NFPA Fluid Power Action Challenge

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Micromatic

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Mechanical Kits Ltd.

Science, Technology, Engineering & Math

2022 08 19 v.2

Index of sections:

Please fill out the Pre-Survey to the best of your ability

Your name is not required!

Video link:

http://www.tpt.org/Fluid-Power:-A-Force-for-Change/

Safety

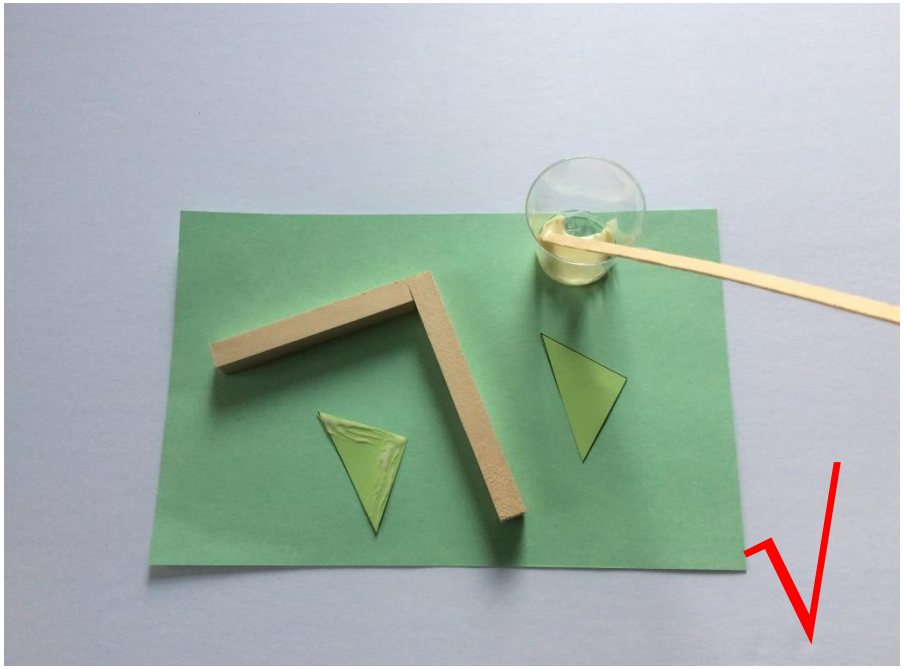
- Safety is everyone's responsibility!
- Always wear safety glasses - even when not cutting or drilling
- No Running, No Throwing, No Horse Play!
- When sawing, drilling, filing or sanding;
  - Ensure a mitre box securely clamped down
  - Ensure each workpiece is secure & stable
  - Ensure your hands/fingers are out of harms way
  - Wipe sawdust, don't blow
- If you use the low-temp glue gun remember the tip is HOT & can burn
- Questions?

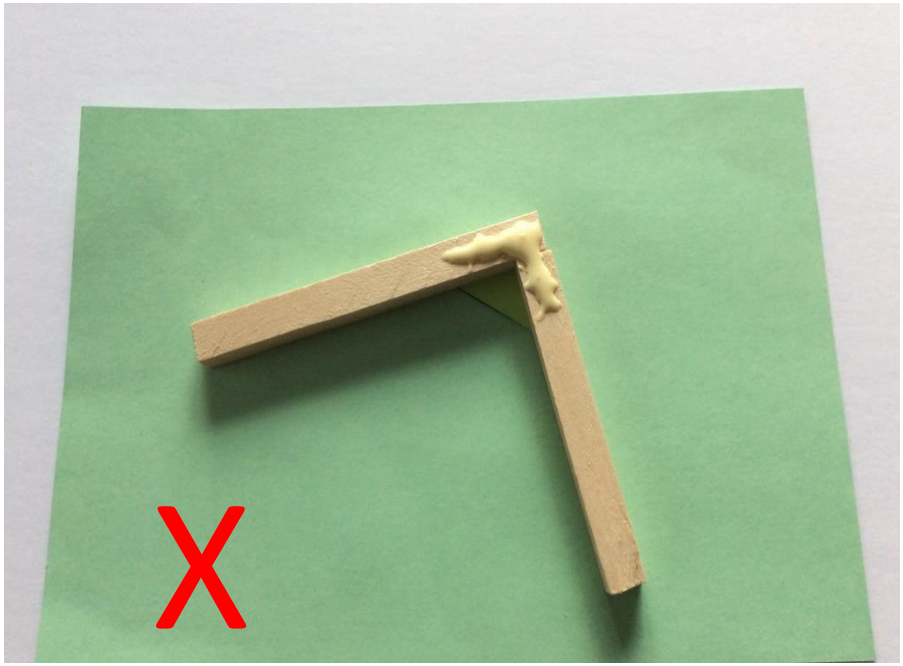
Construction Tips

- Have a plan
- Measure twice, cut once
- Accuracy is important
- Wood Glue
  - Less is more!
  - Excessive glue takes longer to ‘set-up’ & does NOT result in a stronger joint
  - Use stick to spread out glue on contact surfaces
  - Use gussets and structural members for strength
  - Consider Center of Gravity of the device you make
  - Know and understand how the piston-syringes are mounted

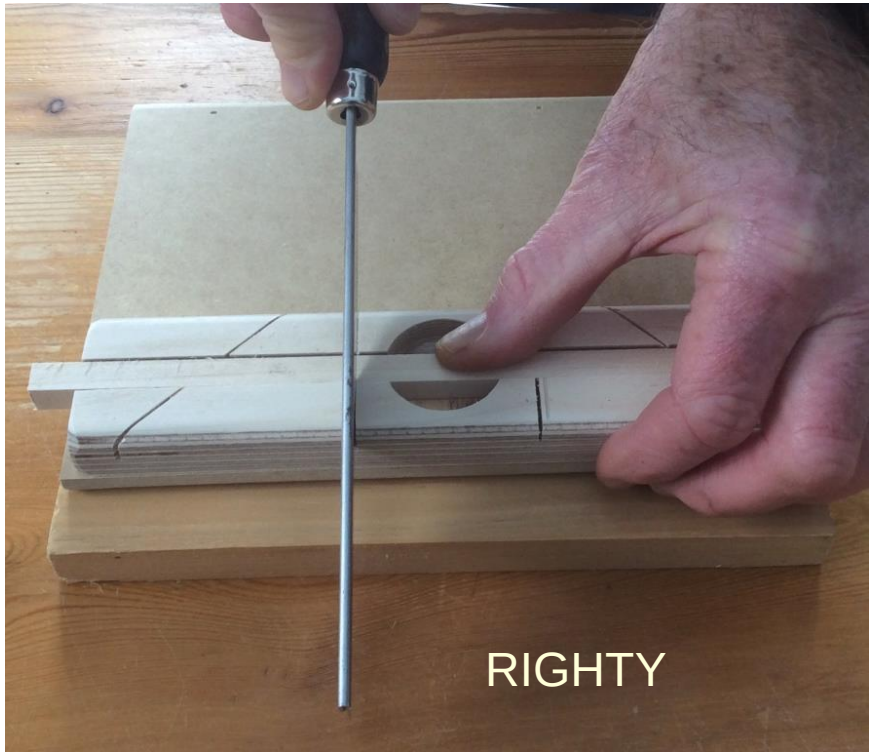
Using Wood Glue

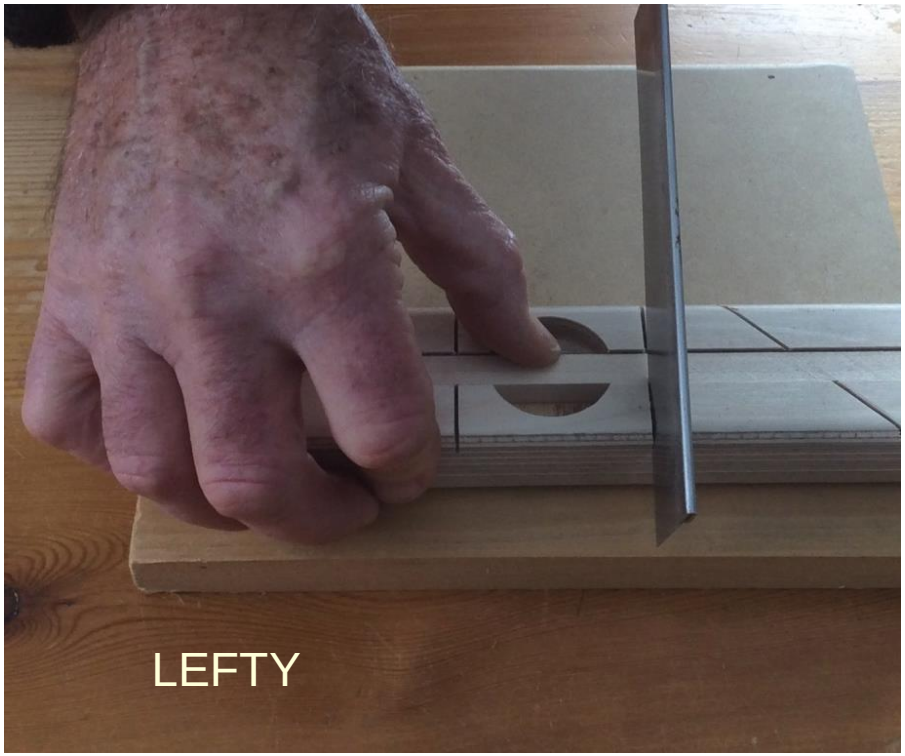
Use a small amount of glue, the glue holder and stirring stick



