

# Evolution of aeronautical marking and lighting of wind turbines in France

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## Arnaud Limouzin

- Engineer background
- French civil aviation authority – (DGAC : Direction générale de l'aviation civile)
- In charge of coordinating and establishing regulation relating to air navigation, including (but not limited to):
  - ⇒ **Obstacle and civil aviation cohabitation,**
  - ⇒ **Wind turbines aeronautical lighting and lighting.**

- French regulation on obstacle marking/lighting is established by the civil aviation authority (DGAC), in close coordination with the military aviation authority (DIRCAM).
- Since 2009, French regulation requires lighting of every wind turbine above 50 meters :
  - Lights on top of the nacelle :
    - Day and twilight time : 20 000 cd white flashing lights, 40 flash/minute
    - Night time : 2 000 cd red flashing lights, 40 flash/minute
  - Intermediate levels : 32 cd red steady lights (day and night) for wind turbines above 150 meters
- Color of wind turbines : white or grey ( $LF > 0,4$ ) everywhere

⇒ **No case-by-case deviation is allowed.**

- Requests for evolution in 2013 in order to :
  - Reduce visual nuisance (especially flashing red lights)
  - Define marking/lighting requirements for off-shore wind farms
- Working group launched by DGAC and DIRCAM (2014-2015)
- Involvement of all stakeholders:
  - Civil and military aviation administrations
  - Civil and military airspace users
  - Wind farm operators and their professional representatives
  - Light manufacturers
  - ...
- Operational evaluations organized in 2016-2017 to complete the WG conclusions

⇒ **Establishment of a new regulation published in April 2018 (applicable from 2019, possible retrofit on a voluntary basis)**

# Noticeable evolutions

- For every wind turbine :
  - Reduction of the frequency of flashing lights (20 flashes/minute)
  - Synchronization of every flashing lights on the territory (based on GPS time)
  - Mandatory rhythm (1/3 ON - 2/3 OFF)
- For wind turbines among a wind farm :
  - Day time : possibility to have lights only on the boundary of the wind farm (subject to conditions)
  - Night time : possibility to replace some flashing lights by either steady lights of the same intensity (2 000 cd) or flashing lights of decreased intensity (200 cd). Also applicable to lines of wind turbines
- Specific requirements for offshore windfarms :
  - Red/orange marks on the blades and on the mast
  - 30 flashes/minute frequency

## Way forward

- The publication of the new regulation is not the end of discussions on aeronautical lighting
- Recent request to study the implementation of aircraft detection systems in order to activate flashes at night only when necessary (all lights being 2 000 cd red steady otherwise)
- New working group created this year,
- Work in progress .....

