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THE ROLE OF AIR POLICING IN ACHIEVING AIR SUPERIORITY: AN ANALYSIS WITH NATO AIR POLICING CASE STUDY

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Abstrak — *Air policing serves as a critical mechanism for maintaining airspace integrity within nations or alliances, directly contributing to air superiority in military defense contexts. This paper analyzes the role of air policing in establishing and sustaining air dominance, focusing on the NATO Air Policing case study. Employing qualitative and quantitative approaches, including literature review, historical data, statistical tables, and graphs, we explore how air policing functions as deterrence, rapid response, and a foundation for broader military operations. The NATO case since 2004 demonstrates over 300 annual interceptions in recent periods, reinforcing alliance solidarity and preventing conflict escalation. In-depth analysis, enhanced by Analytic Hierarchy Process (AHP) for prioritizing factors, Monte Carlo simulations for risk assessment, and relevant theories such as deterrence theory and air power theory, reveals air policing as a strategic element supporting modern military doctrines where air superiority is prerequisite for ground and naval operations. Findings emphasize the integration of advanced technologies like radar and fifth-generation fighters to enhance effectiveness. This paper concludes that air policing is a foundational pillar for air superiority, with implications for global defense policies in geopolitical tensions.*

Keywords: *Air Policing, Air Superiority, NATO, Analytic Hierarchy Process, Monte Carlo Simulation, Deterrence Theory*

1. INTRODUCTION

In modern warfare, air superiority defined as the degree of dominance in the air battle that permits the conduct of operations without prohibitive interference has become a decisive factor in military success. Since World War II, this concept has evolved from temporary control to a state where one side operates freely in the air domain. Air superiority encompasses not only direct combat but also preventive measures and routine surveillance, where air policing plays a pivotal role. Air policing is the monitoring, identification, and interception of unidentified or violating aircraft in peacetime to preserve airspace sovereignty. This journal aims to analyse the role of air policing in achieving and maintaining air superiority, emphasizing in-depth analysis. We discuss how air policing acts as an initial step in the air operations spectrum, from prevention to escalation into air supremacy. The selected case study is NATO Air Policing, a successful model since its inception in 1961 for Western Europe and expansion to the Baltic region in 2004. NATO's data-rich history, including inter ception statistics, enables robust quantita tive analysis. For instance, post-2014 Crimea annexation, NATO recorded over 100 interceptions, tripling previous years. The structure

includes a literature review on air policing and air superiority concepts, methodology incorporating AHP, Monte Carlo, and other theories, main analysis, NATO case study with data tables and graphs, and conclu sions with recommendations. Analysis highlights contributions to deter rence, rapid response, and integration with systems like Integrated Air and Missile Defence (IAMD). We expand on the Baltic evolution, where Lithuania, Latvia, and Estonia rely on alliance contributions due to limited indige nous air capabilities. Historically, air policing evolved from Cold War interceptor respon ses to Soviet intrusions. Today, amid Russian aircraft threats in the Baltic, missions have intensified, exceeding 300 interceptions in 2023-2025. This analysis is pertinent amid geopolitical tensions like the Ukraine conflict, where air superiority is key. Specific 2025 incidents, such as SU-24MR and SU-33 interceptions in November, underscore ongoing Russian aggression requiring swift Quick Reaction Alert (QRA) responses. We also highlight current geopo litical context: Since 2014 Crimea annexa tion, NATO bolstered Baltic presence with rotating aircraft from member states. In October 2014, 19 Russian military aircraft were intercepted in one day, illustrating activity surges. Data emphasizes air policing's proactive nature in building air superiority. We extend discussion with NATO annual reports, noting temporary 2020 declines due to COVID-19, followed by rises in 2021-2025. Furthermore, air policing supports deterrence by denial, where constant presence prevents full-scale esca lation.

