

# Progress Update

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AST CONFERENCE SEPTEMBER 2021

# Introduction

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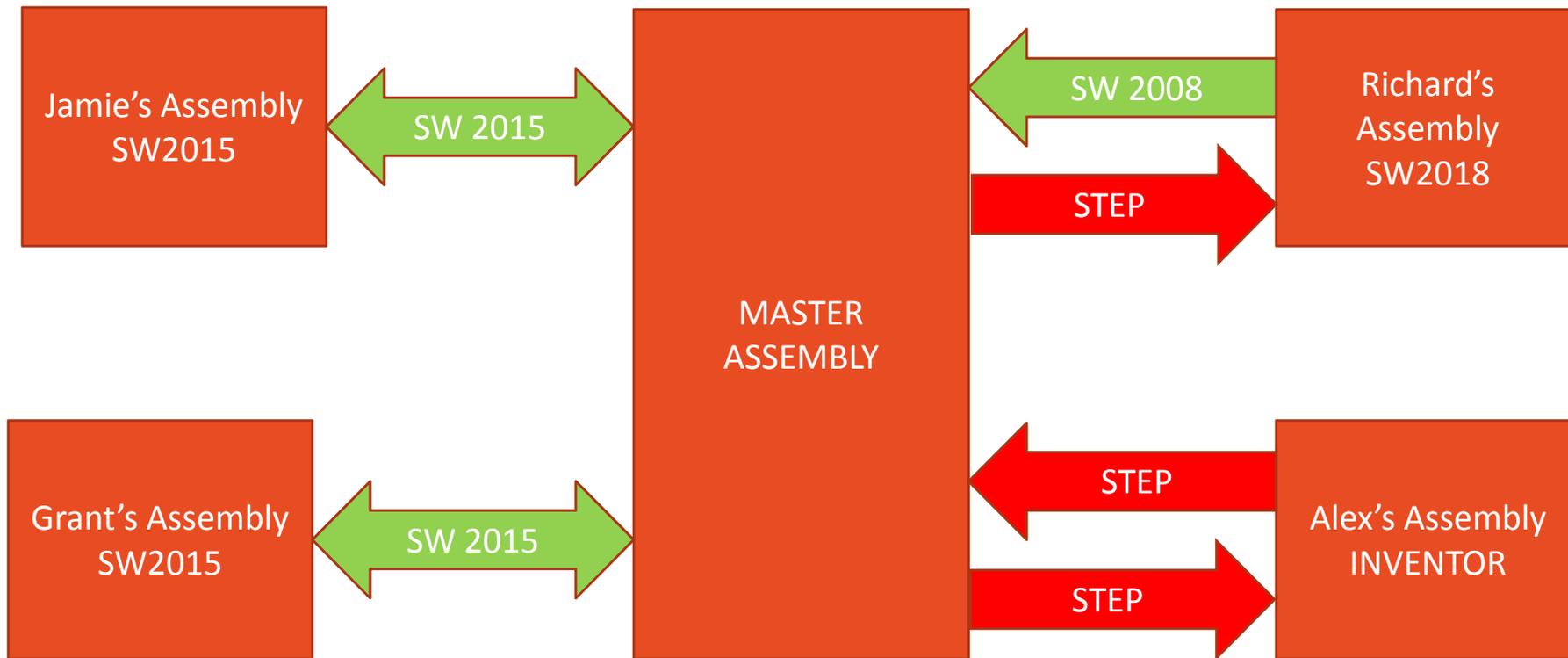
- Organisation
- Purchasing
- Design
- Manufacture
- Work in Progress
- Next Steps

# Organisation

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- Periodic Zoom meetings
- Design Team
  - Grant & Jamie: SolidWorks 2015
  - Richard: SolidWorks 2008
  - Alex: AutoCAD Inventor
- Issues with Neutral Format – step files
- Discipline with File Transfers

# Design Organisation



# Design Organisation

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- Use “Pack and Go”
- All file names “Date stamped”
  - Prevents overwriting of files of same name
- Transfer P&G assembly to STEP format
- Each modeller retains “ownership” of their assemblies

# Purchasing

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Master Spreadsheet

Purchase orders

Known and Trusted Suppliers

Multiple quotes of expensive items

John pays the bills

Chris keeps us in line!

# Design Progress

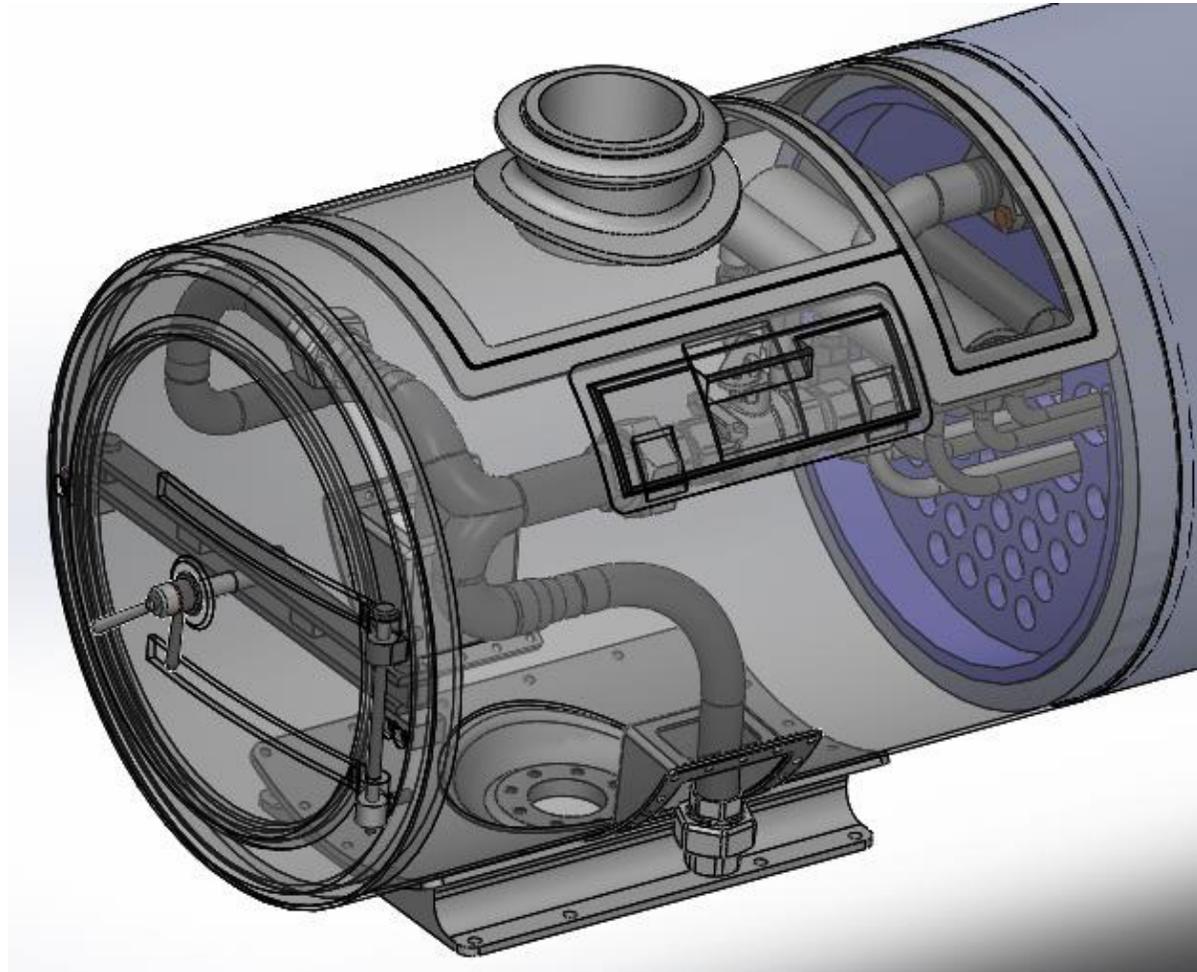
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- Smokebox Layout
  - Superheater Headers
  - Regulator
  - Steam Pipes
- Blast Pipe
- Saddle
- Removeable Top

