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AERODROME AREA LIMITATION AND ALLOWANCES FOR AIRPORT SECURITY OPERATIONS

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ABSTRACT

This paper offers a comprehensive analysis of the constraints and operational challenges faced by the school airport near Gevgelija and the commercial airport near Šibenik, focusing on security-related location permits and their impact on aircraft monitoring and management. It examines legal frameworks, existing obstacles, and operational issues, ultimately proposing a new methodology aimed at enhancing safety, efficiency, and compliance. The findings have broader implications for airport management practices, emphasizing the need for streamlined regulations and innovative monitoring solutions to address complex air traffic regulation issues at smaller and larger airports alike.

Keywords: aerodrome circle; obstacles; school and commercial airport; school and commercial flying; assessment model Operation

1.0 INTRODUCTION

The paper highlights the evolution of airports into intricate "airport-cities," emphasizing their strategic urban role and the importance of GIS tools in obstacle analysis and safety assessments, especially within complex case studies like Gevgelija and Šibenik airports. It notes that school airports, due to their specific functions, are unlikely to be integrated into urban frameworks, requiring specialized obstacle and operational evaluations within existing GIS systems. Employing rigorous scientific methods, the research systematically explores obstacle management, safety during pilot training, and resource-based development inspired by Leonardo's "Codex on the flight of birds," advocating for refined monitoring to enhance safety and sustainability. While existing literature primarily addresses environmental impacts and safety, there is a significant gap concerning the integration of ecological sustainability with infrastructure development, underscoring the need for future research to balance industry growth with ecological preservation, ensuring airports remain competitive without compromising environmental integrity.

2.0 OPERATIONAL PLAN AND OBSTICLES FOR AIRPORTS

The paper highlights the critical role of obstacle data in ensuring safe pilot training at school airports, with a specific focus on Gevgelija Airport as a prospective site. Recognizing that no airport is solely dedicated to training, it advocates for the utilization of GIS technology to accurately analyze and visualize obstacles and training segments, thereby offering valuable insights for airport operators, instructors, and pilots. This approach enhances safety, optimizes training procedures, and improves operational efficiency by enabling precise risk assessment, informed decision-making, and effective management of training activities, ultimately contributing to safer and more effective aviation training environments.

2.1 Operational plan of the school airport

Special attention is given to ensuring compliance with safety regulations, detailed documentation verification, obstacle clearance, facility supervision, and the integrity of aeronautical information within VFR manuals, all aimed at maintaining certification standards and safeguarding operational safety for both general and commercial flights. Special attention is focused on:

- Compliance of the Instruction with the actual situation at the airport,
- Flatness of the operating surface,
- Surfaces with limited obstacles,
- Documentation of published aeronautical data in the VFR manual,
- Regularity of maintenance and general condition of the operating surface,
- Marks and signs,
- Airport rescue and fire protection, etc.

2.2 Obstacles at school airports

Obstacles are all immovable (temporary or permanent) and movable objects, or their parts, or vegetation, which:

a. are located on a surface intended for aircraft movement on the ground;
b. overhang the defined surfaces of obstacle restrictions;
c. are located outside or below the defined surfaces of obstacle limits that the competent authority assesses as threatening the safety of air navigation.

Obstacle Limitation Surfaces (OLS) are essential imaginary boundaries around an airport designed to ensure safety and operational efficiency by keeping the airspace clear of obstacles that could interfere with aircraft during various flight phases, as specified by the aerodrome reference code. These surfaces help prevent restrictions on airport use by defining maximum permissible obstacle heights, thereby safeguarding aircraft during takeoff, landing, and other critical operations, and are tailored to the specific needs of each aerodrome based on its operational requirements. Obstacle limitation surfaces that should be established for all types of approaches to USS are:

- conical surface,
- internal horizontal surface,
- approach surfaces i
- transition surfaces.

For USS with category II and II instrument precision approach, more is needed establish:

- internal access surfaces,
- internal transitional surfaces i
- aborted landing surfaces.

The take-off surface is the departure surface.

