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ANALYZING OPEN-SOURCE DATA TO INFORM MILITARY VEHICLE DESIGN

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ABSTRACT

The modern battlefield is increasingly transparent, generating large volumes of open-source data on the use, damage, and loss of military vehicles. This paper presents a structured methodology to exploit such data for deriving operational requirements for future vehicles. It uses a mixed-method framework combining qualitative reporting with quantitatively verified loss data. Daily battlefield reports are analyzed with large language models to extract operational context, employment patterns, and tactical conditions. These insights are cross-referenced with loss data to assess how operational factors affect vehicle survivability, with the findings being used to prioritize requirements that improve vehicle performance. The approach is demonstrated through a case study of Leopard tanks in the Russia-Ukraine war, using Institute for the Study of War reports and Oryxspioenkop loss data. Results show how open-source intelligence can systematically inform survivability, mobility, and combat effectiveness in modern vehicle design.

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1. INTRODUCTION

To maintain relevance, military vehicles must be able to adapt to the complex dynamics of the modern battlefield, shaped by persistent surveillance, precision fires, and rapid adversary adaptation. As a result, vehicles are typically designed to be upgradeable so they can respond to evolving requirements. However, traditional acquisition processes for these upgrades rely on classified reporting, post-conflict studies, and controlled testing, often leading to significant delays before upgrade packages are fielded [1].

Meanwhile, recent conflicts have generated an unprecedented volume of publicly available data documenting how vehicles are employed, damaged, and destroyed in near real time [2]. Widely shared images, videos, and reporting offer direct insight into battlefield performance, while daily reporting and documented equipment losses create a continuous record of vehicle employment and attrition. When analyzed systematically, this data can reveal broader patterns in survivability, mobility, and doctrine for these military vehicles.

This paper presents a methodology for analyzing open-source data to support the evaluation of military vehicles, with a focus on informing requirement generation and prioritization for future upgrade packages. The approach integrates narrative operational reporting with visually confirmed loss data to examine how vehicle design features interact with operational context. It is applied to a case study of the Leopard tank in the Russia–Ukraine war, demonstrating how open-source intelligence can identify recurring patterns and trade-offs relevant to future vehicle development and incorporate real-world combat observations earlier in the system design process.

2. BACKGROUND

2.1. The Challenges of Designing Military Vehicles

Designing military vehicles involves a level of complexity that is fundamentally different from commercial vehicle development. As shown in Figure 1, military platforms must balance survivability, lethality, and mobility, which are often in direct competition [3]. Increasing survivability typically requires additional armor, which adds weight and reduces mobility and payload capacity. Conversely, highly mobile systems must often sacrifice protection to remain maneuverable. Lethality further complicates this balance by driving the integration of advanced weapons, sensors, and networked systems, all of which increase demands on power, cooling, and crew coordination. These trade-offs are further constrained by cost, which directly affects how many systems can be fielded. This balancing challenge is intensified by an evolving battlefield, where survivability now includes

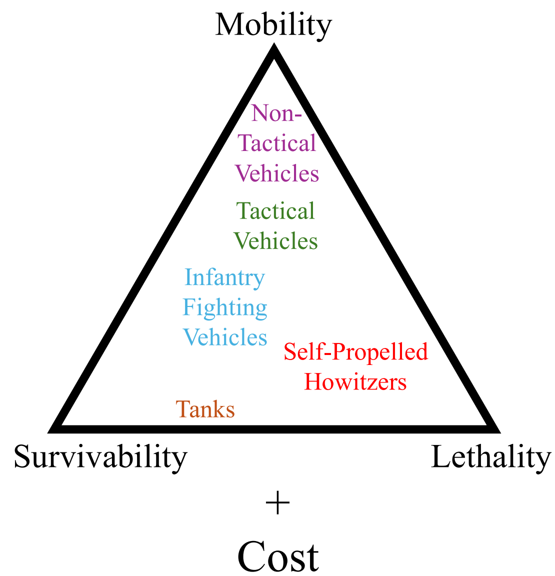

Figure 1: The trade-offs between survivability, lethality, mobility, and cost inherent in military vehicle design.

protection against mines, top-attack threats, and multi-spectral detection, and where the proliferation of precision fires, drones, and electronic warfare continues to reshape operational requirements.