# Design Progress-

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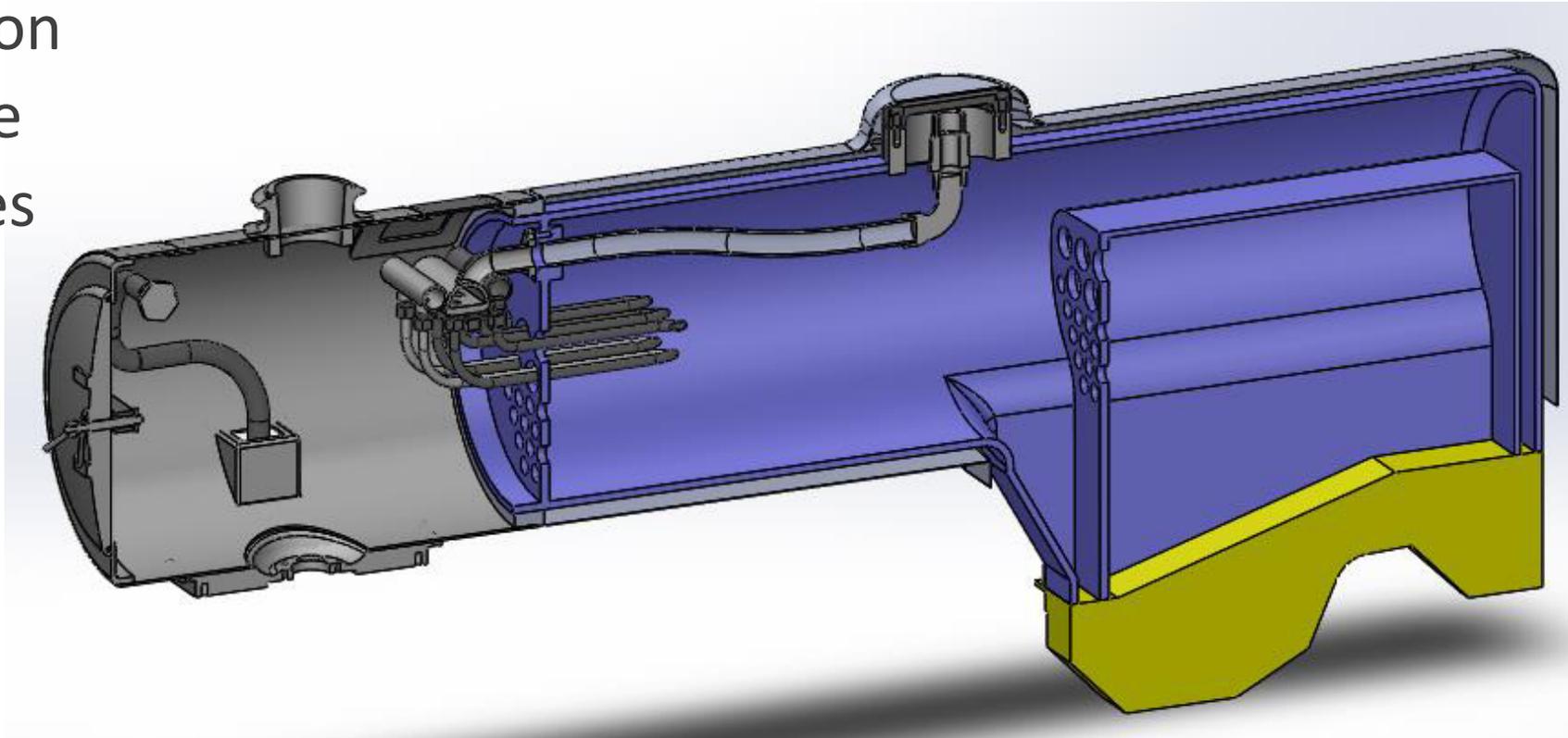
## Smokebox Layout



# Design Progress

## Boiler

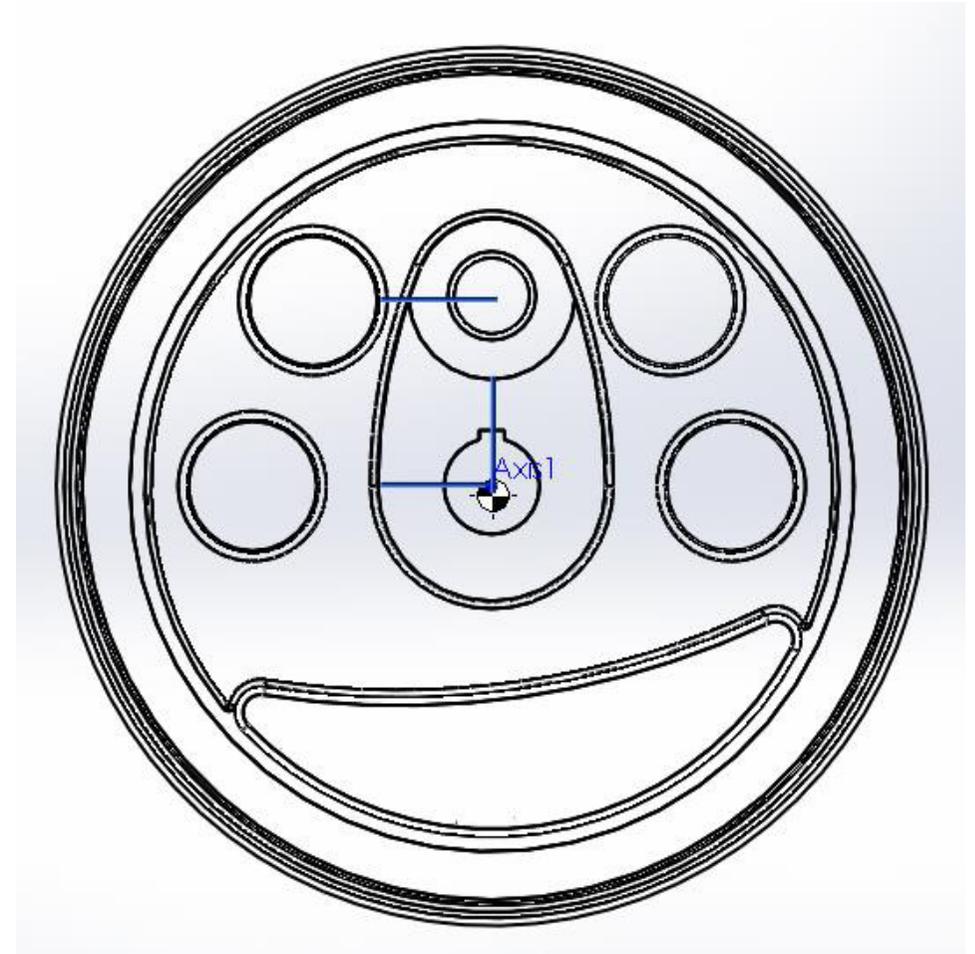
- Dome Position
- Shutoff Valve
- Firebox Slides
- Cladding



# Design Progress

## Wheel Balancing

- Solid “Scullin” style wheels
- Cast with dummy balance weights
- Ballanced by machining pockets in rear face
- Approx 15kg each



# Design Progress

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## Reciprocating Balance

- Low reciprocating mass
- High loco mass (ballasted)
- Rigid tender drawbar
- Low rotational speed

## Conclusion:

Reciprocating balance not required in 10.25" gauge

But if we had it.....

- As per BR 9F

# Design Progress

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## Rotating Balance

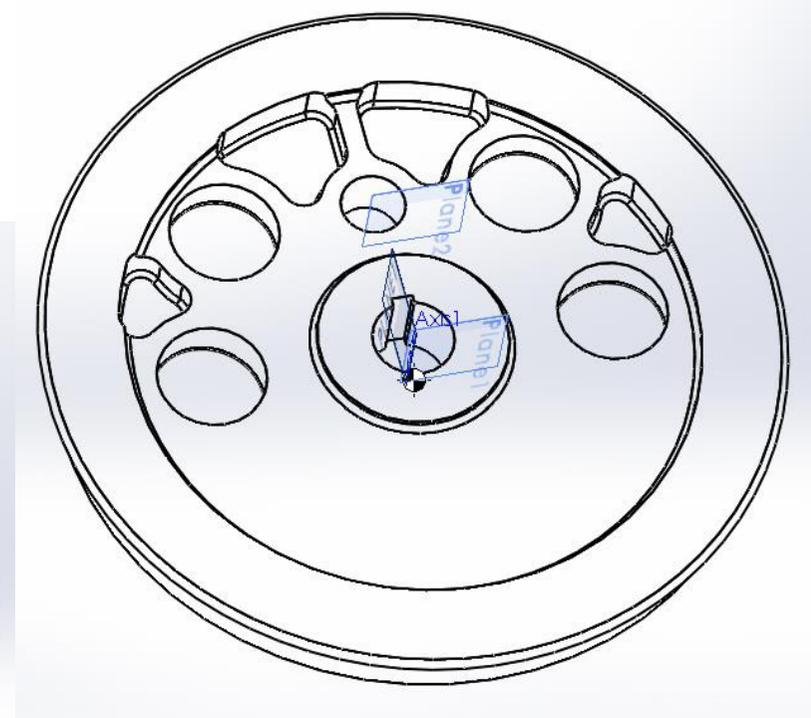
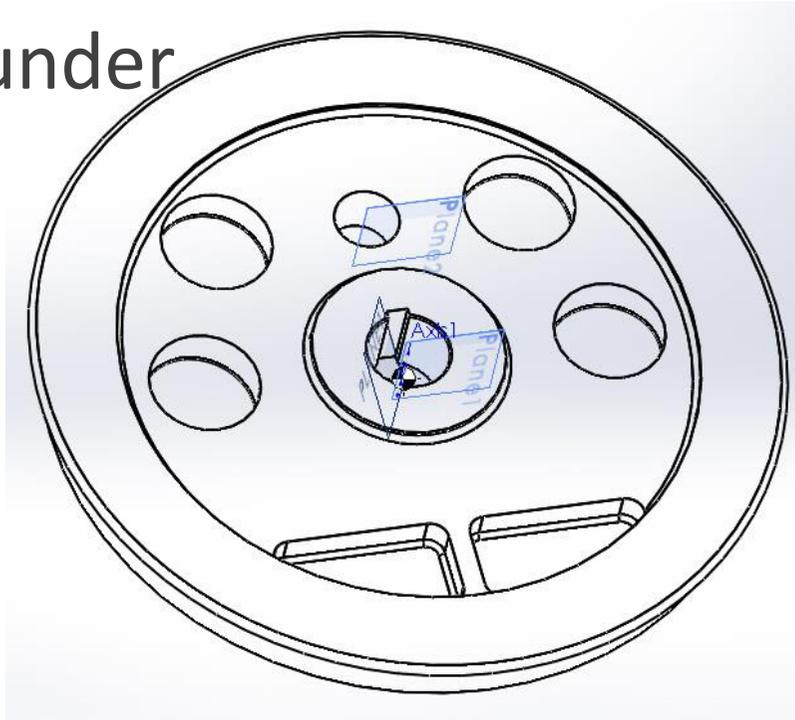
- Accurate weight analysis:
  - Excel spreadsheet / CAD data
- A lot of metal on the “wrong” side
- Relatively large rod bearings
- Difficult to achieve balance on centre axle
- Aluminium Alloy rods.
  - Slightly thicker web
  - Increased interference
  - More material round the rod ends

