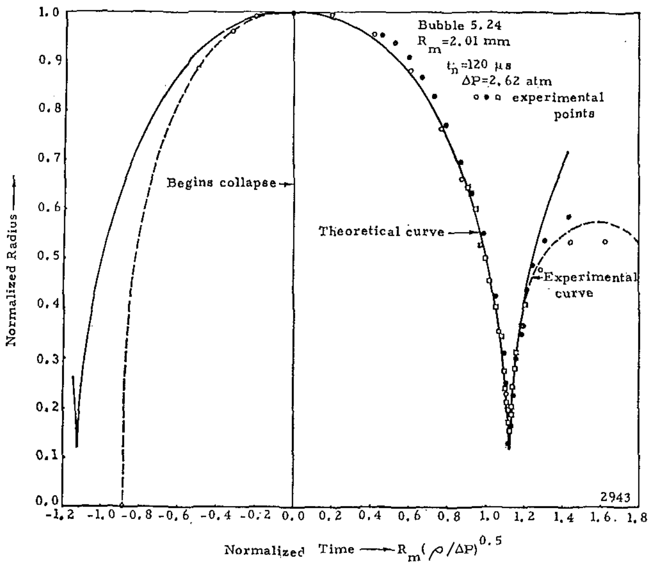

Fig. 9(a) Normalized radius versus normalized time for the spark induced cavitation bubble shown in Fig. 4 (serial no. 2951)

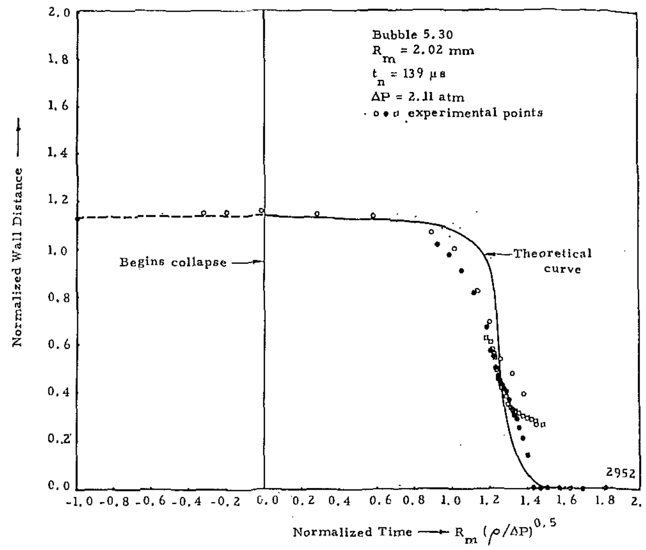

Fig. 9(b) Normalized wall distance versus normalized time for the spark induced cavitation bubble shown in Fig. 4 (serial no. 2952)

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DISCUSSION

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The authors are to be congratulated on a very well done piece of experimental work. Although this discusser has no quarrel with any of the observations or analyses, there are a few items that I believe deserve some further explanation. First, the jet impingement velocity of the bubbles is in the range of 50 to 100 m/sec (Table 1 of paper) while the high speed liquid jets, whose damage the bubble damage is compared to, apparently had a velocity of 600 to 700 m/sec. Would a lower speed liquid jet, perhaps of smaller diameter, produce damage comparable to the bubble induced damage? Second, the results indicate that no damage was induced by the collapse of a bubble initially attached to the wall. However, the analytical and experimental results of Naudé and Ellis (reference [14] in paper) seem to indicate that this type of bubble collapse is capable of producing damage. Do the authors have an explanation for this discrepancy?

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Authors' Closure

The questions raised by Professor Dodge are most readily explained with reference to the experimental equipment and impingement materials used for this investigation. Unfortunately, the apparatus used to produce the 600m/s liquid jets could not produce jets in the 100m/s range; however, the damage potential of the lower speed jets produced during bubble collapse is indicated by the "water hammer" pressure (Table 1). Therefore, the striking similarity in the damage pattern is the major comparison between the high speed liquid jets and the bubble collapse produced, lower speed jets. The actual damage produced depended upon the impingement material. The 50μ thick aluminum foil was soft enough to be damaged by the jets produced during each nearby bubble collapse, but hard enough not to be effected by the collapse of an attached bubble. When a stronger 500μ thick aluminum foil was used to coat the wedge, only three pits were produced for 50 nearby bubble collapses, while the aluminum plate used by Naudé and Ellis was soft enough to be damaged by either the initiating spark or the jet produced by the collapse of the attached bubble.