

Vertiport????????????

Vertiport ??????????????

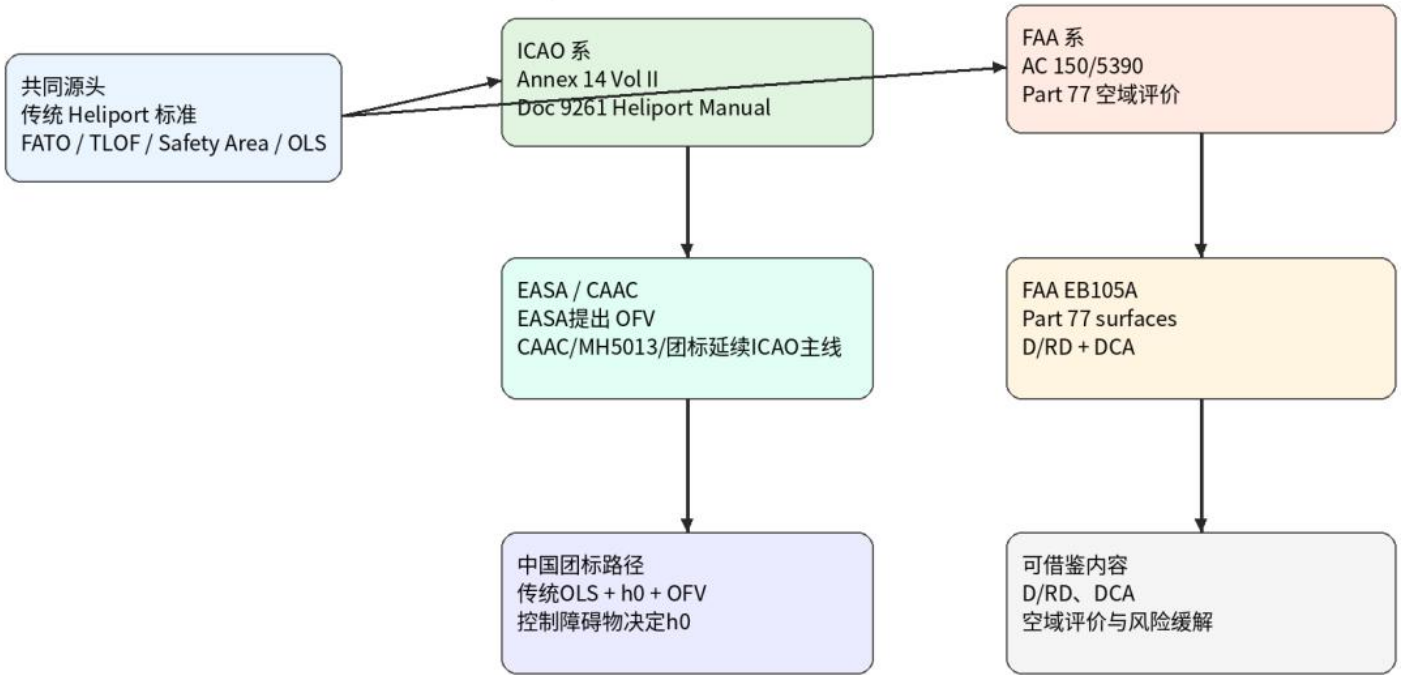
— ICAO Heliport Manual ICAO FAA

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Vertiport
FATO TLOF Safety Area OLS eVTOL
OFV
Vertiport heliport ICAO
Annex 14 Volume II ICAO Doc 9261 MH5013
Heliport
Manual MH5013 OLS EASA OFV OFV eVTOL
OLS FAA EB105A 14 CFR Part 77 imaginary surfaces D/RD
DCA eVTOL
EASA OFV
OLS OLS eVTOL OFV OLS
OLS OFV OLS h0
OLS OFV eVTOL /FATO
h0 h0 OLS
OFV
heliport Heliport Manual MH5013 45°
D

图1 Vertiport标准源流：同源不同支



注：ICAO/EASA/CAAC与FAA均源自heliport；我国净空主线宜采用ICAO系，FAA作为参考和补强。

1 Vertiport

????????ICAO ????????????????

???FATO?TLOF ? Safety Area
????????????????

ICAO Annex 14 Volume II FATO TLOF
 Safety Area FATO
 ICAO/MH5013 Safety Area
 FATO
 Safety Area OLS FAA Part 77 primary surface=FATO FATO
 ICAO

Elevated heliport. A heliport located on a raised structure on land.

Ellipsoid height (Geodetic height). The height related to the reference ellipsoid, measured along the ellipsoidal outer normal through the point in question.

Final approach and take-off area (FATO). A defined area over which the final phase of the approach manoeuvre to hover or landing is completed and from which the take-off manoeuvre is commenced. Where the FATO is to be used by helicopters operated in performance class 1, the defined area includes the rejected take-off area available.

Geodetic datum. A minimum set of parameters required to define location and orientation of the local reference system with respect to the global reference system/frame.

Geoid. The equipotential surface in the gravity field of the Earth which coincides with the undisturbed mean sea level (MSL) extended continuously through the continents.

Note.— The geoid is irregular in shape because of local gravitational disturbances (wind tides, salinity, current, etc.) and the direction of gravity is perpendicular to the geoid at every point.

Geoid undulation. The distance of the geoid above (positive) or below (negative) the mathematical reference ellipsoid.

Note.— In respect to the World Geodetic System — 1984 (WGS-84) defined ellipsoid, the difference between the WGS-84 ellipsoidal height and orthometric height represents WGS-84 geoid undulation.

Gregorian calendar. Calendar in general use; first introduced in 1582 to define a year that more closely approximates the

□ 2 ICAO Annex 14 Volume II □□ FATO □□□□

Chapter 1

Annex 14 — Aerodromes

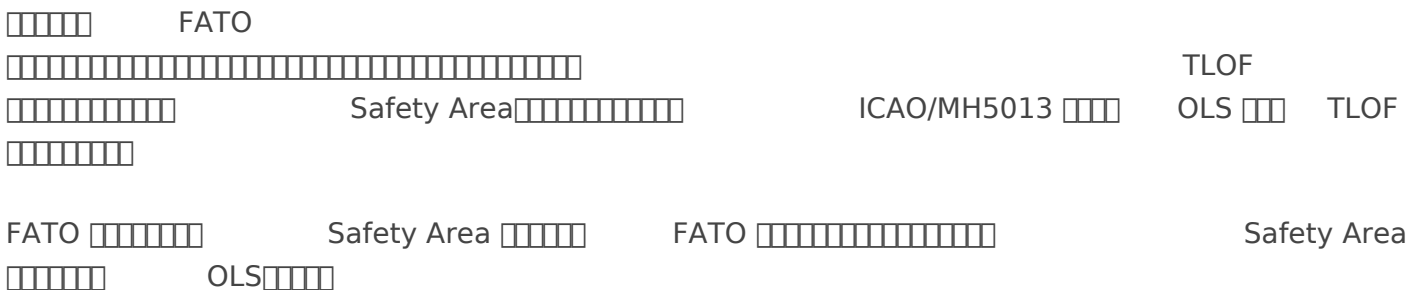
Heliport. An aerodrome or a defined area on a structure intended to be used wholly or in part for the arrival, departure and surface movement of helicopters.

Integrity (aeronautical data). A degree of assurance that an aeronautical data and its value has not been lost nor altered since the data origination or authorized amendment.

Obstacle. All fixed (whether temporary or permanent) and mobile objects, or parts thereof, that:

- a) are located on an area intended for the surface movement of aircraft; or
- b) extend above a defined surface intended to protect aircraft in flight; or

□ 3 ICAO Annex 14 Volume II □□ TLOF □□□□



FATO □□□□□□□□ Safety Area □□□□□□ FATO □□□□□□□□□□□□□□ Safety Area □□□□□□ OLS□□□□□□

Doc 9261 1D 0.83D sub-1D ?????