Military vehicles also face far more demanding operating conditions than their commercial counterparts. They must function reliably under enemy fire, across severe terrain, with disrupted logistics, and in contested electromagnetic environments. These conditions require tight integration of mechanical, electrical, human, and digital subsystems, while accounting for complex and often cascading failure modes [4]. In contrast, commercial vehicle design operates within more predictable environments and is driven primarily by regulatory standards, cost efficiency, safety, and consumer expectations. As a result, commercial platforms emphasize reliability, efficiency, and user comfort, while military systems prioritize mission effectiveness, even at the expense of efficiency, cost, or technical risk.

Further, military vehicle development is shaped by long acquisition timelines, rigid requirements, and narrowly defined operational roles. Major programs can take decades to progress from concept to fielding, with requirements derived from formal processes and projected threat assessments that limit flexibility once development is underway [5]. Unlike commercial vehicles, which can be updated or replaced in response to market demands, military platforms must be designed to remain effective against anticipated threats far into the future. To do so, they are often designed to be upgraded to account for emerging threats; however, even these upgrades often require significant time.

2.2. The Increasing Availability of Open-Source Intelligence

Recent conflicts have underscored the growing role of open-source intelligence derived from publicly available platforms and independent analysis. The war in Ukraine has been particularly illustrative, generating a continuous stream of battlefield data from sources such as Telegram, X, YouTube, and commercial satellite imagery. Combatants and civilians routinely share images and videos of vehicle losses, weapons employment, and tactical engagements, often in near real time. At the same time, organizations such as Oryxspioenkop catalog visually confirmed equipment losses [6], while groups like the Institute for the Study of War (ISW) synthesize dispersed reporting into operational assessments [7]. Together, these sources provide an unprecedented level of visibility into modern combat.

This availability of data has important implications for the analysis and design of military vehicles. Open-source imagery and reporting offer direct evidence of how armored platforms perform against contemporary threats, including top-attack weapons, loitering munitions, and precision fires. Photos and videos of damaged or destroyed vehicles, often paired with geolocation and timestamps, allow analysts to identify recurring vulnerabilities in protection, mobility, and crew survivability. At the same time, rapid information dissemination reduces the duration of any technical advantage, as adversaries can quickly observe and adapt to both successes and failures.

As a result, open-source intelligence is becoming an essential complement to traditional, classified analysis rather than a secondary source of insight [8]. It enables more continuous and iterative assessment of system performance, supports faster feedback loops between operational use and design adaptation, and provides a broader empirical basis for evaluating trade-offs in vehicle design. Incorporating these data into capability development and experimentation can help ground requirements in observed battlefield behavior rather than projected scenarios alone.

3. PROPOSED METHODOLOGY

The proposed methodology for analyzing open-source intelligence is shown in Figure 2. This study uses a mixed qualitative and quantitative approach built on two complementary data streams. The first consists of systematic textual analysis of reporting from major international and regional news outlets covering ongoing military operations. These sources provide narrative accounts of battlefield activity, including how equipment is employed, the constraints units face, and how vehicles perform in combat. Analyzing this reporting makes it possible to identify recurring patterns in vehicle use and to capture the operational context in which specific platforms are employed.

The second data stream focuses on combat losses. While official loss figures reported by each side could be used, they are often incomplete, inconsistent, or influenced by strategic messaging. Instead, this study relies on open-source datasets that track visually or independently confirmed equipment losses. These datasets compile publicly available photos, videos, and other evidence to create a longitudinal record of vehicle attrition. By aggregating and standardizing these records over time, the study builds a continuous dataset of losses across multiple phases of the conflict. Linking these losses to operational events identified in news reporting enables analysis of whether certain design characteristics are associated with higher attrition under specific tactical conditions.

