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MEMORANDUM FOR PRS (Contractor Publication)

FROM: PROI (STINFO) 20 October 2000

SUBJECT: Authorization for Release of Technical Information, Control Number: **AFRL-PR-ED-AB-2000-226**
Liu, C.T.; Kwon, Y.W. (Naval Postgraduate School), and Hendrickson, T.L., "Predicting the Initial Crack Length in a Solid Propellant"

JANNAF 34th Structures & Mechanical Behavior Subcommittee Meeting
(Cocoa Beach, FL, 20-26 Mar 2001) (Deadline: 06 Nov 2000) **(Statement A)**

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PHILIP A. KESSEL Date
Technical Advisor
Missile & Space Propulsion Division

12th Nondestructive Evaluation Subcommittee (NDES)
21st Rocket Nozzle Technology Subcommittee (RNTS)
34th Structures & Mechanical Behavior Subcommittee (S&MBS)
Joint Meeting
26-20 March 2001
Doubletree Oceanfront Hotel, Cocoa Beach, Florida

ABSTRACT

Title of Paper: Predicting the Initial Crack length in a Solid Propellant

Author(s): C.T. Liu ,Y. W. Kwon, and T. L. Hendrickson

Is this paper an update? , Yes , No. X Has it been presented elsewhere? , Yes , No. X

In this study,a micro-macromechanical approach was used to predict the initial crack length near the edge of the hole in solid propellant specimens. The approach was based on a simplified micromechanical model, damage mechanics at the micro-level, and finite element analysis at the macro-level. Both micromechanical and macromechanical analyses were conducted in tandem. The developed technique together with a mechanistic criterion was used to predict the initial crack length in high stress regions. The criterion was based on the instability of the damaged material just ahead of the crack tip. The initial crack length is equal to the length of unstable material zone when the damage at the crack tip element is saturated. Based on the definition of the initial crack length and the micro-macromechanical approach, the initial crack lengths in the high stress regions were predicted. The predicted initial crack lengths and the experimentally measured values were compared and the results were discussed.