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Observation and Simulation of Motion and Deformation for Impact-Loaded Metal Cylinders* R.J. HICKMAN, J.L. WISE, J.A. SMITH, J.P. MERSCH, C.V. ROBINO, J.G. ARGUELLO, Sandia National Laboratories — Complementary gas-gun experiments and computational simulations have examined the time-resolved motion and post-mortem deformation of cylindrical metal samples subjected to impact loading. The effect of propagation distance on a compressive waveform generated in a sample by planar impact at one end was determined using a velocity interferometer to track the longitudinal motion of the opposing rear (i.e., free) surface. Samples (24 or 25.4-mm diameter) were fabricated from aluminum (types 6061 and 7075), copper, stainless steel (type 316), and cobalt alloy L-605 (AMS 5759). For each material, waveforms obtained for a short (2 mm) and a long (25.4 mm) cylinder corresponded, respectively, to one-dimensional (i.e., uniaxial) and two-dimensional strain at the measurement point. The wave-profile data have been analyzed to (i) establish key dynamic material modeling parameters, (ii) assess the functionality of the Sierra Solid Mechanics-Presto (SierraSM/Presto) code, and (iii) identify the need for additional testing, material modeling, and/or code development. The results of subsequent simulations have been compared to benchmark recovery experiments that showed the residual plastic deformation incurred by cylinders following end, side, and corner impacts. *Sandia National Laboratories is a multi-program laboratory managed and operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.

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