

C-Nav

Positioning Solutions

Outline Test Procedures for Initial Navtech Radar Evaluation

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C-Nav Positioning Solutions

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DOCUMENT CONTROL

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Introduction

The following outlines the proposed test schemes used to evaluate and develop The Navtech Radar System for use Offshore as a DP reference and as an aid for Tanker / FPSO operation.

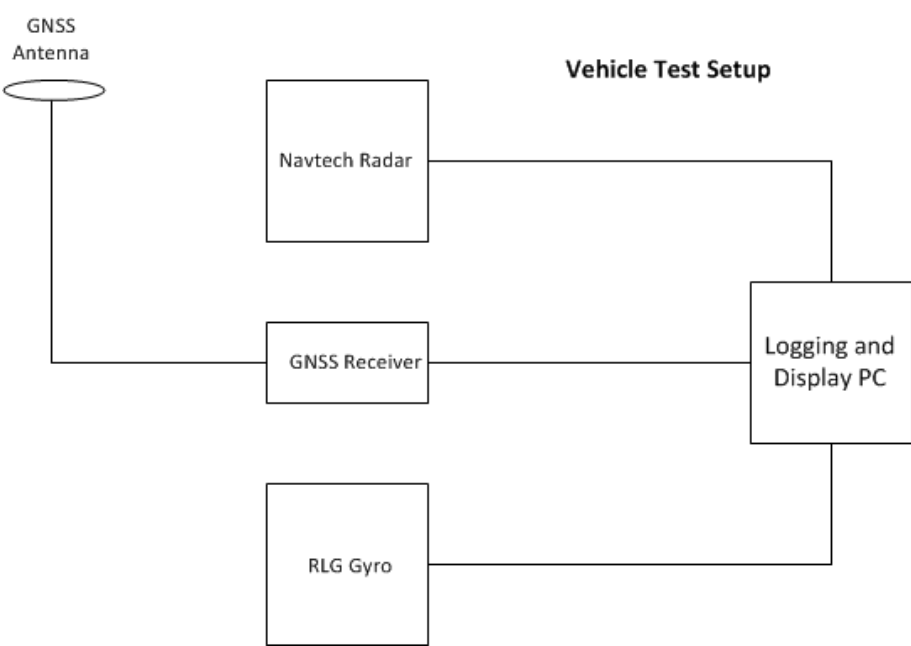
Late last year C-Nav did a review of several radar positioning technologies to determine their possible use as offshore positioning aids. The Navtech Radar system stood out as the most likely candidate. Initial discussions suggested that a system using passive reflectors would be most likely to be workable and an NDA was put in place between Oceaneering and Navtech Radar.

Navtech have agreed to provide as radar system, reflectors, and PC software for the test while Oceaneering will provide the people, PC, and location. After each major test step data will be sent to Navtech for evaluation.

By the end of these tests we should have a good idea of the system’s performance and what, if any changes to hardware or software would be required to optimize the design for each of the primary applications.

Test Equipment

Land Trials



For the land trials the test equipment will be installed in a SUV or truck. We have plenty of experience doing this during testing of our INS equipment.

In addition to the Navtech Radar unit the vehicle will have a RLG gyro, and the rover part of a moving base RTK GNSS system. With the base unit of the MBRTK system co-located with the radar target. This system will give range to a couple of centimeters and azimuth to better than 0.1 deg. This will be used as the ‘truth’ measurement in the initial tests.

The PC will log position and heading data in addition to radar information.

It is assumed that the Navtech radar will output a range and bearing to each target

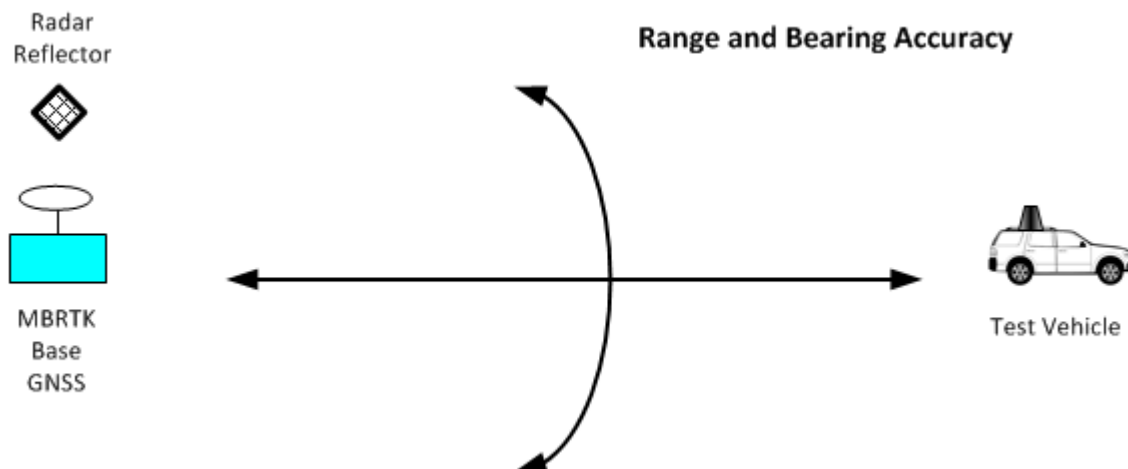
as a digital data stream in addition to producing an analog display.