ICAO Doc 9261 Heliport Manual Annex 14
1D
/

1D FATO 0.83D TLOF
0.83D

reduced TLOF (Figure I-3-2 refers). The FATO is bound by the outer circle from which the obstacle sector surfaces derive their origin. The TLOF is bound by the inner circle (represented as a circle within the octagon shape of the helideck load-bearing area). The FATO outside the TLOF perimeter represents a non-load bearing surface for helicopters as it usually extends over the safety device (whether safety net or safety shelf) which is incapable of supporting even the static load of a helicopter. Therefore, a helideck incorporates one FATO and one TLOF; notwithstanding for a fixed or floating offshore facility, to improve operational flexibility, there may be the possibility to provide additional helideck(s) elsewhere on the facility – the advantages of this are raised in Chapter 3, 3.2.1.10.

3.3.3 It should be remembered that the basic size of a 1 D FATO with coincident TLOF is, of necessity, a compromise for offshore operations where space is invariably limited. Nonetheless, it is essential that the TLOF provides sufficient space for the landing gear configuration and sufficient surface area to promote a helpful “ground cushion” effect from rotor downwash. The area provided should also allow adequate room for passengers and crew to alight or embark the helicopter and to transit to and from the operating area safely. In addition, space consideration needs to be given to allow essential on deck operations, such as baggage handling, tying down the helicopter or helicopter refuelling, to occur safely and efficiently, and, in the event of an incident or accident occurring, for rescue and firefighting teams to always have good access to the landing area from an upwind location (see also Chapter 6).

3.3.4 The design should allow for sufficient clearance from the main rotor and tail rotor of the helicopter to essential objects permitted to be around the perimeter of the TLOF, including obstacles that may be present in the limited obstacle sector (LOS). It should be clearly understood that a FATO of 1 D is the minimum dimension sufficient for the containment of the helicopter; in this case, where a precise landing is completed (see also Chapter 5, especially the use of touchdown/positioning marking circle), the main and tail rotors will abut the edge of the 1 D circle. For this reason it is important that the yellow touchdown/positioning marking circle is accurately and clearly marked and is used by aircrew every time for positioning the helicopter during the touchdown manoeuvre.

3.3.5 Sufficient margins to allow for touchdown/positioning inaccuracies as a result of normal variations or handling difficulties, for example due to challenging meteorological conditions, aerodynamic effects and/or dynamic motions due to ocean waves, should be allowed for in the design. The helideck and environs should provide adequate visual cues and references for aircrew to use throughout the approach to touchdown manoeuvre, from initial helideck location and identification (acquisition) through final approach to hover and to landing. In addition, adequate visual references should be available for the lift-off and hover into forward flight.

3.3.6 In consequence of the considerations stated above, except where an operational study/risk assessment is

4 ICAO Doc 9261 1D sub-1D FATO/TLOF

eVTOL “ “ / ”
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ICAO Annex 14 Volume II [REDACTED]

critical design

helicopter

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ICAO Doc 9261 Heliport Manual ?????? “Design

helicopter”

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Doc 9261

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[REDACTED] design helicopter [REDACTED]

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OFV [REDACTED]

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FAA ??

[REDACTED]

ICAO/HeliportManual/MH5013 [REDACTED]

EASA [REDACTED]

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[REDACTED] vertiport [REDACTED]

FATO [REDACTED] TLOF [REDACTED] SafetyArea [REDACTED]

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TLOF [REDACTED] / [REDACTED]

Safety Area [REDACTED] FATO

[REDACTED]

Safety Area

[REDACTED]

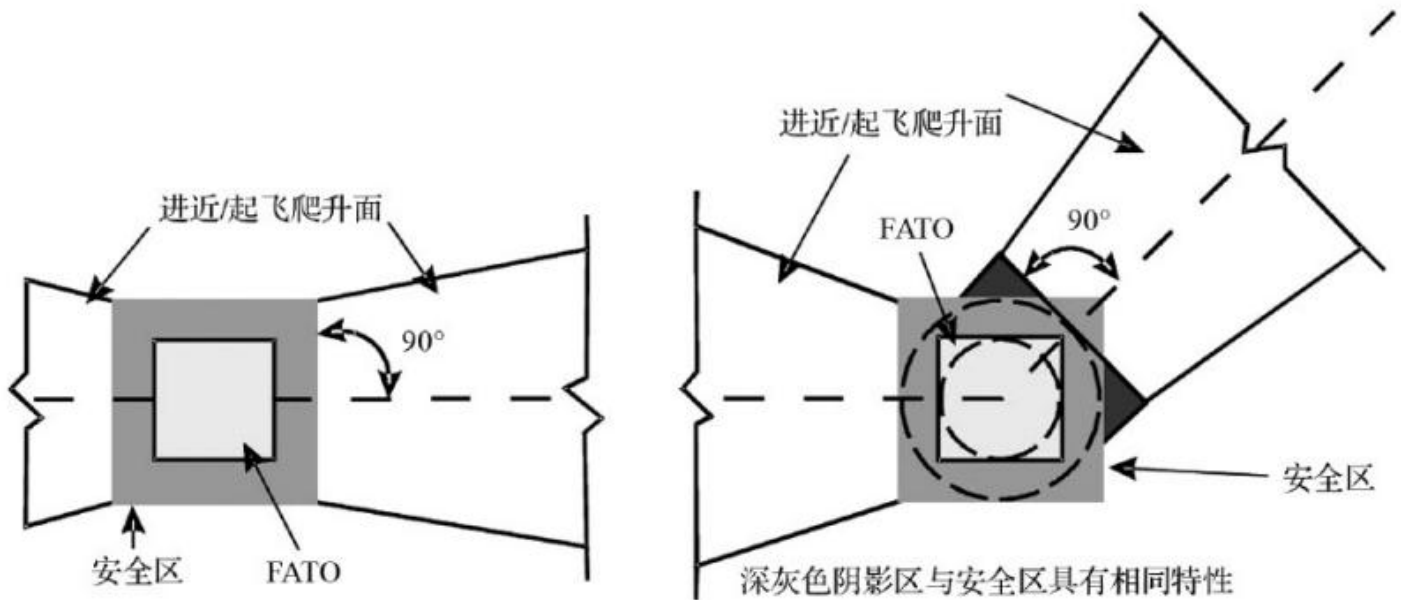
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ICAO MH5013 OLS

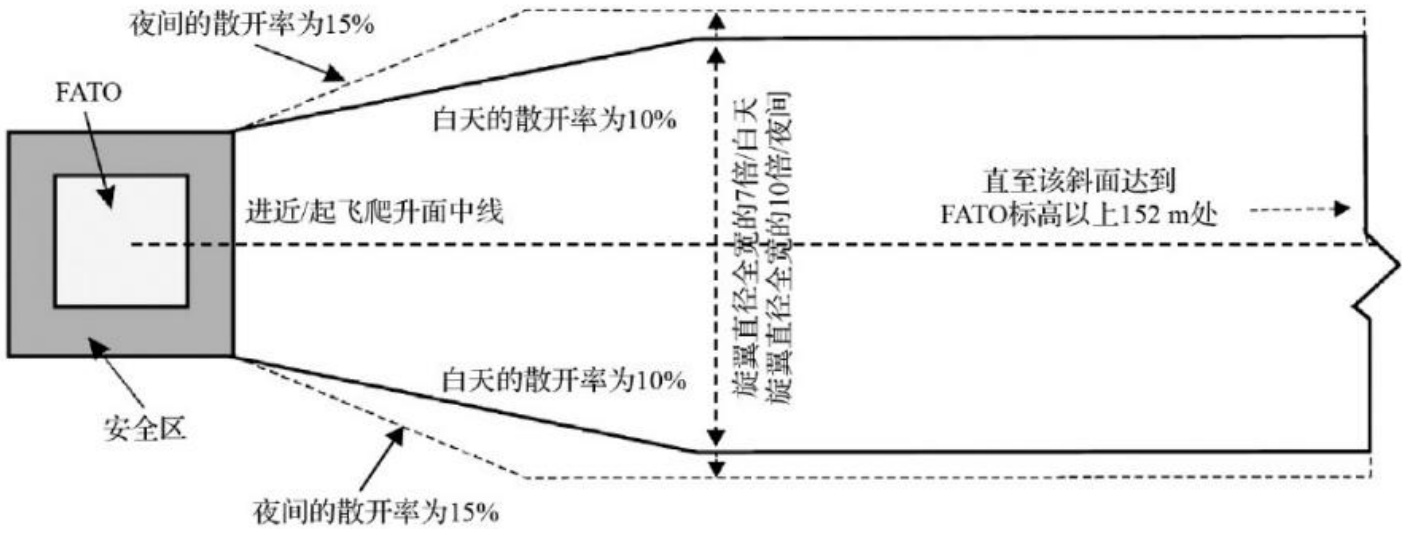
	ICAO Annex 14 Vol II	MH5013-2023	
	Safety Area FATO		
			Safety Area
	Safety Area		
	270m 30m	1 R+S R≥270m	
	ICAO 150°	135°	
			OLS

