

THREATS TO MILITARY TRANSPORT AIRCRAFT: A TECHNICAL REVIEW

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Abstract. Without assuming any particular operational scenario, possible threats to military transport aircraft include hits from small arms, high explosive incendiary projectiles with impact or proximity fuzes, frangible armour piercing discarding sabot (APDS) rounds, and small warheads from man-portable anti-aircraft missiles or medium-to-large anti-aircraft warheads. This paper briefly describes each of these threats and their potential effect on aircraft. The hit density as a function of distance is schematically presented whereby high hit densities lead to different synergistic effects. The principal function of radar proximity sensors is briefly described, as well as the prediction of the initial velocities of fragments and their decrease in the ambient atmosphere. Some tests are proposed to define quantitatively the blast/fragmenting loads on aircraft skins with cost-effective individual fragment tests and with fragment generators for high hit densities.

INTRODUCTION

While military aircraft structures should be as light as possible, they should also have high resistance to attack by the impact of small-arms projectiles, high-explosive rounds, or anti-aircraft warheads. One of the major difficulties in designing aircraft to survive attacks by these types of threats is that the type of attack will depend on the operational scenario, which cannot (particularly in modern warfare) be accurately predicted in advance. Aircraft therefore need to be protected against attacks from the full wide spectrum of possible threat scenarios.

THREATS

The possible threats to military transport aircraft can be divided into three main categories, as illustrated in Figure 1:

- small-arms projectiles,
- medium-calibre projectiles, and
- blast/fragmenting anti-aircraft warheads fired from man-portable air defence systems (MANPADS) and small missile systems.

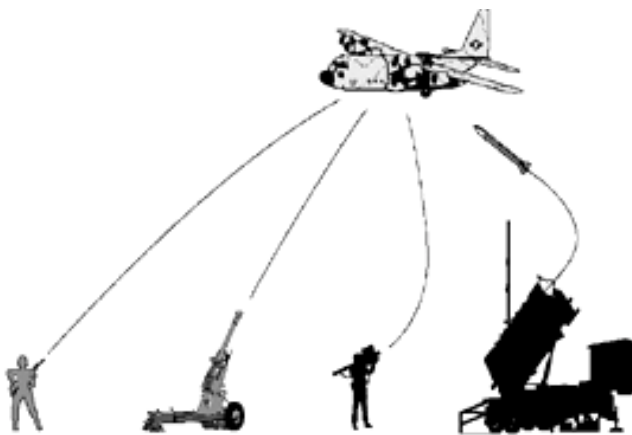


Figure 1. The main threats against military transport aircraft.

Small-arms Projectiles (Bullets)

Bullets are fired from small arms such as rifles and machine guns. The calibre of the bullets lies typically between 5.56 mm and 14.5 mm. When fired from short ranges, the commonly used ball projectiles can perforate steel that is around 6-mm thick. The so-called hard-core bullets, which have a high-hardened-grade steel core, can perforate approximately 17-mm of rolled-homogeneous armour (RHA) when fired from short ranges.

Sweden [1] has performed tests with 7.62-mm tungsten-alloy projectiles. Figure 2 shows the penetration as a function of distance through RHA of HB 400 and 0° NATO angle compared with a normal AP projectile with a steel core.

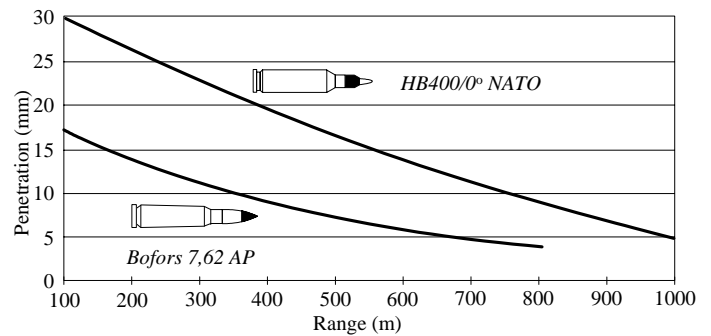


Figure 2. Swedish tungsten-alloy penetration capability through high-grade RHA plates (upper line) in comparison to a normal AP projectile (lower line).

The velocity of a small arms projectile decreases relatively rapidly with distance. Hits against aircraft are therefore only possible when the aircraft flies at low altitudes such as during takeoff and landing or during operation with low-altitude parachute-extraction systems. Consequently, the hit probability of small arms against aircraft is generally very low. However, in a hail of projectiles fired from many rifles, the possibility of some hits on cargo aircraft cannot be fully excluded.

Even if an aircraft is hit by small-arms fire, however, the damage is most likely to be very limited because most

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