Radar: Basics – scenario 10a

Probability of Detection P(D): Maritime scenario - Effect of intervening terrain – sharp ridge island

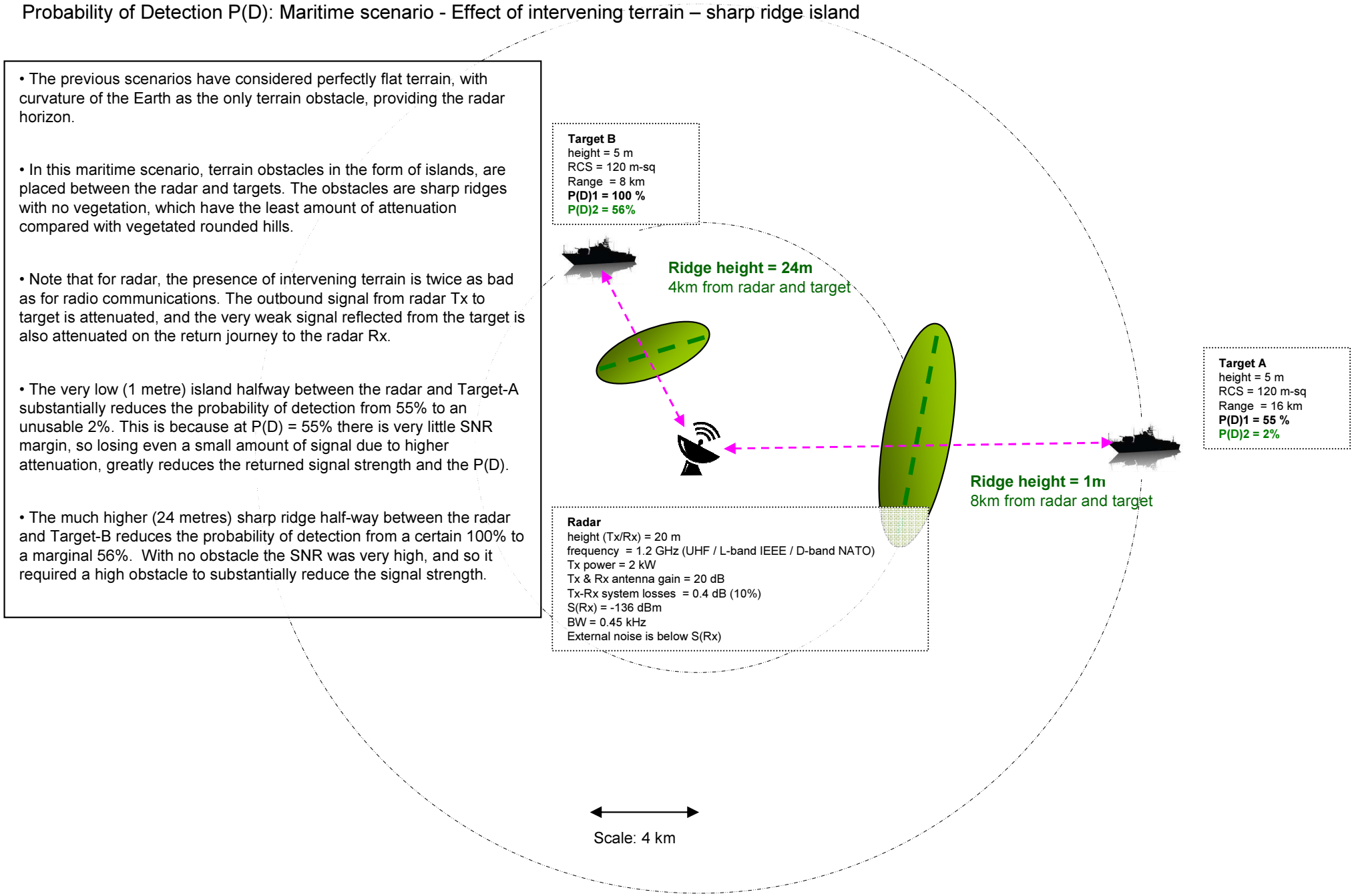
- The previous scenarios have considered perfectly flat terrain, with curvature of the Earth as the only terrain obstacle, providing the radar horizon.

- In this maritime scenario, terrain obstacles in the form of islands, are placed between the radar and targets. The obstacles are sharp ridges with no vegetation, which have the least amount of attenuation compared with vegetated rounded hills.

- Note that for radar, the presence of intervening terrain is twice as bad as for radio communications. The outbound signal from radar Tx to target is attenuated, and the very weak signal reflected from the target is also attenuated on the return journey to the radar Rx.

- The very low (1 metre) island halfway between the radar and Target-A substantially reduces the probability of detection from 55% to an unusable 2%. This is because at P(D) = 55% there is very little SNR margin, so losing even a small amount of signal due to higher attenuation, greatly reduces the returned signal strength and the P(D).

- The much higher (24 metres) sharp ridge half-way between the radar and Target-B reduces the probability of detection from a certain 100% to a marginal 56%. With no obstacle the SNR was very high, and so it required a high obstacle to substantially reduce the signal strength.



