DNV·GL

Technical Note - Laufer Wind Aircraft Detection System

Laufer Wind

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1 INTRODUCTION

Laufer Wind has developed a radar-controlled aviation obstruction lighting system which can be used on wind power installations (hereafter referred to as an “Aircraft Detection System” or ADS). The function of the Laufer Wind ADS is to allow the Federal Aviation Administration (FAA)-required obstruction lights on wind power installations to be turned on only when aircraft are detected in the vicinity of the project and therefore, to remain off when no aircraft are in the vicinity of the project.

Laufer Wind requested Garrad Hassan America, Inc. (doing business as GL Garrad Hassan America Inc. and DNV KEMA Renewables Inc.) provide independent engineering services related to the Laufer Wind ADS, including an independent review of a system demonstration. This technical note is issued to Laufer Wind pursuant to a written agreement between Laufer Wind and GL Garrad Hassan, dated 26 July 2013 (document no. 702365-USSD-P-01), and summarizes DNV GL’s review of the Laufer Wind ADS.

2 LAUFER WIND ADS BACKGROUND

The Laufer Wind ADS uses radars to monitor the perimeter of a wind power installation. The radars, the number of which depend on the size of the wind power project, communicate aircraft position information to a central controller, which in turn commands obstruction light controllers (mounted with the lights) to turn lights on or off.

The radars can track multiple aircrafts and the ADS manages the “loss” of aircraft as they fly above the project area (thus out of radar contact) such that obstruction lighting remains on in such circumstances. The system’s fail-safe mechanism turns obstruction lighting on in the event of various system failure scenarios such as a loss of radar, loss of central controller or other communication, loss of power, or radar malfunction.

The Laufer Wind ADS radar has a specification detection distance of 12 km. Once the aircraft is detected, the ADS tracks aircraft and activates the obstruction lights if the aircraft penetrates a given radius as specified by local requirements.

3 REGIONAL CONSIDERATIONS

3.1 United States Requirements

The FAA, within the U.S. Department of Transportation, publishes regulations and guidance related to the construction or alteration of structures which may affect the national airspace system. Regarding wind turbines, meteorological towers, and other structures related to wind power installations, the FAA Advisory Circular on Obstruction Marking and Lighting [1] details FAA recommendations for lighting.

The current FAA Advisory Circular on Obstruction Marking and Lighting does not address ADS in any detail. However, the FAA has developed draft recommendations for ADS which will be included as a new chapter in a forthcoming update to the Advisory Circular on Obstruction Marking and Lighting (expected in late 2014). DNV GL reviewed the FAA draft recommendations as part of its evaluation.

There are two critical aspects to the FAA draft recommendations: (1) the ADS must activate the obstruction lighting prior to an aircraft penetrating a volume defined as 3 nautical miles (5.56 km) from the closest obstruction (i.e. wind turbine) from ground level to 1,000 ft above the highest point of the obstruction; and (2) the ADS must activate the obstruction lighting in the event of system failure.

3.2 International considerations

Obstruction lighting requirements in each country are dictated by country-specific rules and regulations. For instance, requirements for radar-activated obstruction lighting systems in Sweden and Canada have been based on a minimum activation warning time (as opposed to distance) and an assumed maximum aircraft ground speed.

Using an assumed maximum aircraft speed and a minimum activation warning time, project developers considering ADS can estimate an equivalent activation boundary perimeter. For example, an assumed maximum aircraft speed of 250 nautical miles per hour and a minimum activation warning time of 30 seconds is effectively equivalent to an activation boundary perimeter of 3.86 km. Thus, international requirements may result in more or less rigorous technical demands on the system depending on aircraft speed assumptions and minimum activation warning times. DNV GL has not witnessed the capabilities of the Laufer Wind ADS compared to any international requirements; however, in countries where the effective requirements are either equivalent to or less rigorous than United States draft FAA recommendations, the Laufer Wind ADS can be expected to comply.

