Collins Aerospace

WARWICK EWB X COLLINS AEROSPACE TRANSMISSION SHAFT STORAGE

ENGINEERS WITHOUT BORDERS WARWICK

Initial Problem

The Problem

- Transmission shafts storage
- Shafts damaged in storage
- Monetary loss from damaged shafts

Our Task

- No contact solution
- Modular design
- Transporting transmission shafts

Collins Aerospace

Background Information

- Shafts are made from composites
- Shafts can be designed with numerous end fittings, allowing a variety of configurations, for example: flanged end fitting, yoke end, fixed and free spined, steady bearing, torque disc tripod, metallic shaft.
- Vary in length from 30cm - 2m length
- Vary in diameter from 20mm – 50mm

Week 1

Briefing

Week 2

Project Charter

Week 3

Concept Designs

Week 4

Concept Designs

Week 5

Briefing

Week 6

Teams Call

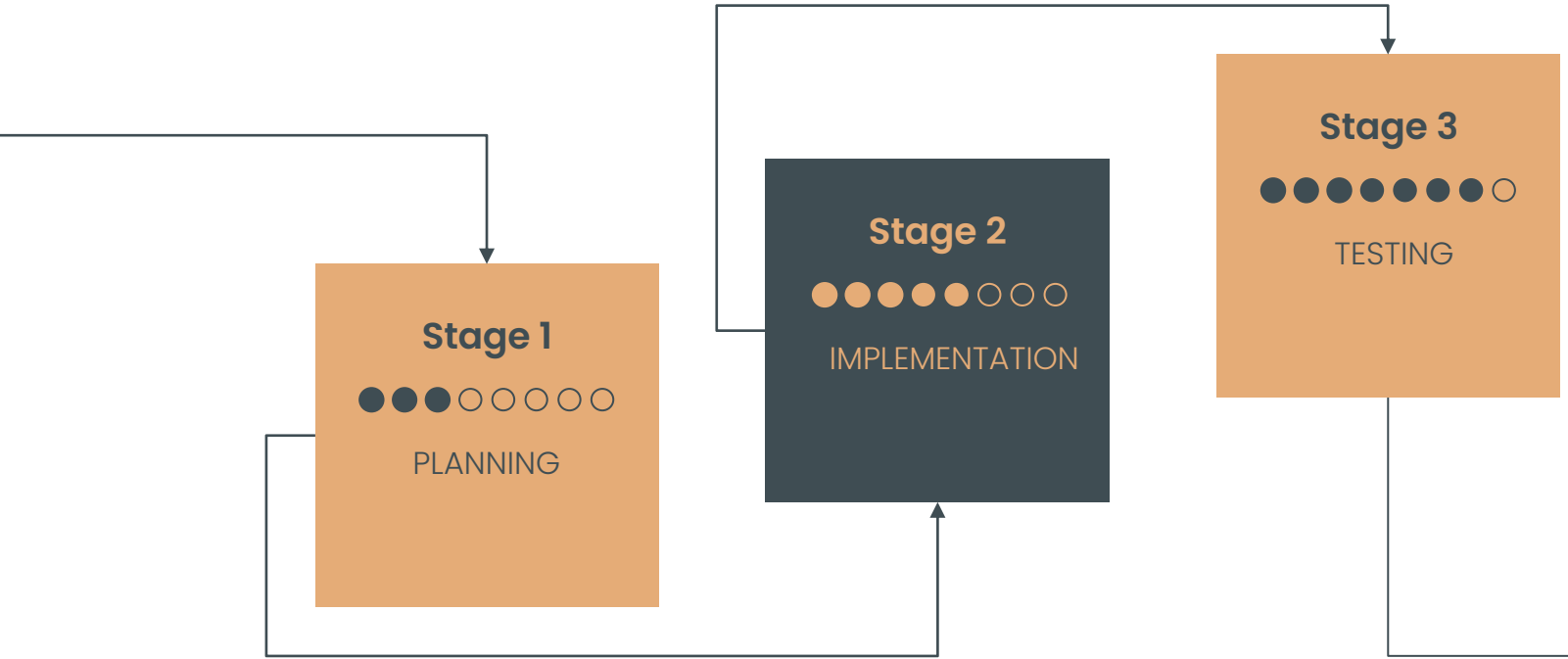
Week 7

Site Visit

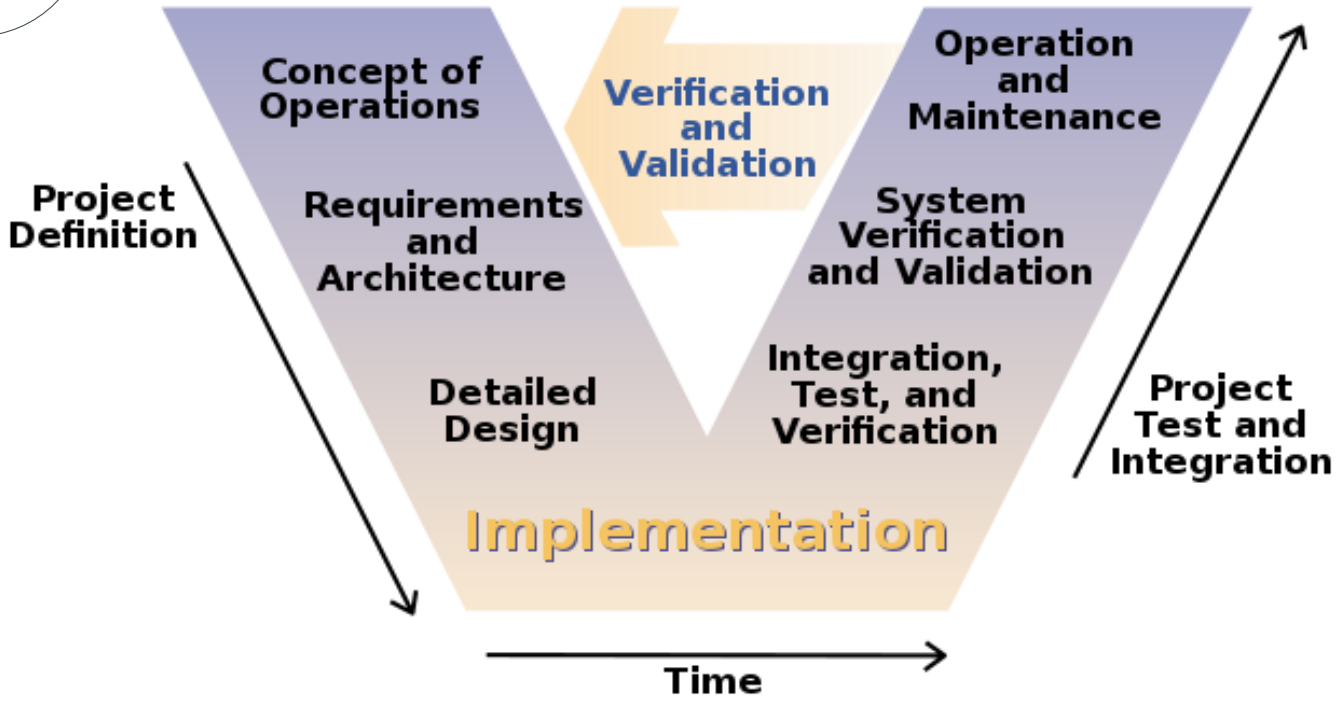
Week 8

Design changes

