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Water Balloon Rupture in Low-G

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Fig. 1


Fig. 3


Fig. 2


Fig. 4

WATER BALLOON RUPTURE IN LOW-G

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A qualitative study of the bursting of water balloons in a simulated low-gravity environment was conducted aboard NASA Lewis's DC-9 aircraft. Following rupture by a syringe needle, the balloon retracts tangent to the water surface leaving a smooth surface near the puncture location, Fig. 1. Asymmetries soon develop as the membrane rips apart, ejecting a directional spray from the surface. When the balloon parts from the drop entirely, it causes a large deformation of the remaining liquid mass leading to significantly underdamped oscillations which persist for the duration of the simulation.

In Fig. 2 an approximately 2.5 liter blob of undulating water hovers after rupture of the membrane. A free floating, red-dyed water blob flattens, crowns, and breaks up after impact by an impinging blue-dyed water jet, Fig. 3. In Fig. 4 a large air bubble is blown into a free floating blob using a straw. Such flows are *unearthly* in that a balance is struck between capillary and inertial forces over truly large length scales.

The tests were performed to develop techniques to rapidly deploy large liquid drops in a microgravity environment. The footage has also proven of general interest and is used to introduce students to low-g phenomena. Quicktime movies may be found at http://zeta.lerc.nasa.gov/balloon/blob.htm. Related ground tests were also performed using high-speed video photography and may be found at http://zeta.lerc.nasa.gov/balloon/hs.htm.

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