3.0 ANALISIS OF AIRCRAFT OPERATIONS IN THE IMMEDIATE VICINITY OF THE PLANNED AIRPORTS

$knv = 7\ x\ hnv : 300 = 7\ x\ 70 : 300 = 1{,}63$
$Tsa = hnv\ x\ 0.0065\ °C = 70\ x\ 0.0065\ °C = 0{,}455$
$kt = Tref - Tsa = 15° - 0{,}455° = 14{,}545$
$kn = n\ x\ 10\% = 2\%\ x\ 10\% = 20$
D0 = 600m
$D = D0\ (1 + knv : 100)(1 + kt : 100)(1 + kn : 100)$
$D = D0(1 + 1{,}63 : 100)(1 + 14{,}545 : 100)(1 + 20 : 100)$
$D = 600\ x\ (1 + 0{,}0163)(1 + 0{,}14545)(1 + 0{,}2))$
$D = 600\ x\ 1{,}0163\ x\ 1{,}14545\ x\ 1{,}2 = 838{,}167 \approx 840m\ RRRY\ GevgeliGGa\ lengh,\ source: AUTHOR'\ Calculation$

$knv = 7\ x\ hnv : 300 = 7\ x\ 594 : 300 = 13{,}86$

$Tsa = hnv\ x\ 0.0065\ °C = 594\ x\ 0.0065\ °C = 3{,}861$
$kt = Tref - Tsa = 15° - 3{,}861° = 11{,}139$
$kn = n\ x\ 10\% = 2\%\ x\ 10\% = 20$
$D0 = 1200m$
$D = D0\ (1 + knv : 100)(1 + kt : 100)(1 + kn : 100)$
$D = D0(1 + 13{,}86 : 100)(1 + 11{,}139 : 100)(1 + 20 : 100)$
$D = 1200\ x\ (1 + 0{,}1386)(1 + 0{,}11139)(1 + 0{,}2)$
$D = 1200\ x\ 1{,}1386\ x\ 1{,}11139\ x\ 1{,}2 = 1822{,}21 \approx 1800m\ RRRY\ Sibenik\ lengh,\ source: AUTHOR'\ Calculation$

3.1 Operating surfaces

The planning of the sports and school airport involves establishing surface elements and obstacle limitations aligned with ICAO standards, focusing on a rectilinear layout measuring 250 x 900 meters at an elevation of 78 meters above sea level. The primary operational area, the PSS, has a corrected length of 840 meters and an initial width of 18 meters, designed for small aircraft with a reference length of 600 meters, with potential expansion to 23 meters in future phases. The airport's layout includes designated maneuvering zones—parking, runway, and taxiway—optimized for visual conditions, with emphasis on safety and efficiency in aircraft take-offs, landings, and maintenance operations, all tailored to the specific geographic and environmental factors influencing performance and design standards.

3.1.1 Controlled zone Gevgelija and Sibenik airport

The establishment of Airport Air Traffic Control for the controlled zone (English Control Zone - CTR) Lučko would encompass an area that partially borders the northwestern edge of CTR

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Skopje and CTR-Ohrid, extending to national airports, as well as covering CTR-Thessalonica for international airports, ensuring coordinated airspace management and safety across these key regions.

3.1.2 Airport traffic zone

Outside the working hours of the Airport Air Traffic Control, the planned traffic zone for Gevgelija Airport remains the same as the controlled area, with the same vertical and lateral boundaries as the Gevgelija CTR, classified as Class G airspace, which is uncontrolled and typically used for general aviation, local flights, and recreational flying, allowing pilots to operate under visual flight rules without air traffic control service unless otherwise specified.

3.1.3 Pilot zones within CTR/ATZ Gevgeli

Within the CTR and ATZ Gevgelija there are school training zones that are used for the training of aircraft pilots, gliders and paratroopers in visual meteorological conditions. Pilot zones for training taken from the Operating Procedure of the Gevgelija Aeroclub. The parachute zone is defined by its lateral and vertical boundaries in the AIP. Glider zones are defined by their lateral and vertical boundaries in the AIP.

3.2 Flight organization and restrictions

According to the regulations, gliders are given priority during flights, and all pilots must review active and upcoming NOTAMs before departure. Flying in the Control Zone (CTR) during working hours requires adherence to class "D" controlled zone rules, with air traffic control services provided accordingly; pilots must notify TWR immediately if unable to follow instructions. Outside of operational hours, the CTR becomes a class "G" uncontrolled zone, and pilots are responsible for complying with general flying regulations, coordinating activities based on submitted flight plans, and maintaining communication with the airport operator as needed.

