Radar: Basics – scenario 7a

Bi-static radar configuration

• Bi-static radars have physically separate Tx and Rx antennas and often physically separate Tx and Rx subsystems, compared with mono-static radars that have co-located antennas, or often the same physical antenna, for Tx and Rx.

• There are several reasons to use a bi-static system

- *High power Tx may interfere with a sensitive co-located Rx.*
- *For distant targets, the long time of flight for the radio waves may exceed the time between Tx pulses, and the Rx would need to be 'open' during transmission to receive the pulses.*
- *It may be advantageous to have a 'loud' Tx in a noisy radio area where it will not cause undue interference, but locate the Rx some distance away in a quieter radio area.*
- *A Rx antenna that is higher, has more gain, larger and closer to the target may offset the need to use a small Tx, or vice versa.*
- *Multiple Rx may be used closer to the targets in different directions to better receive weak returned signals than a single Rx.*

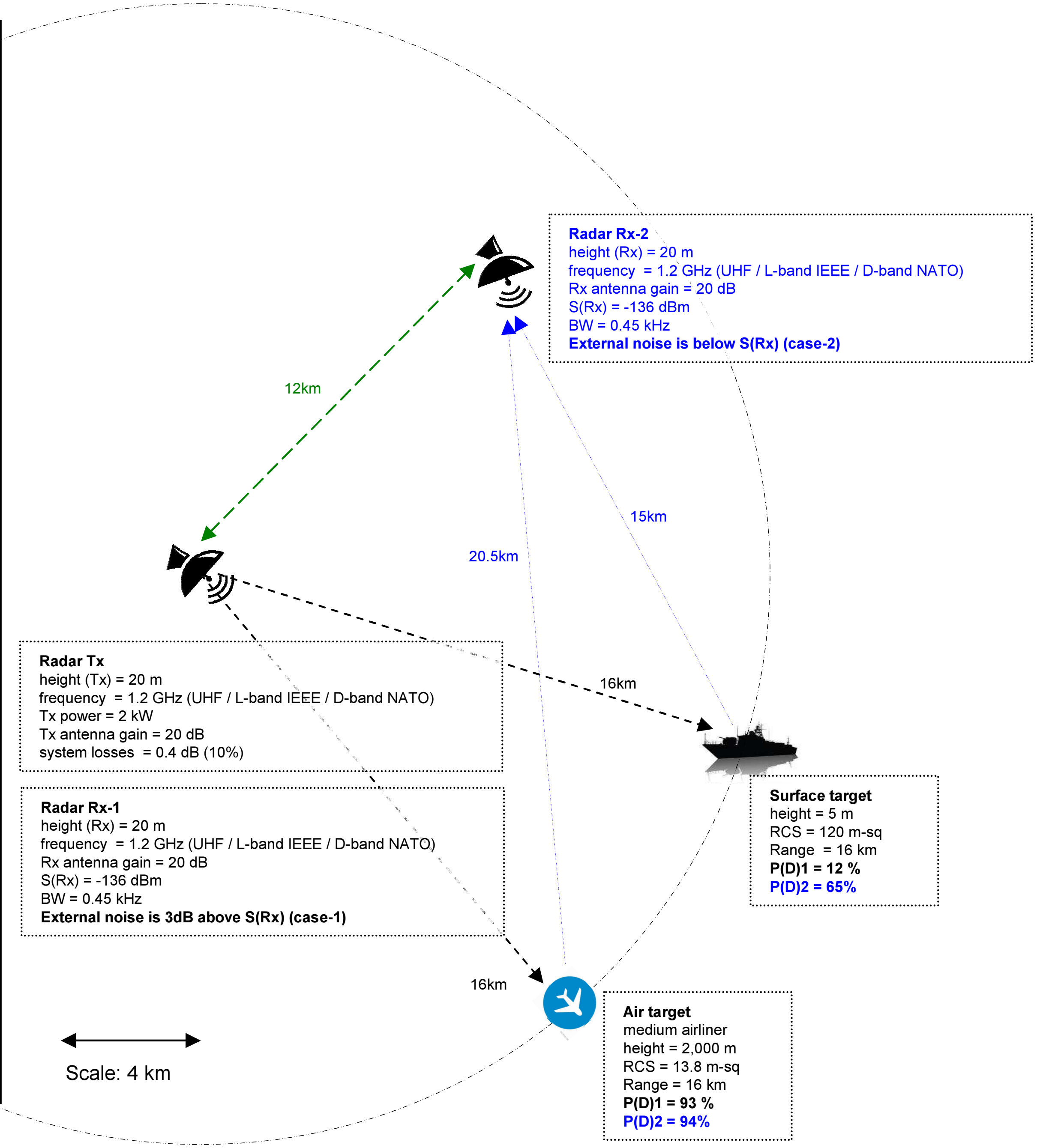
• The scenario shown here is where the mono-static radar situated at the centre (case 1) has a relatively high noise environment at the Tx, and co-located Rx-1 in the centre of the plot.

• The probability of detection, P(D)1, for the Air Target is still a fairly high 93% but the Surface target is a very low 12%.

