UDT
Undersea Defence Technology
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Stockholmsmässan, Sweden

Confusion / dilution countermeasure

#UDT2019

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Objective

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Two types of anti torpedo countermeasure exist :

- Hard kill countermeasure

  The aim is to home in, on torpedo and to destroy or disabling torpedo by blast or physically smashing into. It is an Anti Torpedo Torpedo (ATT)

- **Soft kill countermeasure**

  The aim is to seduce or/and hide the target

An introduction of the global effect on torpedoes acoustic head will be presented for the last one

Summary

- Introduction
- Approach
- Range ambiguity
- Bearing ambiguity
- Future Work

Introduction

The sonar guidance systems of torpedoes are homing-in :

- On the sounds that targets are making with engine and propellers
- On echoes due to active pulses reflection on target surface

To deceive torpedo sensor several possible systems :

- Addition of a ship noise maker and lure decoy towed by the ship
- Addition of a stationary jammer to mask the target noise and echoes with a mobile target, which retransmit the received signal as false echo on target.
- Use of confusion and dilution counter measure. This system emits a signal :
  - that mask the target noise and echoes
  - simulated echoes of several possible targets spread in space.

Approach

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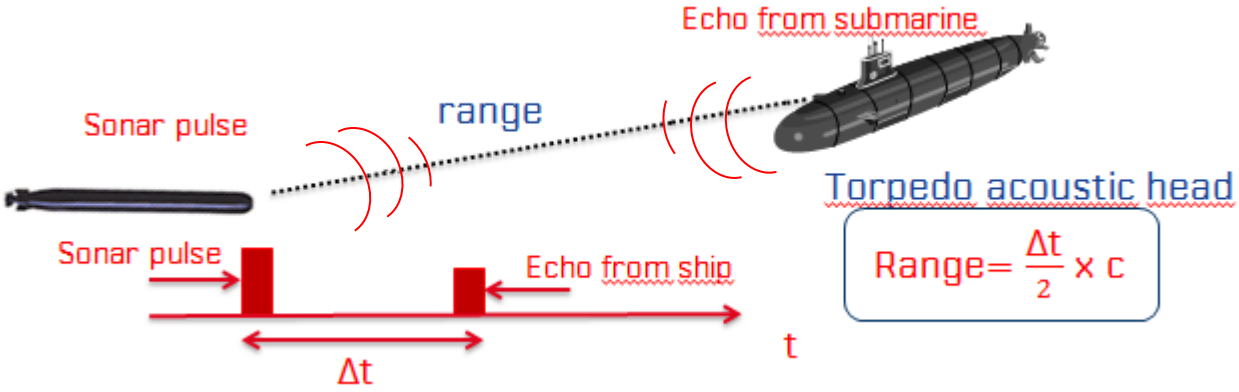
To homing-in on target, the sonar guidance system needs to determine :

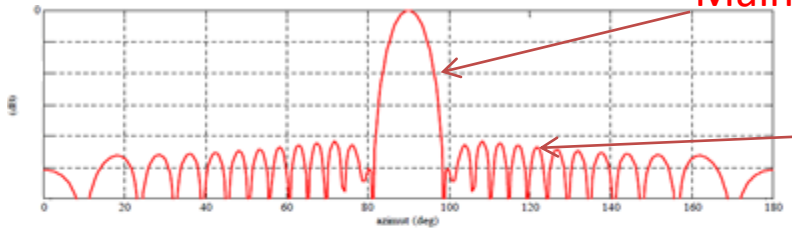
- the range : Estimated by using Time difference between torpedo sonar pulse and echo reflected by the target



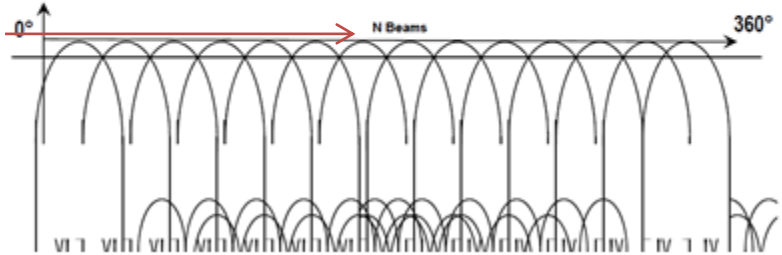
Approach

To homing-in on it target, the sonar guidance system also needs to determine :

- the bearing : Estimated using beamforming or spatial filtering by combining elements of an antenna array.



