EASA CAT SET IMC Workshop

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Route Planning / Selection of Landing Sites / Use of Risk Period(s)

Who's speaking ?

Established	2011 in France
Key Activity	Air Taxi
Operations	Europe & North Africa
Fleet	4 aircraft – 3x TBM 850, 1x PC12
SET IMC Experience	> 2000 Flight Hours

Who's speaking ?

Established	1968 in Denmark, 1993 in Norway
Key Activity	Air Cargo
Operations	Europe
Fleet	15 aircraft, of which 3 Cessna 208B
SET IMC Experience	> 75.000 Flight Hours

What's the idea behind CAT SET IMC ?

Philosophy	**Manage our risk by choosing a safe flight path**
Practice	**Optimize our flight time in gliding range of landing sites**
Route Planning	**Plan our SET IMC flights accordingly – routing & altitudes**
Landing Sites	**Identify, assess, select & program our landing sites**
Risk Periods	**Use risk periods as appropriate, if and when needed**

Route Planning

CAT SET IMC relies on specific route planning procedures that are designed to ensure that the routings and cruise altitudes are selected so as to establish a safe flight path where flying time within gliding range of a landing site is optimized.

A safe path can be, but is not always, the straightest route.

Route Planning – Practical Steps

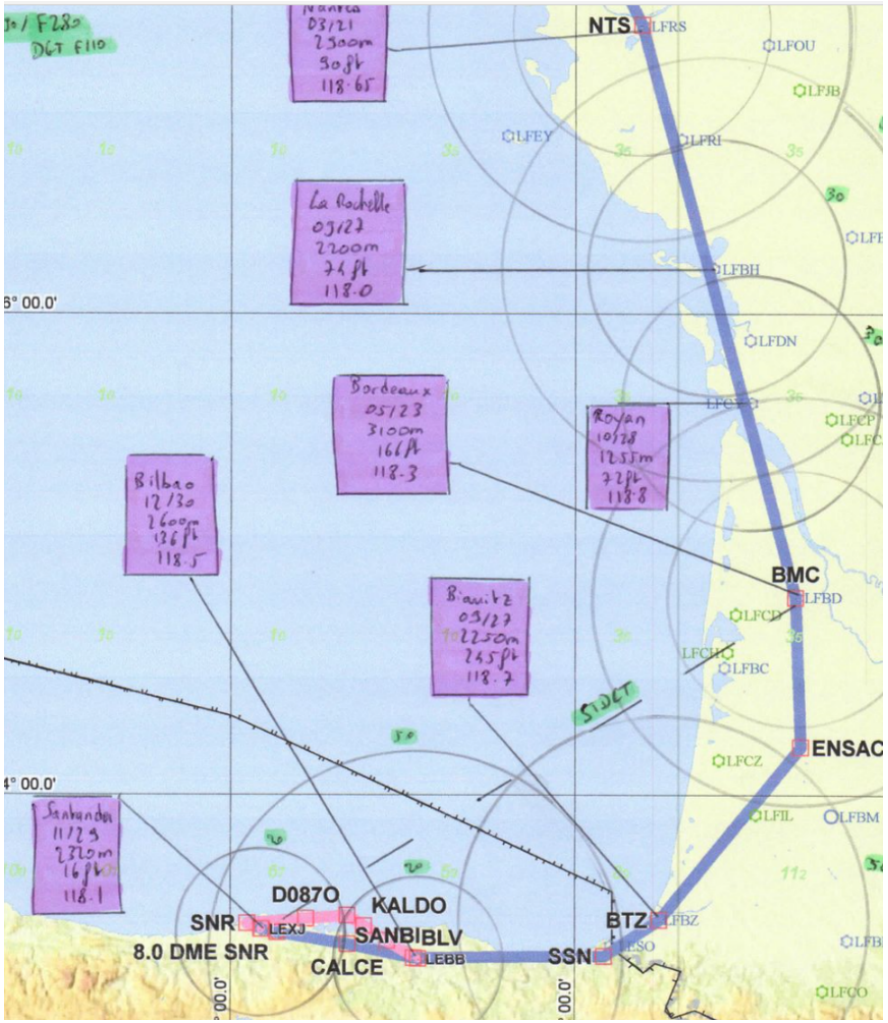
Step 1 Find the shortest CFMU accepted route

Step 2 Identify, select & assess the airports and landing sites along the route

Step 3 Assess the risk period(s) if required

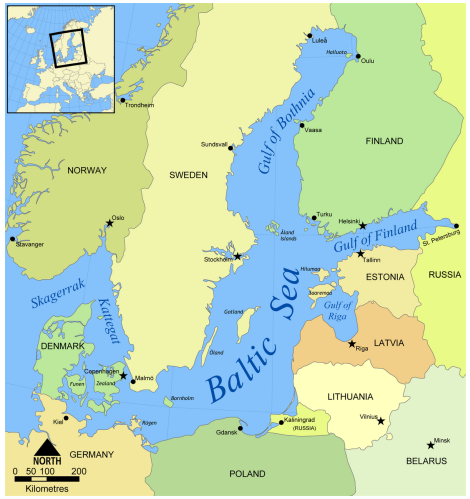
Step 4 Program the landing sites & prepare the documentation for the crew

