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Advisory Circular

AC 139-18(0)

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OBSTACLE MARKING AND LIGHTING OF WIND FARMS

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1. REFERENCES

- [CASR Part 139, Subpart 139.E](#)
- [Manual of Standards Part 139](#)

2. PURPOSE

- 2 Wind turbines can be hazardous objects to aviation.
- 3 This Advisory Circular (AC) provides
- 4 general information and advice to:
- proponents of wind farms (including single wind turbines), and
 - planning authorities with jurisdiction over the approval of such structures.
- 4 This AC also provides specific advice on
- 5 measures to reduce the hazard, and how to
- 5 implement them.

3. STATUS OF THIS AC

- 6 This is the first AC to be issued on this
- 6 subject.

Advisory Circulars are intended to provide advice and guidance to illustrate a means, but not necessarily the only means, of complying with the Regulations, or to explain certain regulatory requirements by providing informative, interpretative and explanatory material.

Where an AC is referred to in a 'Note' below the regulation, the AC remains as guidance material.

ACs should always be read in conjunction with the referenced regulations

4. BACKGROUND

4.1 This AC applies to:

- (a) A single wind turbine, or
- (b) A group of wind turbines, referred to as a wind farm, which may be spread over a relatively large area.

4.2 The height of a wind turbine is defined to be the maximum height reached by the tip of the turbine blades.

4.3 Wind turbines pose a particular practical problem in that their highest point is not a fixed structure, and therefore obstacle lights can not be appropriately located. The highest fixed part of the turbine where lights can conveniently be located is the top of the generator housing, also known as the nacelle, and this is typically of the order of 2/3 the maximum height of the turbine.

5. NOTIFYING CASA OF A WIND FARM PROPOSAL

5.1 Under the Civil Aviation Safety Regulations CASR Part 139, the Civil Aviation Safety Authority (CASA) must be notified:

- (a) by an aerodrome operator, if it becomes aware of any development or proposed construction near the aerodrome that is likely to create an obstacle, or if an object will infringe the obstacle limitation surfaces (OLS) of an aerodrome; or
- (b) by a person who proposes to construct a building or structure the top of which will be 110 metres or more above ground level.

Note: Obstacle limitation surfaces are a complex of imaginary surfaces associated with an aerodrome. They vary depending on number and orientation of runways, and the instrument-approach type of the runway(s). Some surfaces can extend to 15 km from an aerodrome. Aerodrome operators can provide details for their particular aerodrome.

5.2 An individual wind turbine, or a wind farm where any turbine in the group meets these criteria, must be notified to CASA.

5.3 Where a wind turbine or a wind farm is proposed to be located in the vicinity of an aerodrome (within 15 km), the proponent of the project should contact the relevant aerodrome operator in the first instance, to ascertain whether the proposal will infringe the aerodrome's OLS. If the proposed height of the wind turbines will penetrate the OLS and the proponent still wishes to pursue the wind farm project at the selected site, then the aerodrome operator is required to notify CASA of this proposal.

5.4 Where the height of a proposed wind turbine or wind farm is going to be 110 m or more above the ground level, the proponent of the project is required to notify CASA. This should be done through the nearest CASA Field Office. Location and contact details of CASA district aerodrome inspectors may be found on CASA's website: <http://casa.gov.au/aerodromes/contacts.htm>.

6. CASA REGULATORY SERVICES FOR A WIND FARM DEVELOPMENT

Note: At the time of drafting this AC (November 2005), CASA is in the process of consultation with industry on a proposed schedule of charges for providing regulatory services. CASA processing of a development proposal which may become hazardous to aviation, such as a wind farm development, is included in the schedule. The actual date of implementation of the cost recovery schedule will be announced in due course.

6.1 On receipt of a wind turbine or wind farm development notification, CASA will assess the complexity of the development and provide the proponent with a quote for the likely fee for processing the proposal. CASA will only commence work on the assessment of the development proposal on receipt of payment of the fee.

