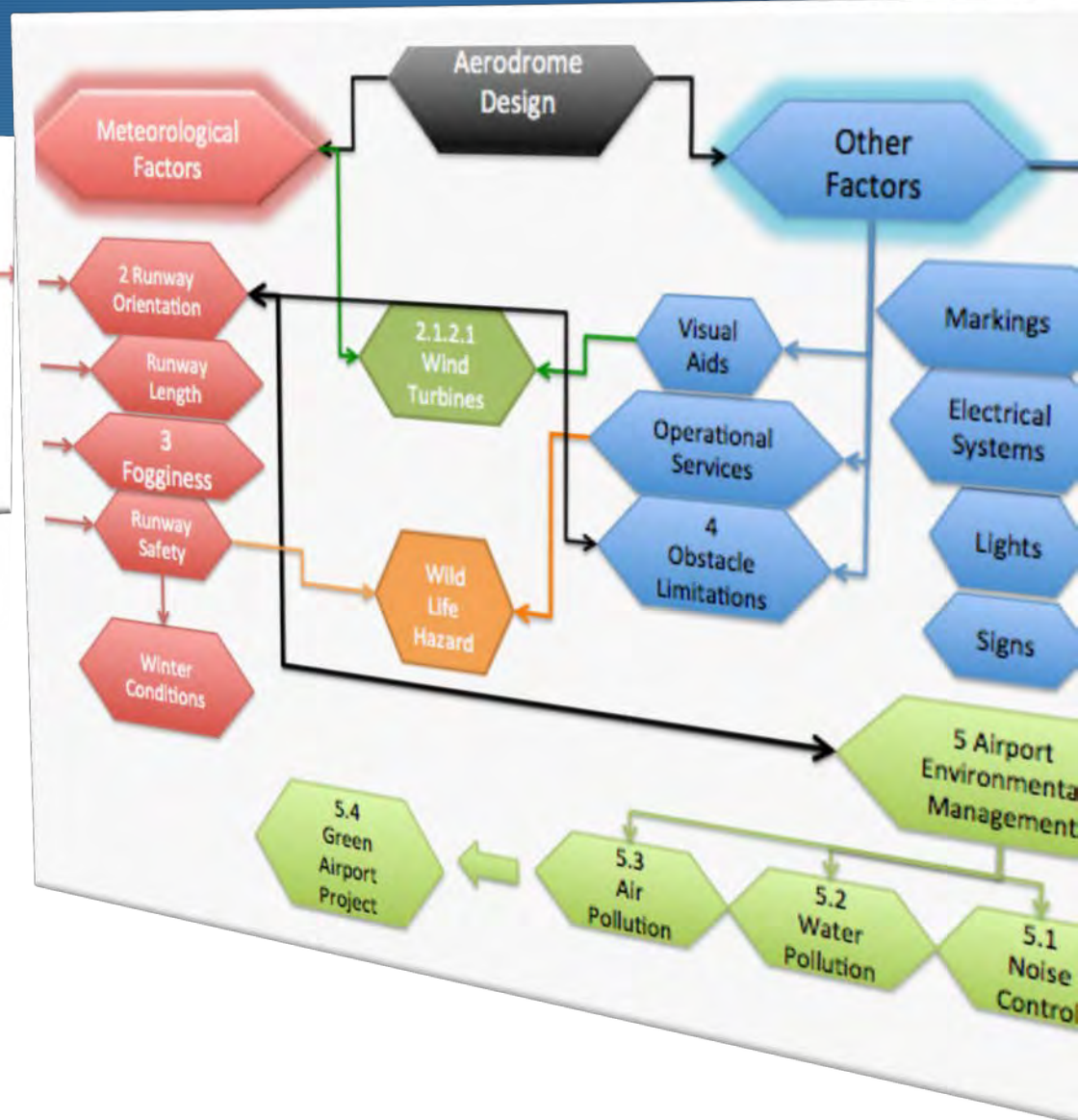
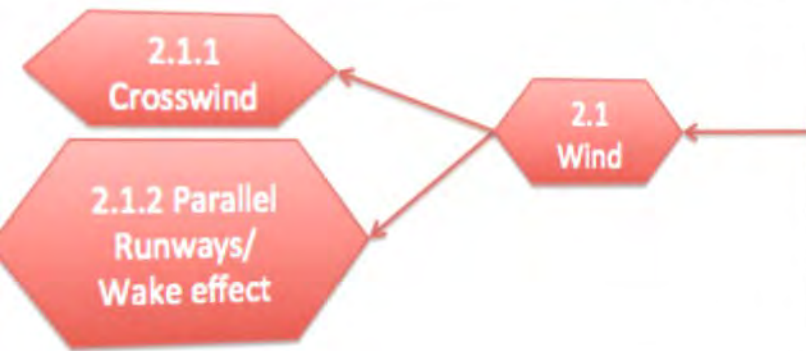


Significant Meteorological Factors in an Airport Design

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Parameters to be discussed in this presentation:

