



1. Problem

Goal: satisfy requirements of single target localization by radar network for the entire strategic area



Challenges

- Maximize measurement accuracy
- Minimize number of radars (system cost)

Multiple parameters of optimization

Scope

- Increase number of radars & use autonomous
- Decrease number of radars & use cooperative

2. Approach

Performance

Volume of possible target position (error ellipsoid)

- Network
- Characteristic
- Parameters

Cramer-Rao lower bound (the Fisher information matrix)

x - measured position
 \hat{x} - unbiased estimate

3. Results

Signal model

$$s(t) = A e^{j(2\pi f_c t + \phi)}$$

CRLB for FMCW radar

$$\text{Var}(t) = \frac{3}{8\pi^2 N^2 \text{SNR}}$$

error variance of time delay measurement

$$\text{Var}(v_r) = \frac{6}{T_s N^2 \text{SNR}}$$

error variance of Doppler frequency measurement

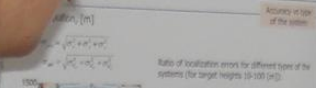
... is taken into account

Study



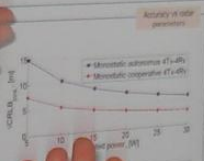
- Advantages: more information about the target
- Disadvantages: require signal orthogonality

Tradeoff shall be made between signal reception (SNR) and number of radars



Ratio of localization error for different type of the systems (for target heights 10-100 m):
 $\sigma_{\text{coop}} / \sigma_{\text{aut}} = 2$
 $\sigma_{\text{coop}} / \sigma_{\text{aut}} = 1.7$

- Cooperative mode of signal reception allows increasing measurement accuracy
- Spatial diversity in multistatic network allows increase measurement performance without increasing number of radars



Cooperative network can be used for parameter estimation with lower number of radars

... compared to monostatic one
... compared to autonomous one
... measurement accuracy without changing