CONTENTS

16 RADAR AND TRANSMISSION SYSTEMS

16.1 Introduction

This section describes the existing radar and transmission systems that may be affected by the Thanet Offshore Wind Farm (Thanet) project and assesses the potential impacts that the project may have on these systems.

16.2 Assessment Methodology

In order to assess the potential effects arising from the Thanet project on aviation radar systems, the standard wind farm developer's application pro forma was submitted to the Civil Aviation Authority (CAA), National Air Traffic Services (NATS) and the Ministry of Defence (MOD) at an early stage in the development process. Dialogue was also initiated with marine radar and radio, telephone and television transmission system operators.

In addition, a study was undertaken by AMS Limited (now BAE Systems; AMS, 2005) to assess the potential affects on the existing radar system located at Kent International Airport (KIA) and indicate other known marine and aviation radar systems that may be affected by the Thanet project.

The study provided an indication of the visibility of the Thanet project and its potential effects on the identified radar systems. The study was carried out using commercial software utilising digital terrain models taken from SRTM™ and other Digital Terrain Map (DTM) data sources.

The results of this study did not consider masking effects due to trees, buildings etc in any detail, except for a brief examination of the possible masking by some urban areas, which may lie between the wind farm and the radar system. For the purpose of this assessment, the number and placement of turbines has been based on the use of the 5.0MW turbines, which are the largest turbines being considered, and hence are the turbine most likely to be visible to the radar systems (see **Table 2.2** in **Section 2, Project Details**).

16.3 Existing Environment

16.3.1 Military aviation

Thanet Offshore Wind Limited (TOW) has consulted with the Ministry of Defence (MOD) and provided details of the wind farm layout in accordance with the required consultation procedures determined by the MOD. Subject to consultation on the final details of the wind farm, the MOD has confirmed that the Thanet project would not have an effect on MOD operations.

16.3.2 Civil Aviation Authority

TOW has consulted with the Civil Aviation Authority (CAA) in order to understand the possible consequence of the Thanet project on civil aviation activities. The CAA advised that contact should be made with Kent International Airport, as Thanet is located within 30km of the airport's radar system.

TOW confirms that it will comply with the CAA guidelines in respect of aviation lighting in accordance with the document 'Lighting of Wind Turbine Generators in United Kingdom Waters Annex A', dated September 2003 (CAA, 2003).

16.3.3 National Air Traffic Services

National Air Traffic Services (NATS) is split into two companies:

- NATS (Services) Limited (NSL) has no direct air traffic control (ATC) responsibility, however, they are subcontracted by many airport operators throughout the UK to provide this function and will consider such applications on behalf of their airport customers; and
- NATS (En-route) plc (NERL) is responsible for the provision of ATC services to aircraft in their en-route phase of flight between their source and destination airports and as such is responsible for the protection of the electronic equipment, such as radar, that allows NERL to carry out this function. The responsibility for the provision of ATC to aircraft in other phases of flight, such as take-off and landing, falls on the airport operator.

Both NATS companies have confirmed that the Thanet project would have **no impact** on their operations.

16.3.4 Kent International Airport

TOW also undertook direct discussions with Kent International Airport (KIA) at Manston, as it was felt that this was the only aviation facility that may be impacted by the Thanet project. KIA has expressed concerns that although the Thanet site is away from the main approach path, and should not affect its outbound and inbound traffic directly, the effect of the wind farm might be to lose some detection of aircraft above the wind farm and to produce false alarms from the moving turbine blades. In particular, this may reduce KIA's ability to detect low flying light aircraft that might pose a danger to the aircraft during their final approach to, or take off from, KIA.

As a consequence of this dialogue, TOW commissioned a Radar Interaction Study from AMS Limited (now BAE Systems).

16.3.5 Television transmission companies

TOW has consulted with the relevant television transmission companies, none of which have raised any comments.

16.3.6 Telephone transmission companies

TOW has consulted with the relevant telephone transmission companies, none of which have raised any comments.

16.3.7 Radio transmission companies

TOW has consulted with the relevant radio transmission companies, none of which have raised any comments.

16.4 Impacts during Construction

No impacts have been identified.

