on Google+, follow the *FIRST* Tech Challenge community for news updates.

### **Feedback**

We strive to create support materials that are the best they can be. If you have feedback regarding this manual, please email [ftcteams@firstinspires.org](mailto:ftcteams@firstinspires.org). Thank you!

## Appendix B: Engineering Notebook Self-Assessment

For Team use only – NOT to be handed in.

Notebook Formatting		
Present?	Item Description	Comments/Goals for Improvement
	<b>Required:</b> Cover page, including Team name & Team number	
	Optional: Creative cover, Team photo, etc.	
	<b>Required:</b> No more than two binders	
	Optional: Neat organization, neat presentation of information	
	Optional: Page Numbers	
	Optional: Table of Contents	
	Optional: Section dividers, clearly labelled	
	Optional: Entries made on both sides of the paper	
Notebook Sections		
Present?	Item Description	Comments/Goals for Improvement
	<b>Required:</b> Team Summary page	
	<b>Required:</b> Engineering Section	
	Engineering Section documents the design, build, & testing stages of the robot	
	Includes code development process (not just the code)	
	<b>Required:</b> Team Section (deeper dive of Team Summary page)	
	Optional: Outreach Section	
	Optional: Awards and Recognition Received Section	
	<b>Required for some awards:</b> Business Plan, Strategic Plan, and/or Sustainability Plan	
	<b>Required for the Control Award:</b> Control Award Content Sheet (check with event on how this sheet will be collected)	
	Optional: Budget section (if not included already)	
Notebook Quality		
Present?	Item Description	Comments/Goals for Improvement
	Team growth and development is documented	
	Team leadership and organization is documented	
	Team failures and struggles are documented	
	Every Team member contributes to the Notebook	
	Every meeting has at least one Notebook entry	
	Entries include pictures, drawings, and text as applicable	
	Notebook is an accurate representation of the Team and journey	
	Notebook documents changes in the robot plan, including <b>WHY</b> the change was made	

For more info and to view example Notebooks, check out the [FIRST Tech Challenge Team Management Resources webpage](#).

## Appendix C: How to Write a Business/Strategic Plan

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### *How to Write It*

[Forbes recommends a five step approach](#) to developing your strategic plan:

**Determine the current status of the Team** – being honest, assess the current state of the Team. Are you a Rookie Team? Are you a five-year Veteran Team with more than half the Team brand new to FIRST Tech Challenge? Whether Rookie or Veteran, brainstorm the following: what do you know, what do you need, and what are your season goals?

**Identify What Is Important** – after you brainstorm a list of goals for the season, narrow it down to one to three that are manageable within this one season. Identify which ones can be achieved the following or later seasons.

**Define What You Must Achieve** – With your goals in mind, determine what you need to do to accomplish those goals. Don't forget that you also need to build a Robot, compete with it, fundraise, and keep an Engineering Notebook, at the very least. Your goals and the steps needed will be in addition to or work with these tasks.

**Determine Who Is Accountable** – this is where it will be good to identify Team Roles and the role of the Mentors in supporting Team members at accomplishing the goals.

**Review** – review the plan once it is written. Refer back to it whenever making a big Team decision, and do a thorough review at the end of each season/before the next season.

### **Additional Resources**

[FIRST Fundraising Toolkit](#) – Team-created instructions and examples, including:

- [Business Plan Instructions](#)
- [Business Plan Webinar](#)

## Appendix D: Sample Business/Strategic Plan



The following is a plan crafted for a fictional Team.

### Cover Page

**FIRST Tech Challenge Team**

**Robo Innovators**

**Portland, ME**

Make your cover page professional and attractive. Use borders, your Team logo, a picture of your Team, school name, etc.

### Contents

- 1.0 Executive Summary
  - 1.1 Team Mission Statement
  - 1.2 FIRST® Description
  - 1.3 Program Summary
  - 1.4 Team Origin, Description, and History
  - 1.5 Team Organizational Structure
  - 1.6 Team Relationships
- 2.0 Team Impact and Goals
  - 2.1 Team Use of Resources
  - 2.2 Team Future Plans
- 3.0 Sustainability
  - 3.1 Team Action/Implementation Plan
  - 3.2 Team Financial Statement
  - 3.3 Team Fundraising Opportunities
  - 3.4 Team Risk and Opportunity Analysis
- 4.0 Outreach and Recognition
  - 4.1 Outreach
  - 4.2 Recognition
- 5.0 Resources

## **1.0 Executive Summary**

### **1.1 Team Mission Statement**

To inspire ourselves and others to develop a life-long love of learning and engagement in our community by building a strong Team that is known and respected throughout Portland and beyond.