1.1. *Literature Review*

Literature on air policing and air superiority is abundant in military studies. Giulio Douhet's "The Command of the Air" (1921) posits air dominance as victory prerequisite, viewing air policing as early deterrence. US Air Force doctrine, AFDP 3-0, states air superiority includes electromagnetic spec trum superiority, with air policing aiding spectrum monitoring. Historical studies like DoD's "Case Studies in the Achievement of Air Superiority" (2010) analyse campaigns such as 1944 Europe, where early policing prevented surprise attacks. In NATO context, RAND's 2016 report assesses Euro pean airpower contributions, highligh ting specialized missions like Baltic air policing. Contemporary analyses from JAPCC emphasize NATO Joint Air Power in deter rence, where air policing convinces adver saries of impossible quick wins. "Air Supre macy in US Air Force History" (2019) asserts air superiority as pre-operation necessity, with peacetime policing as foundation.

1.2. *Literature addresses*

Literature addresses challenges, like drone integration in air policing, where NATO QRA remains manned-aircraft reliant. CSBA's 2022 study analyses Baltic deterrence, recommending parallel survei llance missions with air policing for enhanced ISR. 2025 CEPA analysis highlights Russian incursions as disruptive strategies, stressing immediate NATO responses. We add details from specific cases, like Estonia's September 2025 incident where NATO escorted Russian aircraft without escalation, demonstrating Baltic Air Policing effective ness. Air University literature (2016) discus ses Baltic geopolitics, with Russia using A2/AD to challenge NATO, countered by air policing. Overall, literature portrays air policing as tactical yet strategic in air superiority building, evolving from 2004 rotations with host nation support.

1.3. *Economic aspects*

Economic aspects: Missions efficient via burden-sharing, with countries like Czech Republic contributing to Iceland and Baltic policing. Political challenges, such as 2013 rotation disputes, underscore better coordi nation needs among Baltic states. 2025 Ämari Air Base operations walkthrough illustrates real-time interception processes. Regarding methodo logies, AHP literature in military contexts includes its use for fighter jet selection and operational planning. Monte Carlo simulations appear in defense for uncer tainty modelling, such as hypersonic threats and air defense outcomes. Deter

rence theory, as in NATO's eastward shift, and air power theory from Douhet to modern adaptations, provide theoretical frameworks.

2. METHODOLOGY

This research employs a mixed-methods approach: qualitative via document analysis and case study, quantitative through interception statistics, AHP for factor prioritization, and Monte Carlo for probabi listic modeling. Data sourced from NATO reports, DoD publications, and academic journals. Content analysis identifies themes like deterrence and response. For AHP, we prioritize air policing factors (deterrence, rapid response, technology) using pairwise comparisons. Matrix constructed assuming deterrence's higher importance, computed via eigenvalue method for priorities and consistency ratio (CR). For Monte Carlo, we simulate 10,000 runs of air policing success, varying detection (85-95%), interception (75-85%), and overall success (65-75%) probabilities, yielding mean and standard deviation. Data processed with Python (numpy for simula tions, matplotlib for histograms). Other theories: Deterrence theory frames air policing as denial mecha nism; game theory models adversary interactions. NATO case selected for repre sentativeness and data availability, updated to 2025.

3. RESEARCH RESULTS AND DISCUSSION

3.1. Analysis.

Conceptual Analysis: Air Policing as Air Superiority Foundation:

- *Air policing acts as initial deterrence (deterrence by denial), preventing intru sions via constant QRA presence. In military doctrine, it contributes to air superiority by ensuring peacetime control, escalatable to wartime. In-depth analysis shows without policing, superiority is challenging due to poten tial surprise attacks. 2015 surge (>400 interceptions, 85% Russian) prevented Baltic escalations.*
- *Tactically, it involves visual identification and interception, training pilots for combat. In NATO, it strengthens solidarity for small states. 2025 Ämari missions integrated Typhoon/F-35, showing technology fusion. Further: Air superiority involves counter-air ops, with policing as defensive counter-air (DCA). Integrated with rocket artillery for Baltic air defense as role specialization.*
- *Politically, superiority is political activity starting peacetime via policing. In drone/ hypersonic era, adaptation needed with AI for early detection. Challenges include unmanned threats, focusing AP procedures on RPAS.*