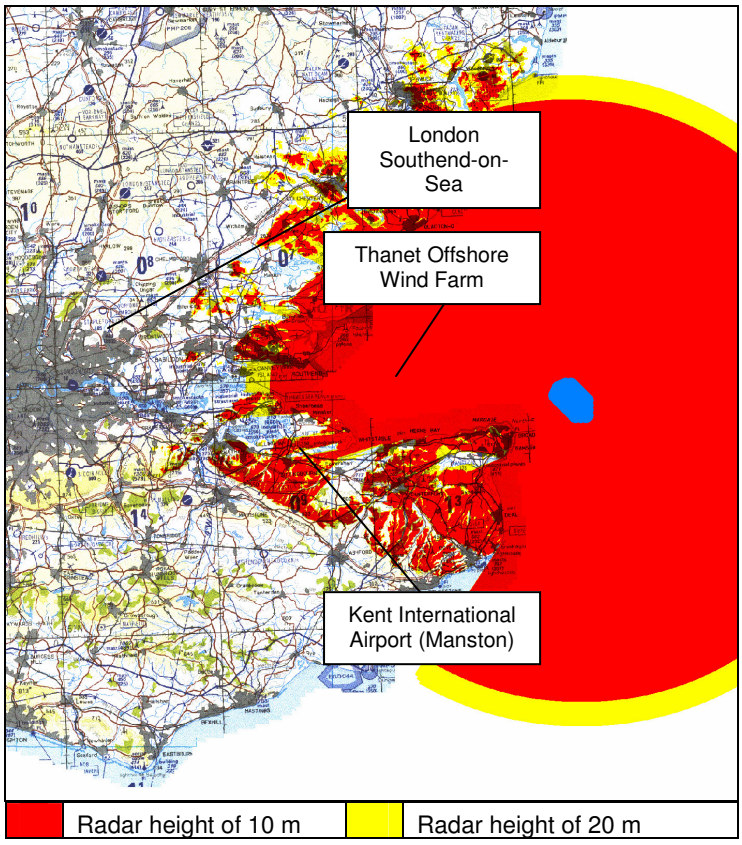
16.5 Impacts during Operation

16.5.1 Effect on radar systems

Line of sight survey

An initial survey to identify any 'victim' radars was conducted by calculating the line of sight from the wind farm to its surrounding area. The red shaded area shown in **Figure 16.1** represents the theoretical area in which the wind farm is visible, for a radar system with an electrical centre (radiating point) height of 10m above ground level. It generally covers an area of Kent, east of a line running from Chatham in the north to Folkestone in the south. The wind farm would also be theoretically visible along the coast, running from Southend on Sea to the aerodromes of Woodbridge and Bentwaters to the north. The area for radar systems at 20m installed height, which is coloured yellow in **Figure 16.1**, only marginally extends the original main area of visibility.

Figure 16.1 Map showing theoretical area of wind farm visibility



After an initial assessment of the line of sight area shown in **Figure 16.1**, the following known radar stations were identified, as shown in **Table 16.1**.

Table 16.1 Identified affected radar stations

Radar	Lat (WGS84)	Long (WGS84)	Radar type	Radar operator	ID Label
1	51°20'54.8"	1°21'00.1"	AR1	Kent International Airport	KIA
2	51°34'13.0"	0°41'55.4"	S511	London Southend Airport	SOU
3	51°22'31"	1°26'40"	Terma Scanner 4100	Maritime and Coastguard Agency - North Foreland	NF
4	51°23'28" approx	1°22'58" approx	Maritime	Port of London Authority - Margate	MAR
5	51°39'28"	0°37'08"	Various	BAE Systems	Bushy
6	51°42'45"	0°56'27"	HFSWR	BAE Systems	Dengie

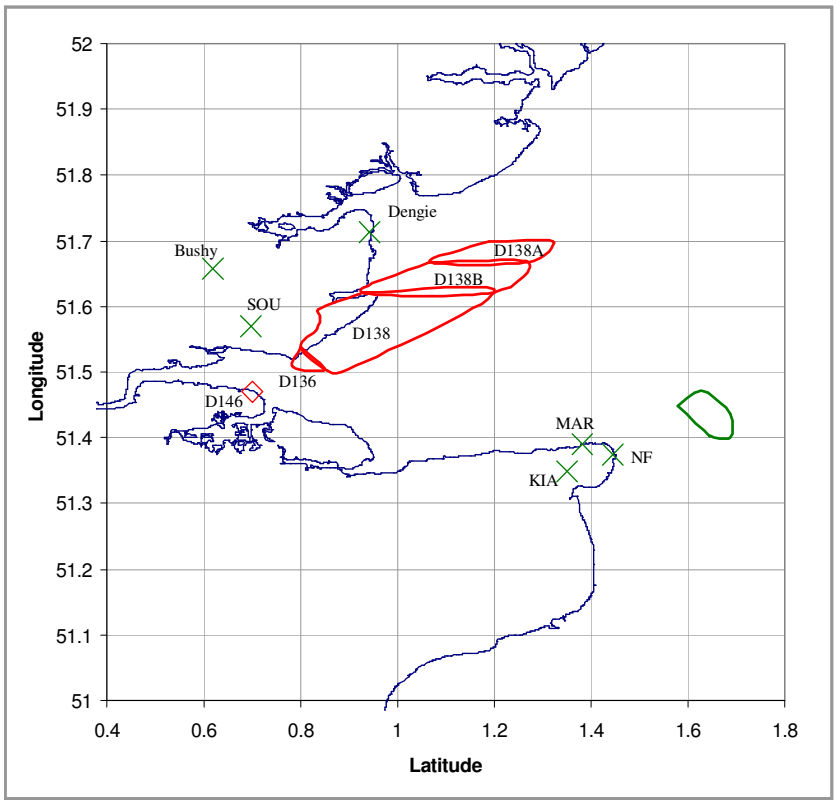
In addition, a number of danger areas, within which radar services may be required, were identified, as shown in **Table 16.2**.

Table 16.2 Identified danger areas

Danger Area	Range Name
D136	Shoeburyness
D138	Shoeburyness
D138A	Shoeburyness
D138B	Shoeburyness
D146	Yantlet (Isle of Grain)

These sites are shown in **Figure 16.2**.

Figure 16.2 Locations of potentially affected areas



16.5.2 Radar site 1 - Kent International Airport

Radar site 1 is the radar system installed at Kent International Airport (KIA) at Manston, on the Isle of Thanet. The airport is currently operated by Infratil Airports Europe, after the previous owners Planestation went into administration.

Air traffic control at KIA is primarily concerned with the safe management of aircraft arriving at and departing from the airport. Aircraft management of local air traffic is conducted by the air traffic controllers at the airport, using the airport's own radar displays to aid them.

Radar information at KIA is derived from two sources. The first of these is KIA's own Plessey AR-1 primary radar. The second source is a data feed from a secondary surveillance radar (SSR) at Debden in Essex, which is owned and operated by NATS Limited.

The main differences between primary radar and secondary surveillance radar are that the former detects radar energy reflected from many different types of objects, not just aircraft, whereas the latter only detects signals from aircraft equipped with a transponder. Both types of radar system monitor the instantaneous position of an aircraft over the ground by measuring its range (distance) and bearing (direction) from the radar. Over time, the history of these measurements shows the recent past movement of the aircraft (its 'track') and gives an indication of its future movements.

Although SSR can only detect aircraft fitted with transponders, for these aircraft, it can also receive information about the aircraft's height, allowing its movement to be followed in three dimensions. Transponder equipped aircraft, operating under air traffic control, also provide the SSR with an identifying numeric code, allowing the air traffic controllers to uniquely identify a particular aircraft's track on their displays.