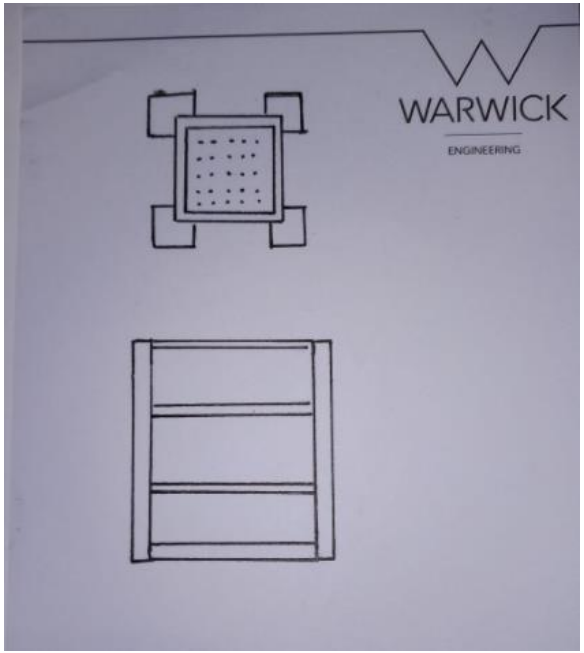
PROJECT STAGES



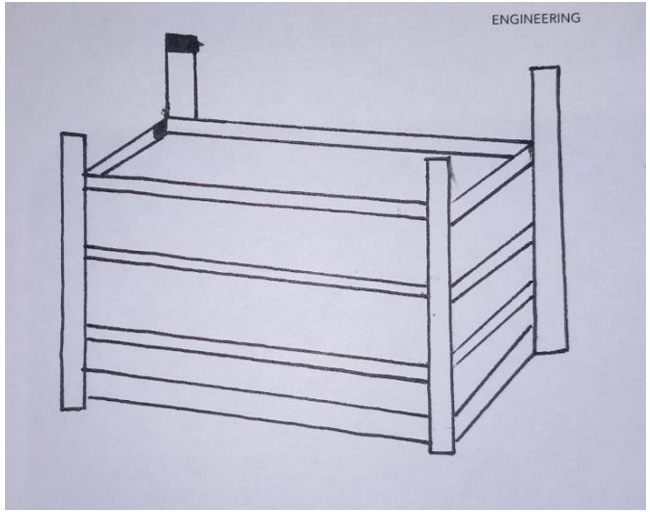
The V-MODEL


Concept of Operations
Requirements and Architecture
Detailed Design
Implementation
Integration, Test, and Verification
System Verification and Validation
Operation and Maintenance
Verification and Validation
Project Definition
Project Test and Integration
Time

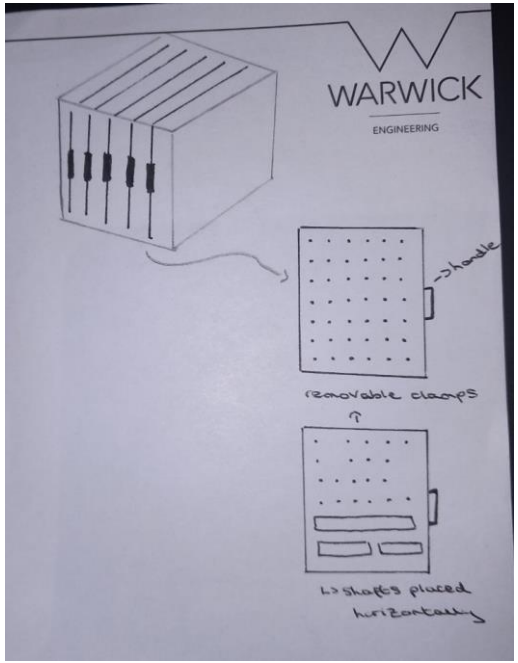
Intermediate Storage System Concept design



