Canadian Fluid Power Association
Association canadienne d'énergie des fluides

FLUID POWER CHALLENGE
DÉFI ÉNERGIE DES FLUIDES

Local Fluid Power Challenge Hints for Overall Success

This file is to be reviewed on the Workshop Day and used as a guide for the team as it works towards the Challenge Day.

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V8- 2023 11 17

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Safety

- Safety is **everyone's** responsibility!
- Always wear safety glasses
  - Yes - even when not cutting or drilling
- No Running, No Throwing, No Horse Play!
- When sawing, drilling, filing or sanding;
  - Ensure mitre box is securely clamped down
  - Ensure each workpiece is secure & stable
  - Ensure your hands/fingers are out of harm's way
  - Wipe sawdust – don't' blow!
- Tip of hot melt glue gun is HOT & can BURN YOU!
- Demonstrations
- Questions?

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Construction Tips

- Have a plan
- Measure twice, cut once
- Accuracy is important - variation is compounding and mistakes keep piling up!
- Use gussets and structural members for strength
- Consider Centre of Gravity

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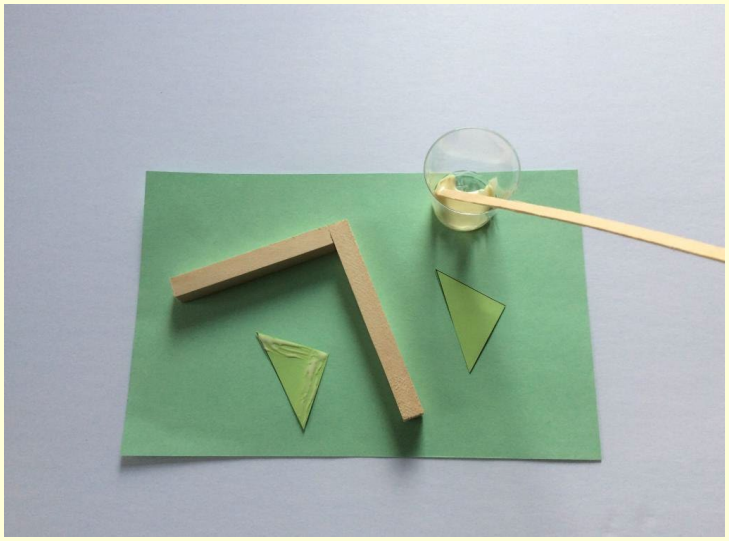
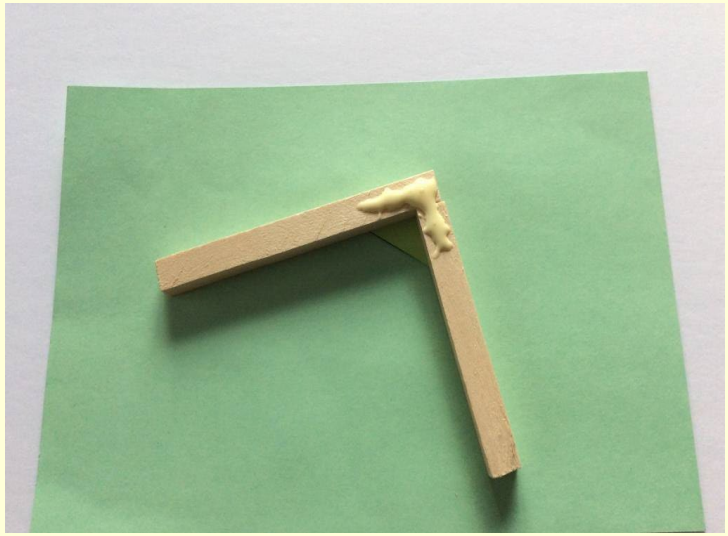
Using Wood Glue

- Use a small amount of glue – less is more!
- Excessive glue takes longer to dry and does NOT result in a stronger joint
- Use stick to spread out the glue on contact surfaces
- The tip of a hot glue gun is **HOT** and can **BURN** you!





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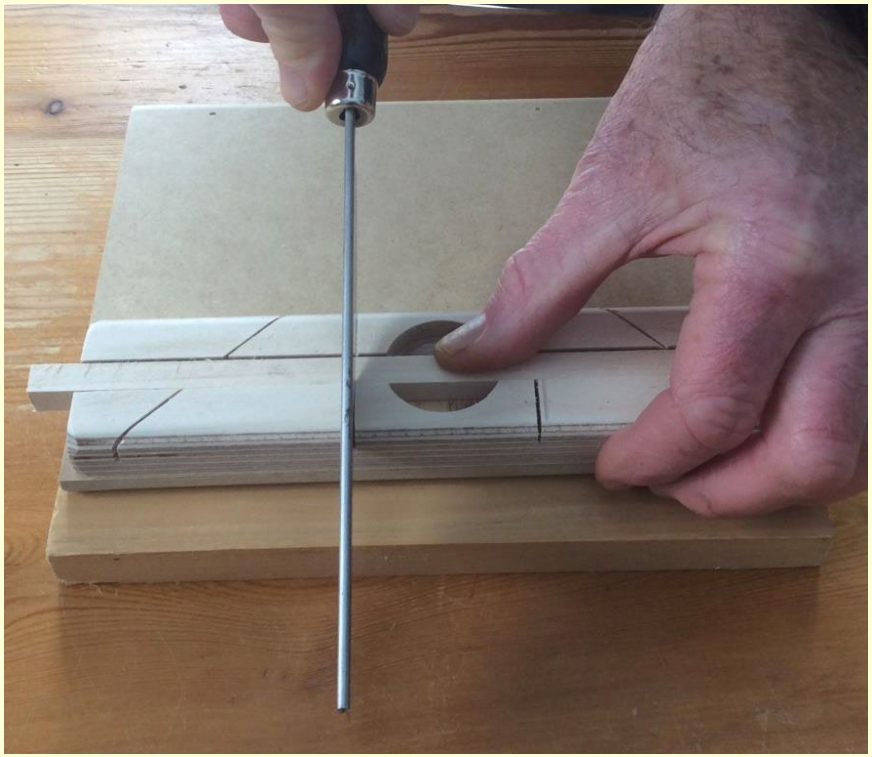
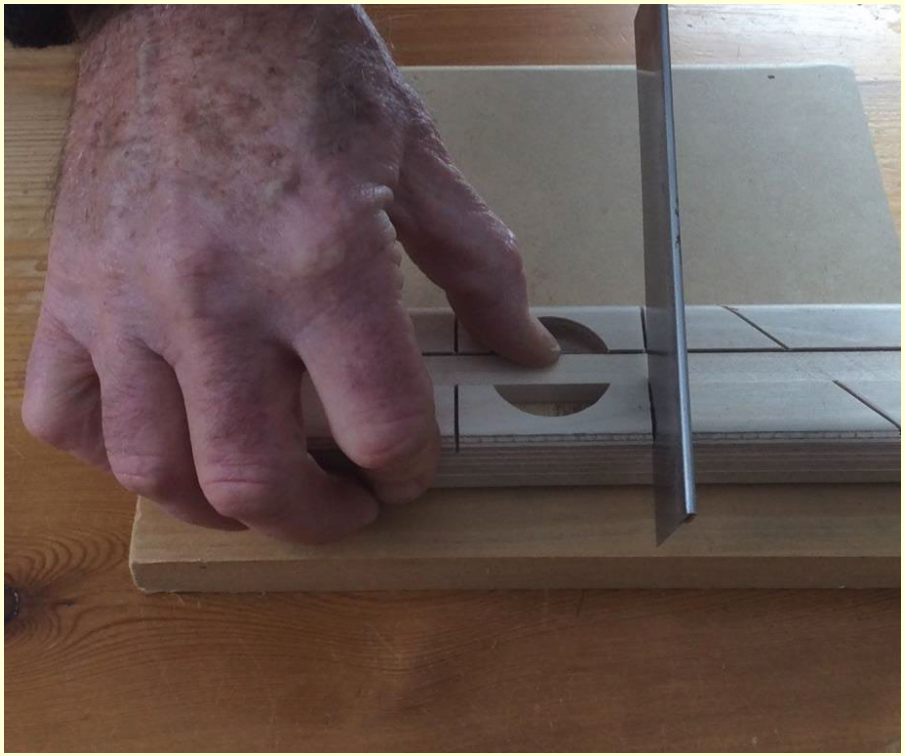
Using the miter box and hand saw to cut wood





