

Wind Farm Effects on Marine Radar

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Introduction

Reported and perceived problems with marine radar operating near off shore wind farms were causing concern with Regulators and the Marine Industry

Concerns included, swamping of radar displays, masking and loss of genuine targets leading to operational difficulties and even accidents

It was recognised that firm information was needed to understand the extent of any problem and assist the wind farm consents process

Earlier this year Marico Marine were tasked with collecting actual data from commercial ships, fishing and leisure vessels operating near a wind farm

The research was commissioned by BWEA and financed by contributions from all Round Two Developers

Background

- Vessels passing the Kentish Flats wind farm in the Thames Estuary were used
- Recording commenced on 30th April 2006 by boarding vessels trading normally to / from the Thames & Medway with full cooperation from the Ship Crews, Pilots, Pilot Boats, PLA and Medway Authorities
- Fishing and leisure interests were included by chartering in vessels
- Marico's 20 metre survey vessel "MORVEN" spent a number of days operating in and around the wind farm
- The Shipping Minister, DfT, MCA & BWEA representatives witnessed some recording from a day on "MORVEN" operating in conjunction with fishing and leisure vessels

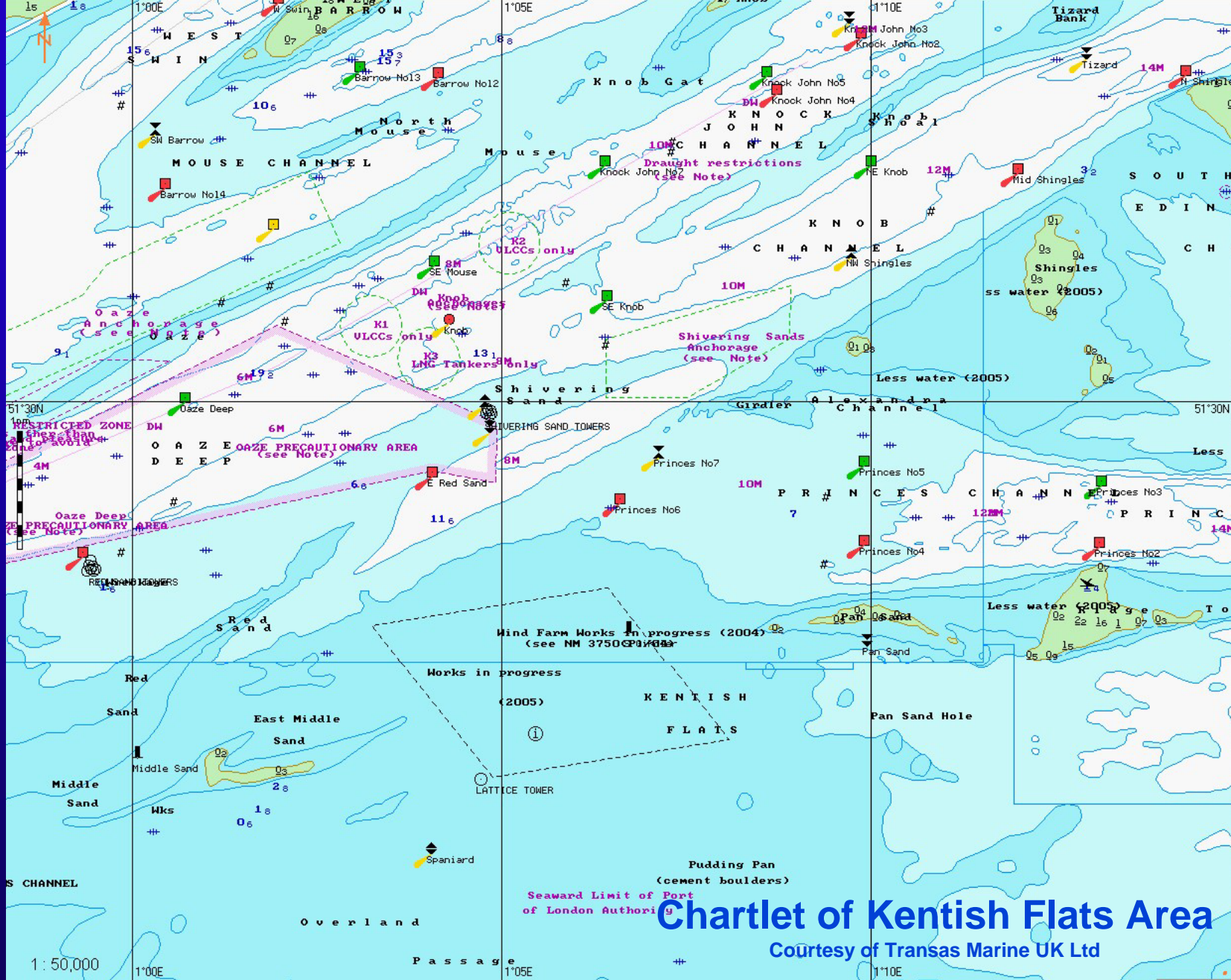
Data Collected

- The video data obtained fills 66 DVDs and that together with other information is still being analysed
- This brief presentation gives some examples of observations and initial findings