At present, light aircraft are encouraged, but not obliged, to carry transponders, which are mandatory on all aircraft above 5,700kg gross take off weight and/or engaged in commercial aviation activities. Those aircraft not fitted with, or not using transponders can only be detected by primary radar, so neither their identity nor height is available to air traffic control unless it is provided through voice radio communications between the aircraft and the ground. However, the Civil Aviation Authority has announced its intention to make the carriage and use of transponders mandatory for all aircraft from March 2008. From that time onwards, SSR will be the main provider of aircraft positional information to air traffic controllers, with primary radar then used as a backup for the detection and monitoring of aircraft whose transponders have failed or have been turned off.

Until that time, primary radar has a major role to play in air traffic control, as it is the only way to detect both commercial air traffic and those light aircraft not yet fitted with transponders. However, primary radar also detects a wide variety of radar reflecting objects other than aircraft, such as birds, rain, ships, buildings and wind turbines. These unwanted radar detections are known collectively as 'clutter' because, if shown on the air traffic controller's radar display, they might clutter the display to such an extent that they might distract the controller or, at worst, hide real radar detections of interest i.e. aircraft.

It is for this reason that air traffic control primary radars use sophisticated techniques for minimising the effects of clutter while protecting the ability to detect real aircraft. Although KIA's radar is very old and thus lacks some of the more recent innovations in this area, it does use a technique known as 'moving target indication' (MTI) to cancel out most radar detections of stationary and slow moving objects.

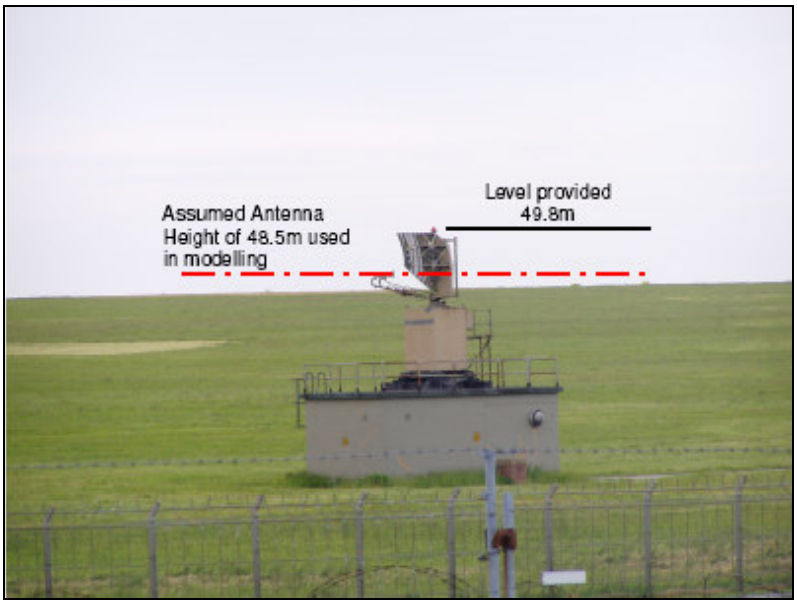
Plessey Radar AR-1

The radar system currently in use at KIA is a Plessey Radar AR-1. From existing documentation it has an indicated maximum range of 68nm (126km) for a target of $5m^2$, when in dual transmitter configuration (AMS, 2005). For the purposes of the Radar Interaction Study, the maximum range has been based on the above and the beam pattern used based on the use of dual transmitters and a $5m^2$ target with a radar beam tilt of 1°. The AR-1 Radar System at KIA is located as follows:

- Location: N 51° 20' 54.80" E 1° 21' 00.06";
- Elevation: 49.8m AOD to the top of the Antenna; and
- Ground Level: 40.73m.

As the value of 49.8m has been confirmed as being to the top of the antenna, some adjustment has been made to bring this value down to the electric centre of the antenna. Therefore for the purposes of the modelling, a level of 48.5m above mean sea level has been used (see **Figure 16.3**).

Figure 16.3 Antenna level used



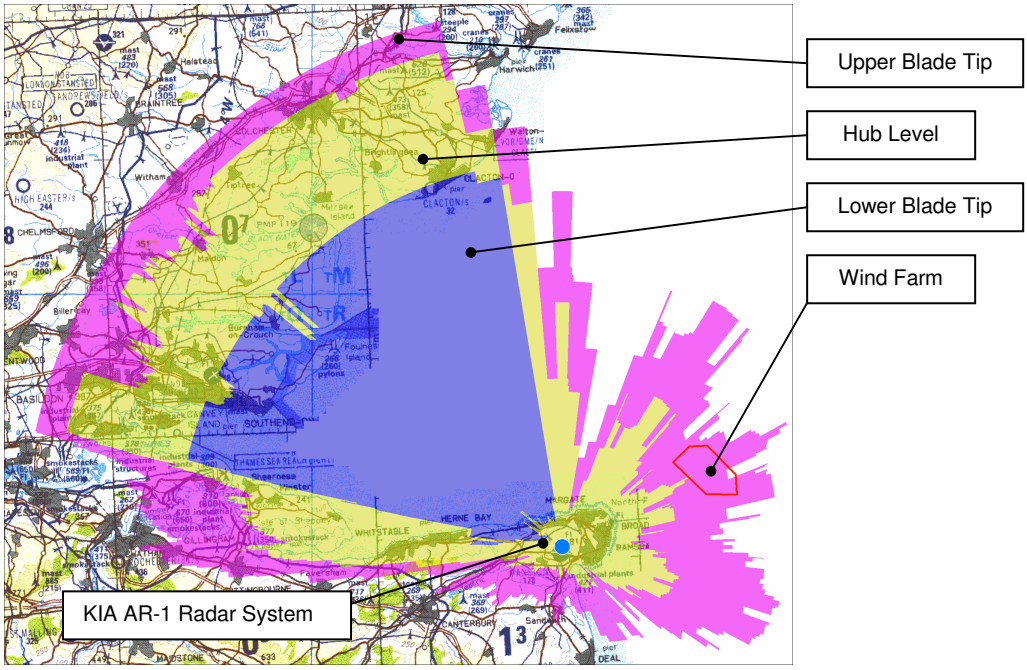
The following heights above mean sea level were used to represent the 5.0MW turbines:

- Lowest blade tip height: 30m;
- Hub height: 90m; and
- Highest tip height: 150m.

