Professor Raabe also questions the usefulness of the image-motion compensation technique as applied to cavitation photography, since he computes the bubble growth rate to be of the same order of velocity as the jet itself. Accepting his calculations as to bubble-radius velocity for the moment, it is still apparent that stopping the axial motion of the jet by the camera mechanism reduces the amount of axial bubble motion to be stopped by the flash. Experiments have shown that we consistently achieve sharper photographs when using the motion-compensation technique.

We have gone over our equipment, electronics, and test records carefully, and are convinced that the flash duration was very close to 1.5 μs, well within the 1 to 4 μs specified in the text. Since the bubbles in the pairs of photographs can be expanding, contracting, rotating, and nonspherical as well as translating, we have no faith in calculations which purport to show bubble growth rate or bubble axial velocity, based on scaling these photographs over the rather long time range involved. Our timing-interval electronics were not very sophisticated (being constructed by the authors themselves) but nevertheless, based on our calibrations, we feel that they yield much more accurate time intervals than one could estimate by scaling bubble movement from the photographs. In going over our results again, we did find a caption error regarding time intervals which we have corrected in the final text, so we are grateful to Professor Raabe for drawing our attention to this area. We agree with Professor Raabe that details of the turbulent flow in the cavitating region of the jet would add grately to our understanding of the physics involved.

We especially thank the discussors for their comments and additional information, all of which combine to make the study of the effect of polymer solutions on cavitation even more intriguing.

Turbulent Boundary Layer Flow Through a Gap in a Wall Mounted Roughness Element[1]

I. P. Castro.[2] My only major criticism of this work is the author's use of ideas developed to describe the growth of an internal layer after a step change in roughness (for which the final equilibrium flow differs from the initial one) for their case, which is essentially one of a wake flow relaxing back to the same initial equilibrium flow. I believe this has led to some confusion in their thinking. They state, quite correctly, that "the mechanism of flow readjustment downstream of the distortion proceeeds by a flow modification that works outwards from the wall" but confuse this internal layer, whose characteristics are determined mainly by the wall conditions (as in the roughness change case) with the "wake" behind the gap; the "edge" of the former is mistakenly taken as δ_i. The latter is simply the outer edge of the wake which does, of course, also move outwards but at a rate which is certainly not determined by wall parameters. The authors do not state to what distance from the wall their Clauser-plots for determining C_f had the usual log-law behaviour, but I surmise that it was always substantially less than δ_i. Indeed, despite the author's claim that equation (4) gives 'a useful description of the internal layer growth', Fig. 4 does, in fact, show that δ_i is always larger than that given by equation 4 by a factor of 3 or 4 in the early stages of relaxation of the wake. With their definition of δ_i I do not believe that z is a relevant length scale at all.

The final comment concerns the author's remarks regarding Fig 4. It would have been interesting to plot profiles measured at the same $x_{/D}$, rather than $x_{/H}$. Far downstream the flow will (to first order) only know about the change in the drag of the block (or, perhaps the change in *moment* of momentum - Counihan, Hunt and Jackson, 1974) which is presumably determined solely by changes in $D_{/H}$. It is therefore more likely that the proper scaling necessary for any possible downstream similarity should be based on $x_{/D}$. In fact, the mean flow profiles demonstrate that the thickness of the inner region is considerably greater for $D_{/H} = 0.5$ ($x_{/D} = 448$) than it is for $D_{/H} = 10$ ($x_{/D} = 22$), in line with the preceding argument.

[1] By W. H. Schofield, D. S. Barber, and E. Hogan, published in the March, 1981, issue of the JOURNAL OF FLUIDS ENGINEERING, Vol. 103, No. 1, pp. 97-103.

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Authors' Closure

The authors do not believe that the flows studied can be described as "essentially a relaxing wake flow;" in fact two of the flows ($D/H = 5,10$) have their wake component *reduced* by the notch. The readjustment of the flows is initiated and driven by the wall flow because it is the wall flow which quickly adjusts to the new conditons. The outer (wake) flow is driven back to equilibrium conditions on its inner boundary by the wall flow. This is illustrated in figure 2 where the outer wake flow is invarient (rather than "relaxing") from $X_{/H} \simeq 8$ onwards and is not changed until the inner readjusting flow works its way upwards through the wake. The growth in the height of this inner flow (for which δ_i is a standard notation) is a central feature of the flow as it is a measure of the flow's readjustment after the perturbation. It is difficult to see how the growth in the outer edge of the wake, which would be governed primarily by the entrainment of inviscid fluid by the outer flow, could be of the same importance.

The use of Z as a nondimensionalizing parameter does give a collapse of the results which is substantially better than that given by any other parameter. The results shown in Fig. 3 show a fairly high degree of correlation with each other even though they come from widely differing flows, $D/H = 0$ to $D/H = 10$. The use of Z is offered simply as the best procedure known to the authors.

The use of X/D as the scaling parameter does not result in downstream similarity either in the mean velocity or the longitudinal turbulence field. This can be appreciated by converting the X/H values on the profiles in Fig. 4 into X/D values and then comparing profiles with approximately corresponding values of X/D for the two gap sizes ($D/H = 1$ and 5). The authors hold to their view that far downstream of the gap the flows have forgotten the details of their distortions and are reapproaching equilibrium in a similar manner and that Fig. 4 supports this view.