

Technical Report on Workshop Session

by Richard Parker

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University of Wales Trinity Saint David
School of Engineering

Technical Report on Workshop Session
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Engineering Applications and Study Skills
Part B

Richard Parker
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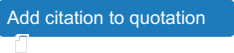
Figure 1	Error! Bookmark not defined.
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1 Introduction

In the session on 14/11/19 in Room 022, the group used the moulds they had ready to make a blade for a miniature turbine out of fibre glass and polyester resin, as practice of composite manufacturing. This report will look into the health and safety regulations surrounding the workshop environment and the composite manufacturing process. It will also demonstrate how this particular part was made and where there was room for improvements in the process,

Missing ''

2 Background Research

Although the university is a learning environment, it must abide by the regulations set out in the Health and Safety at Work etc. Act 1974 and its amendments. This is a very extensive document, and as such the relevant sections to workshops are set out in HSG 129 as it was “written for people who run and work in small engineering workshops” (HSE, 2004). The topics covered in this that are relevant to the university workshops generally regard the use of proper PPE and good working environments. It also explains that the university must provide “good light” and to “use natural light where possible but try to avoid glare.” 

The workshops would also come under PUWER – The Provision and Use of Work Equipment Regulations, which is also referenced in HSG 129. It says that “employers shall have regard to the working conditions and to the risks” that may face, and that they should not be subject to “any additional risks” that can be prevented or limited easily. (HSE, 2008) The university, considered an employer for the purposes of the document, also must ensure “equipment is maintained in good working order and repair” and that sufficient “training is provided for operators and supervisors” to limit accidents. 

Although the fumes from the polyester resin and catalyst aren’t very dangerous, they would mean that COSHH regulations should be followed, as contact with eyes or ingestion would be harmful and could easily be prevented with proper PPE. The Control of Substances Hazardous to Health Regulations generally that the university should “look at any substance” and minimise “exposure by breathing in or skin contact.” (HSE, 2002) 

 3

3 Methodology

As the moulds were produced in pairs, members of the group needed to pair up with someone who's mould was a good match for their own. Richard and Gwydion paired up, and were given a technical drawing showing the laminations, shown in Figure 1. One half of the finished mould is shown in Figure 2.  4

As shown in the technical drawing, each half of the mould would need 2 strips of glass fibre strips,  5
 6 cut with a scissors to both be the same width as the mould taking into account the contours with 5mm extra to overlap at each edge, but one cut at 45° across the weave.  7

Polyester resin and MEKP catalyst then had to be mixed at a ratio of 98g to 2g catalyst and mixed thoroughly. Then they brushed a small amount onto the mould surfaces to ensure there were no dry patches later on.

The first strip would be orientated at 0/90° to the mould, so the individual fibres of the weave would either be parallel or perpendicular to the mould edge. One edge of this strip was positioned at one edge of the mould, so the 5mm overlap protruded past the opposite edge. More of the resin mix was then added, ensuring there were no dry patches but minimal excess resin.

The next strip was orientated at 45°, with the 5mm overlap placed at the opposite side to ensure both halves of the mould met at each edge. More resin was brushed in.

The next step was to add the 12k Carbon Tows. These parts had 12000 strands of carbon each, and 3 lengths were added as explained in the technical drawing; one at each edge and one in the centre, all running lengthways through the part. A little more resin was brushed in.

The other half of the mould was then made in the same way, then the vacuum tube was laid through the middle and the two halves fitted together so that the 5mm overlaps were arranged properly. A cross-sectional diagram is shown in Figure 3 for clarity. The part was then vacuum bagged carefully using layers shown in Figure 4, then the vacuum was checked, and it was left to set for a week as shown in Figure 6.  8

