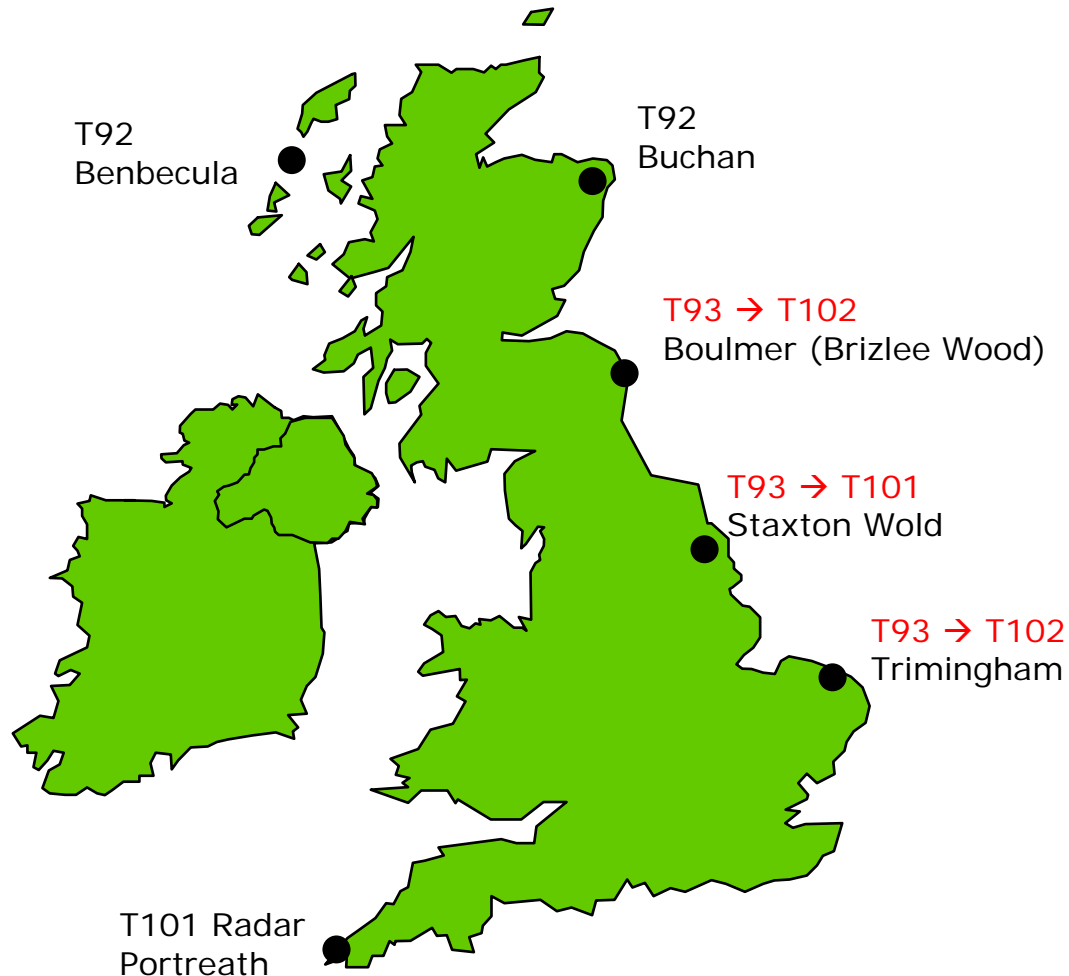


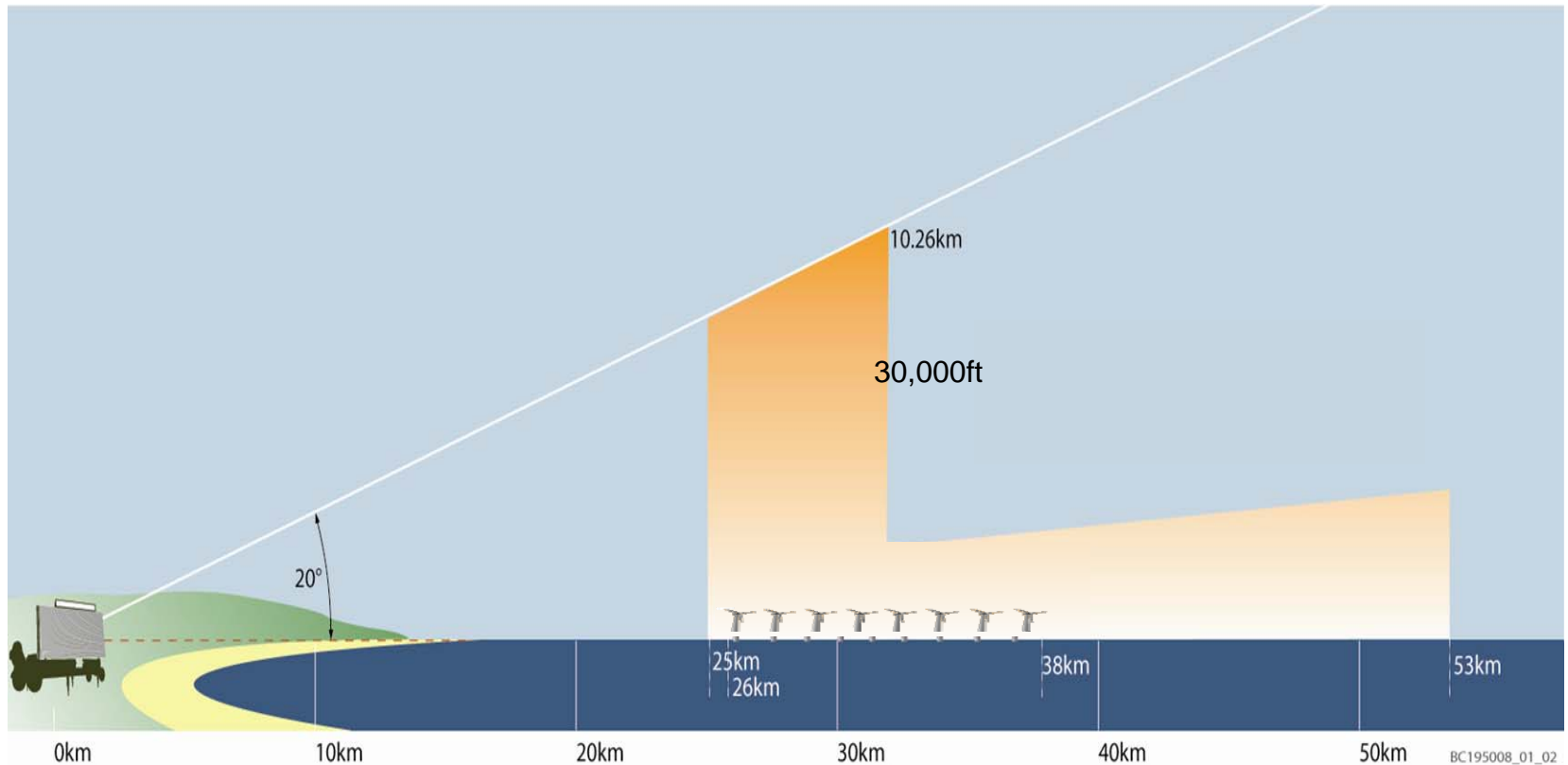
MoD and Sheringham Shoal

Project Director Rune Rønvik, StatoilHydro

UK Air Defence radar sites relevant for offshore wind farms



Trimingham Air Defence radar - Volume with reduced radar performance resulting from Sheringham Shoal Wind Farm



