

DEVELOPMENT OF A NOVEL CONCEPT OF EXPLOSION-RESISTANT CARGO CONTAINER FOR NARROW-BODY AIRCRAFTS

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Abstract

The rise in worldwide terrorism has required measures be taken to protect aircrafts from catastrophic in-flight failure due to concealed explosives. This paper presents the development of a concept of flexible textile-based luggage container able to resist a small to medium explosion by controlled expansion and containment of the overpressure and absorbing the shock waves whilst, at the same time, preventing hard luggage fragments from striking the main structure of the aircraft at high speed. A multi-layered “soft-sandwich” structure is required to absorb the large dynamic loads of the explosion and the large deformation related to the gas expansion. The concept under development is based on a multi-layered textile structures made of ballistic yarns as an internal high strength layer, coupled with an external ductile layer which is deforming in a controlled way during the explosion, in a kind similar to air-bags in cars. Composite elements and textile belts contribute with reinforcement and containment functions.

Keywords Aircraft safety; counterterrorism, blast resistant container; technical textiles.

1. Introduction

The rise in worldwide terrorism requires that measures be taken to harden aircrafts against catastrophic in-flight failure due to terrorist bombings. Since the crashes of Air India Flight 182 (1985, 329 casualties) and Pan Am Flight 103 (1988, 270 casualties), both of which exploded due to bombs concealed within the passengers' baggage, much effort has been carried out by governments and international bodies to prevent such disasters; nevertheless, the risk that a small quantity of an explosive, below the threshold of the detection instruments, could get undetected is not negligible. The introduction of countermeasures to reduce the effects of on-board explosions has to be considered. Hardened luggage containers (HULD) have been developed for the latter scope, but their shortcomings, the biggest being their high weight and high cost, have prevented their wide utilisation and market acceptance; moreover, they are not available for most narrow-body aircrafts. The issue of containing explosions aboard narrow-body aircrafts has yet to be resolved.

FLY-BAG aims at addressing these issues, by means of a multidisciplinary approach to the study, design, prototyping and validation of a novel concept of textile-based blast resistant luggage container for the aviation