

Enhancing Dual-Purpose Child Store Performance Against Diverse Military Targets: An Innovative Novel Approach

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Abstract: Military organizations, like their civilian counterparts, must adapt to future challenges and the evolving global landscape. Falling behind in technical innovation can lead to obsolescence. Hence, advocating for internal changes within the military is crucial. In this context, "Child store" refers to a cutting-edge technology or system designed to enhance dual-purpose equipment for targeting both soft and hard military objectives. This technology improves performance and adaptability across various operational scenarios. The objective of this research is to explore advanced techniques that enhance the operational capabilities of military systems. Employing qualitative analysis, the study focuses on technical advancements crucial for deterring conflicts during peace and providing strategic options during crises. During wartime, these innovations improve combat efficiency, minimize casualties and equipment damage, and offer cost-effective conflict resolutions. Understanding and implementing these advancements is vital for maintaining a competitive edge and effective military readiness.

Keywords: *Child Store; Hard Targets; Soft Targets; Military Targets; Performance; Dual-Purpose.*

INTRODUCTION

In the coming decades, the current systems and activities of military establishments are likely to be replaced by more advanced and effective means and ways of battle. The focus of this study is the "military-technical revolution" (MTR) [1]. The speed at which this transformation will occur is uncertain, especially considering that the amount of competition that drove military innovation during the Cold War is unlikely to happen again, at least in the near future [2]. However, the preliminary analysis of the MTR strongly confirms the hypothesis that, in due course, dominant military forces will utilize existing and emerging technologies, resulting in significant alterations to their methods of preparing for and executing warfare, and achieving substantial improvements in military efficiency [3].

Military structures, similar to their counterparts in the civilian sector, must exhibit their capacity to adapt and respond to the demands of the future and the rapidly transforming global landscape. As to the analysis conducted by Richard Foster and Sarah Kaplan from McKinsey, organizations that resist adapting to changing conditions and fail to keep up with the evolution of their target markets are destined to fail [4]. Similarly, a military that lags behind its peers in terms of technical progress is destined to fail. Hence, advocating for internal military reform is a prudent course of action that ought to be encouraged and, ideally, implemented [5]. Therefore, it is logical to make the necessary modifications that will have the most significant effect. The military typically has a greater inclination towards conservatism in the realm of innovation. Unlike the majority of enterprises, the military's strategy, tactics, and operations are seldom tested in direct battle. This suggests that while firms engage in everyday competition to make a profit, militaries should be prepared for an international conflict to refine their tactics and assess their effectiveness beyond controlled drills. So the main objective of this study are:

- To identify the latest techniques employed to improve the effectiveness of both soft and hard military targets
- To understand the impact of fragmentation and penetration effects on the effectiveness of both soft and hard military targets.
- To determine methods for increasing the penetration effect and to evaluate the efficacy of Bomblet design.

LITERATURE REVIEW

The subsequent part provides a detailed analysis of previous research pertaining to improving the performance of child stores with dual purposes against a wide range of military targets. A novel and innovative approach.

Tab. 1. Related Works

Authors and year	Methodology	Findings
Guo et al., (2019) [6]	Experiments with Reactive Liner Shaped Charge (RLSC), both without and with wave shaper, are performed against the steel plates at standoff distances of 0.5 CD, 1.0 CD, and 1.5 CD, respectively.	The experimental results showed that structural damage effects and penetration depths of steel plates decrease with standoff, but the RLSC without the wave shaper has much higher damage effects and penetration depths at the same standoff.
Do et al., (2020) [7]	Presented the influence of the wave shaper position on the jet formation and penetration depth of a shaped charge by using experimental and numerical method.	According to the findings, moving the plexiglass wave shaper closer to the liner apex increases jet tip velocity and jet velocity gradient. The investigation also found a wave shaper position with the maximum penetration depth.
Mei et al., (2022) [8]	Seven projectiles and two concrete target strengths were tested. The proposed formula is supported by our experiments and classic empirical models.	Next-generation semi-empirical resistance force formulas are coming. By studying the scaling issue with physical insights, this paper aimed to reconstruct Forrestal's resistance force manifestation. Damage and fracture, not plasticity, determine target failure under penetration in quasi-brittle materials like concrete and rocks.
Wang et al., (2023) [9]	A high-reduction numerical simulation model was created. Using experimental data, the damage mode of high-velocity prefabricated spherical fragments to sensitive structures, notably secondary damage from debris clouds, was explored.	This article can be used for aircraft design and damage mode analysis under diverse threat sources.
Catovic (2024) [10]	Asys Autodyn numerical simulations of projectile collisions were evaluated. The computer model materials were validated using experimental data.	Denser and harder penetrators increase penetration depth; other parameters being held constant. A projectile without a gilding metal jacket in the frontal ogive can reduce the energy spent stripping the jacket, which may increase penetration capability.