### **1.2 FIRST Description**

The mission of *FIRST* is to inspire young people to be science and technology leaders, by engaging them in exciting Mentor-based programs that build science, engineering and technology skills, that inspire innovation, and that foster well-rounded life capabilities including self-confidence, communication, and leadership.

*FIRST* was founded in 1989 to inspire young people's interest and participation in science and technology. Based in Manchester, NH, the 501 (c) (3) not-for-profit public charity designs accessible, innovative programs that motivate young people to pursue education and career opportunities in science, technology, engineering, and math, while building self-confidence, knowledge, and life skills.

### **1.3 Program Summary**

*FIRST* Tech Challenge is designed for students in grades 7-12 to compete head to head, using a sports model. Teams are responsible for designing, building, and programming their robots to compete in an alliance format against other Teams. The robot kit is reusable from year-to-year and is programmed using a variety of languages. Teams, including coaches, Mentors and volunteers, are required to develop strategy and build robots based on sound engineering principles. Awards are given for the Competition as well as for community outreach, design, and other real-world accomplishments.

### **1.4 Team Origin, Description, and History**

The Robo Innovators began in 2012 as an afterschool program for four girls very interested in learning about robotics. Eager to share the experience, once the Team was registered with *FIRST* Tech Challenge, they opened the Team up to interested parties and the Team quickly grew to twelve. Team Mentors included two parents and the high school physics teacher. Currently the Team has 15 members from grades 7-12, both boys and girls.

In 2013 the Team attended the Massachusetts State Championship and the robot had a good showing on the field. They were honored with a nomination for the Motivate Award.

In 2014 the Team again attended the Massachusetts State Championship. The Team won the Think Award and the robot was selected to be part of a Semi-Final Alliance.

### **1.5 Team Organizational Structure**

The Team is managed by the physics teacher and a parent volunteer. In addition, there are three technical Mentors from local businesses who coach the students on engineering principles, computer programming, and construction. Team members take on the responsibility of managing the Team, deciding roles, and completing project tasks, including fundraising.

### **1.6 Team Relationships**

2014 Sponsors: Swell Middle High School, Eden Electrical Corp, and Wilson's Metalworking.

Swell Middle High School provides funding for all after school clubs and organizations. In addition, they allow the Team to use a school computer, space in the shop to store the robot, to work on the robot, and use of the shop tools.

Eden Electrical Corp provides two Mentors and annual funding for the Robot materials.

Wilson's Metalworking also provides Mentor support and funding in the amount of \$600 annually.

## 2.0 Team Impact and Goals

### 2.1 Team Use of Resources

Robo Innovators have taken their robot to local events, providing information about the program, Team, and inviting guests to touch or drive the robot.

### 2.2 Team Future Plans

In 2015 the Team plans to start a second *FIRST* Tech Challenge Team to allow more students access to the creative process of building a robot and the rewarding experience of being on a Team. In addition, the Team is planning to run a summer robo camp for children ages 6 – 12 to encourage more students to get involved in robotics at a young age.

## 3.0 Sustainability

### 3.1 Team Action/Implementation Plan

The Team has identified the following actions for growth and sustainability:

Strategy	Actions	Responsibility	Planned Completion
Transition six Team members into a leadership/Mentoring role to support the new Team	<ul style="list-style-type: none"> <li>Develop a leadership training program</li> <li>Select and develop Team members to transition to a Mentoring role for the new Team.</li> </ul>	Team Mentors	January 2015
Prepare the Team to transition to Java	<ul style="list-style-type: none"> <li>Develop training materials to teach the Team Java programming language</li> </ul>	Technical Mentors	June 2015
Raise funds to support the start of a new Team and Robo Camp initiative	<ul style="list-style-type: none"> <li>Craft amended budget</li> <li>Strategize a fundraising plan</li> <li>Identify and implement one large fundraiser</li> <li>Identify and implement a small, long-term fundraiser</li> </ul>	Fundraising Committee	March 2015
Robo Camp	<ul style="list-style-type: none"> <li>Develop budget</li> <li>Develop Marketing plan to recruit campers</li> <li>Outline schedule for the camp.</li> </ul>	Outreach Committee Mentors	January 2015
Identify six sub-committee members to become Leadership committee members by the end of the season.	<ul style="list-style-type: none"> <li>Identify six members</li> <li>Develop targeted training to prepare them for the roles</li> </ul>	Leadership Committee	April 2015