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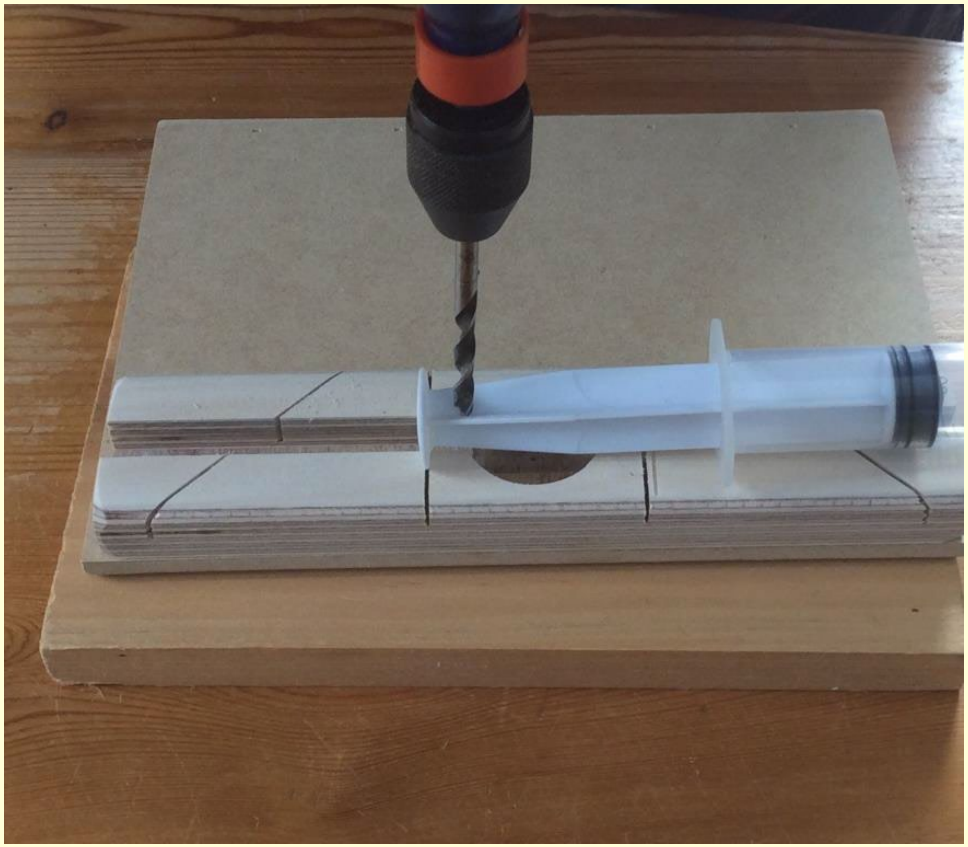
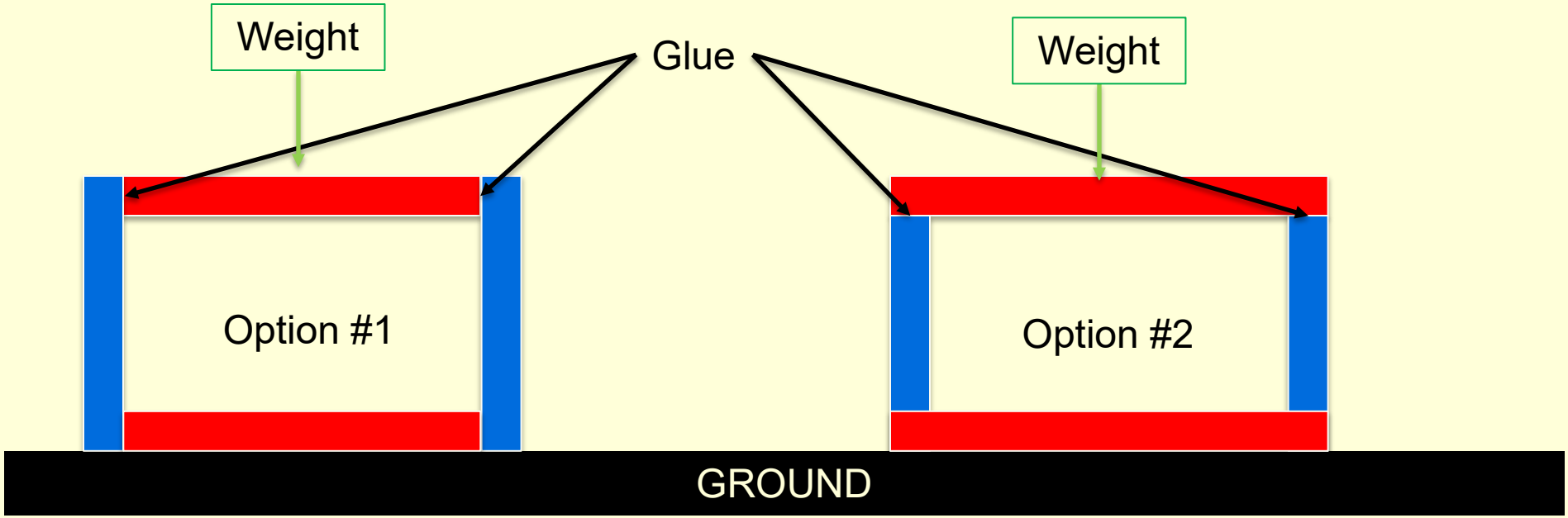
Using the hand drill to drill a hole in a syringe



Keep the drill upright – ask your partner to make sure and lend a hand to keep the piston syringe still.

