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INVESTIGATION AND EVALUATION OF NONFLAMMABLE, FIRE-RETARDANT MATERIALS

Final Report

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By

S. Atallah
H. Buccigross

Prepared by

Arthur D. Little, Inc.
Cambridge, Massachusetts

for

EUSTIS DIRECTORATE
U.S. ARMY AIR MOBILITY RESEARCH AND DEVELOPMENT LABORATORY
FORT EUSTIS, VIRGINIA

ABSTRACT

The objective of this study was to evaluate the feasibility of containing or restricting in-flight or postcrash helicopter fires to allow the crew and passengers to escape or remain within a livable environment until the fire could be extinguished or the burning fuel consumed.

A comprehensive survey was made of present materials technology. A number of materials and composites were selected and tested in a specially designed furnace capable of providing a thermal flux equivalent to that encountered in JP-4 fires. Final candidate wall systems were compared for protection effectiveness, cost and weight penalty. Various combinations of isocyanurate foams, sodium silicate hydrate panels, a mineral insulation, and intumescent mastic paints were then applied to the walls of two crash-damaged helicopters (UH-1D and CH-47) and exposed to full-scale fires simulating in-flight and postcrash fires. The helicopters were fully instrumented to measure temperature, heat flux, smoke density, and toxic gases.

The results of the in-flight simulation tests indicated that it should be possible to protect the habitable compartment against a fire occurring in an adjacent compartment resulting from a fuel or hydraulic oil line leak. Sodium silicate hydrate panels placed on the fire side appeared to give the best performance.

Interior temperature and heat fluxes were above tolerable levels for humans during the postcrash fire tests in both helicopters. Smoke and particulates were also judged to be too high for human tolerance. Penetrations in the CH-47 walls occurred where isocyanurate foam could not be applied because of the presence of wiring, air ducts and hydraulic oil tubes.

The UH-1D walls did not lend themselves to foaming because of the absence of ribs and formers. The sodium silicate hydrate panels used to protect the interior walls partially collapsed because of the absence of structural support.

It was concluded that total wall protection of existing helicopters against postcrash fires is not feasible and should not be pursued any further because of cost, unreliability, and lack of assurance that the walls will maintain their integrity in a crash.