6.2 The fee is to cover the costs of providing regulatory services by CASA specialist staff in assessing the development proposal. CASA services include the following:

- (a) assessment of the risks that the proposed wind farm will pose to aircraft safety in general, and local aircraft activities in particular;
- (b) determination of any need to change aircraft flying operational procedures when the wind turbines are erected;
- (c) in the case of an infringement of the OLS, determination of any impact on existing runways;
- (d) determination of requirements for the provision of obstacle marking or lighting, including the assessment of the wind farm obstacle lighting plan;
- (e) contact AIP publisher to initiate changes to published procedures and charts, and the issue of NOTAMs where necessary; and
- (f) liaising with planning authorities who have responsibility for the approval of the development proposal, on air safety requirements.

6.3 Under CASR Subpart 139.E, CASA may determine that a proposed structure will be a hazardous object because of its location, height or lack of marking or lighting. Depending on the assessment, CASA will advise the proponent whether the proposed wind farm will be determined:

- (a) as not a hazardous object to aviation, or
- (b) that with the provision of approved marking and/or lighting, it will not be a hazardous object, or
- (c) as a hazardous object, but that the risks to aircraft safety may be reduced with the provision of approved marking and/or lighting.

6.4 If CASA makes such a determination, a notice will be directed not only to the proponent of the wind farm, but also to any authorities whose approval is required for the construction. The hazard determination is a notice to recipients that, if CASA's advice is not followed, they are responsible for creating the hazard to aircraft safety and may be liable for their actions.

7. MARKING OF WIND TURBINES

7.1 CASA considers that, by day, large wind turbines are sufficiently conspicuous due to their shape and size, provided the colour of the turbine is of a contrasting colour to the background, not to require additional markings.

7.2 Accordingly, unless the colour of the turbine is likely to blend in with the background, the characteristic obstacle marking colours and/or patterns, detailed in MOS Part 139, are not applicable.

8. LIGHTING OF WIND TURBINES

8.1 The normal standard for obstacle lighting requires lights to be located as close as practicable to the top of the objects, and at other locations so as to indicate the general definition and extent of the objects.

8.2 For a wind turbine, the highest point is the tip of a rotating blade, presenting a practical problem with placement of lights and meeting the standard. The highest fixed part of the turbine where lights can conveniently be located is the top of the generator housing.

8.3 In balancing the risks and providing a practical solution, CASA has adopted a measured approach by treating the turbines differently, depending on whether they are located close to an aerodrome or some distance away from it.

9. LIGHTING OF WIND TURBINES IN THE VICINITY OF AN AERODROME

9.1 CASA strongly discourages the siting of wind turbines in the vicinity of an aerodrome, as these tall structures can pose serious hazards to aircraft conducting take-off and landing operations.

9.2 Where a proposed wind turbine has to be located such that it will penetrate the OLS of an aerodrome, and it is determined by CASA that it will require obstacle lighting, the top lights are required to be arranged so as to mark the highest point reached by the rotating blades. The need to mark the highest point is necessary because aircraft conducting the take-off and landing phases of flight will be close to the ground and providing obstacle lights at only approximately 2/3 of the maximum height of the turbine could lead pilots into a false sense of vertical separation.

9.3 As it is not practicable to install obstacle lights at the tip of the blades, these lights may be located on a separate supporting structure adjacent to the wind turbine, at a height that is corresponding to the highest point of the rotating blade of the turbine.

10. LIGHTING OF WIND TURBINES NOT IN THE VICINITY OF AN AERODROME, WITH A HEIGHT OF 110M OR MORE

10.1 Where a proposed wind turbine is located not in the vicinity of an aerodrome, and CASA has determined that obstacle lighting is required, the obstacle lights may be placed on top of the generator housing.

11. OBSTACLE LIGHTING STANDARDS FOR WIND TURBINES

11.1 In the case of a single wind turbine:

- (a) two flashing red medium intensity obstacle lights should be provided;
- (b) the light fixtures should be mounted at a horizontal separation to ensure an unobstructed view of at least one of the lights by a pilot approaching from any direction;
- (c) both lights should flash simultaneously; and
- (d) the characteristics of the obstacle lights should be in accordance with MOS Part-139, Chapter 9.

Note: Intermediate height lights, normally required for obstacles in excess of 45m height above ground level, by MOS Part 139 standards, are not required in the specific case of wind turbines.