To convert narrative reporting into usable data, the text corpus is processed to isolate references to the vehicle of interest. Rather than treating each article as a single data point, every mention of the selected vehicle is identified, and a small segment of surrounding text is extracted. These excerpts capture the immediate operational context,

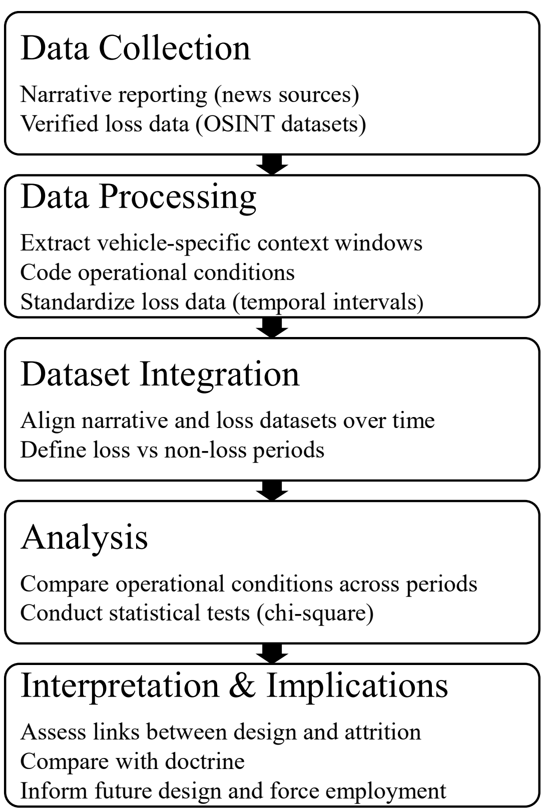

Figure 2: The proposed methodology for analyzing qualitative and quantitative open-source data to support military vehicle design.

allowing the analysis to focus on how the vehicle was being used. Each excerpt is then categorized into a set of recurring operational conditions, such as minefields, drone-enabled ISR, artillery, defensive operations, electronic warfare, and logistics activity. This step transforms unstructured text into a structured dataset while preserving key contextual details, enabling systematic analysis of the environments in which the vehicle operates.

The structured narrative data is then aligned over time with the dataset of confirmed vehicle losses. Losses are grouped into weekly intervals, creating a consistent timeline that allows comparison between periods with and without recorded losses. The analysis then examines whether specific operational conditions appear more frequently during periods when losses occur. To test this, chi-square tests of independence are applied to each category, comparing how often each condition appears in loss periods versus non-loss periods. This makes it possible to determine whether observed differences are likely due to chance or reflect meaningful relationships [9]. The resulting statistics identify which operational factors are most strongly associated with vehicle attrition, providing a more rigorous basis for interpreting patterns observed in the data.

4. CASE STUDY

This methodology was applied to analyze survivability challenges associated with the Leopard main battle tank in the Russia-Ukraine War. The usage and losses associated with this distinctive tank have been well documented throughout the war.

4.1. Background on the Leopard Tank

The Leopard family of main battle tanks, developed in Germany during the Cold War, remains widely fielded across Europe. Introduced in 1979, the Leopard 2 was designed to balance lethality, mobility, and protection in accordance with NATO maneuver warfare concepts. Earlier variants, such as the Leopard 1, emphasized mobility and firepower over armor, reflecting assumptions about engagement range and speed. Subsequent Leopard 2 variants incorporated improvements in composite armor, fire control, and thermal imaging, reflecting evolving threat environments and shifting trade-offs among survivability, lethality, and maneuverability [10].

Recent variants, including the Leopard 2A6 and 2A7, illustrate these trade-offs in more demanding threat environments. Lethality is centered on the 120 mm smoothbore gun, with the 2A6 introducing a longer L55 barrel to improve muzzle velocity and armor penetration. Survivability has been enhanced through modular composite armor, including additional protection against mines and top-attack threats, along with improved internal protection for crew survivability. These upgrades have increased vehicle weight to approximately 60 to 65 tons, depending on configuration, placing greater demands on mobility systems. To offset this, the platform retains a 1,500 horsepower diesel engine, maintaining a high power-to-weight ratio relative to its class, though increased weight can still constrain maneuverability in certain conditions [11].

