



From Fixed Surfaces to Data-Driven Safeguarding: Modernising Airport Obstacle Protection

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The Legacy of Airport Safeguarding

For more than 70 years, the concept of a protected airspace around airports has remained largely unchanged. Introduced in the 1950s, the Obstacle Limitation Surfaces (OLS) comprise a series of invisible, sloping planes extending outward from the runway. These surfaces establish a protected volume of a no-build zone in the air, ensuring that buildings, trees and structures do not intrude into flight paths, thereby preserving a clear and safe corridor for aircraft take-offs and landings.

This framework has served aviation well. However, it was developed for an era when aircraft navigation was far less precise. Today, advances in aviation technology and satellite-based navigation allow aircraft to follow designated flight paths with significantly greater accuracy. It became evident that the OLS framework needed to evolve. Modern aircraft no longer require the same uniform buffer zone, but a more precise safeguarding approach which better considers actual flight operations while reducing unnecessary constraints on surrounding urban development.

Singapore's Role in Shaping the New Framework

With Amendment 18 to the International Civil Aviation Organization (ICAO) Annex 14 in place from 4 August 2025, the aviation industry is transitioning from traditional safeguarding methods rooted in fixed geometric surfaces to a performance-based, data-driven framework.

This new framework is a result of the work led by the ICAO OLS Task Force (OLSTF)¹. The Civil Aviation Authority of Singapore (CAAS) has played a central role in its work since joining at its inception in 2015 and assuming chairmanship from the US Federal Aviation Administration in 2017. With subject matter experts from 13 ICAO Member States and five international organisations, the task force brought together global operational expertise to develop the revised ICAO standards that better align safeguarding with modern flight operations.

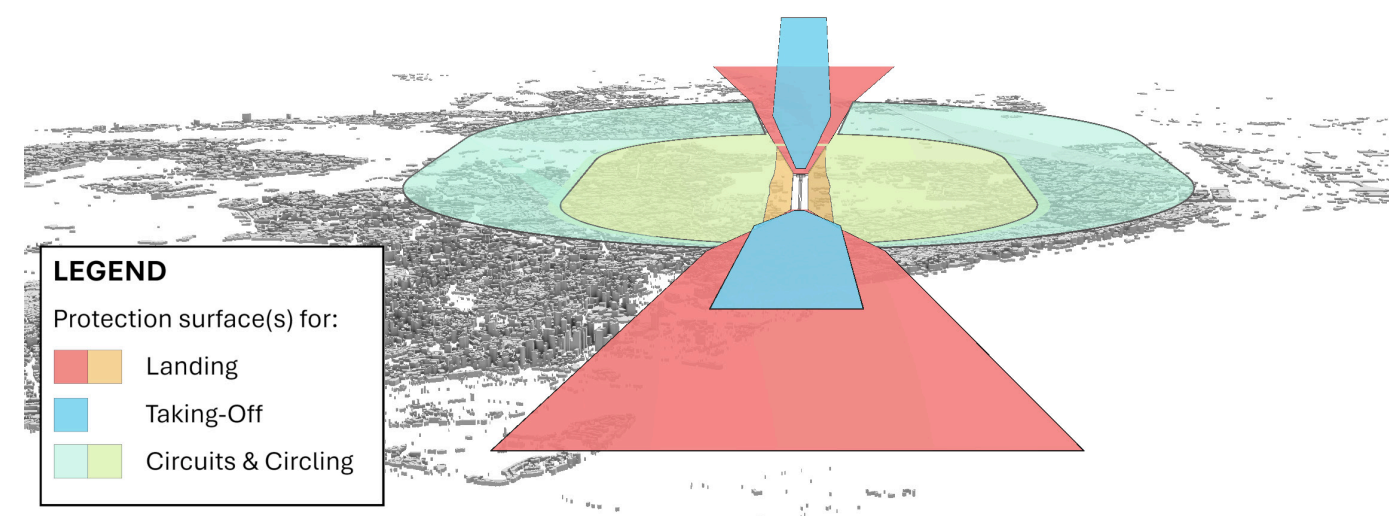


Figure 1: Example of a uniform OLS surrounding an airport

¹ OLSTF members are: (States) Australia, Austria, Brazil, People's Republic of China, Canada, France, Germany, Italy, Japan, Republic of Korea, Spain, United States, and the United Kingdom; (International Organisations) Airport Council International, European Union Aviation Safety Agency, International Air Transport Association, International Federation of Air Line Pilots' Association, and International Coordinating Council of Aerospace Industries Associations.