Overall Statistics

Recording was carried out during 56 Vessel Transits

VESSEL TYPE	NUMBER
• Bulk Carriers	4
• Container Ships	7
• LASH (Lighter Aboard Ship) Carrier	1
• General Cargo Ships	9
• Tankers	6
• (Oil 4; Chemical 1 and Gas 1)	
• Refrigerated Cargo Ships (Reefers)	3
• Car Carriers	7
• Dredgers	3
• Passenger Cruise Vessels	3
• RoRo Ferries	6
• Workboat	1
• Survey / Service Vessel	1
• Leisure Vessels	3
• Fishing Vessels	3



Chartlet of Kentish Flats Area

Courtesy of Transas Marine UK Ltd

1:50,000



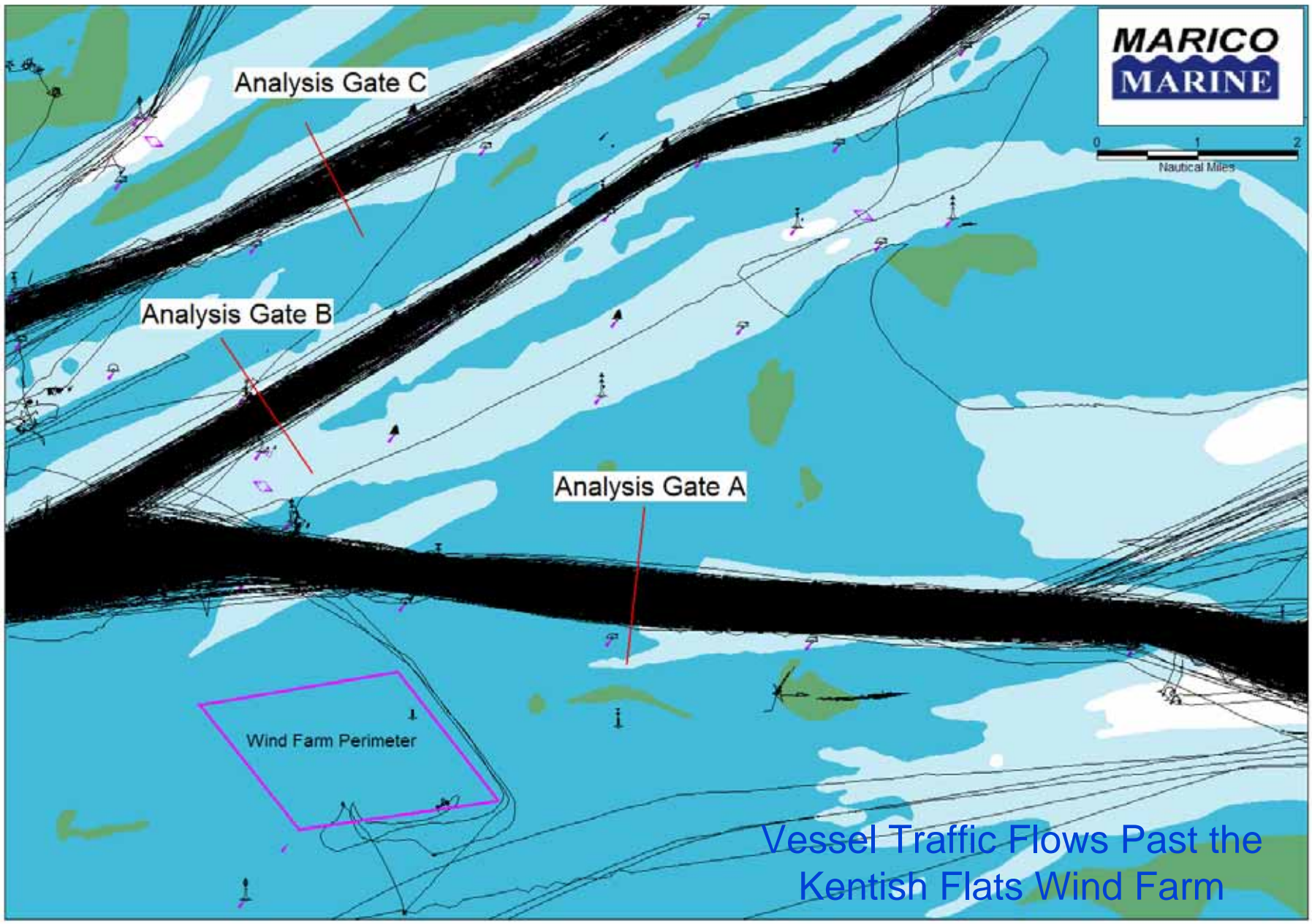
Analysis Gate C

Analysis Gate B

Analysis Gate A

Wind Farm Perimeter

Vessel Traffic Flows Past the
Kentish Flats Wind Farm



Observations

Effects were observed on some ships' radar displays when they were navigating close to the wind farm which did present a very strong radar target

