Review on requirement of sequence flash lighting system (SFLs) for the barrette approach lighting system in CAT i/ii/iii conditions.

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SUMMARY

- SFL system is provided with different configurations with respect to CAT I and CAT II/III system based on the nature of the meteorological conditions.

- Few primary concepts of AGL system would be reviewed in connection with the several regulatory references and standards.

- Analysis on the requirement of the SFL system in different categories of lighting based on the technical considerations and other concepts discussed in this paper.

2. SARPS References (ICAO Annex 14 Vol 1)

2.1 Precision approach category I lighting system

5.3.4.17 Recommendation: — If the centre line consists of barrettes as described in 5.3.4.14 b) or 5.3.4.15 b), each barrette should be supplemented by a flashing light, except where such lighting is considered unnecessary taking into account the characteristics of the system and the nature of the meteorological conditions.

2.2 Precision approach category II and III lighting system

5.3.4.34 Recommendation: — If the centre line beyond 300 m from the threshold consists of barrettes as described in 5.3.4.31 a) or 5.3.4.32 a), each barrette beyond 300 m should be supplemented by a flashing light, except where such lighting is considered unnecessary taking into account the characteristics of the system and the nature of the meteorological conditions

3. DISCUSSION

3.1 UNDERSTANDING THE COMPLEXITIES IN LANDING PHASES

- The **approach and runway lighting system are viewed only in perspective.**
- Only few seconds are available in the landing phase.
- Pilot visual workload depends on his experience and effectiveness of available cues
- Rate of processing of information is very crucial

