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Investigation of Non-Conventional Bio-Derived Fuels for Hybrid Rocket Motors

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Abstract: Non-conventional bio-derived fuels have been evaluated for use in hybrid rocket motors. Tests were conducted at combustion pressures in the range of 100 - 220 psig and thrust levels of 40 - 170 newtons. Beeswax was tested with oxygen as the oxidizer and showed a regression rate at least three times as high as traditional hybrid propellant combinations such as hydroxyl-terminated polybutadiene (HTPB) and liquid oxygen (LOX). This provides the promise of a high thrust hybrid rocket motor using a simple, single port geometry and overcomes the main weakness of traditional hybrid rocket motor propellants, which are low regression rates. Beeswax was also tested with nitrous **oxide** as an oxidizer, but further testing is needed to attain high enough combustion chamber pressures to achieve stable combustion. Experimental evaluation of the specific impulse for beeswax and oxygen was moderately successful for lab scale testing, but needs further refinement. Analytical studies were performed to evaluate the theoretical performance of non-conventional hybrid rocket motors This analysis indicates beeswax, lard, a mixture of paraffin and lard, and combinations of beeswax and **aluminum** should all perform better than traditional hybrid rocket propellants considered when burned with oxygen.

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Limitations:	APPROVED FOR PUBLIC RELEASE
Description:	Doctoral thesis
Pages:	144
Report Date:	AUG 2007
Report Number:	A534074

Keywords relating to this report:

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- COMBUSTION CHAMBERS
- FUELS
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- HYBRID ROCKET ENGINES
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