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Land Tests

Distance and Accuracy Test

In this first test we will determine the system distance and accuracy by measuring the radar range and bearing to a single target, and comparing this to the actual range and bearing as measure by the MBRTK system and the RLG gyro in the vehicle.



The test will begin with the vehicle relatively close to the target, then move at increasing range while keeping the target in line of sight. At some point range or bearing data will be lost. Range will be increase and the vehicle turned towards the target and driven towards it. The range at which range and bearing is re-establish will be noted.

If possible an arc will be driven centered on the target to determine if performance varies with bearing.

Results will be

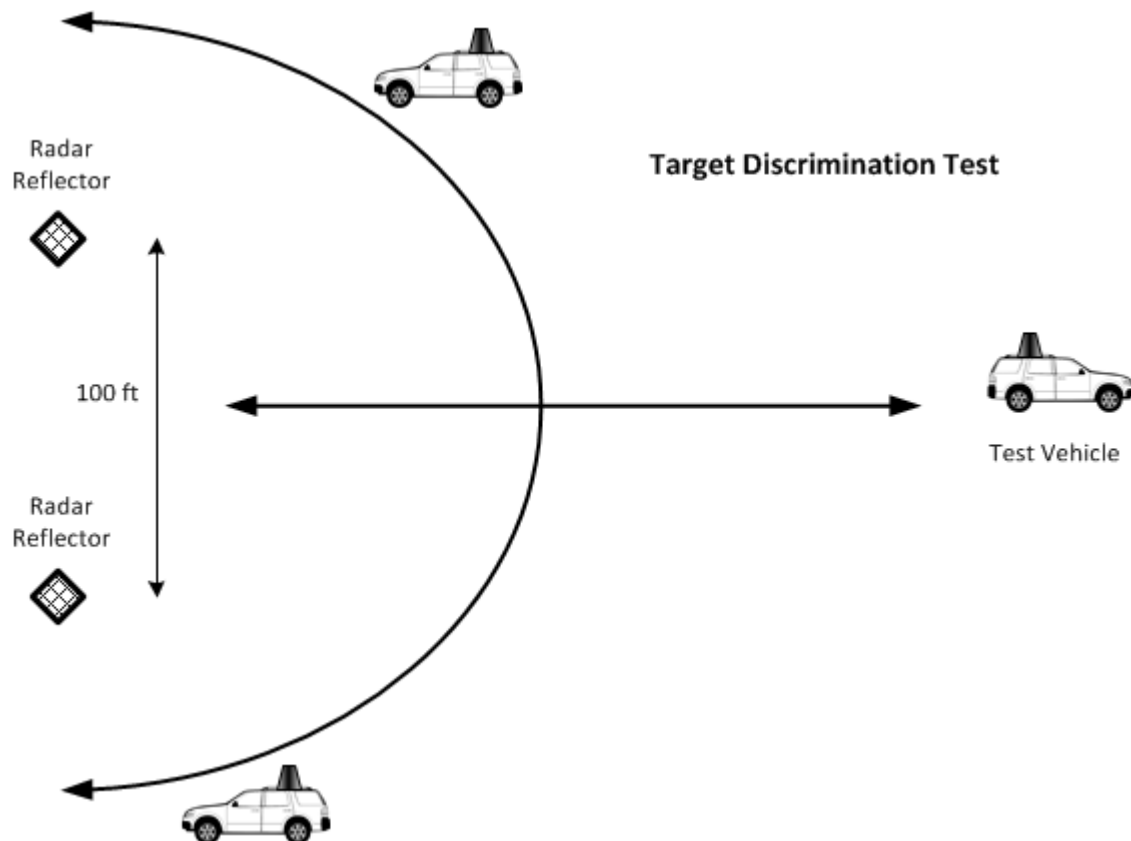
- Range to loss of data
- Range to re-acquisition of range and bearing data
- Range and bearing accuracy v range to target
- Range and bearing accuracy with varying angle to target

This test will establish overall accuracy and the MBRTK system will not be used for the other land tests.