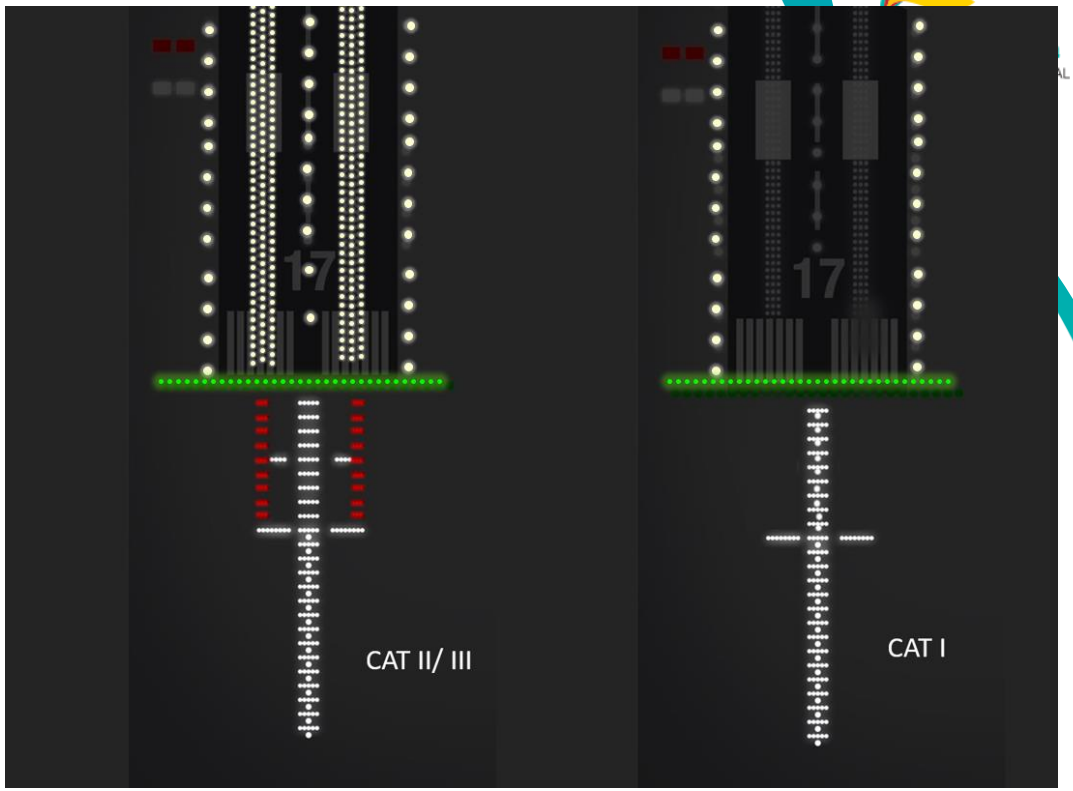
3.2 STANDARDIZATION

- AGL design shall be having easily recognizable patterns
- The AGL system to be unfolded as an expected standard system
- Visual workload can be best handled through standardization, maintaining the balance and integrity of elements with each other system

4. PROBLEM, ANALYSIS, AND PROPOSED SOLUTIONS

4.1 Deviation in general understanding of AGL system pattern in different categories and elements guiding the expectations of the pilot.

IN AGL SYSTEM with the reduction in the visibility the spacing reduces, supplementary system would be added to configuration or there may not be any change.



"BUT"

THE SECTION OF GUIDANCE IS NEVER BEEN REMOVED

Considering if an airport is having both CAT I and CAT II/III barrette approach lighting system. The aircraft used to land under CAT I conditions with SFL at every barrette leading upto threshold could find it ambiguous to have the barrettes leading up to only 300 mtrs cross bar in CAT II/III conditions and would be quite common to expect the SFL lights even for 0-300 mtrs.

"A study on a survey of operational tests and human factors, states that ***"If the pattern contains ambiguous or conflicting information with respect to the guidance parameters it is to provide, the pilot is confronted with a difficult decision problem and response time will be significantly delayed".***

4.1.1 Why the SFL system starts from the 300 mtr cross bar for CAT II/III?

In order to ensure that the first 300 mtrs for Approach lighting types- distance coded and barrette approach lighting in CAT II/III be identical the SFL lighting initiated after the 300 mtrs length of Approach lighting as per ADM part 4- “17.4.8 and 1.2.14 and as per the cooperative programme by ICAO States achieved this objective in the 1960s

Based on several studies at lower heights flashing lights could be **causing distraction, creating light diffusing effects** in some cases, when pilot maneuver prior to touchdown.

When observing the system closely, the other reason the author opines **could be the cross bar (Decision bar) installed** at 300 mtrs which acts as reference bar providing lateral deviation and banking cues