Final Storage System Concept design

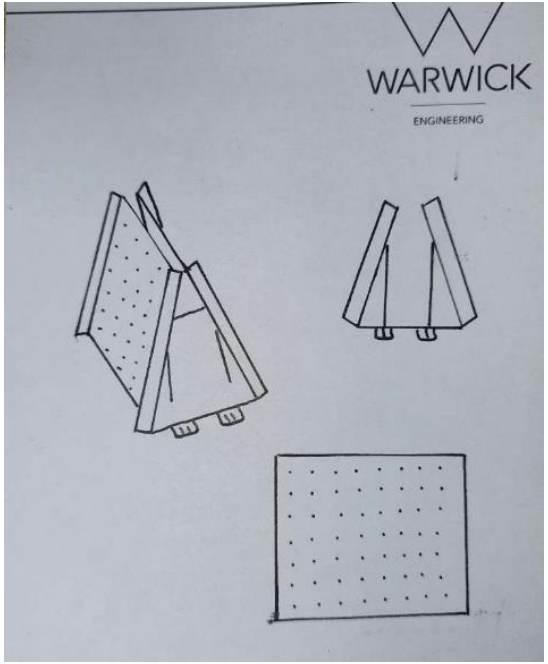


Concept 1

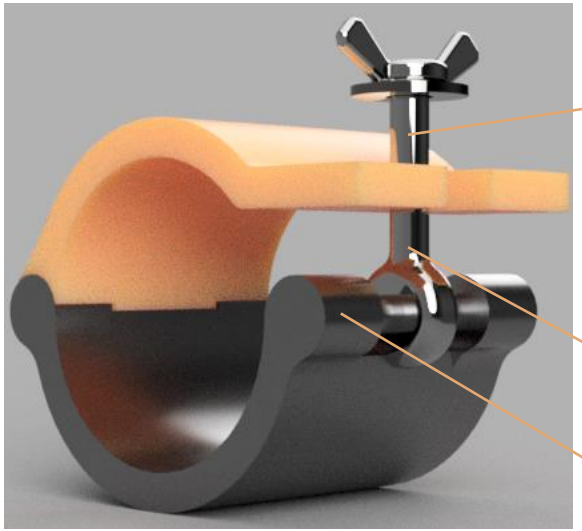


Concept 2

Trolley Concept design



Clamp Concept design



Stopper to constrain the shaft inside the clamp

Threaded to tighten the stopper to secure the shaft

Axis around which the stopper rotates to allow shaft storage.

PUGH MATRIX

Legend
Weighting: 1-5
Criterial: 0 or 1

Criteria	Weighting	Design 1	Design 2
Modular	4	1	1
Shaft Accessibility	2	0	1
Capacity	3	0	1
Efficiency	3	0	1
Design Simplicity	3	1	1

Teams meeting and adjustments

Points discussed in teams meeting:

- Current process of transporting shafts
- Production rate
- Manual process to store shafts.
- Specific considerations
- Dust and debris
- Intermediate trolley system
- Pipe lengths

Changes made after meeting :

- Foam cut out consideration
- Modular design to fit production numbers
- Edges lined with foam
- Rod inclination to reduce dust collection
- Shaft lengths considerations for all sizes

VISIT TO COLLINS

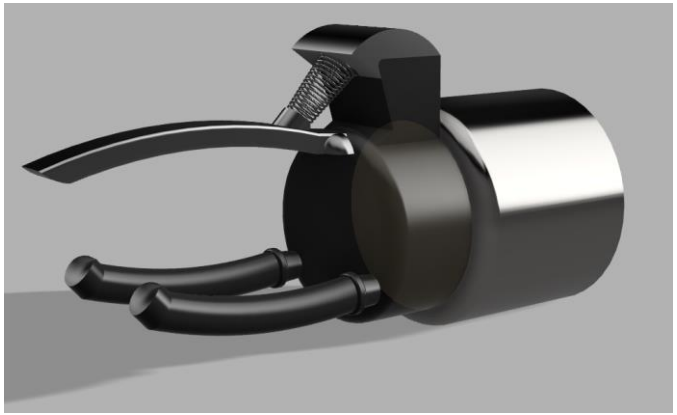
Site visit to Collins Aerospace

- Shown around the factory
- Able to see the area in which our design had to be suitable for
- Talked to those who handle the shafts on a day-to-day basis to understand the needs of our customer
- Made significant changes to our design

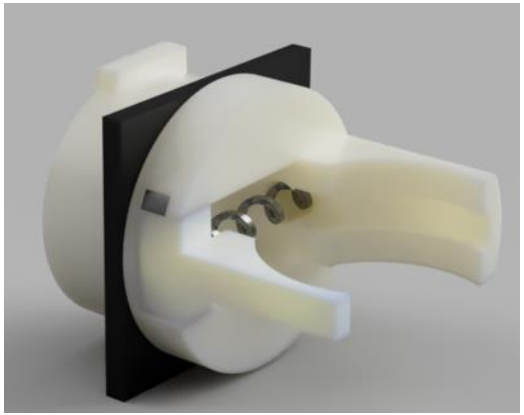
Changes made after visit :

- Began creating new designs for the clamps as the issues surrounding security of clamps had not been established prior
- Started a design for a trolley to transport the shafts to the storage system

