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**Dampak Aktivitas Layangan Serta Burung Dalam Pengelolaan Kawasan Keselamatan Operasional Penerbangan
(KKOP) di Bandar Udara Internasional I Gusti Ngurah Rai Bali**
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INTISARI

Kawasan Keselamatan Operasional Penerbangan (KKOP) merupakan kawasan strategis di sekitar bandar udara yang berfungsi untuk mendukung keselamatan operasional penerbangan, khususnya pada fase lepas landas dan pendaratan. Bandar Udara Internasional I Gusti Ngurah Rai Bali sebagai salah satu bandar udara dengan tingkat pergerakan tinggi di Indonesia menghadapi tantangan dalam pengelolaan KKOP, terutama akibat aktivitas layangan dan keberadaan burung yang berpotensi mengganggu keselamatan penerbangan. Aktivitas tersebut dapat meningkatkan risiko gangguan lintasan pesawat dan kejadian *bird strike* yang berdampak terhadap keselamatan serta keandalan operasional bandar udara. Penelitian ini bertujuan untuk menilai tingkat risiko keselamatan penerbangan akibat aktivitas layangan dan burung, mengevaluasi efektivitas strategi pengelolaan KKOP, mengidentifikasi hambatan implementasi kebijakan keselamatan penerbangan, serta merumuskan strategi peningkatan efektivitas pengelolaan KKOP.

Penelitian menggunakan metode campuran (*mixed methods*) dengan pendekatan kuantitatif dan kualitatif. Analisis kuantitatif dilakukan melalui statistik deskriptif, *Hazard Identification and Risk Assessment* (HIRA), dan analisis spasial. Sementara itu, pendekatan kualitatif dilakukan melalui analisis tematik dan wawancara terhadap sebelas narasumber yang dipilih secara purposive, terdiri atas masyarakat sekitar, pihak desa, personel AirNav, dan unit keselamatan bandar udara. Selain itu, analisis SWOT digunakan untuk merumuskan strategi pengelolaan KKOP yang lebih efektif.

Berdasarkan hasil penelitian dalam tesis ini, aktivitas layangan dan keberadaan burung memberikan pengaruh signifikan terhadap peningkatan risiko keselamatan penerbangan pada kategori *Medium* hingga *High* (berdasarkan analisis HIRA standar ICAO), terutama di zona kritis pendekatan (*approach*) dan keberangkatan pesawat (*take-off*) seperti *Runway 09* dan *Runway 27* Bandar Udara Internasional I Gusti Ngurah Rai Bali. Pengelolaan KKOP yang berjalan saat ini dinilai cukup berkontribusi, namun efektivitasnya masih terhambat oleh keterbatasan pengawasan teknis (seperti sistem radar utama yang tidak mampu mendeteksi objek non-metalik berukuran kecil), rendahnya kesadaran masyarakat akibat adanya benturan kultural antara tradisi bermain layangan dan regulasi keselamatan, serta belum optimalnya koordinasi penegakan hukum lintas instansi di luar perimeter bandara. Oleh karena itu, guna memitigasi potensi bahaya serius seperti kejadian *bird strike*, *engine ingestion*, dan tindakan *go-around*, tesis ini merekomendasikan strategi komprehensif melalui penguatan manajemen risiko, peningkatan sosialisasi berbasis pendekatan partisipatif-kultural (melibatkan Desa Adat/Banjar), pembentukan satgas terpadu lintas sektor (Avsec, TNI AU, Satpol PP, Kepolisian), serta pengadopsian teknologi pemantauan modern (seperti *Avian Radar* atau sistem sensor 3D) demi mendukung tercapainya target *zero accident*.

Kata kunci: Kawasan Keselamatan Operasional Penerbangan (KKOP), keselamatan penerbangan, layangan, burung, manajemen risiko.

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ABSTRACT

The Aviation Safety Zone (ASZ) is a strategic area surrounding an airport designed to support aviation safety, particularly during takeoff and landing. I Gusti Ngurah Rai International Airport in Bali, as one of Indonesia's busiest airports, faces challenges in managing the OSZA, primarily due to kite-flying activities and the presence of birds that have the potential to disrupt flight safety. These activities can increase the risk of aircraft runway incursions and bird strikes, which impact both safety and the operational reliability of the airport. This study aims to assess the level of aviation safety risk caused by kite flying and birds, evaluate the effectiveness of BMS strategies, identify barriers to the implementation of aviation safety policies, and formulate strategies to improve the effectiveness of BMS.

The study employs a mixed-methods approach combining quantitative and qualitative methods. Quantitative analysis was conducted using descriptive statistics, Hazard Identification and Risk Assessment (HIRA), and spatial analysis. Meanwhile, the qualitative approach involved thematic analysis and interviews with eleven purposively selected informants, comprising local residents, village officials, AirNav personnel, and airport safety unit staff. Additionally, a SWOT analysis was used to formulate more effective strategies for managing the KKOP.

Based on the findings of this thesis, kite-flying activities and the presence of birds significantly increase aviation safety risks, categorized as Medium to High according to ICAO-standard Hazard Identification and Risk Assessment (HIRA), particularly within critical aircraft approach and departure zones such as Runway 09 and Runway 27 at I Gusti Ngurah Rai International Airport, Bali. While the existing management of the Flight Operational Safety Zone (KKOP) has contributed to mitigating these risks, its effectiveness remains constrained by limited technical surveillance capabilities, including the inability of primary radar systems to detect small non-metallic objects, low public awareness resulting from cultural conflicts between traditional kite-flying practices and aviation safety regulations, and suboptimal inter-agency coordination in law enforcement beyond the airport perimeter. Therefore, to reduce the potential for serious hazards such as bird strikes, engine ingestion incidents, and go-around maneuvers, this study recommends a comprehensive strategy involving strengthened risk management, enhanced community outreach through participatory and culturally sensitive approaches involving Desa Adat and Banjar institutions, the establishment of an integrated multi-agency task force consisting of Avsec, TNI AU, Satpol PP, and the National Police, and the adoption of advanced monitoring technologies such as Avian Radar and 3D sensor systems to support more effective KKOP management and achieve the aviation industry's zero-accident objective.

Keywords: *Flight Operation Safety Zone* (KKOP)*, aviation safety, kites, birds, risk management.*