Research Gap

Considering military technological developments, there is a research void in systematically integrating creative methods to improve dual-purpose child shops' performance against soft and hard military targets. Current studies generally ignore fragmentation and penetration effects' synergy, especially in bomblet design optimization. Penetration augmentation approaches have been studied, but their use with these effects to improve target efficacy has not, leaving room for more research in these crucial areas.

A qualitative research methodology implemented for the purpose of this research in order to investigate the unique techniques that may be utilized to improve the performance of dual-purpose child stores in relation to a wide number of military targets. This research will be conducted in order to achieve the objective of this research. This strategy makes it possible to get a comprehensive understanding of complex occurrences by means of the acquisition and study of secondary data. Examples of secondary data include academic literature, technical reports, military manuals, and case studies. The collection of secondary data will primarily concentrate on the gathering of particular information concerning the processes that are currently being utilized in relation to fragmentation, penetration effects, and bomblet production. This will be the primary focus of the secondary data collection. A comprehensive study of these data is going to be carried out in order to get a better understanding of the patterns, gaps, and new trends that are occurring in the industry.

RESULTS AND DISUSSION

There is a multidimensional strategy that incorporates modern materials, precision engineering, and smart technologies, as revealed by the study's research of creative approaches to boost the performance of both soft and hard military targets. According to the findings of a review of secondary data [11,12,7], current developments in explosive formulation, detonation mechanisms, and targeting algorithms have resulted in a significant improvement in the accuracy and lethality of dual-purpose child stores. Adaptive fusing and programmable explosives are two examples of techniques that enable real-time adjustments to be made to environmental circumstances and target characteristics. This allows for optimal performance against a wide variety of military targets. An additional factor that contributes to the efficacy of these systems is the use of modern sensor technologies, which enables improved target recognition and categorization [7]. Not only do these improvements boost performance in comparison to conventional targets, but they also expand the potential of engaging non-traditional and defended targets. This highlights the need of continuing research and development in this particular field.

- The present study has identified several major regulating parameters that can be used creatively to enhance the effectiveness of the child shop within its scope or bounds. These modifications will enhance the weapon's efficacy in terms of its ability to penetrate and inflict damage on both hard and soft targets, respectively.
- The vertical standoff is calculated by measuring the gap between the kid store base and the copper cone base. Measured by explosive charge diameter.
- The existing warhead case material cannot withstand launch and impact firing forces; hence a tougher material can be created. The casing can be constructed to open in a certain way to spread bomblets effectively and controllably.
- Bomblets with more explosives detonate harder and can completely destroy the target. A bomblet containing more explosive will fragment more when detonated, increasing the possibility of damaging many targets within the blast radius.
- Cluster bombs provide tactical air aid most often. This method treats bombs like artillery. The plane wasn't in the appropriate position when it dropped, and the environment made an unguided bomb imprecise when dropped from a long distance or high altitude.

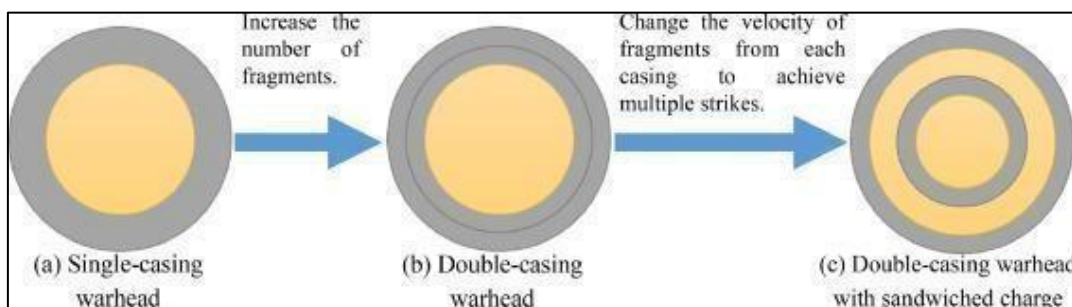


Fig. 1. Warhead employment in bomblet [15]