# Design Progress

Rotational Balance														
Leading Rod L		450 mm											Moments	
Trailing Rod L		475 mm												
Con Rod L		480 mm		Axle 1			Axle 2			Axle 3				
Item	Mass	Long CofG		Mass Carried	Radial CofG	Moment	Mass Carried	Radial CofG	Moment	Mass Carried	Radial CofG	Moment		
	kg	mm		kg	mm	kg.mm	kg	mm	kg.mm	kg	mm	kg.mm		
Total				15.530		-0.981	17.469		1.048	15.548		0.387		
Rods														
Con Rod	0.445	191.5	From BE	0	0	0	0.267463542	75	20.05976563	0	0	0		
Leading Rod	0.478	215.8	From No2	0.229227556	75	17.19206667	0.248772444	75	18.65793333	0	0	0		
Trailing Rod	0.372	240.5	From Knuckle	0	0	0	0	0	0	0.188349474	75	14.12621053		
On Knuckle														
Trailing Rod Part	0.18365	525	From No1	-0.030608421	75	-2.29563158	0.214258947	75	16.06942105	0	0	0		
Traction Bolt	0.086	525	From No1	-0.014333333	75	-1.075	0.100333333	75	7.525	0	0	0		
Traction Nut	0.02	525	From No1	-0.003333333	75	-0.25	0.023333333	75	1.75	0	0	0		
Knuckle Brg	0.065	525	From No1	-0.010833333	75	-0.8125	0.075833333	75	5.6875	0	0	0		
Lead / Trail Crankpin														
Lead/trail Crank Pin	0.325	0		0.325	75	24.375		0	0	0.325	75	24.375		
Bearing Cap	0.014	0		0.014	75	1.05		0	0	0.014	75	1.05		
Brg Retain Screws	0.051	0		0.051	75	3.825		0	0	0.051	75	3.825		
2205 Bearing	0.16	0		0.16	75	12		0	0	0.16	75	12		
Crank Pin	0.559	0		0	0	0	0.559	75	41.925	0	0	0		
Bearing Spacer	0.015	0		0	0	0	0.015	75	1.125	0	0	0		
Bearing sleeve	0.058	0		0	0	0	0.058	75	4.35	0	0	0		
2206	0.26	0		0	0	0	0.26	75	19.5	0	0	0		
2206	0.26	0		0	0	0	0.26	75	19.5	0	0	0		
Retaining Nut	0.026	0		0	0	0	0.026	75	1.95	0	0	0		
Extraction Nut	0.033	0		0	0	0	0.033	75	2.475	0	0	0		
Return Crank	0.332	0		0	0	0	0.332	75	24.9	0	0	0		
Radius Rod	0	0		0	0	0	0	75	0	0	0	0		
Return Crank Bolt	0.02	0		0	0	0	0.02	75	1.5	0	0	0		
Total Imbalance				0.720		54.009	2.493		186.975	0.738		55.376		
%						-101.815616			-99.43972074			-99.3017209		
Wheel Axle 1	14.81	0		14.81	-3.713	-54.98953	0	0	0	0	0	0		
Wheel Axle 2	14.976	1		0	0	0	14.976	-12.415	-185.92704	0	0	0		
Wheel Axle 3	14.81	0		0	0	0	0	0	0	14.81	-3.713	-54.98953		

# Design Progress

- Leading 1.8% over
- Centre 0.5% under
- Trailing 0.7% under



# Design Progress

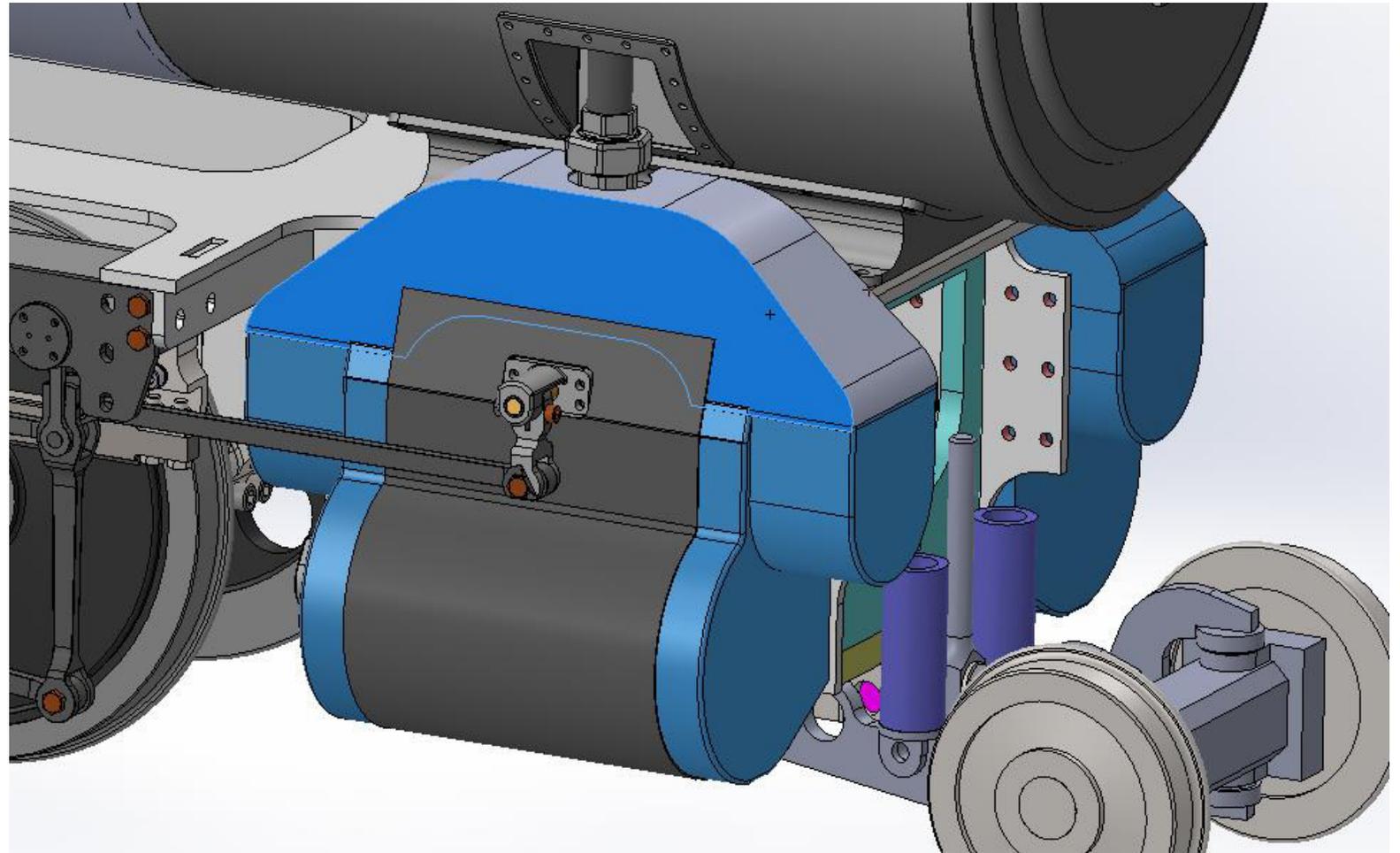
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## Cylinders

- Originally designed as fabrication
  - Grant uses 3D Printing
  - Access to 3D printer
- Investment cast parts
- Redesign as casting

