Letters

La Jolla, California

Dear Dr. Clauser:
The purpose of this letter is to tell you that I thoroughly enjoyed your article, "The Boat That Almost Was." I asked for and received additional copies of *Engineering & Science* which I have sent to friends and sailing aficionados because you have so beautifully rendered a murky subject clear.

You are the first person to make sense out of the 12-meter formula. (I am still interested, from a purely intellectual view, in the derivation of the dimensionless factor 2.37.) Of equal interest to me is your keen appreciation for the potential of (parochial) interpretation of the rules by the IYRU. My involvement with ship design and construction at Litton and Newport News Shipbuilding made it abundantly clear to me that naval architecture was firmly and inextricably based on the technology of yore; only heretics questioned the "rules."

Thank you for taking the time to write your article. You have brought a great deal of pleasure to a number of people. My wife and I recently returned from Australia where we spent a few days in Perth and Fremantle watching the races. I wonder whether or not the Kiwis knew of your findings. They certainly have a competitive boat.

Sincerely,
Bruce A. Worcester
Caltech '48

Dear Mr. Worcester:
I very much enjoyed receiving your letter. Your words of encouragement were pleasant to hear.

I, too, am interested in the origins of the factor 2.37 in the 12-meter formula. I have a hunch that it was chosen to fit some existing boat.

Best wishes for the New Year,
Francis Clauser

Greenwich, Connecticut

Dear Dr. Clauser:
I have read with great interest your article, "The Boat That Almost Was," in the November issue of *Engineering & Science.* It's too bad that boat, or some variation thereof, didn't materialize — in retrospect, the New York Yacht Club certainly needed help of some kind.

Together with its accompanying charts and illustrations, the article puts forward a very lucid explanation of the complexities of 12-meter yacht design. Also, your explanation of how bulbous bows work, or do not work as the case may be, was most helpful to me in understanding that phenomenon.

Your other concepts of lightweight boats with outrigger pontoons and/or ailerons sound like great possibilities. You point out that the wetted area of these devices would be about the same as the amount that wouuld be saved if the lead were removed from the keel. Hence, the fluid friction would not be materially increased while other advantages would be gained.

So far so good, but I don't recall that your article got into the question of the torque resulting from dipping one of the pontoons selectively into the water on only one side of the boat. Similarly, if the upwind aileron were to rise out of the water, a significant drag turning force would tend to develop.

It seems to me that such turning forces would have to be counteracted by a hard opposite rudder position. If so, the boat wouuld be constantly fighting its rudder, with the net result that overall resistance through the water would rise appreciably, thus negating the other advantages gained.

If I have overlooked something in the article which answers this question, please forgive me. In any case, if you can take the time, I would appreciate receiving your comments.

Yours sincerely,
S. Kendall Gold
Caltech '42

Dear Mr. Gold:
I have received quite a number of letters about my article in *Engineering & Science*, but I believe yours was the most perceptive and penetrating. It was a pleasure to read your comments.

You are quite right that the important question of the yawing torque of the pontoons was not addressed in my article. Earlier, I wrote a memorandum to Johan Valentijn and George Tooby on this subject, but I deemed it a little too technical to include in the *E&S* article.

The fact is that this torque is actually favorable in that it takes load off the rudder instead of adding to it. When the boat is close hauled, the leeward pontoon will of course be in the water. By the same token, the mast and sail are also out on the leeward side. Thus, the center of effort of the sail is displaced to leeward and will cause the boat to want to head up into the wind. In all boats with stable helms, if the helm is let go free, the boat immediately heads up into the wind. As a consequence, a significant amount of rudder has to be used to counteract this tendency. There is a large increase in resistance from this rudder action.

Now the drag of the immersed pontoon tends to turn the boat away from the wind, i.e., it is opposite to that of the sail. Let us look at the magnitudes involved. The center of pressure of the sail is up about 18 ft., and if the boat is heeled 15 degrees this gives it a lever arm of about 4 ft. The pontoon will have a lever arm of about 35 ft., but its resistance will be about 1/8 of the total. If the effort of the sail just counteracts the total resistance of the hull, then it is clear that the yawing torque of the pontoon is very nearly equal and opposite to that of the sail. Thus the force required of the rudder is almost entirely eliminated, leading to a significant reduction in overall drag.

I hope this overly long discussion allays your worries that "the boat would be constantly fighting its rudder."

Cordially,
Francis Clauser