8.6.2 5

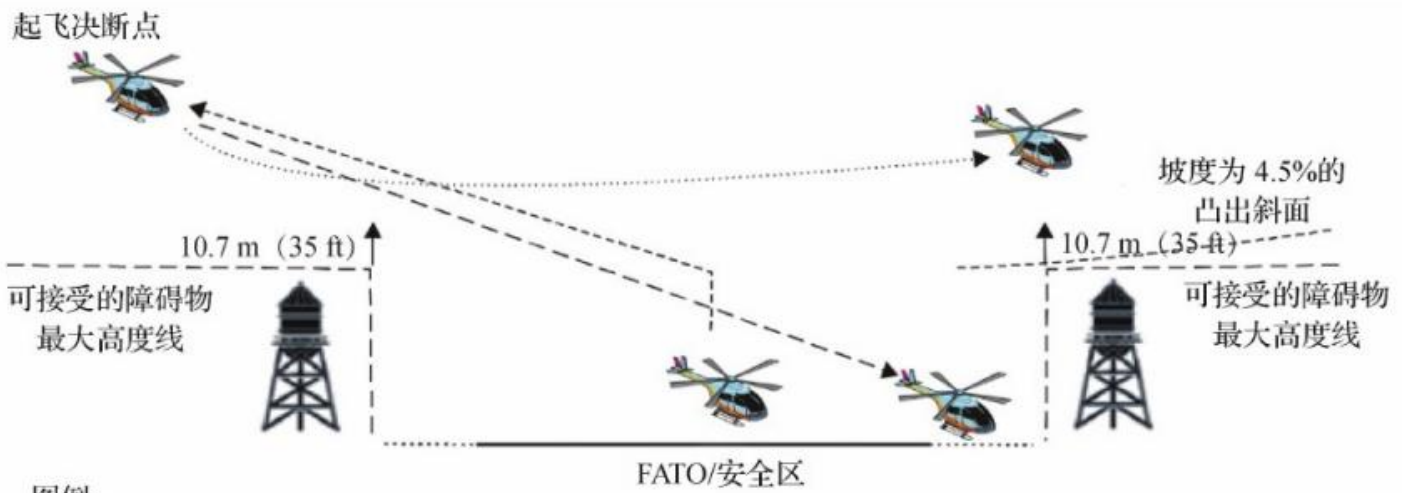
4



6.2.1-1 /

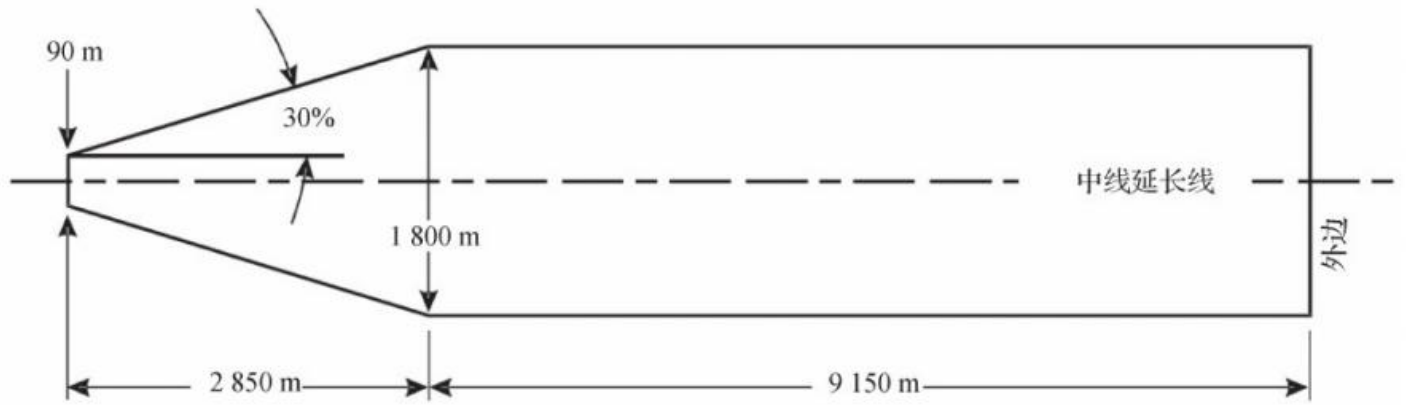


□ 6.2.1-2 □□□□ / □□□□□□



图例：

□ 6 MH5013 □□□□ / □□□□□□□□□□



7 MH5013 /
 ICAO/MH5013 FAA Part 77
 OLS ICAO Annex 14 Volume II Safety Area /
 FATO ICAO
 FATO FATO FATO
 MH5013-2023 PinS
 FATO FATO
 ICAO/MH5013 OLS
 eVTOL Safety Area OFV
 " " MH5013
 OLS OFV eVTOL
 FAA FAA EB105A 14 CFR Part 77 heliport imaginary surfaces primary surface
 approach/departure surface transitional surfaces VFR vertiport
 2:1 primary surface approach surface
 Part 77 ICAO/MH5013
 vertiport
 eVTOL h0 OFV /

PTs VPT-DSN.D.455 Obstacle-free volume (OFV)

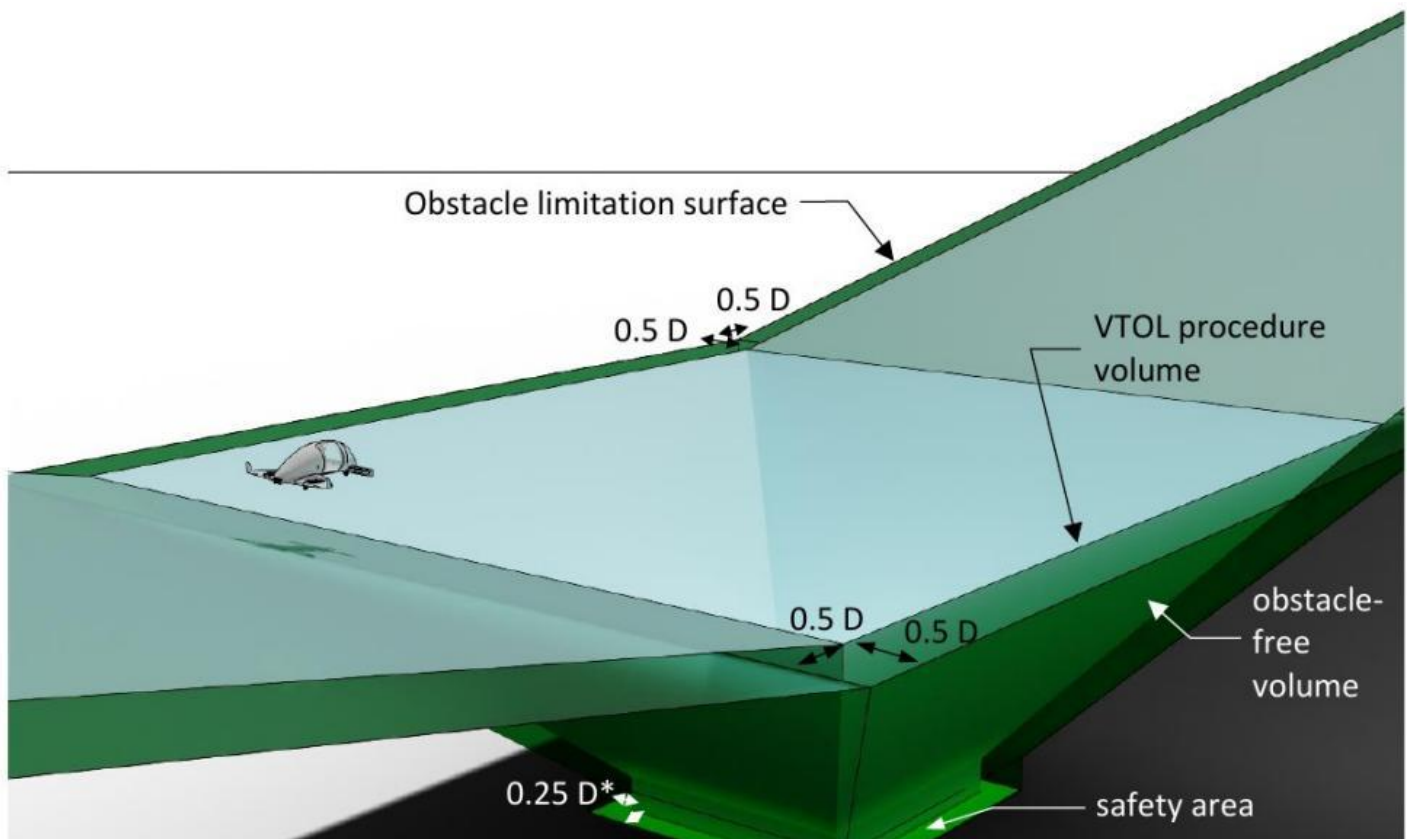
(a) The obstacle-free volume, as depicted in Figure D-15, is created by extending vertically upward the outside edges of the SA up to height h_1 . The edges at height h_1 are then extended upwards linearly up to height h_2 to provide a funnel-shaped volume. At height h_2 , $0.5 D$ are added on each side of the VTOL procedure volume so that the dimensions of the obstacle-free volume at height h_2 are:

(1) the length $(T O)_{back} + 0.5 D$ behind the aircraft and the length $(T O)_{front} + 0.5 D$ in front of the VTOL-capable aircraft, referenced to the aircraft centre of the smallest enclosing circle when positioned on the FATO; and

(2) the width $(T O)_{width} + 1 D$

(b) The obstacle-free volume should not be penetrated by obstacles.

Note: A larger SA may be warranted for specific local conditions, e.g. severe aerology.



9 EASA PTS-VPT-DSN Figure D-15

OFV

(a) Applicability

The purpose of the approach surface is to protect a VTOL-capable aircraft during the final approach to the FATo by defining the area that should be kept free from obstacles to protect a VTOL-capable aircraft in the final phase of the approach-to-land manoeuvre.

(b) Description

An incline plane or a combination of planes or, when a turn is or turns are involved, a complex surface sloping upwards from the inner edge and centred on a line passing through the centre of the FATO.

11 EASA D.410 Safety Area/

EASA OLS D.415 where appropriate VFR
 vertical procedures include lateral transit Table D-1 VTOL
 vertiports lateral transit Table D-1 VTOL
 transitional surface may be provided EASA OLS "VFR + /
 + " "

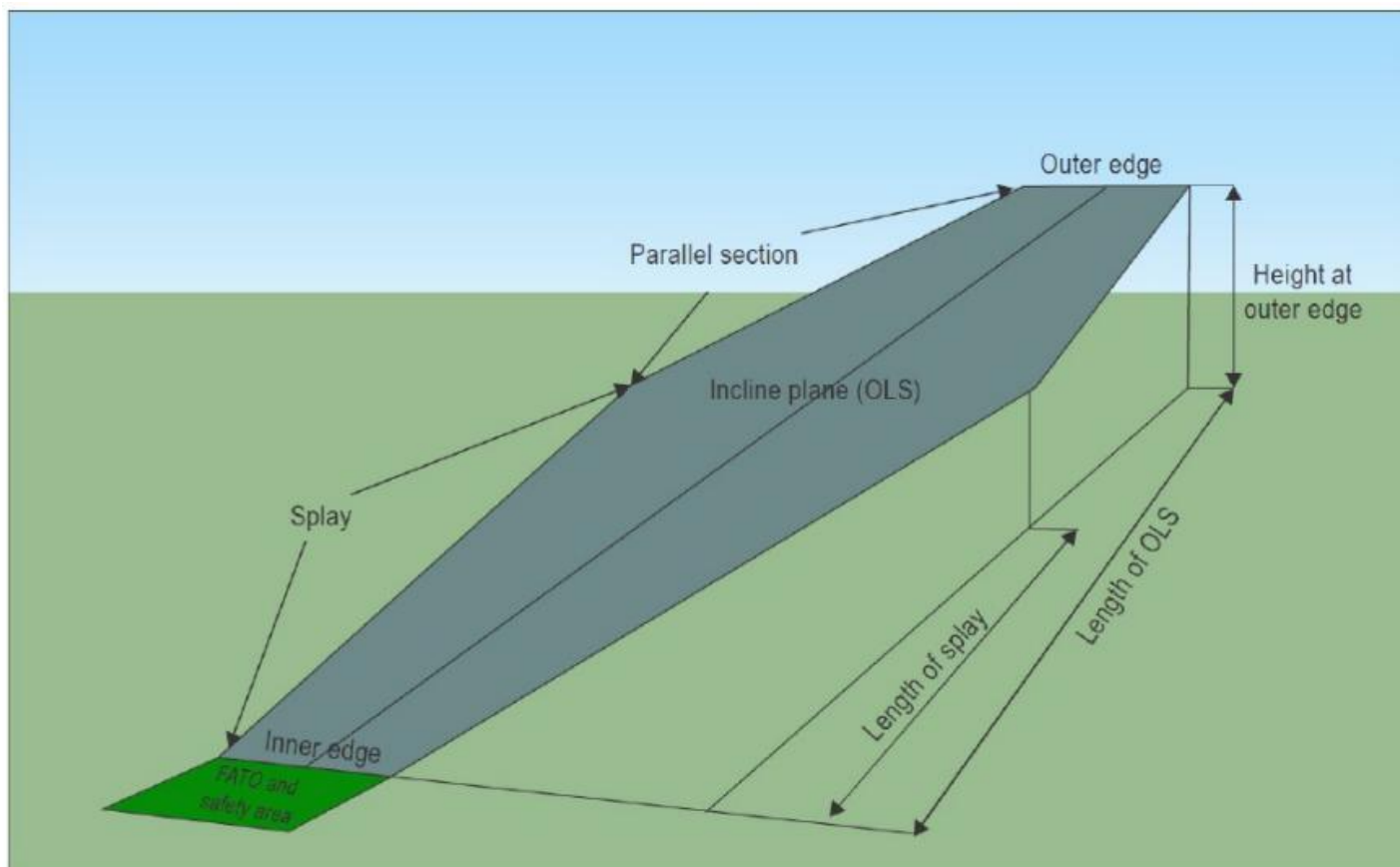


Figure D-6. Generic approach/take-off climb surface

(c) Characteristics

(1) The limits of an approach surface should comprise:

(i) an inner edge, horizontal and equal in length to the minimum specified width of the FATO plus the SA, perpendicular to the centre line of the approach surface and located at:

(A) for a runway-type FATO, the outer edge of the SA; or

(B) for other than a runway-type FATO, the outer edge of the reference circle;

(ii) two side edges originating at the ends of the inner edge and diverging uniformly at a specified rate from the vertical plane, containing the centre line of the FATO to a specified width and continuing thereafter at that width for the remaining length of the approach surface; and

