Math 106—Project 2
Floating merrily in the waves...

by Gavin LaRose (glarose@NebrWesleyan.edu), Nebraska Wesleyan University, 1999

Hocklead-Tarmin, Inc.

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1 October 1999

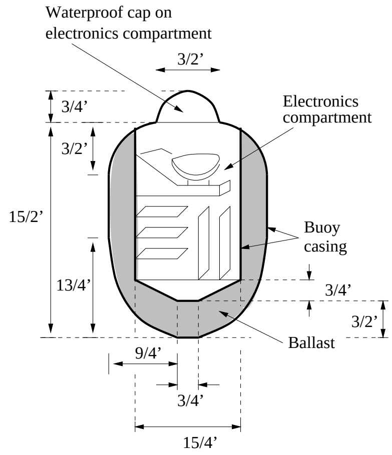
Sophisticated Technical Contractors, Inc.
Suite 1, Strawmarket Business Plaza
Lonlinc, SK 04685

Dear STC:

As you know, we are here at Hocklead-Tarmin a leader in aerospace and electronics contracting for the military. Concerned with the inconsistency of this line of contracting (there are, after all, only so many wars that one can start), we are branching out into other areas of high-technology manufacturing. The most recent contract we are pursuing has to do with the construction of a new scientific buoy for the coast guard. This is to be moored in the open ocean, and contains a number of rugged electronics pieces that are to continually monitor the environment in which the buoy is located.

A diagram of the buoy is shown to the right. The buoy casing is in all cases $\frac{1}{4}''$ steel plate (density 486 lb/ft^3), and the ballast is an insulating padding with fairly low density (21 lb/ft^3). The electronics are quite light, but packed differently at the top and the bottom so that the density at the bottom is approximately 5 lb/ft^3 and at the top only 1 lb/ft^3. The cap on the electronics compartment is empty.

The buoy is designed so that the electronics compartment cap is approximately hemispherical, and the upper $3/2'$ of the buoy is similarly the upper quarter of a torus. The lower $13/4'$ of the buoy is parabolic, with the exception of a flat circular section of $3/4'$ diameter at its very bottom.



While we have been assured by our engineers that the configuration that we show here will work impeccably, their area of expertise is in aeronautics and we are looking to you for a second opinion. We need to know how low in the water the buoy will float. It is probably relevant that the buoy is to be anchored to the ocean floor by a steel cable of diameter approximately $1/2''$ and, because of its braided nature, density approximately $\frac{1}{8}$ of that of solid steel. We expect that the buoy will be anchored in water approximately 6,000 ft deep.

We look forward to receiving your final report on this problem *on or before the 27th of October*. We have arranged with a local expert in all things mathematical, the estimable Dr. P. Gavin LaRose, to serve as a contact with you should you find that you have questions in its completion. *Please note that you must contact him by the 14th of October* with your initial appraisal of the problem and the manner in which it should be resolved. Failure to meet this deadline will be cause for a significant penalty in your payment.

Yours sincerely,
O. W. R. Eit III
CEO, Hocklead-Tarmin, Inc.

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