Press down while drilling.

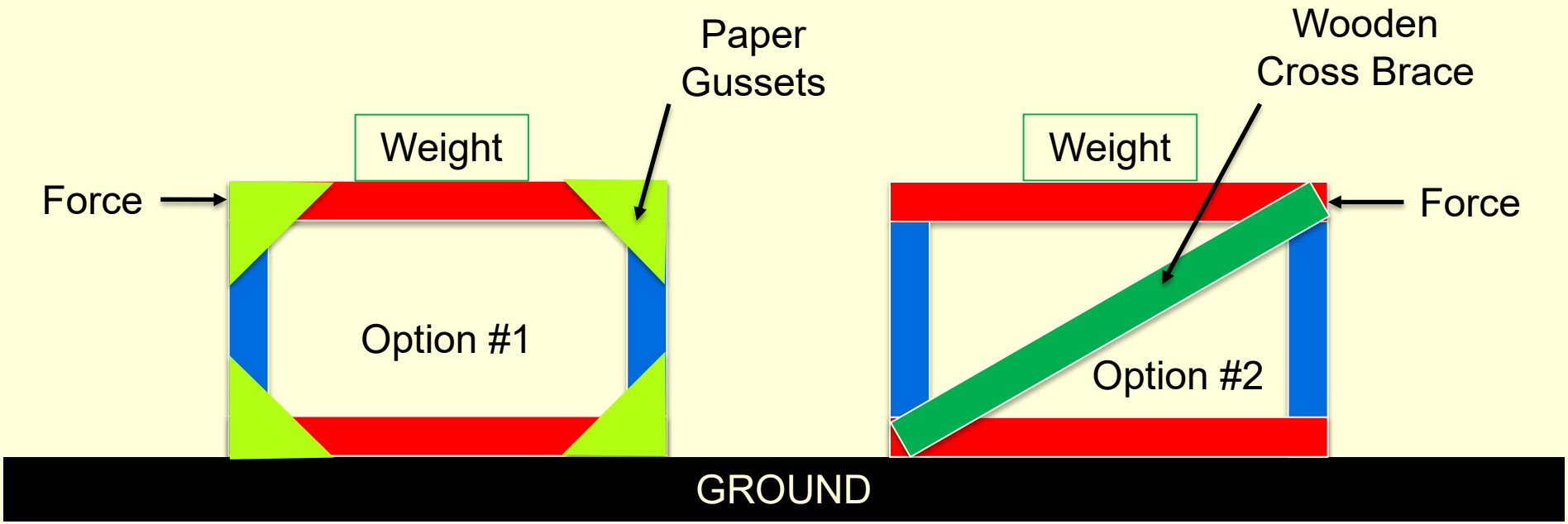
To remove the drill bit from the hole rotate in the same direction and pull the drill up.



Structural Strength

Which option is a more structurally sound design? -- Why?

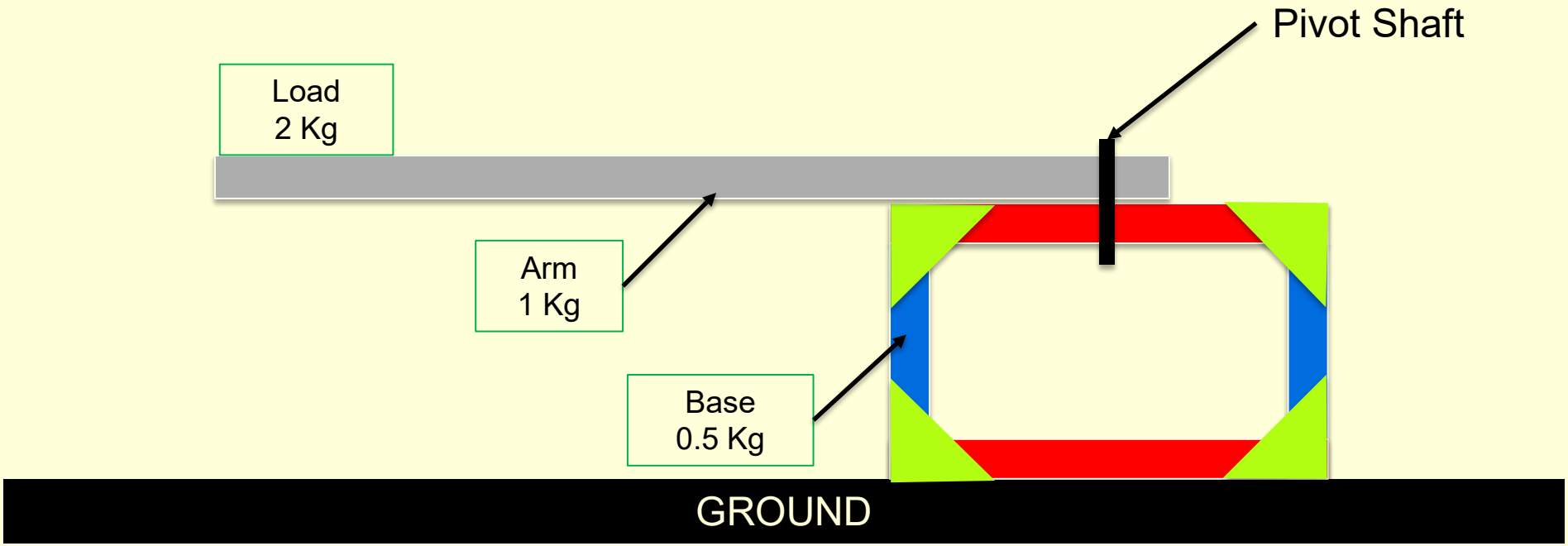
What else can go wrong and how can we improve it?