Route Planning – Example : TBM passenger flight from France to Spain

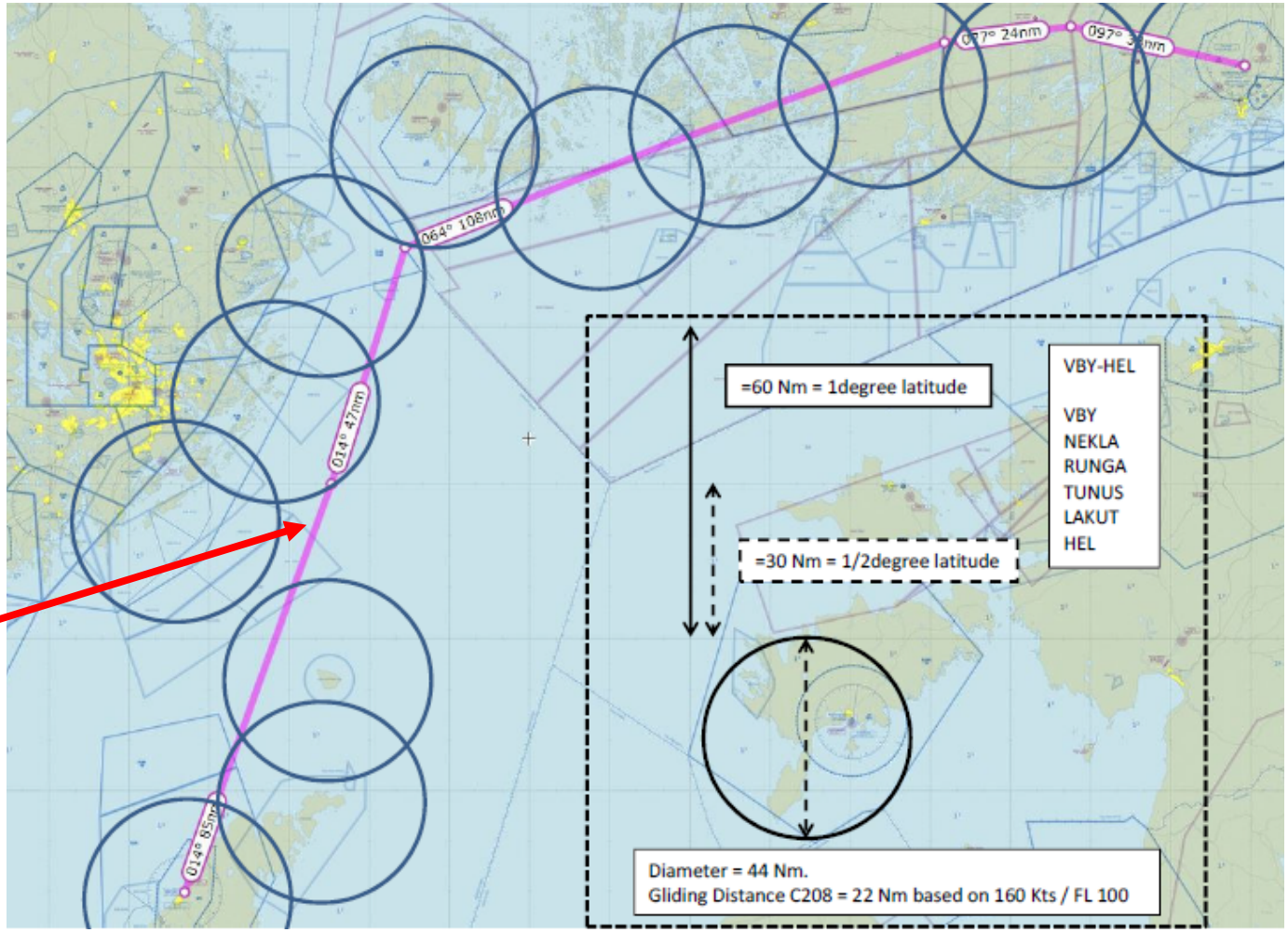


Without a risk period

Route Planning – Example : C208 cargo flight from Sweden to Finland

