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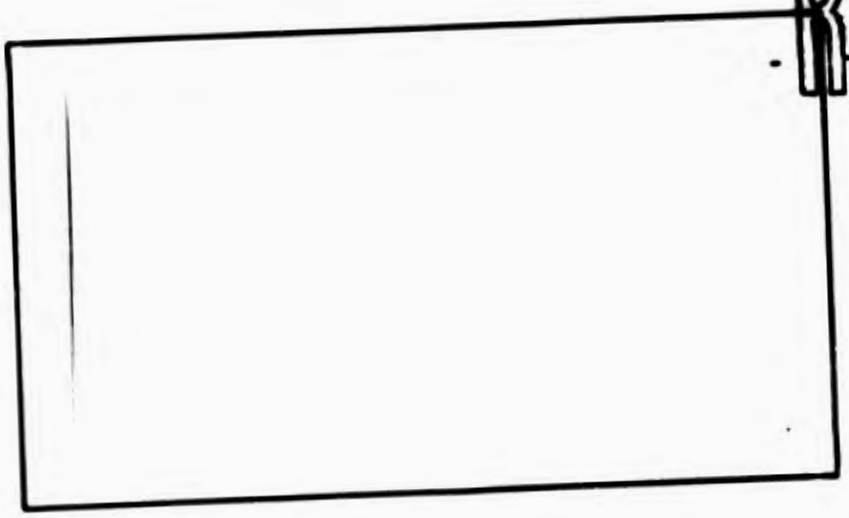

SCHOOL OF ENGINEERING

WRIGHT-PATTERSON AIR FORCE BASE, OHIO

AFLC-WPAFB-AUG 68 6M

THE AIR FORCE ADVANCED EDUCATION

SYSTEM

THESIS

GSA/SM/70-19

Carlton Eugene Thorne
Major USAF

THE
AIR FORCE ADVANCED EDUCATION
SYSTEM

THESIS

Presented to the Faculty of the School of Engineering

of the Air Force Institute of Technology

Air University

in Partial Fulfillment of the

Requirements for the Degree of

Master of Science

by

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Graduate Systems Analysis

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Preface

In this report, I have attempted to systematically identify and examine the establishment of advanced degree requirements, the sources from which advanced degrees are obtained, and the utilization of these hi-value resources as these factors relate to the Air Force advanced education system. Hopefully, this effort will provide a framework which will enable decision-makers at all echelons in the system to weigh the consequences of their actions on the over-all objectives of the system. The Air Force advanced education system, as I have delineated it, involves every organizational level of the Air Force. Any attempt to investigate such a diffuse and complex system in a limited time is subject to raise as many questions as it provides answers, but questions can be of value also if used as a basis for future research. A selected bibliography is included at the conclusion of the report. This bibliography is provided to complement the sources used directly in the preparation of the report and to aid future researchers in their efforts.

I wish to acknowledge the co-operation and support given to me by the many persons in the Officer Programs Branch and the Education Requirements Board Secretariat at Headquarters United States Air Force and at the Air Force Institute of Technology. Special thanks are given to Colonel Thomas S. Ford, Director of the Civilian Institutions Programs, and to Lieutenant Colonel Steve S. Chag of the Officer Programs Branch for their encouragement and assistance in this study and to my faculty advisors, Major Kenneth E. Brant and Major Ronald J. Quayle, for their support and suggestions in the preparation of this report.

A debt of gratitude is owed my wife, Shirley, for the many hours spent typing the drafts and the final report and for her patience and understanding during the course of the research.

Carlton E. Thorne

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Abstract

The report systematizes graduate education in the United States Air Force and examines all elements of the system as they relate to the system objectives. It covers the establishment of advanced degree requirements, the sources of graduate degrees, and the utilization of advanced degrees. The report contains the annual production of advanced degrees by sources with emphasis on gains and losses during fiscal year 1969. The factors which affect the retention of officers with advanced degrees are examined. A proposed advanced education model is presented which will incorporate all sources into the system.

THE AIR FORCE ADVANCED EDUCATION SYSTEM

I. Introduction

In order to perform its mission, the United States Air Force must possess a highly competent corps of officers. The need for officers with advanced academic degrees exists in all areas of the Air Force. This need can be attributed to many factors. Among these factors are the rapid technological advances in weapon system design and operation and the need for Air Force management to keep pace with the scientific and technical changes.