11.2 In the case of a wind farm, sufficient individual wind turbines should be lighted to indicate the extent of the group of turbines:

- (a) the interval between obstacle lighted turbines should not exceed 900 m, which is the current standard for an extensive object or a group of closely spaced objects;
- (b) in addition, the most prominent (highest for the terrain) turbine(s) should be lighted, if not included amongst the turbines lighted in accordance with (a) above; and
- (c) the lighting of individual turbines should be in accordance with 11.1 above.

Note: Some international regulatory authorities are considering requiring that all lighting provided at a wind farm should flash simultaneously. This proposal is still to be validated and accepted. It is suggested that wind farm operators bear in mind that the simultaneous flashing of all lights at a wind farm could become accepted practice some time in the future.

11.3 Where obstacle lighting is to be provided, it is necessary to establish a monitoring, reporting and maintenance procedure to ensure outages are detected, reported and rectified. This would include making an arrangement for a recognised responsible person from the wind farm to notify the relevant CASA office, so that CASA can initiate NOTAM action to advise pilots of light outages.

12. SUBMISSION OF WIND FARM OBSTACLE LIGHTING PLAN

12.1 When the design of the wind farm is finalised, the developer will need to submit a wind farm lighting plan showing the obstacle lighting arrangement for the wind farm. This is to allow CASA to assess whether the lighting arrangements are in accordance with standards and whether they would provide pilots with a clear indication of location and extent of the wind turbines.

12.2 CASA may require changes to be made or require additional lights where exceptional local conditions require these.

12.3 The wind farm obstacle lighting plan would also be used for checking that the agreed lighting has been provided and maintained.

12.4 This plan needs to be updated if further development of the wind farm takes place.

13. REPORTING OF WIND TURBINES LESS THAN 110M IN HEIGHT

13.1 There is no requirement for CASA to be notified if a proposed wind turbine is less than 110 m in height and does not infringe the OLS of an aerodrome. However, being tall structures, they may still need to be included in the national database of tall structures maintained by the Royal Australian Air Force. Information on reporting of tall structures may be found in AC 139-08 - Reporting of Tall Structures: <http://casa.gov.au/rules/1998casr/139/139c08.pdf>

14. ENVIRONMENTAL CONCERNS WITH OBSTACLE LIGHTS ON WIND TURBINES

14.1 There have been concerns raised that the obstacle lights may be visually unacceptable to humans. It should be noted that obstacle lighting has been in use on buildings and structures for a very long time, and been accepted in Australia and the rest of the world. It is possible that some of the visual amenity criticism of obstacle lighting on wind turbines may be an expression of concern with operation and siting of the wind turbine itself, rather than the lights. In any case, correct alignment, and if necessary, appropriate shielding of the light fittings should minimise the visual impact of the obstacle lighting on adjacent areas.

14.2 There have also been concerns raised that standard obstacle lighting might adversely affect wildlife, including birds and bats. CASA is prepared to examine innovative options to relieve the impact on the environment, provided they can be proven to effectively satisfy the operational requirement of making the wind turbines conspicuous to pilots. In this case, the onus rests with the proponent of the wind farm to develop and support, with evidence, the effectiveness of their proposed alternative.

14.3 Proponents of wind farms should be aware that there may be more regulatory requirements of other government departments and organisations, other than described in this AC.

15. VOLUNTARY PROVISION OF OBSTACLE LIGHTS

15.1 CASA's regulatory regime for obstacle lighting provides an appropriate level of safety for normal aircraft operations. Certain flying operations, by their functional nature, involve lower than normal flying, for example aerial agricultural spraying, aerial mustering, power line inspection, helicopter operations including search and rescue, some sports aviation and some military training. These pilots require special training, and are required to take obstacles into account when planning and conducting low flying operations. Wind farm operators should check if proposed wind turbines will be located near areas where low flying operations are likely to be conducted and, if so, consider their duty of care to such activities.

15.2 If a wind farm operator chooses to provide obstacle lighting of his own volition, the owner should follow the standards for lighting contained in this AC. This will ensure pilots will recognise, and correctly interpret the visual warning provided, and provide low flying pilots with a last line of defence against inadvertent collision.

Patrick Murray
Group General Manager
Air Transport Operations Group