A number of different effects were recorded but we only have time to show a few examples here today

Typical electronic chart display overlaid with a clear radar image

Small craft 'A' clearly visible within the wind farm from 6.5 miles



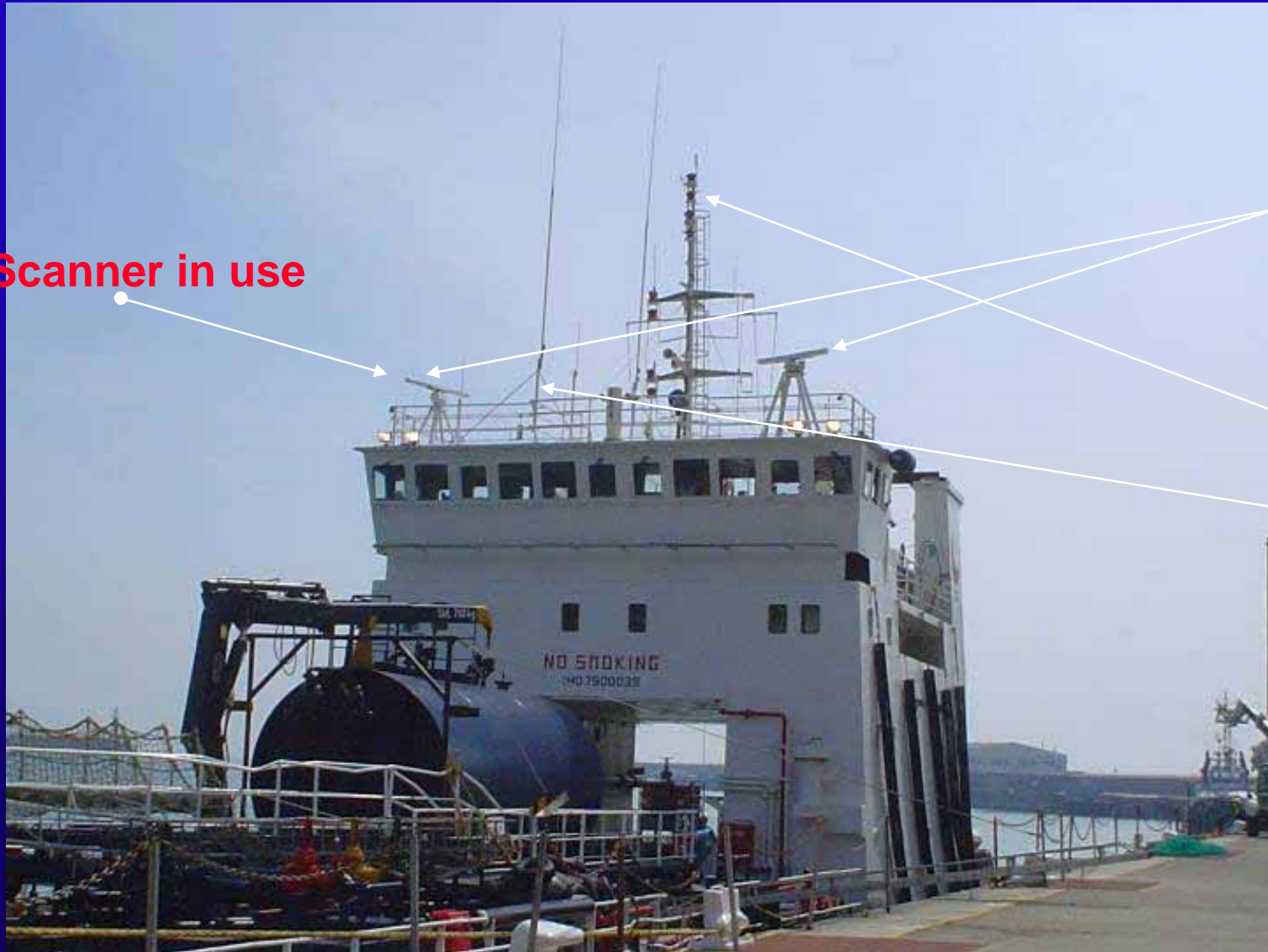
Ships Structure & Fittings

Some ships structures and fittings were found to cause effects on the radar displays when strong radar returns were encountered