The Leopard platform gained renewed operational relevance during the Russia–Ukraine war, as European states began transferring Leopard 2A4, 2A6, and refurbished Leopard 1A5 tanks to Ukrainian forces in 2023 [12]. This resulted in a mixed fleet operating under varied conditions, often without the full integration and sustainment structure typical of NATO forces. The combination of widespread deployment and extensive open-source documentation makes the Leopard a useful case for analyzing how design trade-offs influence performance and survivability in contemporary combat.

4.2. Data Sources

The case study draws on two primary datasets. The first consists of ISW campaign assessments, which provide recurring narrative descriptions of battlefield developments, force employment, and operational situations. These reports were parsed to isolate windows of text surrounding Leopard mentions and then coded for recurring contextual features such as electronic warfare, air defense, drone ISR, artillery, minefields, offensive operations, and defensive operations. The outcome produced a structured narrative dataset that preserves the contextual richness of operational reporting while allowing for systematic comparison over time.

The second dataset consists of manually structured Oryxspioenkop loss records for Leopard variants. These entries were cleaned, standardized, and grouped by week to provide a confirmation-based record of visually documented attrition. Leopard variants were preserved during cleaning but collapsed into a single Leopard category for direct comparison with the broader ISW narrative dataset, since ISW reporting did not consistently distinguish among Leopard 1A5, Leopard 2A4, and Leopard 2A6 platforms. Weekly aggregation facilitated temporal alignment of the two datasets while maintaining the distinction between narrative descriptions and confirmed loss outcomes.

4.3. Analysis

The first stage of analysis examined whether ISW mention intensity tracked confirmed loss activity over time. It would be logical to expect weekly narrative emphasis on the Leopard to increase during weeks of higher confirmed attrition. However, the data showed that this assumption was not supported. Weekly ISW mention volume exhibited weak and negative relationships with Oryx-confirmed weekly losses for

Leopard platforms. Across the merged analysis panel, 59 weeks contained confirmed Leopard losses, but only 10 of those weeks were also represented in ISW tank-related narrative windows. In practical terms, only about 17 percent of confirmed attrition weeks were narratively represented in ISW. This immediately suggests that ISW should not be treated as a comprehensive week-by-week tracker of Leopard tank losses. Instead, it functions as a selective contextual source that highlights a limited subset of operationally salient moments. Just as importantly, this selectivity was not driven by the magnitude of losses. Weeks covered by ISW averaged 1.36 confirmed losses, while weeks not covered averaged 1.47. The difference is negligible. ISW therefore does not appear to narrate Leopard attrition simply when losses are numerically larger. The weak and negative weekly correlations between ISW mention volume and Oryx-confirmed losses are best understood as a consequence of this structural mismatch: one source is a selective operational narrative, while the other is a confirmation-based attrition record.

A temporal pattern further clarified the relationship. ISW coverage of confirmed Leopard losses was concentrated in a limited number of early and mid-war periods and declined sharply over time even as confirmed losses continued. Coverage was limited in 2023, somewhat greater in 2024, and nearly absent by 2025 despite continued Oryx-confirmed attrition. This suggests that Leopard losses became less narratively salient over time. Early losses appear to have attracted greater operational and political attention, while later losses were increasingly normalized within the broader pattern of battlefield attrition. This is a significant methodological finding because it shows that open-source narrative coverage cannot be assumed to function as a stable proxy for battlefield outcomes over time.

