ENGINEERS
AUSTRALIA

PRESENTATION 3
4TH MAY 2015
NEWCASTLE DIVISION OFFICE

Teacher Development Program
Bringing schools and Engineering together

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- **Welcome & Introduction**
- **A look at the Engineering Studies Resource Centre - Drop Box**
- **Engineered Products – Preliminary Module 2**
- Engineering Mechanics
- Engineering Materials
- Communications
- **Exam questions Q and A**
- **Message from Engineers Australia's Division President**
- **Refreshments**
- **Q + A and Networking**
- **Close**

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- Introduction:

Paul Reynolds – BEng (Mechanical), Chair of Education Subcommittee for EA

- EA to be your link with the Engineering Profession / Industry
- These forums to provide important networking opportunities with other teaching professionals
- We want to assist in providing exciting ways of presenting concepts with real world examples and applications.
- We encourage a link of support with exam assessors
- We would like to make clear the pathways to engineering that exist for all students- Professional, Trades, VET
- **WE AIM TO BE A FACILITATOR IN SUPPORTING YOU.**

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Engineering Studies 2015 Teacher Development Program					
Term	**Week**	**Date (week beginning)**	**Year 11 Preliminary Modules**	**Year 12 HSC Modules**	**Venue**
1	3	Feb-09	Engineering fundamentals		Merewether High school
	7	Mar-09		Civil structures	HVGS
2	3	May-04	Engineering products		Division Office
	7	Jun-01		Personal and public transport	Division Office
3	3	Jul-27	Braking systems		TBA
		August	Engineering week	Networking Function witn UON and TAFE	TBA
3	7	Sep-04		Aeronautical engineering	TBA
4	3	Oct-19	Biomedical engineering		TBA
	7	Nov-16		Telecommunications engineering	TBA

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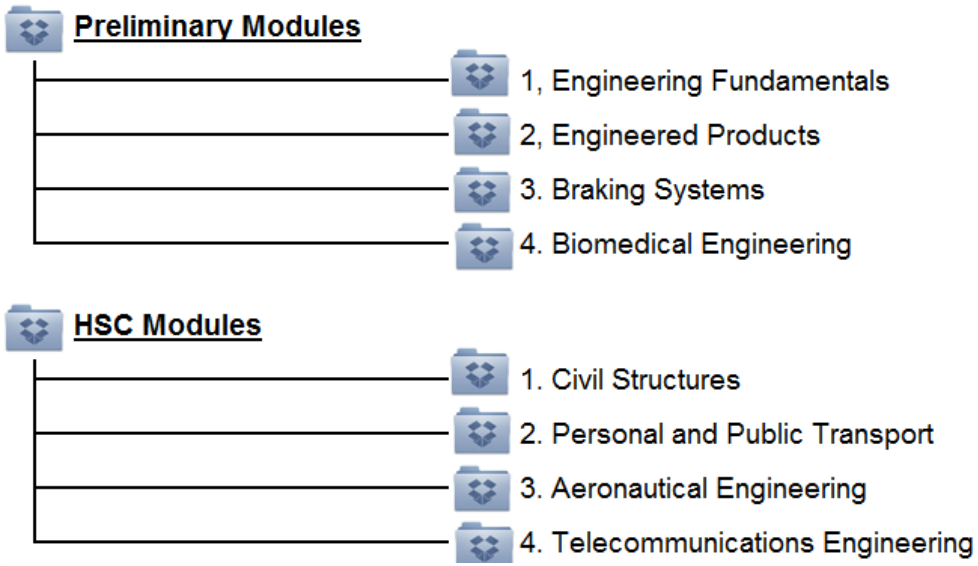
- Drop box

- Creation of the **“ENGINEERING STUDIES RESOURCE CENTRE”** on Dropbox.
- Teachers and Engineers Australia to share and communicate useful resources.



CASE STUDY – Design and Material Process

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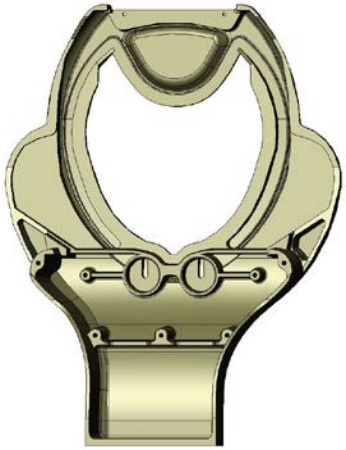
Design and Supply of a Walkover Aisle Side Seat Casting