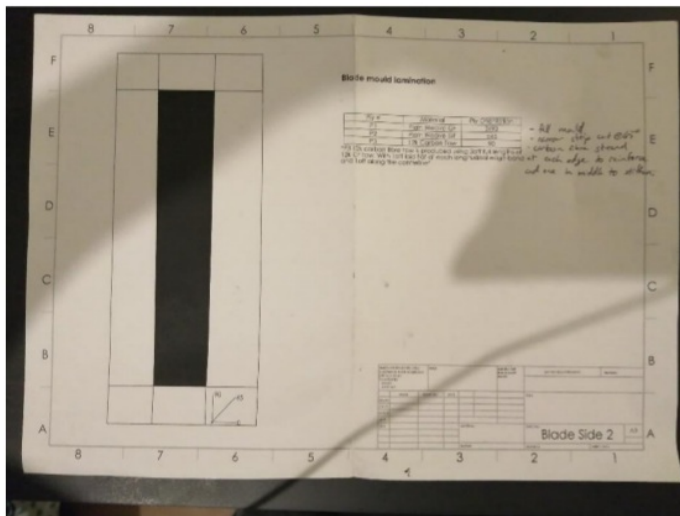


Figure 1 - Technical Drawing of Blade Mould Lamination



Figure 2 - Finished Surface Ready for Laminations

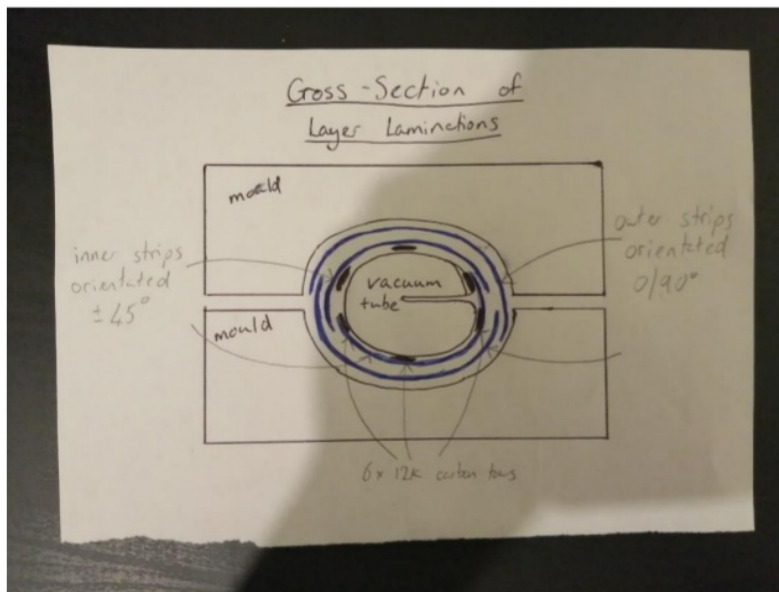


Figure 3 - Cross Section Showing Lamination Arrangements

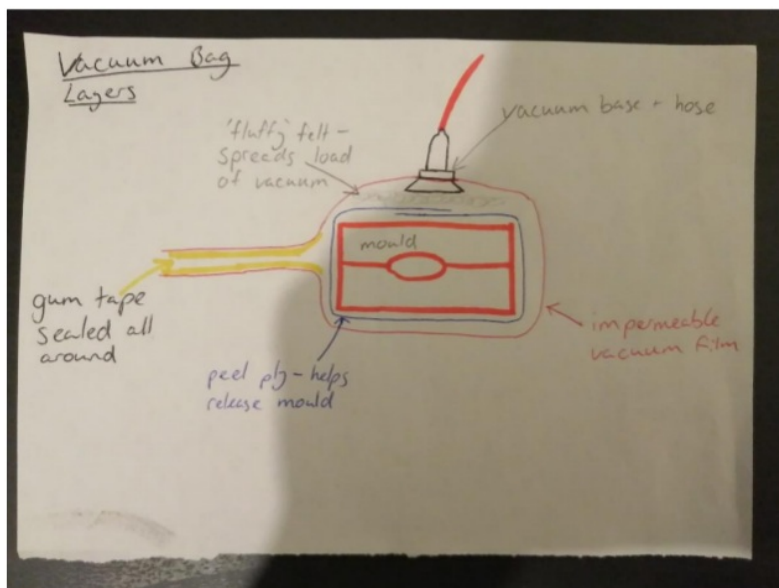


Figure 4 - Diagram Showing Vacuum Bag Layers



Figure 5 - Vacuum bag ready to be opened

4 Discussion and Conclusions

As Figure 6 shows, the part came out with some frayed edges where the edges of the glass fibre had got pinched between the moulds. However, some sections came out with a very neat surface, and after some trimming and sanding it looked much better. The problem with the method in the first attempt was that it was hard to align the layers properly because of how sticky the resin was, and as small adjustments were made other sections ended up worse. The carbon fibre tows ended up very thin, so their expected strength improvements are limited.

