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Operations Research/Systems Analysis

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Functional Area 49

Operations Research/Systems Analysis

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1. OPERATIONS RESEARCH SYSTEMS ANALYSIS

Operations Research/Systems Analysis is a dynamic approach to decision making characterized by investigation of new concepts and the development of new quantitative tools to analyze these concepts. The role of the OR/SA analyst in military decision making has grown without precedent as the Army has recognized the need to support its decisions with detailed qualitative and quantitative analyses. Civilian and military OR/SA analysts are complementary team members in analytical organizations, OR/SA cells, and ad hoc committees which examine the critical equipment, doctrine, training, operation and organization concepts, and force structure decisions which will shape the way the Army will fight on future battlefields. Opportunities for the OR/SA analyst to influence these decisions exists in assignments throughout the Army as shown by the distribution plan contained in this pamphlet. The OR/SA career field is demanding in every regard. Entry level requirements are stringent and retention standards high. To maintain quality in the functional area, we send a high percentage of FA49 officers to fully-funded graduate school. OR/SA analysts also have the opportunity to continue their formal and informal education through attendance at Army sponsored short courses, seminars and conferences, or cooperative degree programs. The results of the selection of officers who are capable of meeting these challenges and demanding responsibilities are reflected in promotion and school selection statistics. In every selection board since the establishment of the Officer Personnel Management System (OPMS) and career fields, OR/SA officers have always equaled or bettered the Army average selection rate.

2. WHAT IS OPERATIONS RESEARCH?

Operations Research is defined in JCS Publication 1 as: The analytical study of military problems, undertaken to provide responsible commanders and staff agencies with a scientific basis for decision on action to improve military operations. Also known as operations analysis.

a. As the last sentence of the definition implies, there is a nomenclature problem. There is a common body of mathematical methods, that in most universities and research agencies, is called Operations Research. But the various people and agencies applying these methods to problems call themselves or their activities by various names. Management Science, Systems Analysis, Operations Analysis, Operations Research, and Weapon Systems Evaluation are, so far as this pamphlet is concerned, fully equivalent titles. This definition exists, in part, because the earliest roots and applications of Operations Research were associated with military operations. As the realization grew that some of the methods could readily be applied to nonmilitary management problems, new names like Management Science came into widespread use.

b. Science and scientists have had a long association with military matters. But, with some notable exceptions, such as the anti-submarine warfare efforts in the North Atlantic in World War II, this association was primarily a role in the design, development, and testing of weapons and other material systems. The most important difference implied by the term operations research rests on the realization that the detailed considerations of how new systems and operational concepts are to be employed, integrated, and supported in battle can be analyzed using scientific, quantitative and qualitative methods. Today, there are 900 officers serving in Functional Area 49. The pool of officer analysts is larger than this since, like other officers under OPMS, there is rotation between assignments in the branch and the functional area.



Figure 1. "Operations Research is the representation and analysis of real world processes using logic, mathematics and computer science."

3. WHAT IS THE ROLE OF THE OFFICER?

An OR/SA officer conducts or supervises the conduct of qualitative and quantitative analysis of complex military and military-related problems by application of the analytical techniques and methodology of operations research/systems analysis (OR/SA). Applies objective, analytical and orderly thinking, supported by selected research tools (normally of a mathematical, statistical, or economic type) to the analysis of complex operational, organizational and management problems. Uses OR/SA tools and techniques such as statistical inference and decision theory, mathematical programming, probabilistic models, network analysis, and computer science in the investigation of these problems. Summarizes and synthesizes complex analyses into simplified terms and presents the results to decision makers. An officer serving in an OR/SA assignment must frequently bridge the gap between military, science and management activities. The officer thereby acquires competence in a wide variety of Army functions as well as experience with the scientific tools of decision making. Comprehensive operational field experience provides the foundation for the OR/SA officer to employ analytic technology to the solution of operations and organizational design problems. Tactics, doctrine, and the organization and employment of new weapons systems are typical examples of study areas which require OR/SA officers to be exceptionally proficient in their basic combat skills.