Final Clamp Design

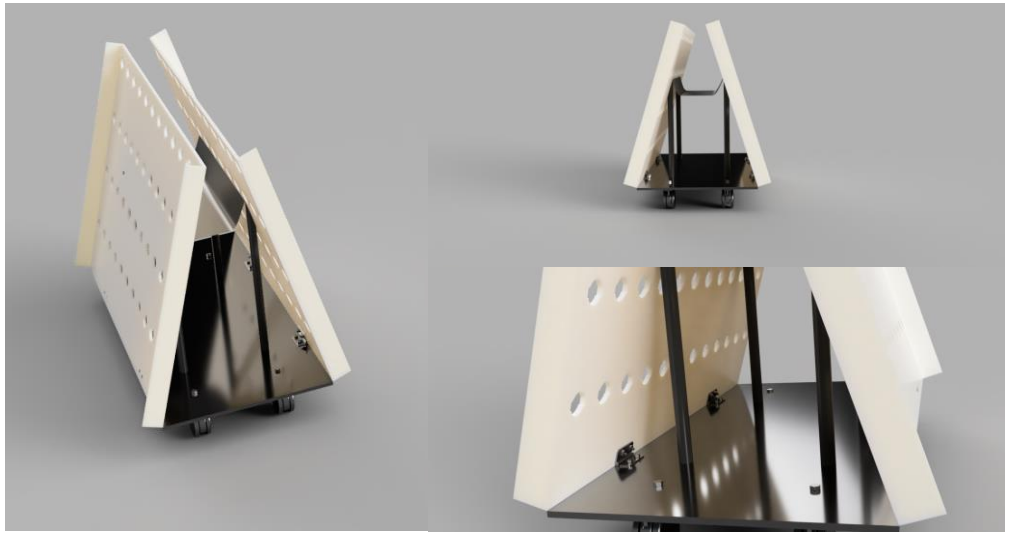


Design 1



Design 2

Final Trolley design



Intermediate storage system final design

Figure 1

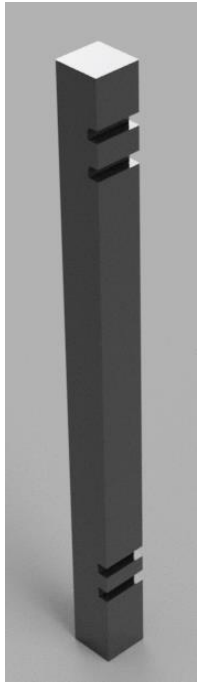
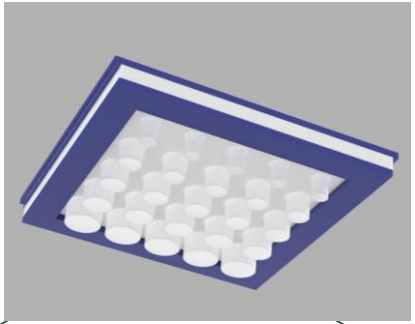


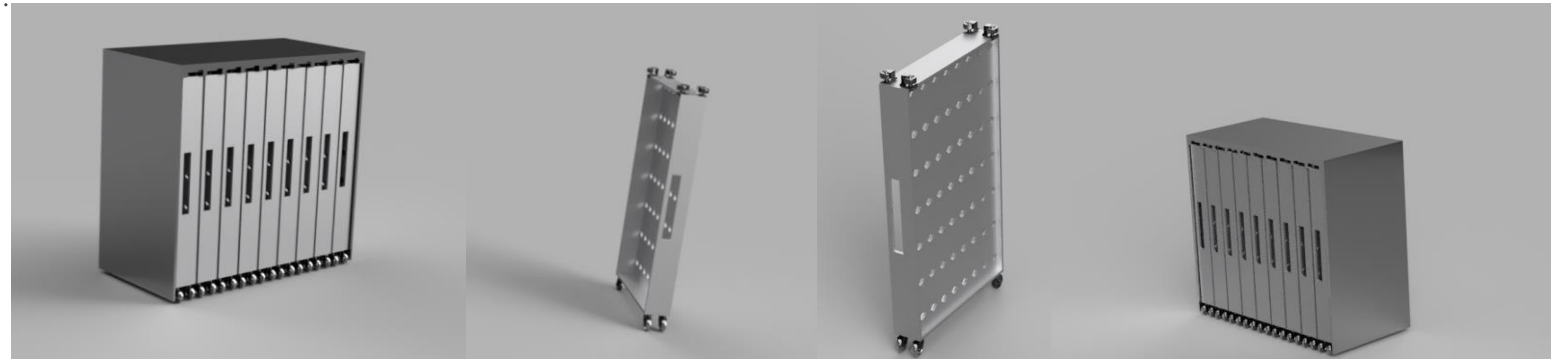
Figure 2

- Height – 85cm to make it easy to put in tall shafts but longer than current system in place to prevent collisions with other shafts.
- Accommodates all lengths of shafts with varying diameters
- Furthermore, top layer off material has 5cm extended tubes to prevent the longer shafts from colliding and preventing damage
- Designed to be small, lightweight, modular and easy to access.
- Layers of foam can be customised with ratio of hole diameters to meet needs and they can easily be taken out and replaced due to the open front-end design