A new method was devised for the second blade, where the layers were formed around the inner vacuum tube, then this was laid between the moulds and bagged. This was much quicker, easier and produced a much neater part, a side by side comparison is shown in Figure 7. In the second attempt the carbon fibre tows ended up twisting along its length by almost 90°, which is due to a combination of the layers moving as a vacuum is formed and their limited experience of composite manufacturing. This is a key point to take from the experience, as no matter how well a part should work in theory, test runs and prototypes are key to success as lessons are always learned when initial attempts fail.  9

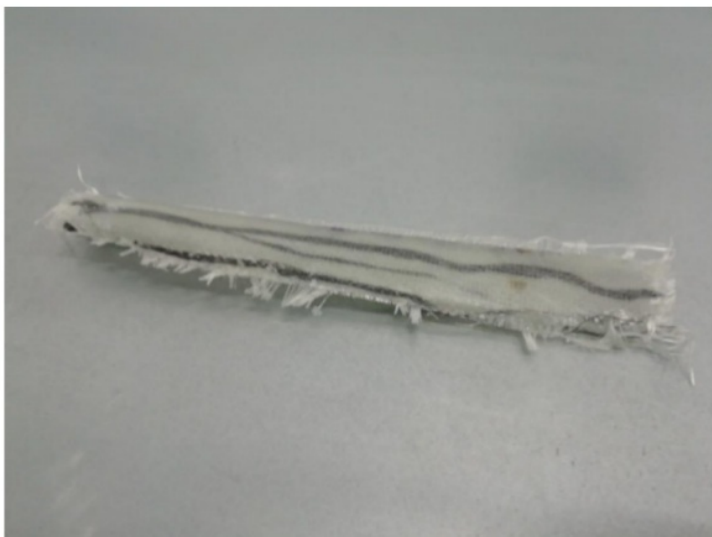


Figure 6 - Frayed Edges of First Blade



Figure 7 - Left - First Blade, Right - Second Blade

5 References

HSE, 1974. *Health and Safety at Work etc. Act 1974*. [Online]

Available at: <http://www.legislation.gov.uk/ukpga/1974/37>

[Accessed 02 02 2020].

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[Accessed 02 02 2020].

Technical Report on Workshop Session

GRADEMARK REPORT

FINAL GRADE

71 /100

GENERAL COMMENTS

Instructor

Engagement with Literature Skills

It is clear that you have done a good level of research into Health and Safety. I am pleased that you have also thought about COSHH when working with the composite materials.

The citations and references are all produced correctly. However in a couple of places, you needed to repeat the citation. Every time you put a quote in, also put in a citation.

Knowledge and Understanding Skills

All the research is linked to the University workshops, which is really good to see that you have thought about how the Health and Safety legislation is linked.

I would have liked to have seen a section about PPE and workshop rules that you have to work to when in the workshop.

in your methodology, you talk about the material and equipment that you used but there is not a separate equipment / tools list.

Cognitive and Intellectual Skills

Very descriptive methodology is included, it is one of the best for the mechanical sessions that has been submitted this year.

I really like your hand drawn diagrams as well, a very good addition to the report.

Perhaps though, I would have put Figure 1 and 2 closer to where they were mentioned in the text.

Practical Skills

I like that you have included Figures within your discussion as it helps to support your discussion well.

It is a good discussion of the problems that you faced and how you overcame them to achieve better results.

Transferable Skills for Life and Professional Practice

This is a very good report and you have followed the technical report guideline very well.

Proofread your work before submitting as there are a couple of small mistakes but nothing major.

Well done this is a good piece of work.

PAGE 1

PAGE 2



Comment 1

Just remember to check things like this when submitting.

PAGE 3

QM

Add citation to quotation | Literature

This quote does not give credit to the original author. When quoting a source, credit the original author with an appropriate citation. Cite the author properly at the end of this quote.

Additional Comment

Even though you have already included the citation in this paragraph, every time you include a quote there should be a citation at the end of it.

QM

Add citation to quotation | Literature

This quote does not give credit to the original author. When quoting a source, credit the original author with an appropriate citation. Cite the author properly at the end of this quote.



Comment 2 | Literature

Really good to see you have considered COSHH as well.



Comment 3 | K & U Subject

What PPE did you have to wear in the workshop?

What are the workshop rules you have to follow when doing practical work?



Comment 4 | C&I Skills

Good use of figures to support the written text.



Comment 5 | Prof Prac

Repetition of the word strips.

The last one is not needed as you have already specified the glass fibre would be in strips.