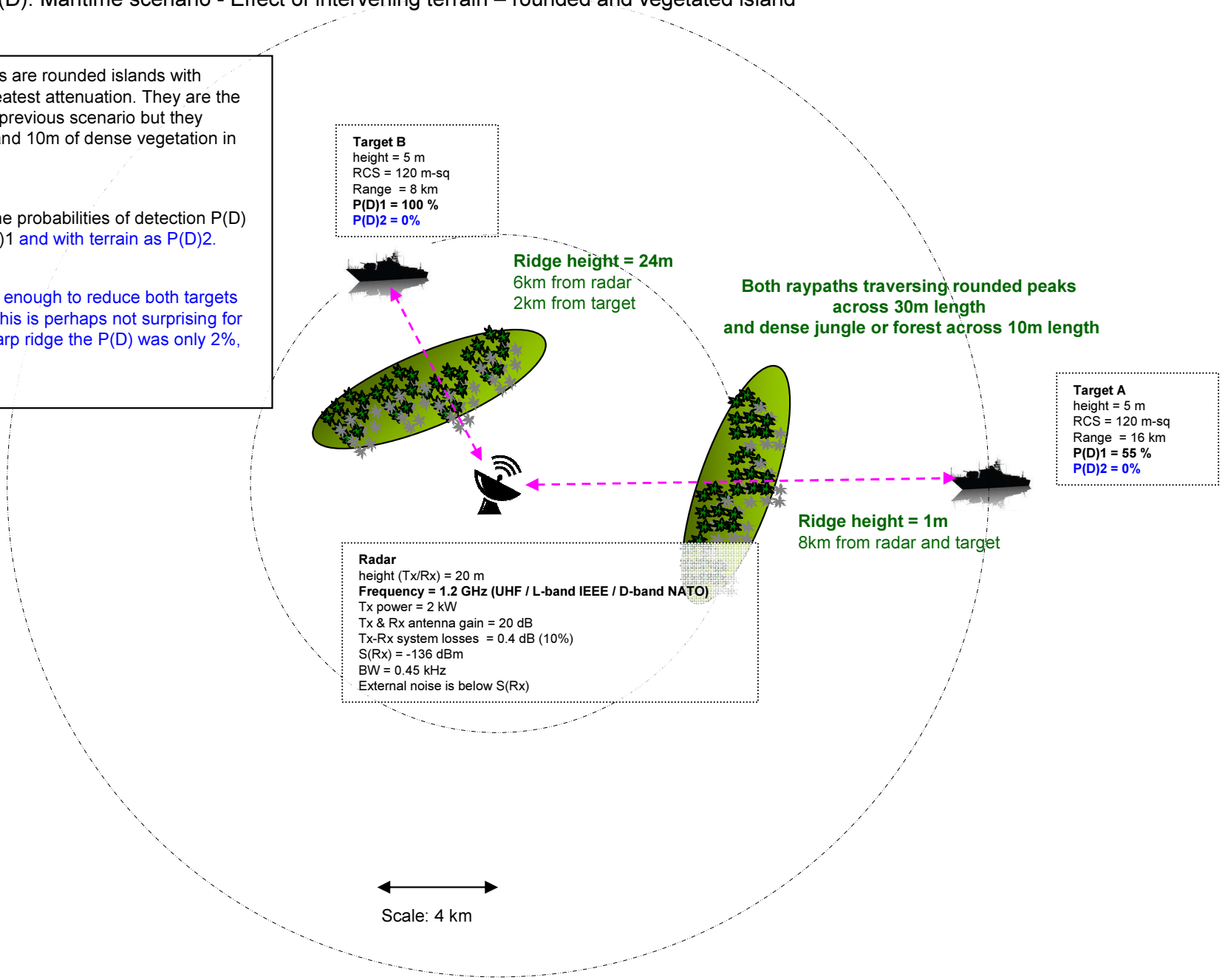
Radar: Basics – scenario 10b

Probability of Detection P(D): Maritime scenario - Effect of intervening terrain – rounded and vegetated island

- In this scenario terrain obstacles are rounded islands with vegetation, which provide the greatest attenuation. They are the same height as the ridges in the previous scenario but they traverse 30m of rounded hilltop and 10m of dense vegetation in each direction.

- As per the previous scenario, the probabilities of detection P(D) are shown without terrain as P(D)1 and with terrain as P(D)2.

- The extra terrain attenuation is enough to reduce both targets to zero probability of detection. This is perhaps not surprising for Target A, as even with only a sharp ridge the P(D) was only 2%, but for Target B it was 56%.



Radar: Basics – scenario 10c

Probability of Detection P(D): Land scenario - Effect of uneven rolling terrain

- In this land scenario, the targets are small to medium trucks with a radar height of 2 metres and RCS at 1.2GHz of 10 sq-metres.
- As per the previous scenarios, the probabilities of detection are shown without terrain as P(D)1, and with terrain as P(D)2.
- On 'normal' terrain with only minor undulations Target A at 8km range is moderately visible with a P(D)1 of 59% and Target B is perfectly visible with P(D)2 = 100%.
- If the intervening 'rolling' terrain has undulations of ~15m height, partway between relatively flat and actual hills, then the attenuation is considerably higher. Both targets have had probability of detection reduced to zero.
- The quite short wavelength (25cm) at 1.2GHz is disadvantageous when dealing with this undulating or broken ground.
- A longer wavelength (lower frequency) would be more appropriate, reducing the spatial and terrain losses, although the radar cross section would also be reduced somewhat.