The following slide shows a radar scanner installation in relation to ship's mast and other fittings. This style of layout was seen on a number of the trials ships

The subsequent slide shows her radar display when passing between the wind farm and the Shivering Sand Fort (also a strong radar reflector)

Small Tanker



Scanner in use

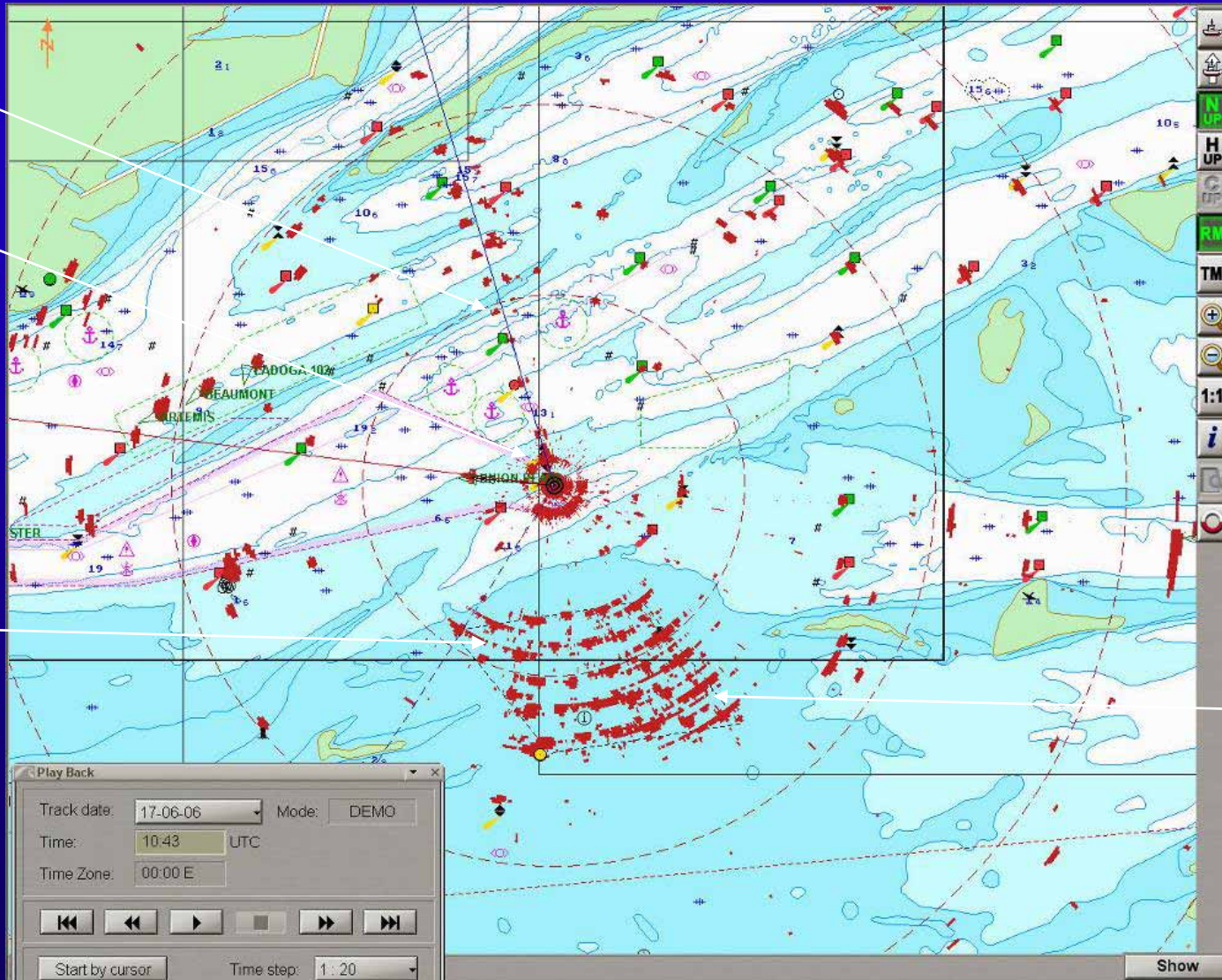
Note the radar scanners mounted transversely