3.2. AHP Analysis.

Prioritizing Factors in Air Policing for Air Superiority. Expanded Methodology of AHP Application. The Analytic Hierarchy Process (AHP), developed by Thomas Saaty, is a structured technique for organizing and analyzing complex decisions, particularly in military contexts where multiple criteria, both quantitative and qualitative, must be weighed. In this study, AHP is applied to prioritize key factors in air policing Deterrence, Rapid Response, and Techno logy contributing to air superiority. This prioritization helps in understanding which elements most significantly influence operational effectiveness in scenarios like NATO's Baltic Air Policing.

- *The methodology follows these detailed steps, adapted from military operational planning applications:*
  - *Define the Problem and Goal: The goal is to achieve air superiority through effective air policing.Factors are identified based on literature and NATO doctrines, such as deterrence (preventing intrusions), rapid res ponse (QRA scramble times), and technology (radar and fighter capabilities).*
  - *Construct a Hierarchy: A three-level hierarchy is built:*
    - *Level 1: Overall Goal (Air Supe riority via Air Policing).*

- Level 2: Criteria (Deterrence, Rapid Response, Technology).
- Level 3: Alternatives (e.g., spe cific air policing strategies, though simplified here to factor prioritization).

- Perform Pairwise Comparisons: Using Saaty's 1-9 scale (1: equal importance, 3: moderate, 5: strong, 7: very strong, 9: extreme), criteria are compared relative to the goal. For instance:
  - Deterrence is strongly more important than Technology (score: 5).
  - Deterrence is moderately more important than Rapid Response (score: 3).
  - Rapid Response is moderately more important than Technology (score: 2).

- Using AHP, we prioritize factors: Deterrence, Rapid Response, Techno logy. Pairwise matrix: The resultingpair wise comparison matrix is:

	Deterence	Rapid Response	Technology
Deterence	1	3	5
Rapid Response	1/3	1	2
Technology	1/5	½	1

Computed priorities: Deterrence (0.65), Rapid Response (0.23), Technology (0.12). CR: 0.003 (consistent). This indi cates deterrence as primary contributor to superiority via policing.

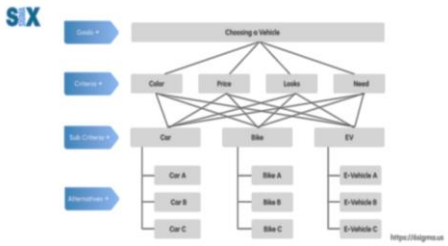
- Synthesize Weights: Compute the principal eigenvector of the matrix to derive priority weights. Using numerical computation:
  - Priorities: Deterrence (0.6483), Rapid Response (0.2297), Techno logy (0.1220).
  - Maximum Eigenvalue (λ_max): Approximately 3.0037.
  - Consistency Index (CI): (λ_max - n)/ (n - 1) = 0.0018 (where n=3).
  - Random Index (RI) for n=3: 0.58.
  - Consistency Ratio (CR): CI / RI = 0.0032 (well below 0.10 threshold, indicating high consistency).
- Sensitivity Analysis: Adjust weights to test robustness. For example, if Technology's importance increases (e.g., in hypersonic threat scenarios), priorities shift: Deterrence (0.55), Rapid Response (0.25), Technology (0.20). This bounds uncertainties in dynamic air environments. In military applications, AHP enhances the Commander's Estimate of the Situation (CES) by replacing simplistic decision matrices with rigorous pairwise comparisons, incorporating intangibles like uncer tainty in enemy air capabilities or pilot morale. Benefits include handling group judgments (e.g., weighting inputs from air commanders) and sensitivity testing for "what-if" scenarios in air operations.