Because raw mention volume did not yield a meaningful measure of effectiveness, the analysis then shifted to operational context. Instead of asking whether ISW and Oryxspioenkop rise and fall together numerically, the study examined what ISW was actually saying during confirmed loss

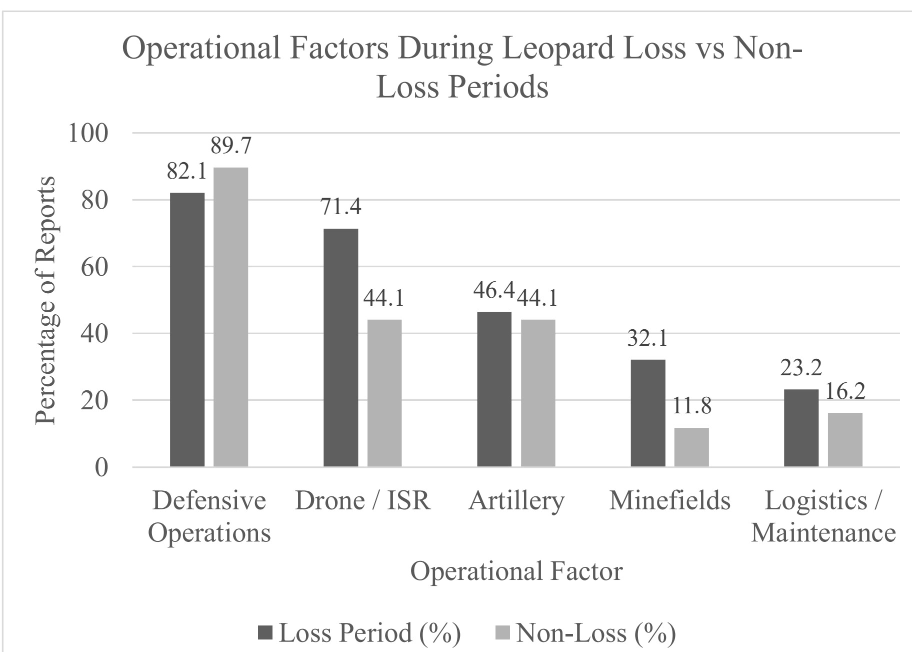

Figure 3: S Comparison of Operational Factors in Leopard Loss and Non-Loss Periods.

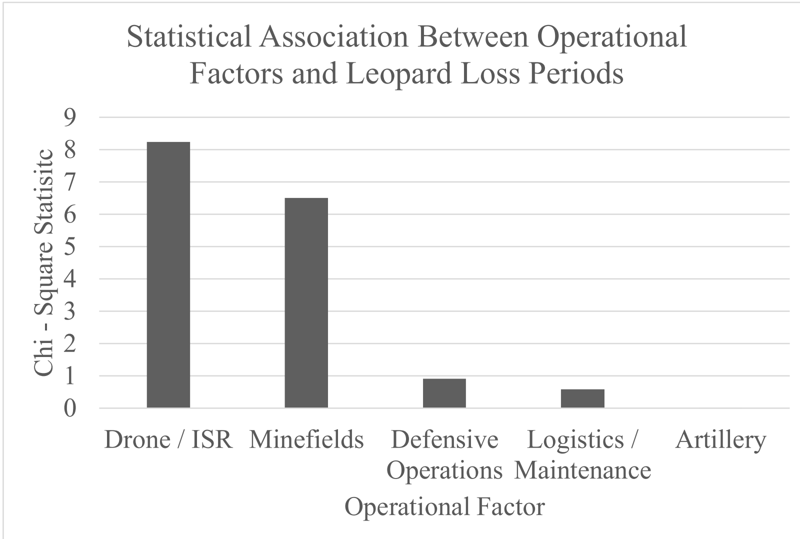

Figure 4: Chi-Square Association of Operational Factors with Leopard Loss

periods. Narrative windows associated with loss weeks, and with the week immediately following them, were compared against windows from non-loss periods. At the aggregate level, several predefined contextual tags appeared frequently across tank-related narratives. These tags included electronic warfare and jamming, air defense activity, drone-based ISR, artillery fires, offensive and defensive operations, minefields, urban terrain, precision fires, logistics and maintenance activity, river crossing operations, and anti-tank guided missile threats, as shown in Figure 3. These tags describe the baseline environment in which the Leopard was being discussed: a contested battlespace characterized by layered sensing, persistent fires, and evolving tactical adaptation. On their own, however, these common tags do not explain attrition. The more important question is which conditions become disproportionately associated with confirmed losses.

