Jurnal TNI Angkatan Udara (Vol. 5 No.1, 2026)
ISSN: 2809-5464

A COMPARATIVE ANALYSIS OF SPUKTA REGULATIONS: A STUDY OF VLOS OPERATIONAL PROCEDURES IN CONTROLLED AIRSPACE BETWEEN THE FAA, EASA, AND DGCA INDONESIA

Muchammad Furqon[1], Ahmad Ilham[2,] Ferdy Susanto[3]
Kamal Muchdatas[4], Suroso[5], Salsabila[6]

[1]Teknik Navigasi Udara,[2,3]Universitas Dirgantara Marsekal Suryadarma;
[4,5,6]*National Air And Space Power Of Indonesia*
[1]Muchammadfurqon10@gmail.com; [2,3] Dronetech Consultan Indonesia
[4,5,6]ikeo.santai@gmail.com;

Abstrak — *This study aims to critically analyze and compare the SPUKTA VLOS operational procedure framework in the Control Area established by three major aviation authorities: the Federal Aviation Administration (FAA), the European Union Aviation Safety Agency (EASA), and the Directorate General of Civil Aviation (DGCA) Indonesia. The integration of Small Unmanned Aircraft Systems (SPUKTA) or drones into civil airspace, particularly in the Control Area (CTR), requires strict and uniform operational procedures. The most common Visual Line of Sight (VLOS) operations pose a high risk in controlled airspace if not properly regulated. Using a descriptive qualitative method with comparative content analysis of primary regulatory documents (FAA Part 107, EASA Reg. (EU) 2019/947, pm 37 of 2020 and PM 63 of 2021/CASR Part 107 Indonesia), the comparison focuses on five key procedural variables: Operational Clearance Mechanism, Operational Altitude Limit, Pilot Communication Requirements, Time Window Provisions, and Pre-flight Procedures. The results show that while the FAA and EASA offer mature systems (automated LAANC vs. risk-based Geozone), the Indonesian DGCA relies on manual permitting processes and local authority discretion. This disparity indicates a gap in regional automation and standardization. This study recommends that the Indonesian DGCA consider implementing a real-time authorization system and digital Geozone to improve compliance and efficiency of VLOS SPUKTA operations in the Control Area.*

Keywords: *Drone/SPUKTA, FAA, EASA, Indonesian DGCA, Control Area, VLOS, Aviation Regulation, Descriptive Qualitative.*

1. INTRODUCTION

The use of Small Unmanned Aircraft Systems (SAU), or drones, has expan ded from recreational to commercial and industrial applications, including mapping, infrastructure inspection, and surveillance. However, the increasing volume of drone traffic poses significant challenges to the safety and efficiency of the civil aviation system, particularly in sensitive areas such as Control Areas (CTRs), or zones surrounding airports. Control Areas are controlled airspace where manned flights operate at low altitudes during critical phases such as takeoff and landing. Therefore, SAU operational procedures in these areas must be highly stringent and consistent with civil aviation standards. This study specifically compares SAU opera tional procedures in Control Areas regula ted by three authorities with different regula tory frameworks:

- *FAA (United States): Pioneer of*

regulation with a focus on Part 107 and automation systems.

- *EASA (European Union): Uses a risk-based framework and Geographic Zones.*
- *DGCA (Indonesia): Using Ministerial Regulation (PM) 163 of 2015 and Civil Aviation Safety Regulation (CASR) Part 107, this represents the regulatory framework in developing countries in Asia.*
- *The primary objective is to identify similarities, differences, and procedural shortcomings, particularly in the Indonesian DGCA, compared to global standards.*

2. RESEARCH METHODS

2.1. Approach and Methods

This research adopted a descriptive quali tative approach using comparative content analysis to in-depth analyze and compare primary regulatory documents from the three authorities.

2.2. *Primary Data Sources*

- *FAA: 14 CFR Part 107, Advisory Circulars (AC) 107-2A, and LAANC guidance.*
- *EASA: Implementing Regulation (EU) 2019/947, AMC, and related GM.*
- *DGCA Indonesia: Minister of Transportation Regulation No. 63 of 2021, PM 37 of 2020, and CASR Part 107.*

2.3. *Analysis Variables*

The comparison is based on five operational procedure variables crucial for VLOS in the Control Area:

No.	Variabel Analisis	FAA (AS)	EASA (UE)	DGCA (Indonesia)
V1	Mekanisme Izin Operasi	LAANC (Otomatis)/Waiver (Manual)	Geozone/Notifikasi Otoritas	Persetujuan Manual (ATC/Otoritas)
V2	Batas Ketinggian Operasional	400 ft AGL	120 meter AGL	150 meter AGL (di luar KKOP)
V3	Persyaratan Komunikasi Pilot	Opsional/Tergantung Waiver	Ditentukan oleh Geozone Lokal	Koordinasi dengan ATC/Otoritas
V4	Ketentuan Jarak Jendela Waktu	Otomatis/Manual	Variabel, tergantung Geozone	Proses Manual (Waktu Variatif)
V5	Prosedur Pra-penerbangan	Part 107 Checklist	Tergantung Sub-kategori Terbuka	SOP Internal Operator/Regulasi Dasar