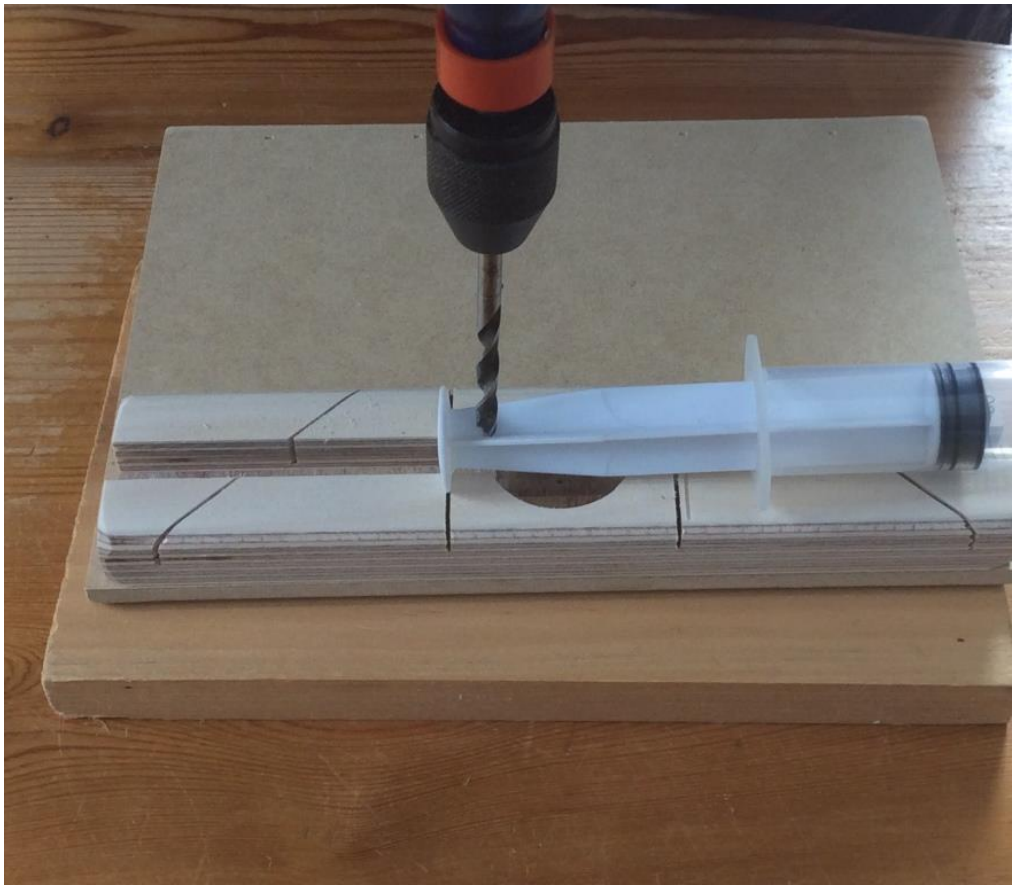


Using the miter box and hand saw to cut wood



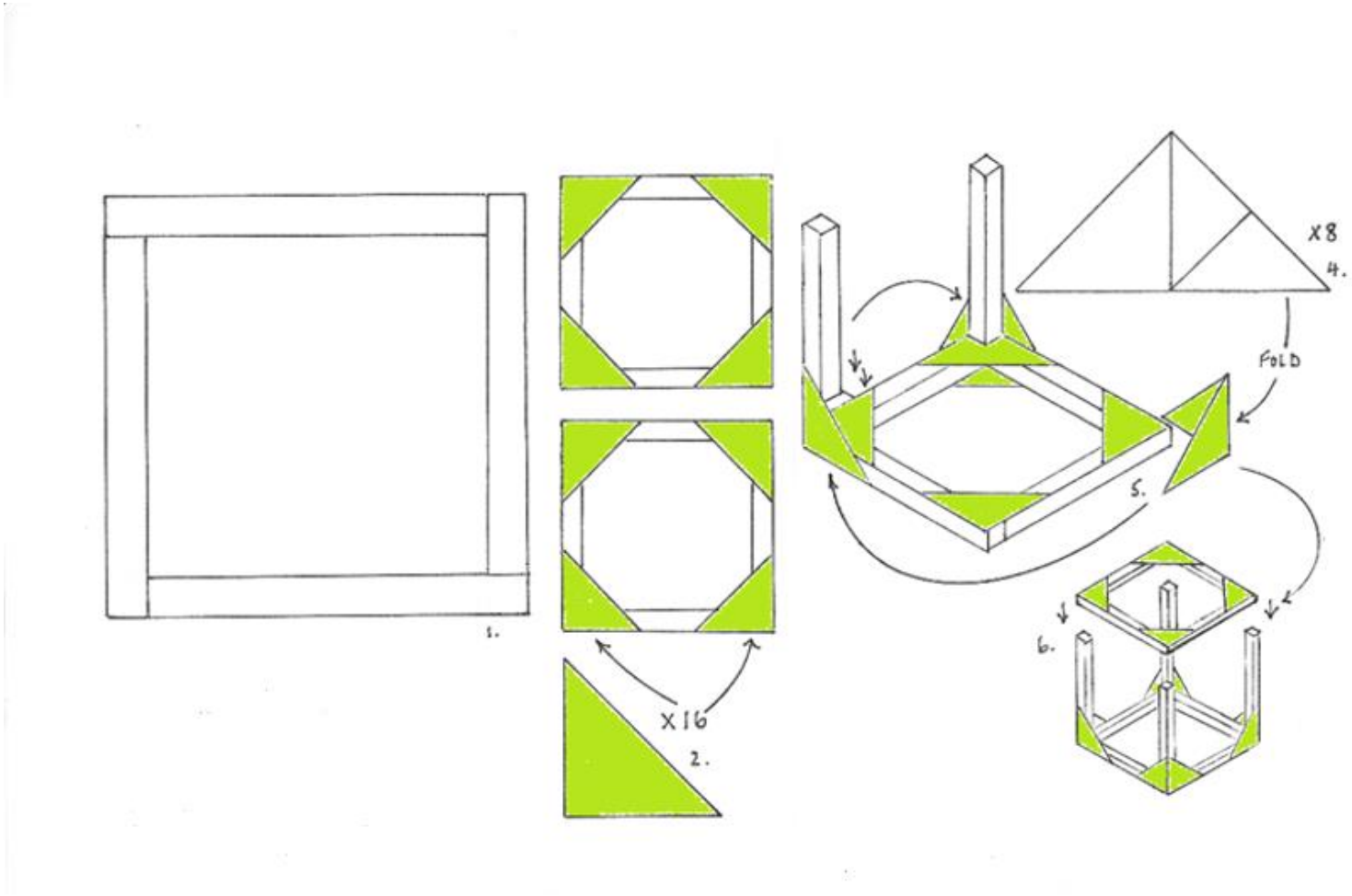


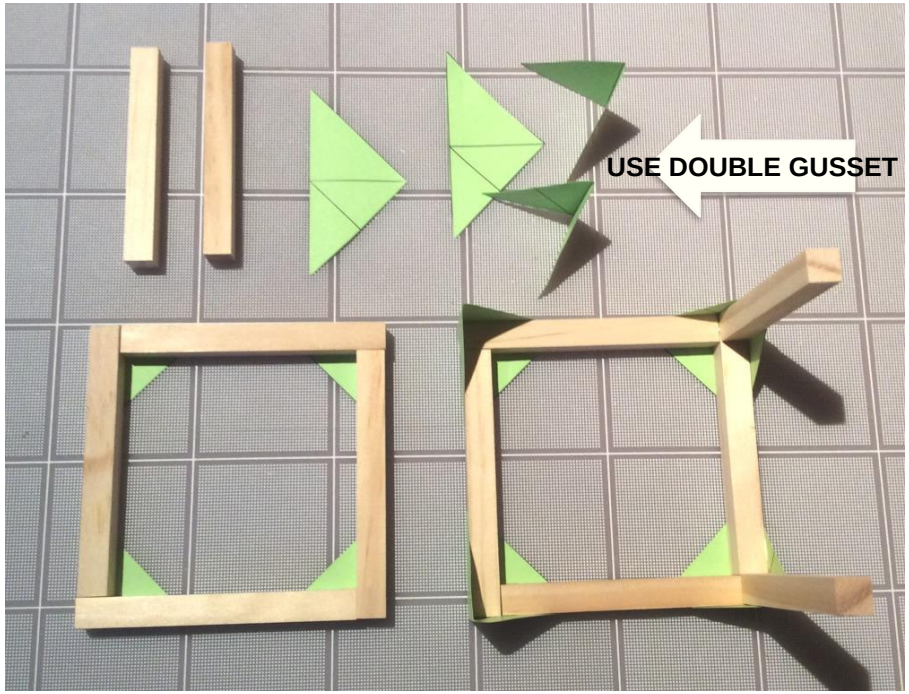
Using the hand drill to drill a hole in a syringe