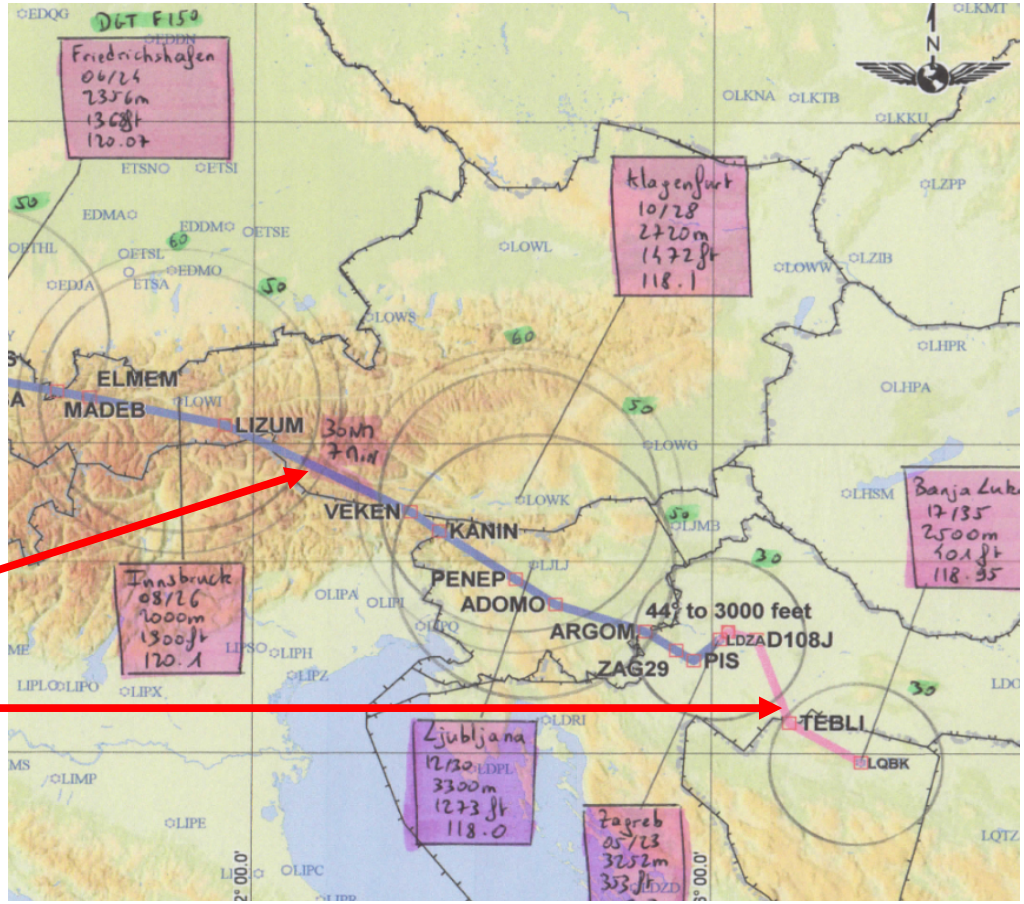


With a risk period

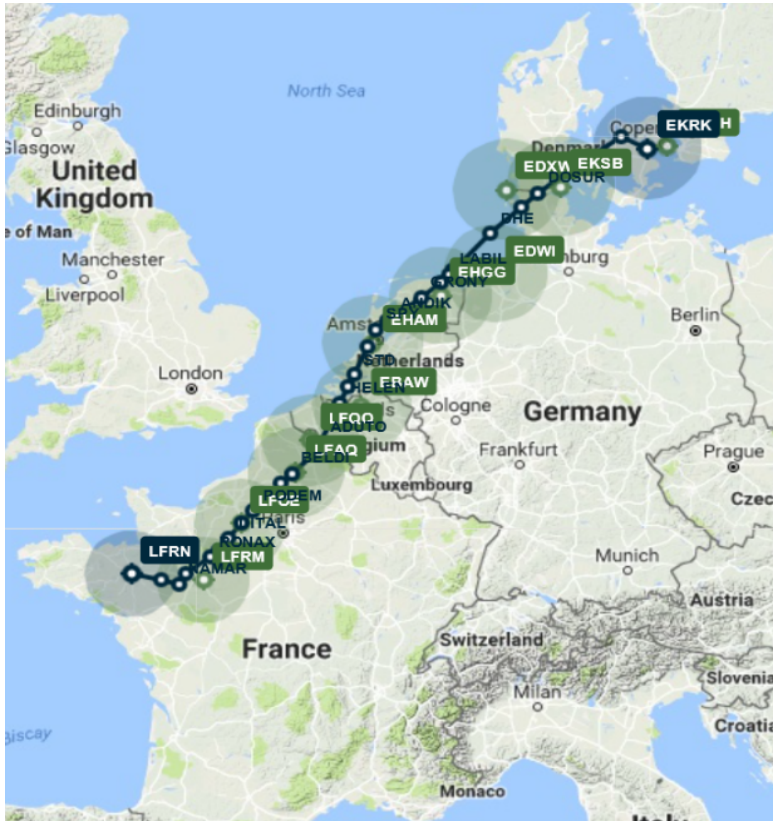


Route Planning – Example : TBM passenger flight from France to Bosnia-Herzegovina