Structural Strength

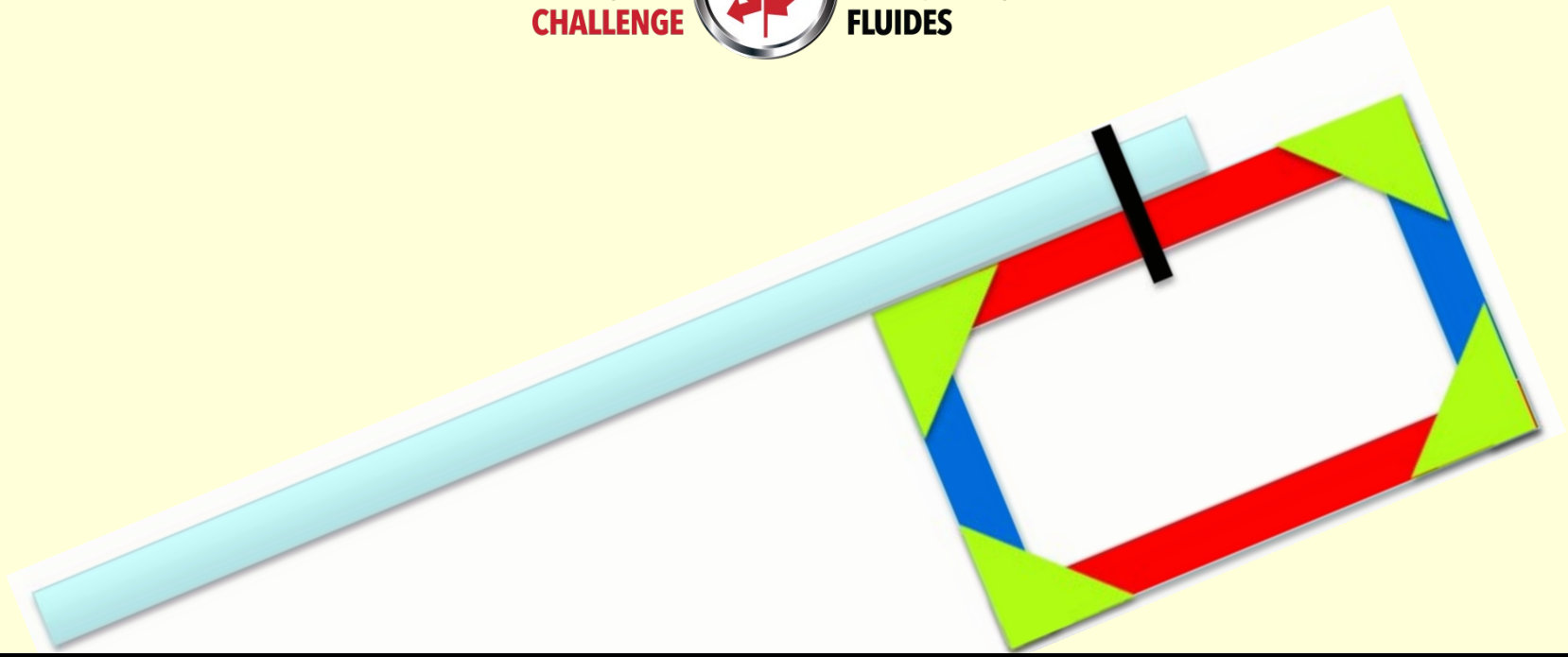
Observations? Pro's and con's of each option?

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?

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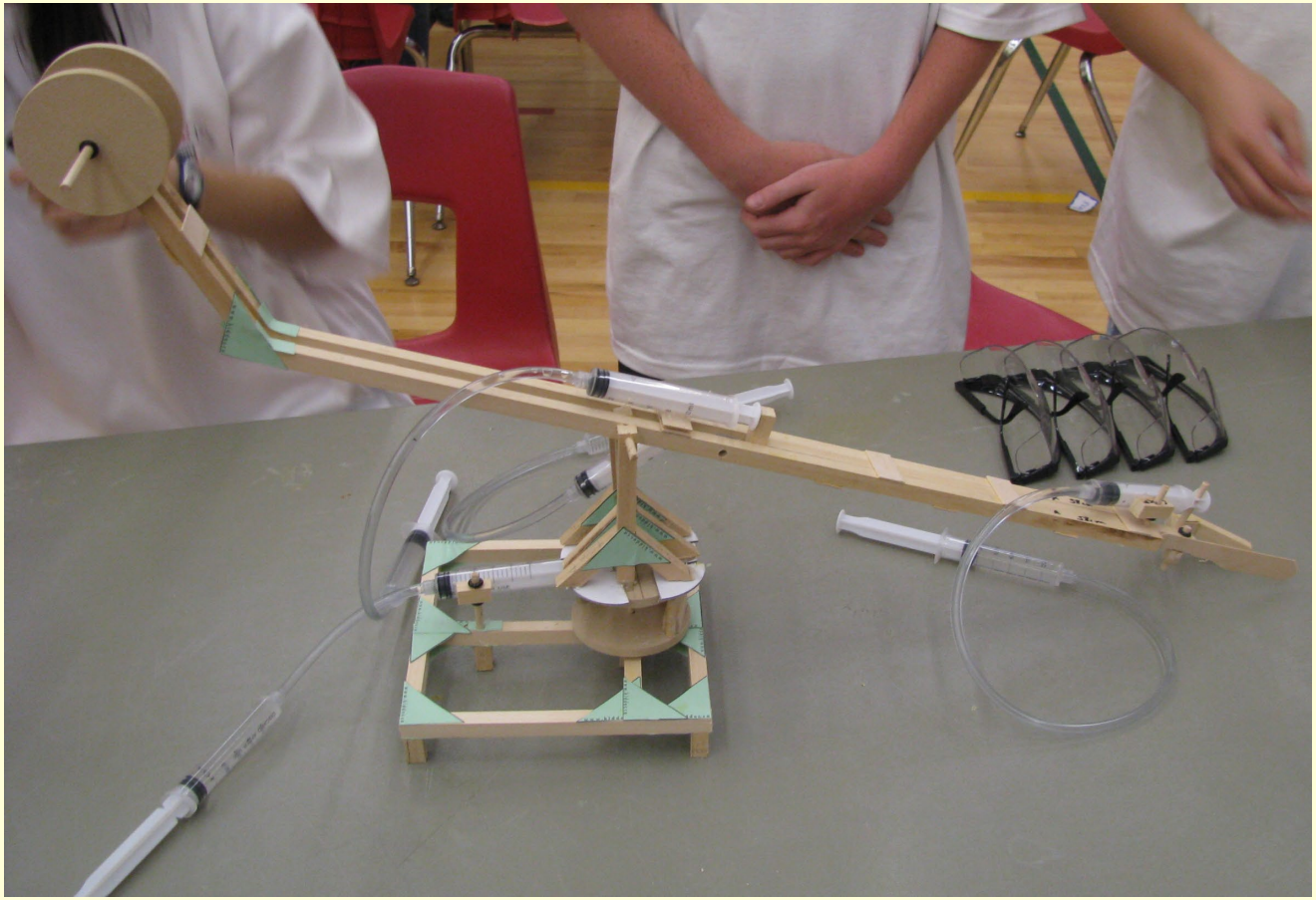
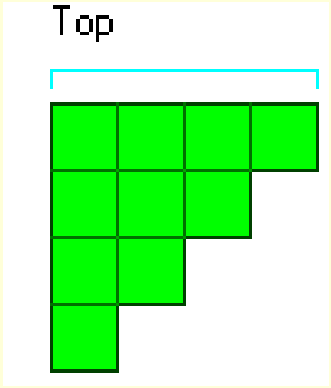
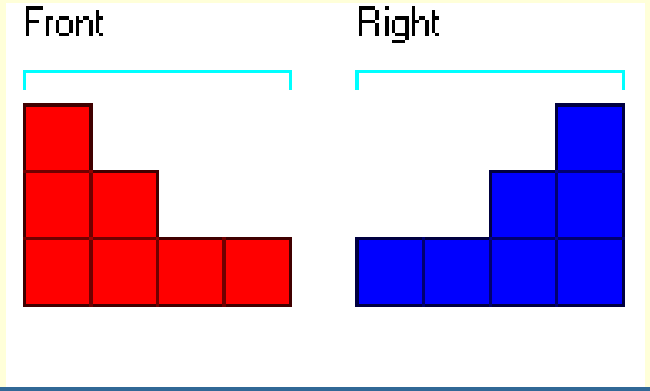
Placement of Hydraulic or Pneumatic Systems