Also, the side row barrettes are providing the required guidance in this section

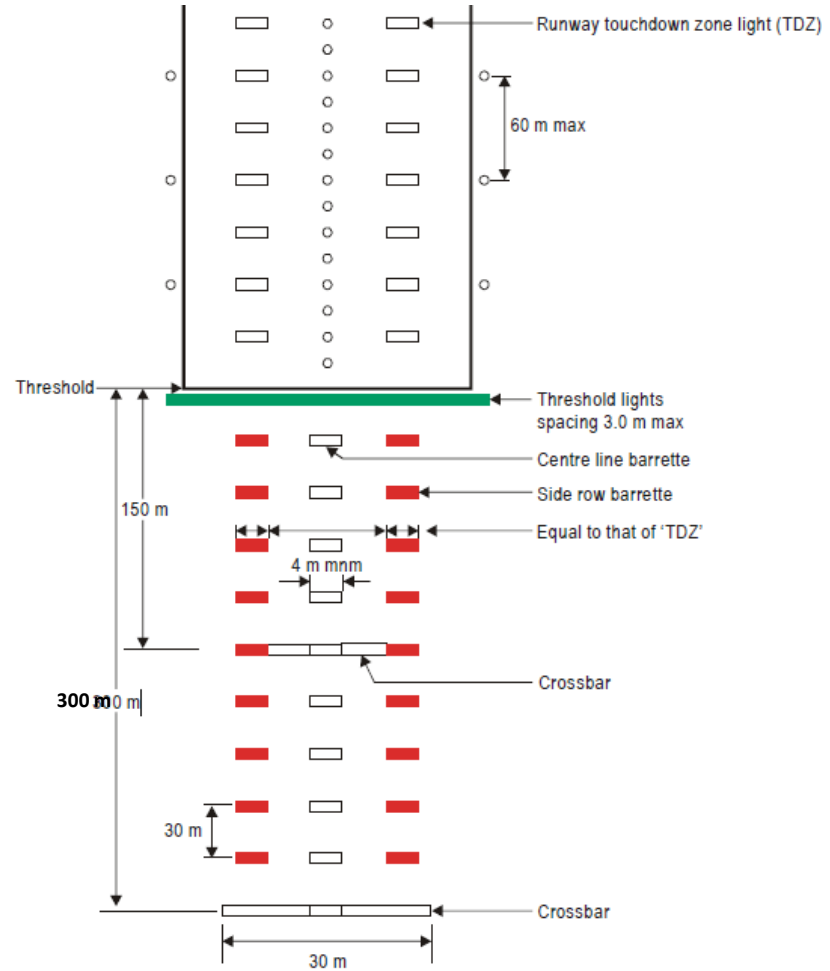


Figure 5-14. Inner 300 m approach and runway lighting for
precision approach runways, categories II and III

4.2 Assessing the functional need of SFL in CAT I conditions from 0-300 mtrs

- In CAT I conditions, RVR > 550 Mtrs
- SFL function is to provide centreline guidance, which is already met well before 300 mtrs
- From distance of 300 mtrs, pilot can visualize and process the visual aids such as Threshold lighting/ Threshold wing bar lighting, the 300 m cross bar and barrettes at every 30 m.

(67) Boeing 737 Foggy Cockpit Landing in London Stansted - YouTube

(67) Air France | A330 BANGALORE LANDING IN 4K WITH ATC - YouTube

4.3 3 Probable distraction of SFL lighting in FOG for the first 300 mtrs

Studies states that "***At night shallow fog conditions present a unique problem as the ALS segment with its flashing strobe lights will be visible through the fog structure during the early part of the approach. As the fog layer is entered, contact with the ALS may be lost, and the strobe lights cause a distracting effect as their light is diffused through fog***" ***[Source: Advisory group for Aerospace Research and Development-AGARD CONFERENCE PROCEEDINGS No. 59 on Aircraft Landing Systems]***

From: ***Aircraft Accidents and Incidents Associated With Visual Disturbances sFrom Bright Lights During Night time Flight Operations-*** *DOT/FAA/AM-06/28 , Office of Aerospace Medicine, Washington, DC 20591, November 2006"*

"Pilots commented that they lost the ability to judge distances (depth perception) after experiencing glare or from being flash blinded by approach or runway lights (5 accidents, 5 incidents). One of these accidents occurred when the pilot asked the control tower to turn up the intensity of the approach lights so she could visually acquire the runway on approach. The pilot reported that she experienced "excessive glare in her contact lenses" on short-final approach, which distracted her and caused her to collide with the approach-light structure."

4.4 BALANCE & Dark adaptation Issues

From the research paper on – "**Aircraft Accidents and Incidents Associated with Visual Disturbances from Bright Lights During Nighttime Flight Operations"**

"When the eyes are adapted to low-light levels, exposure to bright light can result in temporary visual impairment due to glare, flash blindness, and afterimages, further limiting the pilot's response time.

During the above phase, with SFLs from 0-300m entering onto the runway doesn't leave with any time for transition from facing an intense light and then leaving no time to adapt to the reduced illumination levels.