With 2 risk periods

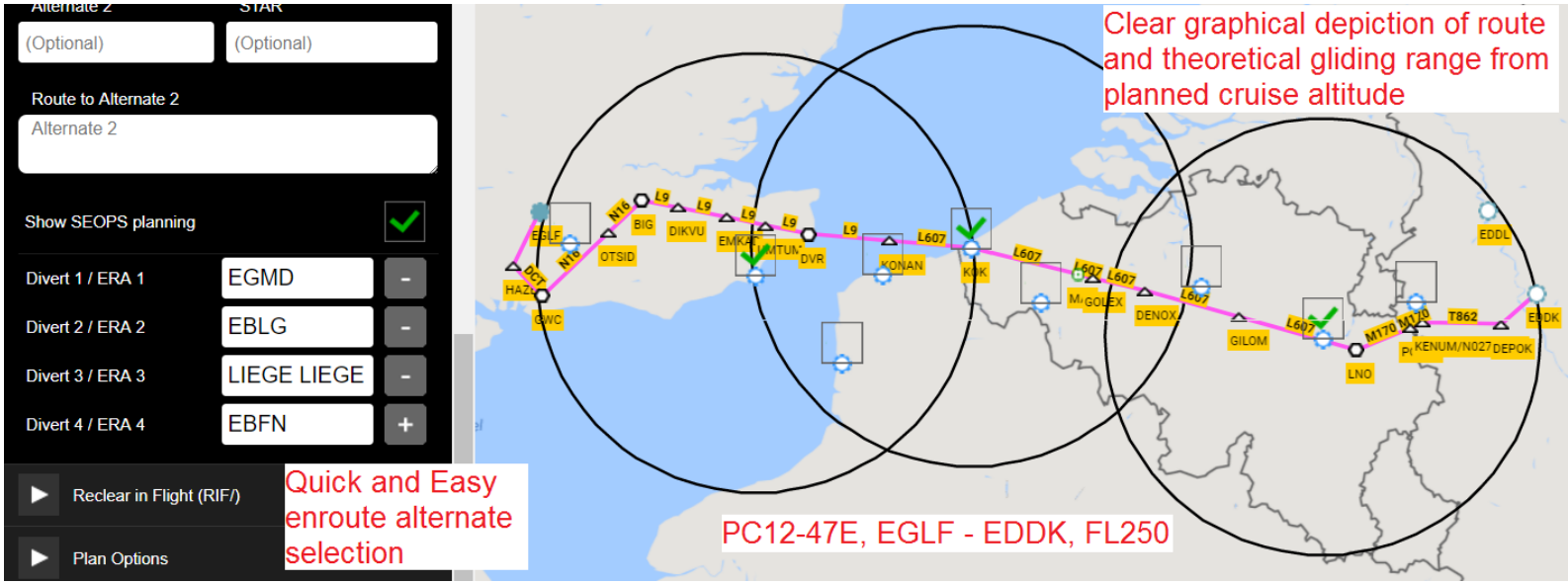


Route Planning – EUROFPL tool developed for VOLDIRECT



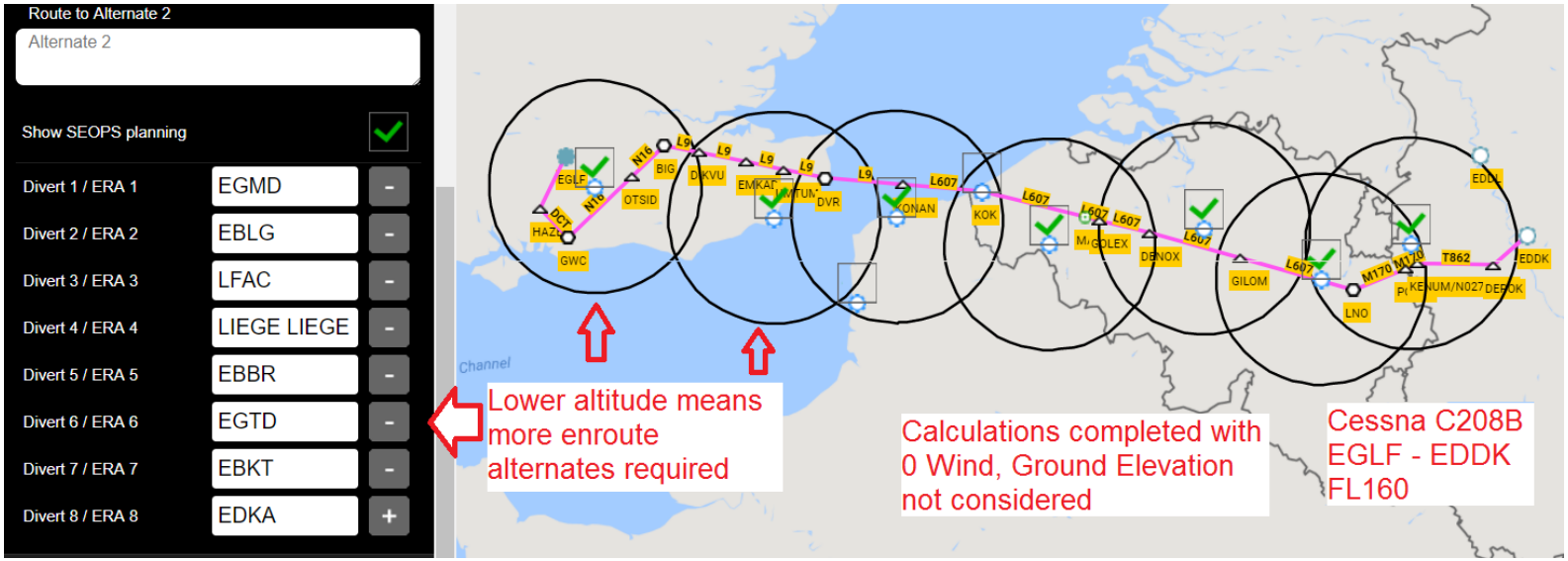
ICAO	Name	Elev.	Rwy.	Length	Notes
LFRN	RENNES SAINT JACQUES	124 ft (37.8 m)	10/28	6890 ft (2100 m)	102/282 TWR 120.5 HRS H24R
LFRM	LE MANS ARNAGE	194 ft (59.1 m)	02/20	4659 ft (1420 m)	021/201 TWR 125.9 HRS 0900-1230/1330-1800L
LFOE	EVREUX FAUVILLE	464 ft (141.4 m)	04/22	9836 ft (2998 m)	040T/220T TWR 125.375 HRS 0600-1500Z Mo-We, 0600-1400Z Th-Fr, O/T PPR
LFAQ	ALBERT BRAY	364 ft (110.9 m)	09/27	7218 ft (2200 m)	085/265 TWR 119.65 HRS H24R
LFQQ	LILLE LESQUIN	157 ft (47.9 m)	08/26	9268 ft (2825 m)	077/257 TWR 118.55 HRS H24R
EBAW	ANTWERPEN / DEURNE	39 ft (11.9 m)	11/29	4954 ft (1510 m)	110/290 TWR 135.2 HRS 0630-2300L, O/T O/R

PC12 Example



RocketRoute

C208B Example



RocketRoute

Company Confidential

Landing Sites

By definition, a landing site is an aerodrome or an area where a safe forced landing can be performed by day or night, taking into account the expected weather conditions.