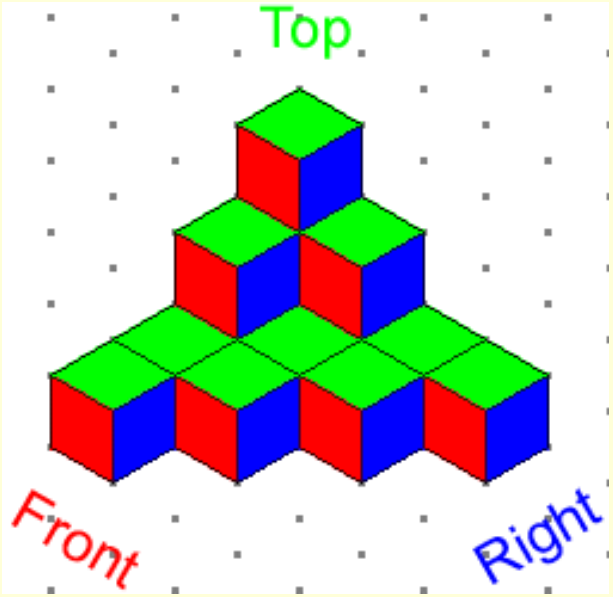
An elegant design where the actuating pistons (the pistons that attach to the device) are efficiently placed so as to maximise movement

Orthographic Projection





Isometric View



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The Challenge - Teamwork & Work Habits

The Challenge relies on **teamwork** to be successful

Successful teams:

- Work together according to a timeline
- Assign & divide tasks
- Plan their work & work their plan
- Complete tasks in parallel
- Leverage individual strengths
- Don’t mess with other Teams materials without permission

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THE CHALLENGE SCENARIO

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 an extra piston syringe holder, two extra 20cc syringes and 2m extra tubing

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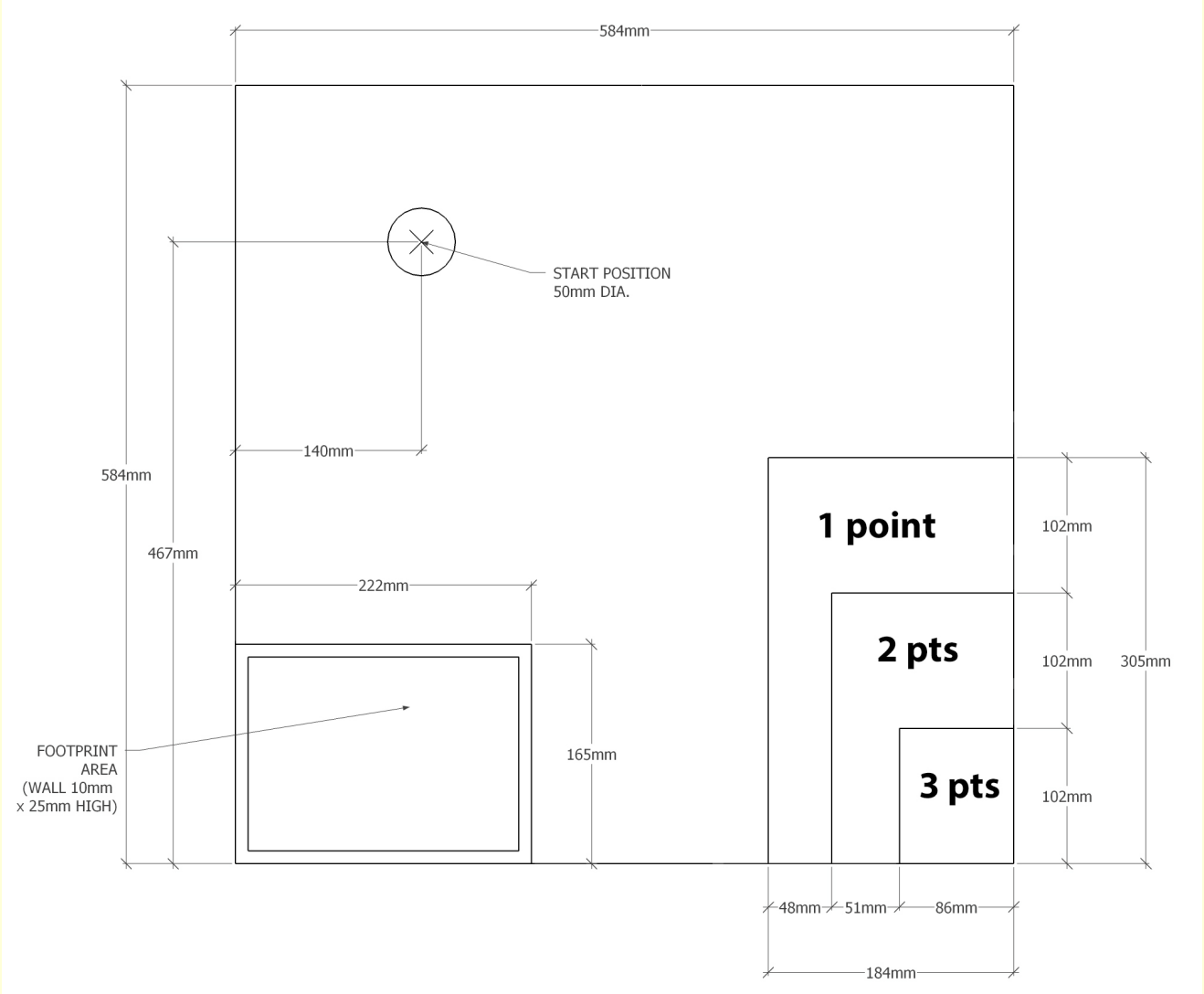
Hints for the Challenge Scenario

- ALL motion must be controlled by fluid power
- USE your materials wisely
- DOCUMENT everything in your design portfolio
- On the competition day, all materials are provided except for tools
- Use your time efficiently
- Have fun and work well
- *Remember: SAFETY is our number 1 concern!*