Comment 6 | Prof Prac

Not needed.



Comment 7 | C&I Skills

Would have been good to explain why you were cutting it at 45 degrees.



Comment 8 | Prof Prac

Should be Figure 5.

PAGE 6

PAGE 7

PAGE 8

PAGE 9



Comment 9 | Prac Skills

Very good discussions.

PAGE 10

PAGE 11

LITERATURE

Excellent 70-84%

(including reading, referencing, academic conventions and academic honesty)

OUTRIGHT FAIL 0-29%	Little or no evidence of reading and/or reliance on inappropriate sources. Views and findings mostly unsupported and non-authoritative. Referencing conventions used incoherently or largely absent.
UNSATISFACTORY 30-39%	Poor engagement with essential reading. No evidence of wider reading. Reliance on inappropriate sources, and/or indiscriminate use of sources. Heavily reliant on information gained through class contact. Inconsistent and weak use of referencing.
SATISFACTORY 40-49%	Engagement with a limited range of mostly relevant and credible sources but with some reliance on information gained through class contact. Some omissions and minor errors. Referencing conventions evident though not always applied accurately or consistently.
GOOD 50-59%	Engagement with an appropriate range of literature, including sources retrieved independently. Some over-reliance on texts rather than other sources. Referencing may show minor inaccuracies or inconsistencies.
VERY GOOD 60-69%	Engagement with a wide range of literature, including sources retrieved independently. Selection of relevant and credible sources. Generally sound referencing, with no/very few inaccuracies or inconsistencies.
EXCELLENT 70-84%	Engagement with an extensive range of relevant and credible literature. Consistently accurate application of referencing.
EXCEPTIONAL 85-100%	Exceptional engagement with an extensive range of relevant and credible literature. High-level referencing skills consistently applied.

K & U SUBJECT

Satisfactory 40-49%

Knowledge and Understanding of Subject. Extent of knowledge and understanding of concepts and underlying principles associated with the discipline.

OUTRIGHT FAIL 0-29%	Major gaps in knowledge and understanding of the basic underlying concepts and principles of the subject matter. Inclusion of irrelevant material. Substantial inaccuracies
UNSATISFACTORY 30-39%	Gaps in knowledge of the basic underlying concepts and principles, with flawed or superficial understanding. Some significant inaccuracies and/or irrelevant material.
SATISFACTORY 40-49%	Limited knowledge and understanding of the basic underlying concepts and principles within the subject area. Some elements may be missing
GOOD 50-59%	Knowledge of the basic underlying concepts and principles is accurate with a good understanding of the field of study but lacks depth and/or breadth.
VERY GOOD 60-69%	Competent knowledge of the basic underlying concepts and principles. Exhibits very good understanding

EXCELLENT 70-84%	Excellent knowledge and understanding of the basic underlying concepts and principles of the subject.
EXCEPTIONAL 85-100%	Exceptional, detailed knowledge and understanding of the basic underlying concepts and principles

C&I SKILLS

Excellent 70-84%

(Evaluate underlying concepts and principles of a subject and interpret qualitative and quantitative data in order to develop lines of argument and make sound judgements.)

OUTRIGHT FAIL 0-29%	Wholly or almost wholly descriptive work. Little or no evaluation of the underlying concepts and principles. Failure to develop arguments, leading to illogical or invalid judgements. Minimal or no use of evidence to back up views.
UNSATISFACTORY 30-39%	Largely descriptive work, with superficial evaluation of the underlying concepts and principles. Weak interpretation of data, flawed development of arguments and judgements. Information accepted uncritically, uses generalised statements made with scant evidence and unsubstantiated opinions. Ideas sometimes illogical and contradictory
SATISFACTORY 40-49%	Limited attempt at evaluation of the underlying concepts and principles, tending towards description. Can interpret qualitative and quantitative data but with some errors. Some evidence to support emerging arguments and judgements but these may be underdeveloped or with a little inconsistency / mis-interpretation.
GOOD 50-59%	Good evaluation of the underlying concepts and principles. Can interpret qualitative and quantitative data, with minor errors. An emerging ability to use evidence to support the argument. Mostly valid arguments and logical judgements.
VERY GOOD 60-69%	Sound evaluation of the underlying concepts and principles. Can interpret qualitative and quantitative data accurately. Ability to devise arguments using evidence to make mostly appropriate and valid judgements.
EXCELLENT 70-84%	Excellent evaluation of the underlying concepts and principles. Can interpret qualitative and quantitative data accurately and with some insight. Excellent ability to devise arguments using evidence and make appropriate and valid judgements
EXCEPTIONAL 85-100%	Exceptional evaluation of the underlying concepts and principles based evidence. Outstanding interpretation of qualitative and quantitative data. Exceptional ability to devise arguments using evidence and make wholly appropriate and valid judgements

PRAC SKILLS

Excellent 70-84%

(Different approaches to solving problems in particular contexts.)

