



BY MAX WALKER-
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TECH205 HEIRLOOM
BOX

STATEMENT OF INTENT

I have in my possession my Great, Great Grandfathers World War I medals have when they were passed onto me, I was instructed to keep them until I wanted to pass them on to the next generation. These medals came inside a metal biscuit tin that was given to him from the Queen. While the tin protects the metals, the tin also needs to be safely preserved to ensure the longevity of this heirloom. As I have no place to store the war medals, I have a need to construct a wooden box that will fit the medals to protect them. I need to take into account constraints I may come across to ensure my box will effective to protect the medals and stay strong so it can be passed on for decades into the future.



CONSTRAINTS

Time

I only have three weeks in the workshop to build my heirloom box so I must practice good time management skills to ensure I complete my project on time. I can achieve this by following a time plan to ensure I complete each task on time and track my completion. I also may need to allocate spare time to come into the workshop to catch up if I'm falling behind on my plan.

Size

The size of the tin is 140 x 110 x 35mm, so I must make a box that is slightly bigger to ensure I have room to pick up the tin. I also need to consider of the ergonomics and anthropometrics of the box, this relates to the width as I need to be able to take off the lid one handed.



ERGONOMICS

- My heirloom box must factor ergonomics into its design as it needs to fit inside my safe. I want to store the heirloom box inside the safe for extra protection of the war medals as they were passed onto me. The box will act as another protection layer as these medals are very delicate and fragile. The safe has dimensions of 300x200x200. The box also be significantly smaller than the dimensions safe as I need to store other objects inside their too.



ANTHROPOMETRICS

- The heirloom box must fit the anthropometrics of my own hand, so the box is easy to open one handed. The lid should come off easily due to the piston fit and have a feeling of air pressure that keeps the lid tight.
- I measured by hand of having a maximum 200mm width when stretching out to pick something up. As I want my heirloom to be easily accessible, I should reduce the width by 50mm, so I have no difficulty taking the lid off.



RESEARCH AND JUSTIFICATION

RESEARCH- MATERIALS

Timber	Advantages	Disadvantages
Blackwood (Britton Timbers, N.D)	<ul style="list-style-type: none"> Wavy looking grain. Unusual curves would look good book match Contrast would work well with a light coloured veneer and lining. 	<ul style="list-style-type: none"> Gluing is more time consuming as polyurethane based glues will stain timber green.
American Red Oak (Britton Timbers, N.D)	<ul style="list-style-type: none"> Strong grain features. Book match would drastically improve aesthetics. 	<ul style="list-style-type: none"> Being a hardwood, it is often difficult to machine. Chunks of timber might occur which could ruin the aesthetics
Sapele Mahogany (Britton Timbers, N.D)	<ul style="list-style-type: none"> Colour contrast would be interesting once a coat of finish has been applied. 	<ul style="list-style-type: none"> Interlocking grain can cause tear out or chipping when machined. I could use hand tools but it would be time consuming
American Rock maple (Britton Timbers, N.D)	<ul style="list-style-type: none"> Looks appealing to contrasts with dark timbers. Could be a good timber to use in lining. Dense timber (supports longevity of box) 	<ul style="list-style-type: none"> Tendency to burn when being machined

RESEARCH-VENEERS

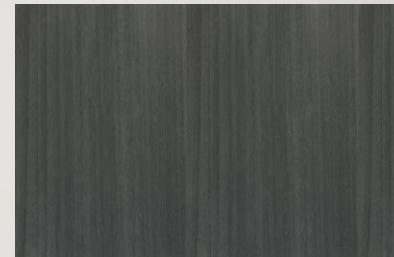
Veneers will be chosen based on their colours and how they interact with one another. Colour contrast is an important aspect into the selection of what veneers will be used in the marquetry pattern for the base and lid. I will research 2 dark and 2 light coloured timbers which will contrasted together to create a pattern.

American
Walnut
(Briggs, N.D)



The American Walnut Vener is quite dark brown and comes from the crown cut of a log from the timber mill. This allows the grain to be book matched which greatly improves the aesthetics of the box. The dark colour would contrast well with a very light coloured timber.

'Woodstock
Charcoal' (Briggs, N.D)



This dark coloured timber is actually from the Koto species however it has been dyed to give the veneer a charcoal colour. This veneer is along available quarter cut, meaning the veneer will slip matched rather than a book match. This would compliment a light coloured veneer well.

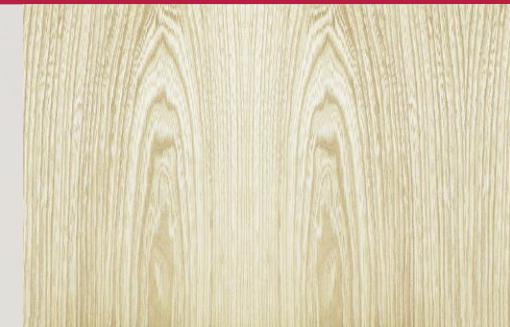
RESEARCH-VENEERS

Queensland
Silver Ash
(Monaro, N.D)



Queensland Silver Ash is a lighted coloured timber that would work well with a dark veneer for my marquetry. It's seen as a rare timber due to it being grown in the rainforests of Northern Queensland (Veneers Panels, N.D)

Japanese
Sen (Briggs, N.D)



This Japanese grown timber has a strong grain effect which would catch the eye on the marquetry. The Veneer is also book matched which is important as the grain is extremely prominent.