Role of Fragmentation and Penetration Effects

When it comes to establishing the efficacy of dual-purpose kid stores against both soft and hard targets, the study underscores the essential role that fragmentation and penetration effects play in understanding the effectiveness of these stores. The utilization of regulated detonation patterns and sophisticated materials that enhance shrapnel distribution and

impact has allowed for the optimization of fragmentation, which is an essential component in the process of engaging soft targets throughout the engagement process. According to the findings of the research, having precise control over fragmentation can considerably raise the likelihood of incapacitating troops and the likelihood of equipment being rendered inoperable within the target region. On the other hand, penetration effects are of the utmost importance when it comes to defeating hard targets like bunkers and armored vehicles. According to the findings of the study, developments in shaped charge technology and kinetic energy penetrators have led to an increase in the capability of munitions to penetrate reinforced structures. When dealing with situations that involve heterogeneous target settings, it is very necessary to take a balanced strategy in order to enhance the overall effectiveness of the mission. This is because the synergy between fragmentation and penetration is exceptionally important [13].

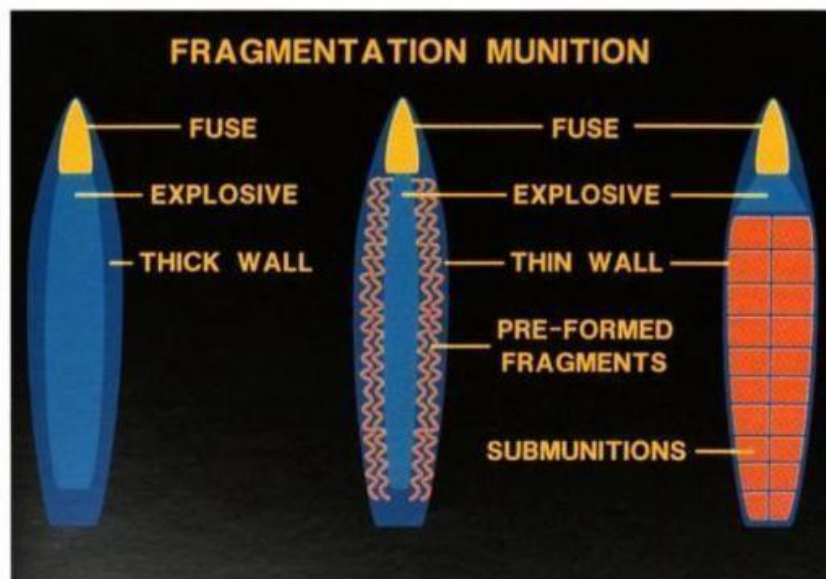


Fig. 2. Three types of fragmentation weapons (a) random fragment shell (b) Improved fragmentation shell with explosive charge (c) cluster munition with sub munitions/bomblet

Enhancing Penetration Effect

According to the findings of a comprehensive investigation into penetration enhancement techniques, there are a number of intriguing tactics that have the potential to further improve the efficiency of dual-purpose child stores. According to the findings of the study, the utilization of tandem warheads for the purpose of overcoming modern armor and fortifications is a particularly effective strategy. These warheads utilize a precursor charge to establish a breach, and then a primary charge to exploit the opening that has been created. Furthermore, it has been demonstrated that the incorporation of reactive materials and self-forging projectiles into the design of warheads results in a large improvement in both penetration depth and efficacy. An increase in the total penetration capability can be achieved by improving the shape and composition of penetrators, according to computational simulations and experimental data. This optimization can lead to significant improvements in both speed and impact force, hence enhancing the overall penetration capability [14]. The significance of these discoveries lies in the fact that they highlight the necessity of continuing research into material sciences and warhead engineering in order to develop penetration solutions that are the more robust and adaptable.

Effectiveness in Bomblet Design

The evaluation of this study's bomblet design focuses on the importance of precise engineering and flexibility in contemporary weapons technologies. The present designs of bomblets are characterized by their modularity and multi-functionality. This inclination enables a single type of ammunition to be suitable for multiple activities. Bomblets can optimize their impact by utilizing advanced technologies like as variable-yield explosives and smart fusing, which take into account factors such as target characteristics, distance, and mission objectives. Utilizing innovative materials that enhance fragmentation and penetrating capabilities is crucial for maximizing the lethality and effectiveness of bomblets.

The study also highlights that these elaborate patterns may incur higher costs and involve greater complexity [11]. Only two instances. Research on future bomblet technology should integrate improvements in performance with considerations of practicality.