1. Crosswind
2. Parallel Runways
3. Wind Turbines
4. Fogginess

Purpose of Thesis

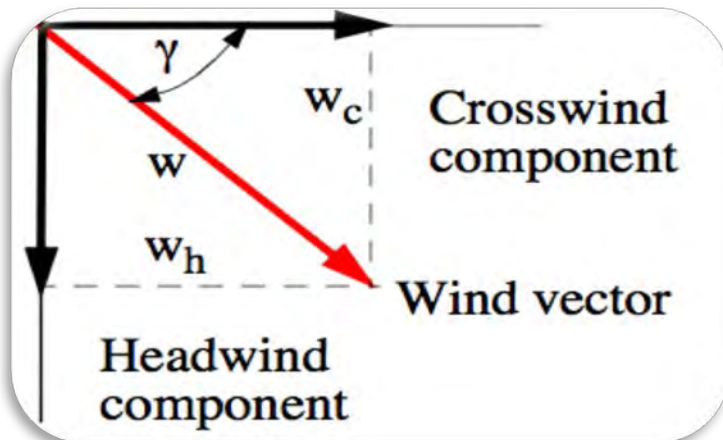
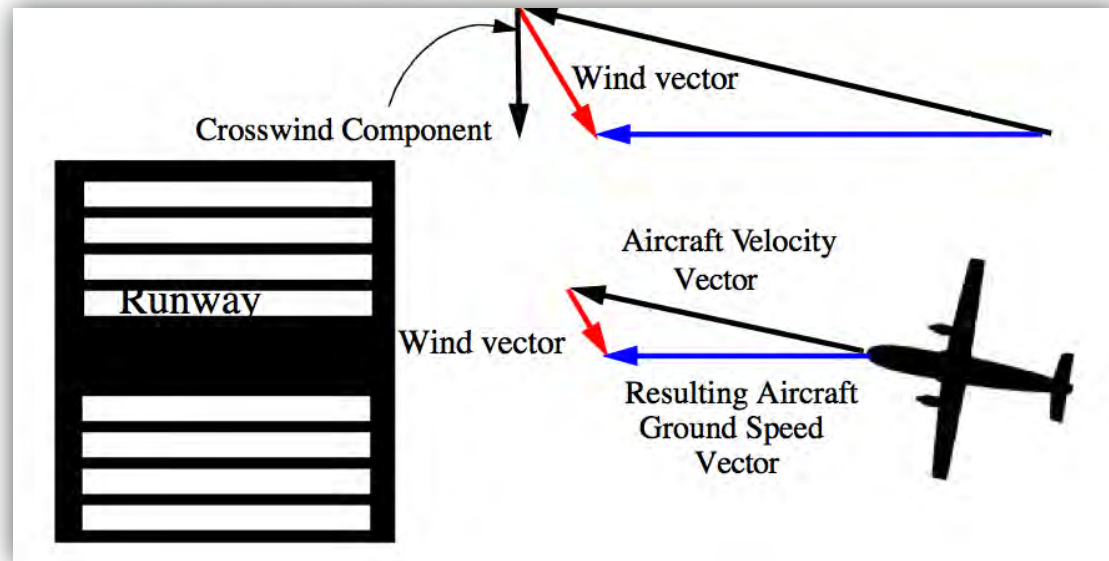
Several factors in aerodrome design, such as runway orientation, runway length, wake turbulence, visibility, and environmental issues are closely related with meteorology. In this study, we indicate the importance of meteorology in aviation, especially in airport design, rather than forecasting the weather for pilots and air traffic controllers. Our goal is also to emphasize the importance of accurate warning preparation about severe weather conditions. We should be aware that a minor mistake could cause hazardous situations, which may result in death or damage financially. Crosswind component, fogginess, wind distribution, environmental management, obstacles, and winter conditions should be analyzed before designing a new airport. For instance, for the third airport to be constructed in Istanbul, crosswind analysis requires an atmospheric model study, since there is no observation available for the airport location. In addition, all the observational data obtained from the nearest meteorological stations should also be examined in detail. Moreover, Runway Visual Range (RVR) data show that especially new CAT III operation is very requisite for Esenboga Airport. Esenboga Airport has more problems with fogginess and visual range than other airports in Turkey. However, CAT III operations are not only about visual range but they are also related with the traffic density. In order to prevent delays due to meteorological conditions, the certification for CAT III operations is crucial for an airport in any case. For the third airport of Istanbul, the existence of CAT operations is important due to the traffic density problem. If potential extreme weather conditions occur, the traffic would need to be directed to an alternative airport, and other airports in Istanbul need to be prepared accordingly for these extreme weather conditions. Finally, ICAO standards in parallel

Runway Orientation


The more important factors for runway orientation are (ICAO, 2006);

- Weather, particularly the wind distribution, and the occurrence of fogs;
- Topography of the aerodromes surroundings;
- Airplane performance;
- Environmental considerations, particularly noise;
- Type and amount of air traffic.

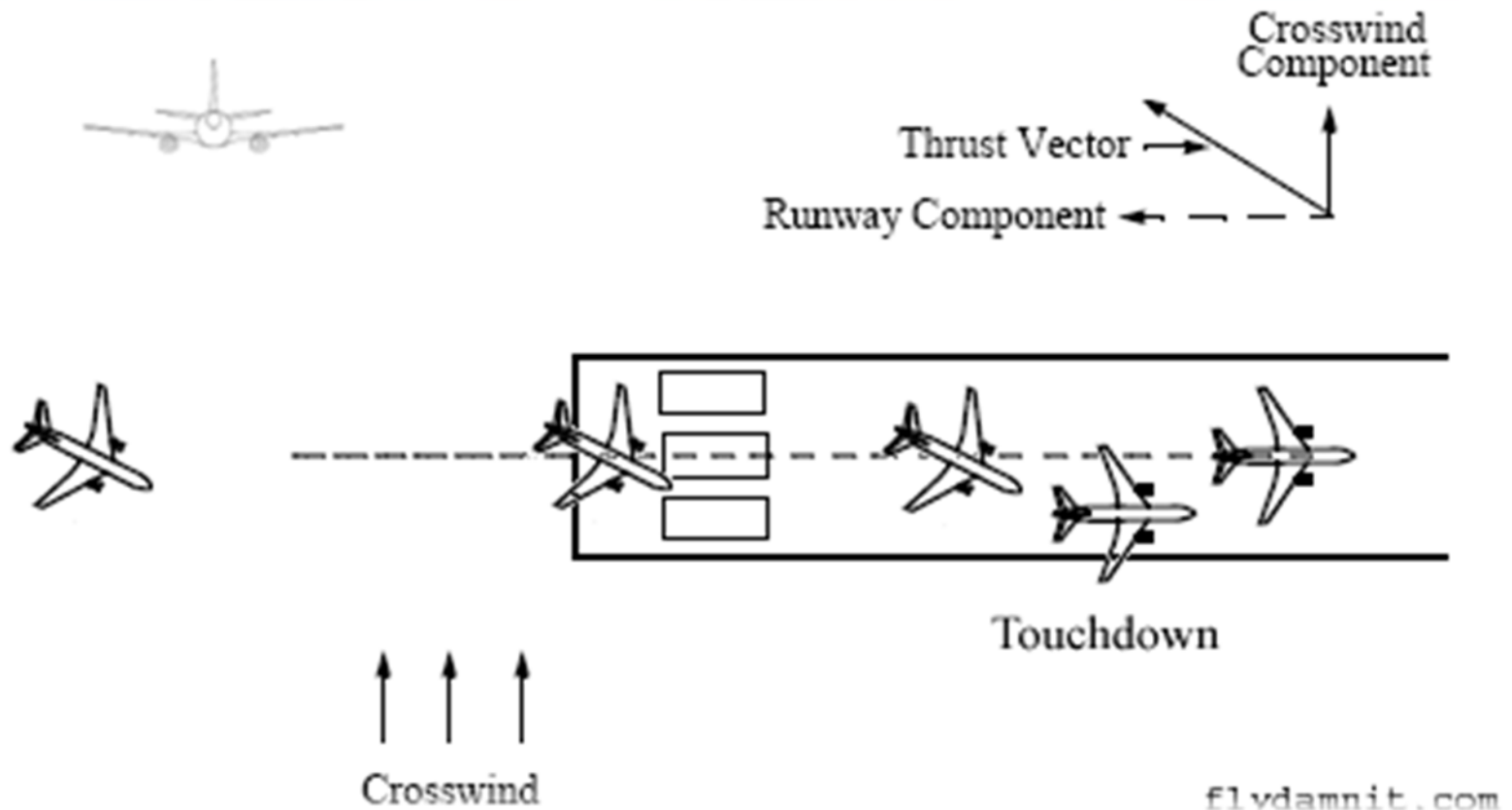
WIND- CROSSWIND



$$w_c = w \sin (\gamma)$$
$$w_h = w \cos (\gamma)$$

- The usability factor of the aerodrome is not less than 95 per cent. However, the prevailing wind and crosswind conditions are not allowing to provide the percentage, the crosswind runway is required (ICAO, 2009).
- The data of wind speed and direction, which used for the calculation of the usability factor, should be as long a period as possible, preferably of not less than five years (ICAO, 2009).
- More performance  bigger CC
- Otherwise, airplane can not land !
- So, the crosswind runway is important.
- Cause the closing runway

