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Paper Title: Computational Fluid Dynamics Models of the NASA White Sands Test Facility Particle Impact Test Nozzles

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Abstract: The particle impact ignition mechanism is considered to be the most effective means for igniting metals in gaseous oxygen environments and is a concern for every oxygen system. For this reason, the National Aeronautics and Space Administration (NASA) commits a large amount of resources attempting to understand and defend against this phenomenon. The most practical means of accomplishing this is through extensive of testing. To this end, over the years NASA has developed and built a facility and various apparatuses to test material or component vulnerability to a particle impact ignition. In testing materials, NASA uses sub-sonic and supersonic nozzles to replicate the conditions that a material is expected to experience in service. However, challenges include obtaining an understanding of the gas dynamics and of the particle behavior through and up to the point of impact at the material under test. One means of addressing these challenges is the use of computational fluid dynamics (CFD). If a CFD model can be built and validated, the model can then be used to confidently interrogate changes to inlet conditions and particle geometries, as well as changes to nozzle geometries to better simulate a material's in-situ conditions and greatly reduce or eliminate trial-and-error approaches in testing. This paper will show NASA's approach to and results of using CFD to better understand their particle impact nozzles.

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