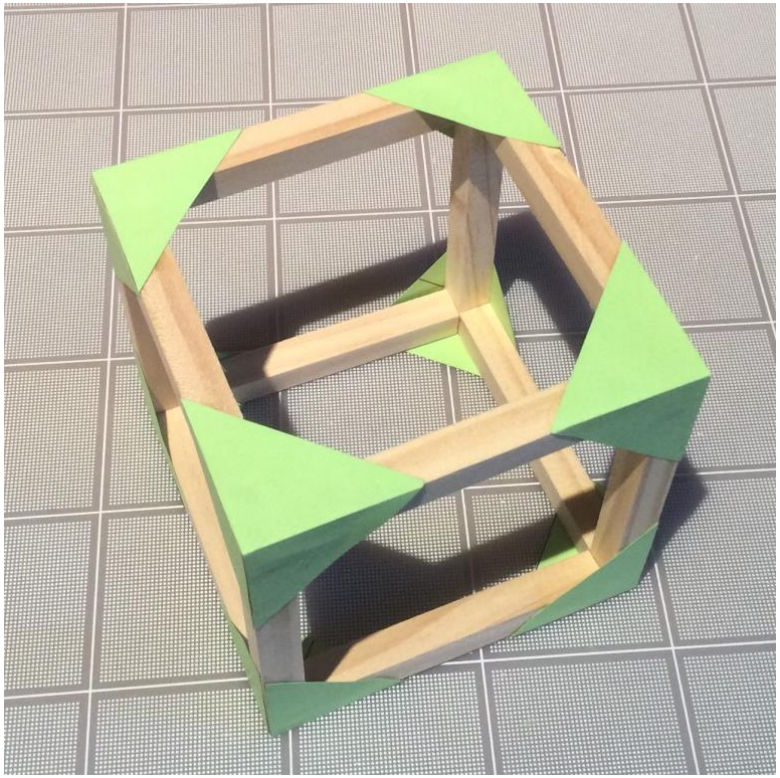


Keep the drill upright – ask your partner to make sure and lend a hand to keep the piston syringe still. Press down while drilling. To remove the drill bit from the hole rotate in the same direction and pull the drill up.

Making the cube

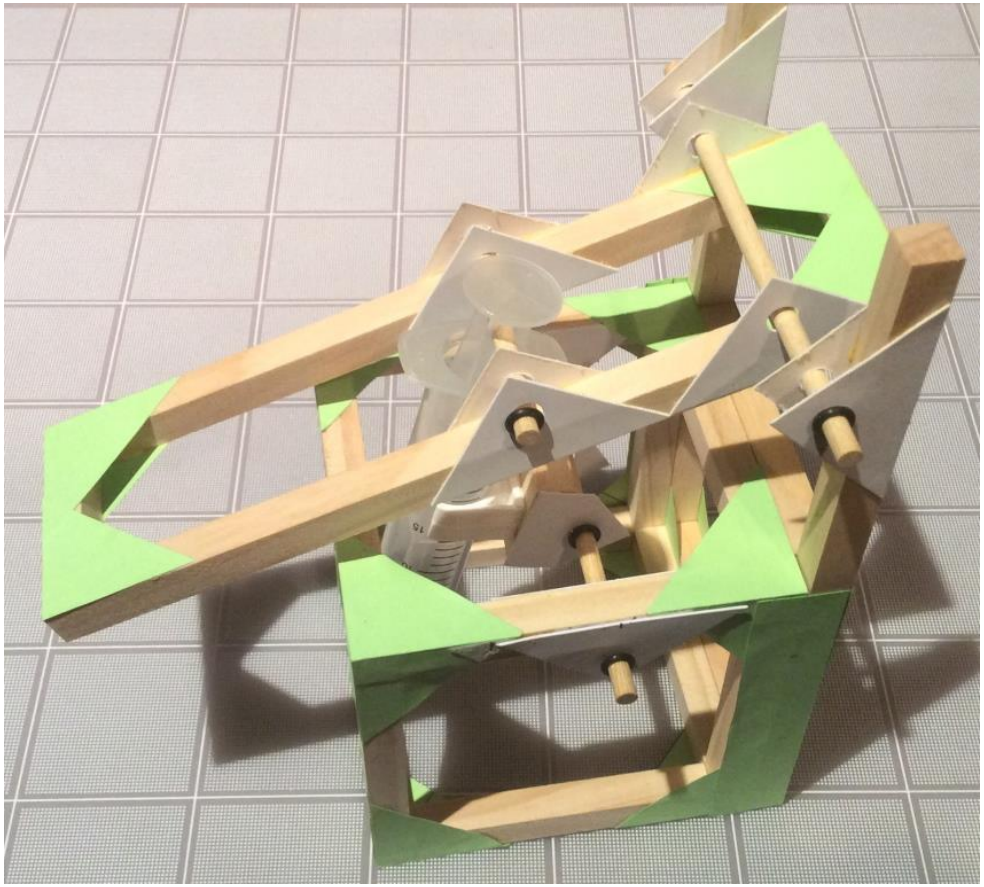



USE DOUBLE GUSSET

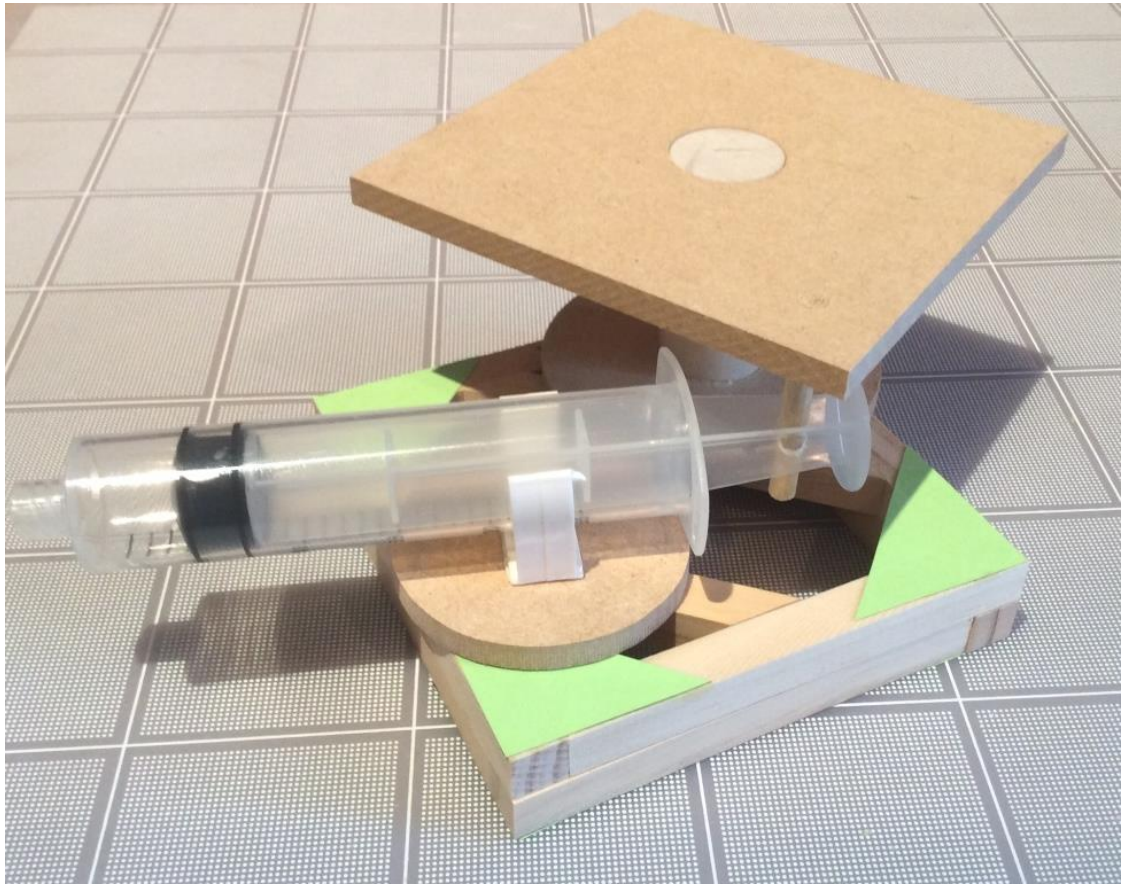


Glue the sides on the Cube

Build the Lifter



Build the Rotating Platform



REFER THE FOLLOWING DOCUMENTS:

- Rules for Challenge Day
- The Current Challenge
- Challenge Rubric
- Portfolio Checklist
- Portfolio Template
- Iso - Ortho Views illustrated

The Challenge – Portfolio Rubric

	Criteria	Points
Portfolio Rubric Contents to include: **Total possible points - 50**	• Quality of portfolio's presentation including title and index pages	• 0-5
	• A detailed outline of each team member's participation in the production of the portfolio and planned production of the device	• 0-5
	• At least 3 illustrations of initial design concepts of possible device	• 0-5
	• Materials used to build prototype from the Workshop Kit including dimensions	• 0-5
	• Description of the use of the principles of a strong and stable structure	• 0-5
	• Rationale used to decide on the type of fluid power used and where to place the piston-syringes	• 0-5
	• Isometric drawing of a portion of the prototype	• 0-5
	• Orthographic drawings showing dimensions and construction notes	• 0-5
	• List of alternatives materials that would have been useful with reasons why	• 0-5
	• Evaluation of prototype including the conclusions from making it	• 0-5

MAXIMISE YOUR TEAM'S PORTFOLIO POINTS (45 Available)

A detailed outline of each team member's participation in the production of the portfolio and planned production of the device

Think about your team – who is good at what?