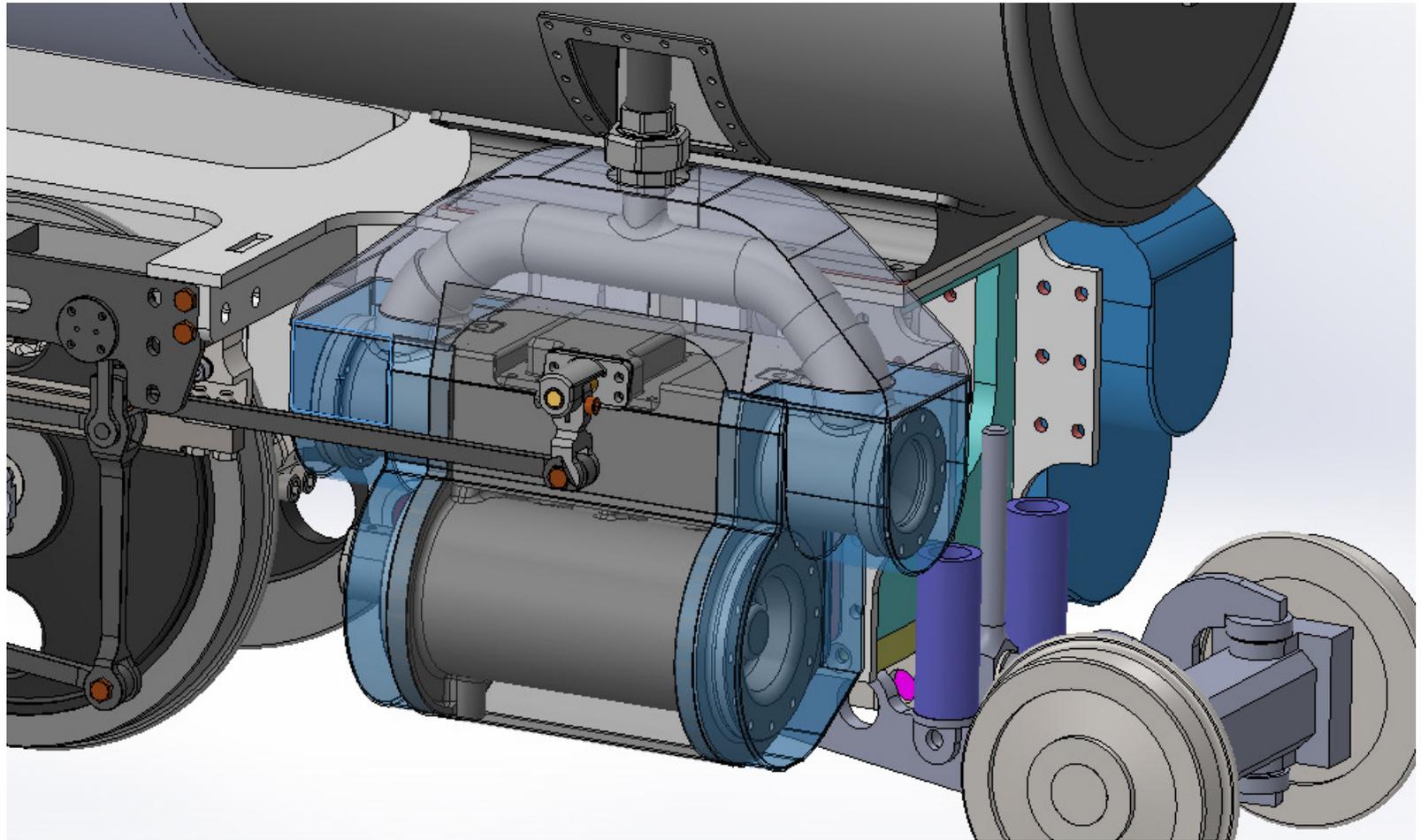
# Design Progress

## Cylinders with cladding



# Design Progress

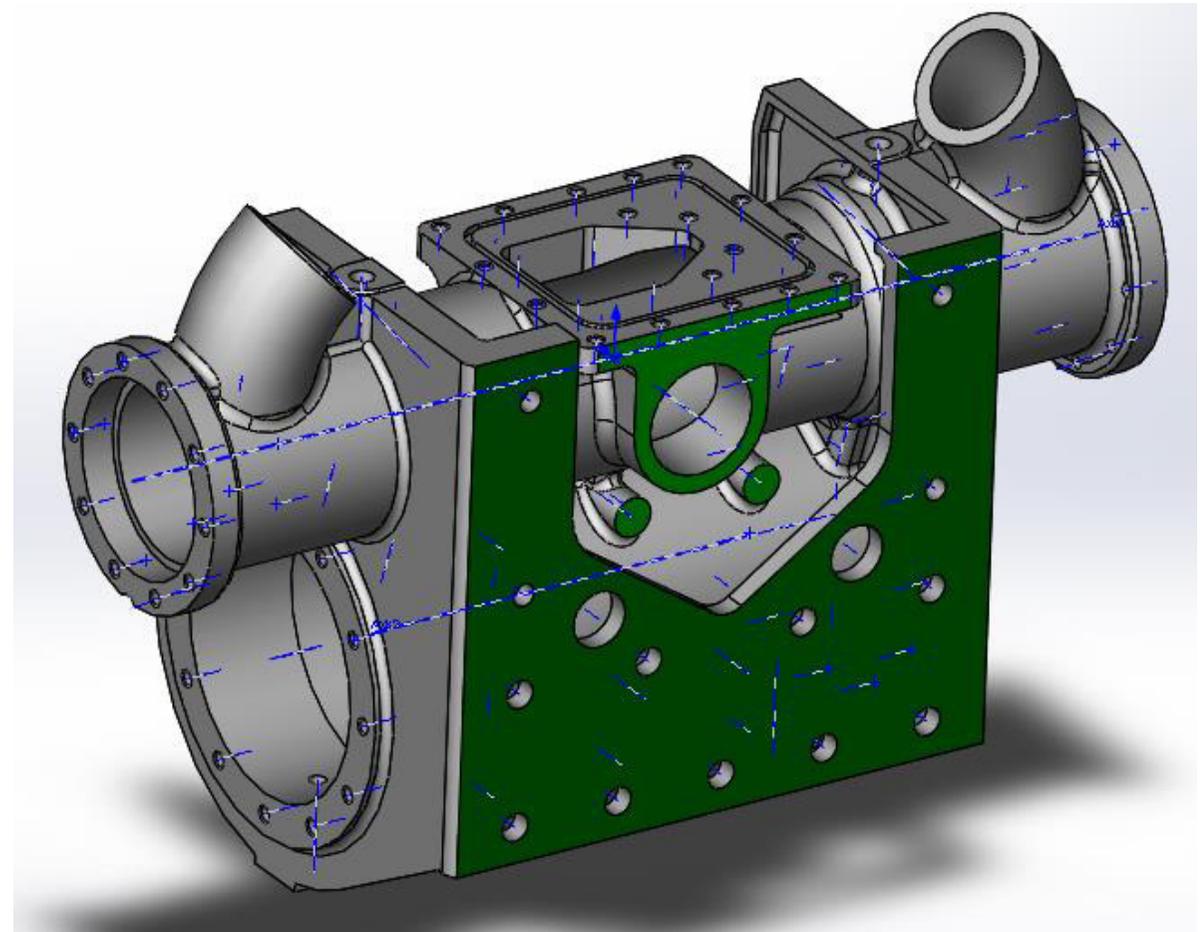
Cylinders –  
No cladding



# Design Progress

## Cylinder casting

- Integral bosses
- Minimal thermal paths
- Flanges for cladding
- Cast in steel

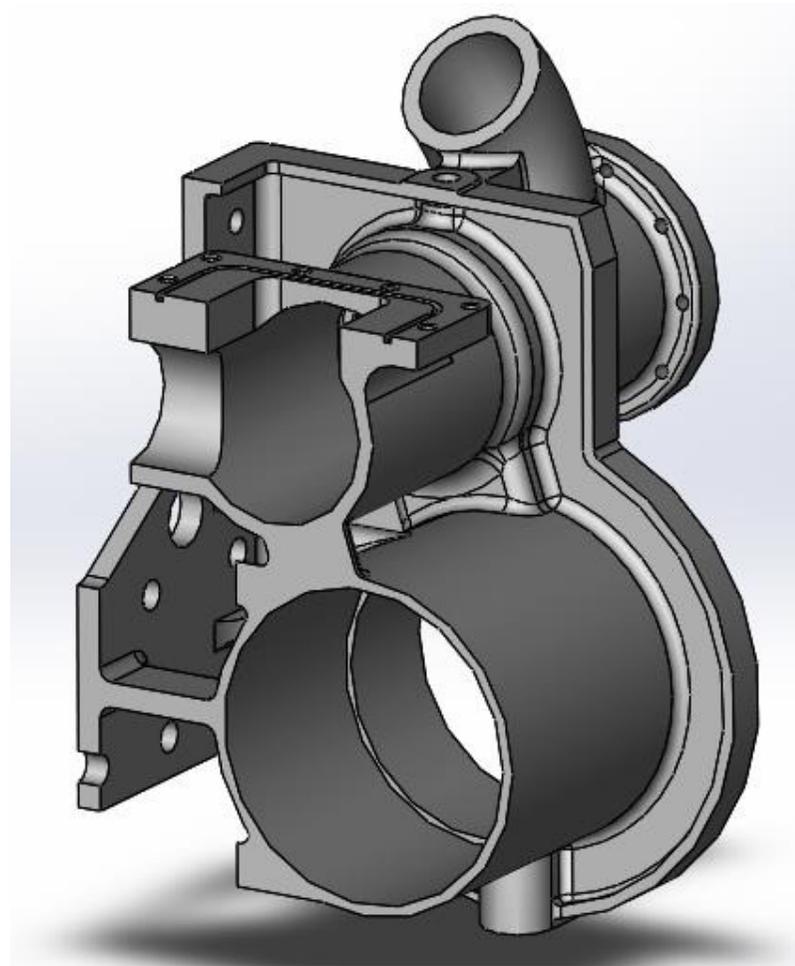


# Design Progress

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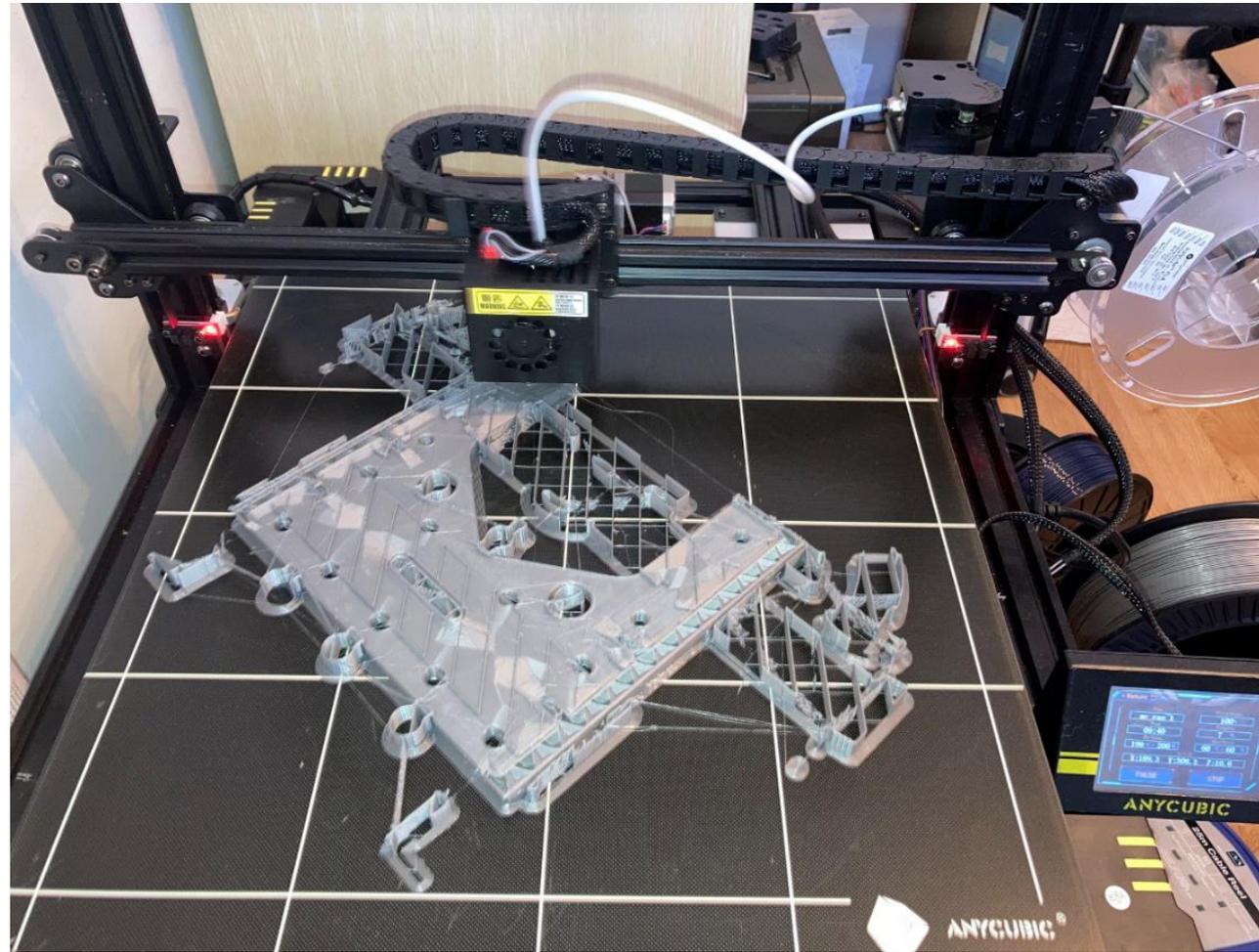
Cylinder:

Section through bore

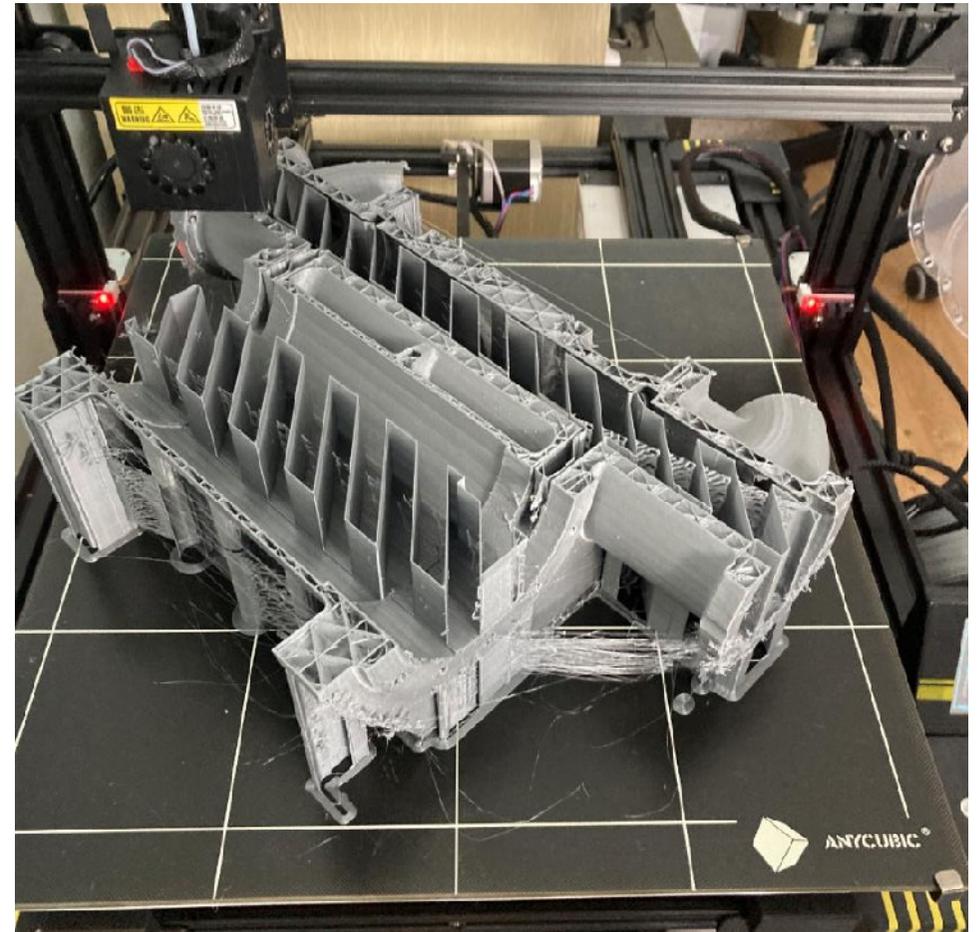
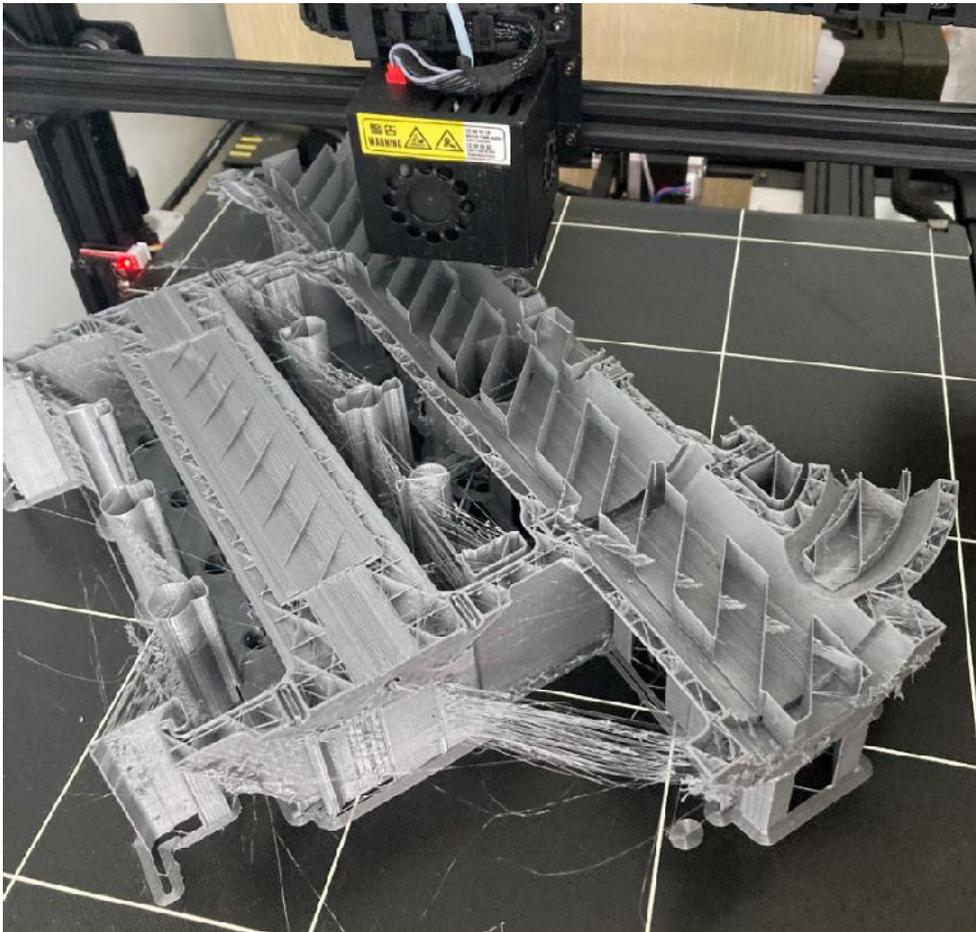