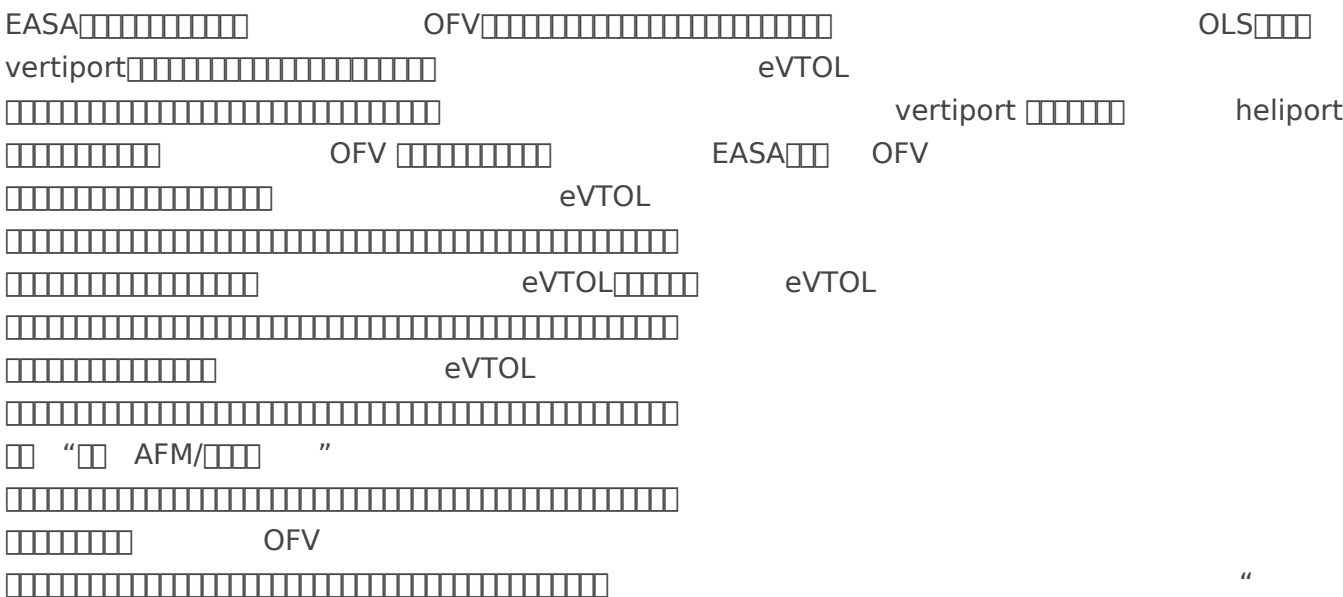
(ii) an outer edge horizontal and perpendicular to the centre line of the approach surface at a specified height above the elevation of the FATO.

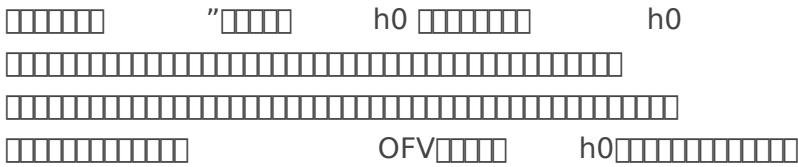
(2) The elevation of the inner edge should be the elevation of the SA at the point on the inner edge that is intersected by the centre line of the approach surface. When safety assessment determines that it would not adversely affect the safety or significantly affect the regularity of operations of VTOL-capable aircraft at vertiport, the origin of the inclined plane may be raised directly above the FATO.

(3) The slope(s) of the approach surface should be measured in the vertical plane containing the centre line of the surface.

(4) In the case of an approach surface involving a turn, the surface should be a complex

□ 12 EASA D.415 □ □ □ □ □ □ □ □ lateral transit □ □ □ □ □





OLS

???CASA???????? FPA/VPS/OFV ??

CASA AC139.V-01 Protection Area VPS Vertical Procedure Surface OFV
 EASA FPA VPS OFV FPA FATO
 GIS

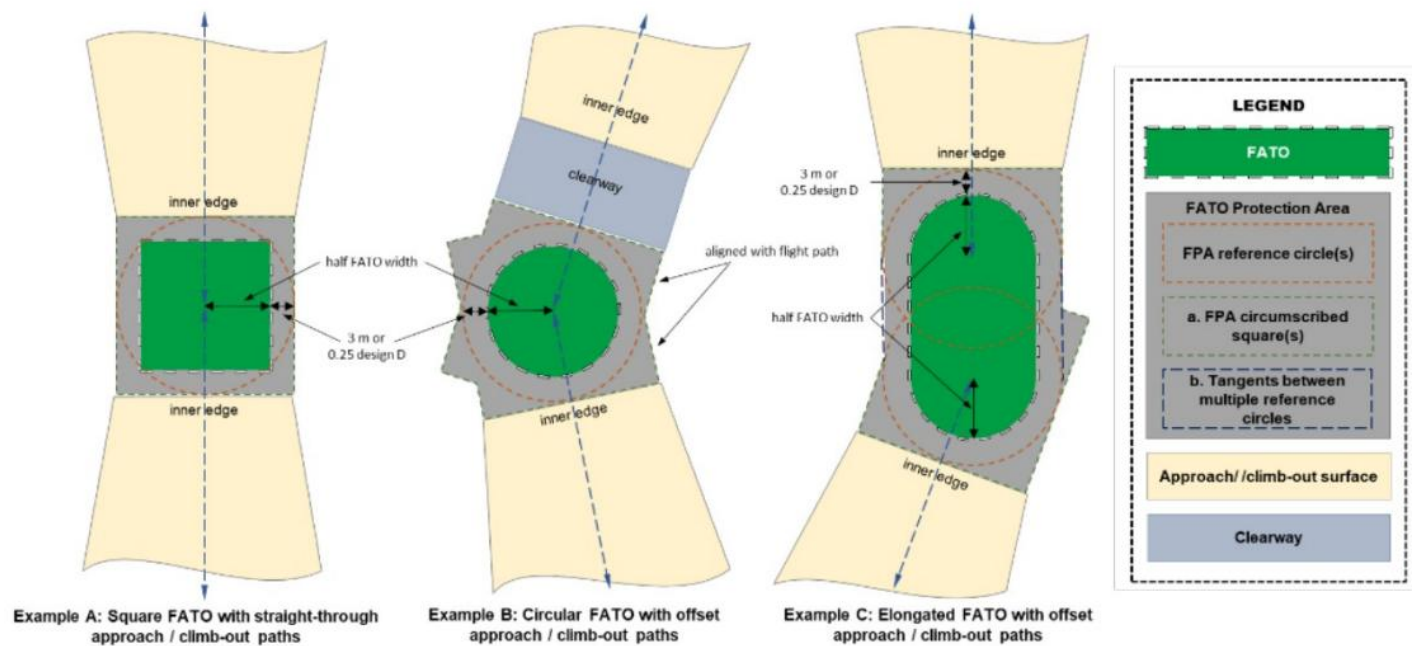


Figure 7 - Protection surfaces for vertiports without vertical procedures

4.2.3 Vertical Procedure Surface

4.2.3.1 A vertical procedure surface (VPS) should be established for where vertical procedures are used for landing or take-off from the vertiport.

4.2.3.2 The VPS is a surface that encompasses the area bordered by a circumscribed square(s) aligned with the intended aircraft flight path(s) centred on the VPS reference circle, as shown in Figures 8, 9 and 11.

4.2.3.3 A VPS should be free of obstacles.

4.2.3.4 A VPS reference circle should be established above and centred on the FATO.

4.2.3.5 The diameter of a VPS reference circle should be the diameter of the associated FPA reference circle, plus 1 Design D per 100 ft increase in height above the FATO.

4.2.3.6 The vertiport operator should determine the elevation of the VPS subject to the performance characteristics of the most demanding VCA intended to use the vertiport or the VCA operator's intended operational requirements.

4.2.4 Obstacle Free Volume (OFV)

4.2.4.1 An OFV should be established between a VPS and the associated FPA.

4.2.4.2 An OFV should be free of obstacles.

4.2.4.3 The OFV is a truncated cone extending between the edge of the FPA reference circle to the edge of the VPS reference circle, as shown in Figure 8, 9 and 11.