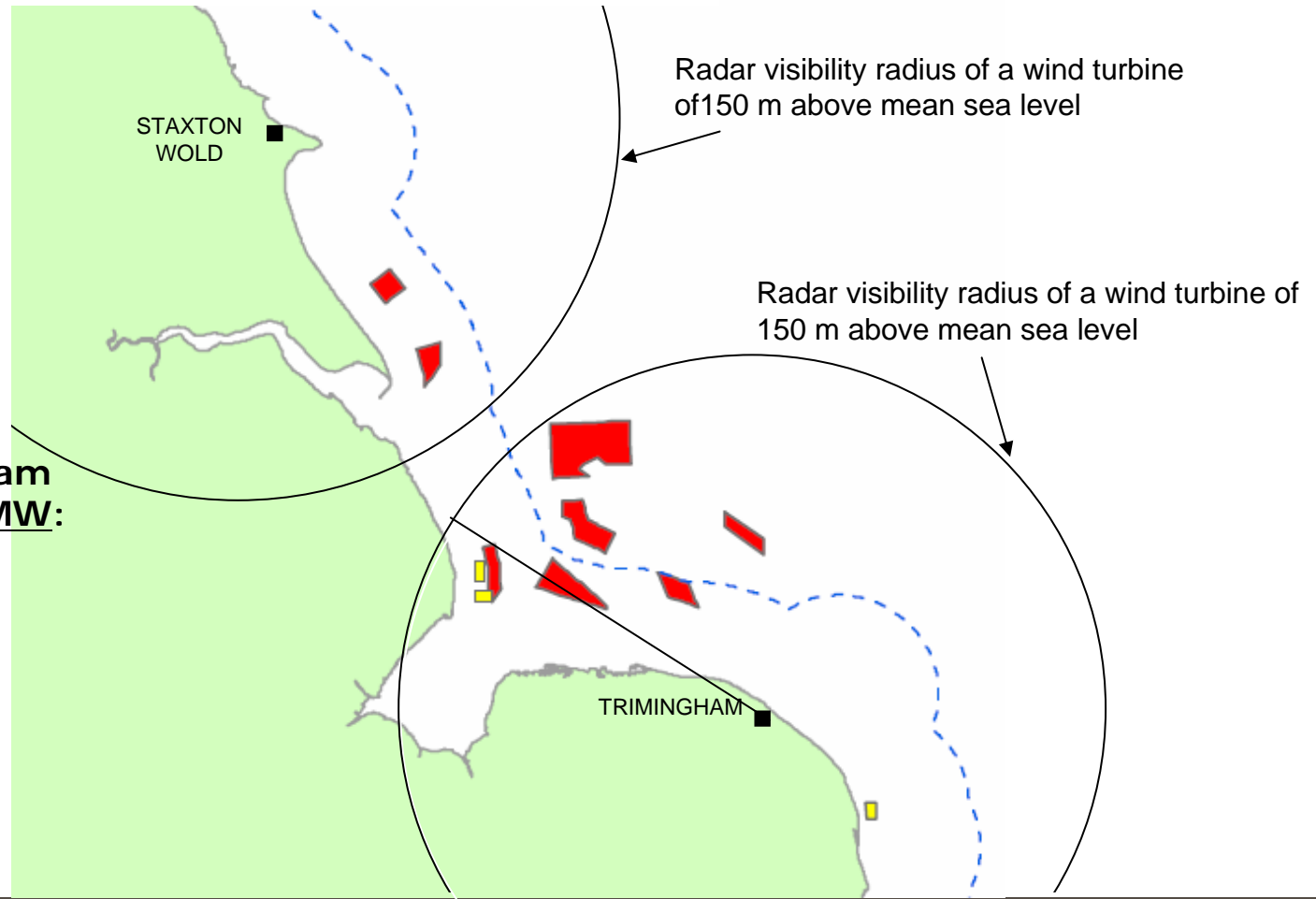
The Greater Wash: Round 2 sites and Air Defense radar

Visible to Staxton Wold – More than 500 MW:

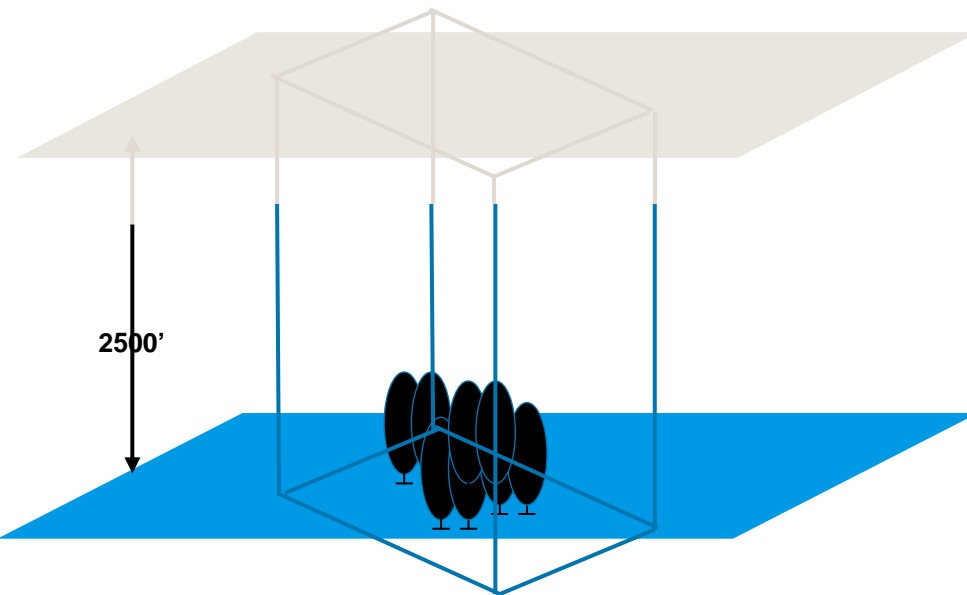
- Humber Gateway
- Westermost Rough

Visible to Trimingham – More than 2800 MW:

- Sheringham Shoal
- Dudgeon East
- Race Bank
- Docking Shoal
- Triton Knoll



Aviation Specification for Sheringham Shoal



- Full radar performance outside a volume defined as **2 km** around the wind farm area - between sea level and **2500 feet** altitude
- Result of negotiated compromise between what can be achieved (mitigation measures) and what can be accepted by MoD

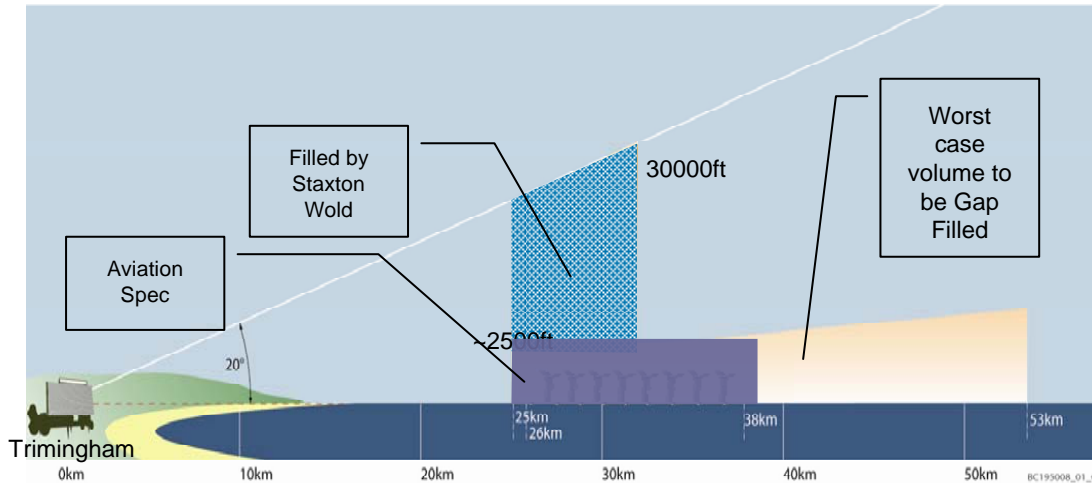
Sheringham Shoal S 36 Consent Conditions

- Before start of construction:
 - MoD shall confirm to Secretary of State (in DECC) that the mitigation solution defined will meet the Aviation Specification
 - Agreement MoD-Scira: Modification of the Trimmingham Radar and use Staxton Wold as infill over the wind farm
- Condition for starting regular production
 - Documentation that the implemented solution meets the aviation specification
 - This has led Sheringham Shoal to also develop a gap infill radar solution as an independent solution number 2 in parallel with the primary solution