Several beams



Beamforming is done in passive mode and active mode

Range ambiguity (decoy concept)

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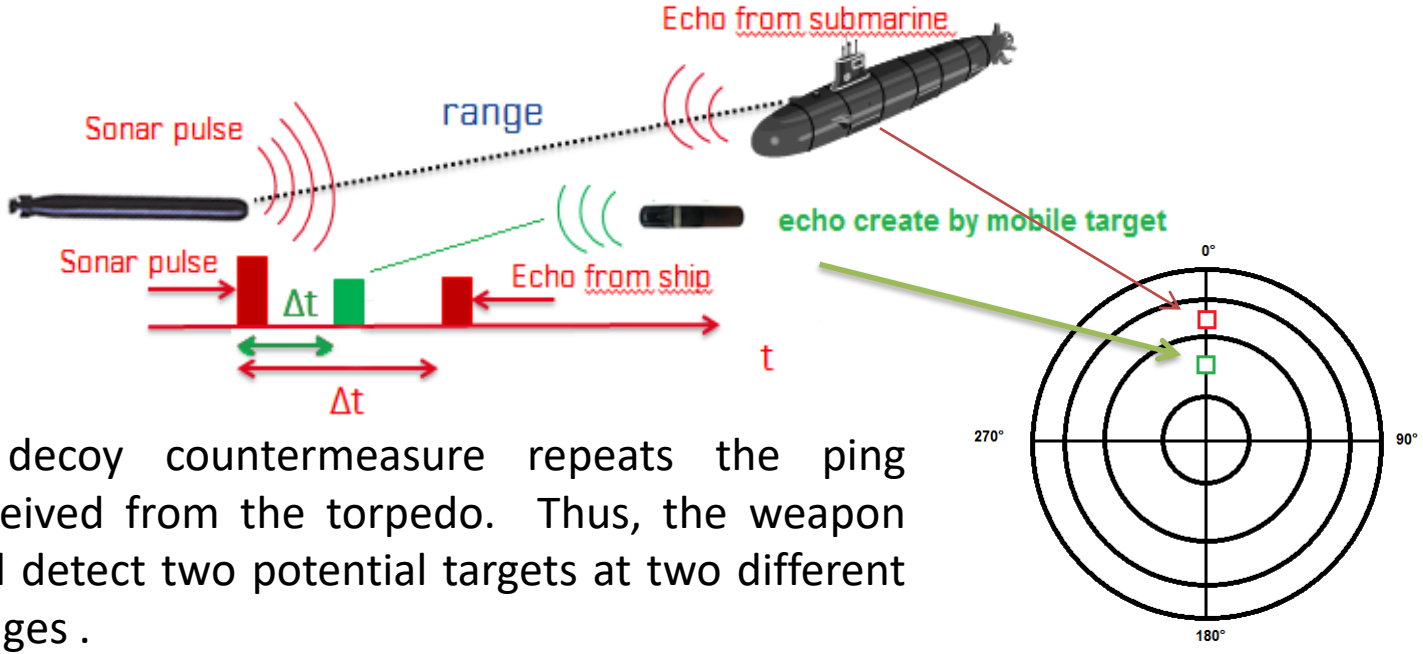
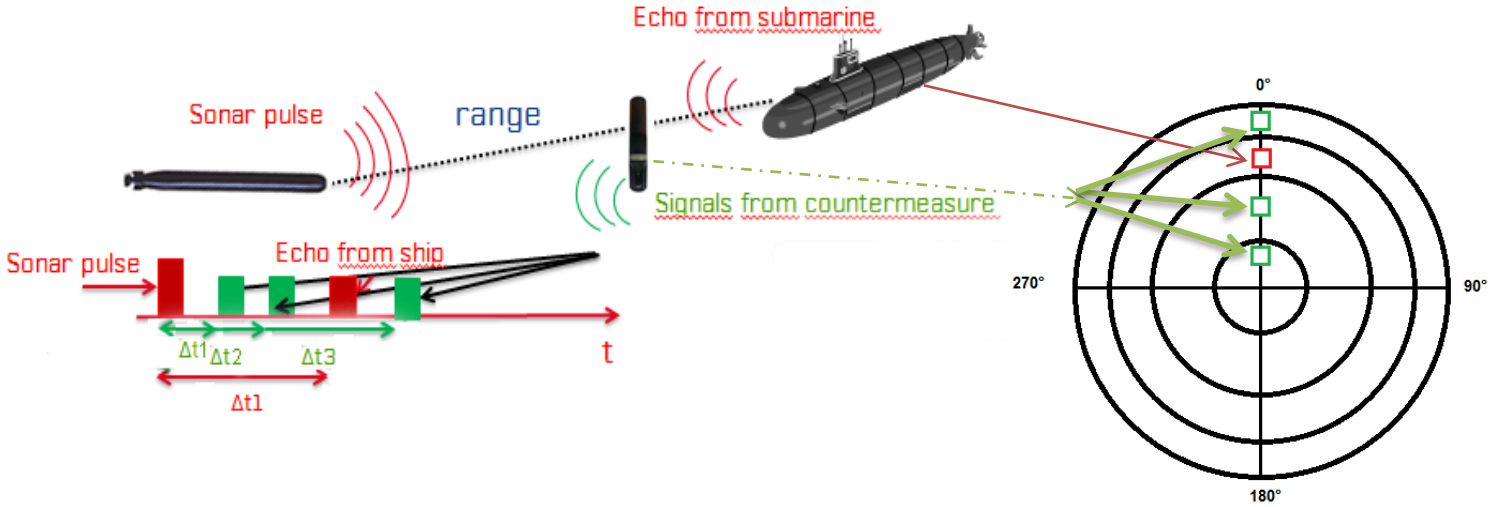