Hence, the balance of the visual exposure to the lighting system during his transition from one lighting system to other is primarily very important to not to have any major dark adaptation issues in terms of intensities or anything contradicting the facilitation of the dark adaptation levels

Source: (67) MUST WATCH - Pilot Lands Aircraft in Cloud Covered Runway | ZERO Visibility ! - YouTube

NATIONAL TRANSPORTATION SAFETY BOARD

WASHINGTON, D.C. 20594

AIRCRAFT ACCIDENT REPORT

KENNEDY ELITE CENTER
GATES LEARJET MODEL 23, N866JS
BYRD INTERNATIONAL AIRPORT
RICHMOND, VIRGINIA
MAY 6, 1980

NTSB-AAR-80-12

c3

UNITED STATES GOVERNMENT

Upon arrival in the Richmond area, the flightcrew requested an instrument landing system (ILS) approach to runway 33 at Byrd International Airport. They were cleared for the approach and landing. Witnesses stated that the aircraft crossed the runway threshold "a bit high," started to rock, and rolled inverted as engine thrust increased. The aircraft crashed adjacent to the runway at 0312 and burst into flame. Both pilots were killed.

The National Transportation Safety Board determines that the probable cause of the accident was the pilot's failure to maintain proper airspeed and aircraft attitude while transitioning from final approach through flare to touchdown. The low-speed/high angle-of-attack flight condition precipitated wing rolloff, wingtip strikes, and ultimate loss of aircraft control. The pilot's improper technique during roundout may have been due to fatigue, his limited knowledge, training, and experience regarding the flight characteristics of the Learjet aircraft, and distraction caused by concern over the intensity of the approach lighting.

17. Key Words IFR flight; practice ILS; approach light intensity; flare; wingtip strike; roll; collision

18. Distribution Statement This document is available

requires professional and precise control at all times, with particular attention to approach speed and angle-of-attack through power reduction and touchdown. The copilot in the Richmond accident had asked for a reduction in the sequenced approach lighting intensity at 0.5 mile on final approach and may have been distracted by this concern over the lighting during the last moments of the flight.

8. The flightcrew's performance may have been affected by fatigue since the pilot had been awake for 20 hours and the copilot for 18 hours.

9. The pilot may have been distracted by a concern over the intensity of the sequenced approach lighting during the final approach.

10. The flightcrew was minimally qualified, and had not had formal in-flight or simulator Learjet training.

4.5 ICAO Vs other regulations

Figure 3.2
MALS layout.

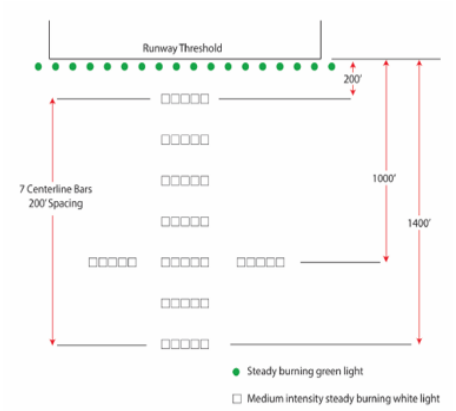


Figure 3.4
ALSF-2 layout.

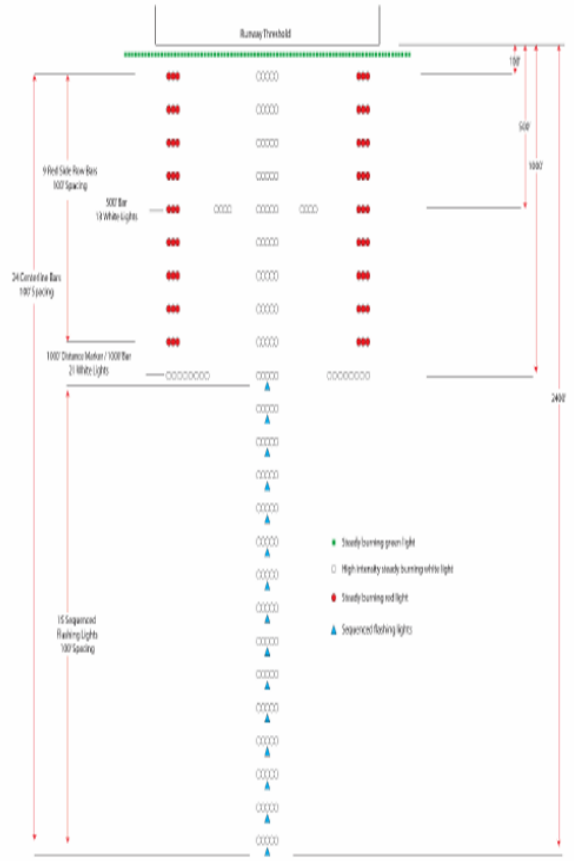


Figure 3.5
ALSF-1 layout.