Key lessons learned from the MoD - Sheringham Shoal consenting process

- Sheringham Shoal was the first
 - MoD and StatoilHydro had to find the way through unknown territory - the process was constructive, but time and resource consuming
 - The result of the process is tailor made for Sheringham Shoal – the principles may be copied by other wind farms, but not necessarily the solution
- Cost and risk
 - MoD was pragmatic and solution oriented when working out the consent conditions, but very firm on developers responsibility for any additional costs and for the risk related to successful implementation of the mitigation measures
- Improvements required
 - MoD is not likely to have resources to run similar process with all applicants. Some copy effect can be envisaged, but the industry will experience delay in their consenting process, unless improvements are found
 - The most obvious is to develop a technical solution that can be applied widely

Sheringham Shoal risk reducing measure: Gap infill radar located on one of the wind farm structures



Feasibility study has concluded that:

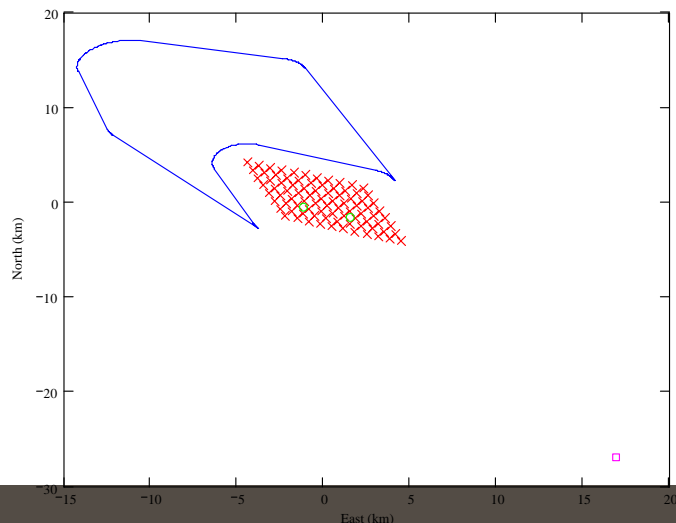
Existing off-shelf X-band naval radar systems perform sufficiently to meet Aviation Specification for Sheringham Shoal

Functional requirement:

Coverage to 15km beyond furthest turbine in line of sight from Trimmingham up to altitude of 2500ft. Do not need to see closer than 2km of wind farm