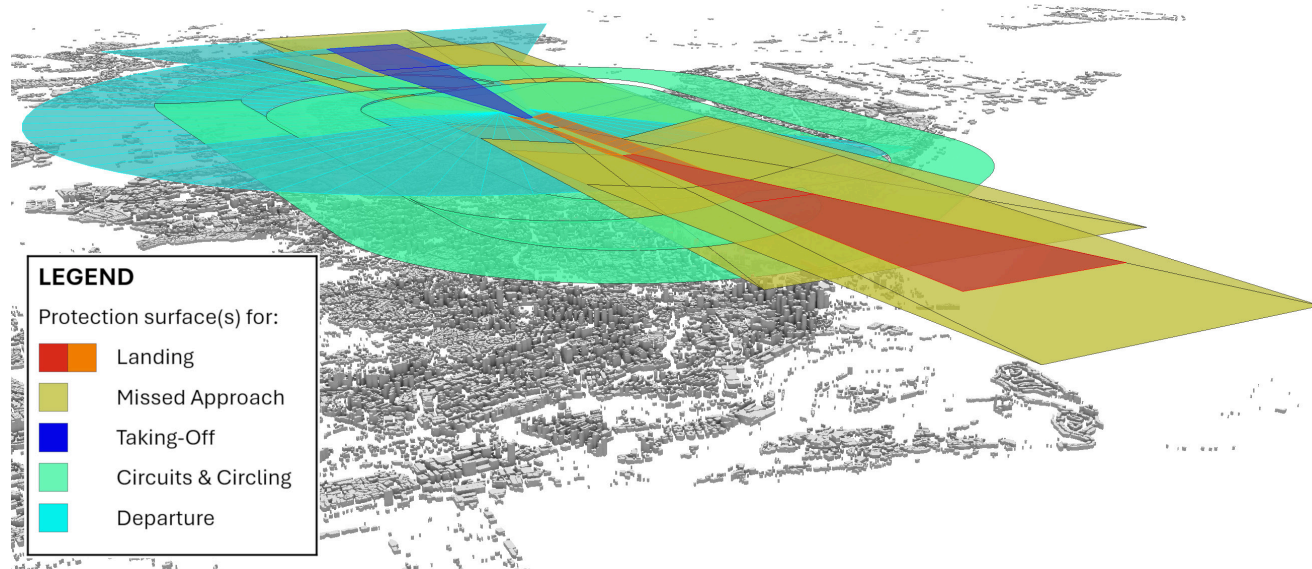


Figure 2: Example of revised OLS customised to airport operational needs

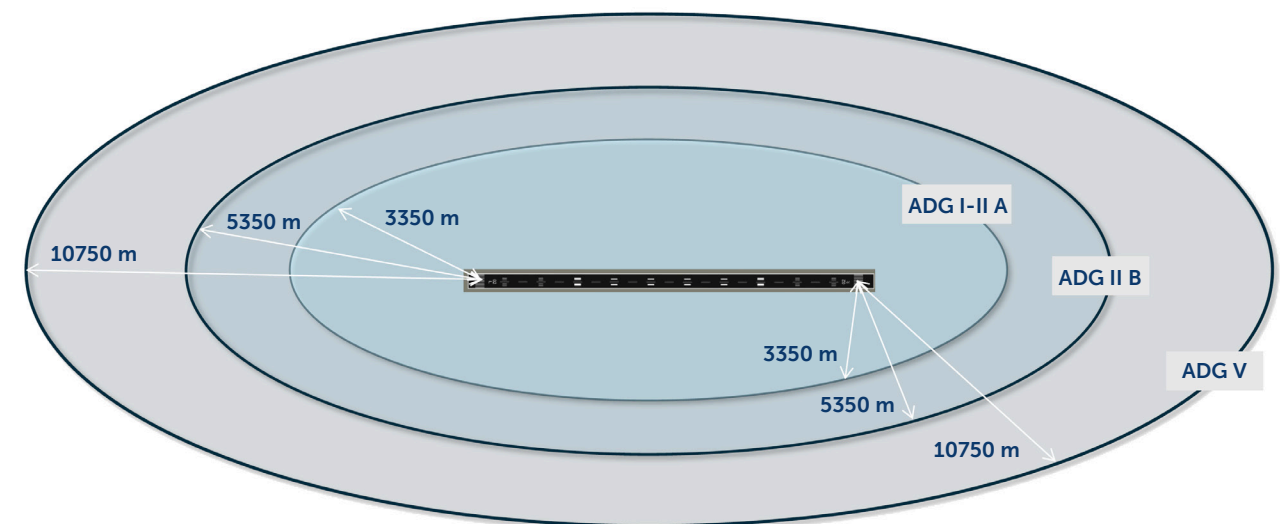


Figure 3: Example of OES (runway in the centre)

Beyond the Geometry: A Two-Tier Safeguarding Model

The revised safeguarding framework replaces the uniform surfaces of the past with a two-tier system designed to balance safety requirements with the demands of urban development.

- 1. Obstacle Free Surfaces (OFS):** The OFS forms an inner protective envelope in the immediate vicinity of the runway. Its dimensions are directly linked to the ICAO Aeroplane Design Group (ADG) classification, which classifies aircraft by wingspan and approach speed. This zone is designed to remain entirely free of obstacles, particularly to protect operations under adverse or contingency conditions. For example, during take-off with reduced climb performance – such as in an event when an aircraft experiences engine failure – the OFS ensures that the pilot has a clear path to climb and manoeuvre safely. Similarly, during a go-around, the OFS provides an unobstructed climb-out path at a critical phase of flight.