# Design Progress

## 3D Printing 1



# Design Progress



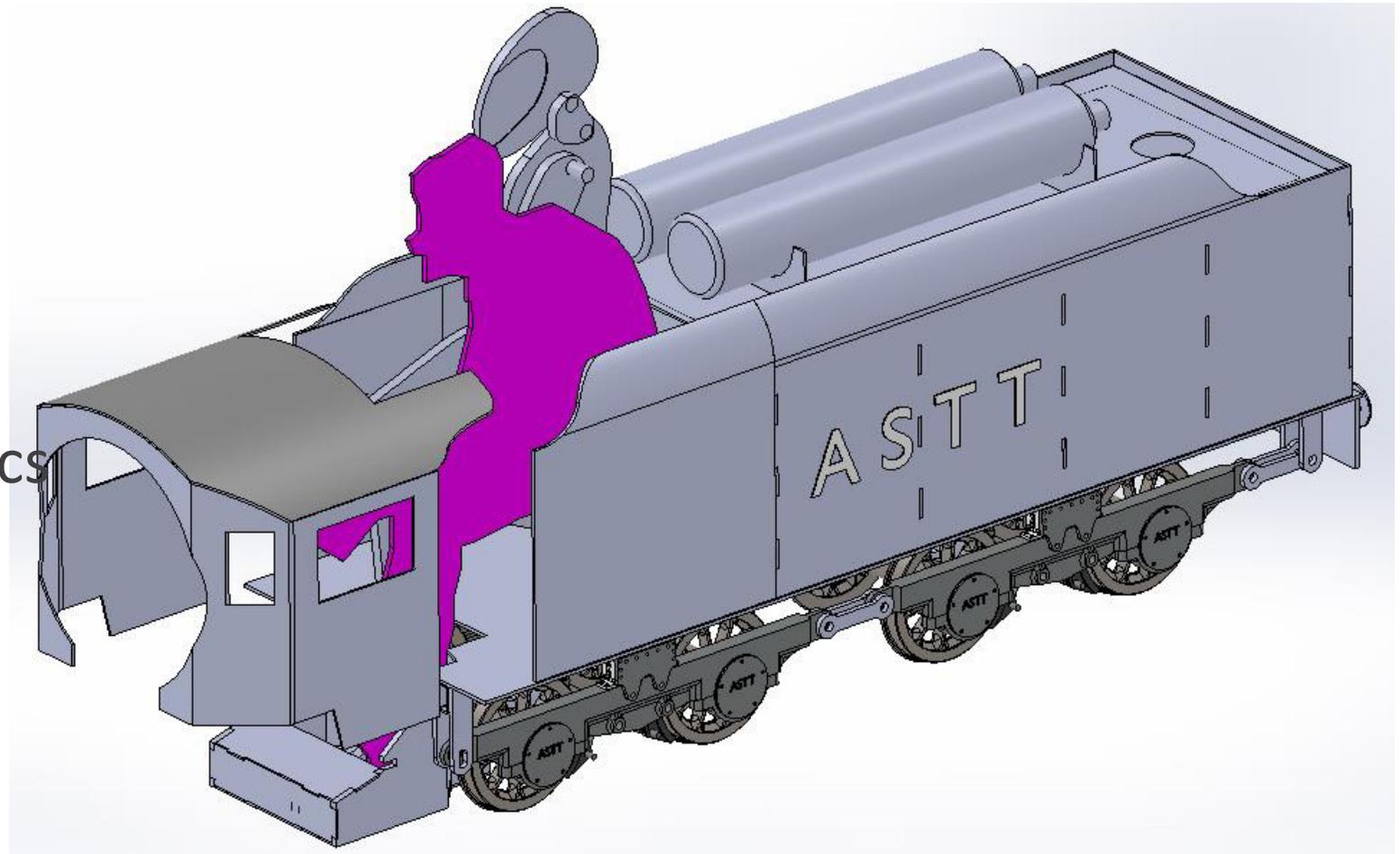
# Design Progress



# Design Progress

## Tender & Cab

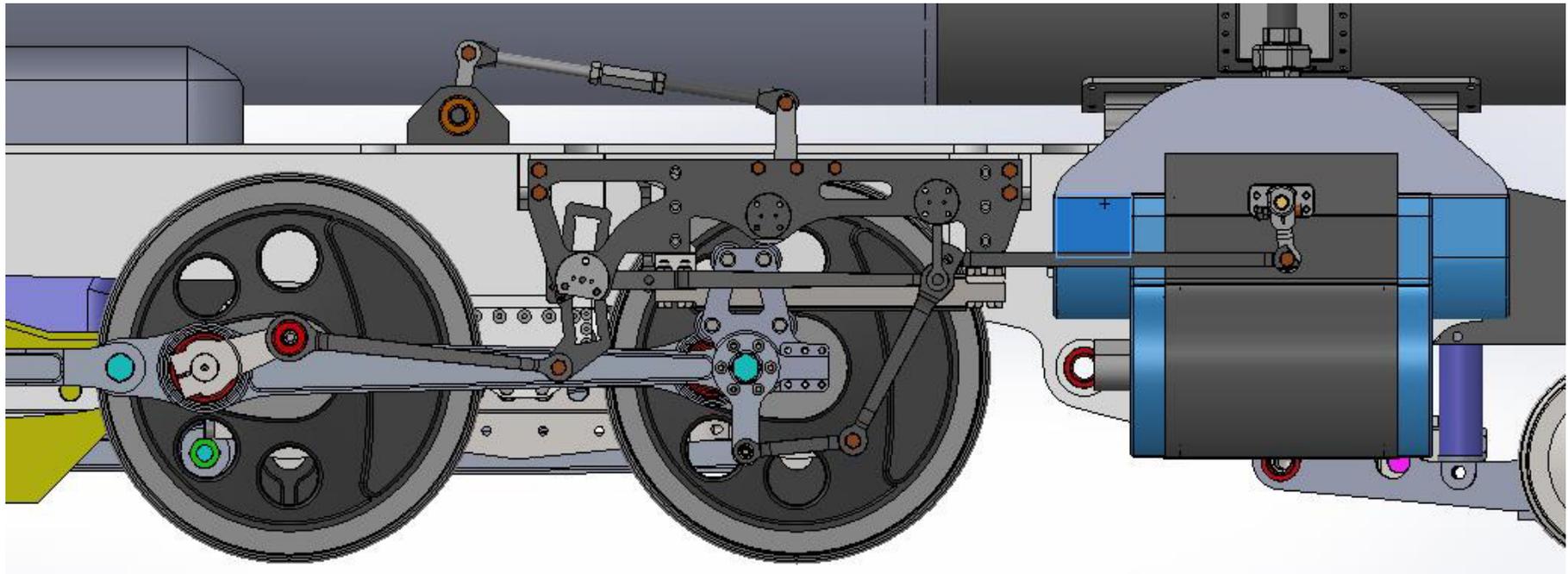
- Drawgear mods
- Air Tanks
- Alternative fuels
  - Liquid/ Gas
- Driver ergonomics
- Cab layout
- Controls



