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# Positive Airplane Control (PAC): When the Signal Lies or Goes Silent

*GNSS Jamming, Spoofing, Silent Deviation, and the PAC Interoperable Aviation Safety Overlay and Framework*  
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## Executive Summary

Positive Airplane Control (PAC) is proposed as an interoperable aviation safety overlay and framework built around three goals: Predict. Prevent. Protect. PAC is intended to support existing aviation systems, procedures, and human decision-making rather than replace them. PAC does not replace pilot authority, air traffic control, certified avionics, ADS-B, TCAS/ACAS, airline procedures, or FAA/EASA regulatory expectations.

This paper builds on PAC's original framework, which identified the acknowledgment blind spot as a safety concern during high-workload, high-congestion, or time-sensitive flight scenarios. White Paper 2 extends that logic into Global Navigation Satellite System (GNSS) interference environments, where jamming, spoofing, or both may affect navigation confidence and shared situational awareness.

**The core PAC insight remains simple: PAC listens for the silence. In aviation, silence is not always empty. A missed acknowledgment, delayed confirmation, repeated instruction, unclear response, or absence of expected communication can become safety-relevant when navigation confidence is uncertain. When the signal lies or goes silent, PAC listens for the silence in the safety loop.**

GNSS jamming disrupts the signal. GNSS spoofing deceives the receiver. Either condition may create uncertainty between what the aircraft believes, what the crew understands, what ATC expects, and what supporting systems appear to show. PAC does not claim to diagnose every technical source of interference. Instead, the framework focuses on identifying early risk patterns when the aircraft-navigation-communication loop may not be closing cleanly.

*This paper is intentionally high-level. It does not disclose PAC's technical design, implementation methods, data-processing approach, system architecture, detection logic, or future development details. Those methods remain proprietary.*

## Key Components

- Interoperable aviation safety overlay and framework
- GNSS jamming and spoofing awareness
- Silent deviation risk pattern
- Acknowledgment blind spot continuity
- Predict. Prevent. Protect. framework
- Pilot/ATC verification support
- High-level public positioning with proprietary methods protected

## GNSS Jamming and Spoofing in Plain English

GNSS supports aircraft position, navigation, timing, surveillance, and operational awareness. In this paper, GNSS interference is discussed at a high level through two major concerns : jamming and spoofing.

Jamming is like loud noise over a radio: the real signal becomes weak, blocked, or unreliable. Spoofing is like someone pretending to be the real direction-giver: the receiver may accept false information as if it were real. Jamming makes the signal unreliable or unavailable. Spoofing makes the signal deceptive.

Jamming and spoofing are different, but they should not be treated as mutually exclusive operational concerns. In some environments, an aircraft may experience degraded GNSS availability while also facing the possibility of misleading position, navigation, or timing information. For PAC, the important question is not only what caused the disruption. The important question is what happens next.

## The Problem: Silent Deviation

Silent deviation is a PAC-proposed risk pattern where aircraft behavior, navigation data, communication patterns, and operational expectations begin to diverge without immediate recognition. In a GNSS interference environment, the first warning may not be a dramatic failure. It may be a gap: a clearance that is not confirmed, a route inconsistency that is not resolved, a pilot-controller exchange that does not close, or an abnormal delay when timely communication matters.

Silent deviation may appear as delayed acknowledgments, repeated ATC instructions, unexpected clarification requests, crew uncertainty about navigation source reliability, course behavior that appears inconsistent with an expected clearance, conflicting cues between navigation confidence and aircraft behavior, or abnormal silence after a safety-critical instruction.

**The key point is that aviation communication is not just conversation. It is part of the safety loop. When navigation confidence, aircraft behavior, route expectations, and human communication stop aligning clearly, silence becomes meaningful.**

## PAC Listens for the Silence

PAC's phrase "listens for the silence" is not a claim that PAC hears every conversation or discloses a technical method. In aviation, certain moments require confirmation, acknowledgment, correction, clarification, or verification. If that expected closure does not occur, the missing response may become part of the risk picture.

In a GNSS jamming or spoofing environment, navigation uncertainty may increase the importance of pilot-controller communication. PAC is proposed to focus on the gap that may follow uncertainty: delayed acknowledgment, repeated instruction, unresolved clearance/course mismatch, abnormal silence, or another sign that the aircraft-navigation-communication loop may need verification.