4.0 ASSESEMENT MODEL OF AIRCRAFT OPERATIONS ARROUND THE PLANNED AREA

The flying elements performed in this process are:

a. Take-off,
b. Landing,
c. school circle,
d. Elements of work in the pilates zone i
e. Flying along the route".

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Figure 1, Aerodrome round in the area of L3 aerodrome source: author and google maps[1]

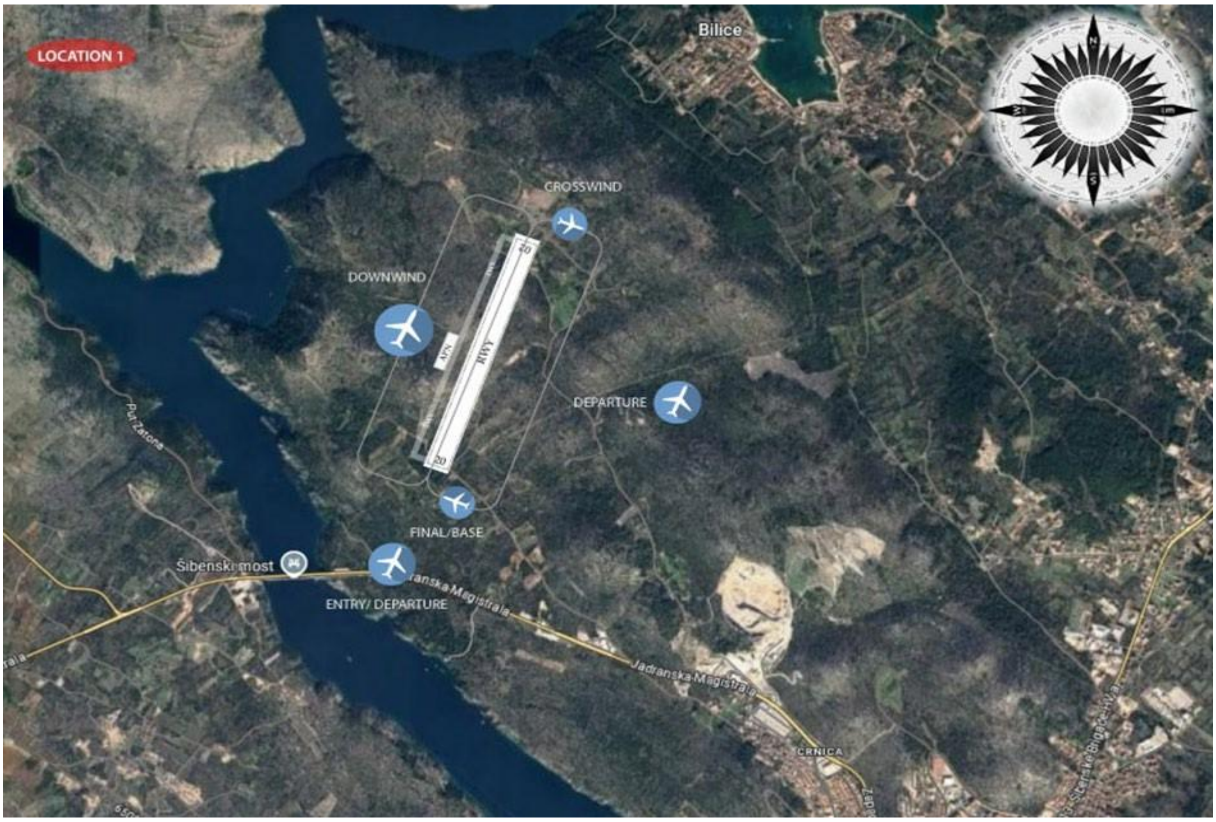

Figure 2, Aerodrome round in the area of L1 source: author and google maps[2]

[1] Attendance in Conference, International Conference on Traffic Development, Logistics & Sustainable Transport, Opatija, 2017

[2] Attendance in Conference, 23rd European Transport Congress 2025, CY Cergy Paris University - Cergy-Pontoise – France, 2025

4.1 Taking off

Take-off is a critical initial phase of flight, involving maneuvering the aircraft from rest on the ground to airborne motion, allowing safe separation from obstacles and ascent to a safe altitude. During visual training, four types of take-offs are practiced: standard, crosswind, short runway, and soft runway, each with specific procedural requirements. The standard take-off involves a sequence of actions ensuring safety, while the other types demand additional skill and precision from trainees due to their increased complexity and challenging conditions, such as wind, limited runway length, or soft surface.

