Books & Reports

Study of Rapid-Regression Liquefying Hybrid Rocket Fuels

A report describes experiments directed toward the development of paraffin-based hybrid rocket fuels that burn at regression rates greater than those of conventional hybrid rocket fuels like hydroxyl-terminated butadiene. The basic approach followed in this development is to use materials such that a hydrodynamically unstable liquid layer forms on the melting surface of a burning fuel body. Entrainment of droplets from the liquid/gas interface can substantially increase the rate of fuel mass transfer, leading to surface regression faster than can be achieved using conventional fuels. The higher regression rate eliminates the need for the complex multi-port grain structures of conventional solid rocket fuels, making it possible to obtain acceptable performance from single-port structures. The high-regression-rate fuels contain no toxic or otherwise hazardous components and can be shipped commercially as non-hazardous commodities. Among the experiments performed on these fuels were scale-up tests using gaseous oxygen. The data from these tests were found to agree with data from small-scale, low-pressure and low-mass-flux laboratory tests and to confirm the expectation that these fuels would burn at high regression rates, chamber pressures, and mass fluxes representative of full-scale rocket motors.

This work was done by Greg Zilliac and Shane DeZilwa of **Ames Research Center** *and M. Arif Karabeyoglu, Brian J. Cantwell, and Paul Castellucci of Stanford University. Further information is contained in a TSP (see page 1).*

Inquiries concerning rights for the commercial use of this invention should be addressed to the Patent Counsel, Ames Research Center, (650) 604-5104. Refer to ARC-14486-2.

More About the Phase-Synchronized Enhancement Method

A report presents further details regarding the subject matter of "Phase-Synchronized Enhancement Method for Engine Diagnostics" (MFS-26435), *NASA Tech Briefs*, Vol. 22, No. 1 (January 1998), page 54. To recapitulate: The phase-synchronized enhancement method (PSEM) involves the digital resampling of a quasi-periodic signal in synchronism with the instantaneous phase of one of its spectral components. This resampling transforms the quasi-periodic signal into a periodic one more amenable to analysis. It is particularly useful for diagnosis of a rotating machine through analysis of vibration spectra that include components at the fundamental and harmonics of a slightly fluctuating rotation frequency. The report discusses the machinery-signal-analysis problem, outlines the PSEM algorithms, presents the mathematical basis of the PSEM, and presents examples of application of the PSEM in some computational simulations.

This work was done by Jen-Yi Jong of AI Signal Research, Inc., for **Marshall Space Flight Center**. *For further information, contact the company at asri@aisignal.com or (256) 551-0008.*
MFS-31409