A decoy countermeasure repeats the ping received from the torpedo. Thus, the weapon will detect two potential targets at two different ranges .
(Echo on real target could potentially be hidden by the jammer)

Range ambiguity (confusion/dilution)



A confusion/dilution countermeasure by emitting a special signal, creates several potential targets at several different ranges while hiding the real echo target.

Bearing ambiguity (decoy concept)

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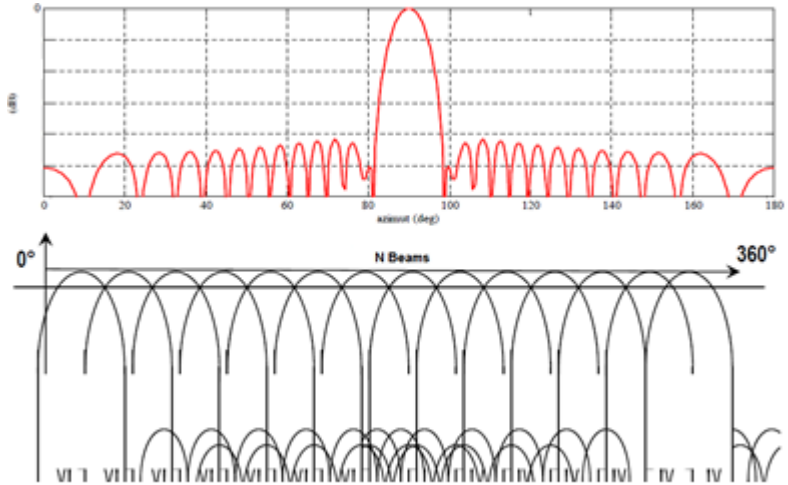
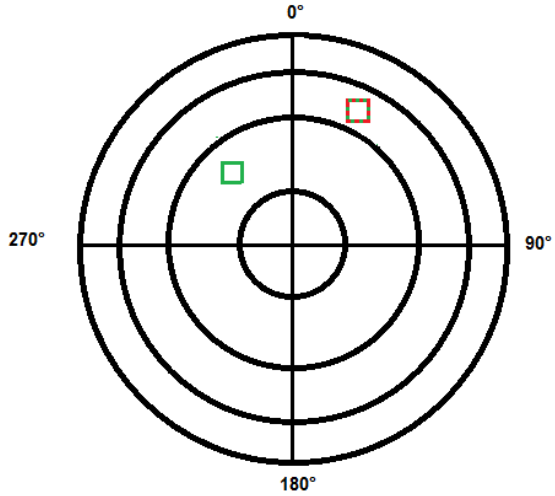
Facing decoy concept of countermeasure, the torpedo by using active ping and beamforming will see :