SELECTION AND JUSTIFICATION OF MATERIAL

Timber

- I have chosen to use Blackwood to construct my heirloom box. I personally think I can incorporate some interesting contrasting colors with the veneers when I make my marquetry. Its grain features would also be enhanced once I apply a coat of finish which will also improve the aesthetics and the longevity of the box. I will need to use PVA glue as polyurethane glue will stain the timber green. I will need to ensure I follow my time plan to ensure I don't fall behind as gluing takes a significant amount of time to cure.

Lining

- Rock Maple will highlight the colour contrast I'm wanting to achieve as its colour is quite white and light coloured. Its density will promote longevity as it will need to withstand bumps and wear from the lip rubbing against the lining. I must take my time to ensure I don't burn the timber when I machine it as it will ruin its colour.

Veneers

I have chosen to use American Walnut and Queensland Silver Ash for my veneers as they complement each other really well as the colour contrast. The Woodstock Charcoal gave the impression that its black like colour wouldn't match the colour and feeling of the heirloom box while the walnut gave a more natural vibe to the project which I wanted. The silver ash contrasted perfectly with the walnut and matched well with the Rock maple linings due to the similarities their colour.

JOINERY

Butt Joint

Butt joints are the simplest joins of timber as it requires two pieces to be glued together. Butt joints need a large surface area for the glue to cure to allow the join to be strong. I could use butt joints along with other joints to ensure my box is strong enough as I need it to last decades as it will be passed down generations.

Mitre joint

Mitre joints are a framing joint that are cut on 45-degree angles. These joints are effective as they hide endgrain which drastically improves the quality of your work. Mitre joints can be cut easily on the drop, table saw or on the disc sander. Mitre joints are often combined with butt or domino joints when assembling and are relatively strong once glue is applied from the large surface area. This could be used as the frame for the heirloom box as it hides the end grain and looks professional when constructed well.

Rebate Joint

A rebate joint consists of a recess or groove that allows another piece of wood to join at a 90 degree angle. They are well known for their strength and stability and commonly used as they are easily constructed. Rebate joints are probably not a good choice for this type of box due to its small size however it could hold up the plywood base for the veneers.

JOINERY

Housing Joint

Housings are another type of joinery that allows timber to sit 90 degrees similarly to a rebate joint. However, housings include a small trench that allows timber to slot into that provides a tight fit. This is an effective joinery technique as due to its strength and its ability to hide the joint once the timber has been slotted into the trench. This would be a good joint to hold the plywood for the base and lid to present the veneer marquetry.

Domino Joint

The domino joint is quite similar to a loose mortise and tenon as the dominos can be removed easily. They are easily cut on the festool domino machine and less time consuming compared to the traditional mortise and tenon. Unfortunately, if used to build the frame for the box, end grain would be showing. Dominos could be used with mitre joints to give extra strength to meet the intent of building a project to last.

SELECTION AND JUSTIFICATION OF JOINERY

I have chosen to use mitre joints as the frame for my heirloom box as it effectively hides the endgrain which will drastically improve the aesthetics. The mitre joints will be glued together with a butt joint as there is enough surface area for a tight joint. I may need to add keys for additional strength to ensure the longevity of the box. The plywood veneer base will include housing joints as they can be easily cut on the table saw and produce a tight fit. The joint will also be hidden which will make the box look of a product of higher quality.

ADHESIVES

PVA

PVA glue is a common choice for adhesives as it has strong bonding properties and its suitable to use in most situations. PVA penetrates wood fibres which secures a strong join which is an important factor when wanting to choose an effective adhesive. It's time to cure isn't super time consuming to dry, its best to leave for a full 24 hours to ensure the glue has set well. Its important to remove any squeeze out that might occur when gluing with a wet rag to limit the amount of chiselling away any dried glue.

Cold Press Veneer Glue

Cold press veneer glue is made by Titbond and is a glue that is used to glue veneers to a surface which promotes a strong bond between the two surfaces. Only a thin layer of glue needs to be used and can be easily applied with a roller or brush. Time to cure is quite quick with around 2 hours which helps times constraints

TitBond II

Titbond II is a water resistant glue that often competes against PVA as they have similar properties. Titbond has a quick time to cure with around 30mins-1 hour however leaving clamped for at least 24 hours would be beneficial as you want the join to be as strong as possible. Unfortunately, Titebond II will stain Blackwood green which will cause myself to sand extra during the finishing process.

SELECTION AND JUSTIFICATION OF ADHESIVE

PVA and Cold press veneer glue will be best suited for my project. While the titbond II glue is a great adhesive, it will stain the blackwood green which will cause extra time to be wasted sanding away green marks. Both adhesives are easily applied and allow enough time to move pieces around before the glue cures which is important as you need time to ensure the joinery is flush.

FINISHES

Wipe on Polyurethane

Wipe on Poly is a type of varnish that is easily applied with a rag and rubbed deep into the grain of the timber. Coats dry up quite fast compared to other finishes however to have an effective buildup of finish, wipe on poly needs to be sanded between each coat with a recommended 220 grit. If I had another week of work, this method of finish would be good to use. It's probably not best to use a finish that isn't applied properly. Wipe on poly can also be used with a wax after its final coat to enhance the finish to further improve the quality of my project.

