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Revisiting the first fluid interface experiment in space<sup>1</sup> YONGKANG CHEN, MARK WEISLOGEL, Portland State University, WILLIAM MASICA, FRED KOHL, NASA Glenn Research Center retired, ROBERT GREEN, NASA Glenn Research Center — This year marks the 54th anniversary of the first fluid physics experiment performed aboard a spacecraft during the Mercury-Atlas 7 mission (MA7). The MA7 experiment test cell served as an early model for a spacecraft liquid fuel tank consisting of a circular standpipe mounted within a spherical container. The low-g free surface configuration was dependent on contact angle, fluid fill fraction, standpipe dimensions, and initial conditions. Well-behaved symmetric equilibrium interfaces in the symmetric tank were expected and observed during the historic flight. We revisit the problem here employing a modern numerical tool and discover a rich variety of asymmetric fluid interface configurations that were not observed during the experiment. Interestingly, experimental support for these newly-computed outcomes may be found in 54 year old drop tower data collected by the original NASA investigator team. In short, rotationally symmetric nodoidal surfaces are unstable in a certain domain giving rise to highly asymmetric surfaces with significant shifts in the mass center of the liquid. The NASA team selected a fluid fill level for MA7 that 'fortunately' fell outside this domain.

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