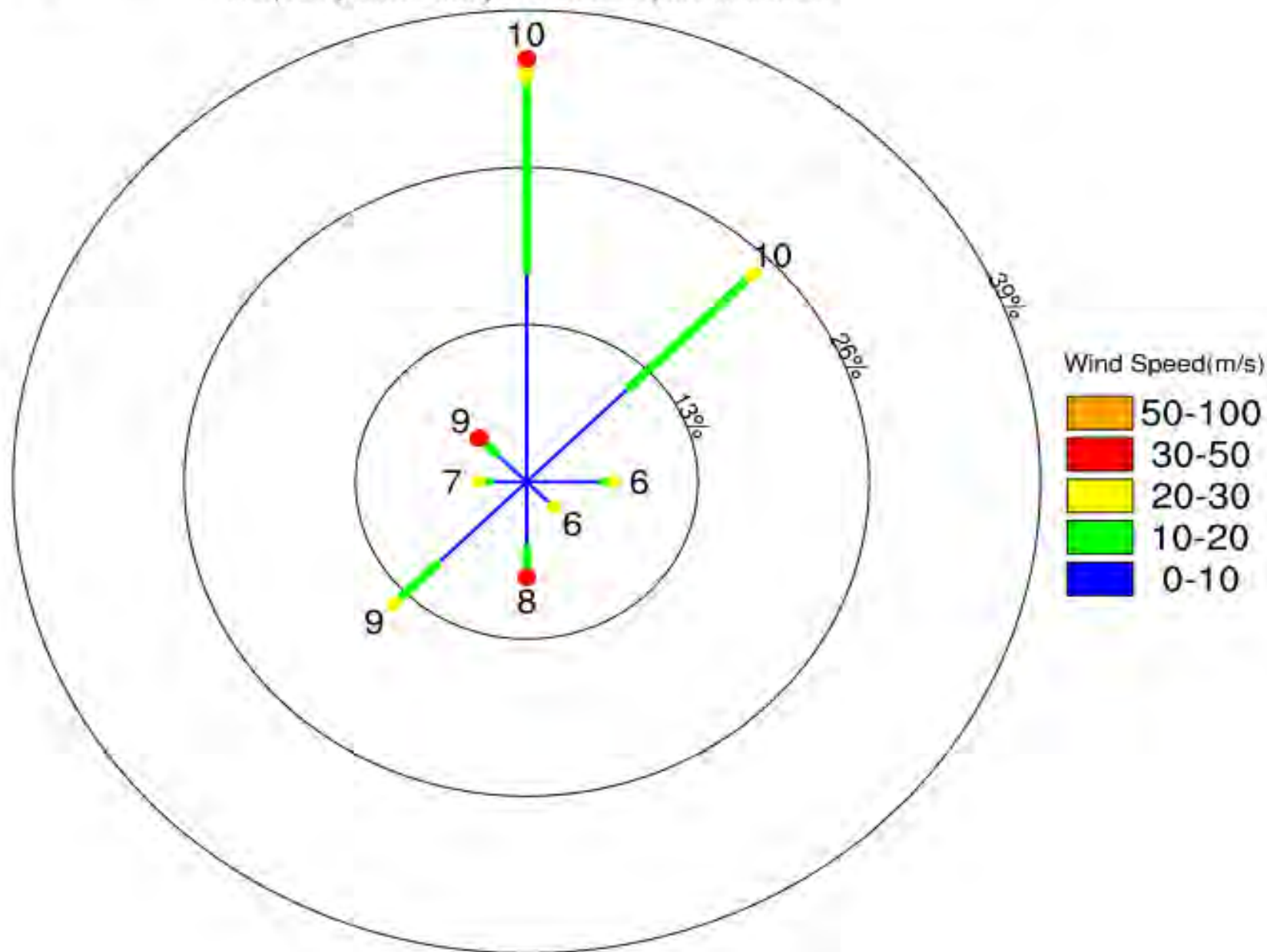
Crosswind Landing : The landing technique with the crosswind conditions that is not above the maximum crosswind demonstrated of the aeroplane.



Ataturk Airport

SpdAve=9 SpdStd=5 DirAve=10 Calm= 4.1% Nwnd=93500

Frequency circles every 13%. Mean speed indicated.



TAF EDDH 010900Z 011019 28025G45KT
9999 SCT015 BKN025 TEMPO 1019 3000
SHRAGS BKN008CB TEMPO 1117
29030G55KT=
METAR EDDH 011220Z 29028G48KT
9000 –SHRA FEW011 BKN014 07/05
Q0984 TEMPO 29035G55KT 4000 SHRA
BKN008=