□ 13 CASA AC139.V-01 □ FPA □ VPS □ OFV □ □ □ □ □ □

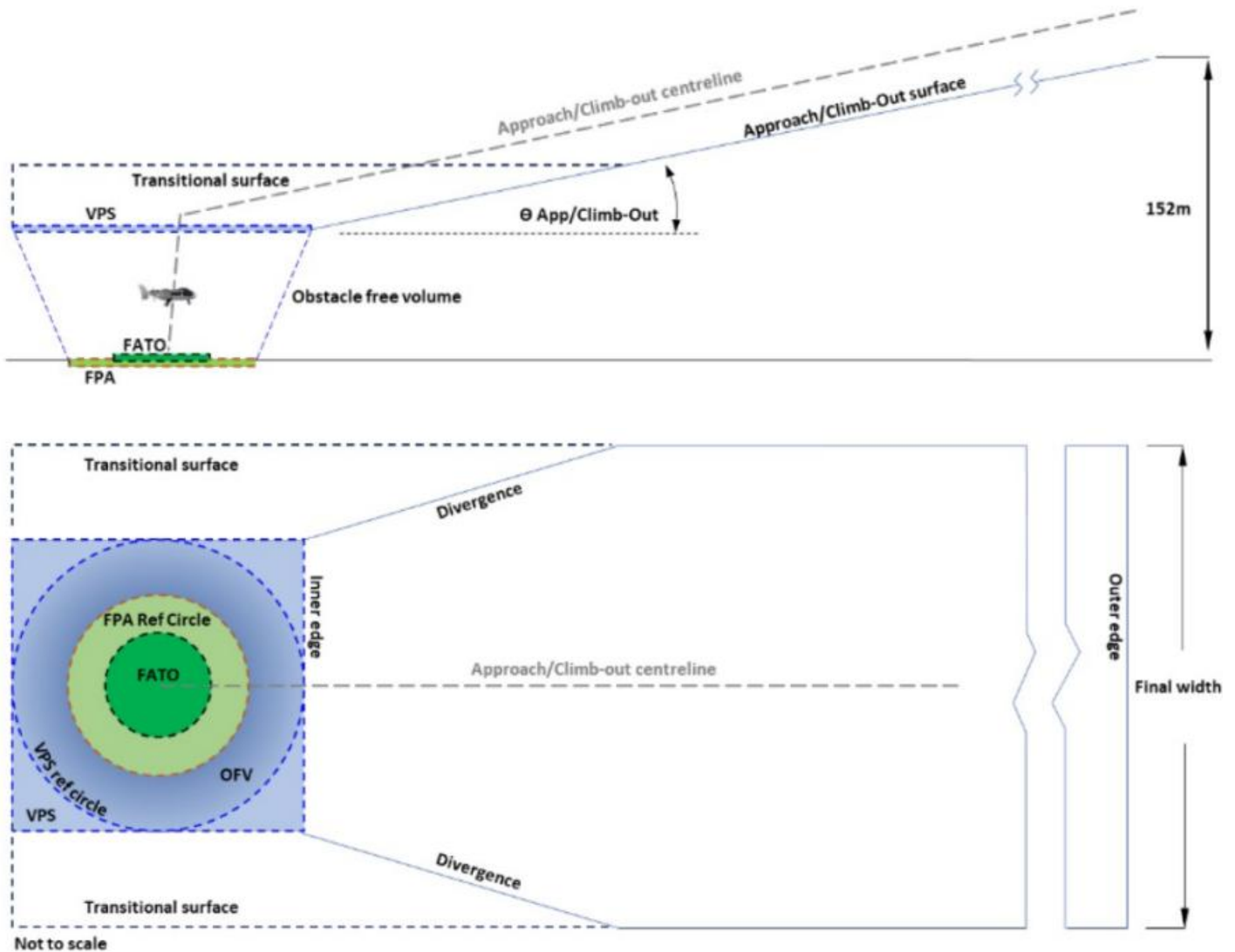
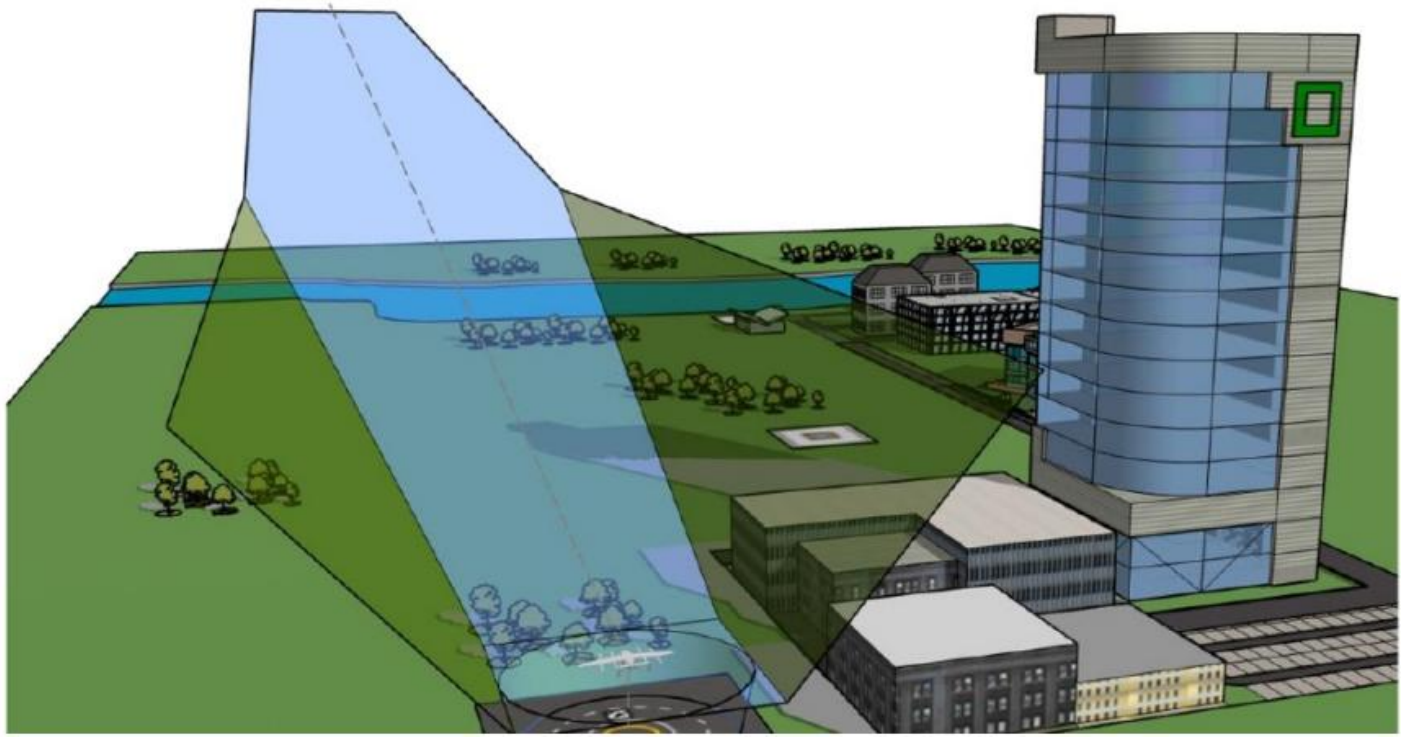


Figure 8 - An example OLS design for a vertiport accommodating vertical procedures



14 CASA AC139.V-01 OFV

CASA " "

???????????? heliport OLS??
 h0+OFV ?? eVTOL ??????

T/CCAATB 0062-2024 " " " "
 heliportOLS MH5013 eVTOL D
 OLS h0 OFV
 OFV OFV
 OLS OLS

6.1???????

6.1.1 eVTOL MH 5013
 eVTOL D
 FATO

6.1.2 eVTOL / 135°

6.2???????

