

Material Characterization of Common Wood Materials Used for Small- to Medium-Sized UAV Construction

AE 510 Aerospace Materials and Processes
Fall 2020

Introduction

Many small- to medium-sized Unmanned Aerial Vehicles (UAVs) are constructed from wood materials due to the ease of construction and low loads experienced by the vehicle. Unlike most materials used in the construction of aerospace structures (such as various aluminum alloys and fiber reinforced composite materials), the mechanical properties of wood are difficult to find in reliable sources due to the product variability and dependence on moisture content. To reduce design risks of future UAV structures by ensuring proper sizing of structural components, mechanical data for wood materials such as balsa, pine plywood, and basswood that are commonly used for hobby aircraft construction is desired. Specifically, data on ultimate strength along and transverse to the grain, Young's Modulus along and transverse to the grain, and Poisson's ratio is sought. Information on the sensitivity to moisture content is also desired.

Technical Approach

You will need to first identify which materials you plan to characterize and then generate a test plan that should consider the following items: available testing apparatus within the School of Engineering, number and size of test specimens, type and number of measurement sensors, specific testing procedures, and data processing approaches. Your team is highly encouraged to refer to existing testing standards as well as work closely with Dr. Arnold when defining your test program.

Given the number of testing variables that could be explored and the time constraints associated with the project, you will wish to design a test plan that addresses the major deliverables while also mitigating schedule risks and maintaining the allotted budget. In experimental research, the test setup is the most critical aspect. Often you will find that initial assumptions or techniques regarding your setup will not result in satisfactory results. You should keep this in mind when developing your project schedule, and you are encouraged to produce un-instrumented sample coupons when verifying your setup.

Deliverables

You will be required to generate a written test plan that should address the following items:

- Proposed testing matrix
- Number and dimensions of test coupons
- Required testing apparatus
- Number and type of strain measurement sensors
- Test program schedule and budget

In addition to the initial test program report, you are also required to write a final report on your testing results and present your results to the class via a formal oral presentation. Your final report and presentation should include documentation of your procedures and testing results as well as a lessons learned section wherein you should reflect on how you would do things differently if given the project again.

Deadlines

- 1 October, 5:00PM: Summary of test program
- 10 November, 8:00AM: Oral presentation
- 12 November, 5:00PM: Final test report
- 30 November: KU Center for Undergraduate Research Fall 2020 Research Symposium (optional)

Outcomes

Experience with:

- Designing experiments
- Conducting experimental research
- Presenting research results