

ACMA6000 Coursework Feedback

Student	Rhys O'Shea
Student ID	2415783
Assessment	Manufacture of Wind Turbine Blade
Final mark	79 / 100

1. Engagement with Literature Skills — 15/20

The report demonstrates a broad range of independent research across wind-turbine fundamentals, NACA 4412 aerodynamics, blade geometry, environmental conditions, materials, manufacturing, cost and mechanical behaviour. The source base includes journal papers, government and technical information, Granta EduPack and commercial or industry sources. Relevant academic evidence is used for NACA 4412 performance, blade design, fatigue and manufacturing decisions rather than merely being listed in the bibliography. The report also compares alternative airfoils and explains why NACA 4412 is appropriate for the selected small-scale application. The mark is limited because a noticeable proportion of the references are general websites or commercial sources, particularly for manufacturing and costing. More consistent reliance on peer-reviewed and recognised technical literature would strengthen this criterion.

2. Knowledge and Understanding Skills — 23/30

The submission demonstrates very good understanding across aerodynamic design, blade geometry, material selection, manufacturing, cost and structural behaviour. The domestic EV requirement is converted into a blade radius using clearly stated assumptions for wind speed, power coefficient, tip-speed ratio, air density and lift coefficient. The blade is then divided into five radial sections with both chord and twist varying along the span, and the NACA 4412 profile is transformed into the individual section geometries used later in CAD. Material understanding is also strong, particularly the Granta-based screening followed by a weighted decision matrix comparing CFRP, GFRP, aluminium and alumina. Manufacturing routes are considered across metals, ceramics and composites. The main limitation is that the mechanical analysis is more developed for bending than torsion; torque is discussed, but a completed torsional-stress calculation is not demonstrated.

3. Cognitive and Intellectual Skills — 16/20

There is strong evidence of comparative judgement throughout the work. The material-selection process does not rely on one property, but considers tensile strength, fatigue, density, manufacturability, cost and sustainability. CFRP achieves the highest weighted score and is then justified through its lower density and superior fatigue and tensile performance despite its higher cost. The cost analysis similarly recognises that aluminium is cheaper but concludes that CFRP offers the stronger cost-performance balance for the intended application. Manufacturing decisions are also made critically: vacuum infusion is selected for the present production scale, while the report recognises that RTM or compression moulding could become more attractive at higher production volumes. A higher mark would require a more complete use of the mechanical results to optimise or modify the final blade design.

4. Practical Application Skills — 17/20

This is a strong aspect of the submission. The work includes NACA 4412 camber and thickness calculations, five spanwise blade sections, chord and twist calculations, Granta screening, a weighted material matrix, manufacturing comparison, CAD-volume-based cost estimates, lift and drag calculations, resolved aerodynamic forces, bending moments, bending stresses and factors of safety. The cost work is particularly good because it uses the actual CAD blade volume rather than only comparing generic material prices. The CAD evidence is extensive, with the airfoil profiles imported, twisted and lofted into the final blade; this fully satisfies the intended CAD requirement. The main practical limitation is the absence of a completed torsional-stress calculation despite tangential loading and torque being discussed.

5. Transferable Skills for Life and Professional Practice — 8/10

The report is comprehensive and well organised, with a clear sequence through literature, design specification, blade calculations, material selection, manufacturing, cost, mechanical analysis, CAD and conclusions. The extensive use of tables, graphs, CAD screenshots and appendices makes the engineering process easy to follow. The conclusion appropriately summarises the design decisions and recognises that the analysis remains preliminary, recommending FEA, fatigue analysis, better aerodynamic data and prototype testing. Some presentation and language issues remain, and parts of the bibliography rely on relatively weak web sources, but overall communication is professional and technically clear.

Mark Summary

Assessment category	Maximum mark	Mark awarded
Engagement with Literature Skills	20	15
Knowledge and Understanding Skills	30	23
Cognitive and Intellectual Skills	20	16
Practical Application Skills	20	17
Transferable Skills for Life and Professional Practice	10	8
Total	100	79

Overall Feedback

This is a strong, well-integrated engineering submission with particular strengths in spanwise blade design, Granta-based material selection, CAD-volume-linked costing, manufacturing comparison, mechanical analysis and extensive CAD evidence. The student consistently justifies design choices rather than simply adopting lecture values, and the CFRP/vacuum-infusion recommendation is supported by mechanical, manufacturing and economic evidence. The principal limitation is that the structural analysis is incomplete in torsion: tangential forces and torque are identified, but the analysis does not progress to a completed torsional-stress calculation. The strongest improvement would therefore be to extend the existing mechanical analysis to include torsional stress and then use the combined structural results to refine or validate the final blade geometry.