Tools

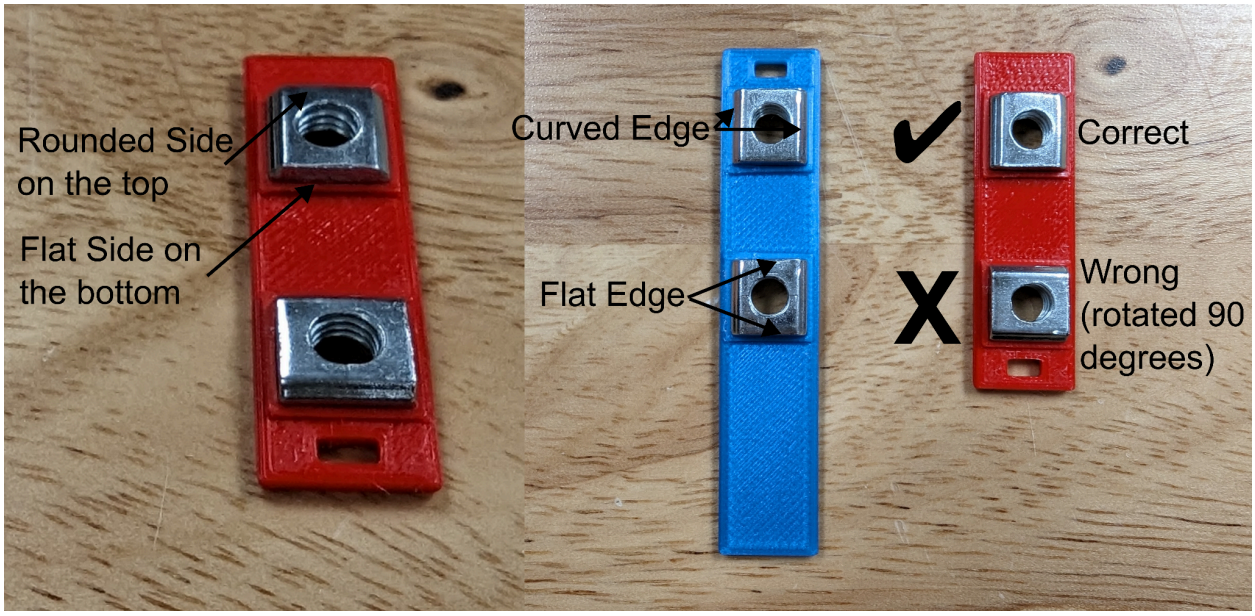
- Allen Key - M4.5
- Measuring Tape
- Bubble Level

Strategy

The document below loosely outlines the assembly. Each section presents a detailed video for you to follow and general written steps to give an overview. Skim the document with your group and devise an assembly plan before assembling.
The guide includes engineering challenges for your team to solve together. Try to figure out how to solve the challenge with the kit materials provided.

Nut Holder Alignment

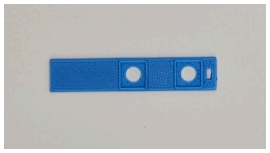
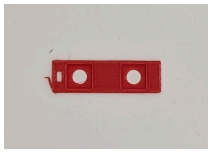
For many parts of the loom assembly, you will need to use nut holders and t-nuts. The proper alignment is shown below:



Main Loom Frame

Base Frame

Materials

Foot holders		2x560mm 8020	
Foot holder side		2x 220mm 8020	
Foot holder nut holder		M5x10mm screws	
Rubber Feet		M5 t-nuts	
10-24 nuts		Nut holder blue	
		Nut holder red	

Steps

- Watch the video here: Base_Frame.mp4

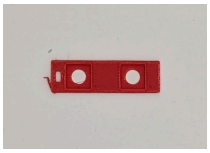
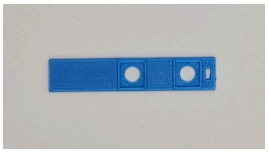
1. Attach the rubber feet to the foot holders
2. Slide an M5 t-nut into the 560mm 8020
3. Layout the base 8020
4. Put nuts in the nut holders (Nut Holder Alignment) and slide into the 8020

