

TOWARDS A RESILIENCE FRAMEWORK FOR SECURING ADS-B SURVEILLANCE SYSTEMS IN AIR TRAFFIC MANAGEMENT

Victoria Lebogang Mofolo

VLM Aviation Infrastructure Advisory (Pty) Ltd | Regenesys Business School

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1. BACKGROUND

ADS-B has become a cornerstone of modern air traffic surveillance, enabling real-time aircraft tracking and supporting enhanced situational awareness within Air Traffic Management systems. However, its open and unauthenticated broadcast architecture introduces vulnerabilities including spoofing, jamming and message injection.

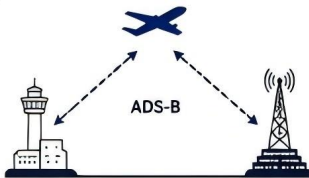


Figure 1. ADS-B surveillance concept.

2. RESEARCH GAP

Existing research has focused mainly on technical vulnerabilities, isolated attack scenarios and detection mechanisms. Less attention has been given to operational continuity, trusted decision-making and resilience under degraded surveillance conditions.

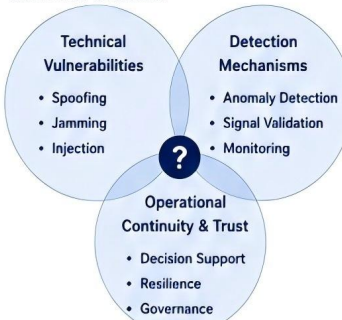


Figure 2. Research gap in existing ADS-B cybersecurity studies.

3. RESEARCH OBJECTIVES

- Identify key ADS-B cybersecurity vulnerabilities.
- Examine operational impacts on ATM decision-making.
- Develop a resilience-oriented framework for surveillance continuity and trust.

4. METHODOLOGY

This study adopts a qualitative, scenario-based research approach supported by a structured review of ADS-B cybersecurity literature and preliminary practitioner insights.



Figure 3. Research methodology.

5. REPRESENTATIVE THREAT SCENARIOS

Three representative cyber threat scenarios were considered.

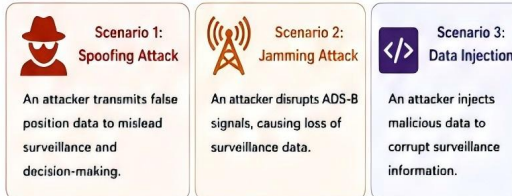


Figure 4. Representative cyber threat scenarios.

6. REPOSED ADS-B CYBER RESILIENCE FRAMEWORK

A resilience-oriented framework comprising five interconnected pillars and a continuity outcome.

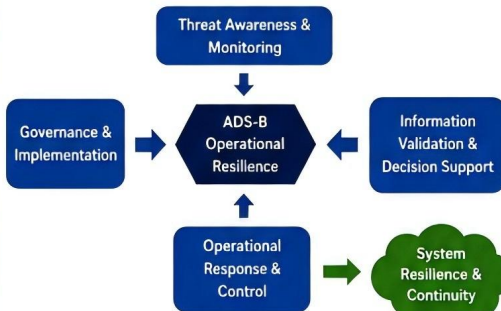


Figure 5. Proposed resilience-oriented framework for securing ADS-B surveillance systems in Air Traffic Management environments.

7. KEY FINDINGS

The study highlights that ADS-B cybersecurity risks can significantly impact surveillance integrity and decision-making. A resilience-oriented approach that integrates awareness, validation, response, governance and continuity is essential to ensure that ATM systems can anticipate, withstand and recover from cyber threats.



Figure 6. From cyber threats to resilience outcomes.

8. CONCLUSIONS

ADS-B cybersecurity represents a critical challenge for modern Air Traffic Management systems. While vulnerabilities are well documented, there is a need to move beyond detection-focused approaches toward resilience-based strategies that support operational continuity and trusted decision-making.

9. FUTURE RESEARCH

- Validation of the framework through empirical studies.
- Expansion of the framework within broader ATM contexts.
- Application to broader critical infrastructure resilience contexts.

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CONTACT

✉ mofolovictoria2@gmail.com

✉ victoria.mofolo@vlmaviation.com

☎ +27 66 370 6002

🌐 www.vlmaviation.com

ABOUT THE AUTHOR

Victoria Lebogang Mofolo is Founder and Principal Consultant of VLM Aviation Infrastructure Advisory (Pty) Ltd and a PhD Candidate at Regenesys Business School. Her research focuses on ADS-B cybersecurity resilience, trusted surveillance continuity. Air Traffic Management systems, cyber-physical resilience, and governance within safety-critical aviation infrastructure environments.

FIGURE ATTRIBUTION

Conceptual diagrams and framework models were developed by the author based on the findings and analysis presented in this study. Decorative icons and visual elements are used for illustrative purposes only.

