Letters

Greenbaum Gets Specific

(Concluded from last month)

sailplanes of current configuration *must be large.*"

Lest this seem a nit-picking surface observation of the questionable usefulness of technical papers for *Soaring* publication, (I prefer stories like Bob Moore's Diamond flight), may I give an example of an exciting possibility.

In your paper "Experimental Investigations of a Thick Laminar Airfoil" you repeat the famous "King Cobra" allegations, i.e., "poor nose design of all the NACA 6 series airfoils," with some if-iness in that the nose radius reduction on your model might have affected the results. This sort of omissional sin shows how many aerodynamicists can dance on the head of a pin.

Seize instead the chance for brilliance rather than blather. The important question, rather than conformal answer, is: "In view of the demonstrated low drag of the NACA 66 airfoils at Reynolds Nos. over 3 million, and despite the observed loss of low drag performance due to predictable reduction of kinematic viscosity at

(Note: Kinematic viscosity is the normally invariant ratio of absolute viscosity to density: the term is here used in the sense developed by T. V. Boussinesq, i.e., as apparent or virtual kinematic viscosity, thereby denoting the observed apparent increase in k. v. when the flow studied changes from laminar to turbulent- see Boundary Layer Theory, Schlichting, Chap. 19 et seq.)

the minimum pressure point due to high surface curvature and steep adverse pressure gradient, is it not also probable and *demonstrable* that what we are seeing in low Reynolds No. investigations of laminar airfoils with minimum pressure points at or behind .6 chord is the sub-layer's incipient approach to laminar flat plate flow with the Blasius form velocity profile changing at about .1 chord (or near the nose) to the asymptotic profile — this changing the critical layer pressure distribution from the calculated form to that having a pressure peak far forward?" At this point (with a low turbulence tunnel at my disposal) I would not have spent any more time verifying for the umpteenth time that all known laminar airfoils are deficient in lift and have high drag at low Reynolds Nos. Instead, with the aid of a cylinder and a NACA 0012 airfoil, I would have traced what has become (to me) an obvious correlation: the change from a cylinder's high drag flow at about R 500,000 to the surprisingly lower value of about one half at about R 600,000, then to the astonishingly low drag of an NACA 0012 at R 250,000, and to the high drag at low R No. of the NACA 66 and even more rearward minimum pressure point airfoils. The key to the observed drag increase should lie, as others have suggested, in the laminar sub-layer.

If I may offer an hypothesis: The laminar sub-layer is not always laminar. It separates and reattaches near the nose of the airfoil in those cases where the change of velocity profile from that due to Blasius to an asymptotic form takes place on the surface of the airfoil wall instead of in the stream.

Now the aerodynamicists may dance on my pinhead.

Seriously, I suspect that we have thrown out the baby with the bath when, in mathematical omniscience and in the name of simplicity, we drop all of those second order variables in the flow near a wall, ignoring: a., Preservation of angular momentum effects; b., Inertial forces; c., Bouyancy; d., Gravitation; e., Centrifugal force; and f., thermal diffusion.

The answer to improving sailplane efficiency does not lie in increasing mechanical complexity to attain suction boundary layer control. This is simply using power to get rid of something imperfectly understood.

Let us review instead the generation of point and line energy sources, remembering that a sailplanist only uses his aircraft wing to displace an equivalent mass of air in time.

We will also remember that Prandtl showed nearly sixty years ago that laminar flows do not generate much lift, turbulent flows do.

Who will suggest a geometry of our source that will produce a turbulent but low (enough) drag stream?

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P.S. You suggested a paper — to put up or shut up. With humility I have found answers but steps along a path of questions. This all began about twelve years or so ago in a shack at the Wurtsboro, N.Y., airport where we prepared for sleep after a wonderful soaring day. Don Lawrence correctly told me that I didn't even know where to begin to design a glider (at the tailskid so as not to require a take-off trench for the tail). I learn. The paper will come. I love to soar, don't you?

¶ Another SSA member named Greenbaum, Robert P. of Los Angeles, Calif., has asked that it be made known that it is not he who is responsible for the exchange of letters over Raspet's "New Approaches." —ED.

Who Should Instruct?

Dear Lloyd:

After reading the notice on the inside cover of the February issue of *Soaring*, which recommended changing the FAA glider instructor requirements, I was shocked! How can the SSA claim that its aim is to promote soaring and at the same time advocate a change in FAA rules which would reduce the number of glider instructors? The change would not improve the quality of instruction given or the quantity. It would not decrease the number of accidents.

Theoretically, it is a good idea to have all instruction done by pilots with a glider instructors certificate. It is not practical, however, nor necessary. A few reasons for this are:

1. There is very little difference between the commercial and glider instructor certificates. A good commercial pilot need only read the Flight Instructors Handbook to learn the principles of flight instruction. In the flight test for a flight instructors certificate, the pilot must demonstrate his ability to recover from spins. Otherwise, the flight tests for the two ratings are identical. The flight experience requirements are the same, and the written tests are somewhat similar. Actually, neither rating will make a pilot into a good instructor — the pilot must want to instruct and must work at the job.

2. It is difficult and expensive to obtain any rating. We must bear in mind through all this discussion that soaring is only a hobby. For the average fellow to get a commercial or flight instructor certificate involves studying, taking off at least one half day from work and possibly driving 20-100 miles just to take the written test. The flight test is not as easy. The pilot must round up a ground crew and tow pilot during the week day (another day off work) and make an appointment with the FAA examiner so that he can demonstrate his aero and auto tow (or winch) skills to the examiner. The weather must be good, especially when spins are required. It has been our experience that an average of two trips to the airport are necessary to secure each rating. In some rare cases a designee can be obtained to give the flight test for a commercial, but an instructor certificate can only be obtained from an examiner.

All things considered, it is easy to spend many hours getting the crew and examiner lined up, take off from work to go over to the airport and find that the weather is bad and you have to start all over again-and what for? Just so you can teach students how to fly on good days when you would rather be soaring yourself. I can speak from experience, having gone through it obtaining a CG and GFI rating.

3. There is always a lack of instructors —lets not make it worse. In our own club, the Soaring Society of Dayton, Inc., a Chapter of SSA, and others, the instructor situation is critical. Some clubs require a student to have soloed a power plane or have a power rating before he can join, in order to lower the amount of instruction that they must give. Another way out may be to send students to commercial glider operations which charge fabulous prices for a few glider rides — obviously not for the average pilot. Possibly we may have to start paying our own club members, in order to get more instructors. In any event, raising the certificate requirements for instructors is not going to increase the number of them, or for that matter the quality.

4. The change will have little effect, if any, on the number of accidents. The majority of accidents are caused by power pilots who have not been properly checked out in gliders. Why not change the regulations so that power pilots must have more glider time before they can obtain a glider rating.

5. It's one thing to have the FAA move to stamp out soaring, but it's another to have the SSA do it. It is our feeling that the submission of this recommendation should be put up to a yes or no vote of the membership. You can be assured that the SSD members will vote NO!

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¶ No action has yet been taken to make the recommendation on glider instructor requirements to FAA which the SSA Directors voted to do at their last Board meeting. In view of the widespread alarm expressed by clubs and individuals on this matter, the Directors will review all