4.2 Landing

During pilot training, landing operations typically include a series of coordinated steps such as approach planning, descent, configuring the aircraft for landing (e.g., lowering landing gear and flaps), stabilizing the approach, executing the flare to reduce descent rate, and finally touchdown, followed by rollout and braking to bring the aircraft to a complete stop. These procedures are crucial for ensuring a safe and controlled transition from flight to ground movement, and trainees learn to execute them precisely under various conditions to handle different aircraft types and environmental factors effectively:

a. standard landing,
b. landing with crosswind,
c. landing with various degrees of flaps,
d. landing on a short runway,
e. landing on a soft runway,
f. glide landing i
g. landing with extension.

A standard landing involves the aircraft approaching the runway at an altitude of at least 500 ft above terrain with a typical approach angle of about 3°, ensuring a controlled descent. During the final phase, the aircraft aligns with the runway and descends to touch down approximately 100 meters from the threshold, a process known as approach and straightening out, which allows for a smooth and precise landing.

4.3 School circle

The school circle is a fundamental aircraft maneuver used to teach pilots how to execute a safe approach and landing, especially in the event of engine failure, by practicing a circular pattern around the airport. Its basic elements include the downwind leg, where the aircraft flies parallel to the runway in the direction of landing; the base leg, where the aircraft turns perpendicular to the runway to prepare for final approach; and the final approach, where the aircraft aligns with the runway to land. This maneuver emphasizes maintaining proper spacing, altitude, and airspeed, as well as precise turn coordination, to ensure the aircraft can reach the airport safely during the initial climb phase or in case of engine failure during other phases of flight:

a. Take-off to turn,
b. The first turn,
c. Flight at a height of 1000 ft above the terrain,

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d. Second turn
e. Flying downwind
f. Two turns i
g. Final approach.

4.4 Elements of work in the piling zone

Work in the pilot zone serves to practice pilot and flight procedures 20 . Elements of work in the zone are:

a. turns with 20° and 30° inclination
b. sharp turns of 45° - 60° inclination
c. flight at minimum speed
d. Dragging with and without throttle
e. sliding
f. simulation of engine failure Special attention is paid to:
g. Aircraft maintenance within the approved zone,
h. Compliance with the approved height,
i. Monitoring the movement of aircraft in neighboring zones i
j. Adherence to the element for introducing into maneuvers.

4.5 Flying along the route

Route preparation for school training flights is a comprehensive process involving careful planning of the flight path within the airport vicinity, adherence to altitude restrictions, and identification of landmarks for navigation. It includes route selection, detailed mapping, safety assessments, and rehearsal flights to familiarize pilots with terrain and hazards, ensuring the training is conducted safely, efficiently, and compliant with aviation regulations, ultimately providing students with practical experience in a controlled environment:

a. Navigation map preparation,
b. Studying data about airports on the route,
c. Checking the meteorological situation,
d. Completing the flight plan,
e. Preparation of the plane.

GIS applications are often used in flying from planning to actual flying.

5.0 CONCLUSION

The study aims to reduce instructor subjectivity in monitoring pilot training by utilizing GNSS trajectory analysis at Gevgelija and Šibenik airports, focusing on key exercises such as the school circle, takeoff, and landing. Specifically, it assesses whether students perform within prescribed limits, including lateral deviations and maintaining a height of 1000 feet during the school circle, providing objective measures of performance. The findings indicate minimal lateral and height deviations, suggesting that students are effectively executing the exercises according to specified parameters, thereby enhancing the accuracy and reliability of performance assessments beyond traditional subjective evaluations.

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The analysis demonstrates that the student's ability to overcome obstacles and stay within designated take-off and approach surfaces enhances the objectivity of flight assessment, reducing instructor subjectivity. To fully validate this approach, further research involving instructor feedback is necessary to develop a standardized, objective evaluation methodology for pilot training. Additionally, the use of GIS technology enables continuous monitoring and detailed feedback, facilitating targeted improvements and more consistent training outcomes in future flights.

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