CONCLUSION

According to the findings and discussions that were based on the objectives of the study, substantial breakthroughs have been made in the techniques, materials, and designs that boost the performance of dual-purpose kid stores against a variety of military targets. These findings not only highlight the potential for further innovation in this vital subject, but they also provide useful insights into the existing state of technology in the military weapons industry. The study makes a contribution to a more in-depth understanding of how fragmentation and penetration effects can be optimized, the ways in which penetration can be enhanced, and the design elements that contribute to the effectiveness of bomblets, which ultimately helps to support the development of military munitions that are more effective and adaptable.

REFERENCES

1. Schmid J. Technological emergence and military technology innovation. *Def Peace Econ* [Internet]. 2023;34(8):1091–109. Available from: <http://dx.doi.org/10.1080/10242694.2022.2076339>.
2. Best RH, Lahiri S. Hard choices, soft targets: Terror proscription and strategic targeting decisions of FTO. *Int Interact* [Internet]. 2021;47(6):955–85. Available from: <http://dx.doi.org/10.1080/03050629.2021.1962856>.
3. Raska M. Emerging Technologies, Defense Innovation & Military Change: How will the AI Wave Change Warfare in East Asia? 2024.
4. Foster R, Kaplan S. *Creative Destruction*. New York: Doubleday & Company, Inc; 2001.
5. Geantă V, Voiculescu I, Stefănoiu R, Chereches T, Zecheru T, Matache L, et al. Dynamic impact behavior of high entropy alloys used in the military domain. *IOP Conf Ser Mater Sci Eng* [Internet]. 2018; 374: 012041. Available from: <http://dx.doi.org/10.1088/1757-899x/374/1/012041>
6. Guo H-G, Zheng Y-F, Tang L, Yu Q-B, Ge C, Wang H-F. Effect of wave shaper on reactive materials jet formation and its penetration performance. *Def Technol* [Internet]. 2019;15(4):495–505. Available from: <http://dx.doi.org/10.1016/j.dt.2019.05.005>.
7. Do V, Le M, Bui X, Pham H, Nguyen P. Influence of wave shaper position on jet formation and penetration depth. *Adv Mil Technol* [Internet]. 2020;15(2):355–64. Available from: <http://dx.doi.org/10.3849/aimt.01385>.
8. Mei Y, Zhang A, Shen J, Wu B, Wei X. A fractal comminution approach for scaling issues of penetration failure of concrete target. *Eng Fail Anal* [Internet]. 2022;140(106553):106553. Available from: <http://dx.doi.org/10.1016/j.engfailanal.2022.106553>.
9. Wang Y-T, He Y-T, Zhang T, Fan X-H, Zhang T-Y. Damage analysis of typical structures of aircraft under high-velocity fragments impact. *Alex Eng J* [Internet]. 2023; 62:431–43. Available from: <http://dx.doi.org/10.1016/j.aej.2022.07.040>.
10. Catovic A. Comparison of Penetration Capability of Several Contemporary 5.56× 45 mm Projectiles into Hard Targets. *Advances in Military Technology*. 2024;19(1):71–90.
11. Janakiramaiah B, Kalyani G, Karuna A, Prasad LN, Krishna M. Military object detection in defense using multi-level capsule networks. *Soft Computing*. 2023;27(2):1045–59.
12. Cheung TM. A conceptual framework of defense innovation. *J Strat Stud* [Internet]. 2021;44(6):775–801. Available from: <http://dx.doi.org/10.1080/01402390.2021.1939689>.
13. Ahner D, McCarthy A. Response surface modeling of precision-guided fragmentation munitions. *J Def Model Simul Appl Methodol Technol* [Internet]. 2020;17(1):83–97. Available from: <http://dx.doi.org/10.1177/154851291881113>.
14. Petrudi AM, Vahedi K, Rahmani M, Petrudi MM. Numerical and analytical simulation of ballistic projectile penetration due to high velocity impact on ceramic target. *Frattura ed Integrità Strutturale*. 2020;14(54):226–48.
15. Ye P, Sun Q, Gao Q, Hao W, An X, Dong Y. Double casing warhead with sandwiched charge to produce multiple fragment groups for sequential hits: Concept and analysis of fragment velocity. *Int J Impact Eng*. 2021;158(104009):104009. Available from: <http://dx.doi.org/10.1016/j.ijimpeng.2021.104009>.