# Design Progress

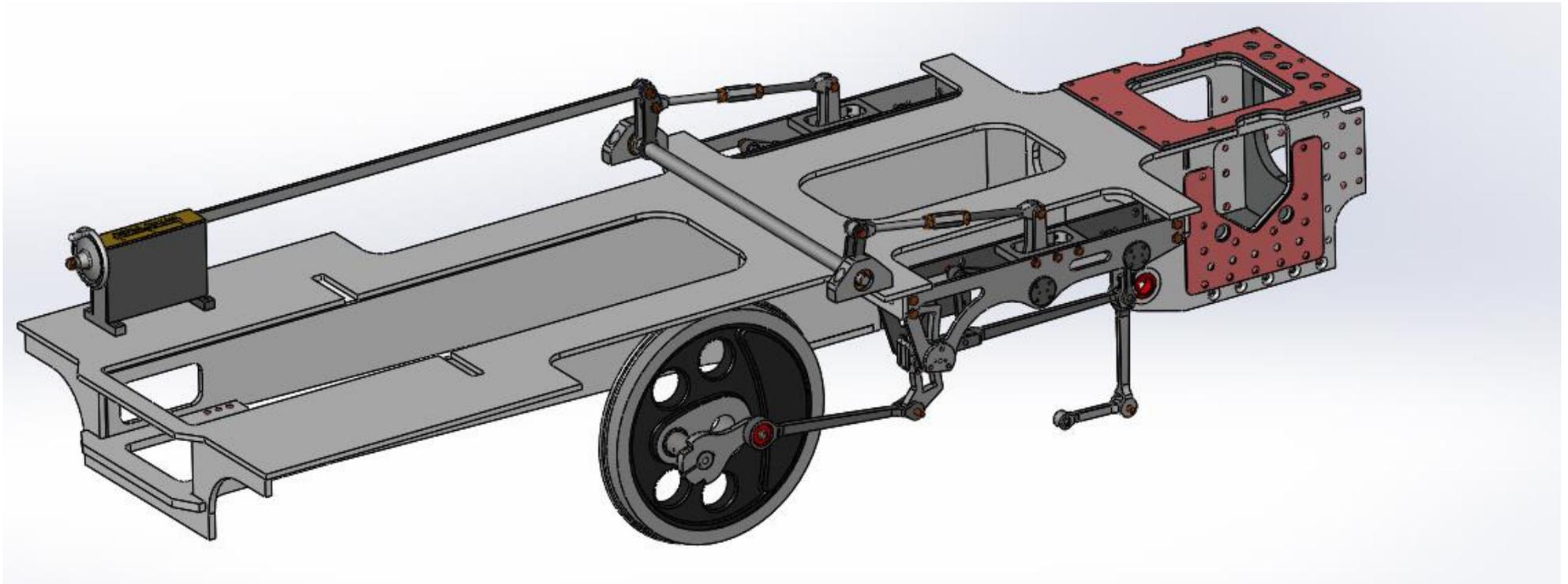
## Valve Gear

- Final tweaks
- Weigh shaft added



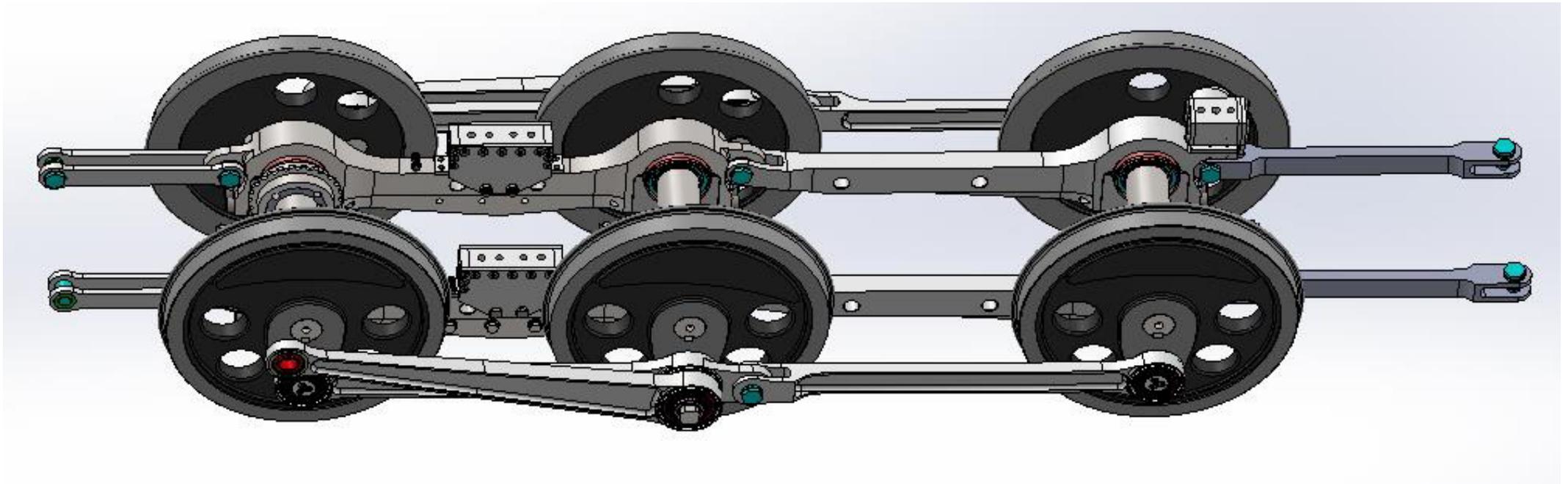
# Design Progress

## Screw reverser and reach rod



# Manufacture

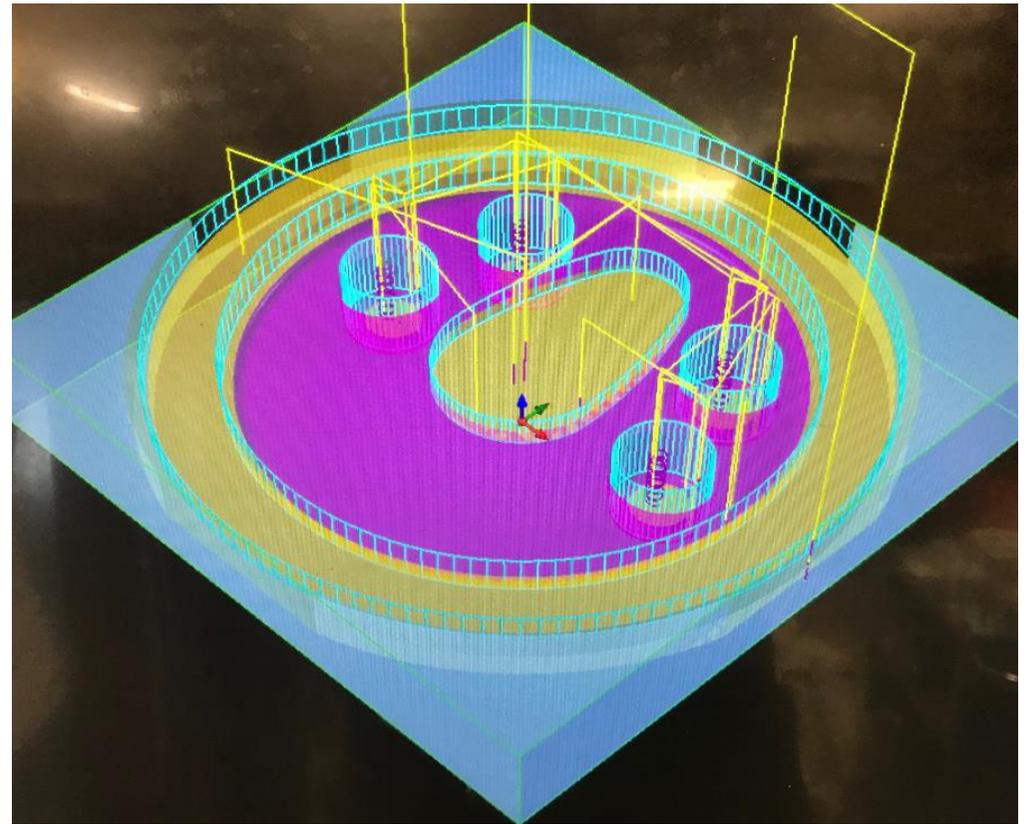
## Running Gear



# Manufacture

## Driving Wheel Pattern

- CNC Machined, Acetal Copolymer



# Manufacture

## Wheels Cast in SG Iron

- Canlin Castings of Langley Mill



# Manufacture

## Wheel Machining

- CNC Mill
- Rough profile tyre
- Finish bores



# Manufacture



# Manufacture

- Spring Beams
- Water Jet cut profiles
- CNC machined
  - 2x Main Beams
  - 2x Trailing Beams
  - 6x Axle Keeps
- 40mm thick
- BSEN 10025:S355



# Manufacture

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## Water Jet cut profiles – Learning curve:

- Good:
  - No thermal effects
  - Good surface finish
- Not so good:
  - Poor sharp internal corners
  - Slight flare to the cut
    - Direction of flare depends on direction of curvature!

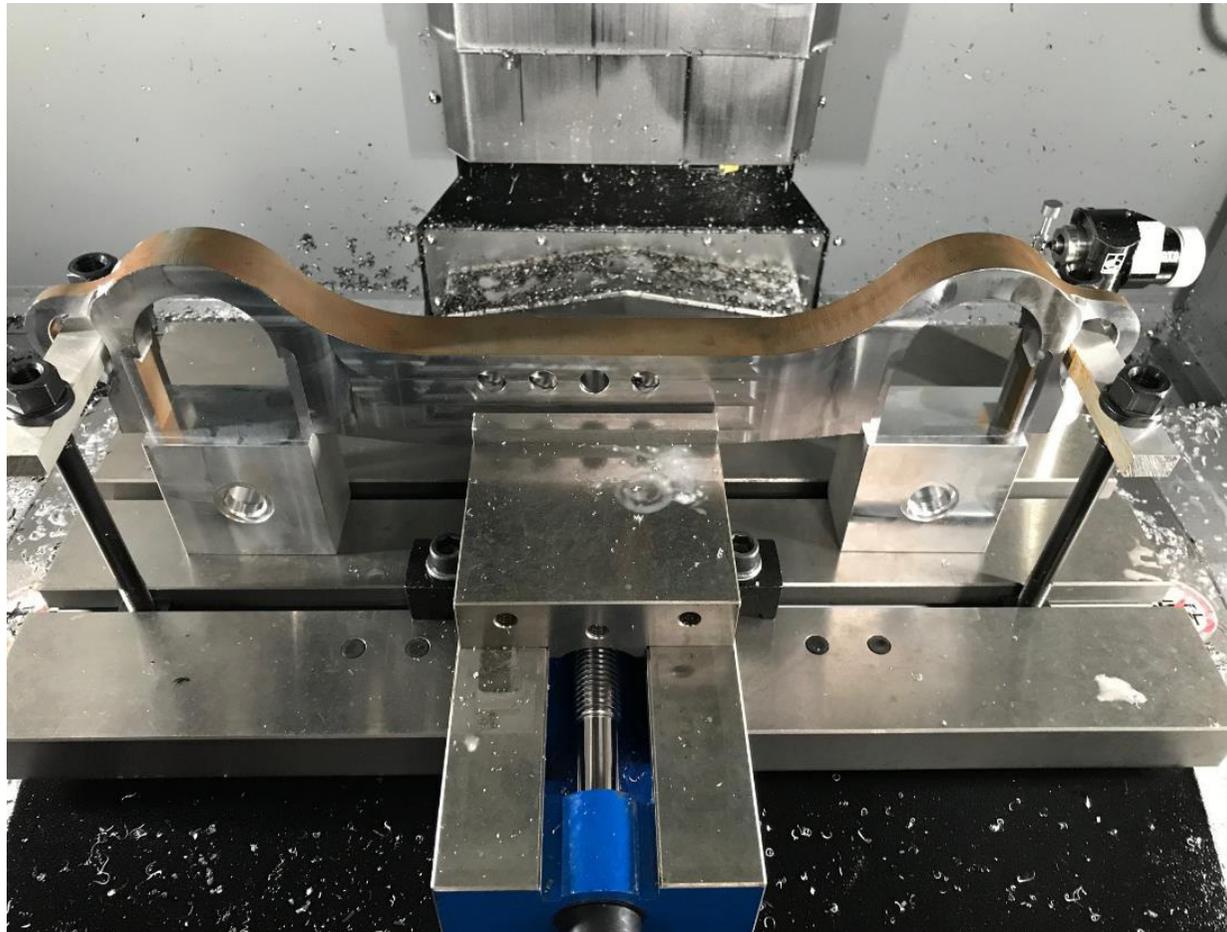
# Manufacture

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# Manufacture

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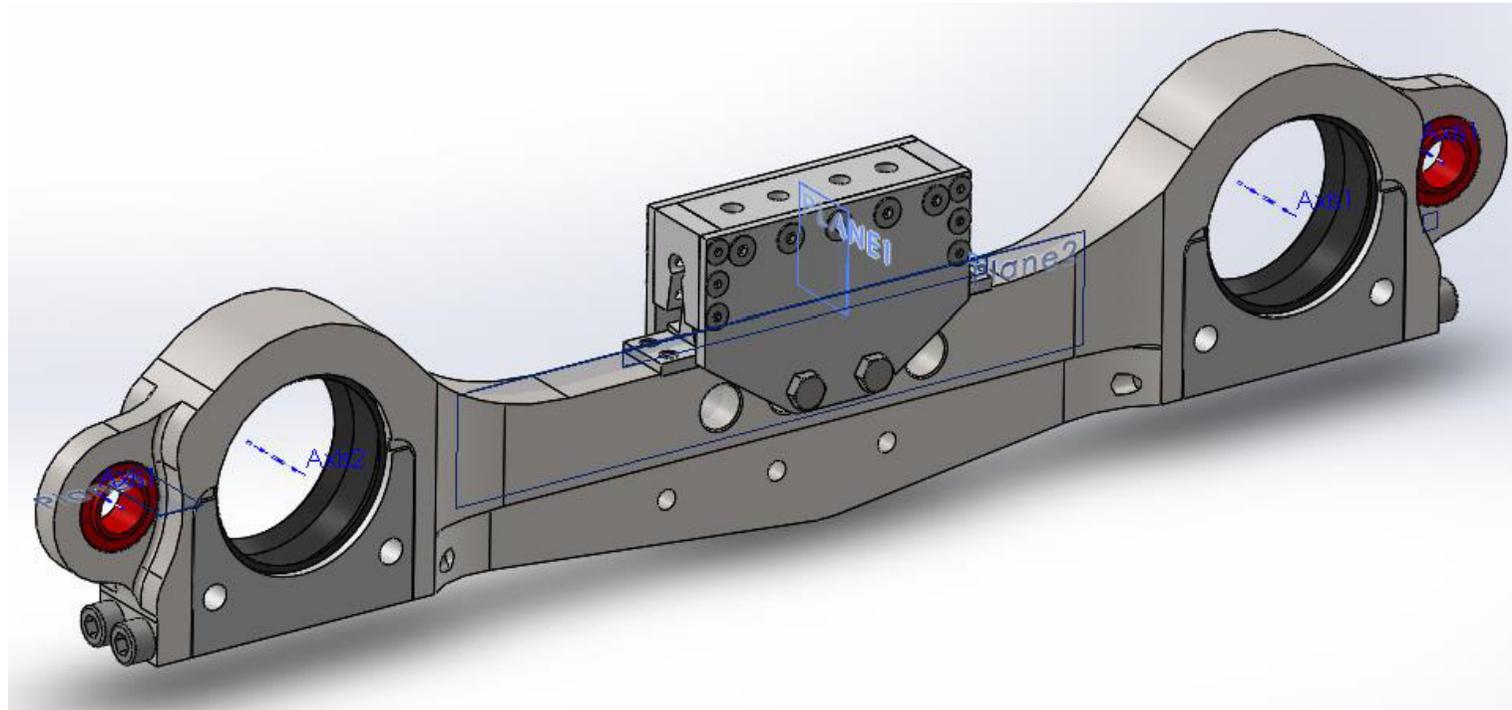
# Manufacture



