

**Averting Fiscal Vertigo: Lessons from Israel's Gaza
War - Balancing Fighter Jets Costs through
Alternatives \ Menashe Aivas**



According to a December 2023 article in the Washington Post, the Israel Defense Forces have launched over 29,000 air-to-ground munitions into Gaza since October 7, with 55 to 60 percent being precision-guided. The article analyzes the current use of jet-dropped munitions and explores alternatives like rockets, missiles, and artillery shells, assessing their cost-effectiveness and operational impact.

The article focuses on the economic efficiency and practical viability of various counterfire alternatives without considering broader strategic factors. It does not address the strategic implications of relying on counterfire over warfare maneuvering. Additionally, the article does not discuss the risks associated with concentrating forces in a few airbases, which are vulnerable to enemy attacks. This is a significant concern for the Air Force, which operates from a limited number of airbases, each with only a few air routes, making them susceptible to being targeted by enemy missiles and drones.

The Iranian attack on April 14 of this year illustrated the potential danger, showing that even a 99 percent interception rate might not prevent thousands of missiles and bombs from crippling Israel's air capabilities. Paired with the critical shortage of interceptors at all levels needed to counter the extensive range of threats. Nonetheless, these strategic considerations lie beyond the scope of the current article and should be examined in a separate discussion.

The analysis I conducted is inherently simplistic to facilitate a comparison between fundamentally different weapons and armaments. While different targets necessitate specific types of ammunition (such as fortified or underground targets), this comparison provides a general idea of the feasibility of preemptively softening targets using various counterfire methods.

Current Situation – The Use of Fighter Jets During the War in Gaza

- **Total Munitions Fired by Fighter Jets:** 29,000
- **Precision-Guided Munitions (PGMs):** 55-60%
- **Non-Precision-Guided Munitions (Non-PGMs):** 40-45%
- **Total Weight of Explosives:** 10,802,500 kg

Platform - Acquisition Costs, Depreciation, and Maintenance for Fighter Jets

Acquisition Cost

- **Average Cost per Jet:** \$50 million
- **Number of Jets:** 100
- **Total Acquisition Cost:** \$5,000,000,000

Depreciation

- **Lifespan:** 30 years
- **Annual Depreciation:** \$166,666,666.67

Maintenance and Operational Costs

- **Annual Maintenance and Operational Cost:** 10% of Acquisition Cost
- **Total Annual Maintenance and Operational Cost:** \$500,000,000

Total Annual Cost for Fighter Jets (100)

- **Total Annual Cost:** \$666,666,666.67

Costs for Current Fighter Jets Munitions

Precision-Guided Munitions (PGMs)

- **Example Models:** JDAM, GBU-12 Paveway II
- **Number of PGMs:** 16,675 (57.5% of total)
- **Total Explosives from PGMs:** 6,213,438 kg
- **Cost per PGM:** \$100,000
- **Total Cost of PGMs:** \$1,667,500,000
- **Cost per kg of Explosive:** \$115

Non-Precision-Guided Munitions (Non-PGMs)

- **Example Models:** Mk-82, Mk-84
- **Number of Non-PGMs:** 12,325 (42.5% of total)
- **Total Explosives from Non-PGMs:** 4,589,063 kg
- **Cost per Non-PGM:** \$10,000
- **Total Cost of Non-PGMs:** \$123,250,000
- **Cost per kg of Explosive:** \$21

Total Costs of Current Fighter Jets Munitions

- **Total Cost:** \$1,790,750,000

Overall Cost Breakdown

Category	Total Cost (USD)
Precision-Guided Munitions (PGMs)	\$1.67B
Non-Precision-Guided Munitions	\$123.25M
Total Costs of Current Fighter Jets Munitions	\$1.7B
Annual Cost for Fighters Jets (100)	\$666.67M
Total	\$2.46B

Alternatives - Comparative Analysis

1. 155mm Artillery Shells

Platform - Acquisition Costs of Artillery Systems, Depreciation, and Maintenance

Acquisition Cost

- **Example:** PzH 2000
- **Average Cost per Unit:** \$7 million
- **Number of Units:** 100
- **Total Acquisition Cost:** \$700,000,000

Depreciation

- **Lifespan:** 30 years
- **Annual Depreciation:** \$23,333,333.33

Maintenance and Operational Costs

- **Annual Maintenance and Operational Cost:** 10% of Acquisition Cost
- **Total Annual Maintenance and Operational Cost:** \$70,000,000

Total Annual Cost for Artillery Systems

- **Total Annual Cost:** \$93,333,333.33

Munitions Costs

- **Example:** 155mm M107 Shells
- **Number of Shells:** 1,080,250
- **Total Cost:** \$540,125,000
- **Cost per Shell:** \$500
- **Cost per kg of Explosives:** \$50/kg
- **Warhead Weight per Shell:** 6.87 kg

2. Rockets

Platform - Acquisition Costs of Rocket Systems, Depreciation, and Maintenance

Acquisition Cost

- **Example:** M270 MLRS
- **Average Cost per Unit:** \$4 million
- **Number of Units:** 100
- **Total Acquisition Cost:** \$400,000,000

Depreciation

- **Lifespan:** 30 years
- **Annual Depreciation:** \$13,333,333.33

Maintenance and Operational Costs

- **Annual Maintenance and Operational Cost:** 10% of Acquisition Cost
- **Total Annual Maintenance and Operational Cost:** \$40,000,000

Total Annual Cost for Rocket Systems

- **Total Annual Cost:** \$53,333,333.33

Munitions Costs

- **Example:** M26 Rocket
- **Number of Rockets:** 120,028
- **Total Cost:** \$1,200,280,000
- **Cost per Rocket:** \$10,000
- **Cost per kg of Explosives:** \$64.1/kg
- **Warhead Weight per Rocket:** 156 kg