Osmo Polyurethane oil

Osmo polyurethane oil provides natural and matte like appearance that highlights the grain and natural texture. Osmo can easily be applied with an abrasive sponge as it allows the oil to seep into the grain of the timber for the best results. It's important to remove any excess oil by rubbing a rag vigorously with friction because it will leave a sticky residue that can impact the quality of my project.

SELECTION AND JUSTIFICATION OF FINISH

The Osmo Polyurethane Oil will be my finish of choice as it's an easy finish to work with and is easily applied with an abrasive sponge. I also have prior experience with working with this finish and it's very reliable and enhances the natural grain of the timber which I want to be prominent as the heirloom box will showcase a match book appearance.

TECHNOLOGIES

Key

Using for process

Not using for process

Process- Dressing Timber

- Buying Dress all Round Timber (DAR)
- Plane Jointer
- Jack Plane
- Electric Plane
- Drop Saw
- Band saw
- Table saw
- Thicknesseser

Selection and Justification

Due to time constrains the timber needs to dress as quickly as possible. Any methods of manual labor such as using a jack plane have been substituted to using machine as they can be complete the task quickly and more efficiently. I will rip the timber on the table and bandsaw and dock any material on the drop saw. I will need to reduce the thickness of the timber on the thicknesser. I must ensure to not reduce too much as this will take away the match book look of the grain.

TECHNOLOGIES

Key

Using for process

Not using for process

Process- Cutting Mitre joints

- Drop Saw
- Table Saw
- Mitre Jig (for table saw and disc sander)
- Disc sander

Selection and Justification

The table saw is one of the best options to cut mitre joints as it can be used with the sled jig to ensure all joins will be square as they will be cut at the same reference point. As the linings for the box will be too small for the drop saw, they will be need to applied to the disk sander. The disc sander also has a jig that allows to accurate sand a 45 degree angle on the end grain.

TECHNOLOGIES

Key

Using for process

Not using for process

Process- Construction of Keys

- Drill Press
- Handheld cordless drill
- Warrington Hammer
- Mallet
- Try square

Selection and Justification

Using the drill press is the best choice from drilling the pilot holes for the keys as I can set a stopper to prevent me from drilling too far and ruining the box. It will allow me to drill the same distance for each hole. The mallet is also too big for the small skewers and will snap when hit, showing why the Warrington hammer is the best option. The try square will also help me mark out where I want to drill the pilot holes.

TECHNOLOGIES

Key

Using for process

Not using for process

Process- Cutting housing joints

- Handheld router
- Table Router
- Table saw
- Bandsaw

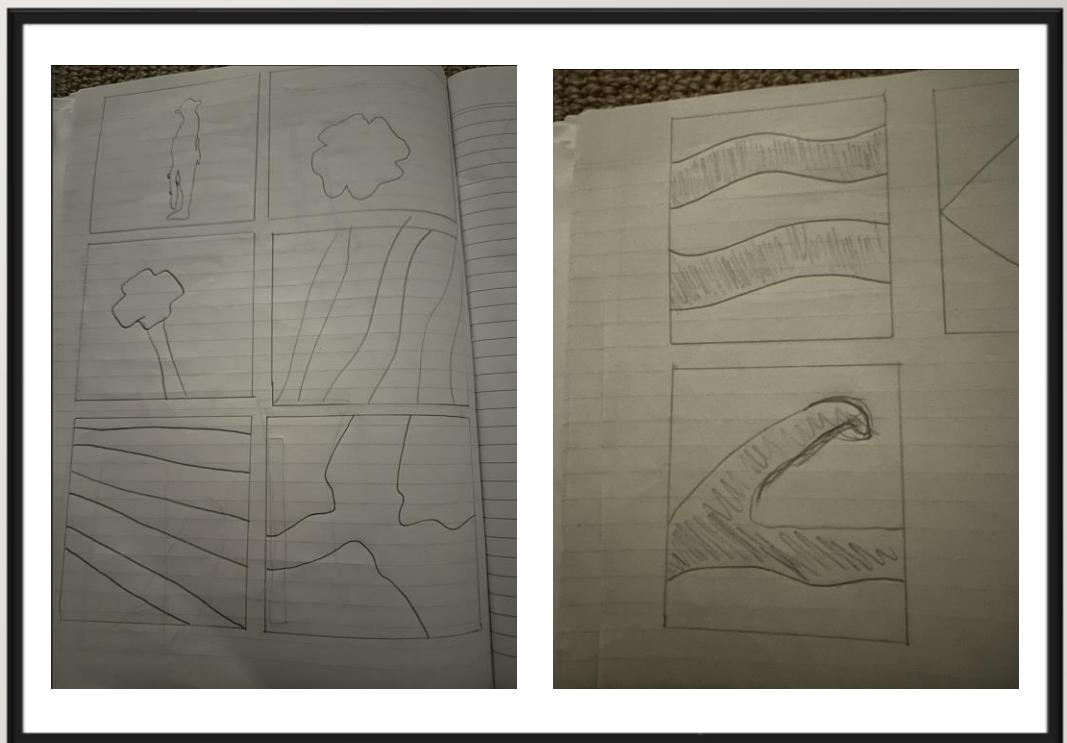
Selection and Justification

The table saw is the best option for cutting housing joints as I can set up the guard to accurately cut in a straight line and evenly on each side of the timber. The 3mm plywood also sits perfectly in the groove as the saw blade is around 3.6mm in thickness.