5. Attach the foot holder side to the foot holder and secure the 4 corners with the foot holders.

Final

Box Frame

Materials

4x 165mm 8020		Nut Holder - Red	
2x 560mm 8020		Nut Holder - Blue	
Back Corner Brackets		M5 T-Nuts	
4x Silver Corner Brackets		M5x10mm Screws	
2x Warp Beam Brackets			

Engineering Challenge: Use the materials to engineer a solution that meets the specifications below

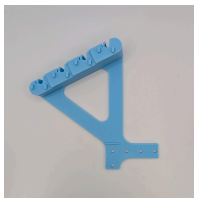
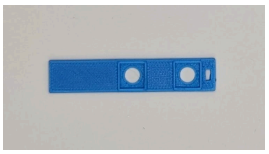
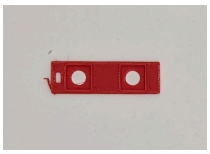
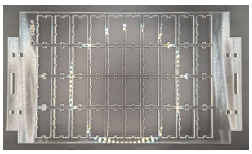
1. Make a box frame that measures **205mm tall** by **560mm long** by **260mm wide**
2. Ensure that there are mounting capabilities for the Electronics Mounts, the Creel, the Heddle Bank and the Warp Beam
    a. The electronics mounts need to be mounted to the outside of the box frame using one red nut holder (with nuts) per mount (two mounts per side)
    b. The creel parts must attach to the back of the loom along with the back corner brackets. Work with your team to ensure there's space for both.
    c. Ensure the warp beam corner brackets are used such that the warp beam can be mounted at the top front of the loom.
    d. The Heddle Bank gets mounted to the top of the box frame on the inside using one orange nut holder (with nuts) per side

Helpful Link - Nut Holder Alignment

Creel

Frame

Materials

Tension Attachment Left		Nut Holder - Orange	
Tension Attachment Right		Nut Holder - Blue	
Bobbin holder attachment		Nut Holder - Red	
2x 205mm 8020		Bobbin holder	

Steps

- Watch the video here: Creel_Frame.mp4

1. Put nuts in the nut holders (Nut Holder Alignment) and slide into the 8020
2. Attach the tension attachment and bobbin holder to the 8020
3. Make the other side
4. Put in the bobbin holder
5. Attach the sides to the loom frame (note this requires the frame to be assembled, but other steps can be done if this is not complete)

Bobbins and Cases

Materials

Bobbins		Bobbin cases	

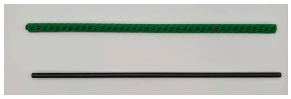
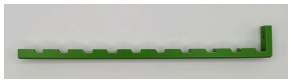
Steps

- Watch the video here: Creel_Bobbins.mp4
- Note this step can be done out of order, closer to the warping routine

1. Wind 40 bobbins (not shown in video)
    - Your chosen colors and the order you put them into the loom will determine what your warp looks like
2. Put each bobbin in a case. Make sure they're in the right direction
3. Put the cases in the holder of the creel. Make sure the open side faces the bumps in the cutouts

Tensioning System

Material

Rods		Springs	
Tension spacer bases		Tension Disks	
Tension spacer walls			

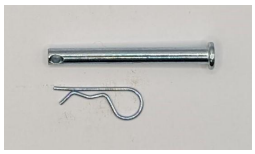
Steps

- Watch the video here: Creel_Tension_System.mp4

1. For each of the 4 tension spacer bases:
    a. Slide a rod into the base
    b. Slide on two tension disks, a spring, and wall
    c. Snap the wall into place
    d. Repeat until the end
2. Put the tension spacers into the creel
    a. **When looking at the creel from the warp beam, ensure the tensions disks are on the left side and the springs are on the right side of each section of the tension spacers**
3. Put the final rod onto the black corner bracket