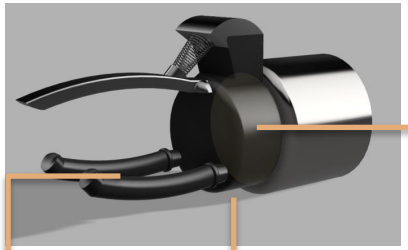
Figure 3



Final storage system design



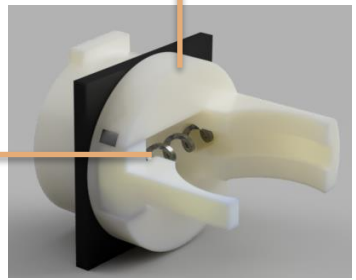
Material selection and manufacturing



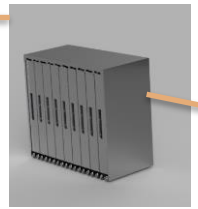
ABS – Clamp and can be made using injection molding

Rubber grips to prevent metal on metal contact and provide grip

Spring/elastic can be bought externally or manufactured in house

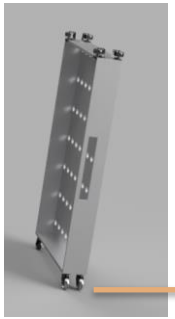


Aluminum for main structure of the storage system, as it is light. This can be shaped using a CNC machine, which creates the slots for the clamp to clip into.



Aluminium or steel casing to prevent damage, it is hardwearing .

Using very little machining to reduce waste and have a sustainable manufacturing process.

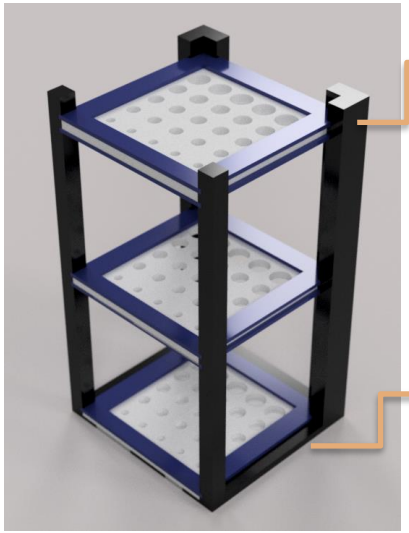


The yokes for wheels should use a thinner type of metal. To form yoke shapes and circular grooves, achieved by running the thin metal sheets on a punch press.

Rubber used for wheels using nylon wheel inserts and place them injection mold, cool and then smooth out edges.

Material selection and manufacturing

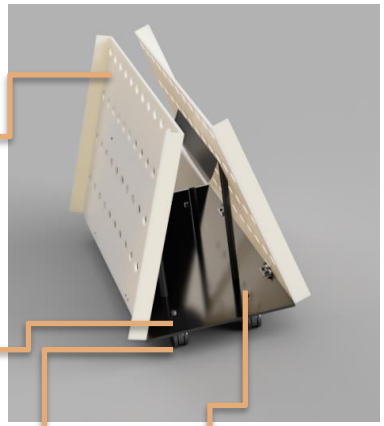
Polyurethane used to line sharp edges of any design. It is light and cheap. It can be coloured brightly to make it more visible to make hazard more visible.



Using Polypropylene for the main body and structure of intermediate storage system and can be manufactured using injection moulding which is cost effective and efficient with very little waste

Polyethylene to protect transmission shafts when being held in area before moving onto next manufacturing stage (addition of end fittings) . Can be easily cut, shaped and stuck together. It is light weight, durable and cost efficient.

Felt sheet draped in between to hold additional clamps when not in use. It is cheap and soft and will prevent damage to clamps. Can be easily cut into the right size.



Simple brake pads used to hold trolley stationary. Made from plastic lined with a thin layer of rubber

Screws to join wheels and separate sections to main body. M10, M12

Aluminum sheet metal used for main structure of trolly. It is light weight durable and easy to manufacture. This can be done through CNC machine

REFLECTION

Highlights of our success

- Good design Concept
- Project Management skills
- Passion

Improvement

- Communication
- Earlier site visit
- Prototype and Testing

Thank You For Listening
Any Questions?