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Developing materials to mitigate hypervelocity and hypersonic threats FREE

Alane Lim

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Recently established facility at Texas A&M University advances capabilities in studying hypersonic missile impacts.

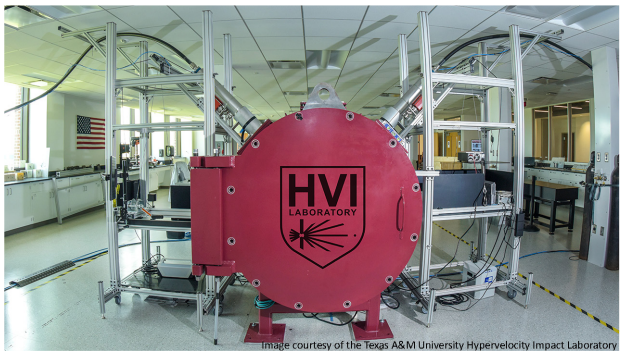

Image courtesy of the Texas A&M University Hypervelocity Impact Laboratory

The physics of hypervelocity impacts, or HVIs, is incredibly complex, so deepening our understanding of this topic could help facilitate the design of materials, structures, vehicles, and personnel gear that would protect against potential threats. Rogers *et al.* discuss the recently established Hypervelocity Impact Laboratory (HVIL), a facility at Texas A&M University dedicated to studying HVI and hypersonic phenomena through state-of-the-art experimental, diagnostic, and simulation techniques.

At the HVIL, researchers can characterize materials subjected to ultra-high strain rates consistent with HVIs; develop and validate computationally efficient, physics-based, multiscale materials models for damage and failure prediction; couple recent theoretical developments in shock physics with advances in numerical methods to perform HVI risk assessments of materials and structures; and characterize environmental effects such as water or dust on hypersonic vehicles.

“Modern and unique experimental capabilities and innovations, diagnostic tool implementation and development, and representative HVI experiments and results are discussed,” author Jacob Rogers said. “The article also offers a useful review and discussion of two-stage light gas gun (2SLGG), experimental methodologies, diagnostic capabilities, 2SLGG prediction methods, and more.”

With this review, the authors hope to encourage the development of technologies that will improve the quality, characterization, analysis HVI data.

“The HVIL aims to develop enabling technologies necessary to increase the amount and fidelity of usable data from a single experiment, extend measurement capabilities and uncertainty quantification, and improve 2SLGG performance characterization,” Rogers said. “More robust and reliable high-rate material data is critical for the creation, validation, and implementation of the next generation of predictive models.”

Source: “The Texas A&M University hypervelocity impact laboratory: A modern aeroballistic range facility,” by Jacob A. Rogers, Nathaniel Bass, Paul T. Mead, Aniket Mote, Gavin D. Lukasik, Matthew Intardonato, Khari Harrison, James D. Leaverton, Kalyan Raj Kota, Justin W. Wilkerson, J. N. Reddy, Waruna D. Kulatilaka, and Thomas E. Lacy, Jr., *Review of Scientific Instruments* (2022). The article can be accessed at https://doi.org/10.1063/5.0088994.