That comparison revealed two especially important results for Leopard-related narratives. Minefield references appeared in 32.1 percent of Leopard loss-period windows, compared with 11.8 percent during non-loss periods. Drone ISR references appeared in 71.4 percent of Leopard loss-period windows, compared with 44.1 percent in non-loss periods.

As shown in Figure 4, Chi-square testing confirmed that both relationships were statistically significant, with $p = 0.0107$ for minefields and $p = 0.0041$ for drone ISR. The chi-square statistic itself provides a measure of how strongly the observed frequencies differ between loss and non-loss periods. Larger chi-square values indicate a greater deviation from what would be expected if no relationship existed between the operational factor and Leopard losses. In this analysis, drone ISR produced a chi-square value of 8.24, while minefields produced a value of 6.52, both well above the critical threshold for statistical significance. These elevated values reflect substantial differences in how frequently these factors appeared in loss-period windows compared to non-loss periods, reinforcing that the observed relationships are not the result of random variation.

These results move the analysis beyond a generic claim that tanks are vulnerable in modern war. The relationship is more specific. Confirmed Leopard attrition is not simply associated with "high combat intensity" in a broad sense, nor does it appear to be reducible to direct armored engagements. Instead, it is significantly associated with minefield-dense and drone-saturated operational environments. Minefields indicate obstacle-belt density, constrained maneuver, and breach exposure. Drone ISR indicates persistent observation, target acquisition, and the likely integration of reconnaissance with fires. These factors together suggest that Leopard losses were most strongly associated with environments in which maneuver was restricted, concealment was degraded, and targeting was enabled by continuous reconnaissance.

This interpretation is reinforced by the broader contextual profile of Leopard loss-period windows. In addition to the statistically significant minefield and drone ISR relationships, Leopard loss windows also occurred in environments consistently tagged with electronic warfare, integrated air defense, defensive operations, and artillery. Although these conditions were not all statistically distinguishing once compared against non-loss periods, they still help define the larger operating system within which attrition occurred. The resulting picture points to a system-level lethality problem. Leopard losses were embedded in defensive belts that combined obstacles, ISR-enabled observation, electronic warfare, and layered fires to constrain maneuver and expose armored forces during movement and breach operations.

4.4. Conclusions of Case Study

This study set out to evaluate whether open-source intelligence could be used not simply to document military vehicle losses, but to derive operationally grounded insights relevant to vehicle design. The combined ISW – Oryxspioenkop methodology demonstrates that it can, but only if each source is used according to its analytical strength. Oryx functions as a confirmation-based attrition record and ISW functions as a contextual narrative source. Their value lies in using each to compensate for the other's limitations.

The first major conclusion is methodological. Open-source reporting intensity should not be assumed to track battlefield attrition directly. In this case study, only a small minority of confirmed Leopard loss weeks appeared in ISW tank-related narratives, and those covered weeks were not associated with higher loss magnitude. Narrative salience and confirmed attrition are therefore not the same phenomenon. For analysts, this is an important caution: publicly visible discussion of a system may reflect novelty or operational salience more than the true tempo of losses.

The second major conclusion is operational. When confirmed Leopard losses did coincide with ISW narrative coverage, they were significantly associated with minefield and drone-ISR contexts. This indicates that Western tank attrition in Ukraine is best understood through the lens of integrated defensive systems. The dominant challenge is not only generic battlefield intensity or isolated direct-fire engagement. Rather, it is maneuver within a battlespace shaped by persistent observation, obstacle belts, and linked targeting systems. These results reinforce broader observations from the conflict, but more importantly provide a structured, data-driven basis for identifying how these conditions affect vehicle survivability.

The third major conclusion is design-relevant. If the environments most strongly associated with confirmed Leopard attrition are minefield-dense and drone-saturated, then future vehicle design should not focus narrowly on traditional direct-fire survivability alone. Greater attention should be given to survivability under persistent ISR, rapid signature exposure, and constrained maneuver through obstacle systems. This points toward requirements associated with reduced detectability, better integration with counter-UAS systems, improved breach survivability, and stronger compatibility with combined-arms formations operating under continuous observation and fires.