Mast &

Aerial within the radar beam

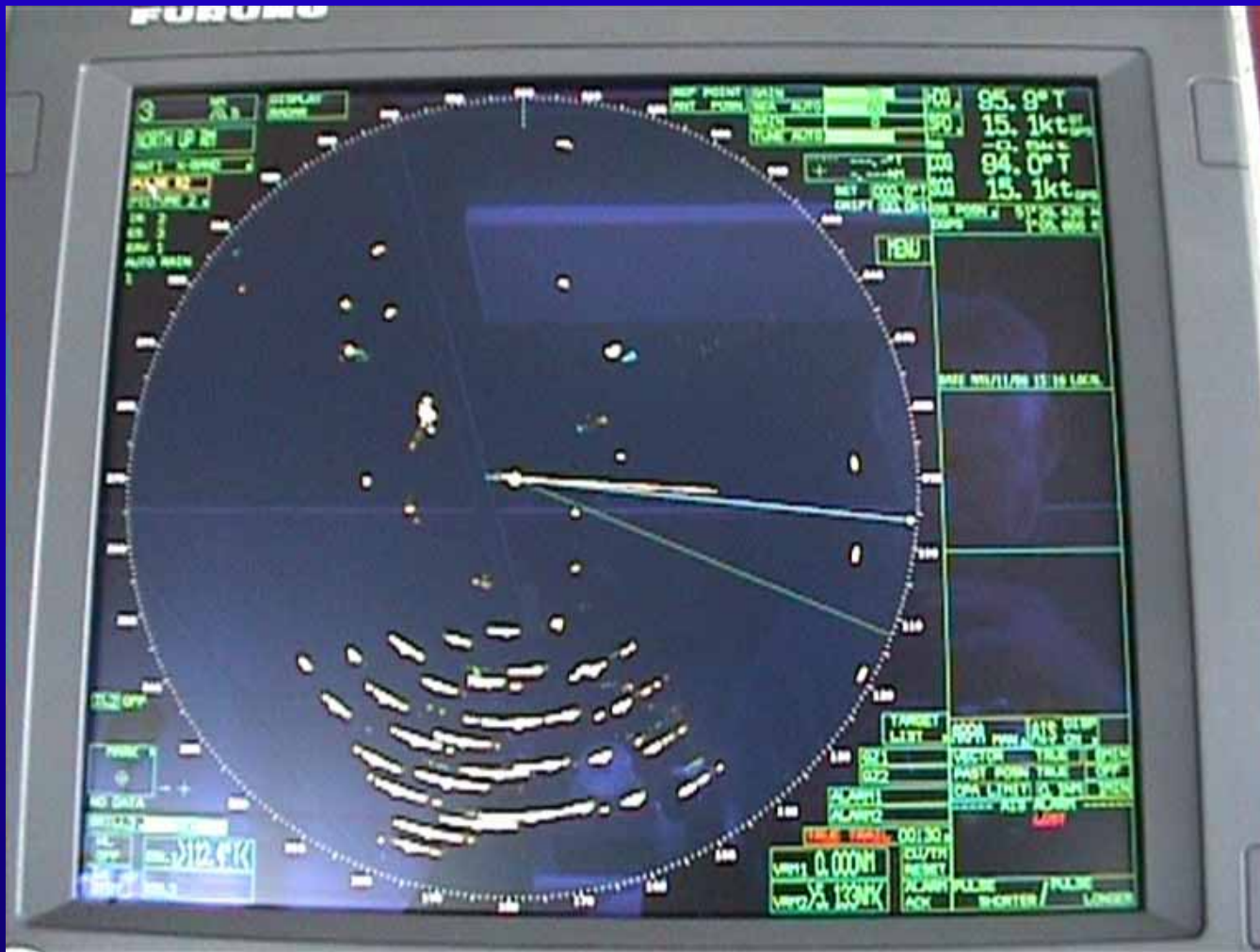
Radar effects when using the starboard scanner passing the wind farm to port

