

MASTER OF SCIENCE
in
RESEARCH AND DEVELOPMENT MANAGEMENT

PROGRAM GUIDE

I. Purpose

The Graduate School of Engineering and Management, Department of Systems and Engineering Management, offers the Master of Science in Research and Development Management (GRD). The GRD program provides students with an in-depth study of the unique challenges associated with the research, development, and use of technology, products, and systems within the Department of Defense (DoD) and Air Force. Students will learn the principles of product development and systems engineering, as well as the importance of integrating research and development (R&D) throughout an organization's business operations and processes to ensure a coherent strategy that provides value to the customer, laboratory, and product center. This is accomplished by focusing on the organizational environment (i.e., people), implementing effective and efficient organizational processes, and developing decision-making tools to analyze and interpret information. The primary objective is for students to better understand the research and development process, build their technical and managerial skills, and prepare themselves to effectively lead R&D efforts throughout the life-cycle continuum of technology, to include technology refresh efforts in the field.

GRD Program Educational Objective:

Provide graduate education and research experience necessary to lead and effectively implement research and development (R&D) processes with a particular focus on systems engineering principles and technological innovation.

GRD Program Outcomes: (Students should be able to)

1. Understand organizational behavior in an R&D environment and apply techniques for managing in a technology-focused organization.
2. Understand the importance of strategy development and the impacts of public policy on R&D programs.
3. Apply critical thinking skills to develop and propose strategies related to technology, R&D efforts, and program management.
4. Apply analysis and decision-making skills to evaluate and select technologies and manage technology portfolios related to R&D efforts.
5. Apply systems thinking to R&D efforts, to include early technology and concept development as well as the planning, directing, and controlling of resources (people, material, equipment, and funds) related to new defense products and technology development.

6. Develop, select, and execute business processes necessary for effective project analysis and decision support.
7. Conduct and present methodological research to solve problems and support decisions.

Program graduates are well grounded in course work related to follow-on assignments within the research and development environment at all levels of the DoD and Air Force (e.g., unit, MAJCOM, SECDEF). The output advanced academic degree (AAD) code is 1APY. (Qualified students will have the opportunity to pursue a 1ASM AAD code by taking an additional 3-course sequence above the program degree requirements).

II. Admission Standards

The general requirements for admission to the Master of Science program in Research and Development Management are:

1. An undergraduate degree in a technical area (engineering, math, or science) or with significant technical content (e.g., USAFA core); an undergraduate degree in a non-technical will be accepted provided the applicant has work experience in a technical field. Mathematics courses to include at least one course of calculus.
2. A cumulative undergraduate GPA of 3.0 (on a 4.0 scale). GPA in mathematics-related courses should be at least 3.0.
3. Graduate Record Examination (GRE) score of at least 1100 (with a minimum 500 verbal and 600 quantitative) or Graduate Management Admissions Test (GMAT) score of at least 550.

Students in the Wright-Patterson area who do not meet these criteria may register for individual courses as a part-time student (space available) but are expected to meet the above criteria prior to being granted candidacy for the degree. Waivers to the criteria may be granted (on an individual basis) by the Department of Systems and Engineering Management.

III. Curriculum Description

The GRD program is conducted in six academic quarters and a short term (18 total months, beginning in September) for full-time students. The short term provides an orientation to the GRD curriculum, a review of acquisition management, a review of basic mathematics skills, and an introduction to the computer systems serving AFIT.

The minimum curriculum satisfying the degree requirements consists of **2 methods courses**, **3 R&D management core** courses, **3 organizational process core** courses, **2 systems engineering core** courses, and 12 hours of **thesis** research. Each of these areas is required to effectively lead large or small research and development efforts. The **methods courses** provide a strong background in probability for understanding and describing the nature of uncertainty in