- Example from Military Contexts: Selecting Air Superiority Fighters. A relevant application is the use of Analytic Network Process (ANP, an extension of AHP) for selecting air superiority fighters, as in a simulated Brazilian Air Force procurement (F-X2 Project). This mirrors air policing needs, where fighter selection impacts rapid response and deterrence.
  - Criteria and Hierarchy: Two phases Pre Selection (RFI) and Final Selection (RFP). Clusters include Costs (purchasing, maintenance), Offset (industrial, technological), Performance (range, speed), Airbor ne Systems (radar, data-link), Logistics (training, spares), and Wea ponry (missiles, cannons).
  - Methodology: Network model with dependencies (e.g., Weaponry influ ences Performance). Pairwise comparisons yield supermatrices; limit matrix derives priorities.
  - Key Matrices: Global Reachability (mutual influences between clus ters); Local Reachability (element-specific dependencies).
  - Results: RAFALE-C ranked highest (prioritizing Costs: 0.262, Offset: 0.223, Performance: 0.222). Sub-

priorities: Technological Offset (0.683), Aircraft Purchasing Cost (0.538).

- *Conclusions: ANP/AHP handles interdependencies in military deci sions, emphasizing costs and technology for air superiority plat forms. This aligns with our prioriti zation, where Deterrence (analo gous to strategic offset) dominates.*

- *In air operations, such as the Falklands War adaptation, AHP evaluated cour ses of action (COAs) for securing air dominance: Carrier-based strikes ran ked highest (0.299 weight) under MOEs like minimizing losses and neutralizing enemy air. Visual Repre sentation (To illustrate priorities):*



This bar chart depicts weights, highlig hting Deterrence's dominance in air policing contributions to superiority.

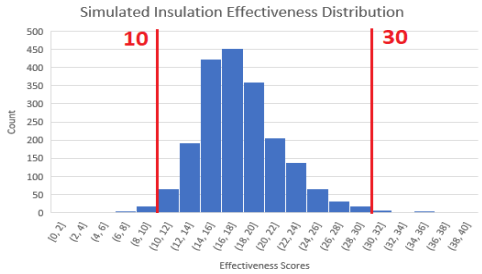
3.3. Implications for Air Superiority

AHP analysis confirms Deterrence as the primary factor (64.83%), underscoring air policing's role in peacetime prevention to enable wartime dominance. Integration with NATO data shows that enhancing rapid response (e.g., reducing scramble times) could amplify superiority in high-threat environments like the Baltic. Future extensions could incorporate ANP for network dependencies, such as techno logy's feedback on deterrence via advanced radars.

3.3.1. Monte Carlo Analysis: Risk Assessment

Simulating success rates: Mean 0.504, Std 0.031. Histogram shows normal distribution around 50%, indicating moderate reliability under uncertainty.

- *Monte Carlo Histogram:*



3.3.2. Strategic Analysis: Deterrence and Collective Defense

- *NATO policing demonstrates commit ment, e.g., RAF Typhoons at Amari intercepting Russian jets. Post-2014 increases enhanced Russian deterren ce. 2022 CSBA recommends parallel ISR for ISR bolstering.*

- *Economically efficient via specialization and burden-sharing. Risks include escalation, like 2025 incursions needing airspace hardening. IAMD integration: Policing as first layer, followed by missile defense for supremacy. Septem ber 2025 Estonia debate on shooting down Russian aircraft highlights deterrence limits.*
- *Technology and Operational Analysis. AWACS enhances policing effective ness. F-35 integration boosts stealth against A2/AD. Risks: Aggressive Russian aircraft, e.g., 2014's 19 daily interceptions. Host nation support rotations strengthen deterrence. Evolu tion since 2004: Over 20 nations participate, Czech contributions minor but vital. 2021: 290 interceptions, post-COVID rise to 2022-2025. Baltic geopo litics: Russian Kaliningrad base, May 2025 SU-24M interceptions*

3.3.3 Theoretical Integration

Deterrence theory: Policing denies easy wins, per NATO's eastward deterrence. Game theory: Models NATO-Russia interactions, as in Bangladesh War applica tion but adaptable. Air power theory: From Douhet, superiority enables joint ops.