On review of the radar coverage diagram produced (see **Figure 16.4**), of the AR-1 radar and for the heights chosen, it indicates that the radar may see most of the Thanet site at the turbine upper blade points for the 5.0MW turbines, unless the wind farm is further screened by buildings and trees. The lower blade points and hubs appear to be masked from the radar system across the whole wind farm by the ground shape. The wind farm's front edge is approximately 19km from the radar system at KIA, with a depth of 5km. It gives an obstruction width of 23° from bearings of 51° to 74°.

Although not specifically included on the DTM, a modified clutter file was created around the area of the habitation indicated on the map to assess the possible masking effects of the towns. As no information was available for the height of the buildings within this area a general height of 9m was used, although a number of high buildings exist in the Margate and Ramsgate areas, which would provide further screening.

Figure 16.4 Indicative radar coverage for KIA radar system (5.0MW turbines) (BAE, 2005)



The study identified that the Thanet project may affect the air traffic cover from KIA. The potential effects that could arise are:

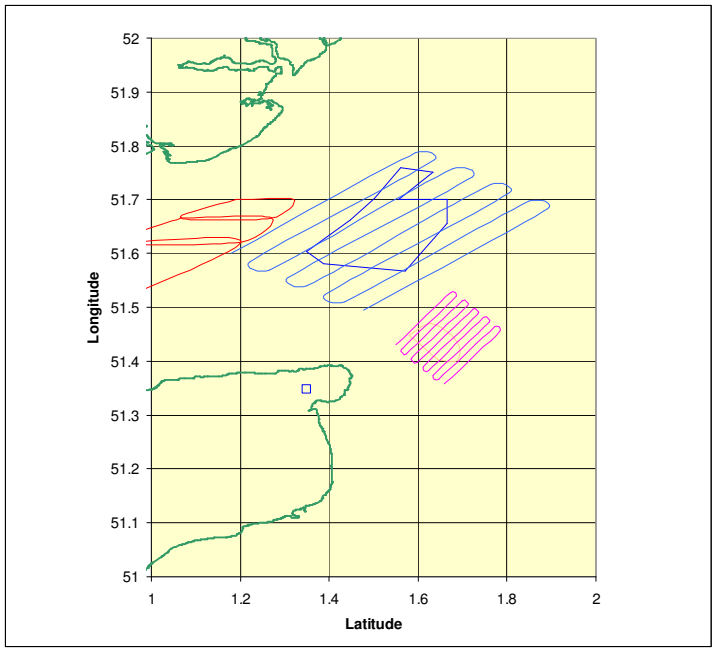
- The generation of 'false alarms', that is plots reported to the operator that do not originate from aircraft; and
- Loss of detection of air targets above the wind farm and at a short range beyond, however, this effect is highly dependent on the design of the radar signal processing. The RAF has verified this effect in recent trials on land based turbines in Wales, although the extent of this effect is difficult to predict and new methods have been proposed for development in conjunction with the MOD and the Department of Trade and Industry (DTI). Modifications to radar settings and changes to the signal processing would help to mitigate this problem.

TOW believe that the limited residual impact identified above would be further reduced, and possibly be eliminated by the additional screening effects of trees and buildings on the Isle of Thanet.

A further study to confirm the exact radar coverage from KIA of the Thanet wind farm was therefore commissioned with BAE Systems with the co-operation of KIA. The study referred to as the flight trials took place on 25th and 27th October 2005 and was conducted by flying an aircraft supplied by TG Aviation in a regular grid pattern over the Thanet site (see **Figure 16.5**).

The purpose of these flight trials was to identify the largest turbine that could be installed, without being visible to the radar at KIA.

Figure 16.5 Flight trials for Thanet and London Array projects



The aircraft was required to fly at a number of altitude levels to determine the altitude Above Mean Sea Level (amsl) at which the aircraft could be detected by the radar system at KIA. The first altitude level flown was set at 500 feet amsl (approx 150m), which corresponds to the maximum blade tip height of the largest 5.0MW wind turbine currently being considered. As the aircraft could not be detected over the wind farm at 500 feet amsl, then the altitude was increased in steps of 50 feet (approx 15m) up to 650 feet amsl (approx 200m). A single run was undertaken at 1,000 feet amsl, at which level the aircraft was visible to the radar system.

Although the preliminary observations suggest that the wind farm would not be visible to the radar system at KIA, the data obtained is subject to further analysis and reporting.

In the event that the flight trials do not prove conclusively that aircraft could not be seen above the wind farm at blade tip height, then by implication, the turbine blades could still be visible to the radar, although it is still not anticipated that there would be any significant effects due to the distance of the Thanet site from the radar. These residual effects are being discussed with KIA to establish their significance. In particular, the classes of air traffic cover provided need to be assessed against the impact of any loss of ATC capability over the wind farm. If these effects are deemed to be significant, then a number of mitigation measures would be explored. These measures could include:

- *Antenna tilt*: It may be possible to reduce the impact of the wind farm by increasing the elevation tilt of the radar antenna. The effect of this is to reduce the gain of the radar at low elevation angles, thus reducing the impact of objects at surface level. However, KIA has advised that this is unlikely to be acceptable due to the potential degradation of their low level air traffic cover across a 360° sector.