For existing Leopard-class platforms, these findings suggest several near-term adaptation opportunities, including add-on counter-UAS protection, improved obscuration and signature management, and tighter integration with engineer assets for obstacle reduction. Looking beyond current platforms, the results also point toward longer-term design considerations, including reduced baseline signatures, increased autonomy or distributed operation, and deeper integration with networked sensing and fires.

The findings do not prove that any single design feature would eliminate losses, but they do provide empirically grounded evidence that modern tank survivability is increasingly determined by interaction with a larger system of sensing, obstacles, and fires rather than by armor protection alone. This also reinforces that survivability is not solely a platform attribute, but a function of how the platform is employed within a formation. As a result, these findings have implications for doctrine and training, particularly in operating under persistent observation, degraded concealment, and constrained maneuver conditions.

5. BENEFITS OF THIS APPROACH

This approach offers several advantages over traditional assessments that rely on modeling, simulation, or controlled testing. Most importantly, it incorporates real-world combat data early in the design process, when key architectural decisions remain flexible. Grounding analysis in observed battlefield performance provides empirical insight into trade-offs in protection, mobility, survivability, and system integration before these choices become costly or irreversible. This is particularly relevant not only for government stakeholders refining requirements, but also for commercial entities seeking to align internal research and development (IRAD) with emerging operational needs. It also enables identification of near-term upgrade opportunities for existing platforms alongside longer-term design considerations for future systems.

Using open-source reporting and documented combat losses allows analysts to evaluate how vehicles perform under actual operational conditions rather than idealized assumptions. This data captures adversary adaptation, environmental constraints, and operational friction that are difficult to replicate in testing. As a result, it can reveal vulnerabilities and strengths that might otherwise remain hidden until after fielding. For commercial developers, this provides an independent view of capability gaps that may not yet be reflected in formal acquisition signals, helping to inform IRAD investments in areas where future demand is likely to emerge. In this way, the approach supports both incremental improvements to current platforms and early exploration of concepts relevant to future conflicts.

Because the analysis is quantitative, it enables direct comparison across observed vulnerabilities. By measuring the frequency and statistical significance of operational conditions associated with losses, vulnerabilities can be rank-ordered to identify which factors are most strongly linked to attrition. This supports prioritization of design improvements and resource allocation toward the most consequential performance gaps. In a commercial context, this provides a data-driven basis for deciding where to allocate limited development resources, even in the absence of clear government demand signals.

A further advantage is the ability to identify second- and third-order effects of design choices. Loss data and reporting often reveal cascading impacts beyond individual platform outcomes, including effects on operational tempo, maneuver options, logistics, and command decisions. Linking vehicle attrition to these broader outcomes highlights how design characteristics influence not only platform performance but also formation behavior and campaign dynamics. These system-level insights can help both government and industry anticipate how new capabilities will be integrated and employed, reducing the risk of developing solutions that are technically sound but operationally misaligned.

Integrating doctrinal frameworks strengthens the analysis by providing a benchmark against which empirical observations can be evaluated. Gaps between expected and observed performance can indicate mismatches between design intent, doctrine, and actual employment, informing both design adjustments and doctrinal refinement. For commercial entities, this also provides context for how potential solutions would fit within existing concepts of operation, increasing confidence that proposed capabilities will be relevant to future force design.

Finally, the approach is scalable across conflicts, vehicle classes, and technological generations. As open-source data continues to expand, it supports a continuous learning process that updates design assumptions, validates emerging concepts, and connects operational experience directly to system development. The use of multiple independent data sources, combined with transparent and repeatable analytical methods, provides a level of confidence that is useful for both government decision-making and commercial resource allocation, particularly in areas where formal requirements have not yet been defined.

6. LIMITITATIONS

While the proposed methodology demonstrates the utility of open-source data for informing military vehicle design, several limitations must be acknowledged. First, open-source information does not provide a comprehensive picture of battlefield activity. The datasets used in this study are shaped by what is observed, recorded, and shared publicly, which introduces selection bias. Visually confirmed loss data, such as that compiled by Oryx, improves reliability relative to self-reported figures, but still captures only documented events. Similarly, narrative reporting emphasizes operationally salient or newsworthy activity rather than comprehensive coverage. As shown in this analysis, narrative mention intensity does not track directly with confirmed attrition, reinforcing that open-source reporting reflects salience rather than total activity.

