SBIR 06.2 PHASE I - AWARD DETAILS	
ORGANIZATION	AMRDEC (M)
TOPIC NUMBER	A06-020
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YEAR OF AWARD	
AWARD START DATE	
AWARD COMPLETION DATE	
PROPOSAL NUMBER	A062-020-0394
TITLE	Transient, Rocket Exhaust Plume Modeling for Static Test Analyses
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COMPANY	Combustion Research and Flow Technology, Inc. 6210 Keller's Church Road Pipersville PA 18947-2010 Minority Owned: No Woman Owned: No Veteran Owned: No Number of Employees: 35
KEYWORDS	Static Testing, Exhaust Plume, CFD, Multiphase, Secondary Smoke
ABSTRACT	Our proposal addresses the high fidelity modeling of transient rocket exhaust plumes in a static test environment. Static testing provides a practical means of obtaining plume signature and interference data to support model validation. However, existing CFD codes routinely used for plumes in flight cannot accurately address many of the complexities associated with a static test environment. As such, we will extend an advanced state of the art Navier-Stokes code that contains much of the requisite physics (finite-rate chemistry, multiphase particulates, condensation/vaporization, etc.)and can operate in a dynamic grid framework. In Phase I, we will investigate the use of “all-speed” preconditioning techniques for mixed regions of high and low speed flow. We will formulate a technical approach to efficiently model a rocket motor exhausting into a quiescent environment including the effects of the test stand, the surrounding terrain, prevailing wind, and physical phenomena such as buoyancy, and secondary smoke formation. Procedures will be devised to accurately model the transient “start-up” and “shutdown” events of the rocket motor firing. We will demonstrate the ability of the extended model to analyze a transient rocket exhaust plume for a static test condition for a simplified geometrical configuration.

BENEFITS	There is significant commercial potential for this work. The ability to predict transient rocket exhaust plumes in a quiescent environment is of interest: for rocket/booster launch applications where dispersion of toxic elements in the exhaust is a major concern; for industrial applications (smokestacks) where transport of pollutant vapors is of concern; and, for many rocket exhaust applications involving varied forms of signal transmission (acoustics, IR, laser, etc) where the plume smoke (primary and secondary) is of interest. The upgraded computer code to be completed in Phase II will be a commercially desirable product to both the defense and commercial industries. Other specialized applications may include WMD applications related to bunker venting and/or post-hit cloud vaporization/ condensation; and meteorological weather prediction applications.