To develop a structured security case for the Airborne Collision Avoidance System Xu (ACAS Xu), I will create a hierarchical tree using Goal Structuring Notation (GSN) elements such as goals, strategies, solutions, and assumptions. Here's how it might look:

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1. [G] High-Level Goal: Ensure ACAS Xu operates securely to prevent mid-air collisions

- 1.1 [S] Strategy: Define and validate security requirements of ACAS Xu

- 1.1.1 [G] Goal: Identify and categorize all operational scenarios of ACAS Xu

- 1.1.1.1 [Sn] Solution: Analyze flight data from field tests

- 1.1.1.2 [Sn] Solution: Conduct expert elicitation sessions with pilots and air traffic controllers

- 1.1.2 [G] Goal: Establish security requirements derived from operational scenarios

- 1.1.2.1 [Sn] Solution: Develop security requirements based on operational scenario analysis

- 1.1.2.2 [Sn] Solution: Validate requirements with simulations and pilot feedback

- 1.2 [S] Strategy: Implement security features according to requirements

- 1.2.1 [G] Goal: Design and incorporate robust security features in ACAS Xu

- 1.2.1.1 [Sn] Solution: Integrating encryption for inbound and outbound communications

- 1.2.1.2 [Sn] Solution: Deploy intrusion detection systems specific to avionic systems

- 1.2.2 [G] Goal: Perform rigorous testing of security features

- 1.2.2.1 [Sn] Solution: Execute field tests with security feature integration

- 1.2.2.2 [Sn] Solution: Conduct red team exercises to test system resilience

- 1.3 [S] Strategy: Document and mitigate residual risks

- 1.3.1 [G] Goal: Identify and prioritize potential residual risks

- 1.3.1.1 [Sn] Solution: Perform comprehensive risk assessment post-implementation

- 1.3.2 [G] Goal: Implement mitigation strategies for highest priority risks

- 1.3.2.1 [Sn] Solution: Develop and apply mitigation techniques for identified risks

2. [G] Goal: Comply with international regulations on airborne collision avoidance systems

- 2.1 [S] Strategy: Ensure ACAS Xu compliance with ICAO (International Civil Aviation Organization) standards

- 2.1.1 [G] Goal: Review and align ACAS Xu features with ICAO standards

- 2.1.1.1 [Sn] Solution: Analyze current ICAO standards and guidelines

- 2.1.1.2 [Sn] Solution: Adapt ACAS Xu functionalities to meet ICAO standards

- 2.1.2 [G] Goal: Certify ACAS Xu against ICAO standards

- 2.1.2.1 [Sn] Solution: Engage with certification bodies for assessment and approval

- 2.1.2.2 [Sn] Solution: Address feedback and modify systems to ensure compliance

- 2.2 [S] Strategy: Continuous update and re-evaluation of compliance status

- 2.2.1 [G] Goal: Maintain ongoing compliance with future amendments to regulations

- 2.2.1.1 [Sn] Solution: Set up a regulatory watch to monitor changes in standards

- 2.2.1.2 [Sn] Solution: Regularly update system as per new regulatory requirements

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- \*\*[G]\*\* denotes Goal

- \*\*[S]\*\* denotes Strategy

- \*\*[Sn]\*\* denotes Solution

This hierarchical view delineates clear objectives, strategies, and solutions for ensuring the security of ACAS Xu in various operational and regulatory dimensions. Each node can potentially be further detailed with specific assumptions, constraints, and justifications to strengthen the overall assurance case.