**Investigation Report (BFU, 2010);
Identification**

Date: 1 March 2008

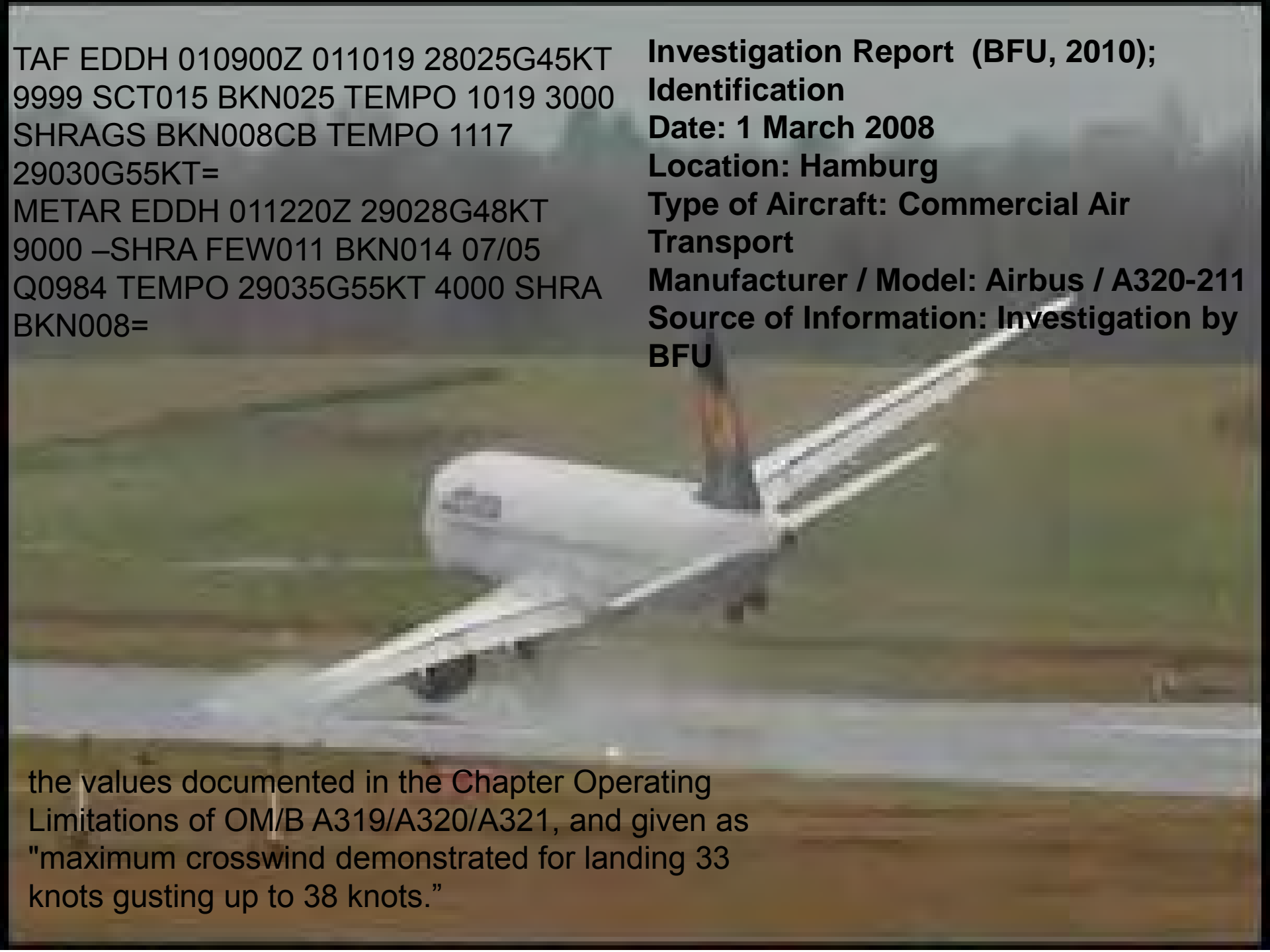
Location: Hamburg

**Type of Aircraft: Commercial Air
Transport**

Manufacturer / Model: Airbus / A320-211

**Source of Information: Investigation by
BFU**

the values documented in the Chapter Operating
Limitations of OM/B A319/A320/A321, and given as
"maximum crosswind demonstrated for landing 33
knots gusting up to 38 knots."





Parallel Runways

For instrument approaches, besides wake effect problem, ILS and MLS procedures and the possibility of wrong runway establishing should be considered. Therefore the separation of aircrafts is important for safety.

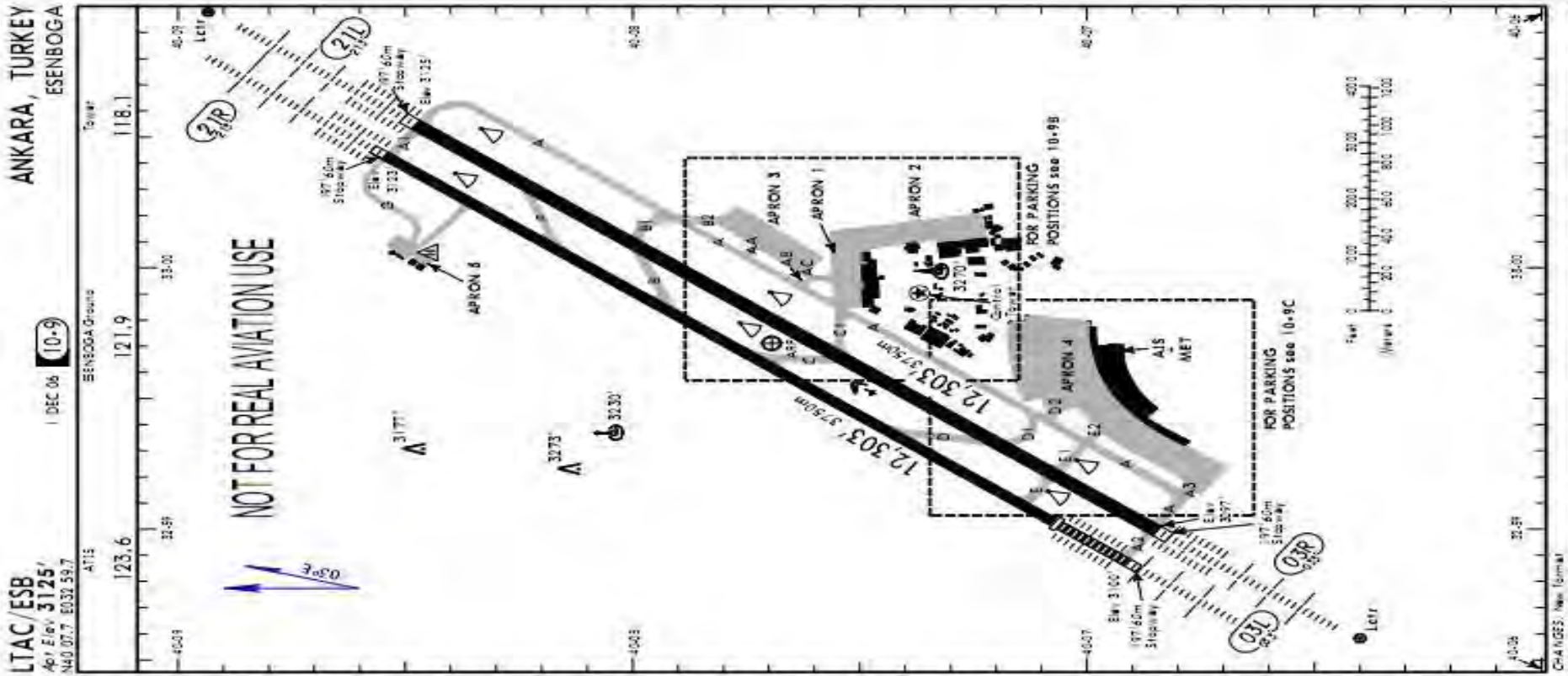
Where parallel non-instrument runways are intended for simultaneous use, the minimum distance between their centre lines should be (ICAO, 2009):

210 m where the higher code number is 3 or 4;
150 m where the higher code number is 2;
and 120 m where the higher code number is 1.

Where parallel instrument runways are intended for simultaneous the minimum distance between their centre lines should be (ICAO, 2009):

1 035 m for independent parallel approaches;
915 m for dependent parallel approaches;
760 m for independent parallel departures;
760 m for segregated parallel operations;

ANKARA, TURKEY
ESENBOGA



Wind Turbines

Minimum distance between runways and wind turbines is defined 80 km for Canada and 30 km for England (Tronik, 2012). However, these rules are not certain.



- The risks of the wind turbines near the airport are not just wake effect problem but also the effects on radar. Wind turbines cause radar clutter that is very important for air traffic or create ghost images.
- A 1.5 MW wind turbine lead to visual pollution that is 10 times of a Boeing 747's.
- This radar clutter is unpredictable because the wind turbines' direction and speed are changing regularly.