Warp Beam

Materials

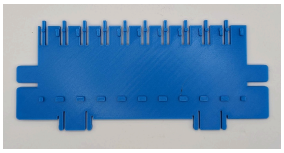
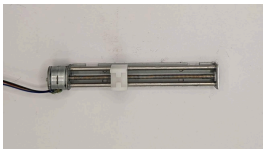
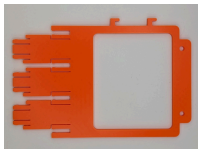
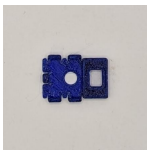
Warp Beam		Warp Beam Rod	
Pawls		Clevis Pins	

Engineering Challenge: Use the materials to engineer a solution that meets the specifications below

1. Use the built-in rachets on the warp beam, the pawls, and the clevis pins to assemble a working ratchet and pawl mechanism
    - A ratchet and pawl mechanism is one that allows rotational motion in one direction and not the other (see this video for reference: https://youtube.com/shorts/lw04cZg59F4?si=7rAnEoU9MW0coVUm)
    - The warp beam should be able to hold tension from the creel as you weave and then roll cloth onto it as needed. Use this to determine the direction your mechanism should rotate
2. Mount the mechanism such that the top of the warp beam is level with the top of the tension rod mounted in the back corner brackets.
    - An aside for those curious: This specification is necessary to ensure that the tension pulled on the warp yarns is even across the up and down positions of the yarn, so the warp beam and the tension rod at the back of the loom must both be aligned with the middle height of each heddle.

Heddle Bank

Materials

Orange nut holder	2		Motor mount	4	
Motor	40		Heddle bank side	2	
Heddle	40		Heddle bank bottom	1	
Heddle Guide	40		Filter reed and top	1	
Heddle cap attachment	40				

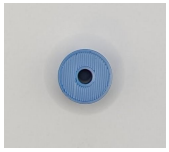
Process

- Watch the video here: Heddle_Bank.mp4

1. Make 40 motor assemblies
2. Put 10 motors in each of the 4 motor mounts
3. Put the motor mounts into the heddle bank bottom
4. Attach the sides of the heddle bank
5. Attach the heddle bank to the main loom frame
6. Add the filter reed

Beater Assembly

Materials

Beater Brackets		M5x10mm Screws	
Beater Bracket covers		M5 Nuts	
Beater spacers		Beater arms	
Reed		M5x25mm Screws	

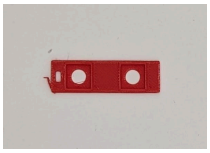
Process

- Watch the video here: Beater_Assembly.mp4

1. Attach a bracket to each side of the reed
2. Attach arms to each bracket
3. Attach the beater to the main frame

Electronics Mounts

Materials

Electronics mounts		Nut Holder - Red	
M5x10mm Screws		M5 T-Nuts	

Process

- Watch the video here: Electronics_Mounts.mp4

1. If you forgot the nut holders earlier, undo a corner and slide them in
2. Attach the electronics mounts
3. When inserting the electronics board, you will likely need to reposition the mounts

Warping Routine

Tension Rods, Heddles, and Filter Reed

- Watch the video here: Warping_Routine_tension_rods_heddles_filter_reed.mp4
- Note this process is split up to keep the videos relatively short but does not necessarily have to be done in this order fully
- Thread the warp threads through the tension rods and respective heddles through the filter reed
    - The warp yarns should make a straight line from the tension rods, through the heddles, and through the filter reed

Reed, Tie-Down, and Tensioning

- Watch the video here: Warping_Routine_Beater_to_Tie_Down.mp4
- Thread the yarns through the reed, try to center your yarns in the reed to ensure even tension will be put on them when weaving
- Once through the reed, separate the warp yarns into three bundles of 10 and two bundles of 5 and thread them through the warp beam and tie them down
- Once tied down, pull tension on the warp yarns and roll the excess back onto the bobbins

Electronics

- Looking at the warp beam the Arduino should stick out of the left side of the loom
- Plug each row of the heddle bank into the corresponding row of the electronics board. Each row gets a green PCB

Weaving

- Listen to this lecture (link) to learn how to use the loom's UI to weave on your loom!