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Theater Torpedo Inventory Optimization

Salmeron-Medrano, Javier; Hauser, Margaret M.; Kline, Jeffrey E.

Monterey, California: Naval Postgraduate School

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Research Objective

Develop formal methods for obtaining optimal loadouts of torpedoes for anti-submarine warfare (ASW)

Method

- Consider:
  - Multiple types of ASW platforms with variable capacities and capabilities
  - Uncertain scenarios
  - Diverse adversary fleets
  - Limited budget
- Develop Torpedo Assignment Stochastic Optimization Model (TASOM)
  - TASOM-1: Minimize E[# of Missed Targets (Subs)]
  - TASOM-2: Minimize deviation from kill-probability goal

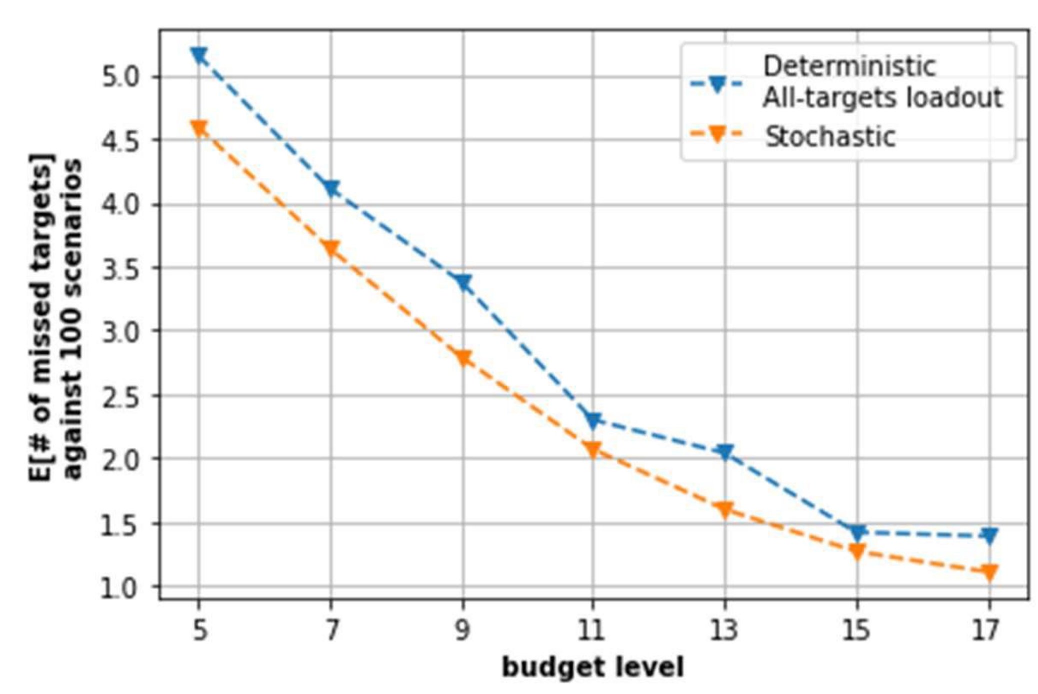
Test and Evaluation

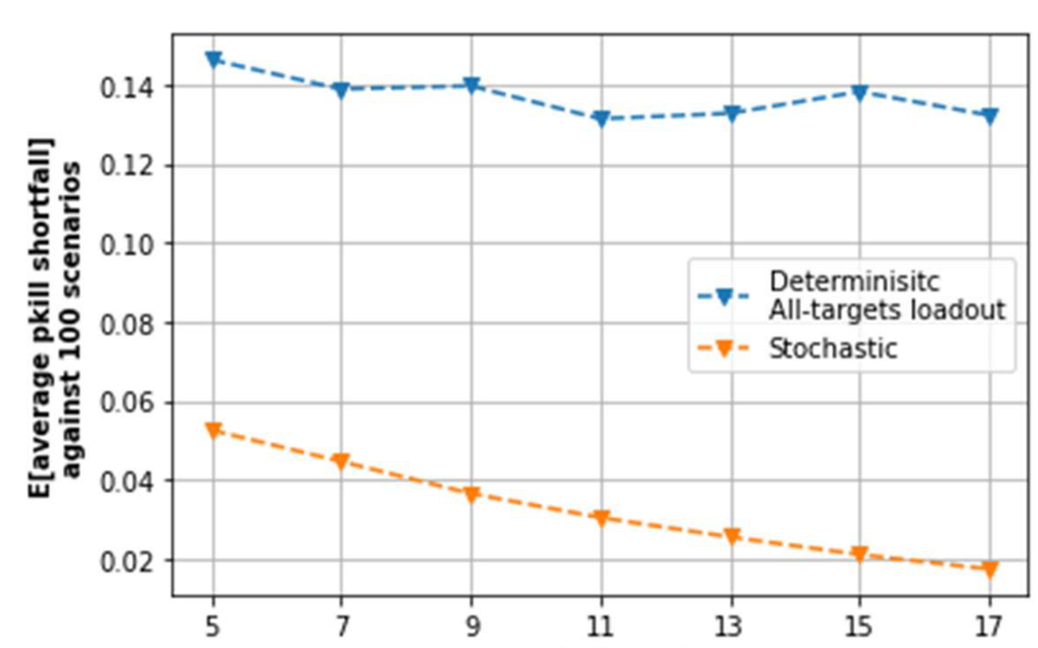
- Simulated 100 random threat scenarios
  - Blue:
    - Four destroyers
    - Embarked MH-60R detachments
    - Two P8 squadrons
    - P_k goal: 90%
  - Red:
    - 20 adversary's submarines of different classes
    - 5 – 10 are deployed per randomly generated scenario
- Compared the performance of TASOMs with a deterministic optimization model

Results

- TASOM-1 performs marginally better than the average loadout:
  - E[Missed targets|Average loadout, Cost = Average] = 2.13
  - E[Missed targets|TASOM-1, Cost = Average] = 1.82
- The effect of TASOM-2 is more prominent:
  - Average P_k given average loadout = 0.78
  - Average P_k given TASOM-2 = 0.87
- When compared to "All-Targets" scenario, the two models behave similarly.
- Models are implemented in an accessible user interface

TASOM-1





TASOM-2

Future Work:

- Focus on further developing TASOM-2
- Introduce variable penalties for probabilities shortfalls
- Expand the treatment of cost
- Consider more realistic ASW scenarios

Researchers: Prof. Javier Salmeron, Prof. Moshe Kress, LT. Violeta Lopez, Operations Research

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