Think about how long you have to design and build your prototype and record the process in your portfolio

At least 3 illustrations of initial design concepts of possible device

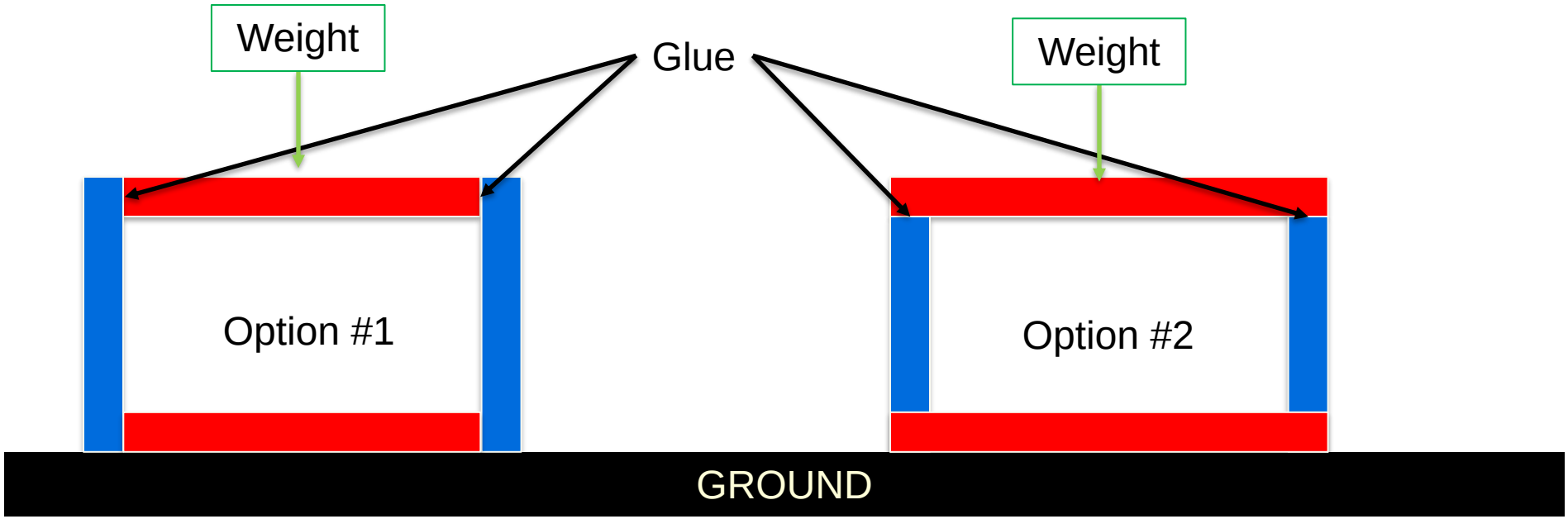
Detail helps you think about the connecting parts!

A list of materials used from the Workshop Kit including dimensions

Record the parts you use and their dimensions (important!)

List of alternative materials that would have been useful with reasons why they would have been so

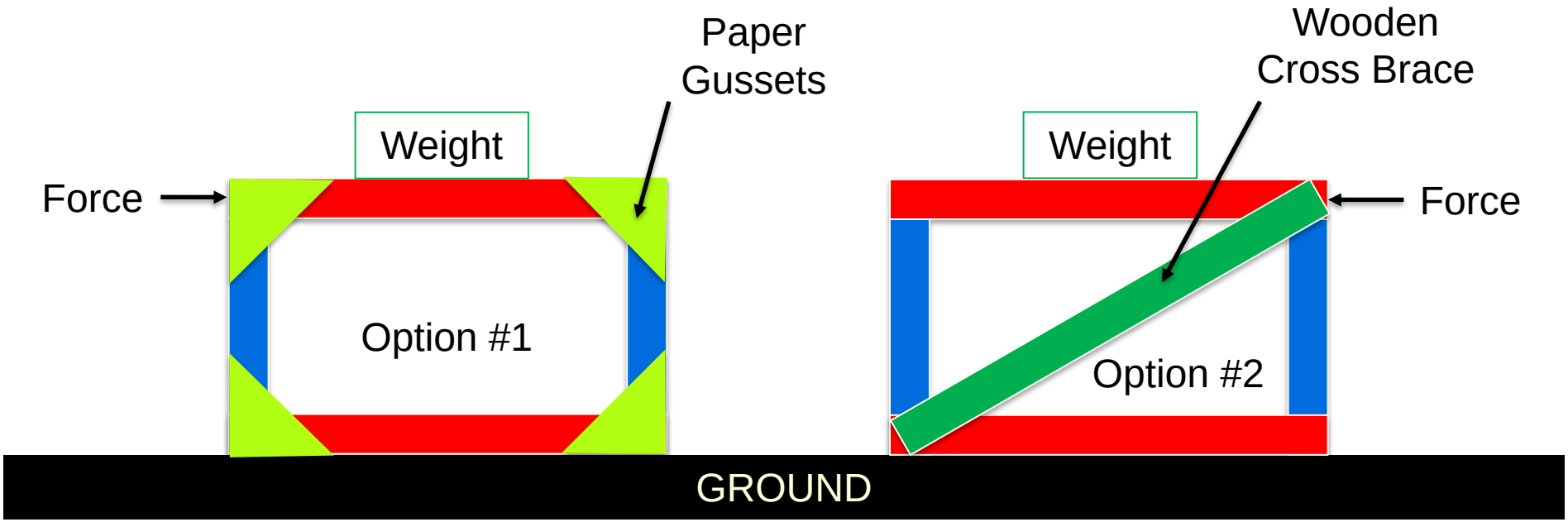
<u>This is asking you to think "outside the box" literally</u>



Structural Strength

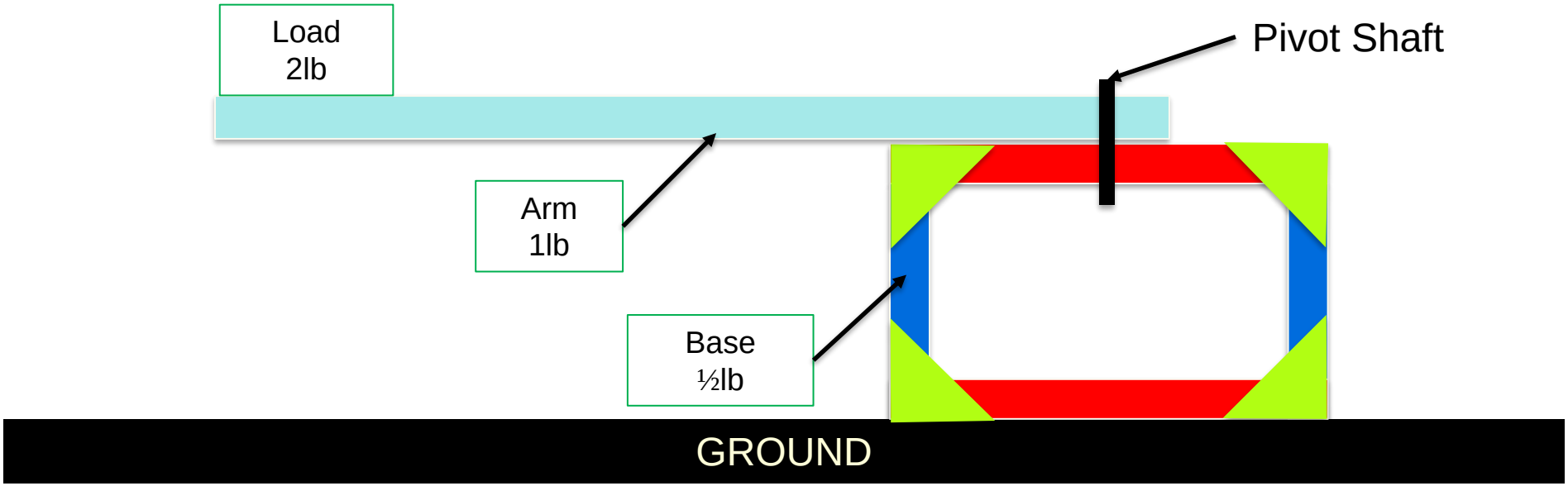
Which Option is a more structurally sound Design? -- Why?

What else can go wrong and how do we improve it?