- the decoy countermeasure in one beam
- the target in an other beam





Bearing ambiguity(decoy concept)

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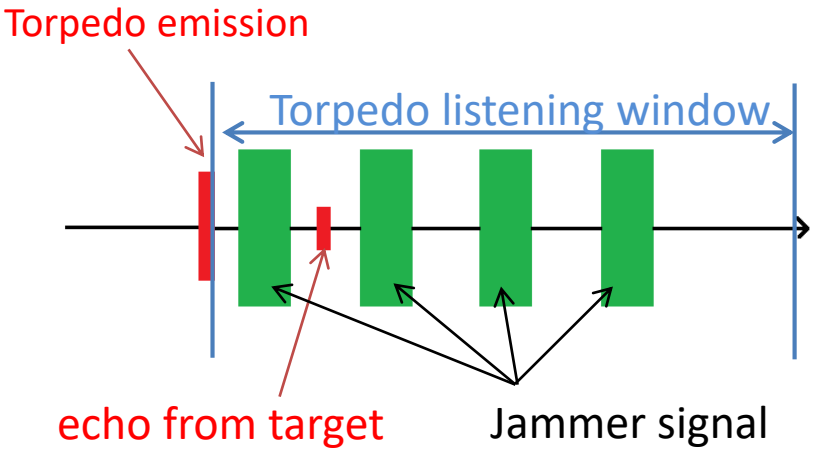
Adding a jammer 2 possible cases :

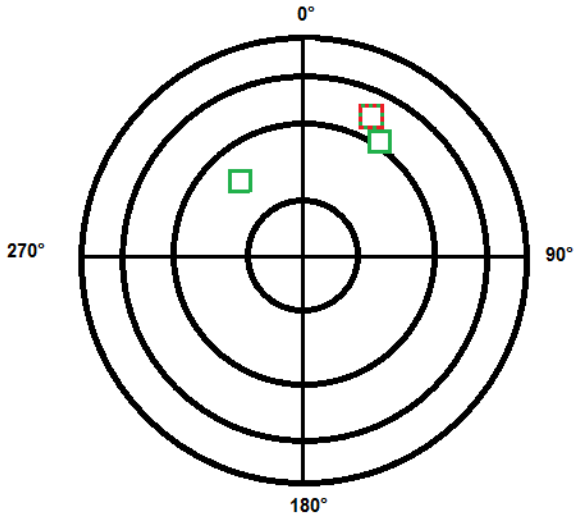
- Jammer is not situated in same bearing,

  ➡ torpedo can discriminated to target using spatial filter

- Jammer is in same bearing

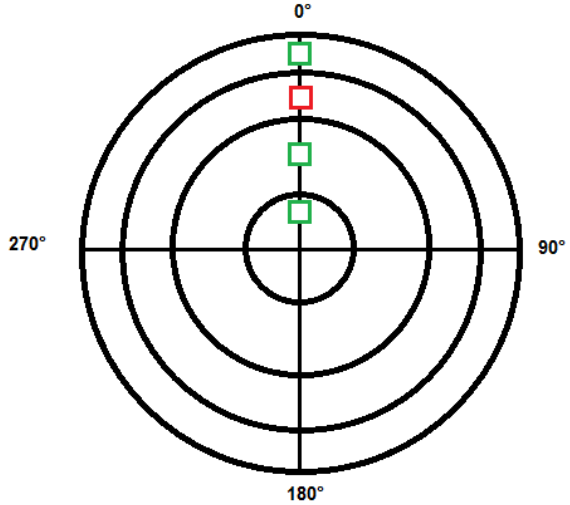
  ➡ torpedo could potentially see the target due to an discontinuous signal