584mm
START POSITION
50mm DIA.
140mm
584mm
467mm
222mm
165mm
FOOTPRINT
AREA
(WALL 10mm
x 25mm HIGH)
1 point
2 pts
3 pts
102mm
102mm
102mm
305mm
48mm
51mm
86mm
184mm

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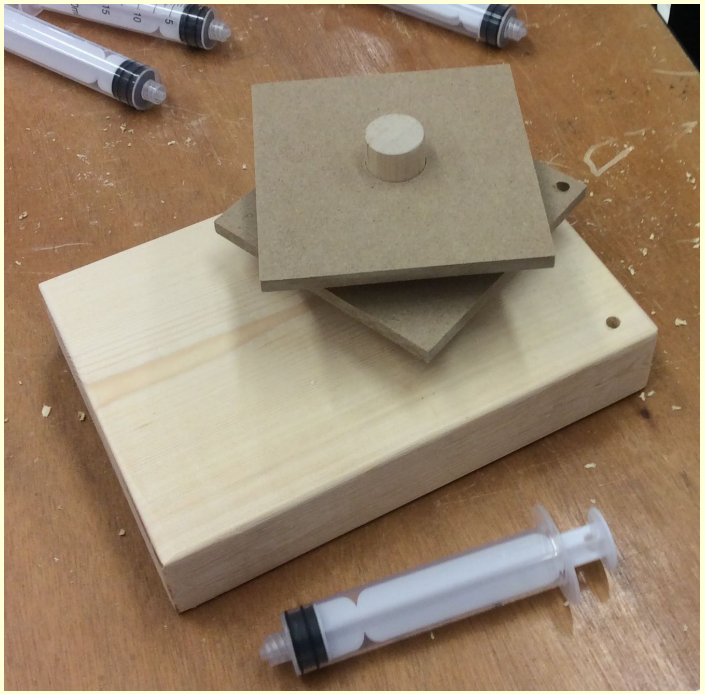
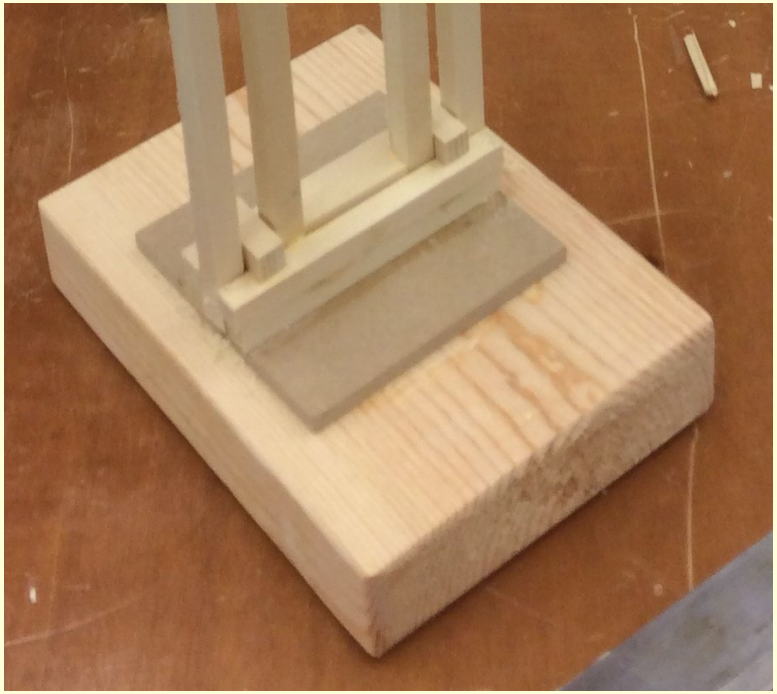
DISCUSSION

- Why are the destination positions worth different numbers of points?
- What if you design a device that only works when using your hands?
- How long will you have to move cylinders?
- What tools/materials can you use?
- Why is the Design Portfolio so important?

The Workshop kit and the Challenge Day kit contain a large wooden base with a hole in 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 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. Another piece of "sticky" double-sided tape can be used with it if a larger area is required. The smaller white syringe holder is for the 10cc piston syringe. Wood glue and hot glue are NOT efficient ways to secure this syringe holder.

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

The Portfolio Review 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 and this should follow the cover page and refer to numbered pages in your team's Portfolio

See "Examples of good Portfolio content"

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	Criteria	Points
Portfolio Rubric *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 three illustrations of the initial design concepts of a possible device	0 – 5
	• List of materials used to build a prototype from the Workshop Kit	0 – 5
	• Description of the use of principles of structural strength and stability	0 – 5
	• Rationale used do decide on the type of fluid power used and where to place the piston-syringes	0 – 5
	• An isometric drawing of the portion of the prototype used to grab the object	0 – 5
	• An orthographic drawing showing dimensions and construction notes	0 – 5
	• A list of alternative materials that would have been useful with reasons why they would have been so	0 – 5
	• Evaluation of a prototype including conclusions from making it	0 – 5
Teamwork & Work Habits *Total possible points: 10*	• Members of the team work independently and co-operatively in an organized way	0 – 5
	• Members of the team demonstrate safe working practices	0 – 5
Device Design, Construction & Operation *Total possible points: 10 + placement points*	• The device uses materials effectively and is well constructed with parts securely attached	0 – 5
	• The device itself operates efficiently and is operated in an organized way	0 – 5
	• Object placement points accumulated in designated time period	
Interview Questions *Total possible points: 20*	• See detailed *Challenge Rubric* for wording of questions	0 – 20

CHALLENGE RUBRIC

Awards are given for each sub-category and for overall.

Discussion

How many points can you earn if your device cannot complete a single cycle?

What pre-challenge action can you take to:

- get the most Teamwork Skills points?
- the most Interview Question points?

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MAXIMISE YOUR TEAM'S PORTFOLIO POINTS

Outline of the division of labor based on each member's skills and the time available to complete portfolio

- 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 three illustrations, no matter how detailed, of initial design concepts

- However, detail helps you think about the connecting parts!

Detailed list of materials used

- Record the parts you use and their dimensions

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

- This is asking you to think "outside the box" literally

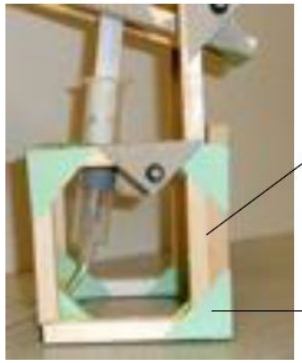
Know the Rubric
e.g.
Description of the use of the principles of a strong and stable structure
1-5 points.

Team 1 ->

Our Robot
It's good.

Team 2 ->

Question 1: Structural Support
We have reinforced the structure of our robot in the following ways:



Wooden dowels are doubled in heavily loaded areas.