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Target Discrimination Test

In this test we will evaluate how well the system discriminates between two configuration of radar targets.



In the first part of this test the vehicle will start at a location where the bearing to each target is significantly different. As the vehicle drives away from the target the bearings will merge and at some point the system will be unable to determine which set of data comes from which reflector.

The second test will be to drive such that the reflectors eventually line up one behind the other. The geometry when this occurs and data is only available to the closer reflector will be noted.

These tests will give us an idea of the operational footprint of a system with two reflector targets.

Results will be:

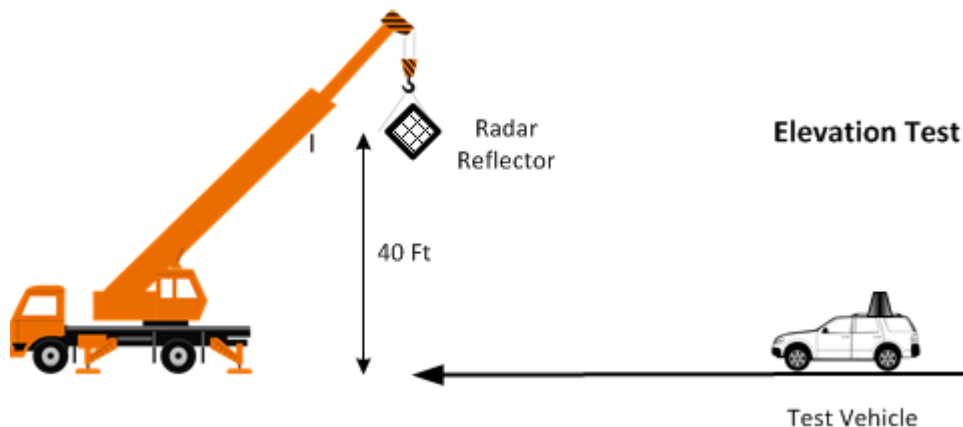
- Distance along the center line between the two targets when the merge and become indistinguishable to the system

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- Angle to a line through the targets when the farther away target cannot be seen by the system

Elevated Target Test

This test will evaluate the system performance with a target located above the sensor at a short horizontal distance.



In this test we use a crane to elevate the reflector and determine how close we can get before we lose range and bearing.

This test simulates operating close to a platform as is required during offloading operations.

Results will be :

- Maximum operational elevation angle

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Over Water Test

This test will evaluate how the system responds to different wave heights. For this we will find a site that overlook an expanse of water which has different wave heights depending on weather. We will do two or three tests under different weather conditions, with and without a reflector target if possible.

Results will be ;

Ability of the system to operate across different wave heights.

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Initial Sea Tests

Initial sea tests will be done on a small survey vessel against targets on a shallow water Gulf of Mexico platform. The primary aim of the test will be to ascertain how vessel motion and sea clutter affect the land results, and to get an impression of analog (image) data of platforms and large vessels on the system.



The trial vessel will be Oceaneering Sea Scout or equivalent. This is a purpose built survey vessel and has permanently installed high accuracy positioning systems which can be utilized during testing.

There are many “small” unmanned platforms in the Gulf which can be used to hang reflectors. Both the Sea Scout and Platform are smaller than our target vessels / platforms but will give scale results.

The easiest way to evaluate its performance close to a vessel (FPSO) would be to test against a moored tanker. There are many opportunities to do this at the entrance to the Houston ship channel.

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Platform Testing

A different reflector would be positioned at each side of the platform and data collect around and close in to the structure. Circumstances on the day of the test will determine exactly the track, but we will try and duplicate the land tests as far as possible.

Results will be :

System performance in realistic conditions and targets.

Tanker Testing

Ideally we would like to have reflectors on the tanker, however by this stage in testing we would hope to have an evaluation of the range and bearing performance of the system and what we are looking for here is the image data of a ship target against a non reflective background. Could we for example estimate the distance across the stern.

Results will be :

Will a high resolution radar image be a help to tankers offloading from a FPSO.

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Process

It is envisioned that following the initial set of land trials, the data will be returned to NavTech with our comments on the results as observed. Navtech can then analyze the results and determine if any perceived problems can be fixed in software. This may require some of the tests to be repeated.

On the conclusion of the land tests NavTech and C-Nav will determine if results were positive enough to move to the sea trials testing which will of course be significantly more expensive.

By the conclusion of these trials, we should have enough data to persuade a Offshore Supply Vessel owner, and a Tanker owner to let us conduct full scale trials on their vessels.