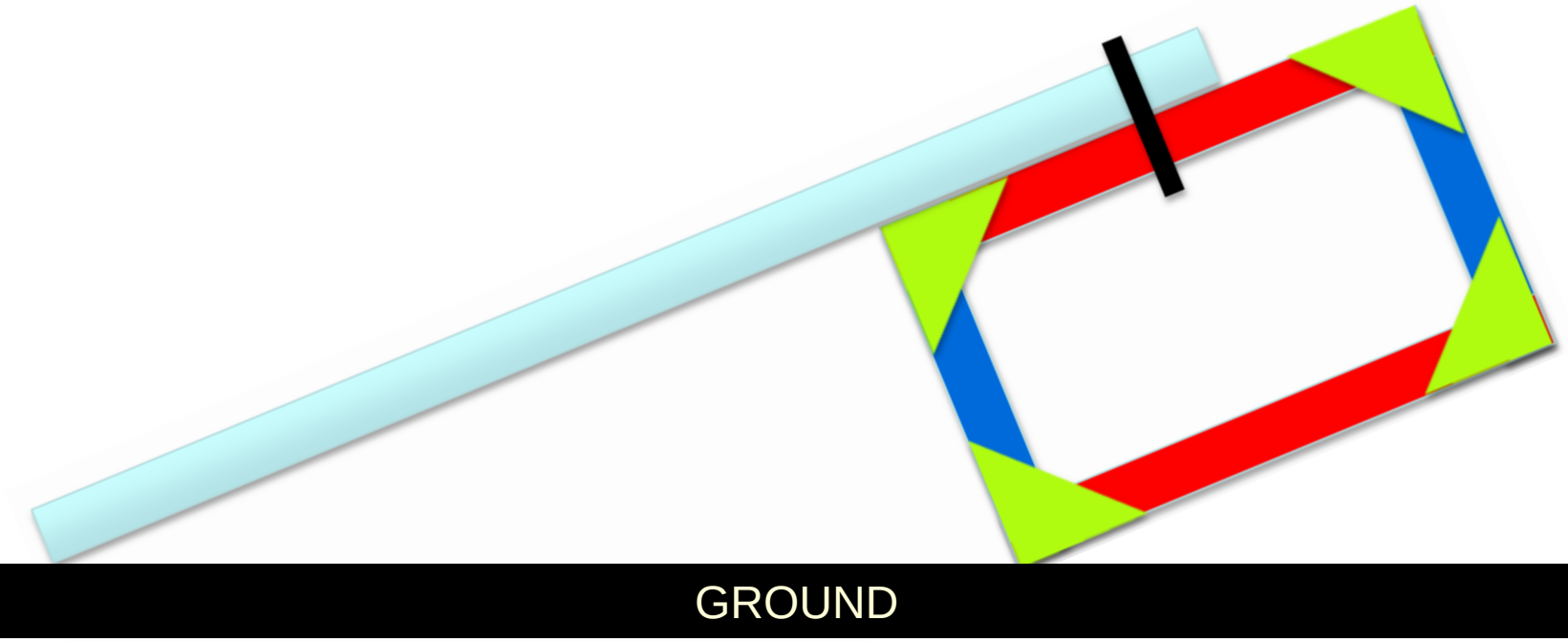
Structural Strength

Observations? Pro's and Con's of each option?
Reasons to use one option vs another? Other Considerations?



Structural Stability

Any concerns with this structure?

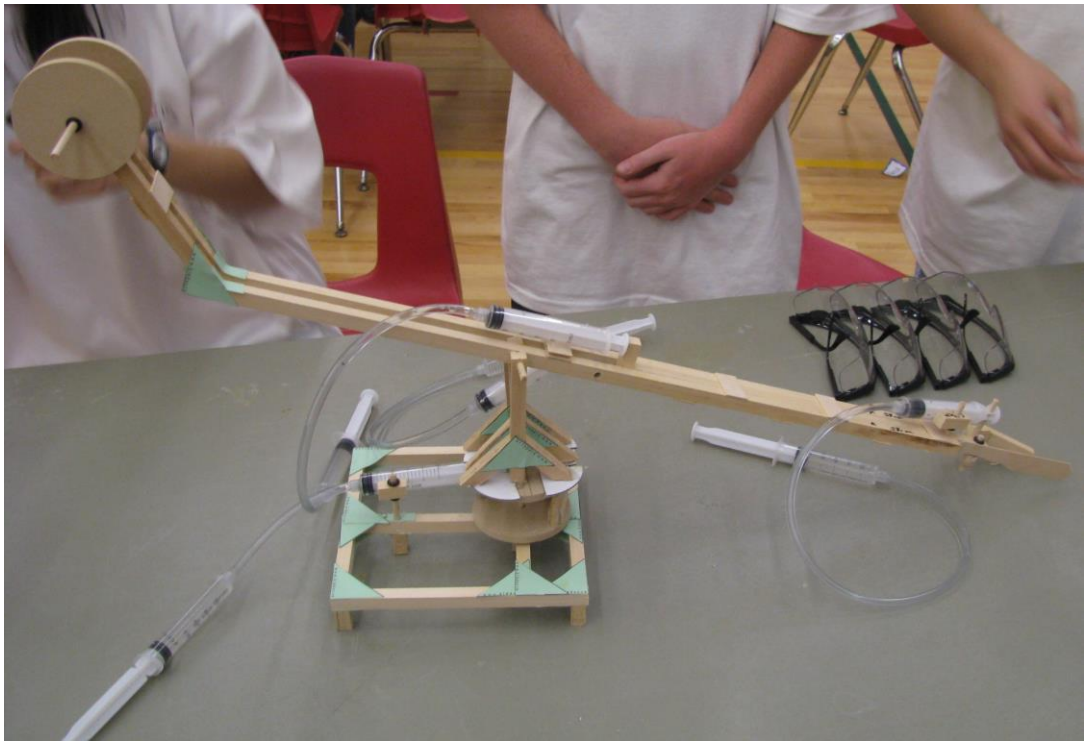


Structural Stability

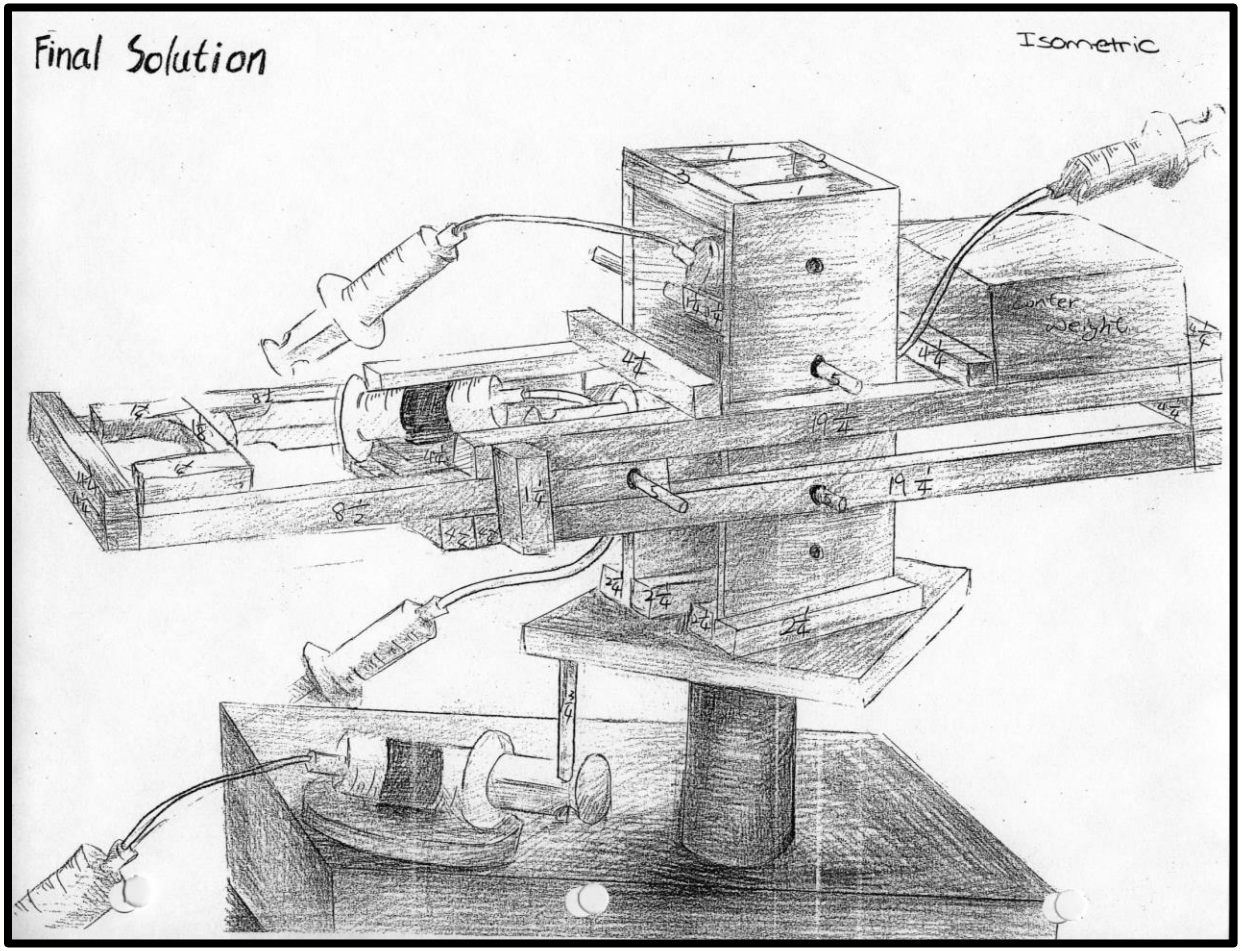
The device will tip over - Why?

How do we prevent this?

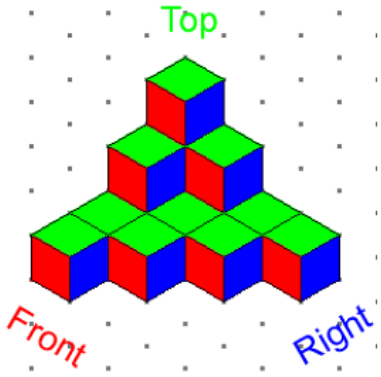
Placement of Hydraulic or Pneumatic Systems



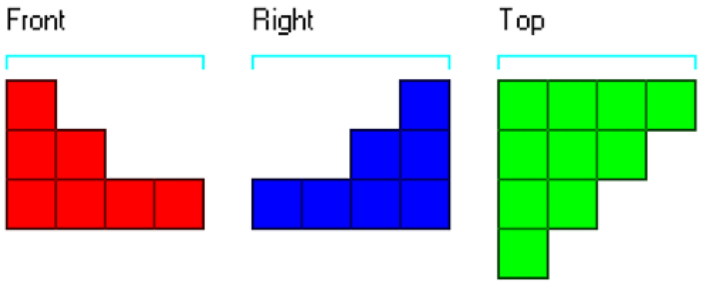
Rationale used to decide on the type of fluid power used and where to place the piston-syringes. This device is an elegant design where the actuating pistons (the pistons that attach to the device) are placed so as to maximize levered movement


Final Solution
Isometric
Counter Weight

ISOMETRIC:



ORTHOGRAPHIC



An Orthographic & Isometric Lesson is available with the following curriculum: *Plot Frame Criteria & Purpose, Orthographic View Creation & Methods, Isometric View Creation & Methods, Hidden Lines & How They Are Used and Practice Exercises*

The Portfolio Template and Checklist

The Portfolio Review Template is considered the minimum requirement for your team's portfolio.