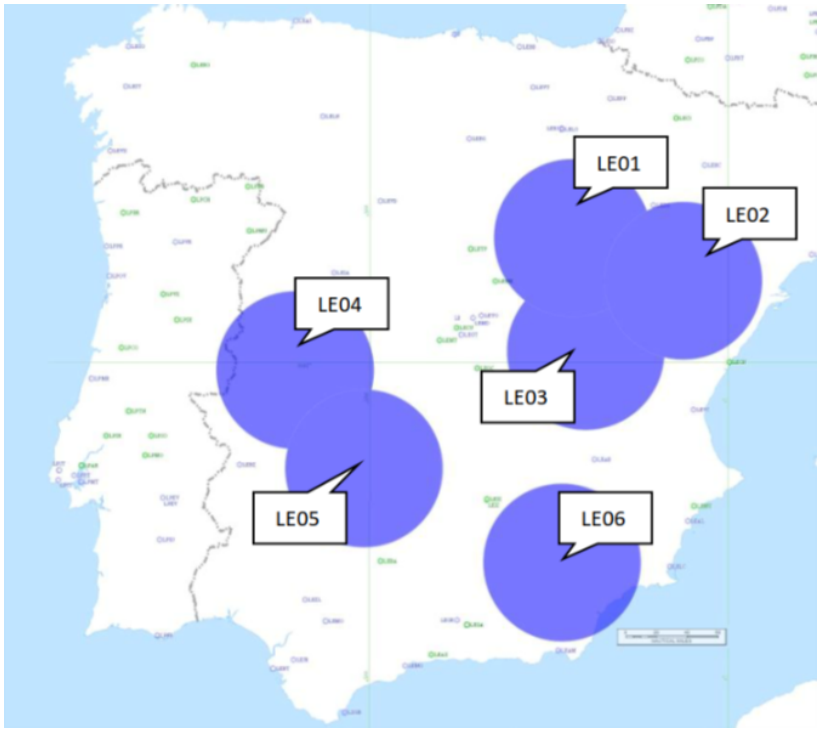
Landing sites suitable for a diversion should be identified, assessed and selected before the flight to maximize possibilities to successfully carry out a safe forced landing.

Landing Sites – Selection order

- Aerodromes with available runway lighting
- Aerodromes without available runway lighting
- Fields with short grass/vegetation, or
- Sandy area not populated

Landing sites must be programmed into the navigation system before the flight so that track & distance are immediately and continuously available to the crew.

Landing Sites - Example



LE01

NOM DU POINT	COORDONNEES	ALTITUDE	AXE	NATURE	LONGUEUR
LE01	N 41°24,4' W 02°10,6'	840 m	140/320	Champs	1700 m

Landing Sites – Information made available to the crew (when not an aerodrome)

For emergency landing sites that are not aerodromes :

(1) Size & shape of the landing area, as well as elevation

(2) Obstacles in the area

(3) Type of ground surface

(4) Longitudinal and lateral slope, if relevant

(5) Recommended landing direction and procedure

Landing Sites – Information & monitoring (when not an aerodrome)