Linear reflection
and
side lobe effects from
Shivering Sands Fort

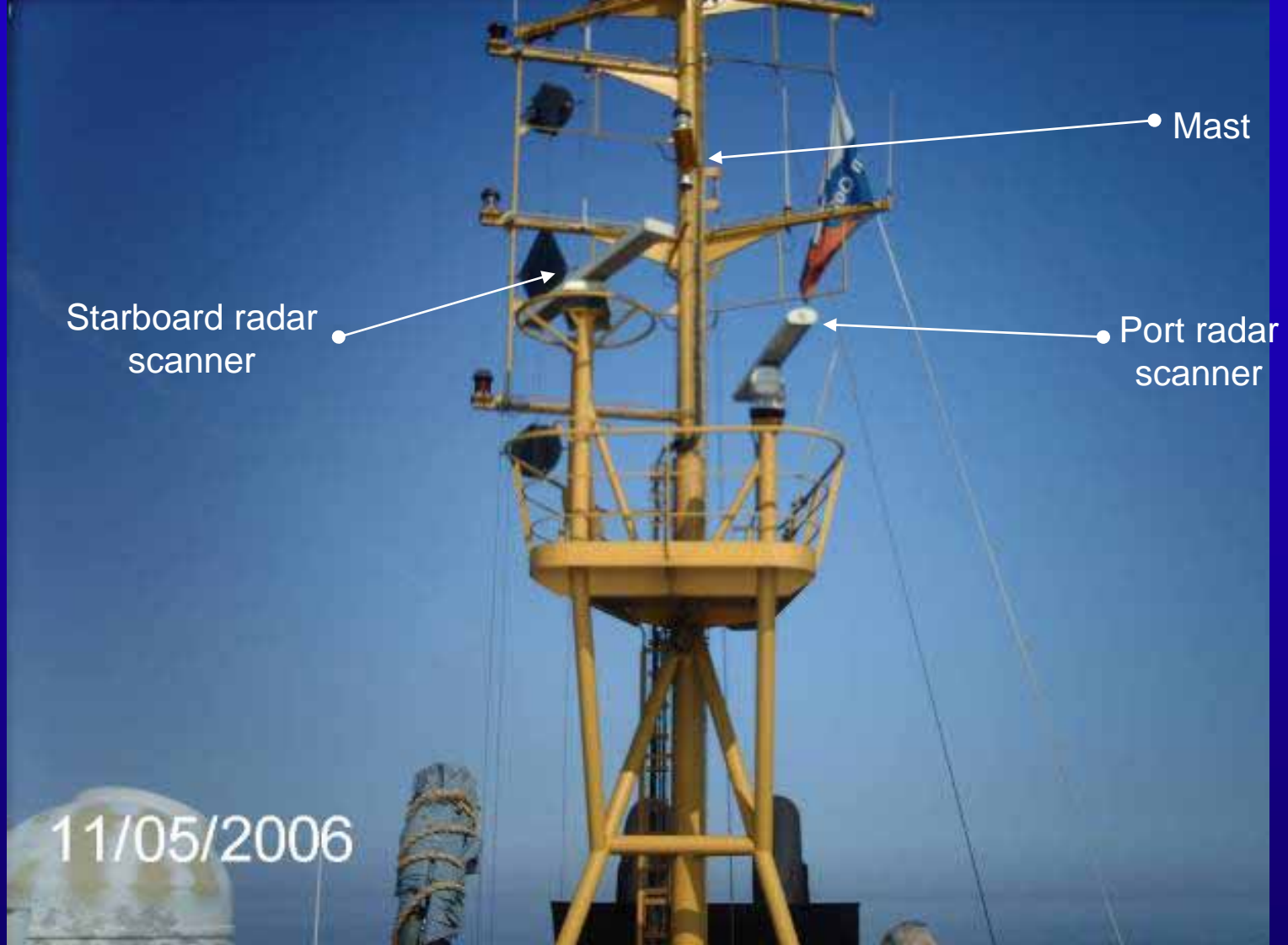


Distortions
due to forward
aerial

Distortions
due to signal
mast



Radar display of Dredger working the Princes channel was affected by distortions caused by the masts around her bridge & her transverse mounted scanners