DESIGN

Veneer Marquetry

I originally had plans to create a silhouette image from veneers that incorporated an image of a poppy or a soldier as war medals would be contained in the box. This can be seen in my sketches. I was instructed this would be too difficult has the veneers would be cut on the scroll saw. I needed to design something organic, I started to sketch wave patterns. The wave patterns resembles my great, great grandfathers' role in the war as he was in the Navy which ended up becoming my final design.



INSPIRATION FOR DESIGN

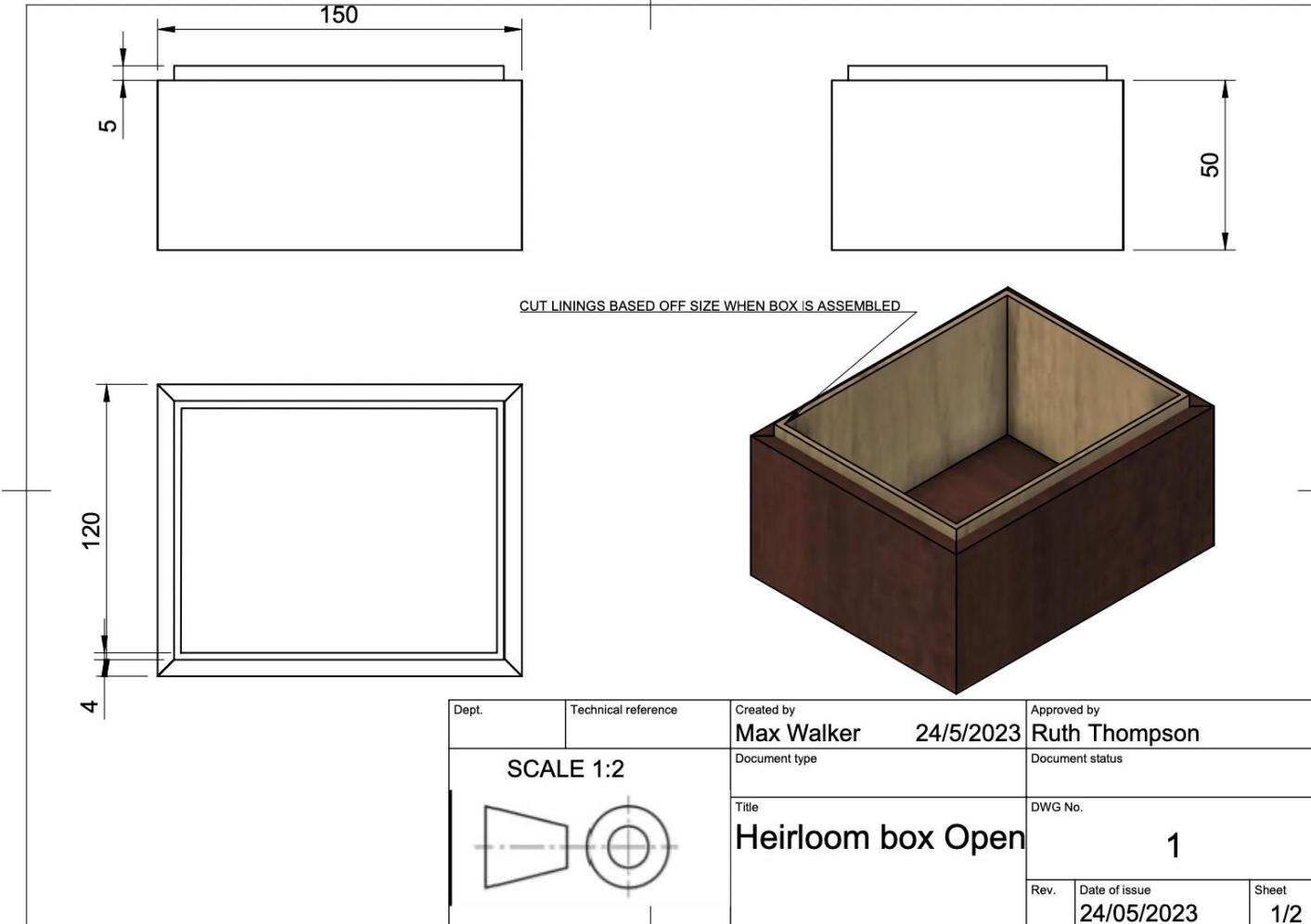
These heirloom boxes for Ironbark (2023) have given in inspirations for my own box as this designer has created these boxes for the intent for storing war medals. These boxes are quite tall in height rather than length which will give me the inspiration in my designs. There is also evidence of dovetail mitre joints. I will use the mitre joints but don't have the time to construct dovetails. Where the designer has including laser cutting, I can swap that with marquetry and design a pattern where veneers will be glued onto a plywood base.