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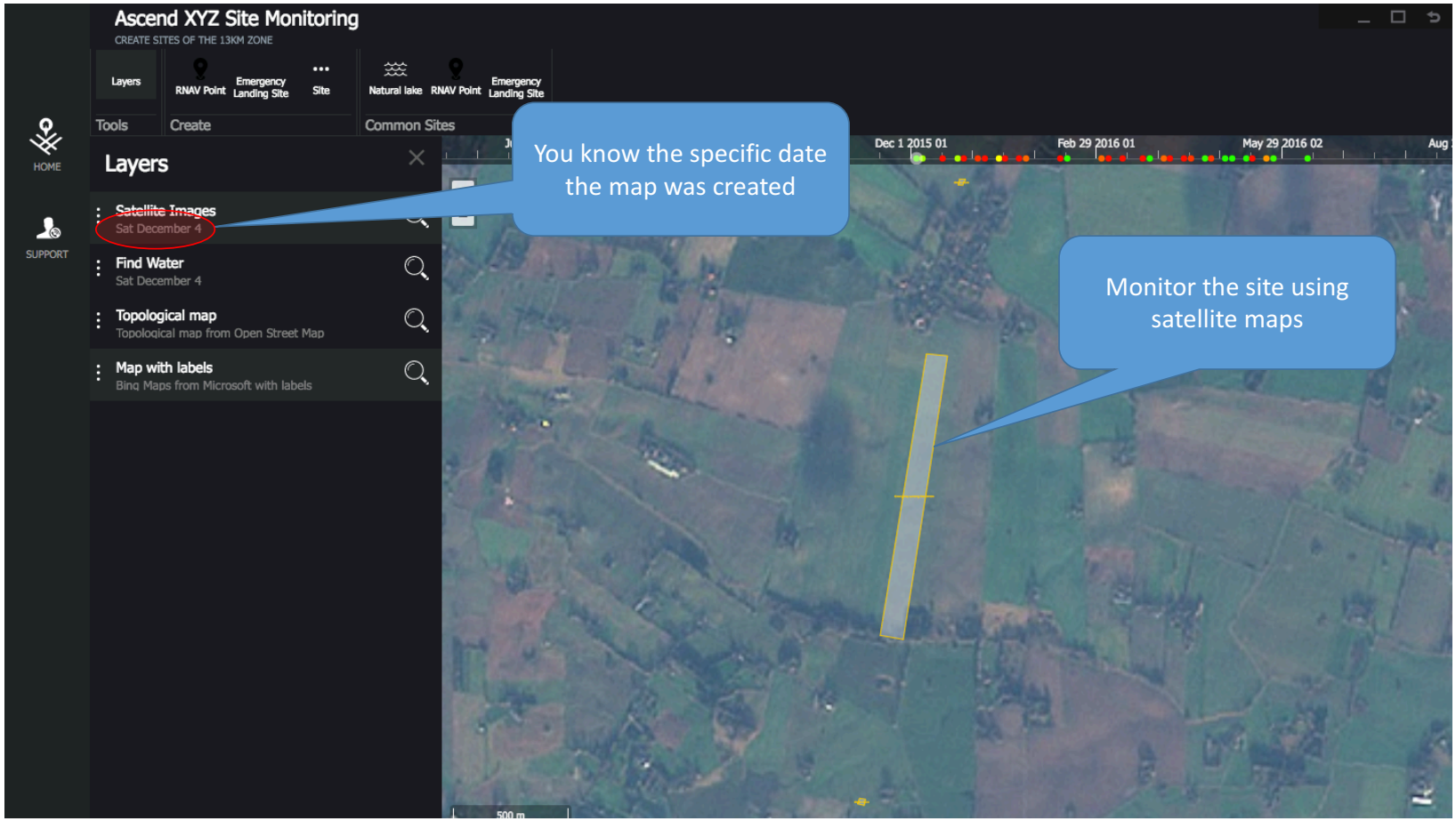
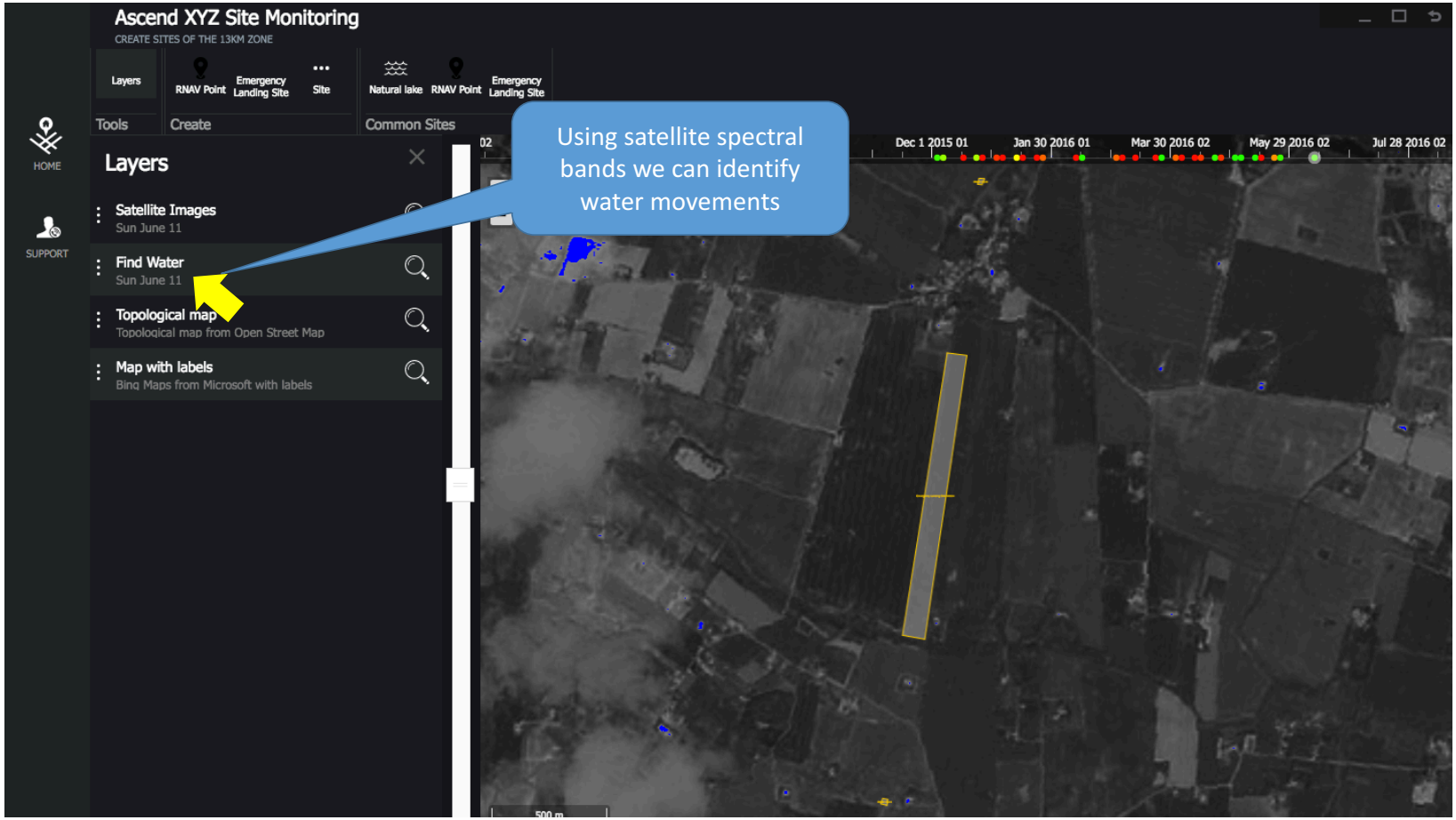


Landing Sites – Information & monitoring (when not an aerodrome)