Problem

To provide the necessary expertise and to allow for full development of individual potential requires an advanced education system which effectively utilizes its allocation of resources. The problem addressed in this research report is to establish a framework from which decision-makers at all levels in the system can assess the impact of their decisions upon the fulfillment of the system's objectives. To provide this framework requires a systematic examination of the advanced education system including its objectives, requirements, sources, and resources.

Scope

This thesis is concerned with advanced degree requirements for

line officers, excluding general officers and officers assigned to the Judge Advocate General. Unless otherwise indicated, all data relates to this group of officers. Although the Professional Military Education programs of the Air Force are an important part of an individual officer's career development plan, this report is limited to the advanced education attained through graduate degree programs leading to a master's degree or a doctoral degree. This research effort is an in-depth analysis of the Air Force advanced education system; but due to time limitations, many problem areas that are exposed by the report are left for future research.

Graduate Education at the National Level

Prior to an examination of the Air Force advanced education system, it is important to place this system in proper perspective by looking at advanced education at the National level.

National Objectives. Former President of the United States Lyndon B. Johnson stated the National objectives of education in a report to the Congress (Ref 31:XIV-XIX). He stated:

> A fundamental objective of this Nation is to assure all Americans full and fair opportunity to develop and apply their maximum productive and earning potential.
>
> Education must provide, as a basic part of its human development responsibility, the preparation needed for effective participation in our economic life.
>
> We must provide increased opportunity for education at the postgraduate level. The increasing complexity of many technical and managerial occupations makes education beyond college essential. Moreover, to foster the leadership resources of the Nation, we must augment the supply of qualified teachers and stimulate the creative talent of our managers, scientists, engineers, educators, and other strategic professional personnel.
>
> As the Nation's largest single employer of manpower,

the Federal Government should set an example of effective manpower development and utilization.

In 1968 Federal aid to higher education amounted to $4.4 billion. President Nixon's Budget for 1970 provides over $5 billion for higher education (Ref 34:666-667).

Educational objectives of the Department of Defense are designed to assist an individual toward:

1. More effective job performance.

2. Personal development.

3. Continuing former educational pursuits while in the service.

4. Preparation for continuation of education after armed forces duty is completed.

5. Increasing his value in the National manpower pool (Ref 7:1.2).

Within the Department of Defense, the primary responsibility for education and training rests with the Assistant Secretary of Defense for Manpower. Other assistant secretaries have customarily assumed responsibility for specific programs within their area of interest provided coordination is maintained with the Assistant Secretary of Defense for Manpower (Ref 23:36-37).

The Joint Chiefs of Staff have established a broad policy for identification and review of advanced degree requirements. Each service is given the responsibility of determining its own requirements in the various academic areas (Ref 23:50-51).

National Production. There has been a large increase in earned degrees during the past ten years in the United States. Master's degrees and doctor's degrees have increased by over 100 percent. The past rate of growth is expected to continue during the next ten years.