4. WHAT ARE THE TYPICAL DUTY POSITIONS?

The Army has three major analytical agencies, (Concepts, Analysis Agency (CAA), the Army Material Systems Analysis Activity (AMSAA) and the TRADOC Analysis Center with its major operational elements at Fort Leavenworth (TRACFLVN) and White Sands Missile Range (TRACWSMR). There are three major testing activities: Operational Test and Evaluation Agency, TRADOC Combined Arms Test Activity, and the Combat Developments Experimentation Command. Additionally, Army centers and schools have OR/SA officers in instructional, materiel, training and combat developments positions. There are also officers assigned to MACOM and DA headquarters staffs and joint activities. These officers are primarily involved with policy and planning functions which require the capability to understand and apply analytical procedures.

Typical duty positions include:

- OR/SA Staff Officer, US Army Training and Doctrine Command
- Systems Analyst, US Army Materiel Command
- Project Officer, US Army Operational Test and Evaluation Agency
- Operations Research Analyst, Headquarters, Department of the Army Staff Agency
- Force Structure Analyst, Organization of the Joint Chiefs of Staff
- Instructor, United States Military Academy, Command & General Staff College, Army Logistics Management Center, or Army War College.



Figure 2. "Basic Branch experience is critical to successful performance in analytical positions."

5. WHO CAN ENTER THE SPECIALTY?

Officers may, within requirements and with HQDA approval, have OR/SA designated as a functional area at any time. Ideally, the officer should request designation not later than the sixth year of service. This will ensure that time is available to attend graduate school, serve an initial utilization assignment, and get back to troops as a Major to acquire the additional branch experience vital to accurate interpretation of analytical results. In any case, designation will occur prior to the end of the seventh year of service. General qualifications for officers entering the specialty include:

- Possess a baccalaureate and/or graduate degree in operations research, engineering, mathematics, physical science,

- management or a related discipline when supported by quantitative analytical background.
- Demonstrate academic proficiency suitable for graduate education.

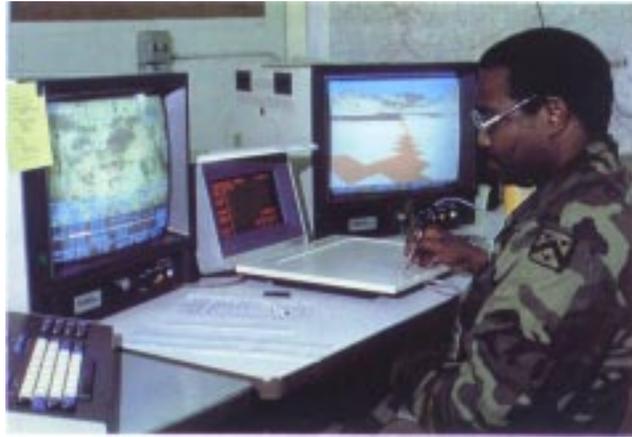


Figure 3. "Technical work requires advanced technical training."

6. WHAT TRAINING IS AVAILABLE?

Advanced Civil Training Study at the graduate level has become a necessity in order to be able to successfully integrate the strong points of one's military background with applied Operations Research skills.

There are two primary sources of funding available to Army officers who desire to obtain a graduate degree:

- Personal:** The individual uses personal time and resources for funding.
- Army funding:**
 - Fully-Funded. Officers may apply to be sent to civil schooling at the Army's expense. The discipline of study must support a follow on assignment in an OR/SA position. The officer is authorized a PCS move and 18-24 months to complete the degree.
 - Partially funded. The officer, through his own initiative, takes courses during non-duty hours using current Army educational assistance programs in addition to personal funds.
- Schools:** Military students attend a wide variety of civilian graduate schools. In order to ensure that the education received is appropriate for military applications, the FA49 Proponent has identified the following schools as preferred academic institutions. Most students will attend one of these designated schools:
 - Naval Postgraduate School
 - Air Force Institute of Technology
 - Georgia Institute of Technology
 - University of California, Berkeley
 - Texas A&M University



Figure 4. "Training at OR/SA MAC I emphasizes mathematical and computer skills."