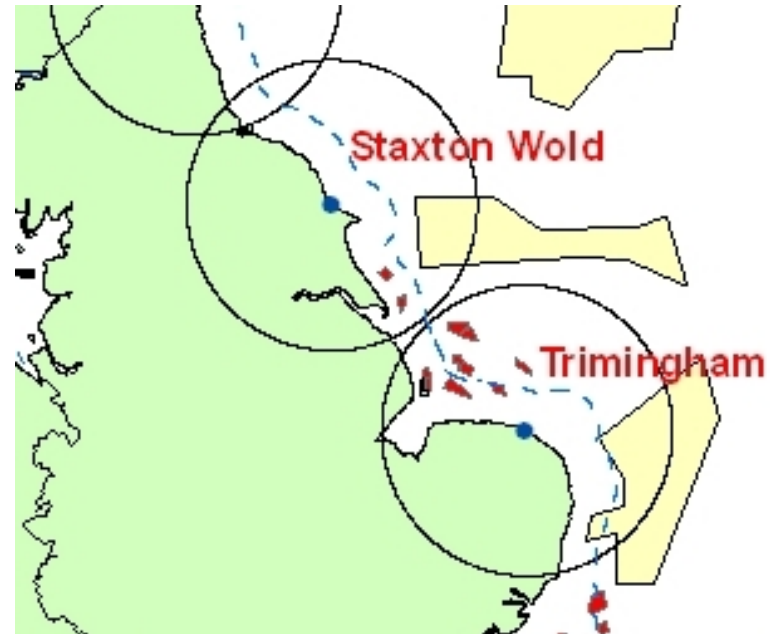
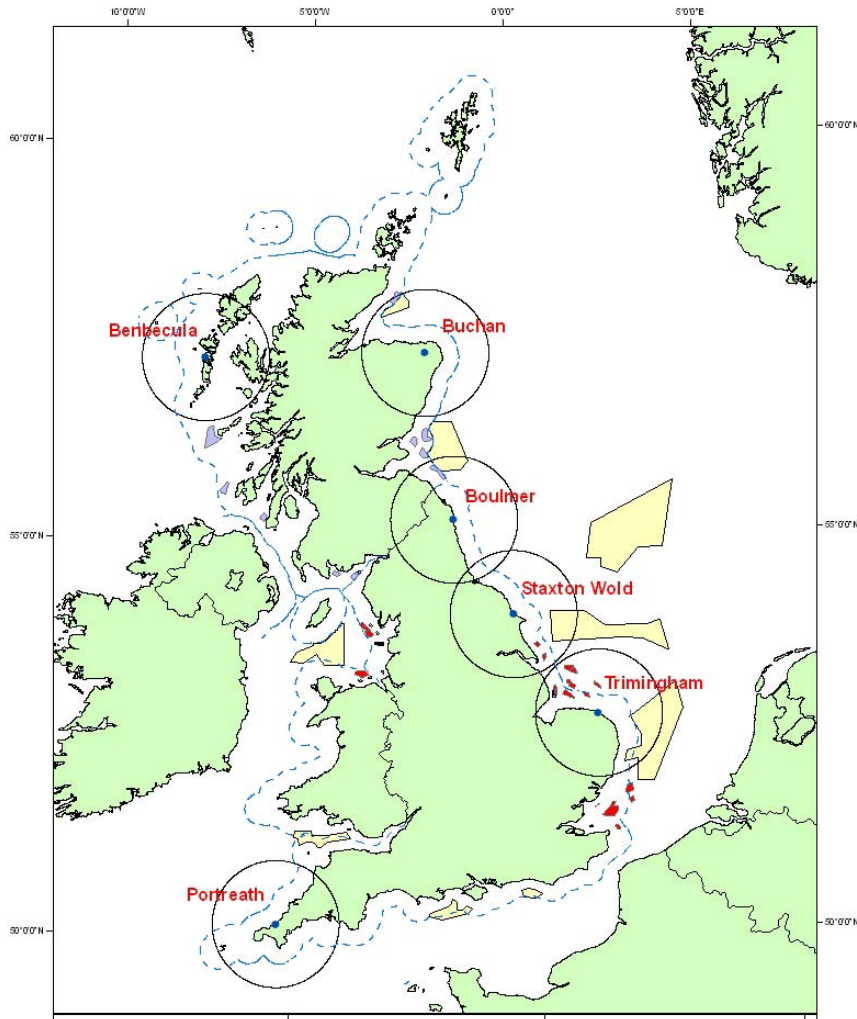
Learning:

- Although feasible, the gap infill radar solution is inferior as compared to modify/replace the air defence radar concerned to become wind farm resilient
- Duplication of solutions are adding cost for the developer and use of resources in MoD



××× turbine locations
 — required coverage boundary
 ○○ sub stations
 □□ Trimmingham

Adding Round 3 zone locations to the map...



...emphasises the importance in finding effective solutions

Current work for a potential regional solution

- Air defence radars exist with built in wind farm resilience that
 - meets Sheringham Shoal Aviation Specification for a stand-alone wind farm (documented by a joint Royal Danish Air Force - RAF trail test in Denmark towards the Horns Rev offshore wind farm)
 - could potentially be an area solution for the Greater Wash R2 sites and the coming R3 zones – although performance and capacity has still to be documented
- Sheringham Shoal and BWEA have taken a lead role together with MoD to establish technical feasibility of such solution
 - other wind farm developers in the Wash have agreed to provide input data and co-finance the study
 - technically and commercially complex, but aim to conclude 4Q 2009
- If successful, this will solve many of the concerns raised under lessons learned from the initial Sheringham Shoal round