Starboard radar scanner

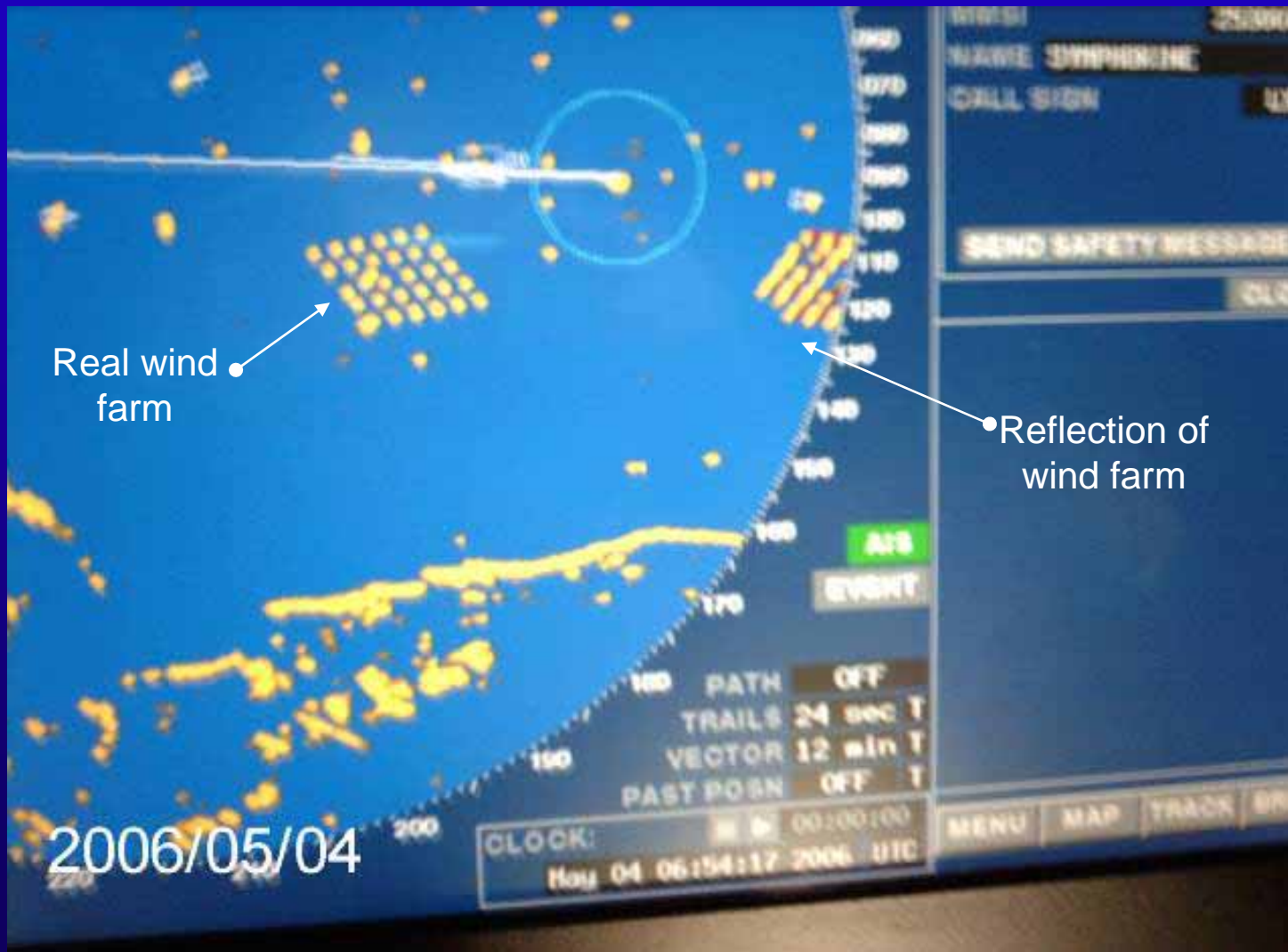
Mast

Port radar scanner

11/05/2006

Transverse mounted radar scanners situated forward of the ship's mast

Reflection of Wind Farm



Investigation

Flat plate of
mast making
reflective surface

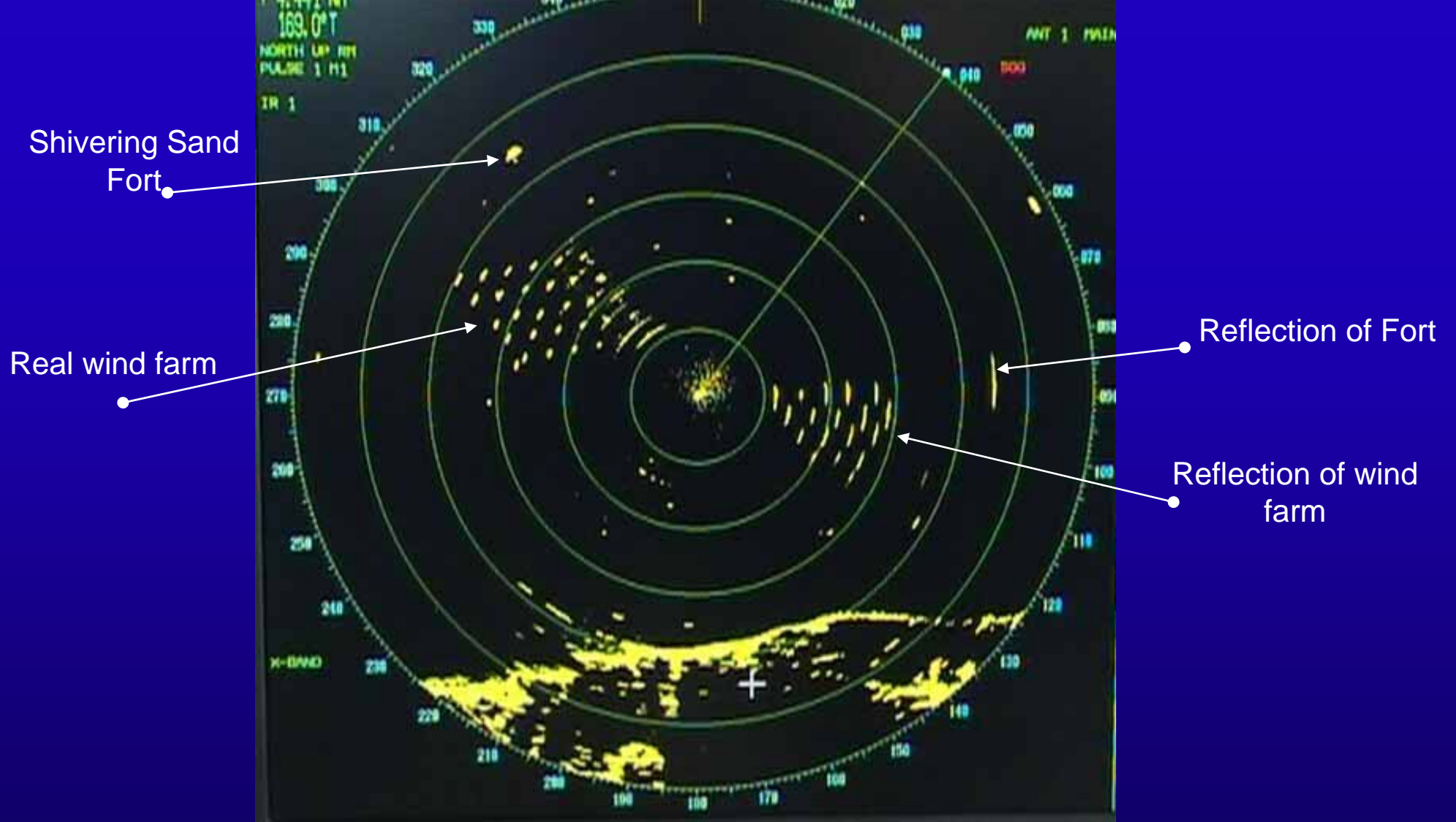
Radar
scanner

2006/05/04



An experiment with a small temporary 'reflector' placed close and to starboard of the scanner produced a mirror image of the wind farm on the "MORVEN" radar display





Result: The display shows a mirror image of both the wind farm and the war time Fort at “Shivering Sands“



Reflections

Actual wind farm

REFLECTIONS; Dredger's radar displayed reflections of wind farm caused by approaching vessel on port bow. The reflections rotated in line as the vessel passed



Incomplete external reflected images. Image A is reflected from the Shivering Sands towers and Image B from an overtaking Car carrier



Image showing multiple echoes generated by a Car Carrier passing between observing vessel and the wind farm. Despite this small vessels & the Spaniard Buoy remained visible on the radar screen



From within the wind farm a motor yacht radar was still able to detect other small vessels. The Met Mast is visible while the Spaniard Buoy is just visible. Turbine A3 is in shadow behind turbine B3.

SUMMARY OF OBSERVATIONS

- A wide range of radar equipment is in use and radar scanner installation varies widely
- Initial analysis indicates that about 1/3 of trials vessels experienced no significant effects but 2/3 did experience significant effects in the vicinity of the wind farm
- Reflections & distortions by ship structures and fittings created many of the effects observed leading us to conclude that the strong returns from the wind farm was highlighting some existing vulnerabilities in ships' radar scanner installations
- Reflections & multiple echoes from WWII Forts and "slab sided" vessels were also noted
- Partial shadowing of turbines & targets close to them did occur
