Preparation of Course Materials: Elementary Mathematics of Powered Flight

by

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Non-science students at William and Mary will soon be required to take a mathematics course in order to earn a bachelor's degree. A standard menu of technique courses is the usual way in which universities provide for this requirement: Trigonometry, probability, geometry for teachers, and the like. In this work, we attempt to break away from these largely unsuccessful choices.

Our intent is to prepare material that sets a variety of simple mathematical procedures in the context of a commonly experienced part of students lives: riding in commercial airplanes. The work, begun last summer at Langley, is now close to completion and trial in upcoming fall term at William and Mary. As of this writing, the narrative is complete for 12 to 14 projected sections.

We have prepared material on wind triangles, wind roses, navigation maps, drag induced loss of velocity for unpowered missiles (tennis balls), luggage and its effect on center of gravity, localized magnetic declination and VOR orientation, geometry of great circles, terminal velocity for falling bodies, pressure vessels: tires and balloons and blimps, global structure of declination lines, map projections (mercator, azimuthal equidistant, Lambert), Ears and their reaction to altitude change. The next section will treat lift, drag and thrust. The last will treat control surfaces.

The entire approach avoids any effort to investigate mathematical topics that arise in the solution of problems. And by the same token, we avoid any organized attempt to explain aeronautical engineering, even on an elementary level. We look only at enough mathematics to do a problem and we select only engineering topics that permit some kind of (elementary) mathematical analysis.

In the end, we will think of the material as successful if two things happen: Students must come away with some confidence that even lay people can quantify parts of their surroundings. Other potential instructors must be willing to gain enough familiarity with the physical content of the material so that it can be used at other universities.