Authors' Closure

The authors are appreciative of the kind remarks and interest shown in this work. The remarks by Prof. Vance and Dr. Walton are addressed together in our reply. In assessing the onset speed of cavitation, consideration was not given to pressurizing the oil supply to permit variations of this parameter for comparison with the clearnace changes. We would have required a different sealing arrangement to handle this type of investigation since the bellow seal described in the paper was not designed to handle pressurization. Concerning the bubble-growth process, the growth and collapse was indeed synchronous with rotational speed and there was some precession of the bubble in the direction of whirl for the non-centered case. An LED indicator together with a capacitance type proximeter probe was used in the filming to indicate the occurrence of the minimum-minimum clearance. One could thus observe bubble motion relative to the minimum film line. In addition, calculations indicate that some precession of the bubble should occur relative to the minimum film line depending on the transport velocity of the fluid through the cavitated region. With regard to bubble appearance, Figure 6 for the most part typifies our observations. In some instances the cavitated region appeared as a coalescence of several bubbles (viz. Figs. 6(*a*) and at other times it would appear with irregular streamers (viz. Figs. 6(*b*) and 6(*c*)) commonly observed during steady-state running. With regard to the lack of residual bubbles in the aftermath of the cavitation event, we believe that the low running speed used in this investigation enabled us to perform tests without the hinderance of air entrainment. We have subsequently performed calculations (Sun and Brewe, 1990) that indicate there is not enough time for gas to re-dissolve in the fluid. Thus the absence of residual bubbles after the main event leads one to believe that the cavitation observed was vaporous when air entrainment was not a factor. Subsequent testing to the writing of this paper indicates that air entrainment becomes a problem at higher running speeds. Thus we are led to believe that this accounts for the discrepancy reported by the separate findings of Dr. Walton and Prof. Vance.

Professor Jacobson furnishes some very incitefull information. As pointed out, the surface adherence of the film is important in considering oil transport through the cavitated region. This becomes an important factor in modeling cavitation for numerical calculations. To comment further, if the surfaces are identical and the bearing is heavily loaded, the attachment will be to both surfaces and the fluid transport will be governed by the average surface velocity of the two surfaces. Under lightly loaded conditions, it is known that the fluid attaches itself to the faster moving surface. Thus the fluid transport is governed by the faster moving surface. If the surfaces have different surface tension characteristics, then depending on how they are different, the fluid can attach itself to either or both surfaces as pointed out by Prof. Jacobson. The fine detail of the inner structure is not so important in present cavitation models as long as the mass content is conserved.

Additional Reference

Sun, D. C. and Brewe, D. E., 1990, "Two Reference Time Scales for Studying the Dynamic Cavitation of Liquid Films," NASA TM 103673/ AVSCOM TR 90-C-030.