- Adjustment of gain settings can minimise the unwanted effects. Some navigators used the adjacent Spaniard Buoy as a reference to avoid over reduction and risk loss of small targets

and

- The effects observed did not cause the experienced Masters & Pilots operating in the area significant problems
- Most of the effects noted occurred in the after sectors of the radar display rather than the area of most importance to Masters and Pilots, ahead of the vessel
- Echoes of small craft within the wind farm can merge with strong echoes generated by the turbine towers when passing close making them temporarily invisible to radar observers or automatic plotting facilities
- AIS equipped vessels did not suffer loss of signal at any point outside or within the windfarm
- VTS radars can be subject to similar phenomena if passing vessels provide a suitable reflecting surface

Suggestions

- Investigate further the provision of designated reference buoys at wind farms to aid Mariners avoid over reduction of gain settings so that small craft may still be detected
- The fitting of radar scanners in relation to onboard structures & fittings should take account of the possibility of vessels operating in areas of strong radar reflection targets
- Fitting vessels with radar scanners mounted transversely should be avoided if possible
- Pilots & Masters should continue to report and if possible photograph any occurrence of observed interference displayed on the radar screen with as much detail as possible
- Although the existing radar training of Mariners covers interference that might be generated by strong targets, there may be benefits to be gained from the inclusion of the findings of this research in future training courses

This has only been a brief outline and analytical work continues

We would like to thank all those who have helped us undertake this project, the PLA, Medway Ports, Thames & Medway Pilots, Ship Owners, Master & others but especially the BWEA and the Round Two Developers

Thank You For Listening