- *Addition of artificial screens*: It may be feasible to erect a screening structure that would generate a radar shadow over just the wind farm i.e. a 23^{o} sector only, and eliminate the potential impacts of the wind farm. Such a screen may be feasible using evergreen trees or by building a structure within the airport perimeter and would be designed to blank out just the wind farm only and not the airspace above the wind farm.
- *Combining data from an additional sensor*: The presence of the wind farm would, on the basis of previous studies and from trials conducted by the RAF, cause reduction in the probability of detection (Pd) of aircraft in the volume of space above the wind farm. It may be possible to locate an additional sensor, such as the radar at London Southend Airport, to 'fill-in' this volume. The data from this additional sensor can be combined with the primary radar data to form a continuous coverage. Initial discussions with London Southend Airport suggest that they would be willing in principle to provide this data.
- *Adjustments to ATC procedures*: If the performance offered by the radar in the volume of space above the wind farm is deemed not to meet CAA standards, then it may be possible to modify flight procedures in the vicinity of the wind farm. This is normal procedure where areas of fixed radar clutter e.g. mountains or regions of intense road traffic, cause radar false alarms. A survey of air traffic movements in the Thames Estuary area and its approaches would provide guidance to proposals for such changes. It may of course transpire that no changes are required if air traffic does not normally use the area of the wind farm.
- *Signal processing modifications*: The purpose of the signal processing modifications is to reduce the effects of the wind farm on the Constant False Alarm Rate (CFAR) processing circuits in the radar. These modifications would, if feasible, allow better tracking of aircraft flying over the wind farm, which would reduce the need for such aircraft to be routed round the wind farm by air traffic controllers.
- *Addition of Advanced Digital Tracker (ADT)*: ADT will be able to filter unwanted detections that arise from the wind turbines. However, due to the geographical extent of the Thanet site, the ADT may not by itself recover the full detection performance loss that may occur in the airspace above the wind farm and additional signal processing modifications would probably also be required.

16.5.3 Radar site 2 - London Southend Airport

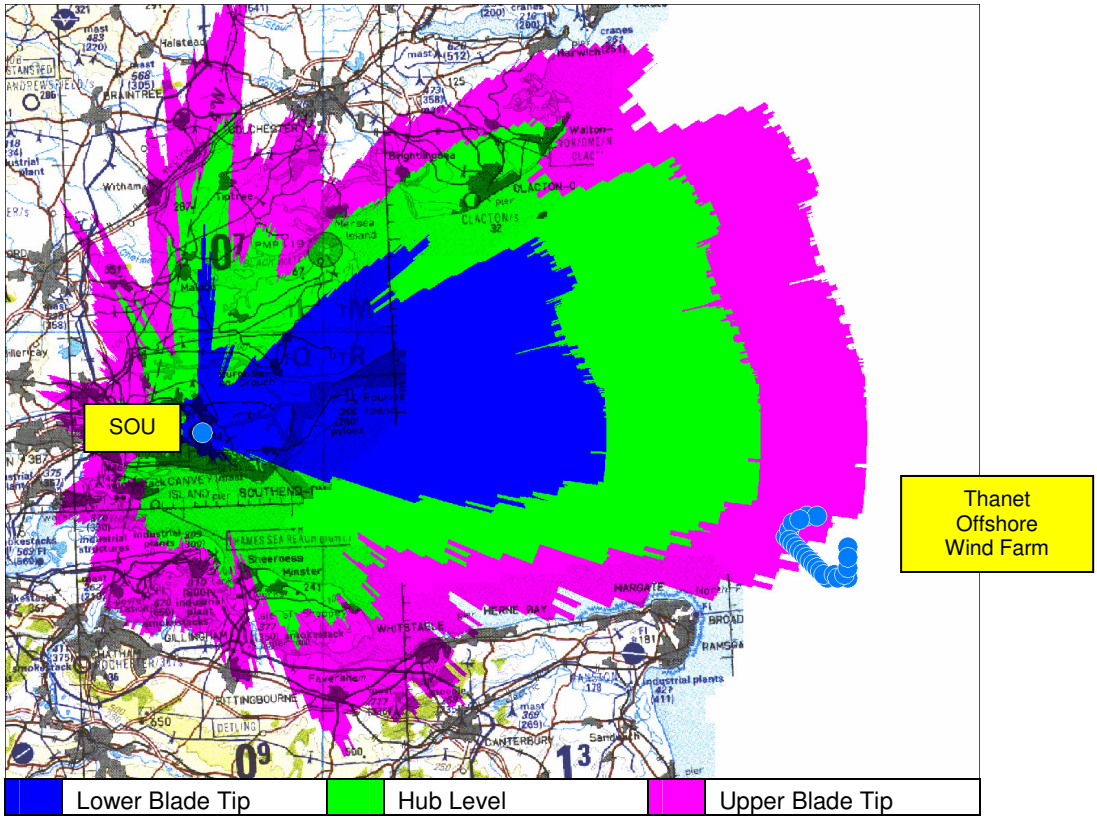
Radar site 2 is the Air Traffic Control (ATC) radar serving London Southend Airport, which is owned by Regional Airports Limited, a member of the Airport Operators Authority (AOA). An assumed position for the radar position, based on the airfield location was used for the purposes of the Radar Interaction Study. The radar system is a Marconi S511, installed on a 6m tower. The radar reflector is a further 4m above the tower platform giving an electrical centre (radiating point) of 10m above the local ground level. The transmitter output is 650kW peak giving the system a range of 64nm (119km).

From the indicative low level coverage diagrams, shown in **Figure 16.6**, the radar system at London Southend Airport generally 'looks' to the east over the Thames

Estuary. This shows that the coverage from the radar system would see only the upper blade tip point in the far northwest section of the Thanet site.

It has been calculated that the sea level at the wind farm is approximately 615m below the electrical centre of the radar. This means that all of the turbines are well below the electrical centre, as the maximum height to the upper tip point for the largest turbine is 150m. The wind farm is also below the earth's horizon in the sea clutter zone.