Customer Requirements

- Minimise Weight
- Optimise Strength
- Minimise Cost
- Time Line Requirements
- Physical Envelope
- Load ratings
- Asthetics



DESIGN

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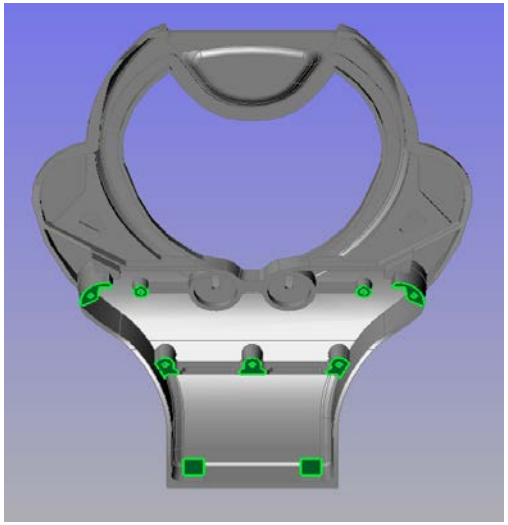
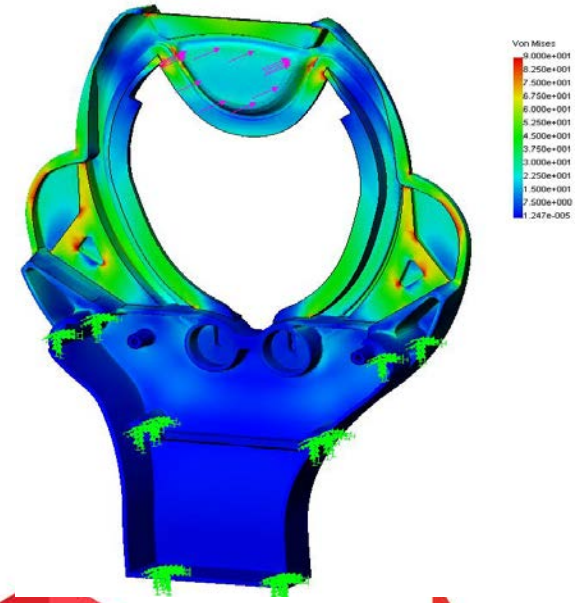


- End casting modeled on SolidWorks and fed into COSMOS for FEA.
- Interface constraints initially determined and applied to the load case

(All interfaces were initially fixed in all directions)



- Load case applied, and model updated
- Rapid prototype manufactured
- Sand casting completed from rapid prototype

VALIDATION of DESIGN

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- Samples from the sand casting method produced and tested.
- Testing was performed by fixing casting to a rigid structure at its mounting positions and loads applied.

PROTOTYPE TEST PASSED

- Based on results green light given to manufacture of gravity die cast tooling +$100K.
- Initial production runs made and complete seats manufactured for validation testing.

FINAL PART TEST FAILED

TESTING

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Testing Specifications:

- 1400N Horizontal Load on Top edge of end casting (both directions)
- 1400N Vertical Load on top edge of end casting

No permanent deformation allowed

SO WHAT WENT WRONG?

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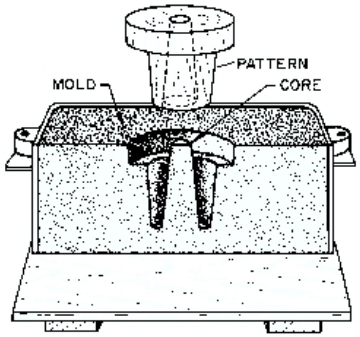
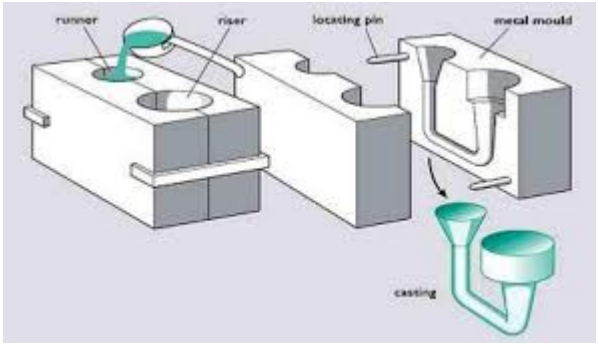
Physical properties of prototype:

- Generated through the different manufacturing process between Sand and Die cast.
- Manufacturing imperfections (air pockets) introduced by the complexity of the part.





Sand Casting:

- Several days for initial production.
- Inexpensive tooling cost.
- Higher unit cost for large runs.
- Sand casting typically stronger

Die Casting:

- Weeks/months for initial production.
- Expensive initial tooling costs
- Lower unit cost for large runs.