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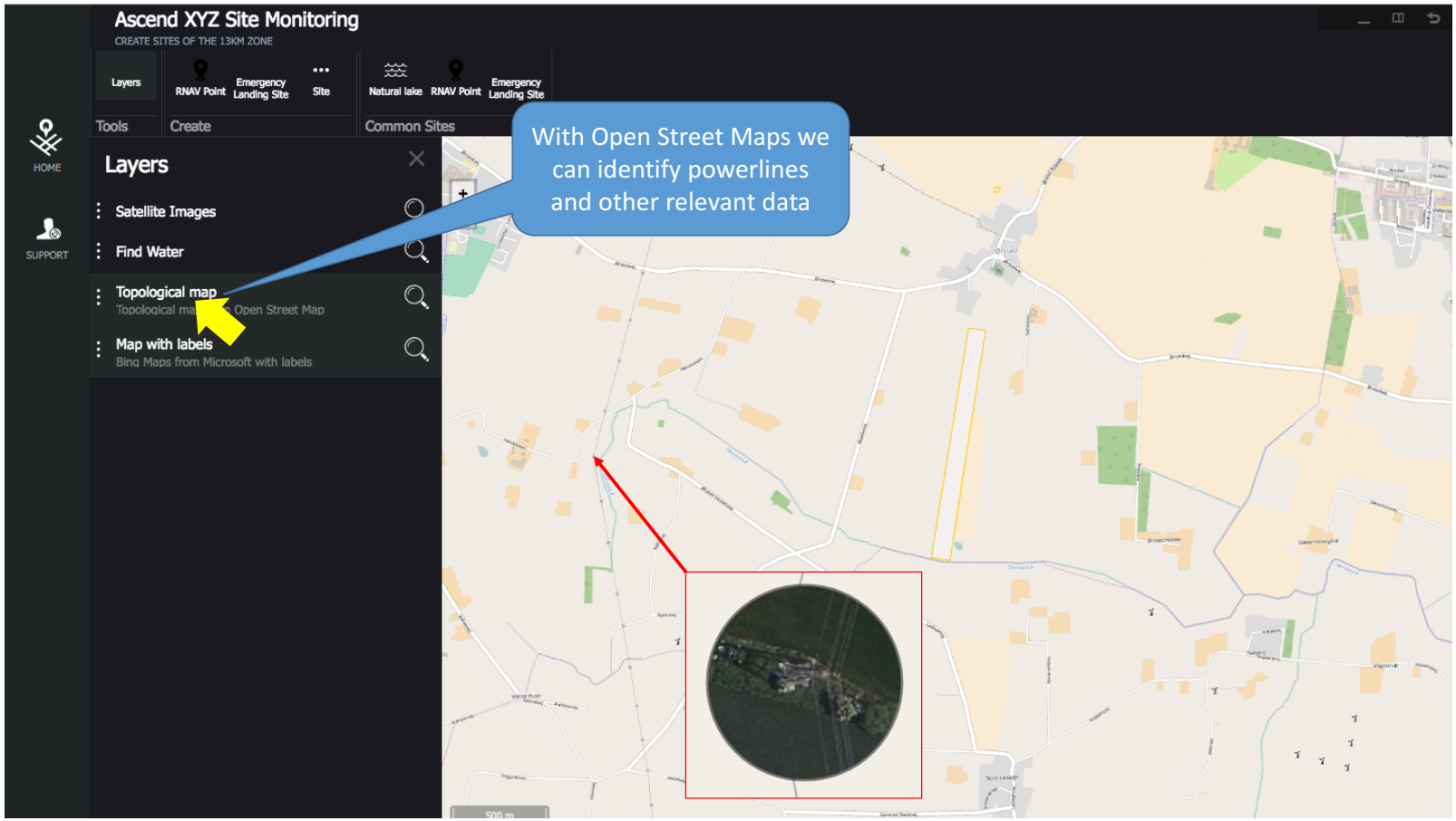
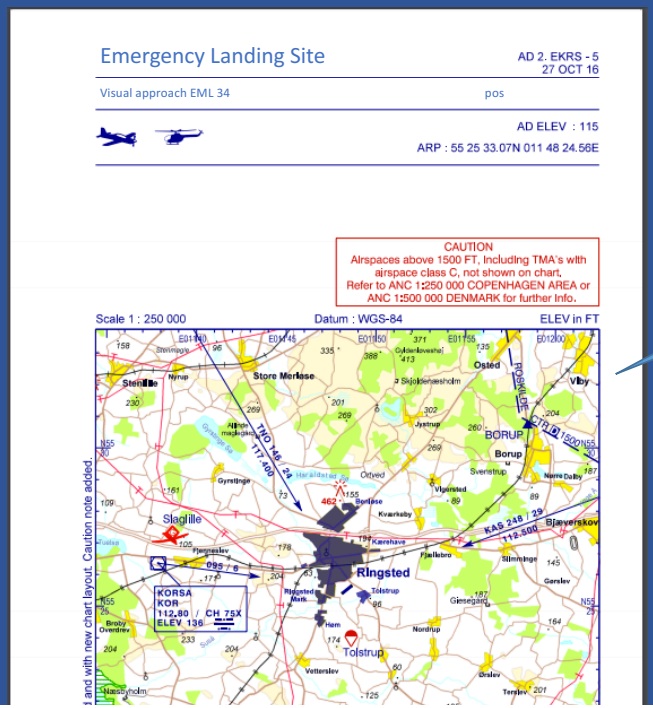


