

————— *Military Operations Research* —————

OR 652
Military Operations Research II
Effectiveness Analysis

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Purpose of the Course

- **Familiarization with the major classes of problems encountered by Military OR Analysts (with emphasis on the Department level of analysis)**
- **Learn how OR techniques are applied in a military context**
- **Learn some new, handy techniques that are not often covered in other courses.**
- **Experience solving realistic smaller scale problems that Military OR Analysts must regularly solve**

Introduction

- **Definition of Military OR**

Simply: **Operations Research** applied to **military problems**

– **Operations Research (from Hillier and Lieberman)**

- “ **1. The structuring of real life situation in a mathematical model, abstracting the essential elements so that a solution relevant to the decision maker can be sought**
- 2. Exploring the structure of such solutions and developing systematic procedures for obtaining them**
- 3. Developing a solution, including the mathematical theory, if necessary, that yield an optimal value of the system measure of desirability (or possibly comparing alternative courses of action by evaluating their measure of desirability). ”**

Important Points about OR

- **Use of Models**
 - **All different kinds**
 - **Assumption that outcomes from models reflect reality**
- **Some measure of desirability or Measure of Effectiveness (MOE) needed**
 - **Many standard MOEs are used**
 - **Often one MOE is not sufficient**
- **Finding an optimal solution involves search through alternatives**
 - **Evaluation of alternatives**
 - **Comparison**
 - **Identify “best” and make recommendation**

Decision Support

- **Analysis provides support and information to the decision maker**
 - **Analyst vs. Decision Maker**
 - **3 possible outcomes of an analysis**
- **Ethics**
 - **The answer at the back of the book**
 - **Advocacy analysis**
 - **Over selling analysis (assumptions and limitations)**

Military Problems Subject to OR Analysis (Broad Overview of the Field)

- (1) **Combat Operations**
 - **Operations Plan Analysis**
 - **Doctrine issues**
 - **Tactics, Techniques, and Procedures (TTPs)**
 - **Course of Action Analysis**
 - **Wartime operations**

Note: Many other problems involve examining combat operations

Military Problems Subject to OR Analysis
(continued)

(2) Equipment and Weapons Modernization Decisions

- Analysis of Alternatives (a.k.a. COEA)
- Capital Budgeting problem (Value Added)

- Usually involves measuring effectiveness of weapons or equipment using combat model
- Cost estimation of developmental programs
- Choice of the best alternative or alternative mix
 - Optimization
 - Exhaustive evaluation

Military Problems Subject to OR Analysis
(continued)

(3) Force Structure - Force Sizing - Force Design

- What should units look like?
(e.g., How many tanks should there be in a tank company?)
- How many units of each type should there be?
(e.g., How many fighter wings are needed for 2 MTWs?
What EAD and EAC CSS units are needed for the 2
MTW Army force?
What forces are needed for a NEO in Africa?)
- How can low density/high utilization units be identified?

Military Problems Subject to OR Analysis

(continued)

(4) Strategic Mobility

- **How long does it take to get adequate force in place to win?**
- **How do different Postures of Engagement affect deployment to MTWs?**
- **How should deployment assets be allocated between the services to maximize force effectiveness?**
- **What is the tradeoff between additional lift assets and prepositioned equipment?**

Note: Sets the context for many analyses of combat operations.

Military Problems Subject to OR Analysis

(continued)

(5) Logistics

- **Is a particular course of action in a campaign plan logistically supportable and feasible?**
- **Where should logistics assets be located on the battlefield?**
- **How can the logistics footprint on the battlefield be reduced?**
- **Requires knowledge of capacity of logistics assets to provide service.**
- **Need to know usage or consumption factors.**
- **Related to requirements.**

Military Problems Subject to OR Analysis
(continued)

(6) Requirements

- **How much ammunition and fuel is needed for a particular conflict?**
- **How much replacement equipment is needed for a particular conflict?**

- **Given a specific force structure.**
- **Depends on scenario and other assumptions.**
- **Depends on level of modernization.**

Military Problems Subject to OR Analysis
(continued)

(7) Theater Missile Defense (TMD)

- **What is the appropriate mix of systems across services to perform TMD in the most cost effective way? (Modernization decision)**
- **How many leakers do we expect for a give scenario and set of assumptions?**

- **Affects combat outcomes.**
- **Affects logistics operations**
- **Usually analyzed separately**

Military Problems Subject to OR Analysis

(continued)

(8) Operations other than war - smaller scale contingencies

- What tasks are needed to be performed for successful completion of a particular SSC mission?
 - How do you measure success in a peacekeeping mission?
 - How many SSCs are expected and how will they last in the next 10 years?
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- Changes the paradigm of MOR
 - Often rely on subjective (expert) judgement

Military Problems Subject to OR Analysis

(continued)

(9) Installations (also a different type of MOR problem)

- How should funds be allocated on an installation for energy conservation programs?
- Where should units be located after a change in force size? (BRAC question)
- What personnel manning should be provided for installation base operations functions?
- How should funds be allocated to clean up toxic waste contamination?

Military Problems Subject to OR Analysis
(continued)

(10) Human Resources

- How should each specialty be manned for the next 10 years?
 - What policy should govern assignment overseas?
 - What is the usage of personnel by specialty in deployments?
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- Related to force structure
 - Data often readily available for analysis
 - Optimization often used

Military Problems Subject to OR Analysis
(continued)

(10) Others

- Homeland defense
- Testing
- Analysis of historical data
- Development of decision support systems
- Issue generation for new problems using Political-Military gaming
- Reserve component employment

Military Operations Research
Interactions