Figure 16.6 Indicative radar coverage for London Southend Airport (5.0MW turbines)



The wind farm breaks the coverage in a 4° sector between the bearings of 97° to 101°, whereas the whole farm has a 7° sector bearing between 97° and 104° when considered from the radar site. From DTM measurement, the nearest point of the Thanet site is 63km from the radar system, with a depth of 9km and falls outside of the Statutory Safeguarding Area for London Southend Airport.

Given the location of the radar system with respect to the Thanet site, the only effect that can be expected is a small rise in the false alarm rate locally over the wind farm. It is not expected that the performance of the Southend radar would be affected in any other way.

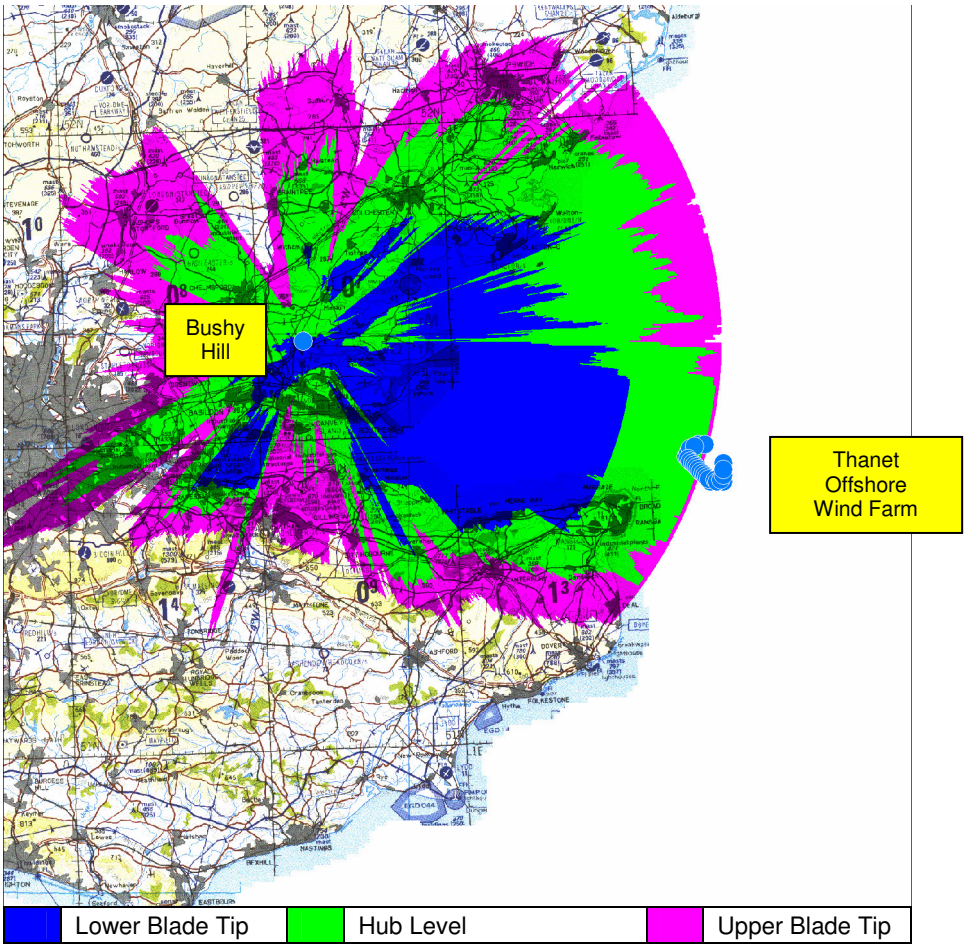
16.5.4 Radar site 3 - BAE Systems test site at Bushy Hill

BAE Systems operates a radar test site at Bushy Hill. Whilst being used to test various systems, it has a permanent S511 radar system in operation at the site. The tower

height and electrical centres are the same as those assumed for the London Southend Airport radar system and so similar figures were used for the modelling.

From the coverage plot shown in **Figure 16.7**, the northwest third of the Thanet site can be seen by the radar at hub level and upper blade tip points.

Figure 16.7 Indicative radar coverage for Bushy Hill (5.0MW turbines)