Examples:

(Tronik, 2012)

Airports	Distance from wind turbines
Aberdeen Airport	7 km
Newcatle Airport	19 km
Cardiff Airport	20 km
Amsterdam Airport	10 km
Tyler Minnesota Airport	1 km

Fogginess

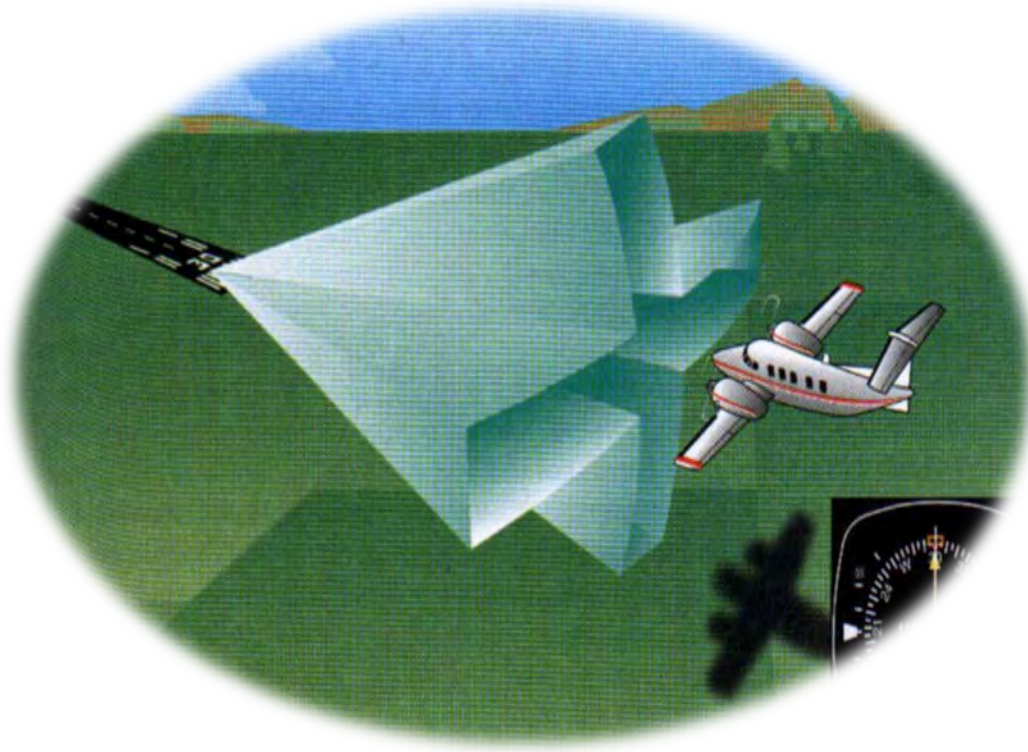
Flying in the clouds is like the flight of a blind bird. Mountains, other airplanes, and runway will be invisible.



Instrument Landing System (ILS)

ILS is an instrument approach system that provides safety under some hard meteorological conditions (IMC (Instrument Meteorological Conditions)). In simple terms, ILS is formed to main guidance

- Vertical guidance (glide slope)
- And horizontal guidance (localizer)



What is Low Visibility Operations?

Low Visibility Operations (LVO) is the rules about landing, take off and taxi systems and categories at very low visibility conditions when the weather conditions do not permit normal operations.

Authorisation in the light of these rules, license by the country's own discipline of Civil Aviation. Essential criteria have to be completed by;

The airplane,

The airdrome (or the part of the airdrome),

The flight crew and,

The airline

These rules separate categories according to two weather conditions, the limits of Decision Height (DH) and Runway Visibility Range (RVR)

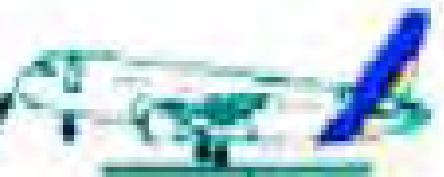
		ICAO	FAA	JAA
CAT II	DH	100ft ≤ DH < 200ft	100ft ≤ DH < 200ft	100ft ≤ DH < 200ft
	RVR	350m ≤ RVR 1200ft ≤ RVR	350m ≤ RVR < 800m 1200ft ≤ RVR < 2400ft	300m ≤ RVR 1000ft ≤ RVR
CAT III A	DH	No DH or DH < 100ft (1)	No DH or DH < 100ft (1)	DH < 100ft (1)
	RVR	200m ≤ RVR 700ft ≤ RVR	200m ≤ RVR 700ft ≤ RVR	200m ≤ RVR 700ft ≤ RVR
CAT III B	DH	No DH or DH < 50ft	No DH or DH < 50ft	No DH or DH < 50ft
	RVR	50m ≤ RVR < 200m 150ft ≤ RVR < 700ft	50m ≤ RVR < 200m 150ft ≤ RVR < 700ft	75m ≤ RVR < 200m 250ft ≤ RVR < 700ft
CAT III C	DH	No DH	No DH	
	RVR	No RVR limitation	No RVR limitation	

Runway Visual Range (RVR) is the horizontal distance that pilot (on the Center Line of the runway) could see the runway visual references. This visibility concept measures with transmissometers that have been set up 3 points of the runway.

Decision Height (DH) is the minimum altitude that pilot could decide for “Go Around”. If pilot cannot see the visual references of the runway, He / she won’t continue for landing