All corners are reinforced with paper gussets

Which team is likely to get points?

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INTERVIEW QUESTIONS

1. What alternative designs did you look at before selecting the design you are building today?
2. Why did you select this design to use for the Challenge?
3. What did you find most difficult with the project overall?
4. How did you decide who on your team would be responsible for which parts of the project?

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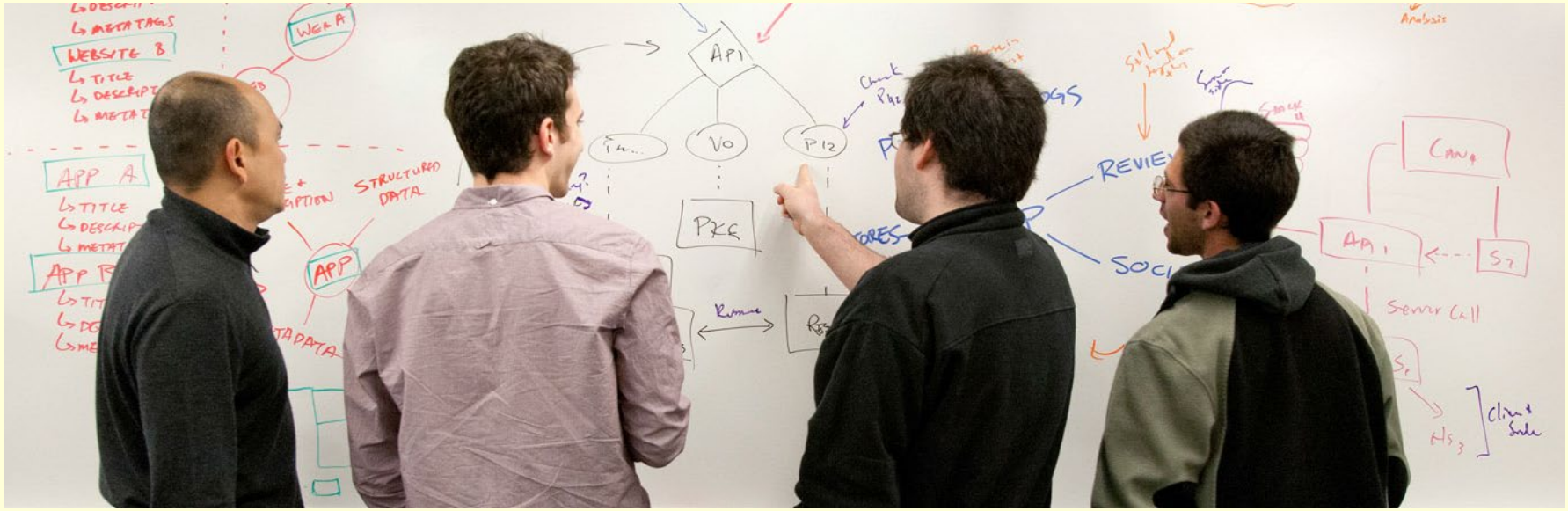
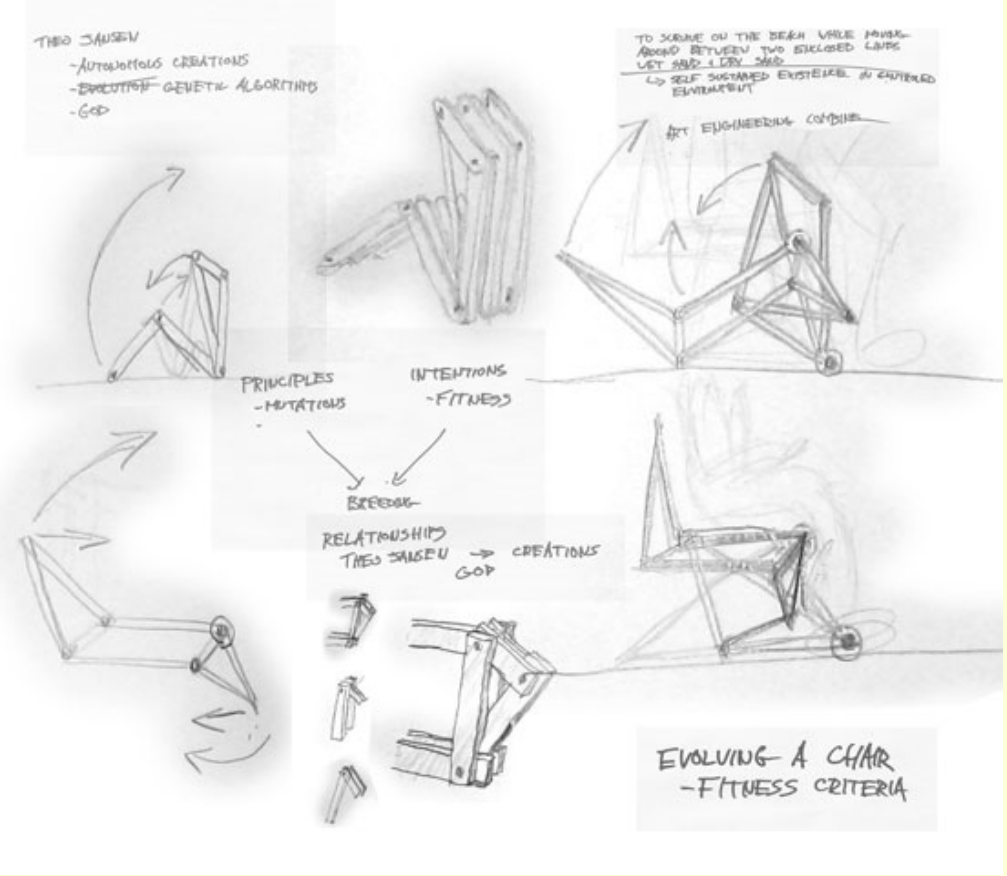
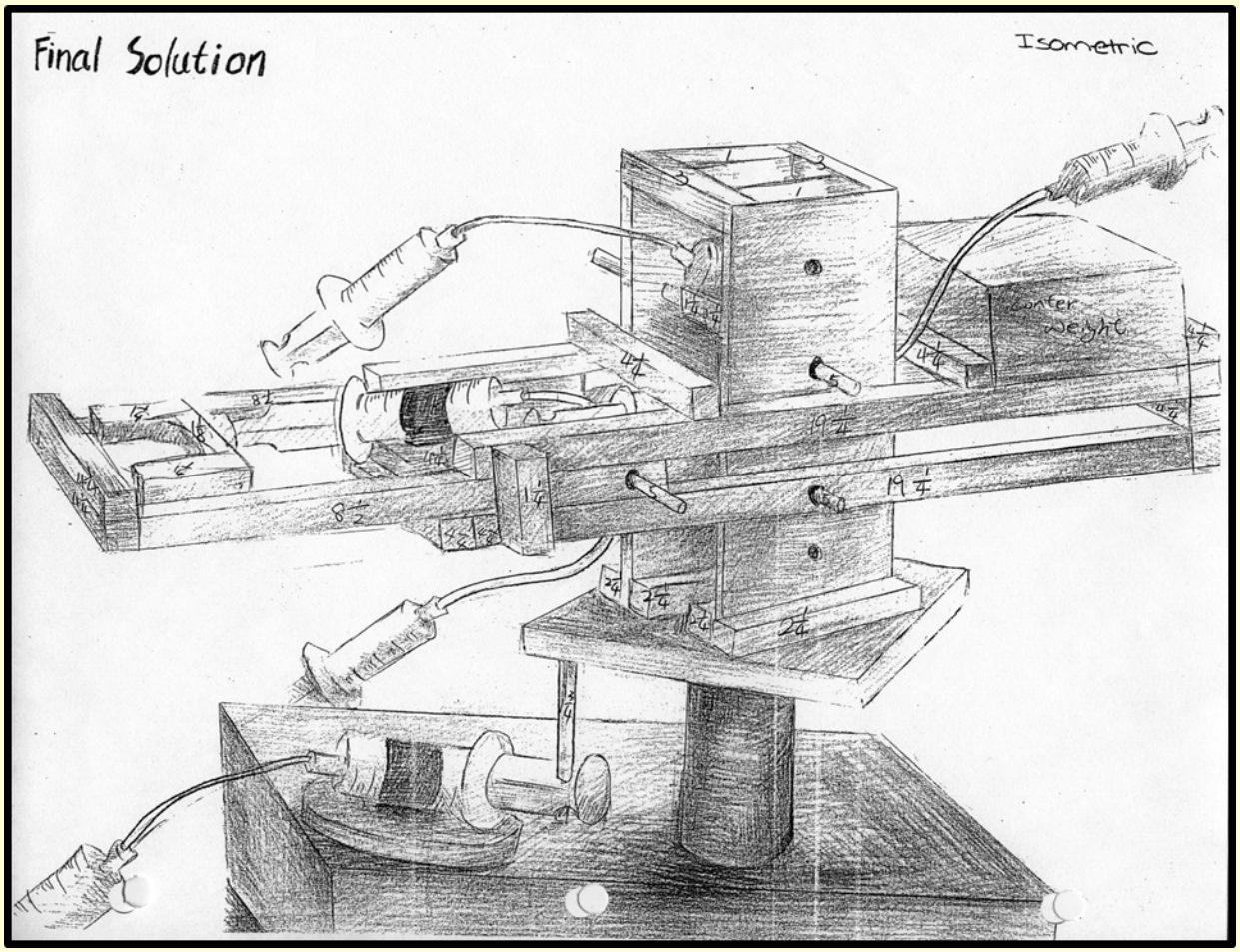
Sketching is a way of communicating ideas