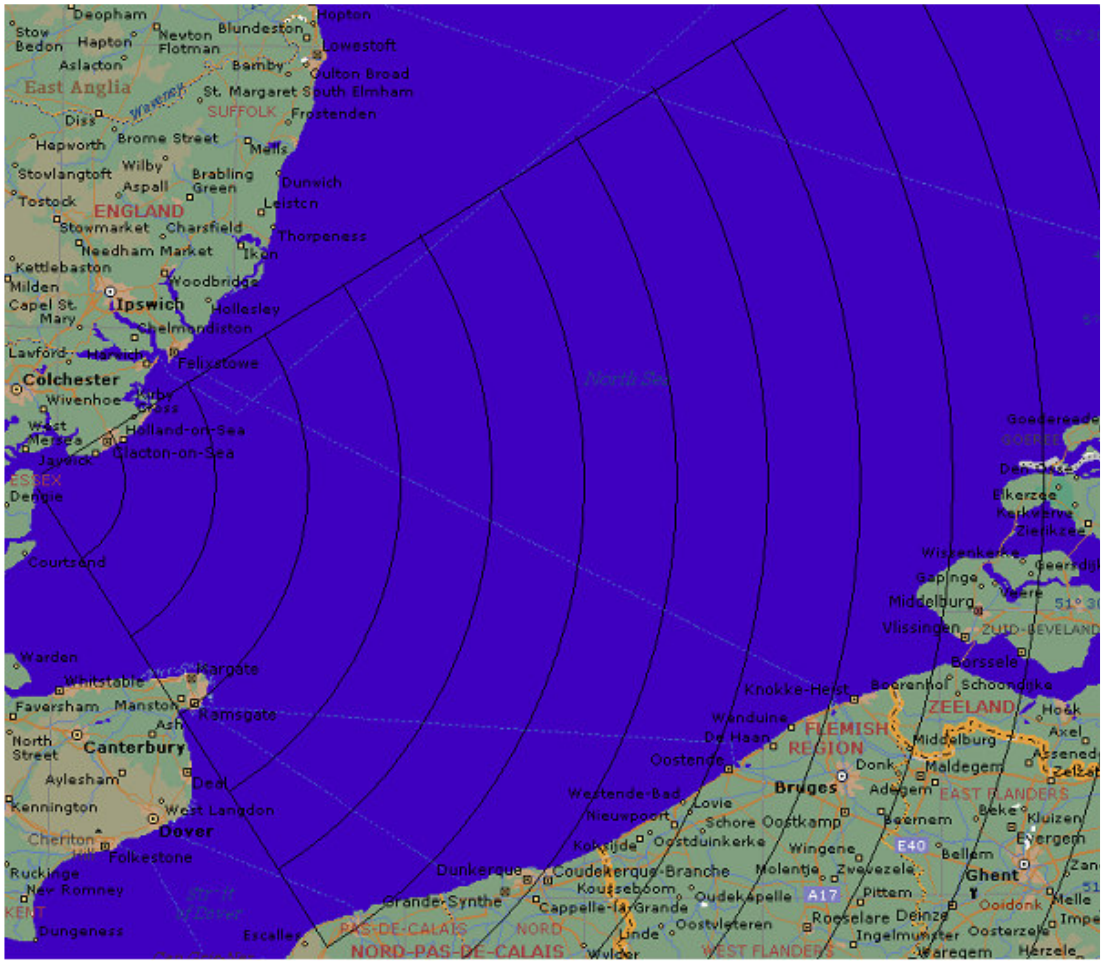
BAE Systems has advised that it would be unlikely to raise any objection to the Thanet project. TOW will continue to liase with BAE Systems on this matter.

16.5.5 Radar site 4 - BAE Systems High Frequency Surface Wave Radar test site

BAE Systems operates a test site on Dengie Flats for the development of High Frequency Surface Wave Radar (HFSWR) systems. This type of radar system uses surface wave effects to provide sea surface and low altitude radar cover at extended ranges compared with conventional microwave radar. The HFSWR, therefore, will have visibility of the sea surface for ranges well beyond the horizon of conventional radar. The system at Dengie Flats is a demonstration and engineering development facility and does not provide data to any civil or military systems in the UK.

Figure 16.8 shows the effective arc of coverage for the current development system and that the Thanet project would fall within this area.

Figure 16.8 Indicative radar coverage for HFSWR system, Dengie Flats



BAE Systems has advised that it would be unlikely to raise any objection to the Thanet project. TOW will continue to liaise with BAE Systems on this matter.

16.5.6 Radar site 5 - North Foreland marine control radar

The Maritime and Coastguard Agency (MCA) and Port of London Authority (PLA) operate two radars in the Dover Strait and the Thames Estuary approaches at Dover and Margate respectively. The MCA plans to install a new radar system at the location of the North Foreland lighthouse on a 40m high tower. This installation is currently subject to planning approval, which was recently refused by the Local Planning Authority.

At present, the performance characteristics for this radar are not available. Discussions with the MCA have indicated that it will be an X-band marine radar of the type commonly used for coastal surveillance. It can be expected that this radar will be located to provide significant range coverage of the sea surface and therefore the Thanet project would potentially impact on its performance. Trial results from North Hoyle offshore wind farm (QinetiQ and MCA, 2004) indicate that the ability to detect and track surface vessels inside a wind farm are reduced and that there may be 'shadowed' areas behind each turbine, which are probably generated by large signal effects within the radar

processing. See **Section 14, Shipping and Navigation** for further discussion on this matter.

Further discussions will be held with the MCA to resolve any issues concerning the radar installation at North Foreland, should this application proceed. Discussions may also be required with the selected supplier for the new radar system to see what facilities they can offer.

16.5.7 Radar site 6 - Port Authorities

Three Port Authorities operate in this area, namely Dover Port Authority, Medway Ports Authority and the Port of London Authority (PLA). Each of these operates radar systems for local control of shipping movements.

As discussed above, the PLA currently operates a radar system at Margate and the data is shared with the MCA. This radar system is scheduled for replacement in 2005.

Medway Ports Authority operates the Medway Navigation Service from Garrison Point, Sheerness using a high-definition radar system for monitoring of ship movements.

It can be expected that radars used by these organisations will be located to provide significant range coverage of the sea surface. However, given the likely locations and the fact that the Thanet site is outside of the jurisdiction of these Port Authorities, it would seem unlikely that the Thanet project would have a significant influence on radar coverage. Ongoing dialogue will be maintained with the Port Authorities to resolve any issues, should any arise.

16.5.8 Shoeburyness trials range danger areas

This facility offers weapon and equipment proving trials over land and intertidal areas. The facility has a land mass covering 3,025 hectares (7,500 acres) and 14,165 hectares (35,000 acres) of intertidal sands, which enables over-water recovery of munitions up to 22km, ground-to-ground firing capability of up to 27km, long range direct fire capability up to 3.5km, sea danger areas up to a 35km range and large radial safety areas for explosive trials.

The trials range is located on the South Essex coast and stretches from Shoeburyness in the south along Maplin Sands to Foulness point in the north. The range has a number of air danger areas associated with it. These Air Danger Areas are:

- D136 up to 10,000ft;
- D138 up to 12,000ft but up to 60,000ft can be imposed by agreement;
- D138a up to 12,000ft but up to 60,000ft can be imposed by agreement; and
- D138b up to 5,000ft.