DH CONCEPT

GO-AROUND*



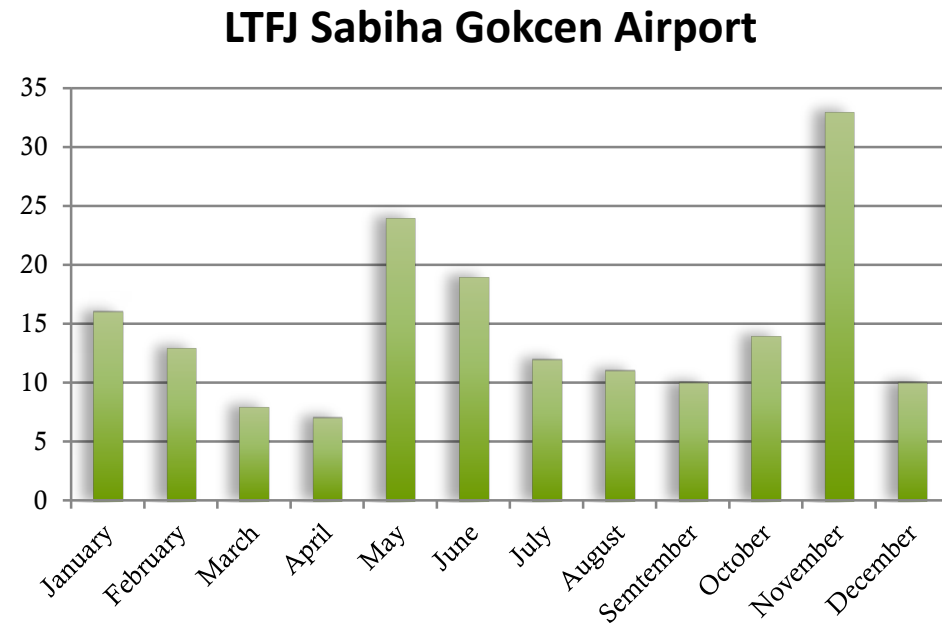
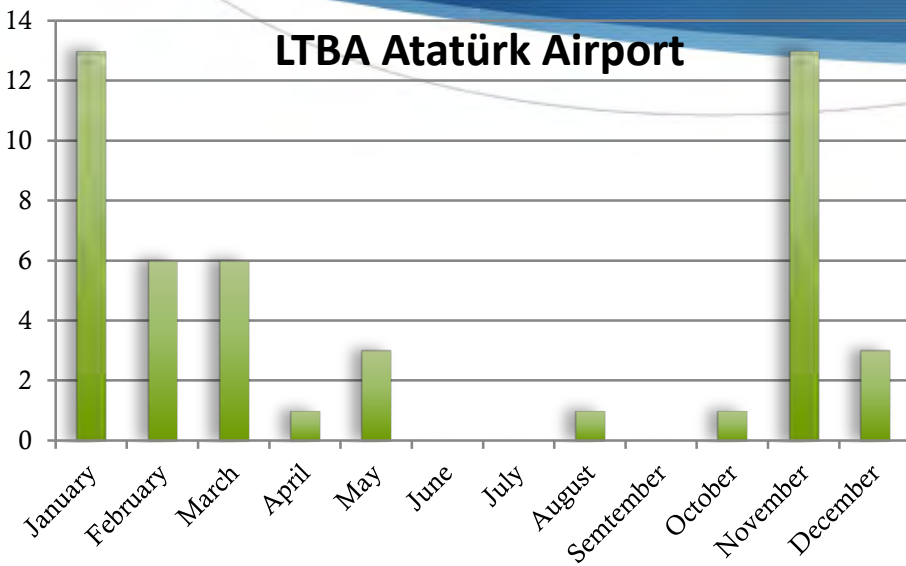
Runway elevation

Visual segment

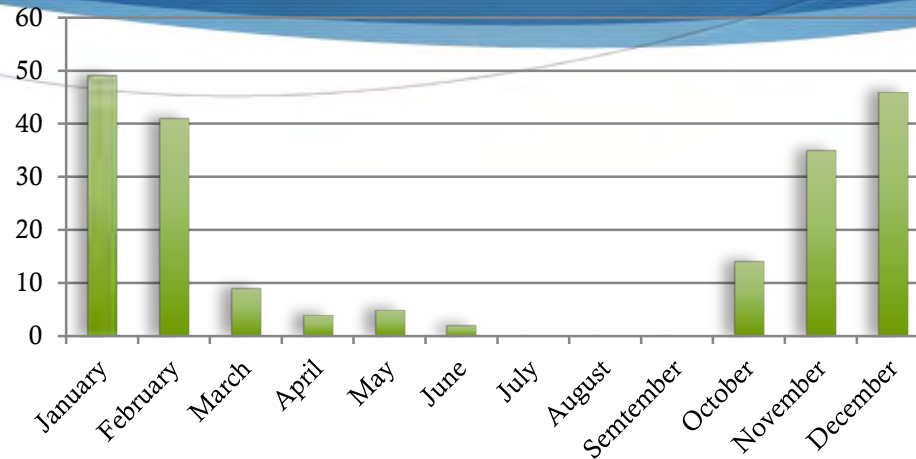
* Unless adequate visual references had been established

Karar Yüksekliği

According to DMI 8 years (2004-2012)
fogginess data;