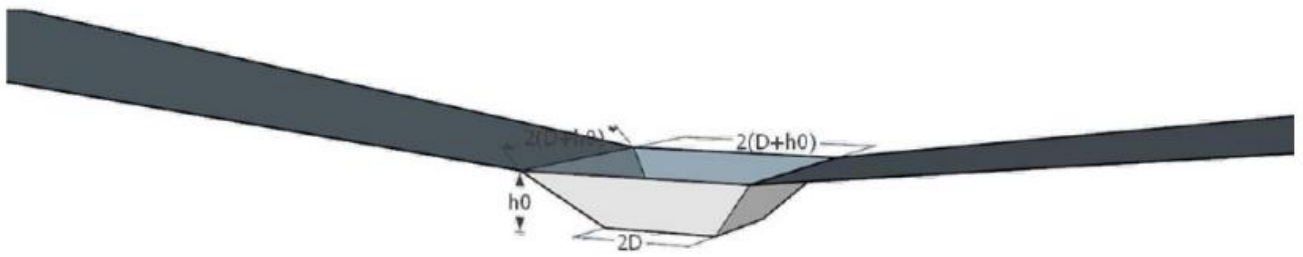
6.2.1 MH5013
 OFV
 MH5013

6.2.2 eVTOL
 FATO $h_0 \leq D$ 6.2-1 $h_0 > D$
 6.2-2

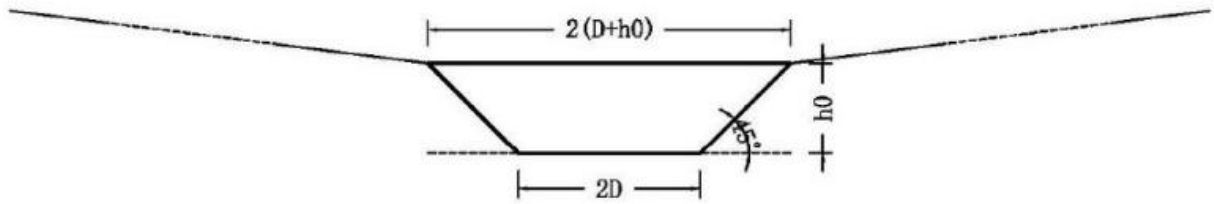
15 $h_0 \leq D$ $h_0 > D$ OFV

$h_0 \leq D$ OFV FATO $2D$ h_0 $2 \times (D + h_0)$
 $h_0 > D$ $4D$ D $4.5 \sqrt{D}$ D
 “ ”
 OLS OFV
 $4.5 \sqrt{D}$

ICAO Annex 14 Volume II
 FATO $4.5 \sqrt{D}$ 10m protected
 side slope MH5013-2023 4.4.1 FATO
 $4.5 \sqrt{D}$ 10m heliport
 $4.5 \sqrt{D}$ eVTOL $h_0 \leq D$ h_0
 $\mathit{h_0}$ $2D$ $2(D + h_0)$ $h_0 > D$ $4.5 \sqrt{D}$ D
 $4D$ D $4.5 \sqrt{D}$ $4D$ OFV h_0
 EASA
 $4D$ D



a) 三维立体图



b) 纵剖面图

16

FATO OFV

“OFV”

eVTOL

h_0 eVTOL

h_0

OLS

h_0

D

OFV

/

??FAA ???Part 77 ??D/RD ? DCA

??FAA EB105A ??? EASA ? OFV

FAA EB105A EASA/CASA/

OFV

FAA 14

CFR Part 77 heliport imaginary surfaces

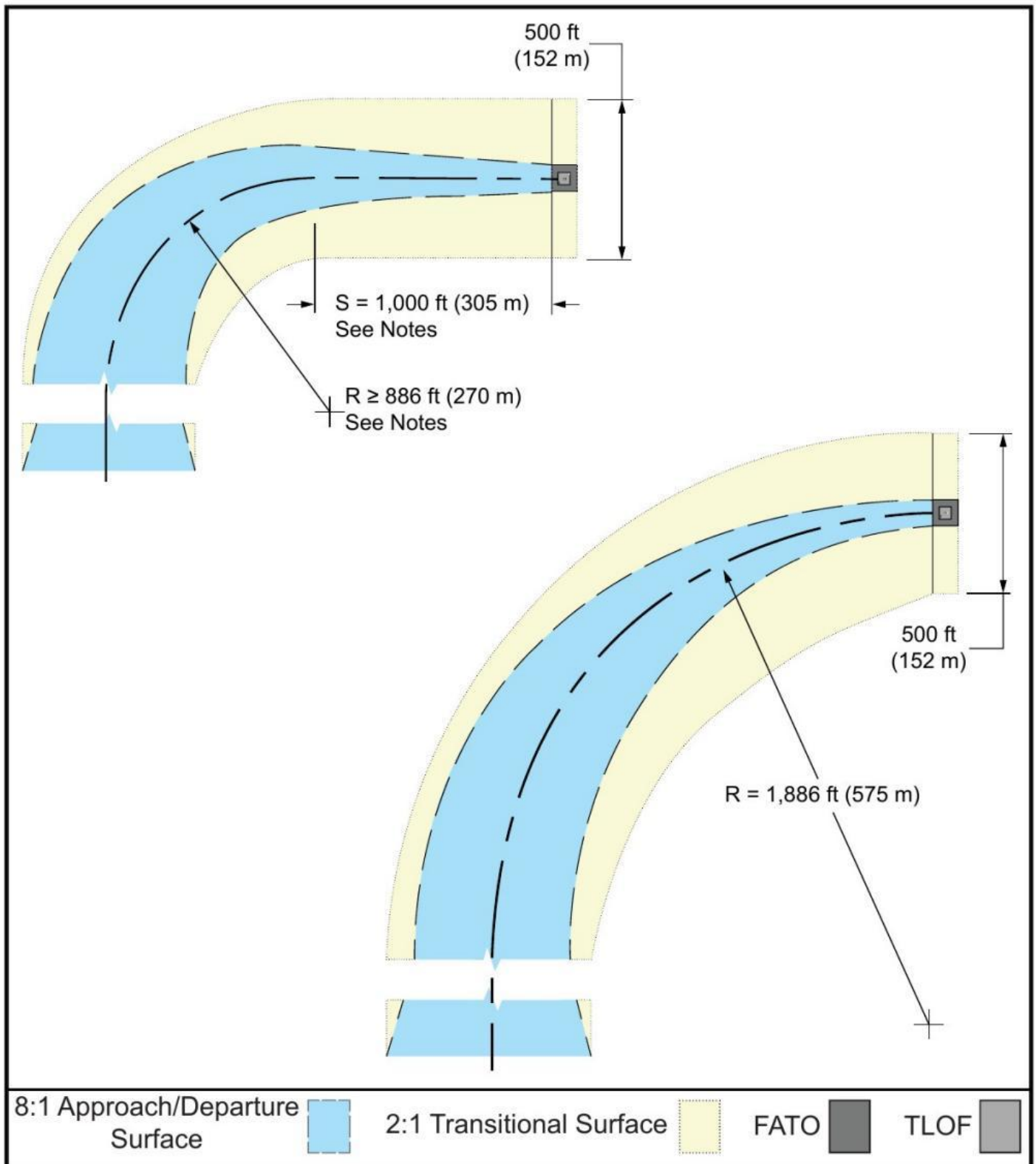
vertiport

primarysurface approach

surface transitional surfaces

Figure 2-5: VFR Vertiport Approach/Departure Surfaces

Figure 2-6: VFR Vertiport Curved Approach/Departure and Transitional Surfaces



Note 1: Use any combination of straight portions of one curved portion using the following formula: $S + R \geq 1,886 \text{ ft (575 m)}$ and $R \geq 886 \text{ ft (270 m)}$, where S is the length of the straight portion(s) and R is the radius of the turn. Note that any combination $\geq 1,886 \text{ ft (575 m)}$ will work.

Note 2: The minimum total length of the centerline of the straight and curved portion is 4,000 ft (1,219 m).

Note 3: VTOL takeoff performance may be reduced in a curve. Consider a straight portion along the takeoff climb surface prior to the start of the curve to allow for acceleration.