Ironbark Works, 2023



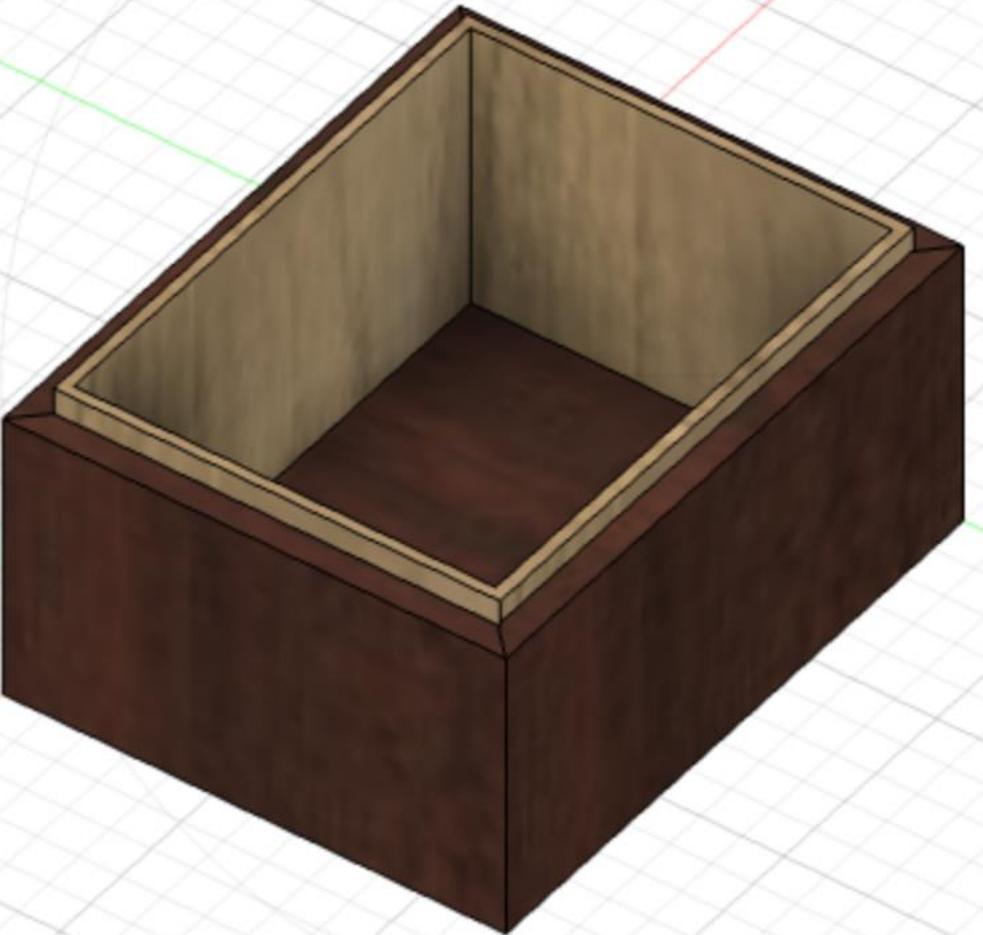
WORKING DRAWING



WORKING DRAWING



Dept.	Technical reference	Created by Max Walker	Approved by Ruth Thompson
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	Title Heirloom Box Closed	DWG No. 2	
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CAD MODEL

Piece	Quantity	Lenth (mm)	Width (mm)	Thickness(mm)	Material
Front/back of box	2	150	90	10	Blackwood
Side of box	2	120	90	10	Blackwood
Plywood base	2	136	102	3	Plywood
Linings	4	Cut to size based off box	55	4	American Rock Maple

CUTTING LIST

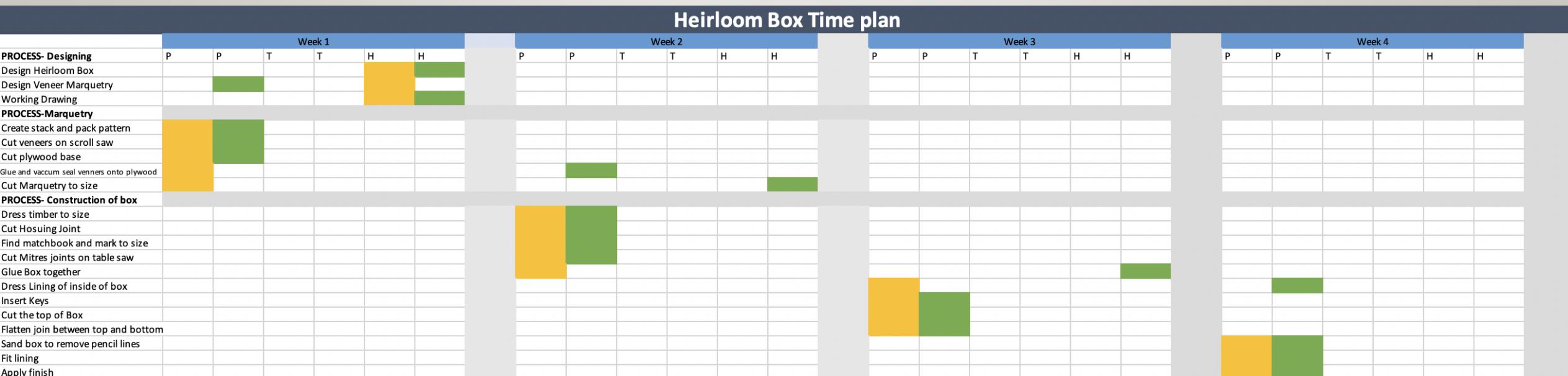
DESIGN MODIFICATIONS

Due to significant time constraints , I had to adapt using bamboo skewers rather than normal keys to support the Mitre joints.This was achieved by drilling multiple pilot holes into the box with the drill press and tapping in the bamboo skewers with a Warrington hammer and removing excess with a chisel.