# Manufacture

## Main Spring Units

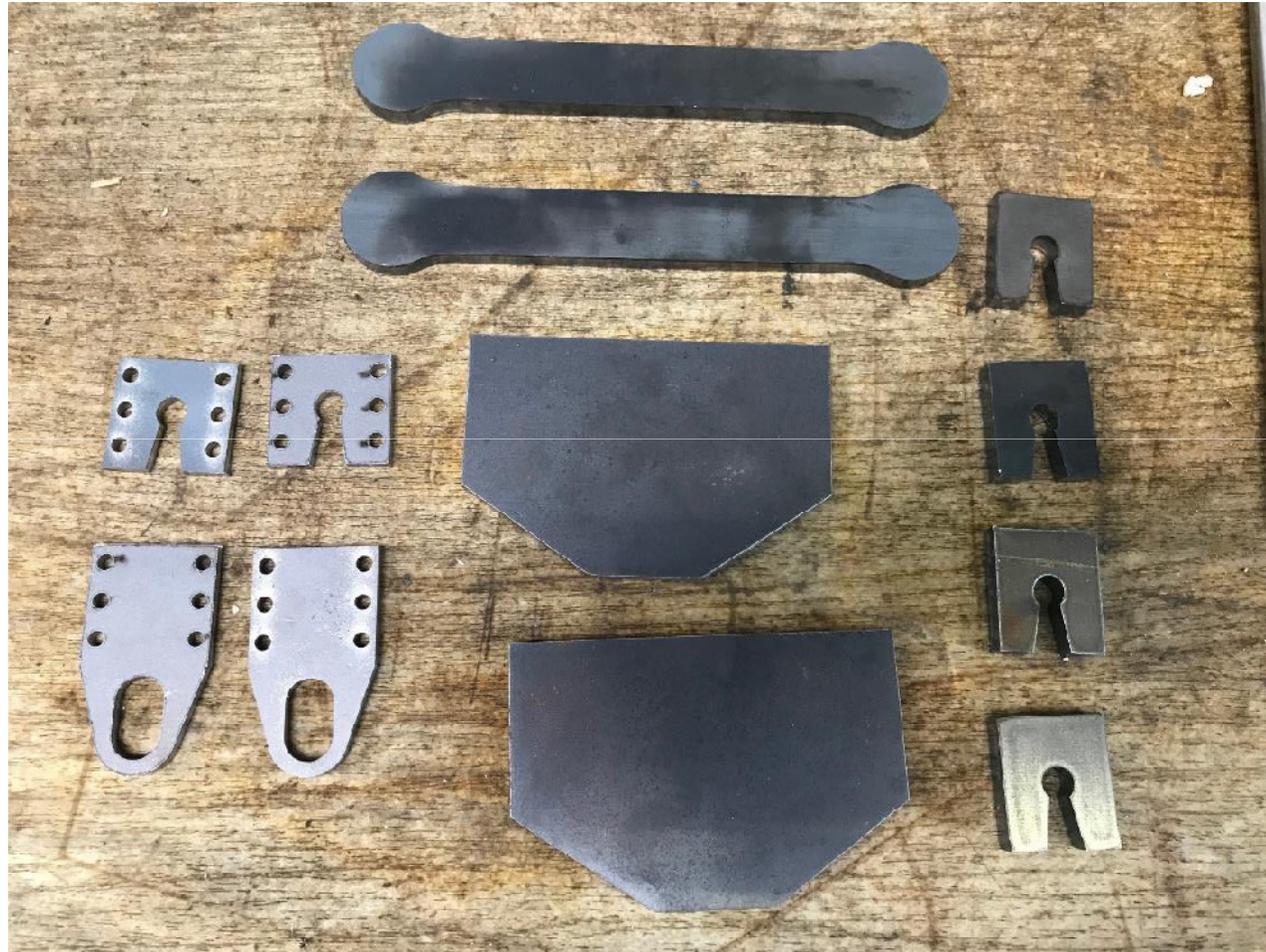
- Trial components made from Al.
- Production from Steel
- Profiles cut for ends/sides
- Bar for top/bottom
- 2x Loco, 4x Tender



# Manufacture

## Profiles

- Traction links
- Trailing Spring end plates
- Main spring side plates
- End caps



# Manufacture

## End Caps

- 3 Ops
- Total 3.5 minutes machine time



# Manufacture

## Traction Links

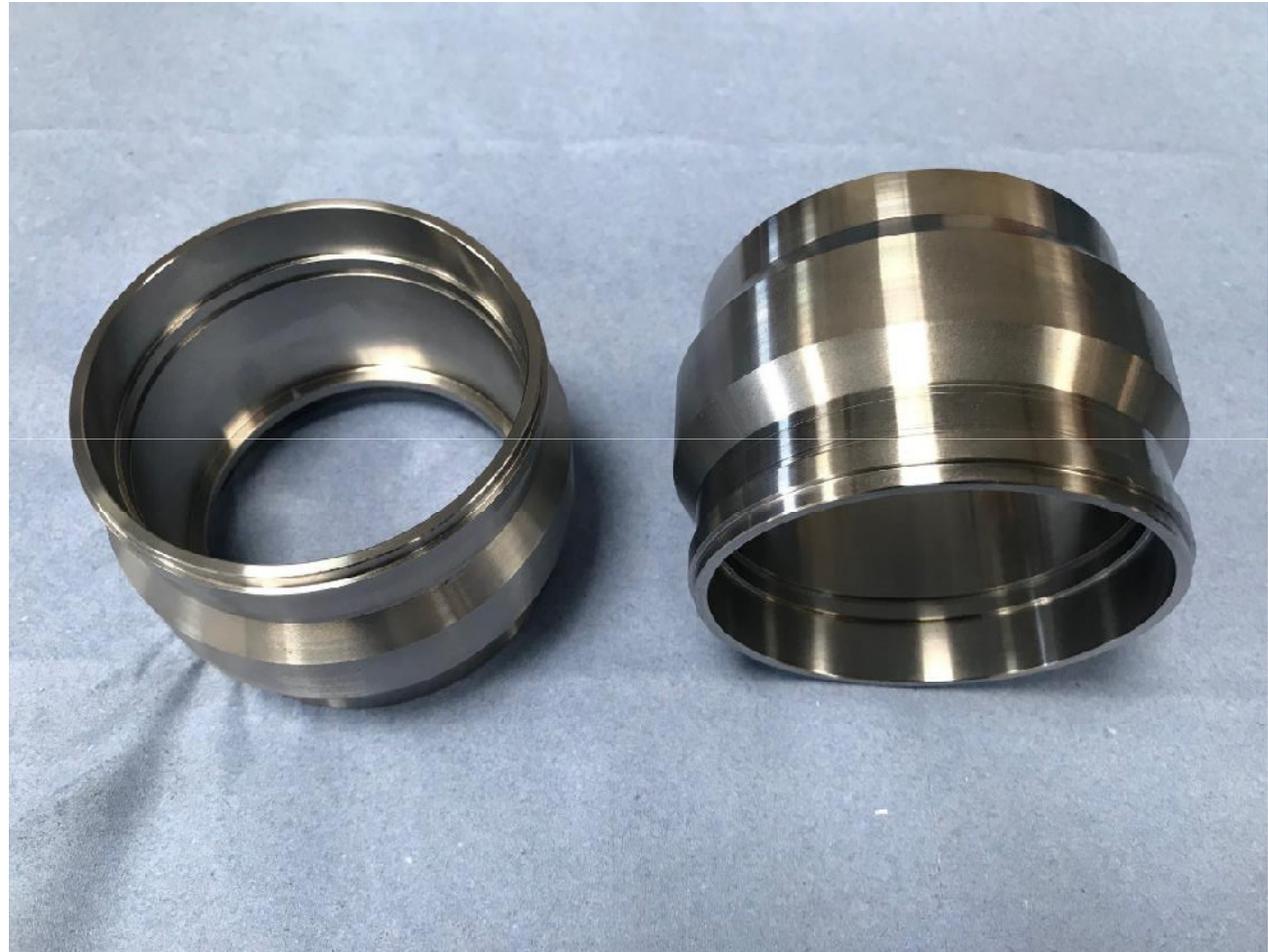
- 6 minutes machine time



# Manufacture

## Main axle bearing housings

- Turned by Vision Precision of Colwick



# Manufacture

## Odds and Sods

- Axle bearings
- Axle seals
- Retaining Clips



# Work in Progress

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## Bits to Machine

- Trailing spring beams (profiles in hand)
- Spring components (material in hand)
- Disc brake hubs
- Coupling & connecting rods (material ordered)

# Work in Progress

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- Parts to Order
  - Traction link bolts
  - Rod support washers
  - Brake components
  - Axle material
  - Bearing Spacers
  - Rod and spherical bearings
- Cylinder Patterns

# Next Steps.....

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- Focus on rolling chassis
- Bob Moore (Stapleford) axles, crankpins and wheelset assembly
- Finalise main frame drgs and order steel profiles
- Finalise pony truck drgs and order parts
- Storage and Transport
- Public Launch
  - Artist Impressions (Robin Barnes)
  - Fund Raising

Please help if you can.



THANK YOU!