### 3.2 Team Financial Statement

Item	Budget Amt.	Actual Cost	Category	Rationale/Explanation
<b>Expenses</b>				
Registration	275.00		Registration	<i>FIRST</i> Tech Challenge registration fee (required).
Parts & Supplies	700.00		Robot Supplies	Annual parts and new technology

Kit of Parts	1500.00		Robot Supplies	For the new Team
<b>Sub-Total</b>	<b>2475.00</b>			<b>Projected total expenses for the 2015 season.</b>
<b>Monies</b>				
Rollover Amount	1700.00			Money left over from the previous season
School Allocated Club Funds	425.00		Income	Annual amount
Wilson's Metalworking	600.00		Income	Annual sponsorship amount
Eden Electrical Corp	500.00		Income	Annual sponsorship amount
Car Wash	300.00		Fundraiser	Planned Team fundraiser with ideal amount raised.
<b>Sub-Total</b>	<b>3525.00</b>			<b>Anticipated amount of money coming in throughout the season. Actual amount may be lower/higher, but it's best to over-plan ways to raise money.</b>
<b>Bottom Line</b>				
Credit/Deficit	<b>1050.00</b>			Current money still left/Money owed that still needs to be raised (marked in red)

### 3.3 Team Fundraising Opportunities

Fundraiser Idea	Projected Income		Category	Notes
Pizza & Dodgeball Fundraiser	500.00		Fundraiser	One large event, and if the pizzas are donated, we could potentially double our profit.
Shirt Sales	300.00		Fundraiser	Small, on-going fundraiser that can continue year after year.

### 3.4 Team Risk and Opportunity Analysis

We have outlined the following concerns that might impact our current goals and strategies:

Risk 1 - Advance to the East Super-Regionals: While we will work with our Mentors and resources toward this goal, we cannot guarantee our success, especially since we cannot control the other Teams and their robots. However, we hope that by learning Java programming right away, as outlined in section 3.1, we will be able to get started on our goal.



Risk 2 - Start and Mentor an *FIRST* Tech Challenge Team: We cannot guarantee that a second Team is viable for our school. We have a dozen students who have expressed interest, but until the school and the students' parents approve, we cannot move forward with the second Team. Mentors and Team members have been building leadership capabilities and documenting the progress of our Team for over a year. We hope that this will prepare us to Mentor the new Team to success. Our fundraising and leadership plans are also outlined in 3.1 and 3.2 and we think this will convince the school and parents we are prepared to start and support this Team.

Risk 3 - Implement Robo Camp: We feel strongly that there is an interest and a need in our community. We have no guarantee that the camp will meet the full desired enrollment of 20 campers, but we have a plan for promotion in the works as outlined in 3.1, so we think we are prepared.

Our Team has identified the following opportunities that we plan to take full advantage of:

Opportunity 1 - Fundraising – Eden Electrical Corp has provided funding for robot materials for our Team for the past two years. We plan to approach them with our idea to start a second Team and see if they will be willing to sponsor that Team as well. The two Mentors who work at Eden Electrical feel strongly that the company is willing and able to do so, we just need to finalize our proposal and present it to the CEO. If we are able to do so, we will continue to have a budgeting surplus, even with the new Team, which ensures our Team longevity.

Opportunity 2 – A new T-shirt business has opened up and we think if we approach them and ask them to partner with us on T-Shirt sales that they will agree as a way to promote their business. The owners are young and liked the idea, we just need to finish our formal proposal. Having a long-term fundraiser will be really useful for budgeting purposes each year.

## **4.0 Outreach and Recognition**

### *4.1 Outreach*

Currently the Team attends a lot of local events, such as the First Night and 4<sup>th</sup> of July celebrations, and showcases the club and the robot. We are excited about starting Robo Camp which will be our first foray into running our own event.

### *4.2 Recognition*

- Think Award, Massachusetts State Championship, 2014
- Swell Middle High School Club of the Year, 2013 and 2014

## **5.0 Resources**

### *5.1 Photos and Other Supplemental Materials*

For more information about the Team and our outreach, please check out the following materials:

- Team brochure (insert URL)
- Team Engineering Notebooks (insert URL)

### *5.2 Team Contact Information*

Lead Mentor: Jesse Teacher, email address

Lead Mentor: Ricky Parent, email address

Team Email address

Team website: insert URL

Team Instagram page