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1. WORK STATUS

1.1 Analytical

The analysis of the generation of pressure waves in a particle fueled combustion system, described in the first semi-annual report, has been generalized to account for either solid or liquid fuel particles. In addition, the reference parameters have been redefined, leading to a self-consistent non-dimensional formulation which is based on the use of an appropriate time constant--in this instance--twice the life-time of the droplets. A manuscript describing this work has been accepted for presentation at the Second Annual Meeting of the AIAA in San Francisco, July, 1965.

The analysis has since been modified to account for the effects of realistic droplet motion. Results indicate that the transient combustion process is insensitive to the form of the drag coefficient, but more important that the particle-gas interaction itself constitutes a mechanism for the generation of a pressure overshoot. Hence particle ballistics may play a significant role in the inception of combustion instability.

As a first step in accessing the influence of heat and mass transfer the gas dynamics of equilibrium particle gas

systems have been investigated. Results demonstrate that both processes have a negligible effect on the propagation of shock fronts, whose properties depend primarily on the concentration of particles.

A detailed analysis of the structure of the relaxation zone behind shock fronts propagating into a two phase mixture containing a volatile species has been developed. The study is essentially parametric in nature and accounts for the influence of droplet size, concentration of inert species, volatility and gas phase concentration of the evaporating species and shock wave Mach number. Regimes of condensation of vaporization have been delineated and the overshoot in gas phase properties found by other investigators for solid particle-gas mixtures has been demonstrated under specific conditions to occur also in the present case. The analysis is being extended to treat a three-particle size system.

1.2 Experimental

The injector used in preliminary experiments was found to perform erratically. Consequently, two new fuel injection systems have been devised. The first, a coaxial pneumatic injector, is designed to produce a reproducible polydisperse spray. Fabrication has been nearly completed and tests are scheduled for the near future. Attempts to generate a uniform sized

spray cloud are being carried out using a second system which is based on the principle of a vibrating capillary. Initial efforts with a single capillary have been reasonably successful and tests of a multiple element injector will be initiated shortly.

A. K. Oppenheim
Professor and
Faculty Investigator

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