FAA $S+R \geq 1886 \text{ ft} \approx 575 \text{ m}$ $R \geq 886 \text{ ft} \approx 270 \text{ m}$ 4000 ft
 1219 m

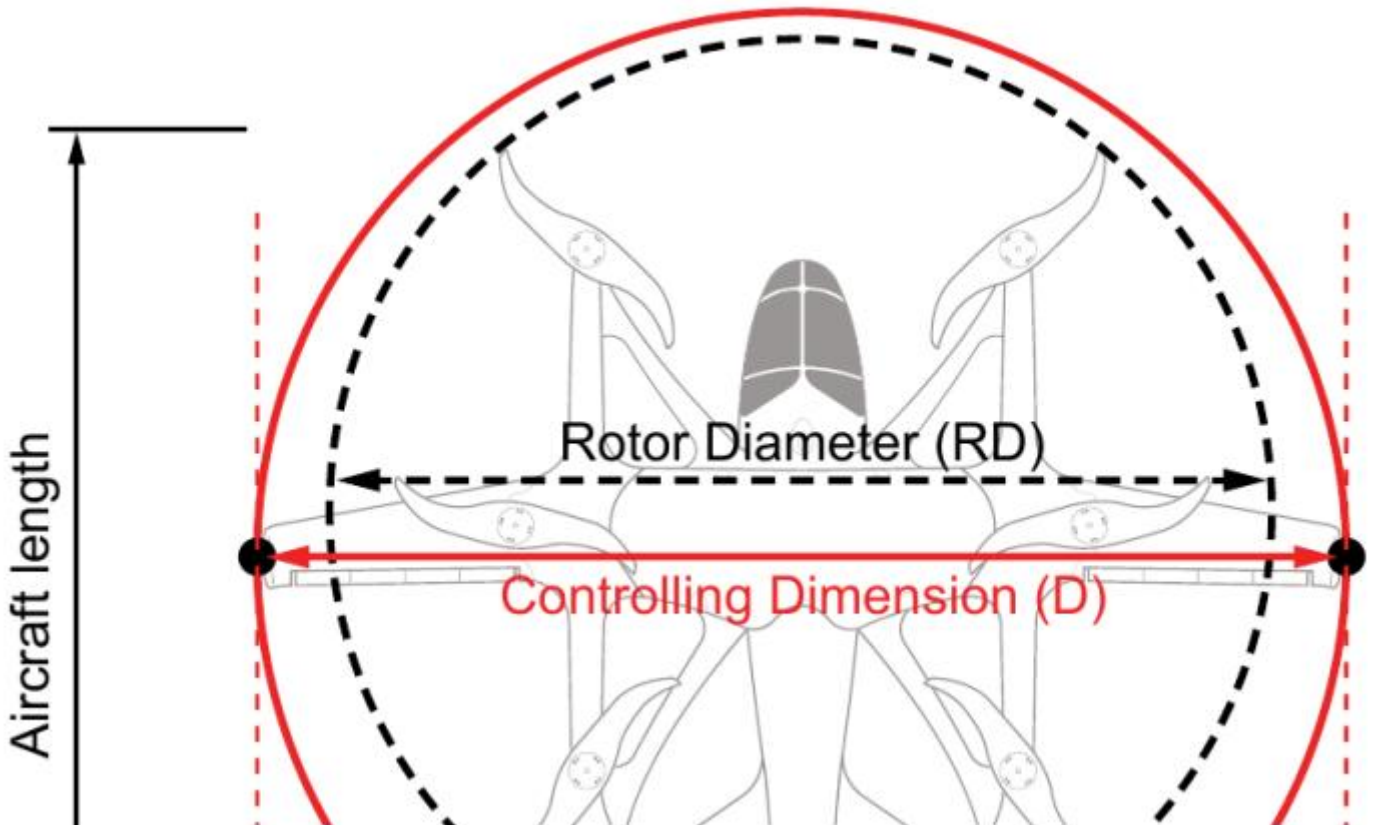
ICAO/MH5013 “ ”

FAA ? eVTOL ???? D/RD ? DCA

FAA eVTOL D/RD DCA /
 EB105A D RD / TLOF
 1RD FATO 2RD Safety Area 2.5D

- Battery system: Comprised of the battery, the battery charger, and any protective, monitoring, and alerting circuitry or hardware inside or outside of the battery. It also includes vents (where necessary) and packaging.
- Controlling dimension (D): The diameter of the smallest circle enclosing the entire VTOL aircraft projection on a horizontal plane, including all possible configurations with rotors/propellers turning, if applicable. See Figure 1-1.

Figure 1-1: Controlling Dimension



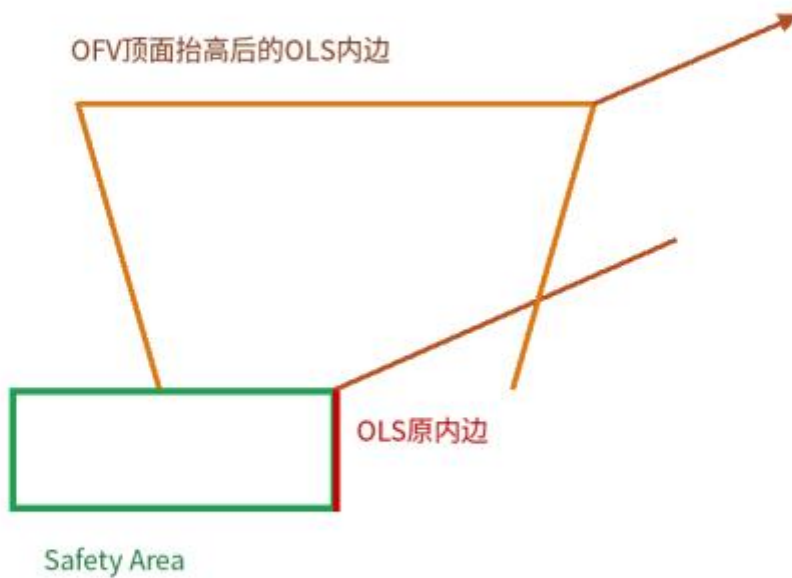
16 FAA EB105A D RD

DCA Downwash/Outwash Caution Area eVTOL /
 34.5 mph 55.5 kph DCA FAA
 Part 77 eVTOL DCA

??FAA ? ICAO/EASA/CASA/ ??????????

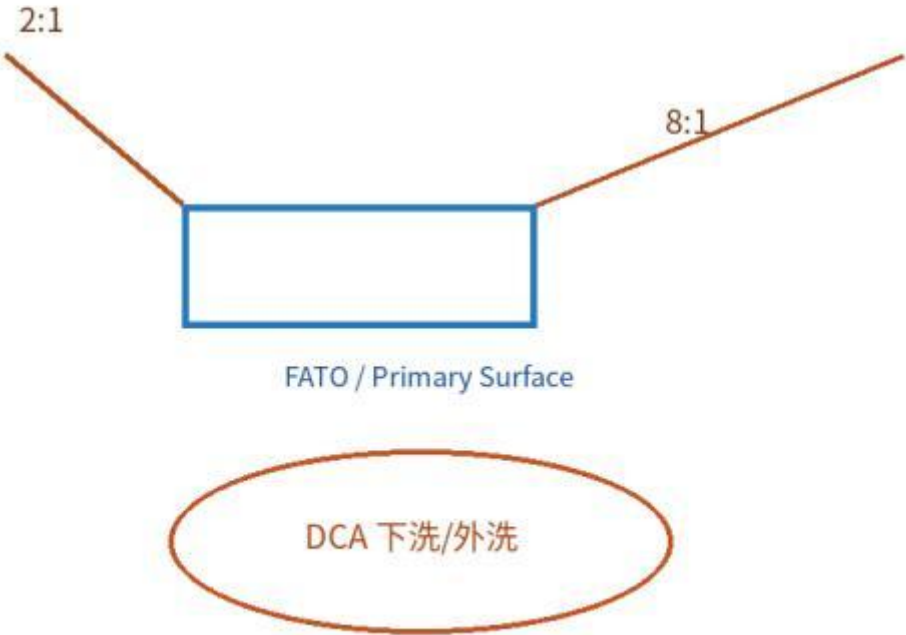
□ 4 ICAO/EASA/CAAC □ □ □ □ FAA □ □ □ □

ICAO/EASA/CAAC主线: Safety Area → OLS; 复杂净空 → OFV抬高OLS



主线: 我国净空体系宜采用ICAO/EASA/CAAC方向, OFV服务于传统OLS。

FAA参考路径: Part 77 primary surface = FATO; D/RD + DCA



参考: FAA用于比较和补强, 不混入ICAO/MH5013边界定义。

17 FAA ICAO/EASA/CASA

	FAA EB105A	ICAO/EASA/CASA	
	Part 77 imaginary surfaces primary/approach/transition surfaces	OLS OFV	FAA OFV
	FAA/Part 77 FATO/primary surface	ICAO/MH5013 Safety Area OLS OFV OFV	
	8:1 OFV	OFV OLS	OFV CBD
eVTOL	D/RD DCA	EASA OFV	FAA
		OLS	