4 SUMMARY OF SYSTEM DEMONSTRATION

On 23 June 2014, Laufer Wind demonstrated their ADS to representatives from the FAA and DNV GL. The demonstration took place at the National Renewable Energy Laboratory (NREL) National Wind Technology Center in Boulder, CO. The demonstration included two flight tests, each including multiple aircraft flight paths, intended to test the system's response to various aircraft scenarios.

Flight Test #1:

DNV GL witnessed the first flight test from the ground, observing both the Laufer Wind radar and ADS display and the NREL FAA obstruction lighting. During the flight test, DNV GL observed aircraft tracking by the ADS system consistently beyond 12 km. DNV GL observed the obstruction lighting system consistently activated as aircraft penetrated the 3 nautical mile radius. DNV GL observed the ADS consistently manage the "loss" of radar contact as aircraft passed above the radar's range such that the obstruction lighting remained activated until the aircraft left the 3 nautical mile radius. Additionally DNV GL observed the ADS activate the obstruction lights due to forced system shutdown, which demonstrated the ADS' response to a fail-safe scenario.

Flight Test #2:

DNV GL witnessed the second flight test as a passenger in the test aircraft. With the aid of onboard GPS, for all flight paths, DNV GL observed obstruction lighting activate at distances beyond the 3 nautical mile radius and de-activate as the aircraft achieved distances beyond the 3 nautical mile radius. The flight test included five flight paths, each completed at different angles and altitudes.

The FAA maintains a webpage with airport technology research & development news [2], which summarized the Laufer Wind demonstration in the following statement:

> "Aircraft Detection System Evaluation: June 23 to 25, Jim Patterson traveled to the Department of Energy's National Renewable Energy Laboratory (NREL) in Boulder, Colorado to participate in an evaluation of an Aircraft Detection System developed by Laufer Wind Group. This system is designed to monitor airspace around a wind turbine farm and activate the farm's obstruction lighting when an aircraft is detected in the area. Conversely, when it does not detect an aircraft in the area, it turns the lights off. A series of flights were conducted to determine if the system performed in accordance with draft standards that the FAA has developed. The system was found to be satisfactory. A technical report will be prepared that describes the evaluation."

5 CONCLUSIONS

On 23 June 2014 DNV GL observed a successful test of the Laufer Wind ADS as assessed against draft FAA recommendations which are intended by the FAA to be included as a new chapter in a forthcoming update to the Advisory Circular on Obstruction Marking and Lighting. During DNV GL's observations, the Laufer Wind ADS consistently tracked aircraft from beyond 12 km and activated obstruction lighting prior to aircraft penetrating a 3 nautical mile radius.

In DNV GL's opinion, assuming proper installation of the system, the Laufer Wind ADS can meet the draft FAA recommendations, which asserts: (1) the ADS must activate the obstruction lighting prior to an aircraft penetrating a volume defined as 3 nautical miles from the closest obstruction (i.e. wind turbine) from ground level to 1,000 ft above the highest point of the obstruction; and (2) the ADS must active the obstruction lighting in the event of system failure.

While international requirements may vary, those requirements which are based on minimum activation times have essentially the same intent as the FAA's recommendations, namely, that the ADS must activate obstruction lighting before the aircraft reaches a certain distance from the wind power installation. In DNV GL's opinion, assuming proper installation of the system, the Laufer Wind ADS has the capability to meet such requirements in countries where the effective requirements are either equivalent to or less rigorous than United States draft FAA recommendations.

6 REFERENCES

[1] "FAA Advisory Circular on Obstruction Marking and Lighting" Document no. AC 70/7460-1K, http://www.faa.gov/regulations_policies/advisory_circulars/index.cfm/go/document.information/documentID/74452.

[2] "FAA Airport Technology Research & Development Branch News Page", http://www.airporttech.tc.faa.gov/news.asp#jun2614 accessed 16 July 2014.