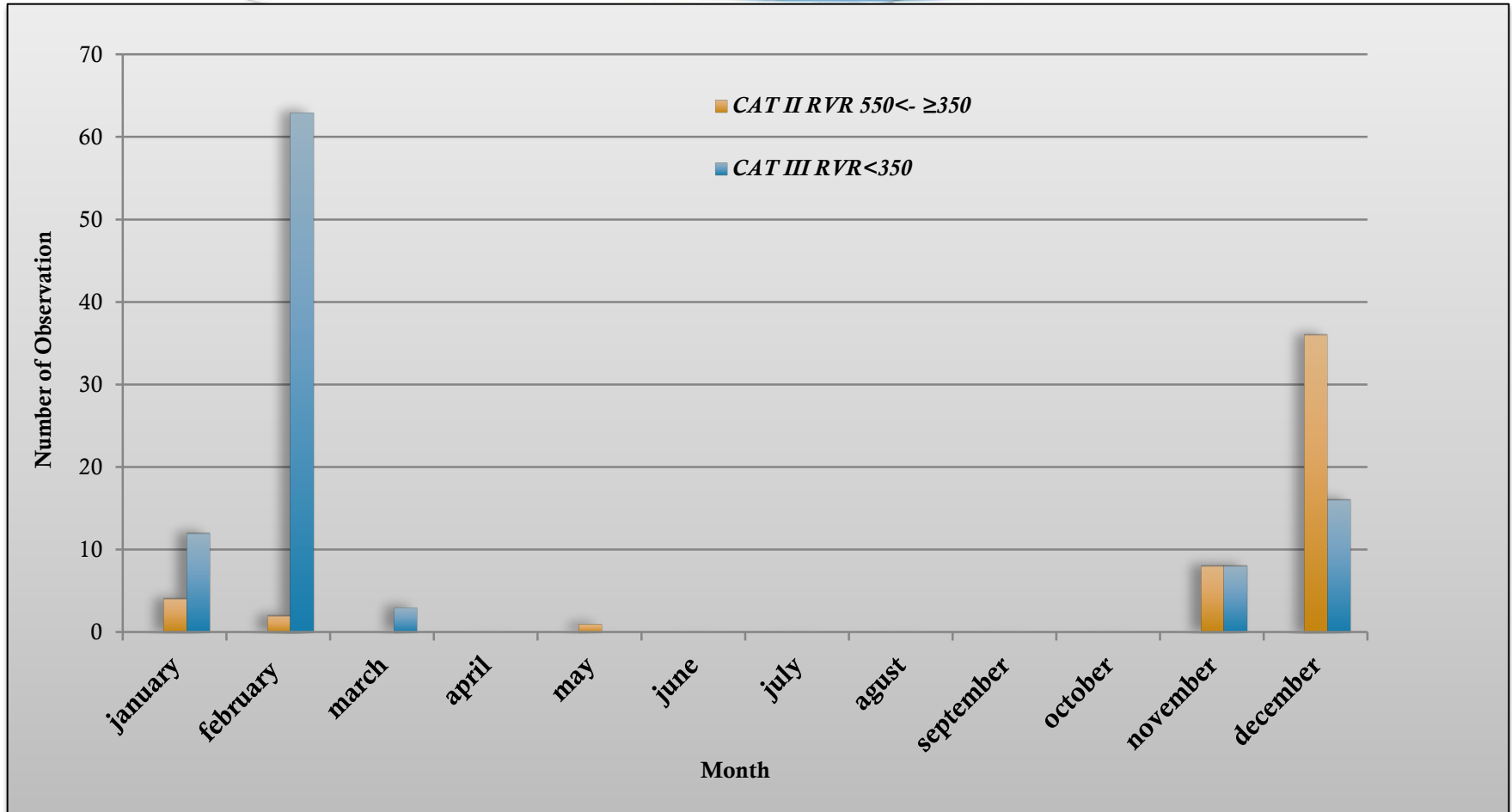


LTAC Esenboga Airport



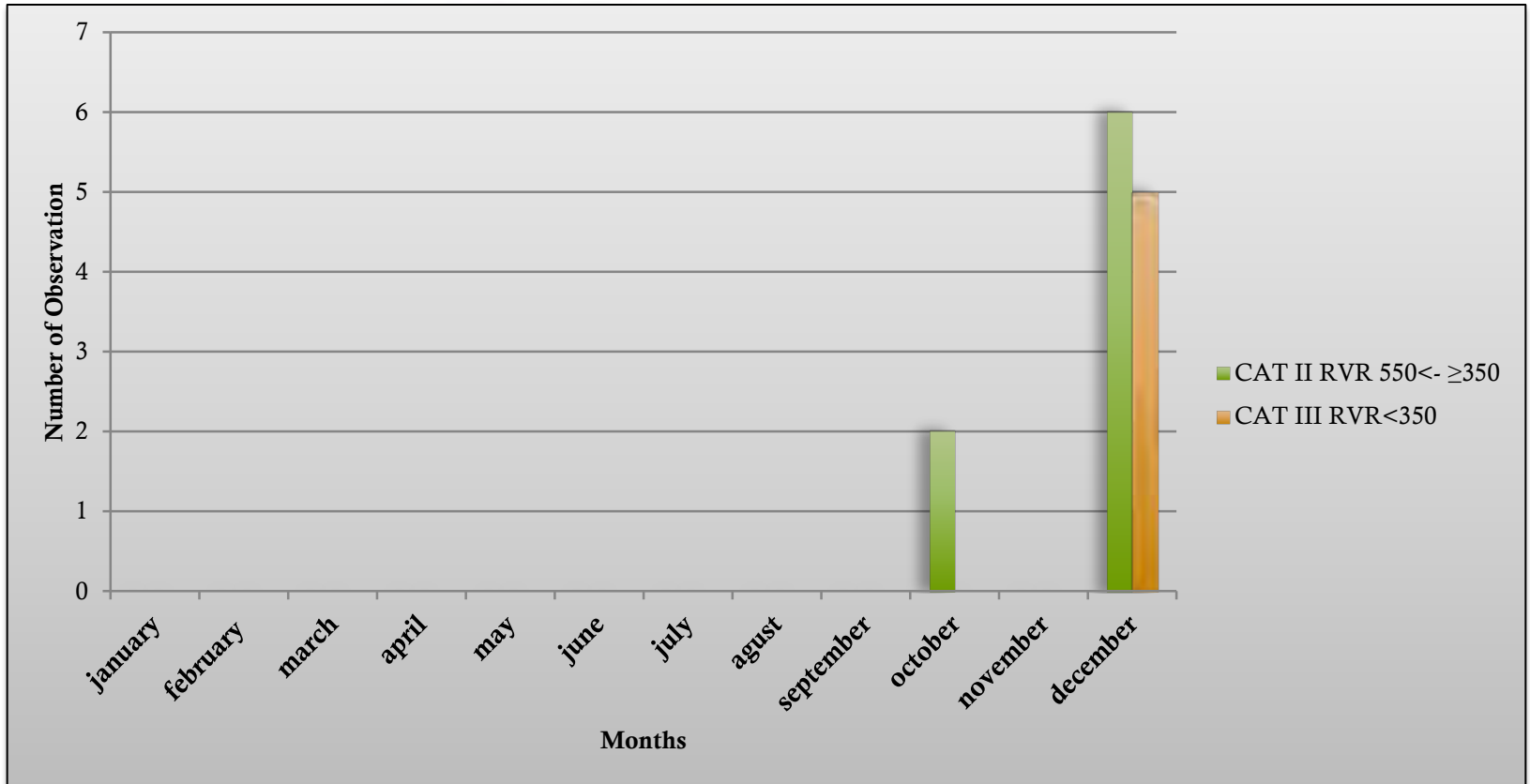
Results; Specially for Ankara Esenboğa Airport Figure has greater maximum values in winter months. However in İstanbul Ataturk Airport looks like have not a fogginess problem. Maybe, with these charts , we can say that the CAT III operations are not necessary, nevertheless, fogginess is not enough for making decision about CATs. We have to look at the values of RVR.

Here is some estimated graphs for CAT limitations according to RVR values;
(Using 2012 METAR informations)