SO WHAT WENT WRONG? CONTINUED.....

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Initial static testing restraints:

- Prototype testing carried out on the casting by itself and not as a completed walkover seat.
- Testing constraints used in static test were fixed and rigid which was not valid when the item was tested as part of the completed walkover seat.

Assumptions used in Finite Element Analysis (FEA):

- In correct assumptions used in applying the boundary conditions or constraints on the model when under load.

WHERE TO NEXT?

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CONTRAINTS:

- Cost implications with making a new tool.
- Time implications
- Mass minimisation
- Customer signoff already achieved on look and physical envelope.

WAY FORWARD

- Using real test data to modify the test constraints and boundary conditions on the FEA model so its results matched the physical test results.
- With these new constraints modify the 3D model so it can pass the test requirements, noting that any changes could only be by achieved by adding material onto the part. Adding material to the physical end product is achieved by removing material from the tool which is a lot easier than adding material to the tool.

MODIFICATION TO DESIGN

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Evolution of Design:

- *Figure 1* – Original design with initial rigid constraints
- *Figure 2* – Original design with constraints that represented actual
- *Figure 3* – Modified design with constraints that represented actual

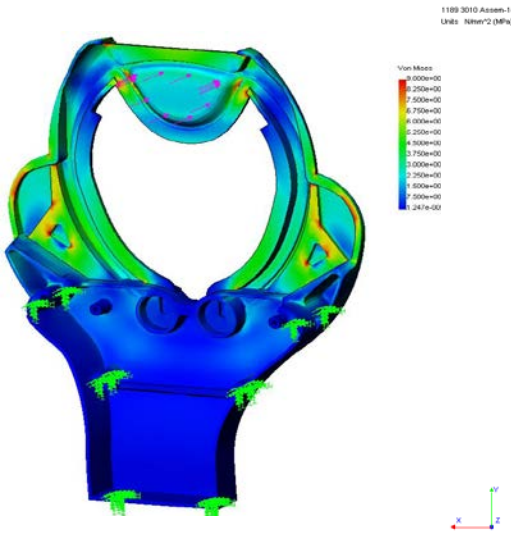

Figure 1:

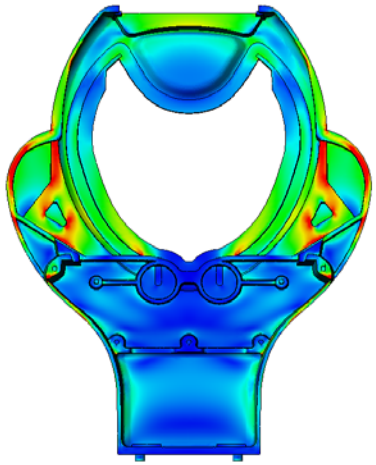

Figure 2:

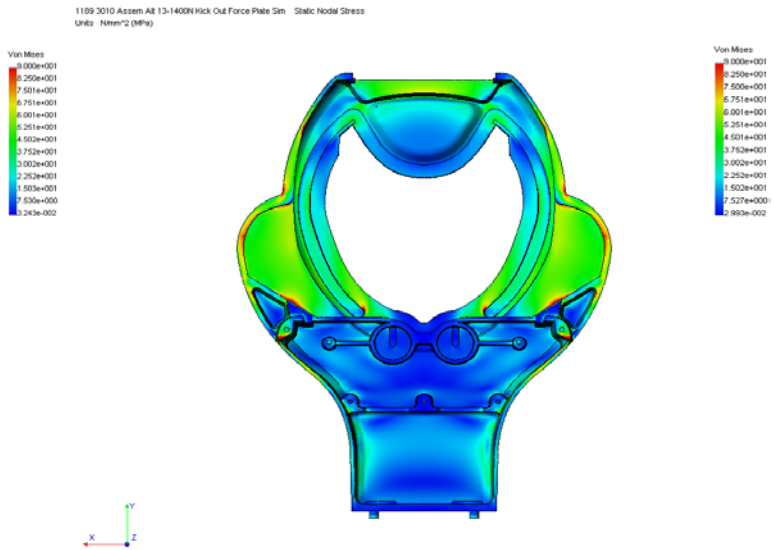

Figure 3:

CONCLUSION

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- The aisle side casting was successfully redesigned.
- Seats passed all testing and went into manufacture
- Learnings made:
  - The importance of designing with the manufacturing process in mind.
  - The importance on the assumptions and constraints used in FEA modelling
  - The importance of clear and concise communication through all stages of design.

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