While the skewers aren't as strong as a key, they still provided enough support to promote the longevity of the heirloom box to ensure it the joinery will last.They also provided some aesthetics to the box from the contrasting colours.



TIME PLAN



Evaluation of Time Management

My time management has greatly improved over the multiple projects. The majority of proposed times met the actual working times which greatly improved stress levels when working. I only needed to glue and cut the plywood base in my own time with all other processes occurring during workshop times which is reflected in the time plan.

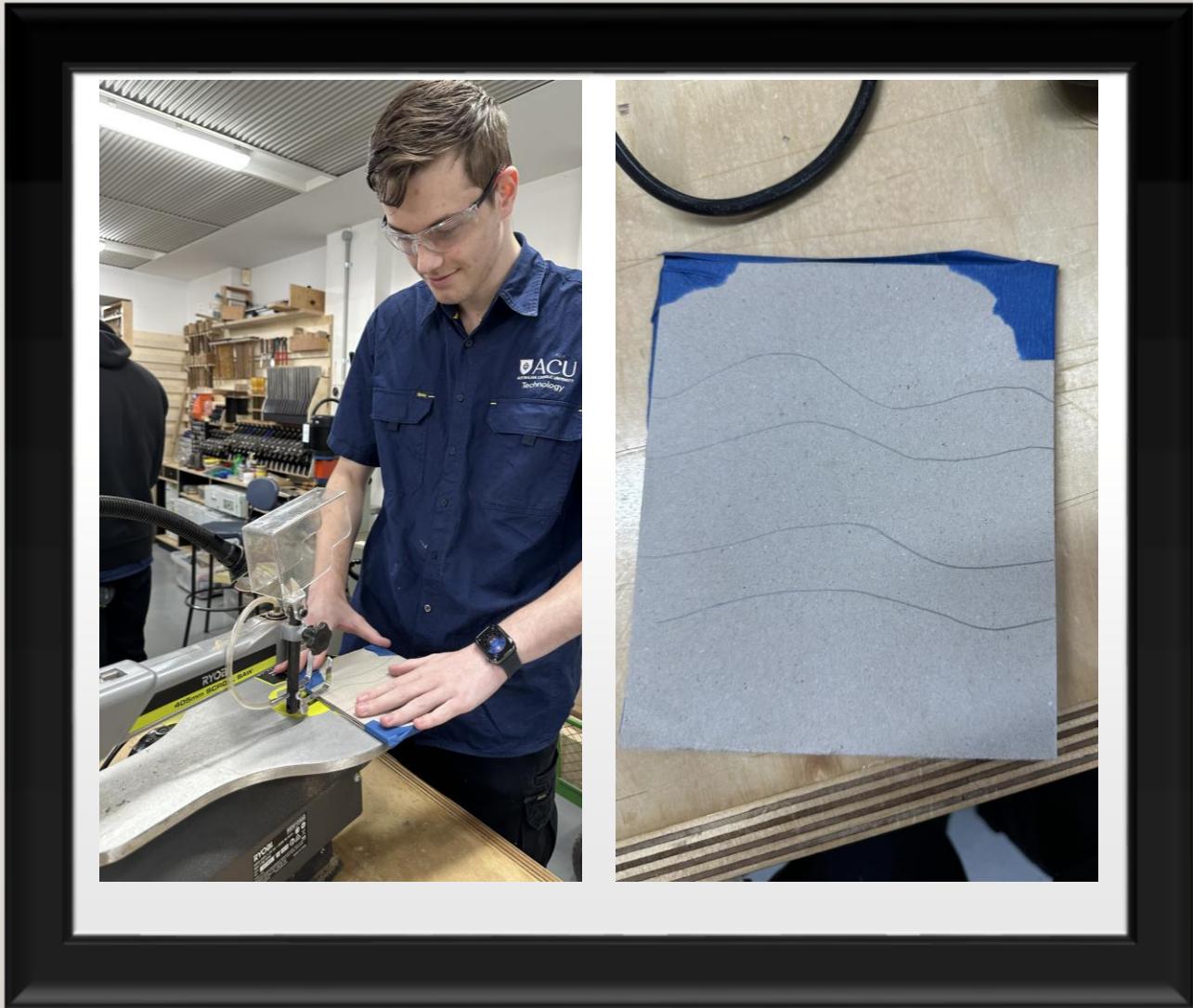
Key	
Proposed	
Actual	
P	Practical
T	Tutorial
H	Home

A large stack of logs is shown in the foreground, with a forest and a sunset in the background.

RECORD OF PRODUCTION

CREATE AND CUT PACK AND STACK MARQUETRY

The veneers were stacked alternately, and I designed a wave pattern that was drawn on the cardboard layer. This allowed me to accurately cut the shape on the scroll saw.