Figure 3.1
MALSR layout.

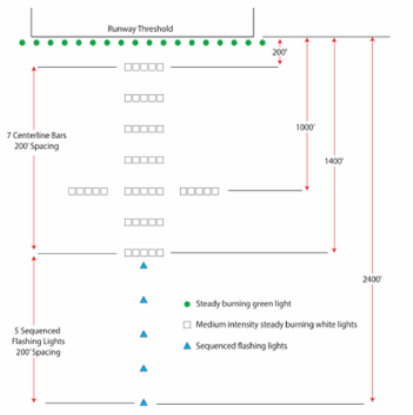
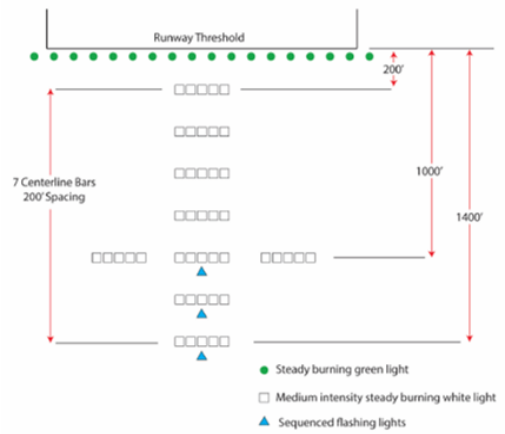
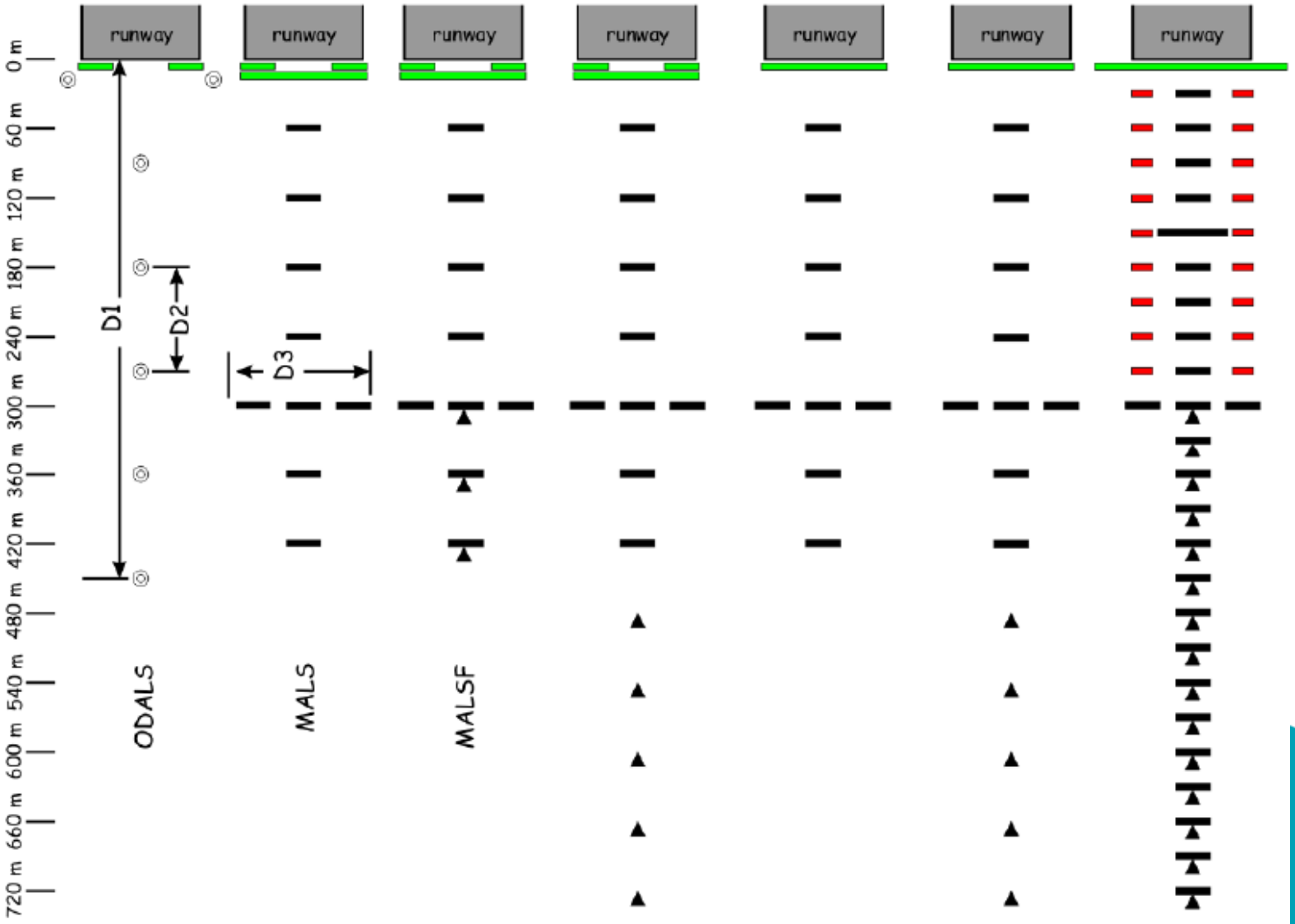