Air traffic services in the danger areas and approaches are provided by London Southend Airport during the airport's operating hours and by London Information at other times. The radar systems that provide data in these areas are all located on the landward side of the danger areas, i.e. the Thanet site is at longer range from the radars

than the danger areas themselves. Therefore, it is extremely unlikely that there would be any concern over the effects of the project.

16.5.9 Yantlet demolition range danger area

The danger area, designated D146, is centred at 51° 28' 09"N, 00° 04' 20.2"E and is a circular area of radius 1km, with an altitude limit of 3,000ft. London Southend Airport provides air traffic services to the area and its approaches. It is understood that the range is managed by the Army Department. Any air traffic services in the danger area and its approaches are extremely unlikely to be affected by the Thanet project.

It is not the responsibility of the Managers of the danger areas to provide any air traffic control. It seems extremely unlikely that the Thanet project would have any impact on these areas, as the operators simply advise the Air Traffic Service of the operating conditions, times etc.

16.5.10 Others sites considered

Other sites have been considered and these are the indicated airfields of Bentwaters and RAF Woodbridge, and the NATS En-Route Radar System at Pease Pottage.

The aerodromes of Bentwaters and RAF Woodbridge were twinned active airfields during World War II. Although still shown as airfields on the air map data, they are both disused as runways. The site at Bentwaters is now classed as a brownfield site for redevelopment, whilst the station at Woodbridge is used by the MOD as an engineering centre. The airfield itself was last used in September 2002 for a military exercise.

The NATS En-Route Radar at Pease Pottage was considered, but the system is well outside of the area of visibility from the Thanet site. Its low level coverage in no way extends to the area of the wind farm and therefore should not be affected by it.

16.6 Impacts during Decommissioning

No significant effects are anticipated during the decommissioning phase.

16.7 Cumulative Effects

The London Array wind farm is considered relevant in terms of cumulative impacts on radar and transmission systems for KIA. The radar coverage plot (**Figure 16.4**) shows that the radar at KIA is unlikely to see the wind turbines at London Array, particularly as the first phase is understood to comprise smaller turbines and be further away than the Thanet site. However, London Array has also participated in the flight trials (see **Section 16.5.2**), and the potential of cumulative effects will be re-assessed after the trials have been completed.

16.8 Summary

In order to assess the potential effects arising from the Thanet project on aviation radar systems, the standard wind farm developer's application pro forma was submitted to the Civil Aviation Authority (CAA), National Air Traffic Services (NATS) and the Ministry of Defence (MOD) at an early stage in the development process. Dialogue was also

initiated with marine radar and radio, telephone and television transmission system operators.

In addition, a study was undertaken by AMS Limited (now BAE Systems; AMS, 2005) to assess the potential affects on the existing radar system located at Kent International Airport (KIA) and indicate other known marine and aviation radar stations that may be affected by the location of the Thanet project.

An initial assessment of the line of sight area indicated that the following known radar systems may be affected by the development:

- Kent International Airport;
- London Southend Airport;
- Maritime and Coastguard Agency, North Foreland;
- Port of London Authority, Margate; and
- BAE Systems.

Kent International Airport

The Radar Interaction Study shows that the wind farm may be visible to the radar site at Kent International Airport, at the upper blade tip point only. It is noted that whilst not included on the DTM, the coastal towns of Margate and Ramsgate lie between the radar site and the wind farm and would provide some masking and therefore reduction of the effects of the wind farm on the radar. The runway and approach/take-off cones for KIA are unaffected, but the ability to detect small aircraft at low altitude in the vicinity of the wind farm may be affected.

In order to further assess the likely impact on KIA operations, an additional study was commissioned with BAE Systems, with the cooperation of KIA, and took place in late October 2005, to conduct flight trials over the Thanet site at a variety of heights to determine whether the turbine blades would be visible to the radar at KIA. Preliminary observations suggest that the wind farm would not be visible to the radar system at KIA.

In the event that the flight trials proved inconclusive regarding whether aircraft could be seen at blade tip height above the wind farm, it is still anticipated that there would be a **negligible** impact due to the distance of the wind farm from the radar. However, if these effects are deemed to be significant then a number of mitigation measures would be explored.

London Southend Airport

Whilst the wind farm does just appear within the coverage of the London Southend Airport radar system its effects are likely to be small. When considering the radar coverage, the wind farm would be below the sea horizon and well below the electrical horizontal centre line and would therefore have **no impact**.

BAE Systems test and trials sites

The wind farm would be visible to varying degrees to the BAE Systems test sites at Bushy Hill and Dengie Flats. The Bushy Hill test site houses an S511 radar, similar to that at London Southend Airport, but the predicted coverage indicates that it would see

more of the wind farm, and to a lower level with some of the northwestern turbines being 'seen' by the radar at hub height. The radar system at Dengie Flat is designed to see both air and surface (land and sea) targets and the wind farm would be located within the southern edge of its coverage arc. BAE Systems has advised that it is unlikely that they would raise an objection to the Thanet project and it is therefore considered that there would be **no impact** on these radar systems.

MCA North Foreland

The planned new radar system at North Foreland, should it proceed, is likely to be affected by the wind farm. Trial results from North Hoyle offshore wind farm indicate that the ability to detect and track surface vessels inside a wind farm are reduced and that there may be 'shadowed' areas behind each turbine, which are probably generated by large signal effects within the radar processing. Further discussions will be held with the MCA to resolve any issues concerning this radar installation at North Foreland, if it proceeds, but there is considered to be a **negligible** impact of the project.

Port of London Authority

The existing radar site at Margate and its proposed replacement may provide surface coverage in the area of the wind farm but this is by no means certain and is likely to be of **negligible** impact due to overlapping radar coverage.

Cumulative effects

Although, it is likely that the Thanet project and London Array would have **no cumulative impact** on radar and transmission systems, a further assessment on cumulative effects will be undertaken following the flight trials, in which London Array also participated.