3. Surface-to-Surface Missiles

Platform - Acquisition Costs of Missile Systems, Depreciation, and Maintenance

Acquisition Cost

- **Example:** ATACMS (MGM-140 Block 1)
- **Average Cost per Unit:** \$3 million
- **Number of Units:** 100
- **Total Acquisition Cost:** \$300,000,000

Depreciation

- **Lifespan:** 30 years
- **Annual Depreciation:** \$10,000,000

Maintenance and Operational Costs

- **Annual Maintenance and Operational Cost:** 10% of Acquisition Cost
- **Total Annual Maintenance and Operational Cost:** \$30,000,000

Total Annual Cost for Missile Systems

- **Total Annual Cost:** \$40,000,000

Munitions Costs

- **Example:** ATACMS (MGM-140 Block 1)
- **Number of Missiles:** 47,589
- **Total Cost:** \$71,383,500,000
- **Cost per Missile:** \$1,500,000
- **Cost per kg of Explosives:** \$6606/kg
- **Warhead Weight per Missile:** 227 kg

Alternative Systems and Munitions into Overall Cost Breakdown

Munition Type	Example	Number of Units	Total Explosives (kg)	Munitions Cost (USD)	Acquisition Cost (USD)	Annual Cost (USD)	Total Cost (USD)	Cost per kg (USD)
155mm Artillery Shells	PzH 2000 + M107 Shells	1.08M	10.8M	\$540.1M	\$700M	\$93.3M	\$1.33B	\$50
Rockets	M270 MLRS + M26 Rockets	120.03K	10.8M	\$1.2B	\$400M	\$53.3M	\$1.65B	\$64.1
Surface-to-Surface Missiles	ATACMS	47.59K	10.8M	\$71.38B	\$300M	\$40M	\$71.72B	\$6,606

Conclusions

The current costs for the counterfire by fighter jets used by the IDF in the Gaza conflict, including all related costs, amount to approximately \$2,457,416,666.67. This includes the fighter jets' operational costs and the munitions costs, both precision-guided and non-precision-guided munitions. This comparative analysis of firearms used in the Gaza conflict underscores the critical role of cost-effectiveness and economic considerations in military operations.

Category	Example	Operational Costs (USD)	Munitions Costs (USD)	Munition Cost per kg (USD)	Total Cost (USD)
Fighter Jets (Current Situation)	F-16, F-15	\$666.67M	\$1.79B	\$227	\$2.46B
Artillery Systems	PzH 2000 + M107 Shells	\$93.33M	\$540.13M	\$59	\$633.46M
Rockets	M270 MLRS + M26 Rocket	\$53.33M	\$1.20B	\$116	\$1.25B
Surface-to-Surface Missiles	ATACMS (MGM-140 Block 1)	\$40M	\$71.38B	\$6611	\$71.42B

This comparative analysis of firearms used in the Gaza conflict reveals the critical need for balancing cost-effectiveness with operational efficiency. The Israel Defense Forces (IDF) have deployed a substantial volume of munitions with diverse costs and capabilities. By examining the economic implications of precision-guided munitions (PGMs), unguided munitions, artillery shells, rockets, and ground-to-ground missiles, this article underscores the necessity of strategic selection to optimize both cost and operational outcomes.

Fighter Jets Munitions: Precision-Guided Munitions (PGMs) such as JDAMs provide exceptional accuracy but come at a high cost of \$115 per kg of explosive. Including platform depreciation and operational costs, the total cost rises significantly, making them valuable for high-value or strategically critical targets where accuracy is essential but impractical for extensive use. Unguided Munitions like the MK-82 are significantly more economical at \$21 per kg of explosive. Their lack of precision may lead to additional operational costs due to the need for repeat missions. Despite this, they remain the most cost-effective option overall when considering the total cost per kg of explosive.

Artillery Shells: Artillery Shells, exemplified by the 155mm M107, offer a cost-effective option at \$50 per kg of explosive for continuous bombardment. When factoring in operational costs and platform depreciation, they still provide a viable solution for scenarios where precision is less critical, and cost savings are prioritized.

Rockets: Rockets, such as M26, present a middle ground with a cost of \$64.1 per kg of explosive, balancing range and payload. They have better accuracy than artillery but have higher operational costs, positioning them as a balanced yet more expensive option.

Surface-to-Surface Missiles: Surface-to-Surface Missiles, like the ATACMS (MGM-140 Block 1), are the most expensive at \$6606 per kg of explosive. Including operational and

platform depreciation costs, their high cost makes them impractical for widespread use despite their precise long-range capabilities.

Total Costs per kg of Explosives Including Munitions, Platform Depreciation, and Operational Costs

- **Fighter Jets Munitions:** approximately \$227/kg
- **Artillery Shells:** approximately \$59/kg
- **Rockets:** approximately \$116/kg
- **Surface-to-Surface Missiles:** approximately \$6611/kg

Considering economic and cost-effectiveness factors, including operational and platform depreciation costs, it is recommended that the IDF adopt a mixed strategy prioritizing unguided munitions and artillery shells for the majority of their operations. These munitions offer the lowest cost per kg of explosives and are operationally feasible for sustained conflict scenarios. Precision-guided munitions (PGMs) should be reserved for high-value or strategically critical targets where accuracy is essential to justify their high cost. Rockets can serve as a supplementary option, providing additional range and accuracy when needed, but should be used judiciously to manage costs effectively.

This approach balances cost and operational efficiency, ensuring that the IDF can conduct prolonged operations without incurring unsustainable expenses. By strategically combining different types of munitions, the IDF can maximize its resources and maintain a robust and responsive military capability. This recommendation ensures that military objectives are met while maintaining economic sustainability and minimizing collateral damage.