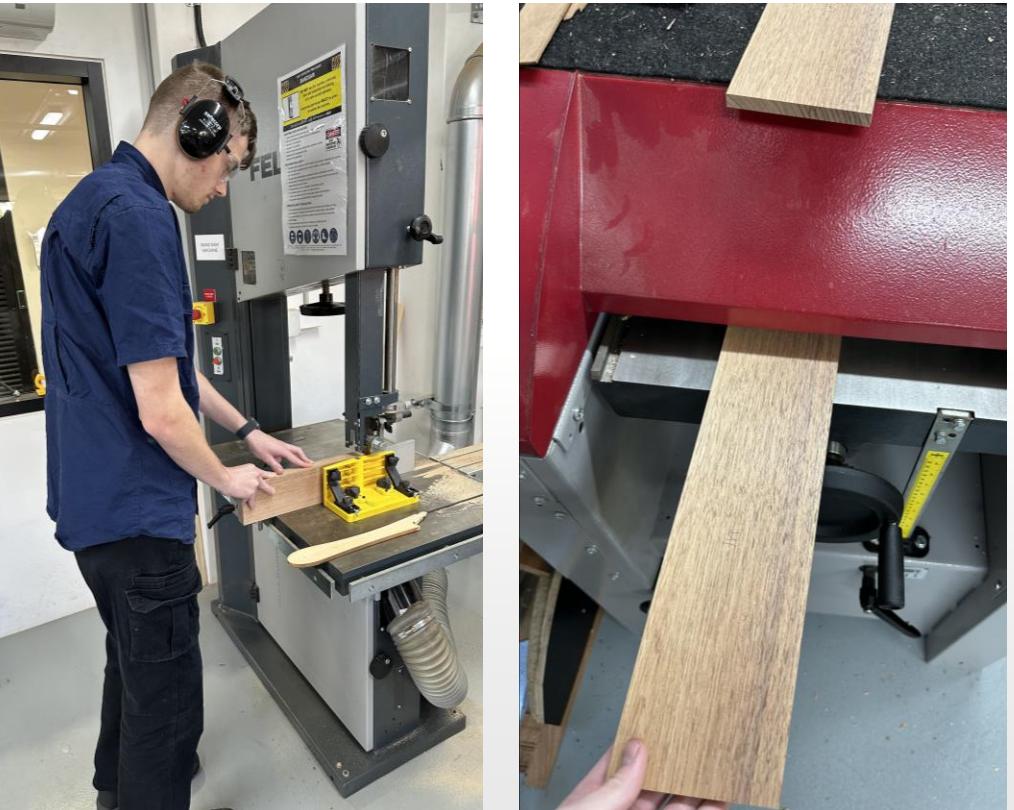


GLUE AND VACUUM SEAL VENEERS.



I next glued the veneer patterns into a plywood base with the veneers being protected with a layer of tape. These were then vacuumed sealed to allow enough pressure to be against to veneers to ensure they were glued well. I left the marquetry in the bag for a week while not In the workshop to allow the glue to dry, however the glue should cure in 2 hours.

DRESS TIMBER



I needed to rip the board of timber in half to maximise the amount of material. This allowed me to fit a side and a front/back on each board. I then needed to run the board through the thicknesser to take off the blade marks from the bandsaw. I ensured I only took off minimal material as I wanted to keep the book match look of the grain.

CUT TIMBER TO LENGTH

The Timber was marked out to ensure there was a match book look along the grain around all sides of the box. I then cut to size with a tenon saw to prepare the timber for the Mitre joints



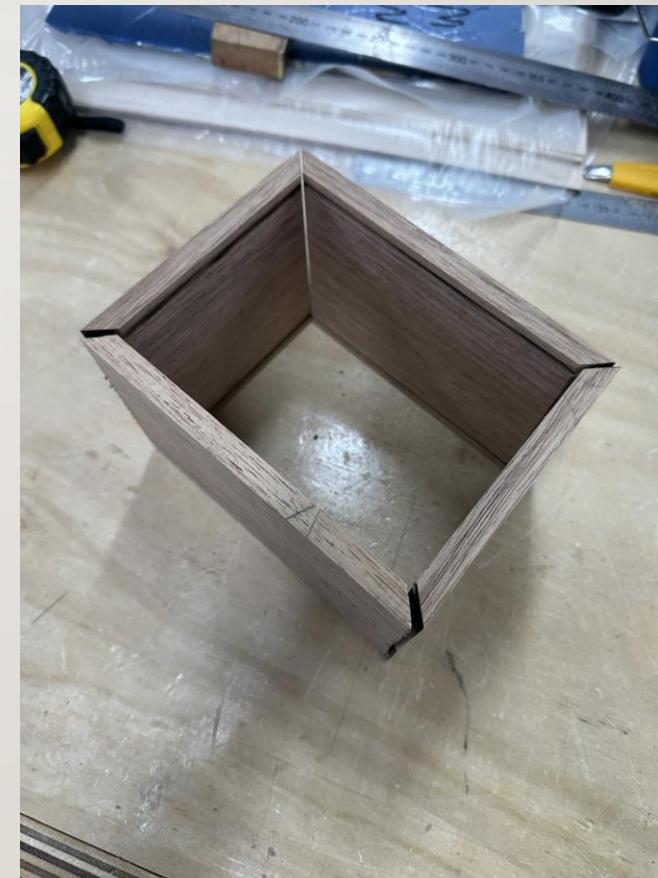
CUT HOUSING JOINTS

All four sides were passed through the table saw to cut the housing joints so the plywood bases could be inserted. The joints were cut on the top and bottom and the saw blade only cutting 5mm into the timber.