## Regulatory Alignment

PAC is not presented as a replacement for FAA rules, EASA expectations, pilot authority, ATC authority, TCAS/ACAS, ADS-B, certified avionics, or airline procedures. It is presented as a framework aligned with existing aviation safety logic: route compliance, ATC clearance integrity, IFR communication, malfunction reporting, surveillance confidence, and clear flightcrew alerting.

Relevant alignment areas include 14 CFR sections 91.181, 91.123, 91.183, 91.187, 91.225, 91.227, and 25.1322. These references show that safe operations depend on assigned routes, clear instructions, timely communication, reliable position/state information, and understandable alerts. FAA, EASA, EUROCONTROL, and ICAO materials also recognize GNSS interference as an operational safety concern for civil aviation.

## Interoperability and Overlay Position

As an overlay, PAC is intended to work with existing aviation safety infrastructure rather than sit outside it. PAC should be understood as a compatibility-first framework: one that supports pilot authority, ATC processes, airline operating procedures, surveillance systems, certified avionics, and regulatory expectations.

As a framework, PAC centers on a practical safety question: when navigation confidence is questioned, is the safety loop still closing cleanly? PAC does not need to publicly disclose how that assessment would be implemented to define the problem and the framework at a high level.

## PAC Framework: Predict. Prevent. Protect.

Predict	Prevent	Protect
Identify early risk patterns: communication gaps, repeated instructions, delayed acknowledgments, degraded navigation confidence, and abnormal silence.	Support timely verification before uncertainty compounds into confusion, route mismatch, or avoidable operational delay.	Strengthen awareness for pilots, controllers, passengers, aircraft, and the broader aviation system when navigation confidence is questioned.

PAC does not claim to predict the exact moment a jamming or spoofing event will occur. PAC seeks to identify the risk pattern. The framework listens for the silence that may follow navigation uncertainty and supports the need for timely verification.

## **Deployment Vision**

PAC is envisioned as a scalable aviation safety overlay and framework that may be further evaluated for integration with existing cockpit, communication, surveillance, and operational safety environments. Any future implementation would require appropriate safety-case development, human factors review, cybersecurity review, validation, and regulatory engagement. PAC is not positioned to replace pilot judgment, ATC, ADS-B, TCAS/ACAS, certified avionics, or approved operating procedures.

## **High-Level Scope and Protection of Methods**

This white paper intentionally separates PAC's public facing safety framework from PAC's proprietary implementation approach. The public facing concern is GNSS jamming, spoofing, and related navigation uncertainty can create communication gaps, delayed acknowledgements, unresolved inconsistencies, and silent deviation risk. PAC's method for applying this framework is not disclosed in this paper.

**PAC listens for the silence - but the method stays proprietary.**

## **Conclusion**

GNSS jamming can make the signal unavailable. GNSS spoofing can make the signal untrustworthy. Both can create uncertainty. PAC extends its original acknowledgment-blind-spot framework into this environment by focusing on whether the aviation safety loop still closes when navigation confidence is questioned.

**PAC is proposed as an interoperable aviation safety overlay and framework built to support, not replace, the aviation ecosystem. Its mission is simple: Predict. Prevent. Protect. Its signature insight is equally simple: PAC listens for the silence.**

## **Legal Notice**

This white paper and its contents are the proprietary work of Saleemah Speller. The Positive Airplane Control (PAC) framework described herein is protected under U.S. trade secret law. Duplication, distribution, or disclosure of any portion of this document without prior written consent is strictly prohibited.

## References

1. [FAA GPS/GNSS Interference Resource Guide](#)
2. [FAA Global Navigation Satellite System \(GNSS\) Interference Resources](#)
3. [EASA Safety Information Bulletin 2022-02R3: GNSS Jamming and Spoofing](#)
4. [EASA GNSS Outages and Alterations](#)
5. [EASA and EUROCONTROL Joint Action Plan for GNSS Interference Events](#)
6. [ICAO: GNSS Radio Frequency Interference and Civil Aviation Safety](#)
7. [Electronic Code of Federal Regulations, 14 CFR Part 91](#)
8. [Electronic Code of Federal Regulations, 14 CFR § 25.1322 Flightcrew Alerting](#)
9. [FAA Advisory Circular AC 25.1322-1: Flightcrew Alerting](#)