OUTRIGHT FAIL 0-29%	Limited or no use of taught, basic methods, materials, tools and/or techniques. Little or no appreciation of the context of the application. Very weak evidence of different approaches to problem-solving in particular contexts.
UNSATISFACTORY	Rudimentary application of taught, basic methods, materials, tools and/or techniques but

30-39%	without consideration and competence. Flawed appreciation of the context of the application. Weak evidence of different approaches to problem-solving in particular contexts.
SATISFACTORY 40-49%	An adequate awareness and mostly appropriate application of basic methods, materials, tools and/or techniques. Basic appreciation of the context of the application. Can identify problems in particular contexts and propose basic alternative approaches or solutions though there may be errors.
GOOD 50-59%	A good and appropriate application of basic methods, materials, tools and/or techniques. Clear appreciation of the context of the application. Good evidence of different approaches to problem-solving in particular contexts and proposes mostly appropriate solutions.
VERY GOOD 60-69%	A very good application of a range of basic methods, materials, tools and/or techniques. Very good consideration of the context of the application. Very good evidence of different approaches to problem-solving in particular contexts and proposes appropriate solutions.
EXCELLENT 70-84%	An advanced application of a range of taught, basic methods, materials, tools and/or techniques. The context of the application is well considered, and insightful. Excellent evidence of different approaches to problem-solving in particular contexts and proposes appropriate solutions.
EXCEPTIONAL 85-100%	Exceptional levels of application and deployment skills in particular practical contexts. Outstanding identification of problems in particular contexts and formulation of wholly appropriate, thoughtful solutions / different approaches.

PROF PRAC

Excellent 70-84%

(Communicate the results of their study/work accurately and reliably, and with structured and coherent arguments; the qualities needed for employment requiring the exercise of some personal responsibility within a structured and managed environment.)

OUTRIGHT FAIL 0-29%	Work is poorly structured, disorganised, inaccurate and/or confusingly expressed. Very weak use of language and/or very inappropriate style. Failure to work effectively individual or as part of a group. Little or no evidence of the skills for employment requiring the exercise of some personal responsibility.
UNSATISFACTORY 30-39%	Work is poorly presented in a disjointed manner. It is loosely, and at times incoherently, structured, with information and ideas often poorly expressed. Weak use of language and/or inappropriate style. Flawed approach to individual or group work, meeting only partial obligations to others. Limited evidence of the skills for employment requiring the exercise of some personal responsibility.
SATISFACTORY 40-49%	Mostly ordered presentation and structure in which relevant ideas / concepts are reasonably expressed. Work may lack coherence and/or accuracy in places. Can work as part of a group, meeting most obligations to others but perhaps with limited involvement in group activities. Demonstrates the basic skills for employment requiring the exercise of some personal responsibility, with some areas of minor weakness.
GOOD 50-59%	Mostly coherent, organised and accurate work, in a suitable structure and is for the most

part clearly expressed. Can work effectively independently and/or as part of a team, with clear contribution to group activities. Demonstrates the skills for employment requiring the exercise of some personal responsibility, with some areas of strength and some of minor weakness.

VERY GOOD 60-69% Work is accurate, coherent, fluent, well-structured and organised. Can work effectively independently and/or as part of a team, with very good contribution to group activities. Demonstrates very good skills for employment requiring the exercise of some personal responsibility, with just occasional minor weakness.

EXCELLENT 70-84% Work is coherent, very fluent and is presented professionally. Can work effectively independently and/or as part of a team, with an excellent contribution to group activities. Demonstrates excellent skills for employment requiring the exercise of some personal responsibility with an appetite for further development.

EXCEPTIONAL 85-100% Work is accurate, exceptionally coherent, very fluent and presented well. Can work effectively independently and/or as part of a team, with an exceptional contribution to group activities. Demonstrates exceptional skills for employment requiring the exercise of some personal responsibility with an appetite for further development