CUTTING MITRE JOINTS

Mitre Joints were cut on each ends of the pieces. The joints were cut on the table saw by turning the blade 45 degrees and holding the timber with a sled jig to safely and accurately cut the joinery. The mitre sled was an effective resource helped reduce stress as time constraints were tight.



ASSEMBLY AND GLUING BOX

The veneer bases were removed from the vacuum sealed bags and then were assembled into the top and bottom housing joints. They were glued into place which allowed the joins to connect tightly. The mitres were glued with butt joints occurring. Due to needing to quickly get the project compressed as quickly as possible, tape was used to tighten the joints. Using clamps was told to be quite difficult as the glue has a quick activation and needed to be compressed quickly. If veneer bases weren't glued at this stage, the time plan would have been significantly disrupted as you cannot continue the construction until the box has been glued.



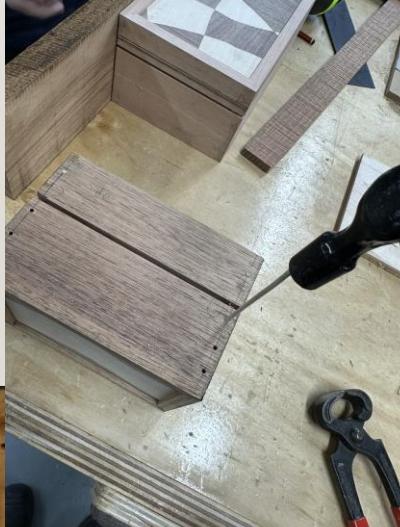
CUTTING LID TO BE READY FOR REMOVAL

The lid was cut on the panel saw with keeping less than a mm of timber. This would still keep the lid attached so it can be easily removed once the keys were inserted. This process caused a lippage of my timber to occur which is addressed in solutions to problems.



CONSTRUCTION OF KEYS

As outlined in the design modifications, the keys were substituted with bamboo skewers as a process to shorten the time of construction to meet the due date. Pilot holes were drilled with the drill press and then were easily tapped in with a Warrington hammer. To ensure the skewers would stay tight, a dap of superglue was added around the edges. I lightly removed any excess bamboo that was sticking out with a chisel, so the keys were sitting flush.



SEPARATION OF LID AND BODY

The body was separated with a Stanley knife were the cuts where completed earlier on the table saw. The next process was to flatten the joint where the lid would sit, but outlined in solutions to problems describes why I didn't need to chisel any lippage.



CONSTRUCTION OF LINING

I found some scrap timber that was used in previous projects and came across American Rock Maple. This Timber was already cut at 4mm which saved me time as I didn't need to dress anything. I ripped the timber to 55mm on the table saw so the lining would sit 5mm above the top of the body. I then cut to size with a tenon saw as using the drop saw was too dangerous as the pieces were too small. The mitre joints were applied to the disc sander. I had to ensure I didn't apply too much pressure as it would burn the timber and ruin its colour.



FULL ASSEMBLY

The linings were tightly inserted in the body. I applied a small amount of PVA to the joins of the mitres to help ensure the joins would remain and stay tight. The construction has completed on the heirloom box with finishing processes to begin.



FINISHING- SANDING, REMOVING GLUE AND APPLYING OSMO FINISH

Before applying a coat of finish, I must ensure that all scratches, marks, glue and pencil lines are removed as they would show up with being easier to see and ruin all of the work I have done. I started with sanding the entire project with starting with high grit sandpaper and working up towards a high grit paper. I then lightly used a chisel to remove any glue that has dried among the Coners. I then applied a coat of Osmo which is a polyurethane based oil. This was applied with a abrasive sponge and I wiped away any excess with an old rag.



SOLUTIONS TO PROBLEMS IN PROJECT

When cutting the box to allow it to be separated, there was a significant lip in the timber which was too drastic to be removed with a chisel or jack plane. Ruth removed this on the panel saw which also made the join between the box and lid perfect which hid the join lines. This improved the aesthetics of the box as hiding the join lines represents quality work. I was happy to see the problem was resolved and allowed me to have a good join between the base and the lid.



FINAL PRODUCT



EVALUATION

I was quite happy with this project of the heirloom box as it effectively met all my statement of intents as I made a box that would fit the priceless possession of my great, great grandfathers WWI medals. I saw an improvement of my time management skills compared to other projects. This could be due to being more prepared and working hard during workshop times to ensure I wasn't stressing during submission time. I was glad to see the box having a tight fit as it was very hard to see the join line between the lid and the body. The Osmo finish also applied really well and gave the box a premium appeal which enhanced the colour contrast to further darken the Blackwood.

Unfortunately, I was disappointed that one corners of the box has a gap where the Mitre joints meet. This could have been due to the gluing processes where the joint could have moved. Using glamps during the gluing process could be an option if I was to compete this project again. I also wasn't very impressed with the design of my marquetry as it looks a little messy. This was due to changing the amounts of veneers colors and cuts during the cutting process. However, I liked the color contrast that it brought to the box.

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