- 2. Obstacle Evaluation Surfaces (OES):** Beyond the OFS, the OES introduces a more flexible, risk-based approach for safeguarding. It begins at the edges of the OFS and slopes upward and outward, similar to a large funnel. Structures that penetrate the OFS are not automatically prohibited. Instead, they are subject to a mandatory aeronautical study to determine whether they pose a conflict with flight operations. Regulators can then use these data-driven risk assessments to determine whether such obstacles can be managed safely. This marks a key shift from the previous framework, where actual operational risks are evaluated and considered, rather than relying solely on geometric constraints.

From Theory to Practice

The two-tier structure translates into practice through two distinct methodologies, each calibrated to the level of risk involved. First, the dimensions of the OFS are derived from analysis of track data from a range of operations and local conditions, such as wind and temperature. This ensures that the surfaces are effectively safeguarding intended operations as reflected by actual aircraft flight behaviour rather than conservative assumptions.

Second, the OES is formulated using flight procedure design criteria. These surfaces offer greater flexibility beyond the OFS by adopting a risk-based approach that reduces instances in which structures are flagged as hazards without a genuine operational basis. This enables regulators and planners to focus their attention and safety resources on genuine safety risks, rather than theoretical infringements.

Operational Impact: Efficiency Gains Without Compromising Safety

This shift has tangible operational benefits. For large aircraft, particularly the Code F aircraft, such as the Airbus A380 and Boeing 747-8, under the previous OLS framework, an aircraft's tail height could trigger restrictions on certain taxiways even where no actual conflict with flight paths existed, resulting in longer taxi routings or operational restrictions. Under the revised framework, where operations are studied and demonstrated to be safe, the aircraft can manoeuvre more efficiently. In a space-constrained airport like Singapore Changi Airport, this translates into shorter taxi times, lower fuel burn and greater runway throughput.

The updated OLS framework also aligns more closely with the Procedures for Air Navigation Services – Aircraft Operations, ICAO's standards that govern how flight procedures are designed. By anchoring safeguarding surfaces to actual flight paths, including those enabled by satellite-based navigation, it also harmonises ground safeguarding with modern flight procedure design, enabling air and ground operators to work from a common operational understanding.





Supporting the Transition: Training for a New Framework

To support aviation practitioners through this transition, CAAS has worked with ICAO to develop a dedicated training package for the new OLS framework. CAAS was recognised for its contribution to the development of the OLS course at the recently concluded ICAO Global Implementation Support Symposium.

Implementation of the revised OLS requires proficiency in the conduct of specialised aeronautical studies, supported by the integration of 3D Geographic Information Systems (digital tools that map and analyse spatial data in three dimensions). The transition demands a higher level of specialised expertise from both regulators and airport operators, and the training programme, known as the [ICAO Training Package – Obstacle Limitation Surfaces](#), has been designed to build that capability systematically across the international community.

The Path Ahead

The shift to a performance-based OLS framework represents a significant change in how the aviation industry approaches airport safeguarding. It demonstrates that safety and operational efficiency are not mutually exclusive. Through the updated standards, the OLSF helped enable a more considered approach to urban planning and land use around airports – one that maintains rigorous safety standards whilst reducing unnecessary constraints. In doing so, the framework’s benefits extend beyond the aviation sector to the communities and cities the airports serve.

ICAO Training Package - Obstacle Limitation Surfaces

Participants will learn the theoretical aspects of the framework as well as gain practical skills through hands-on exercises in ADG calculation and safety case development. The training is designed to equip participants to begin implementing the revised framework in their own states, supported by practical implementation examples drawn from real-world experience. The inaugural run of this specialised training was conducted at the Singapore Aviation Academy (SAA) in April 2026. As demand was strong and the course was fully subscribed, a second run has been scheduled in September 2026.

Scan the QR code below for more details on the programme and register your interest.



CAAS, Flight Safety Foundation and Japan Civil Aviation Bureau are jointly organising the fourth Asia Pacific Summit for Aviation Safety (AP-SAS) in Osaka, Japan from 4-6 August. Join us as we bring together over 400 aviation leaders and experts to address emerging aviation safety priorities and strengthen collaboration in the Asia Pacific region.

Themed “Achieving Safety Excellence: Collaborate, Reinforce, Transform”, some key highlights of this annual summit include:

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- Expert discussions on operational resilience, safety culture, and human capital development;
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Registration is now open. For programme details and to secure your spot: flightsafety.swoogo.com/ap-sas-2026.



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	ICAO Annex 14 Requirements and Application
24-28 Aug 2026	Safety Oversight Inspectors (Aerodrome)
24 Aug-3 Sep 2026	Safety Oversight Inspectors (Airworthiness)

September

28 Sep - 1 Oct 2026	Aviation Security Management Programme
21-25 Sep 2026	ICAO Training Package: Obstacle Limitation Surfaces (OLS) <i>[New]</i>
21-23 Sep 2026	SMS Evaluation – The Enhanced PSOE Approach <i>[New]</i>

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13 - 15 Oct 2026	Safety Leadership Programme <i>[New]</i>
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