

## FITTING A HIGH-PERFORMANCE GUN ON A LIGHTER PLATFORM

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**Abstract.** There is great interest in the design and manufacture of lightweight weapon platforms that have capabilities near to existing heavy armour systems. This quest initially started with the requirement to transport field artillery guns via helicopter. With the change in the global situation, the threat has changed and new enemies have developed. This has given birth to *rapid deployment forces* capable of being effective in a short time. Naturally this force has to be highly mobile (fly light), with its direct-fire weapon platform being able to be delivered to the theatre of operations by C130 or A400 type aircraft. This has imposed serious limitations on the overall weight of a piece of equipment, limiting it to 17–25 tonnes. On the other hand, it is desired that the firepower of this platform matches existing systems. The aim of this paper is to look at some existing guns, having a bore sizes in the region of 105–140 mm, and their mounting on a light platform (17–25 tonnes). Work reported here concentrates on highlighting some of the important constraints that exist and possible ways of dealing with them.

### NOMENCLATURE

$cg$	Centre of gravity
$d$	Turret ring diameter
$h$	Trunnion height
$k$	Krupps constant = $1 + v_a/v_p$
$m_c$	Charge mass
$m_p$	Projectile mass
$M_{Rm}$	Mass of recoiling components
$R$	Firing load (Trunnions pull)
$R_1, R_2$	Reaction as a result of gun fire at the rear and front end support respectively
$R_{mean}$	Mean trunnions pull
$E_{Recoil energy}$	Recoil energy
$R_{w1}, R_{w2}$	Reaction due to the turret weight at the rear and front end support respectively
$T$	Horizontal distance between the turret ring centre and the trunnion
$\theta$	Angle of elevation
$v_a$	Acoustic velocity
$v_c$	Charge velocity
$v_p$	Projectile velocity
$V_{Rm}$	Velocity of the recoiling parts
$W$	Gun weight
$x$	Distance between the gun cg and the trunnion
$Z$	Recoil travel

### INTRODUCTION

There is much interest in the design and manufacture of light weapon platforms having capabilities near to that of existing heavy armour. This quest originally started with the requirement to transport field artillery guns by helicopter, which led to a reduction in weight of about 50%. FH70 weighs about 9,000 kg, while M777, selected for the US Marine Corps, weighs about 4,000 kg.

The modern trend is to develop rapid deployment forces typically consisting of light armour, light guns, and light forces that are able to fly light, yet are armed and armoured heavily to engage effectively with the enemy. Consequently

there is a requirement to design and manufacture armoured vehicles, which weigh in the region of 17–25 tonnes, that are C130/A400 transportable, and have the necessary firepower to destroy existing T-series armour. Hence US and UK effort is now concentrated on the Future Combat System (FCS) [1,2] and the Future Rapid Effect System (FRES) programmes respectively [1,3].

The deployment of existing and future fighting vehicles is more likely to favour wheeled platforms to improve ride, economy of fuel, and dash speed. This has a direct impact on vehicle dimensions, as more space is required to accommodate a suitable size and the number of wheels. On the other hand, the inclusion of wheels will increase platform height. Although not a UK requirement, it may also be desirable for the vehicle to have an amphibious capability—this has a direct impact on mass in order to improve its buoyancy. Rapid reaction force demands that these vehicles can be transported into theatre as soon as possible, which means they will either be transported in C130s or A400s, which puts serious and strict limitations on mass, width, and height. As a result, existing heavy armour that weighs approximately 60–70 tonnes and has 18.5 cubic metres of internal volume must be reduced to approximately 17–25 tonnes, having an internal volume of 11 cubic metres. This means that the available space has reduced by 40%. Nevertheless, the requirements of protection and firepower remain the same. Light vehicles having thin armour must rely more on active protection, or be designed so that additional armour can be added prior to participation in the action. It is also desirable to have the same firepower capability or, better still, to improve it.

The aim of this paper is to look at some of the existing guns, with a bore size in the range of 105–140 mm, and their ability to be mounted on a light platform (17–25 tonnes).

Work reported here concentrates on highlighting some of the important constraints that exist and possible ways to deal with them. Generally, the gun is mounted in a turret providing protection to the crew; this can be considered the conventional method. In the past, and also recently, some manufacturers have tried mounting guns, without a turret, externally above the platform hull. This allows the gun to have a longer recoil stroke. In addition, the crew is located inside the hull. This paper also identifies advantages and disadvantages of both approaches.

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