Figure 3.3
MALSF layout.



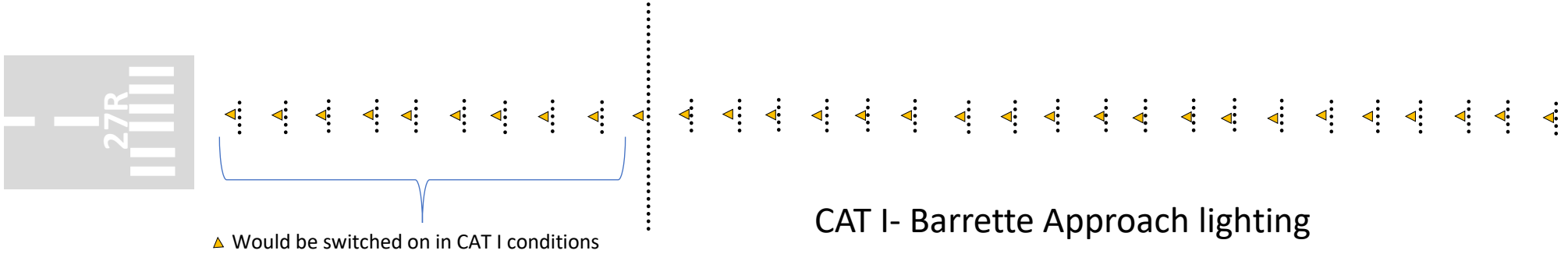
Approach lighting configurations - FAA

4.5 ICAO Vs other regulations

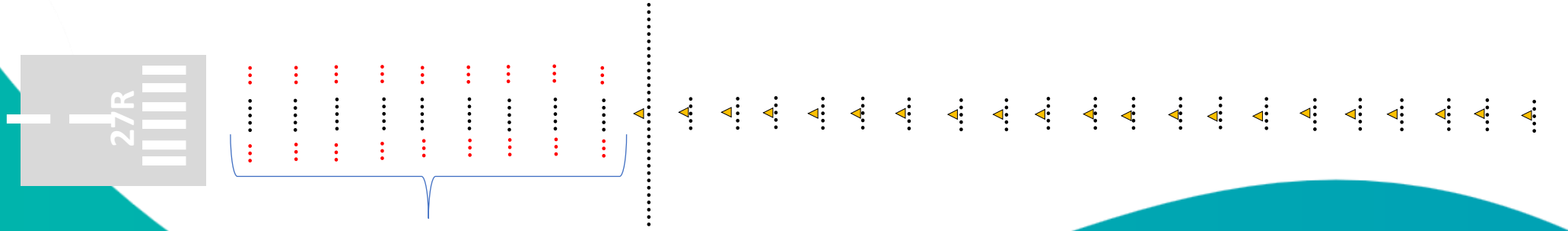


Approach lighting systems configurations - *TP312 5th edition*

4.6 Runway with both CAT I and CAT II/III approaches



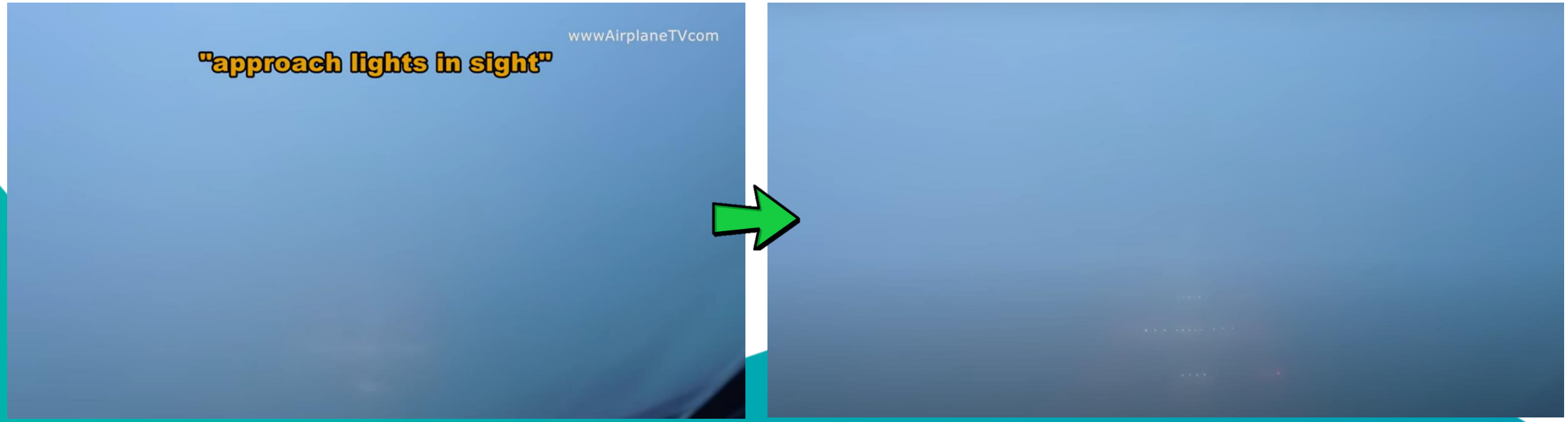
CAT I- Barrette Approach lighting



CAT II/ III - Barrette Approach lighting

4.7 Requirement of SFL system in CAT II/III REGULATIONS

If meteorological conditions are lower, then apparently the operations shift from CAT I to CAT II/ III conditions. Hence, “Nature of meteorological condition for CAT II/III may be removed and the SFL lights requirement to be made mandatory.



CAT III barrette approach lighting without SFL *Source: Airbus A320 Autoland ILS CAT III RVR 300, very low visibility landing (Youtube)*

Action By the Meeting:

The meeting is invited to discuss, analyze, and propose an amendment to the following provisions of Annex 14, Volume I as appropriate

5.3.4.17 **Recommendation:—** *If the centre line consists of barrettes as described in 5.3.4.14 b) or 5.3.4.15 b), each barrette beyond 300 m should be supplemented by a flashing light, except where such lighting is considered unnecessary taking into account the characteristics of the system and the nature of the meteorological conditions.*

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Kempegowda
INTERNATIONAL
AIRPORT
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Thankyou