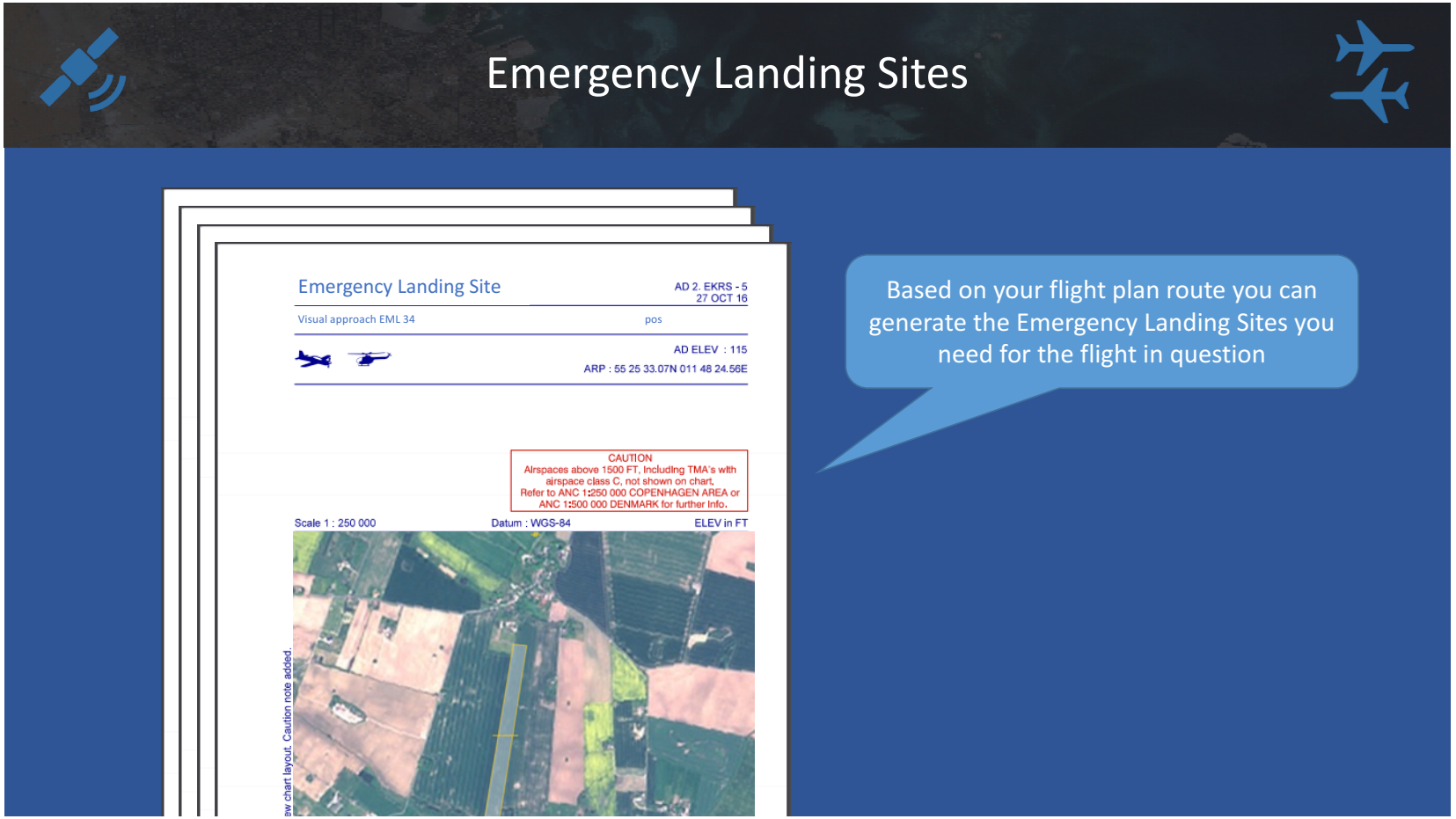
Landing Sites – Information & monitoring (when not an aerodrome)

Emergency Landing Sites



Generate plates for operational use

Landing Sites – Information & monitoring (when not an aerodrome)



Risk Periods

A risk period may be used whenever a landing site is not within gliding range.

The total duration of the risk period(s) per flight shall not exceed 15 minutes, unless a route-specific risk assessment is carried out.

Risk Periods – How to calculate & possibly extend the 15 minutes of risk period(s)

EASA CAT target for overall fatal accident rate (all causes) = 4,0 per million flight hours

The engine failure contribution is estimated at 33%

SET-IMC target = 4,0E-6 * 33% = 1,3 per million flight hours

Based on the minimum required SET reliability rate of 10 IFSD per million flight hours

However, when OEMs show a better reliability, it is possible to consider a longer total risk period without increasing the risk.

PWC demonstrated engine failure rate per flight hour, worldwide basis, civil singles (June 2017, 12-month average, C208B w/ PT6A-114A TIFSD rate 7 per million flight hours)	7,00E-06	LANDING SITE						
Phase of flight	**Assumed height or height band AGL (in ft)**	**Aerodrome**	**Other**	**Exposure time in that phase of flight (seconds)**	**Cumulative flight time from start to phase completion (seconds)**	**Estimated probability of unsuccessful forced landing if engine fails in this phase of flight**	**Risk of unsuccessful forced landing if engine fails in this phase, per flight**	**Cumulative risk per flight**
Take-off ground roll	0	X		20	20	0,00%	0,00E+00	0,00E+00
Climb out	0 to 50	X		8	28	0,00%	0,00E+00	0,00E+00
	50 to 200	X		10	38	1,00%	1,94E-10	1,94E-10
	200 to 900			45	83	100,00%	8,78E-08	8,80E-08
	900 to 2000	X		58	141	25,00%	2,82E-08	1,16E-07
	2000 to 4000	X		129	270	25,00%	6,27E-08	1,79E-07
Climbing to en route height. Assumed FL 100	4000 to 10000	X	X	387	657	5,00%	3,76E-08	2,17E-07
En route cruise: emergency landing site available	10000 and above	X	X	5.700	6.357	5,00%	5,54E-07	7,71E-07
En route cruise: emergency landing site **NOT** available	10000 and above			900	7.257	100,00%	1,75E-06	2,52E-06
Descent to initial approach fix for IFR approach	10000 down to 4000 on a 4° slope (1200 ft/mn)	X		300	7.557	5,00%	2,92E-08	2,55E-06
Aircraft must descend below a glide approach capability, to set up for a normal powered landing at 3° app. From 1000 ft	4000 down to 1000 ft on the approach			150	7.707	50,00%	1,46E-07	2,70E-06
Aircraft descends on 3° approach path.	1000 ft down to 50 ft on approach @ 120 Kt , 5%, 600 ft/mn			95	7.802	100,00%	1,85E-07	2,88E-06
Landing	50 ft above threshold to touch down	X		10	7.812	5,00%	9,72E-10	2,88E-06
Landing ground run	Touch down to stop	X		15	7.827	0,00%	0,00E+00	2,88E-06
			Cumulative flight time (min)		**130**		Risk per flight	**1,33E-06**
			Max risk period (min)		**20**		Max target	**1,33E-06**

Thank you for your attention

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