The Checklist is a sample Index for your Portfolio

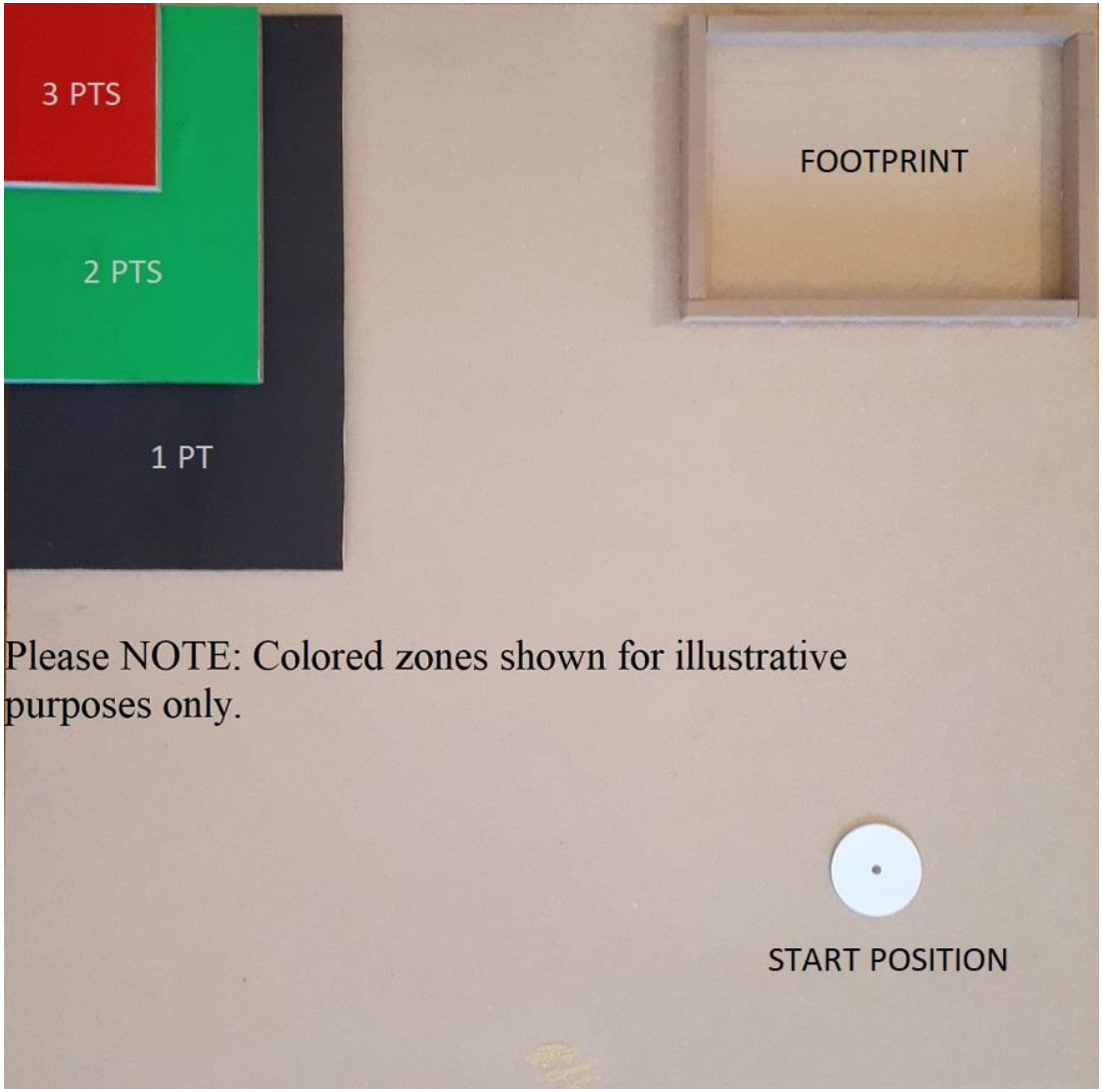
See sample Middle School Portfolio on Resources Center

Teamwork & Work Habits

The Challenge relies on teamwork to be successful

Successful teams will:

- Work together according to a time-line
- Assign & divide tasks
- Plan their work & work their plan
- Complete tasks in parallel
- Leverage individuals' strengths
- Won’t mess with other teams



This is the 2023-2024 Challenge layout board. Your team must build a device that sits in the footprint area and moves a wooden cylinder from the start position to any one of three shelved target areas. An object placed upright on the target area is worth 1, 2 or 3 points according to the area it is located in. The task is to accumulate as many points as possible in two minutes

Discussion

Why is one destination area worth more points than the other?

What if you design a device that only works when using your hands?

How long will you have to move objects?

What tools/materials can you use to build your device on the Challenge Day?

Why is the Portfolio so important?

The Challenge Process

Objective
To design a device using only the supplied tools and materials, that can score as many points as possible.

Deliverable
Two copies of the portfolio

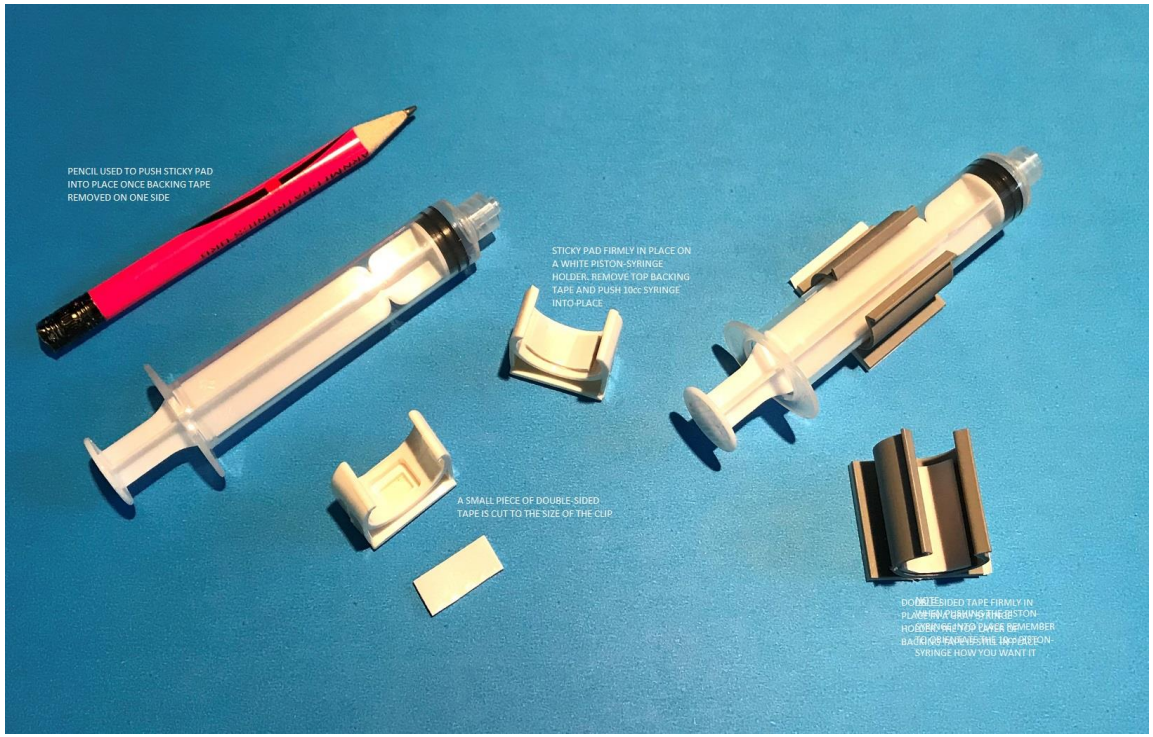
Challenge Kit
On the Challenge Day your team will bring your portfolio and tools. A Challenge Kit will be provided. It contains all the materials you will use including two extra 20cc syringes and 6ft. of extra tubing, and some glue sticks in case you need them

Using the piston-syringe clips

The #1 reason why devices fail is because the clips are not fixed correctly to the device. A platform must be used to accommodate movement and the clips must be secure. Use the gray clips where a greater resisting force is required. Locate the clips first before fixing them to the device. *Using hot glue is not a good alternative*.

Connecting the 10cc piston-syringe to white and gray clips

For gray clips use a piece of double-sided tape cut to the size of the clip. Peel off one (1) side of the tape and insert firmly into clip.