Sketching is a way to explore new ideas.





This is an example of how a sketch can be included in a Design Portfolio.

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Examples of tasks

- Read project rules
- Research clamping mechanisms
- Sketch ideas for clamping mechanisms
- Research rotating mechanisms
- Sketch ideas for rotating mechanisms
- Build prototype mechanisms
- Sketch whole robot design
- Build robot 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 piston-syringes
- Have writing reviewed by a mentor
- Assemble all portfolio elements into a final report

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Identify concrete tasks and milestones

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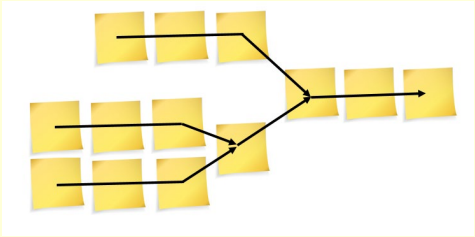
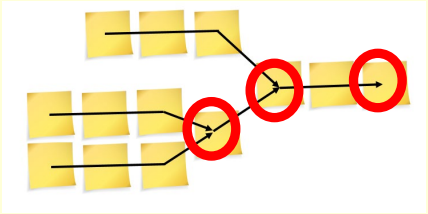
What you should be doing right now

- Identify 3 tasks or milestones



- Lay out the schedule



- Choose dates for your milestones

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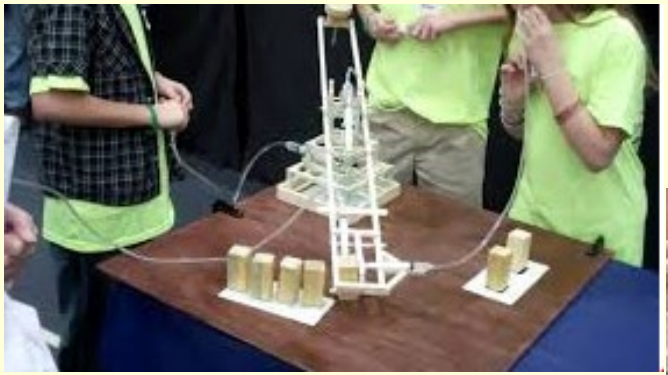
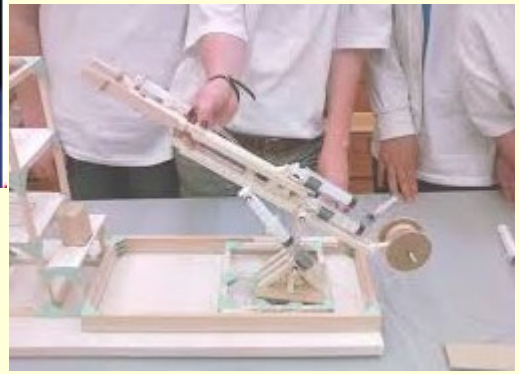
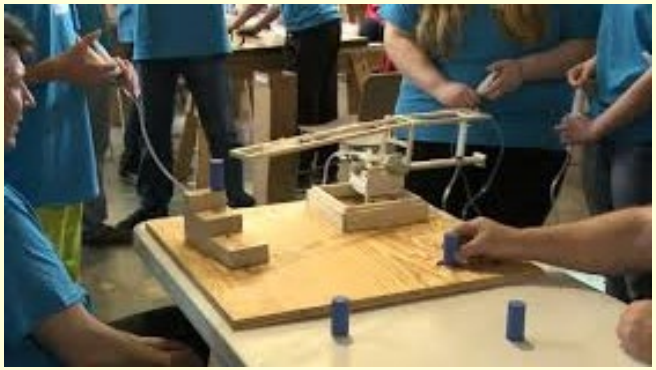
Watch videos from previous Fluid Power Challenges on YouTube or Google “Fluid Power Challenge”







YouTube & Google
Fluid Power Challenge

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Good luck!