7. MILITARY SCHOOLING

The US Army Logistics Management Center (ALMC) located at Fort Lee, Virginia is the primary Army trainer of Operations Research/Systems Analysis (OR/SA) officers. ALMC teaches the following courses:

a. The Operations Research/Systems Analysis Military Applications Course I (OR/SA MAC I), is 14 weeks in length and provides prospective Army analysts with a knowledge and an understanding of the military applications of operations research and systems analysis methodologies. This course is intended to provide initial entry training in OR/SA for officers who do not possess a graduate degree or whose graduate degree was not in Operations Research or Industrial Engineering.

b. Operations Research/Systems Analysis Military Application Course II (OR/SA MAC II), is two weeks in length and provides a refresher course in the latest OR/SA techniques and the current application of these techniques to military problems. Attendees must have either received formal OR/SA training through graduate school or the OR/SA MAC I course. Officers normally attend this course prior to their second or later tour.

c. Operations Research/Systems Analysis Continuing Education Program (OR/SA CEP), is normally three–five days in length, and allows OR/SA analysts to remain current on new developments in the OR/SA field by providing them with short, intensive courses on subjects which either they have not taken during the formal education process or have undergone significant enhancement.

d. Professional Development Programs Since the opportunities for fully funded graduate education are not universal, the major analytical agencies have implemented training programs to make up some of the shortfall. The purpose of these programs is to improve OR/SA skills. However, at the student's option, all program work can be credited toward a degree. Officers are selected to participate based on the individual's desires, and the needs of the local command. In order to qualify, the applicant must have an undergraduate degree in one of the "quantitatively oriented" sciences, mathematics or engineering. A summary of each program follows (these details are subject to change):

CAA:

Program presented by George Washington University. CAA pays for tuition, and the program is conducted during off duty hours. Course work can be credited toward an M.S. in Operations Research.

TRAC–FLVN:

Program presented by the University of Kansas. TRACFLVN pays for tuition and books. The program is presented both on and off duty. Course work can be credited towards a M.E. or M.S. in Operations Research.

TRAC–WSMR:

Program presented by New Mexico State University. TRAC–WSMR pays for tuition and books. The program is conducted during duty hours. Course work can be credited towards an M.S. in Industrial Engineering.

AMSAA:

Program presented by George Washington University. AMSAA pays for tuition and books. The program is conducted during duty hours. Course work can be credited towards an M.S. in Operations Research.



Figure 5. "OR/SA officers put "mud on the numbers" and must be able to interpret study results in terms of battle outcome."

e. It is important to note that all costs associated with the completion of a degree (thesis fees, graduation fees, etc.) must be borne by the student. In addition, the course offerings for all programs are based on the professional development needs of the offering command and are subject to change.

8. WHERE ARE FA49'S SERVING?

(current as of CY86)

	Cpt	Maj	Ltc	Col	Total
Army Staff	5	39	59	17	120
Defense					
Agencies	2	7	19	15	43
USAREUR	5	12	4	1	22
FORSCOM	7	8	3	1	19
Joint					
Activities	4	11	16	4	35
USMA	14	5	2	0	21
USAREC	11	17	3	1	32
TRADOC	192	106	37	8	343
AMC	43	17	6	4	70
Other	20	100	47	18	185

Figure 6. Where are FA49's serving?



Figure 7. "FA49 officers are involved in the analysis of new equipment from conceptualization on the drawing board to the integration into and employment of the system in current and proposed TOE organizations."

9. SUMMARY

a. Operations research is an exciting, demanding career field. Although some of the results in operations research date back many years, its use as a formal discipline can be traced to the beginning of World War II. Some of the procedures developed during the war were mathematically formalized, and a number of organizations were formed to provide continuing scientific support to the military. Since those early beginnings, OR has grown to become a major activity in today's Army. Virtually all organizations at the highest echelons of the Army use OR/SA techniques in performing their mission.

b. The problems OR analysts address are diverse, complex, and challenging to solve. They employ a common set of solution techniques which we call the basic methodologies of Operations Research. Solutions to these types of problems require OR analysts who are skilled, carefully trained, creative, flexible and hard working.

c. In conclusion, we have tried to indicate why OR might be a wise career choice for you. There are many exciting and rewarding opportunities for the well-trained OR/SA officer. It is a profession with excellent growth potential, and one that requires continual interaction with management at all levels. Finally, it is a challenging career field that involves the analyst in a broad spectrum of important decision-oriented problems with top level decision makers.

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