

**FIRST<sup>®</sup> LEGO<sup>®</sup> League**

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**ENGINEERING NOTEBOOK**

SESHAN BROTHERS

# WHAT IS AN ENGINEERING NOTEBOOK?

- Documentation is an important aspect of *FIRST* LEGO League and something you can share during judging
- The Engineering Notebook is a way to record your team's journey through your season of *FIRST* LEGO League.
  - Record the process of designing and building the robot
  - Record your research, fieldtrips and interviews, and testing your solution
  - Record your outreach events, what you do during team meetings, and your even your future ideas

**In short, you can record EVERYTHING!**

*FLL Tutorials has provided some pages from actual Engineering Journals in FIRST LEGO League and also provided some blank templates for your team to use (see Worksheets section of Resources)*

# WHAT CAN BE INCLUDED?

- Photographs and drawings
- LDD CAD drawings of your robot
- Plans for the season and tasks to complete
- Discussions & decisions during team meetings
- Robot and attachment designs ideas and tests
- Code printouts and pseudocode
- Problems you faced
- Improvements you made
- Ideas you have

# SOME QUESTIONS THAT ARE USEFUL

- What is the goal for today's meeting?
- What decisions were made today?
- Why did you make that choice?
- What did you try today?
- What worked, what did not work?
- When something didn't work, how did you solve the problem?
- What modifications are you planning on making next time? What are your next steps?

# ENGINEERING JOURNAL SAMPLE I

Record how the team came up with their Robot Game Strategy

Record what missions you will complete in each run and pseudocode

Record who is going to work on what

**Student Name:**

**Date:**

**Goal:** Today we worked on developing a robot strategy. Each student on the team came up with their own strategy plan. They presented it to the team. We discussed each one and then we merged the ideas together, taking the best ideas.

This is our final plan: We plan to have 4 runs from base.

In run 1, we will do M01, M06, M09, M15. We feel this will work well since there are lines to follow and the missions are close together.

**Run 1 Pseudocode:** 1) The robot will leave base and head towards.....

In run 2, we will do M03, M25, M07

**Run 2 Pseudocode:** 1) The robot will leave base and head towards...

**Next Steps:**

John, Jessica and Ellie will work on run 1 attachments programming  
Fred, Eli, and Ananth will work on run 2 attachments and programming  
Eric and Samantha will work on creating the base robot.



# ENGINEERING JOURNAL SAMPLE 2

Record tests on different base robots

**Student Name:**

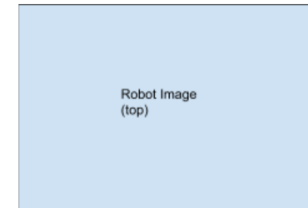
**Date:**

**Goal: Comparing different robot designs.**

## Robot #1

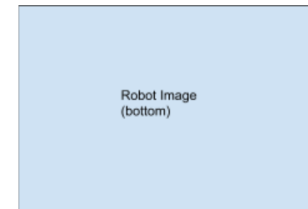
### What works well

- It has a low center of gravity.
- It drives and turns accurately.
- It has 4 walls protecting it from external forces.
- Dual color sensors (Shielded) for line squaring
- Gyro sensor position in the middle and out of the way.
- Lots of areas to to add attachments



### What needs improvement

- Weight balance between front and back is causing robot to jerk
- Robot is tilting back too much
- High walls seem to be making it heavy
- We only use 3 of the 4 available motors



### Next Steps

- Position the Brick more backwards to balance out weight.
- Leave charging port more easily accessible.
- Add one more motor.
- Experiment with different wheels.

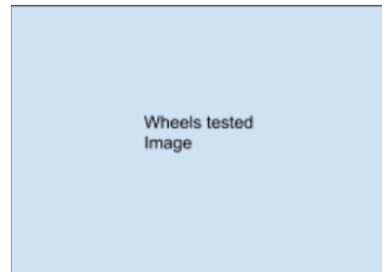
### Sample Comparison Table:

Robot	Size	Wheels	Motors	Sensors	Strength	Speed
Robot 1	17X10X1 5cm	Edu wheels 2 ball bearing	4 Large	1 color	Low center of gravity	Medium speed
Robot 2		Large Motor. Cycle Skids	2 Large 2 Med	2 color Gyro	Tall	Fast

# ENGINEERING JOURNAL SAMPLE 3

**Student Name:**

**Date:**



**Goals: Compare different robot wheels**

Today we tested different tires for our robot. The goal was to make a decision on which tire to use.

Record other tests such as comparing different wheels

Category	Robot 1 with EV3 Edu Wheels	Robot 1 with Large Motorcycle wheels	Comments
Move Straight 25 inches	Worked well	Curved, jerks	
Four 90 degree Right and Left t			

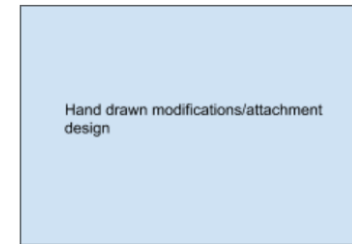
# ENGINEERING JOURNAL SAMPLE 4

□ Document  
different  
attachment ideas

**Student:**

**Date:**

Goal: Work on Mission 01. The pictures show different designs for M01 that we created.



- Initial idea involved a flat box for M01. As we tested it out, we realized that we needed wall guide to make sure that the attachment will align on the mission model.
- We also realized, that a small ramp would help guide the delivery of the model to inside the circle.
- To retrieve the box back, we originally designed frames and beams and used an axle to grab it and bring it back to base.
- We improved the capture method by replacing the frames and beams with light tubes. This would not only make the box lighter but also would give more accuracy for capturing.

□ Document  
interviews/fieldtrips

Goal: This week we also went on a field trip to the Space Museum and spoke with Astronaut X who volunteers there every weekend. We asked him questions about his experiences. He pointed us to a new resource on the NASA website which we plan to review before our next meeting.



# ENGINEERING JOURNAL SAMPLE 5

**Student:**

**Date:**

- Document goals you have set
- Document problems encountered
- Document what you worked on during a meeting

This week we accomplished the following goals:

- Made a plan for what we want to get done by our qualifier. We all sat down and had a discussion on how we should organize our documents.
- We made some more progress on our third run. We made this run more consistent by using our color sensor to find the line. We also added M08 to this run so that we could increase out points.
- We had to test our color sensors this week. Last week we decided that if we wanted to go over the ramp we would have to move our light sensors up as they were hitting the ramp. When we were testing the mission where we go over the ramp, the light sensors would get in the way and our wheels would lift a little bit off the ground. Now, we lifted the light sensors up and tested that mission run and it worked, but we also had to recalibrate our light sensors so they can still sense lines.
- We also started working on our presentations this week. We started working on them before the meeting was over. It was good to do this at the meeting so that we could discuss with the team and make sure that everyone else was on track of all the presentations.

# CREDITS

- This lesson was written by Sanjay and Arvind Seshan
- More lessons for FIRST LEGO League are available at [www.flftutorials.com](http://www.flftutorials.com)



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