real world decision-making along with a strong foundation in research methods and supporting statistics to both prepare for research required within the degree and to prepare the student for rigorous problem solving inherent in product development. In the **R&D management core**, students gain additional understanding of the commercial and defense R&D process while studying the innovation process, risk analysis techniques, and the state of emerging technologies. The **organizational process core** provides students an understanding of the management and behavior of organizations along with an introduction to the role public policy, strategic management, and business process improvement plays in R&D efforts. In the **systems engineering core**, students are provided a foundation in system science to include conceptualization, design, modeling, testing, implementation, and operation of a working system, particularly as it applies to the analysis and synthesis of large and complex systems. Included is a substantial technical foundation in systems architecture, analysis, and design. These core areas represent an interdisciplinary approach to the degree and establish a framework to help integrate courses and research streams within both the program and the department. The **thesis** must address a real-world problem of interest to the DoD systems development community in a research and development management area. Principal purposes of the thesis are to demonstrate the student's ability to integrate concepts and techniques acquired through course work and to demonstrate scholarly pursuit of a research question. Typically, thesis topics are provided by the DoD and USAF agencies interested in sponsoring student research in areas of practical concern. Supplemental courses are provided in these areas for students who need them. Students are expected to participate in colloquiums throughout the year that will assist them in the identification, development, and execution of their research.

In addition to degree requirements, all DoD-sponsored full-time students must complete an average of 12 credit hours per quarter over the total number of quarters in residence. These sponsored students subsequently take additional courses to reach a total of 72 credit hours. Five of the additional courses are specified and expand on the core areas identified above. The students are also required to choose a 3-course application sequence to develop depth in a particular area of their choosing. The sequence must be developed by the student, in consultation with their academic advisor, and approved by the GRD faculty curriculum committee. Provisions are available to tailor sequences to meet specific student and research requirements.

Sponsored students may also be required to take additional courses to satisfy education needs of the sponsor or to qualify for award of an additional advanced academic degree code. Some students may be required to earn the 1ASM AAD code by taking an additional course sequence in **Software Systems Development and Management**. This specialty sequence provides an in-depth, specialized study tailored to the development of software systems. These include networks, databases, and embedded systems. The required courses to earn the 1ASM code are:

CSCE 093	Object Oriented Program Design (short term orientation)
CSCE 593	Introduction to Software Engineering (4 credit hours)
IMGT 651	Systems Analysis and Design (3 credit hours)
CSCE 693	Software Evolution (3 credit hours)

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 (Suggested six-quarter program for the full-time student)

<u>FALL Short Term</u> [*]	<u>Credit Hours</u>
DL Math Review, Technical Writing Review, Acquisition Mgmt Review (ACQ 101), and Project Management Review	0
 <u>1st FALL</u>	
RDMT 501 [*] Research & Development Mgmt Colloquium	0
ORSC 542 Management and Behavior in Organizations	4
RDMT 554 Management in R&D Organizations	2
SENG 520 Systems Engineering Design	4
STAT 525 Applied Statistics for Managers I	4
	14
 <u>1st WINTER</u>	
RDMT 502 [*] Research & Development Mgmt Colloquium	0
RDMT 541 Operational Technology & Innovation	3
SENG 640 Systems Architecture	4
STAT 535 Applied Statistics for Managers II	4
XXXX xxx ^{**} Sequence course	3-4
	14-15
 <u>SPRING</u>	
RDMT 503 [*] Research & Development Mgmt Colloquium	0
RSCH 630 [*] Research Methods	4
ORSC 638 [*] Seminar in Contemporary Leadership	3
XXXX xxx ^{**} Sequence course	3-4
XXXX 799 Thesis Research	3
	13-14
 <u>SUMMER</u>	
RDMT 504 [*] Research & Development Mgmt Colloquium	0
IMGT 669 Business Process Improvement	3
ORSC 647 Organizational Policy and Strategic Mgmt	4
XXXX xxx [*] Sequence course	3-4
XXXX 799 Thesis Research	3
	13-14

2nd FALL

RDMT 505*	Research & Development Mgmt Colloquium	0
OPER 501*	Quantitative Decision Making	3
QMGT 680	Project Risk Analysis	4
XXXX xxx**	Sequence course	3-4
XXXX 799	Thesis Research	<u>3</u>
		13-14

2nd WINTER

RDMT 654*	Seminar in R&D Management	2
EMGT 550*	Engineering Economics Decision Analysis	3
XXXX 799	Thesis Research	<u>3</u>
		8 (Total = 72-75)
		(Min Required = 72)

* Required for full-time Air Force quota students but not part of 48 credit hour requirement for award of degree.

** Only 3 courses required for focus sequence; courses required for full-time Air Force quota students but not part of 48 credit hour requirement for award of degree.