• The Rx-2 is located (case 2) in a quieter radio noise area ~12km from the Tx. The noise background is lower than Rx sensitivity. Information must be shared between Tx and Rx (e.g. pulse times) shown by green line.

• The Rx-2 is slightly closer to the Surface target than Rx-1 but further from the Air target.

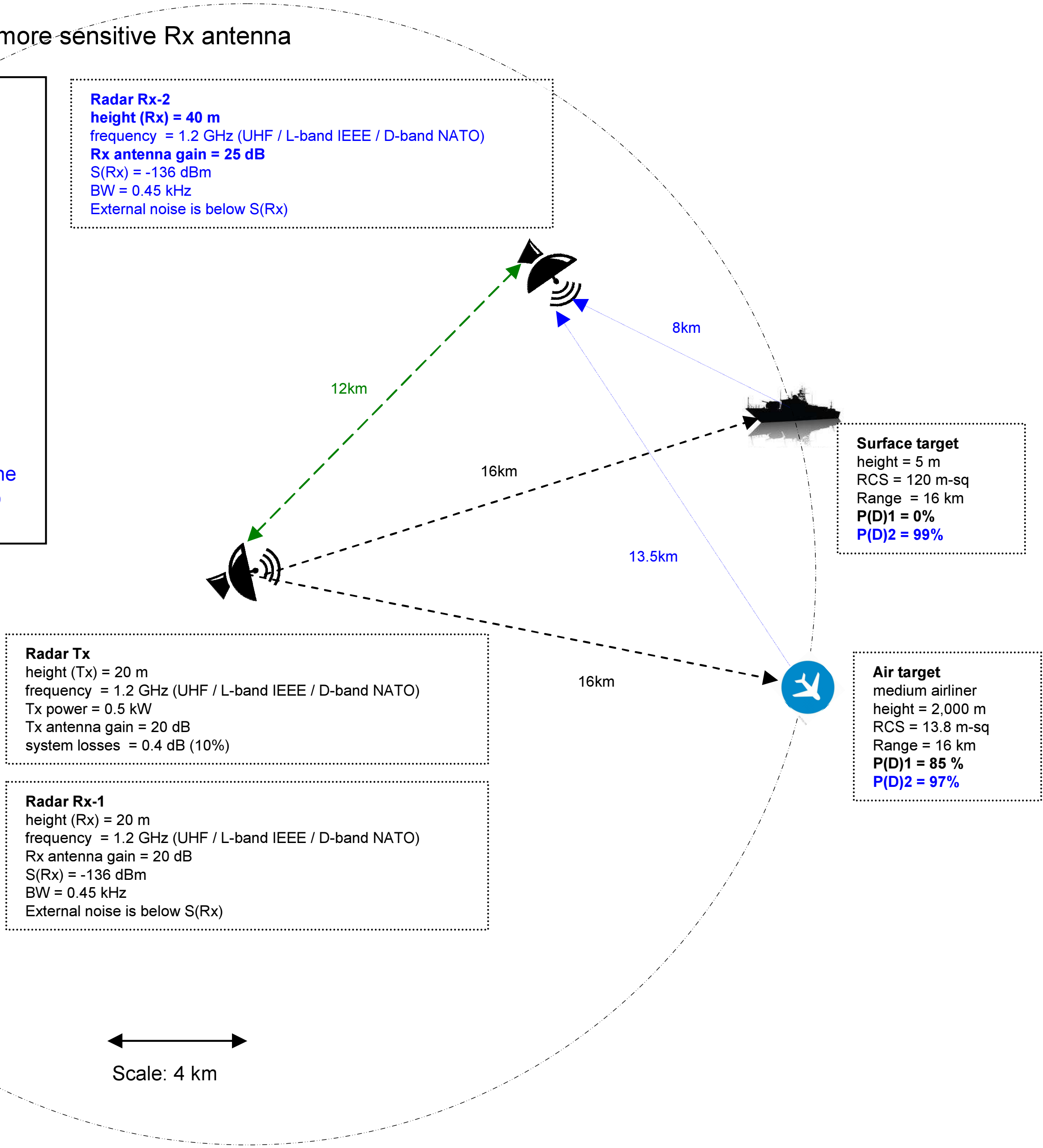
• The probability of detection P(D)2 for the Surface target is considerably improved by 53%, from 12% to 65%. The Air target is only improved by 1%, as lower noise background is offset by the higher path loss from the longer range, but probability of detection was good anyhow.



Radar: Basics – scenario 7b

Bi-static radar configuration – lower Tx power and more sensitive Rx antenna

- In this scenario the Tx power is reduced by 75% to only 500W, so to compensate this, the Rx antenna 2 (case 2) has been placed higher (+20m) and given more gain (+5dB), and is closer to the targets.
- The probability of detection P(D)1 for case-1 is for a mono-static system at the Tx location where the same antenna is being used for Tx/Rx.
- For case-1 the Air target has a quite high probability of detection at 85%, albeit lower than the previous scenario. However the surface target is not detectable with the lower Tx power.
- For Rx antenna 2 the probability of detection P(D)2 is improved considerably for the Air target by 12%, from 85% to a high 97%. For the Surface target the probability has been raised dramatically from 0% to 99%.



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