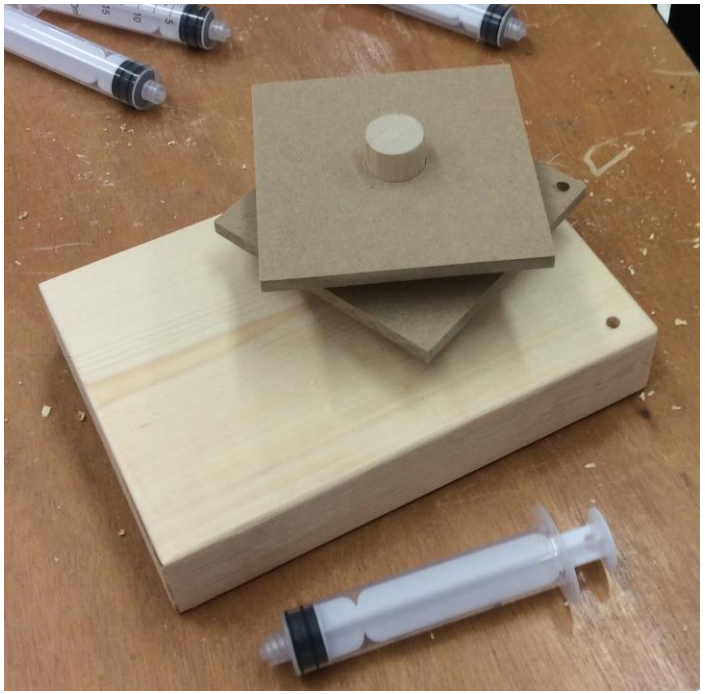


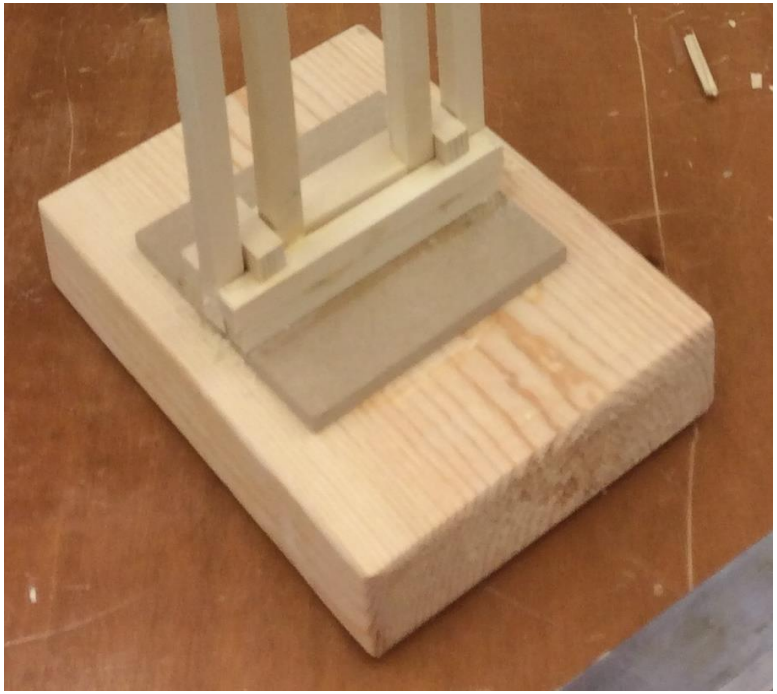
Alternatively use the smaller white clips provided. NOTE: one of the 10cc piston-syringes <u>has a hole in the plunger.</u>

Contents of the kits – Base block and 4” Squares

The Workshop kit and the Challenge Day kit contain a large wooden base with a hole in it to accommodate a large diameter dowel found in the kits. This can be used as a stable base if your team decides to do so. The hole is off-center and the dowel may require sanding to fit as your team wants.

The large dowel fits the two square platforms in the kit. The picture shows that this team decided to drill a hole in the lower platform for a dowel and another hole in the base presumably for a rotating wheel with a piston holder fixed to it – an arrangement demonstrated by the Workshop Rotating Platform kit.





In this picture the large wooden base was used in a different way – there is no large dowel involved and a fixed structure is being built upon it

The Workshop kit and the Challenge kit both contain syringe holders. It has a "one-time" sticky pad on its base and must be pushed firmly onto a paper, plastic or a wooden surface to adhere sufficiently to hold the 20cc or 10cc piston syringe in place. A double-sided sticky pad can be used with it if a larger area is required.

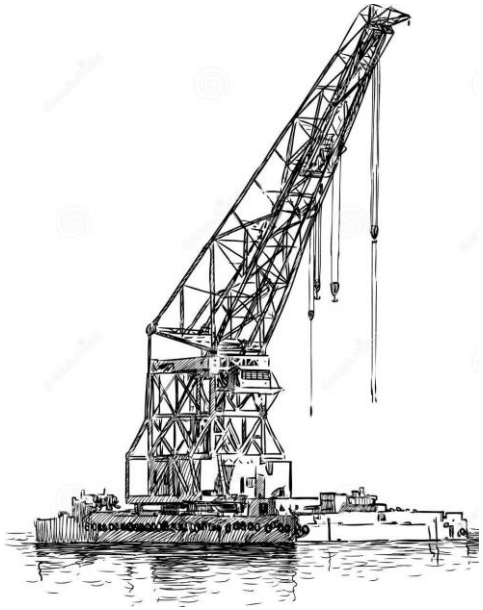
Wood glue and hot glue are <u>NOT</u> efficient ways to secure a syringe holder

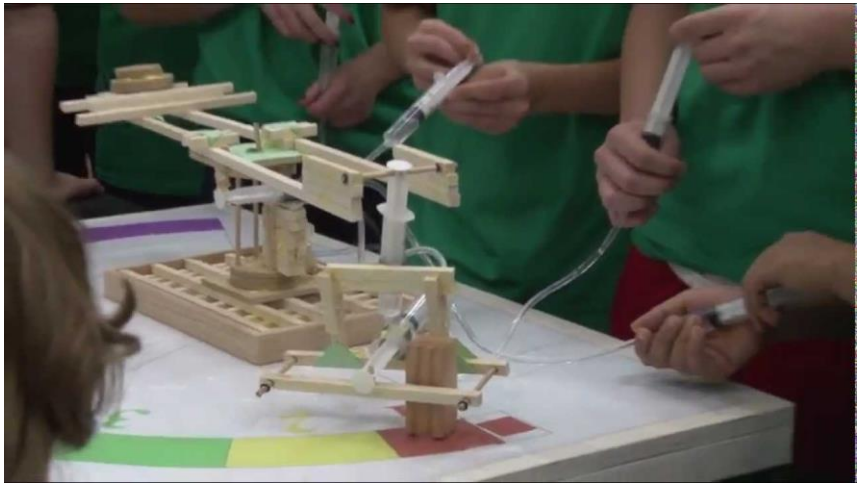
The arrangement in the picture above may have potential problems. Why?

QUICK RECAP:

- SAFETY is our number #1 concern
- ALL motion must be controlled by fluid power
- USE your materials wisely
- DOCUMENT everything in your portfolio
- All materials to build device are provided
- Bring tools
- Use your time efficiently
- Have fun and work well

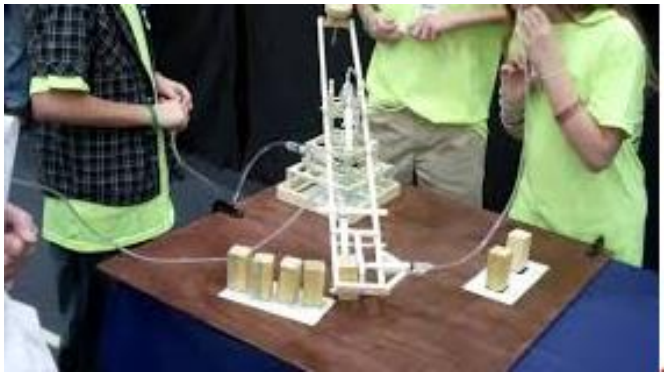
Watch videos from previous Fluid Power Action Challenges on YouTube or Google web (“Fluid Power Action Challenge”)

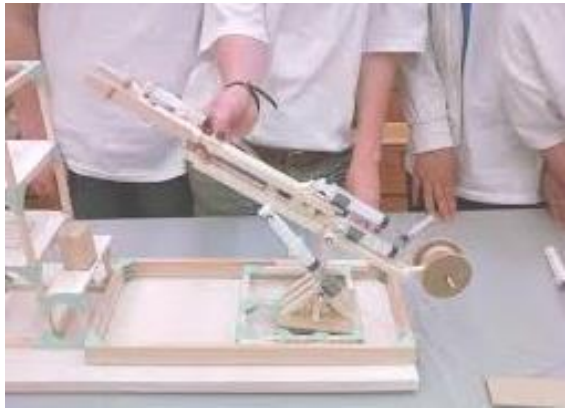


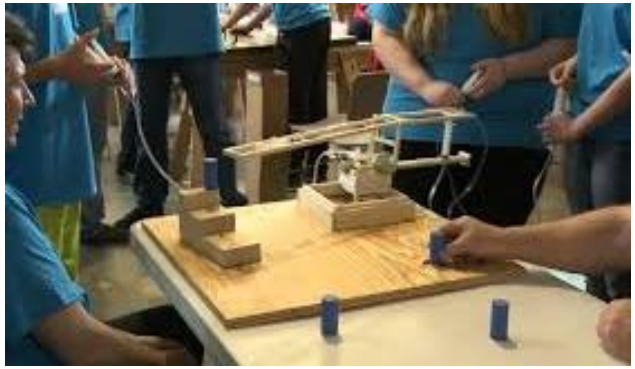


Successful products are always made by carefully researching existing products.