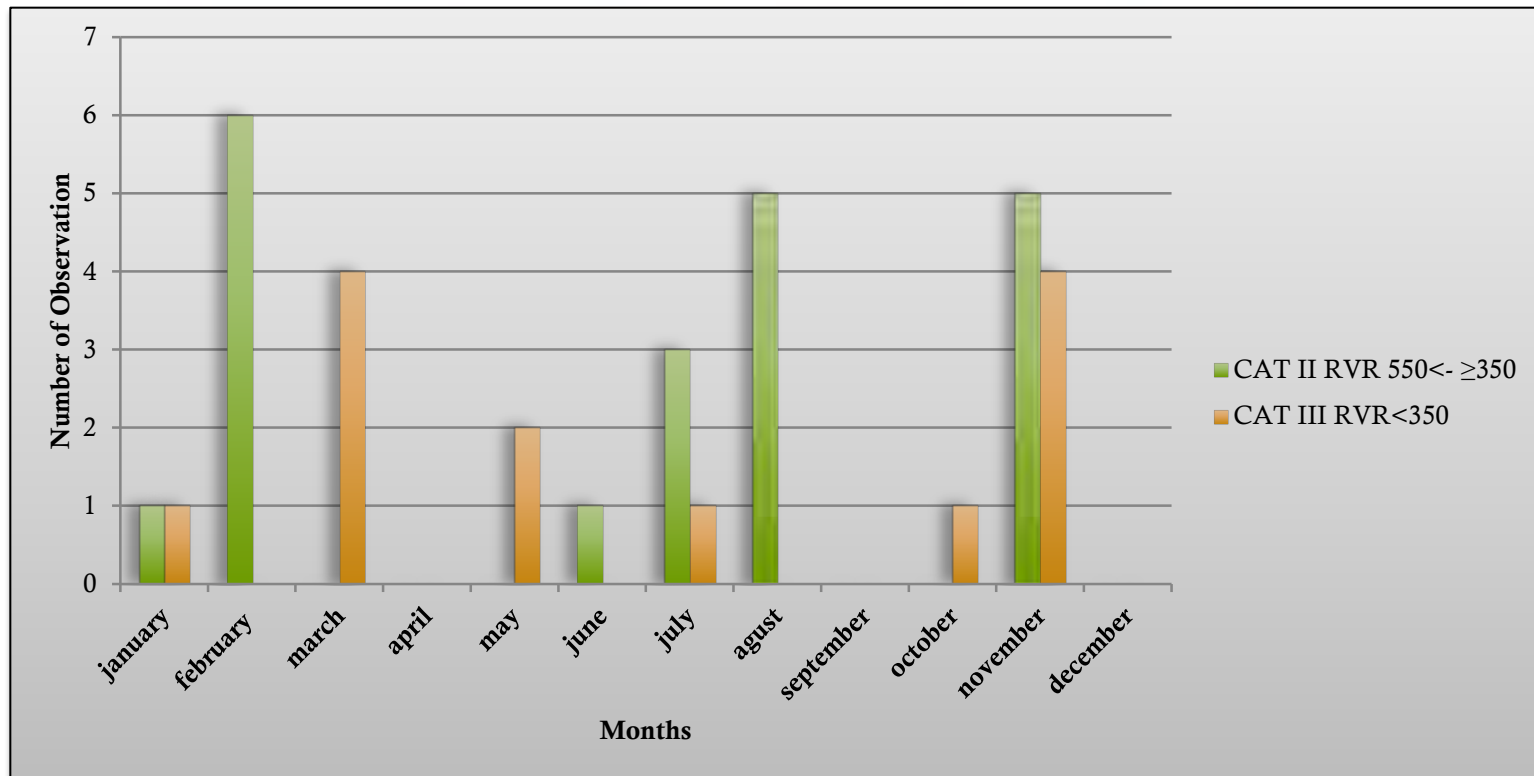


LTAC Ankara- Esenboga Airport

LTBJ İzmir Adnan Menderes Airport



LTFJ İstanbul Sabiha Gökçen Airport





HARMONIZATION AND IMPLEMENTATION OF EC DIRECTIVE
RELATED TO ENVIRONMENTAL NOISE
EUROPEAN UNION TWINNING PROJECT TR 2004 IB TS 02

Pilot region Istanbul

Air Noise Lden

Grid Noise Map 4 m above ground
Annoyance analysis

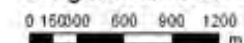
Area statistics Lden in dB(A)



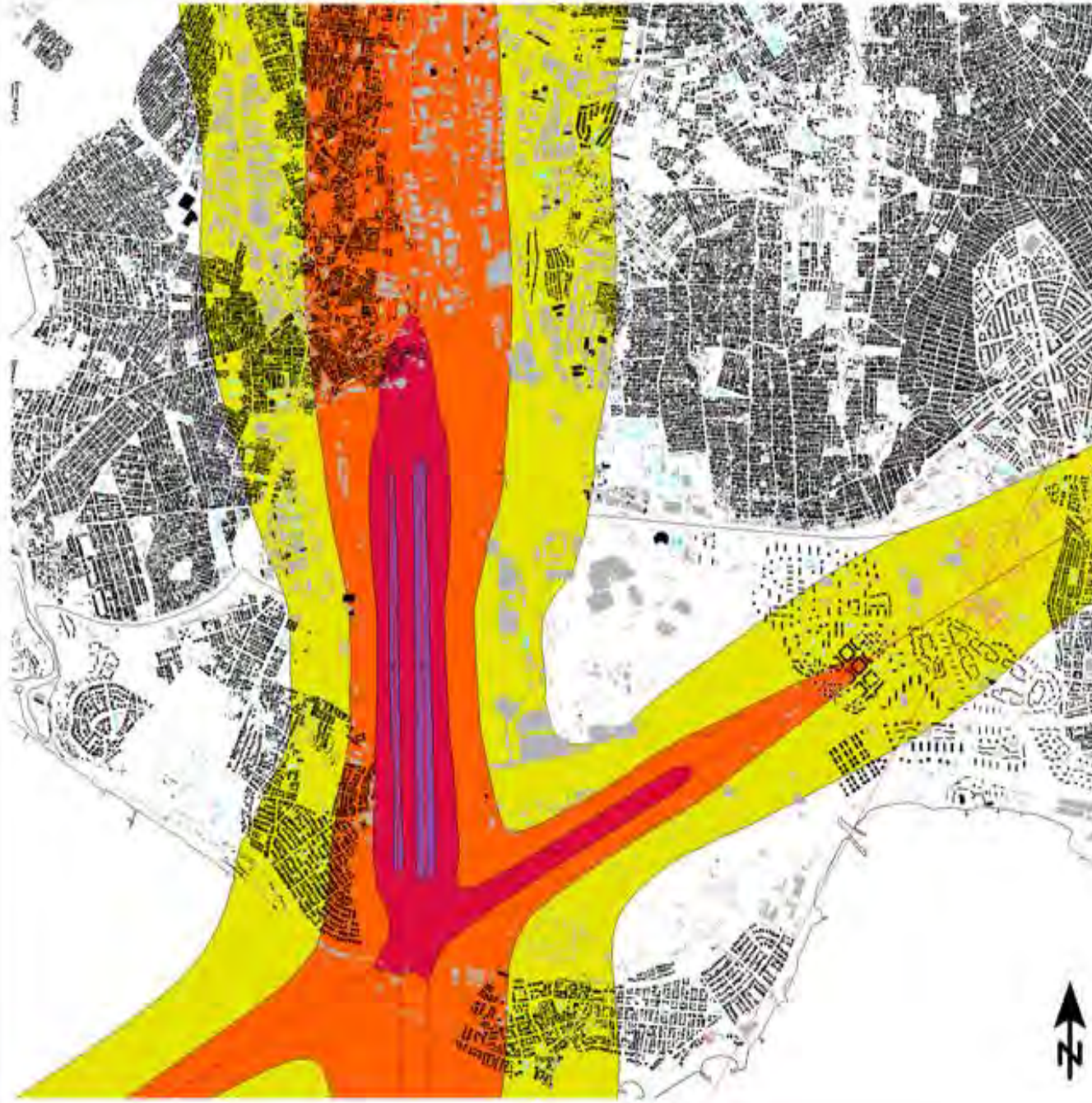
Signs and symbols



Length Scale 1:30000

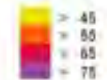


Istanbul
Metropolitan
Municipality



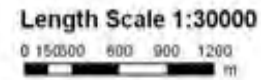
Pilot region Istanbul
Air Noise Ln
Grid Noise Map 4 m above ground
Annoyance analysis

Area statistics Ln in dB(A)



Signs and symbols

-  Main building
-  Auxiliary building
-  School
-  Hospital



As a result,

- closeness between city centers and airports create more noise problems day by day due to the development of cities around the airports.
- This closeness does not create only noise complains but also other organizational problems, such as due to this problem, the runway 05 in Atatürk Airport cannot be extended.
Therefore, for the third airport in Istanbul, noise control issue should be considered in the renewal plan of the airport and therefore the development of the city around the airport should be limited with respect to their maximum elongation and their closeness.

Planning for next works;

- *calculating the usability factor for LTBA, LTFJ with crosswind component values and discussing if today designing is true.

- *winter conditions on runway

- *bird strike

- *other runway operations like circle to land and MLS

- *Other meteorological effects on aviation not about only designing.

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