2.4. *SPUKTA Regulations and ICAO Principles*

SPUKTA operations globally are guided by the principles of the International Civil Aviation Organization (ICAO), which emphasize airspace separation and risk mitigation. A Control Area is controlled airspace where Air Traffic Control (ATC) clearance is absolutely required.

2.5. *Comparative Regulatory Framework*

- *FAA Part 107: Establishes operational standards for Small SPUKTAs in the US, with controlled airspace authorization through LAANC (automatic) or Waiver (manual).*
- *EASA (EU 2019/947): Uses a risk-based approach, categorizes operations (Open, Specific, Certified), and applies Geographic Zones to manage Control Areas.*
- *DGCA Indonesia (PM 37/2020, PM 63/2021 & CASR 107): Regulates drone operations in Indonesia. Operating permits in controlled airspace require approval from aviation authorities and coordination with local ATC, which is generally still manual, even though using the SIDOPI GO Application still requires manual risk mitigation analysis and correspondence between agencies.*

3. *RESEARCH RESULTS AND DISCUSSION*

3.1. *Comparative Analysis of Operational Permit Mechanisms (V1 and V4)*

Otoritas	Mekanisme Izin Operasi (V1)	Jendela Waktu Otorisasi (V4)
FAA	LAANC (Otomatis)	Instan hingga Jam (Sangat Cepat)
EASA	Geozone berbasis risiko	Variabel (Cepat hingga Moderat)
DGCA	Persetujuan Manual/Disposisi	Proses Manual (Beberapa Hari hingga Minggu)

The FAA excels in its efficient VLOS authorizations in the Control Area through LAANC. EASA provides regional risk mitigation-based solutions through Geozo nes. The Indonesian DGCA, on the other hand, still relies heavily on manual proces

ses involving correspondence and dispo sitions from ATC authorities. This results in the DGCA's V4 (Time Window) being variable and often slow, hampering the rapid response of commercial opera tions.

3.2. *Comparative Analysis of Altitude Limits (V2)*

Both the FAA (400 ft) and EASA (120 m) demonstrate consistency with ICAO standards, keeping SPUKTA below 150 meters, which is the critical altitude limit for low-altitude manned flights. The Indonesian DGCA sets a general limit of 150 meters AGL (Above Ground Level) outside the Flight Operations Safety Area (KKOP). In principle, all three authorities are aligned in maintaining strict vertical separation, but the Indonesian DGCA needs to be more detailed on the mechanism for lowering altitude limits around KKOPs, which are equivalent to Control Areas.

3.3.*Comparative Analysis of Pilot Communications (V3)*

The FAA and EASA tend to exempt VLOS pilots in Control Areas from the obligation to maintain direct two-way radio communi cation with ATC, as long as operations are within approved authorization limits, to reduce the burden on ATC frequencies. In contrast, the Indonesian DGCA procedures often require intensive and direct coordi nation with local ATC for operations in Control Areas. While intended for safety, these requirements can be cumbersome and increase ATC workload for relatively low-risk VLOS operations.

3.4. *Pre-flight Procedures and Compliance (V5)*

All three authorities require rigorous pre-flight procedures (V5), including SPUKTA eligibility checks and site risk assessments. Compliance with these procedures at the FAA and EASA is supported by a robust regulatory checks and balances system. The Indonesian DGCA relies on internal operator SOPs and more manual oversight by the authorities. A key gap at the DGCA is the lack of a standardized, legally mandated pre-flight checklist, which can lead to variations in compliance between operators.

4. *CONCLUSIONS AND RECOMMENDATIONS*

To improve compliance, safety, and efficiency of Spukta VLOS operations in the Control Area, the following recommenda tions are recommended for the Indonesian DGCA:

- *Implementation of an Automatic Authori zation System: The DGCA should invest in and implement a LAANC-like system for rapid and automated authorization in the Control Area at low-altitude VLOS, to reduce bureaucracy and waiting times (V1 & V4).*

- *Development of Digital Geozones: Deve lop legally binding digital airspace maps (Geozones) that can dynamically restrict/permit Spukta operations, in line with the EASA approach, to enhance situational awareness (V1).*

- *Standardization of Pre-flight Procedures: The DGCA should mandate and dissemi nate a standardized SPUKTA pre-flight checklist to ensure uniform compliance across operators (V5).*

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