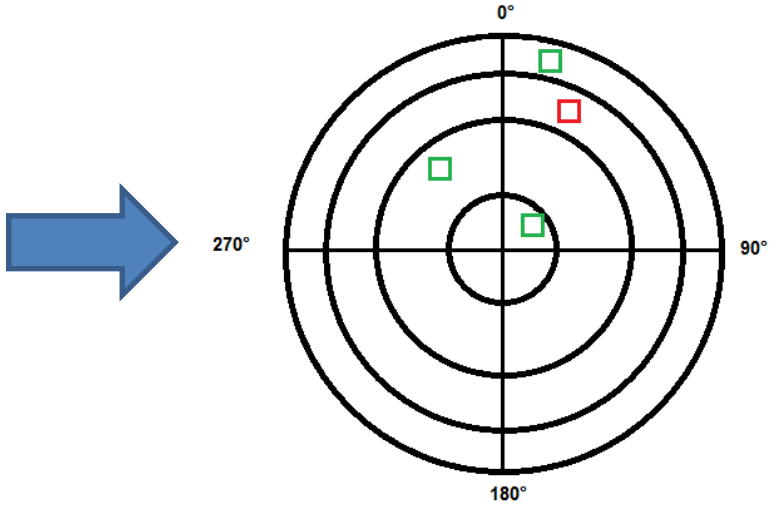


Bearing ambiguity(confusion/dilution)

Confronting a confusion dilution countermeasure, the potential targets spread in ranges will also be spread in bearing.



Range ambiguity



Range + bearing ambiguity

Bearing ambiguity(confusion/dilution)

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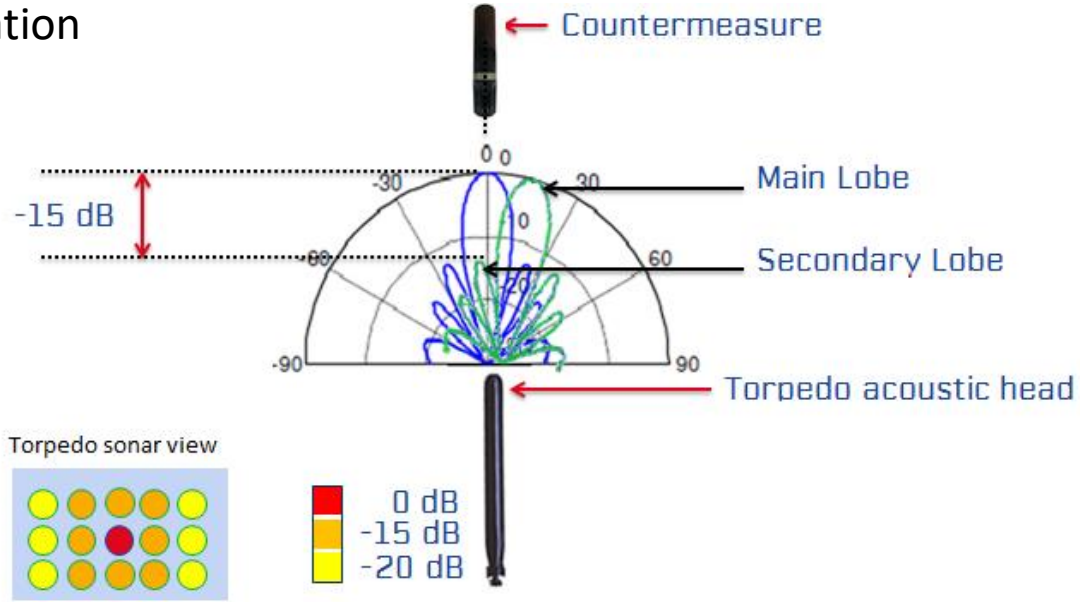
How it works ?

- Bearing ambiguity is due to side lobes created during beamforming computation



Future Work

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New generation of countermeasure might :

- Change its tactic in response of torpedo tactic
  - Torpedo is in research, attack modes
- Use acoustic communications links to connect separate countermeasures devices
- Act as a network against torpedo using full duplex communication
- Use new technology of transducer like for example single crystal

Questions

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ANY QUESTIONS ?