A second limitation is the susceptibility of open-source information to misinformation, disinformation, and manipulation. Content from social media, unofficial channels, or secondary reporting may be incomplete, selectively presented, or intentionally misleading. This challenge is increasing with the rapid evolution of generative AI, which lowers the barrier to producing realistic synthetic imagery and content. As a result, distinguishing authentic from manipulated information is becoming more difficult, especially at scale. While this study mitigates some risk by relying on curated and cross-referenced sources, it does not eliminate the underlying uncertainty.

A related limitation is the difficulty of establishing ground truth in an active conflict. Even when individual observations are accurate, they often lack the full context needed to determine causality. For example, a documented vehicle loss may not capture the full sequence of events leading to its destruction, including factors such as command decisions, support, or prior damage. This methodology links loss data with narrative context, but the relationship remains probabilistic rather than definitive. The results should therefore be interpreted as statistically supported associations, not direct causal conclusions.

Finally, the results are sensitive to how data is structured and interpreted. Converting unstructured reporting into discrete categories introduces abstraction and may obscure variation across events. Different source selections, coding approaches, or time aggregation methods could lead to different results. Future work could improve robustness through cross-source validation, confidence scoring, and the integration of additional data streams, including commercial sensing and limited ground-truth datasets.

Despite these limitations, the approach provides a scalable and transparent way to extract useful insights from imperfect but increasingly available open-source data, particularly when used alongside other analytic methods.

7. CONCLUSIONS

This study examined the potential of open-source intelligence to not only document military vehicle losses but also generate analytically meaningful insights relevant to vehicle design. By integrating narrative operational reporting with visually confirmed attrition data, the methodology provides a structured approach for linking battlefield context to observed outcomes. When applied to the Leopard platform in the Russia–Ukraine war, the results indicate that vehicle losses are unevenly distributed across operational conditions and are more strongly associated with environments characterized by persistent ISR and constrained maneuver, particularly in the presence of minefields. These findings reinforce broader observations from the conflict, while also providing a data-driven basis for understanding how these conditions affect platform performance. More broadly, these findings underscore the necessity of conceptualizing modern combat as a system of interacting components rather than as a series of isolated engagements. Vehicle survivability is influenced not only by platform-level characteristics but also by the surrounding network of sensing, obstacles, fires, and operational constraints. This perspective reveals a widening gap between traditional design assumptions and the realities of increasingly transparent and adaptation-driven battlefields.

The primary contribution of this work is to demonstrate that systematically structured and interpreted open-source data can support earlier and more operationally grounded design decisions. Although such data cannot substitute for controlled testing, modeling, or classified assessment, it serves as a valuable complement by revealing patterns of real-world use and attrition that are otherwise difficult to capture. As open-source reporting expands, methodologies of this nature offer a pathway for integrating observed combat dynamics into the design process in a more continuous and responsive manner. Importantly, this includes both near-term adaptation of existing platforms and longer-term design considerations for future systems. For current platforms such as the Leopard, this may include incremental improvements in counter-UAS integration, signature management, and obstacle-breach survivability. For future systems, it suggests a greater emphasis on reduced detectability, operation under persistent ISR, and tighter integration within networked formations.

Ultimately, the study suggests that future military vehicle design will rely less on optimizing individual platform attributes in isolation and more on understanding platform performance within complex, observable, and rapidly evolving combat systems. This shift also has implications beyond design, including how forces are organized, trained, and employed in environments characterized by continuous observation and rapid adaptation. In this context, the systematic extraction and interpretation of operational insights from open-source information will become an increasingly important component of effective force development.

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11. ACRONYMS

ISR	Intelligence, Surveillance, and Reconnaissance
ISW	Institute for the Study of War
IRAD	Internal Research and Development