Examples of previous projects



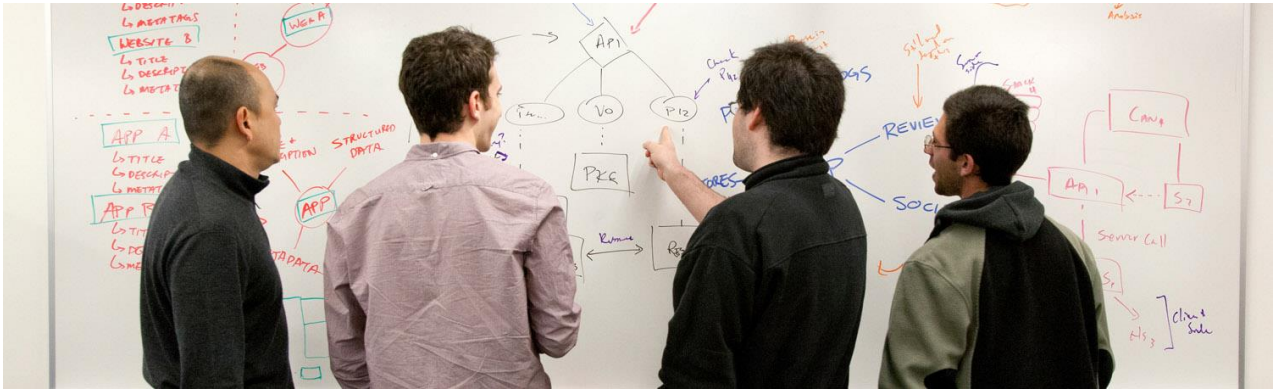




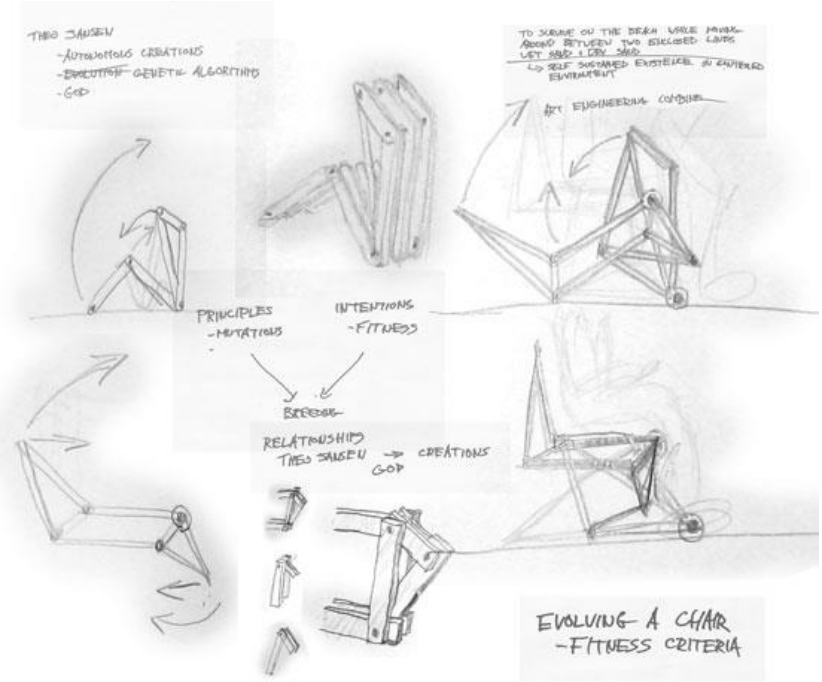
YouTube & Google
“Fluid Power Action Challenge”

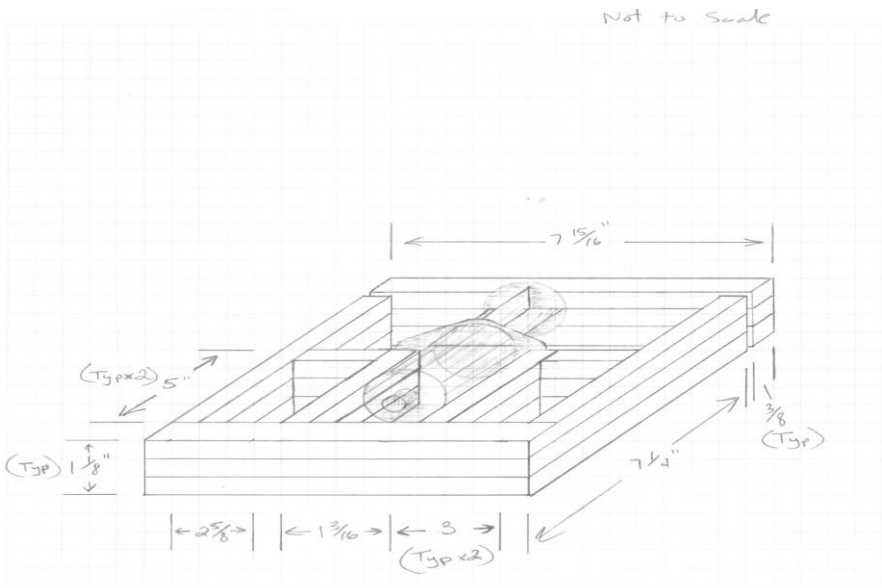
Challenge Video 2 Challenge Video 3

Sketching is a way of communicating ideas



Sketching is a way to explore new ideas.





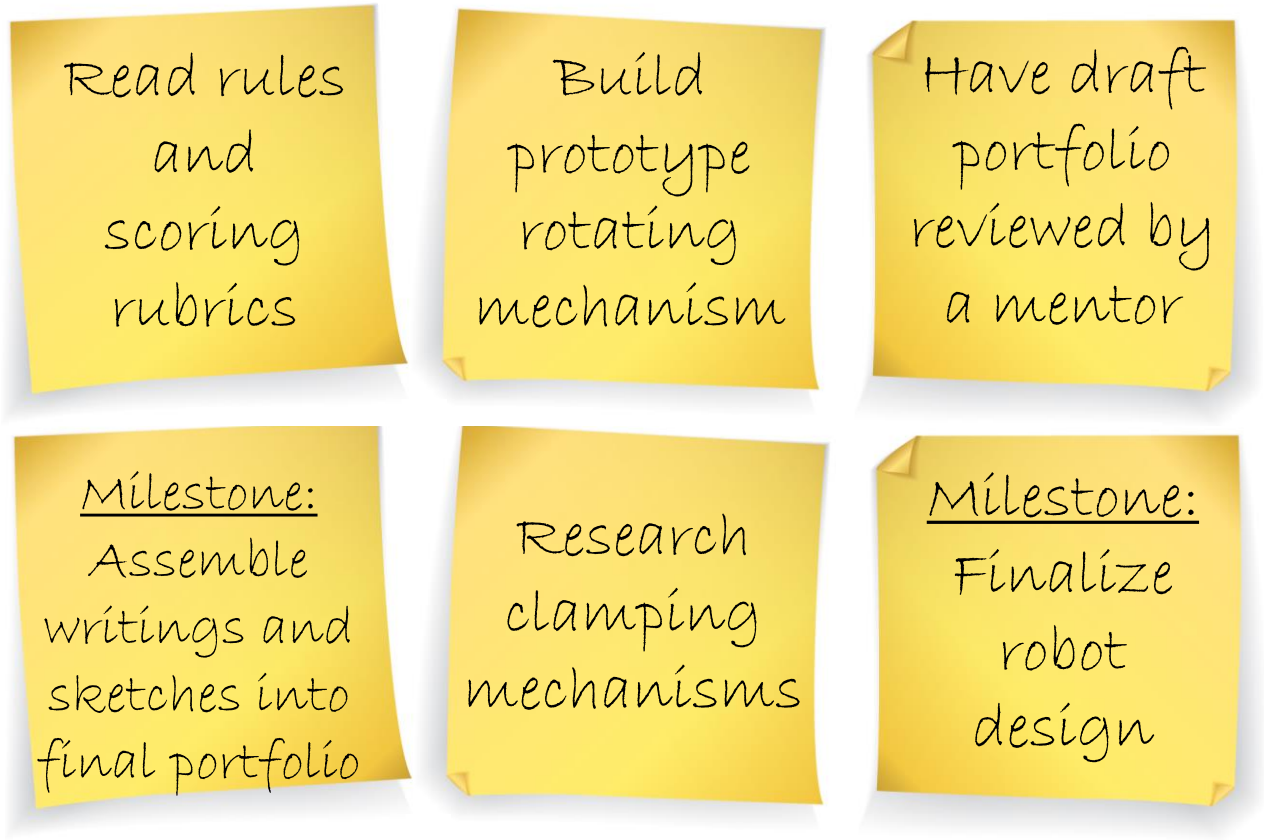
Examples of team tasks:

- Read project rules
- Research clamping mechanisms
- Sketch ideas for clamping mechanisms
- Research rotating mechanisms
- Sketch ideas for rotating mechanisms
- Research rotating mechanisms
- Build prototype mechanisms
- Sketch whole robot design
- Build a whole prototype
- Practice challenge activity

- Read portfolio scoring rubric
- Generate final sketches of design for portfolio
- Write a description of the principles of strength and stability
- Write an explanation of the chosen location of your syringes
- Have writing reviewed by a mentor
- Assemble all portfolio elements into a final report

Who will be responsible for what?

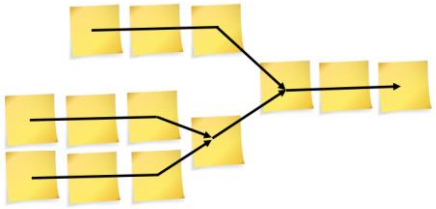
Identify concrete tasks and milestones



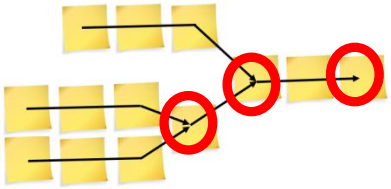
What you should be doing right now

- Identify 3 tasks or milestones

- Lay out the schedule



- Choose dates for your milestones



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