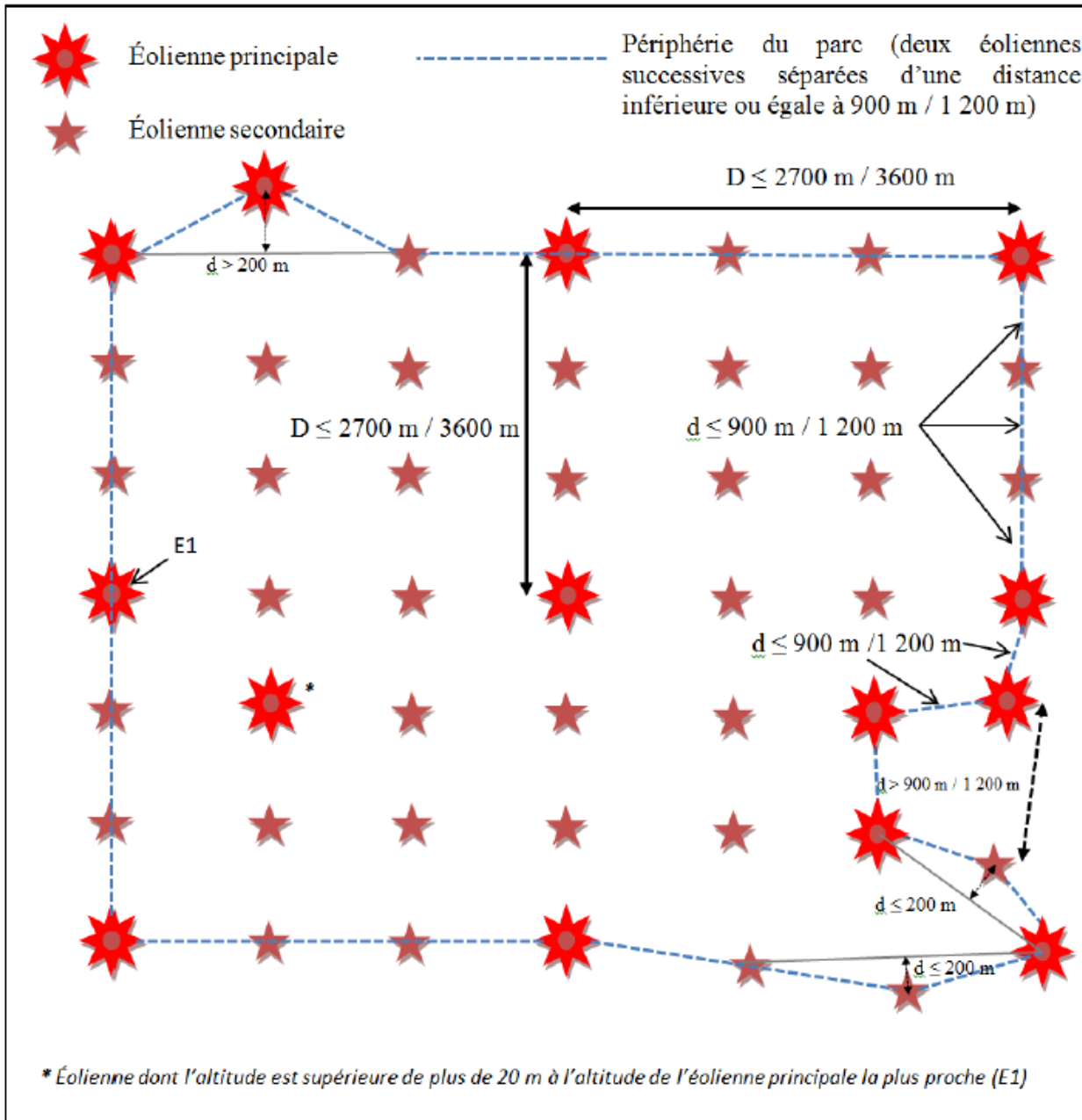
# End of presentation

# Thank you for your attention



# Illustrations

Figure 7. – Illustration du balisage nocturne des champs éoliens terrestres



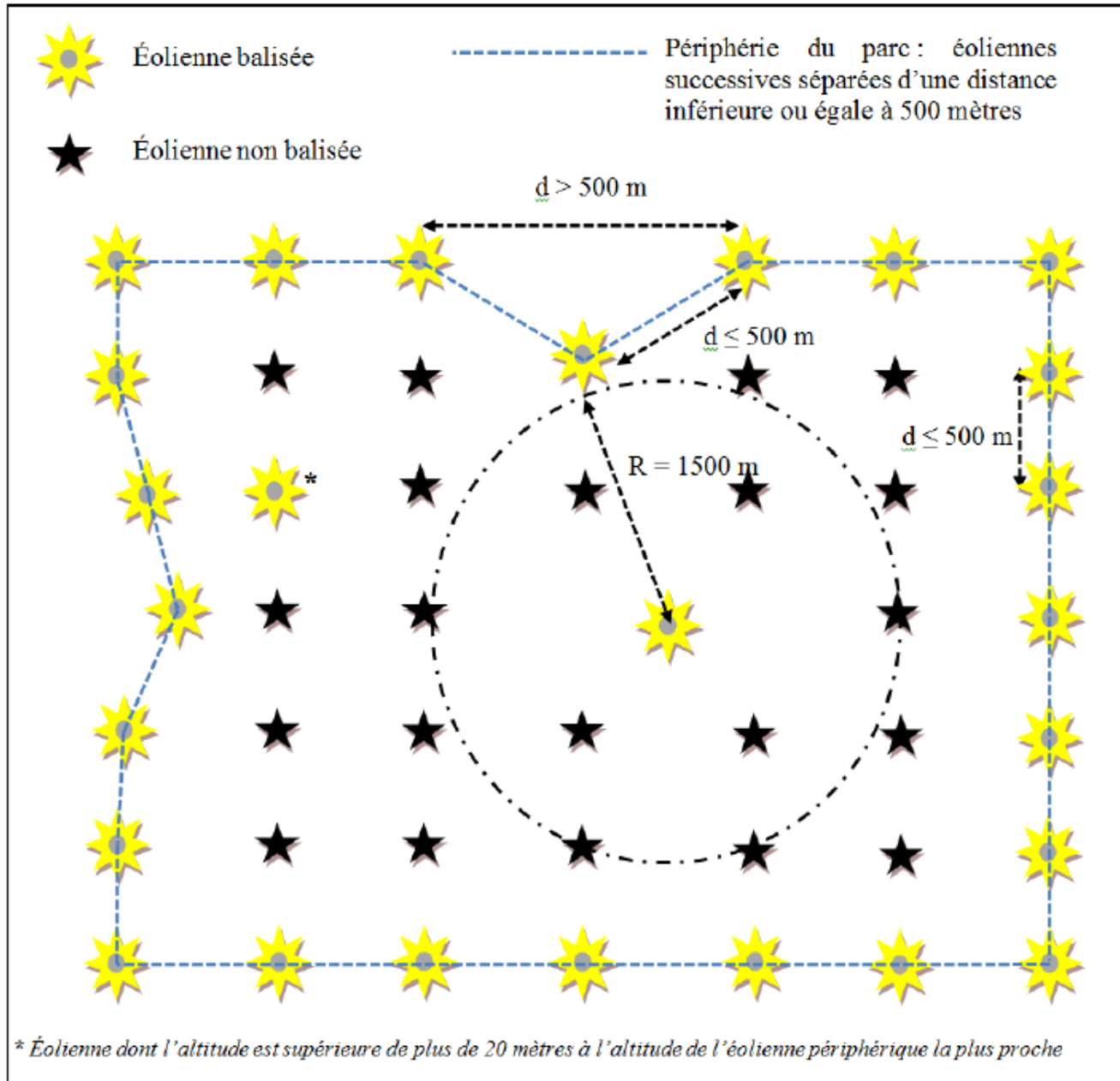
Off shore :

- $D = 8 \text{ NM} (14\,816) \text{ m}$
- $d = 2000 \text{ m}$



# Illustrations

Figure 5. – Illustration du balisage diurne des champs éoliens terrestres



Off shore :

- R = 3600 m
- d = 2000 m