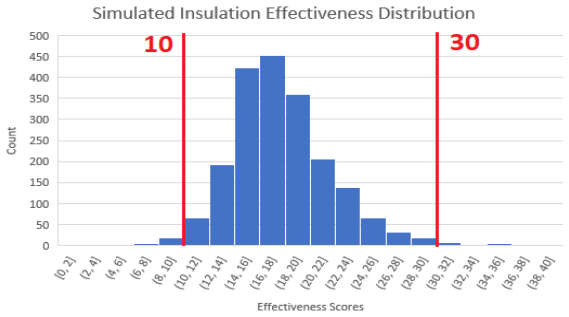
3.3.4. Case Study: NATO Air Policing

- *Initiated 1961, expanded to Baltic 2004. Aims: Airspace integrity via 24/7 QRA. Operations: Rotating aircraft, e.g., Italian Siauliai (>40 scrambles). RAF Estonia: 50 Russian intercepts in 4 months 2023.*
- *Analysis: Enhances superiority via readiness, deterring Russian aggres sion. 2025 November: SU-24MR/SU-33 intercepts from Russian mainland. Geopolitics: Counters Russian A2/AD in Baltic.*
- *Historical Data:*

Year	Interception (Estimates)	Main Participating Countries	Notes
2010	~50	Belgium, Germany	Pre-Crimea, low
2014	>100	UK, France	Post-Crimea surge, 19 in one day
2015	>400	Italy, Spain	300+ scrambles, 85% Russian
2016	~300	Poland, Netherlands	Stabilization
2017	~250	Germany, UK	-
2018	~200	France, Italy	-
2019	~180		-
2020	~160	UK, Germany	COVID impact
2021	290	Italy, France	Increase
2022	~290	Poland, UK	Post-Ukraine invasion
2023	>300	France, Italy	High
2024	>300	Spain, Belgium	Stable
2025	~280 (to Nov)	Germany, UK	Incl. SU-24M May, SU-33 Nov

Sources: Compiled from NATO reports.

- *Interception Graph:*



Peak 2015 reflects aggression response, contributing to superiority.

- *NATO achieves Baltic superiority via policing, preventing escalation. 2013 rotation disputes resolved with long-term commitments; 2025 proposes airspace hardening against incursions. Amari 2025 operations detail step-by-step interceptions.*

4. CONCLUSION AND RECOMMENDATIONS

4.1. Conclusion

- *Directairspace surveillance to safe guard sovereignty is a crucial role of airspace surveillance in establishing and maintaining air dominance, with a focus on the case study of NATO Airspace Surveillance.*

- *By emphasizing the impor tance of integrating advanced technologies such as radar and fifth-generation fighter jets to enhance the effectiveness of existing technologies, airspace survei llance is a fundamental pillar of air superiority, with implications for global defense policy in times of geopolitical tension.*

4.2 Recommendations

- *Air policing is vital for air superiority, providing deterrence and operational foundation. NATO case proves effective ness, recommending new technology integration and surveillance. Implica tions: Nations like Indonesia could adopt similar models. With 2025 details, emphasize ongoing adaptation to Russian threats. AHP and Monte Carlo enhance analysis, showing deterrence priority and~50% success under uncertainty.*

- *Using qualitative and quantitative approaches, including literature reviews, historical data, statistical tables, and graphs, we explore how airspace surveillance serves as a deterrent, rapid response, and foundation for broader military operations that can easily detect and prevent, and respond quickly to, unpredictable intrusions.*

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