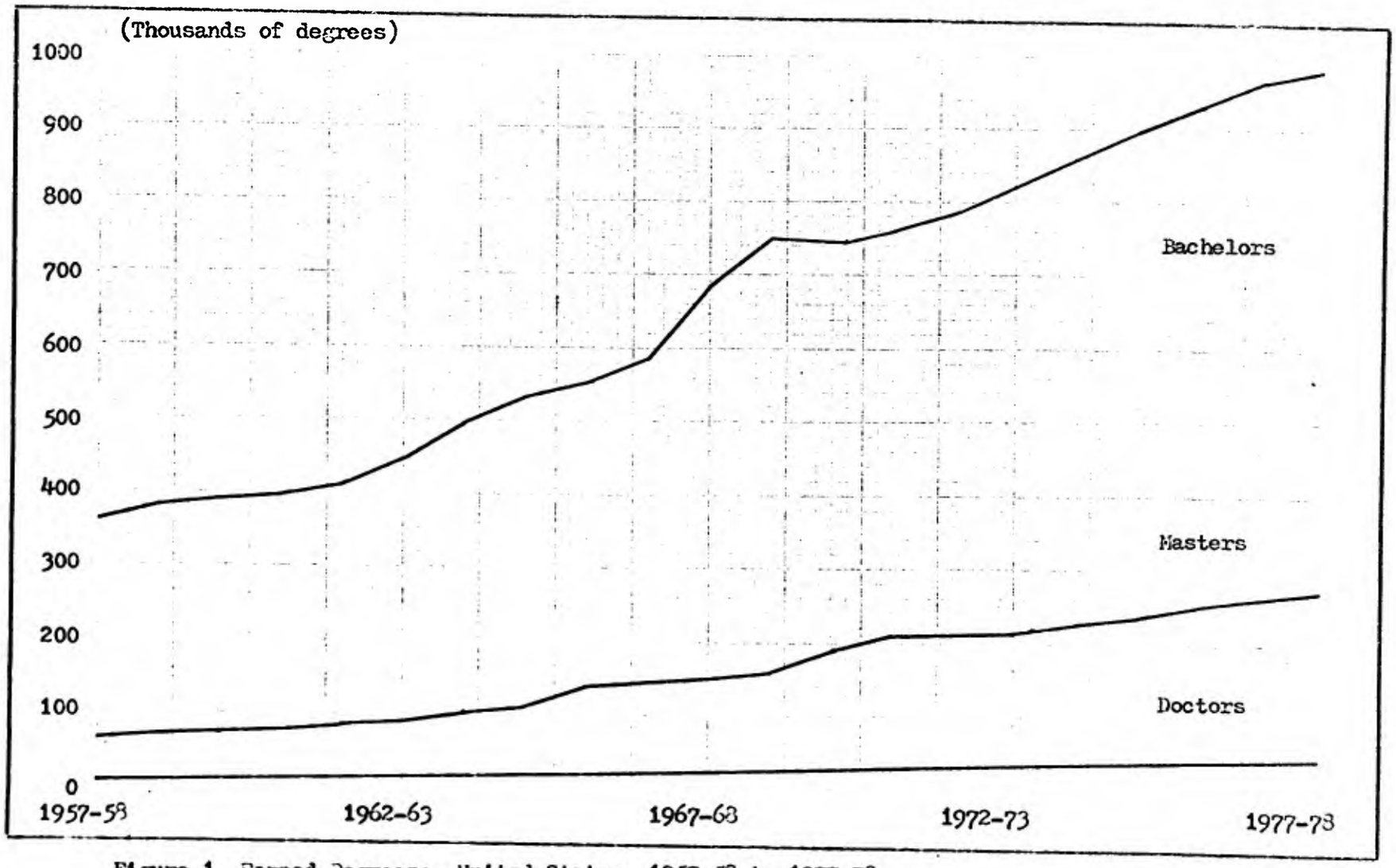

Figure 1 Earned Degrees: United States, 1957-58 to 1977-78

See Appendix A for the past and projected production of advanced degrees in the United States. These figures are shown graphically in Fig. 1. The Department of Health, Education, and Welfare in arriving at projections for the seventies assumed the relationship between college-age population and degrees granted that existed in the past would continue. The trend for more baccalaureate holders to pursue an advanced degree is expected to continue (Ref 66:25-31).

Master's degrees earned in the natural sciences are expected to rise to one-third of all masters awarded in 1977-1978. The current percentage is one-fourth. Doctorates earned in the natural sciences are predicted to rise from 50 percent to 55 percent of all doctor's degrees earned. Percentages of degrees earned by women are predicted to remain at current levels of 34 percent of the master's degrees and 12 percent of the doctor's degrees (Ref 66:26-27).

Air Force Advanced Education System

The advanced education system of the Air Force involves the interactions of many organizations operating at all levels of the Air Force. A graphical model of the system is contained in Fig. 2. The verbal model will be brief by design since the purpose of this chapter is to delimit the system, to identify the major components, and to delineate the objectives of the system.

Present Air Force advanced degree needs are identified by specific manning document positions to Headquarters United States Air Force (Hq. USAF). In the validation process, a forecast is made of future needs. From the inventory of Air Force officers with advanced degrees, assignments are made by the Military Personnel Center to satisfy posi-

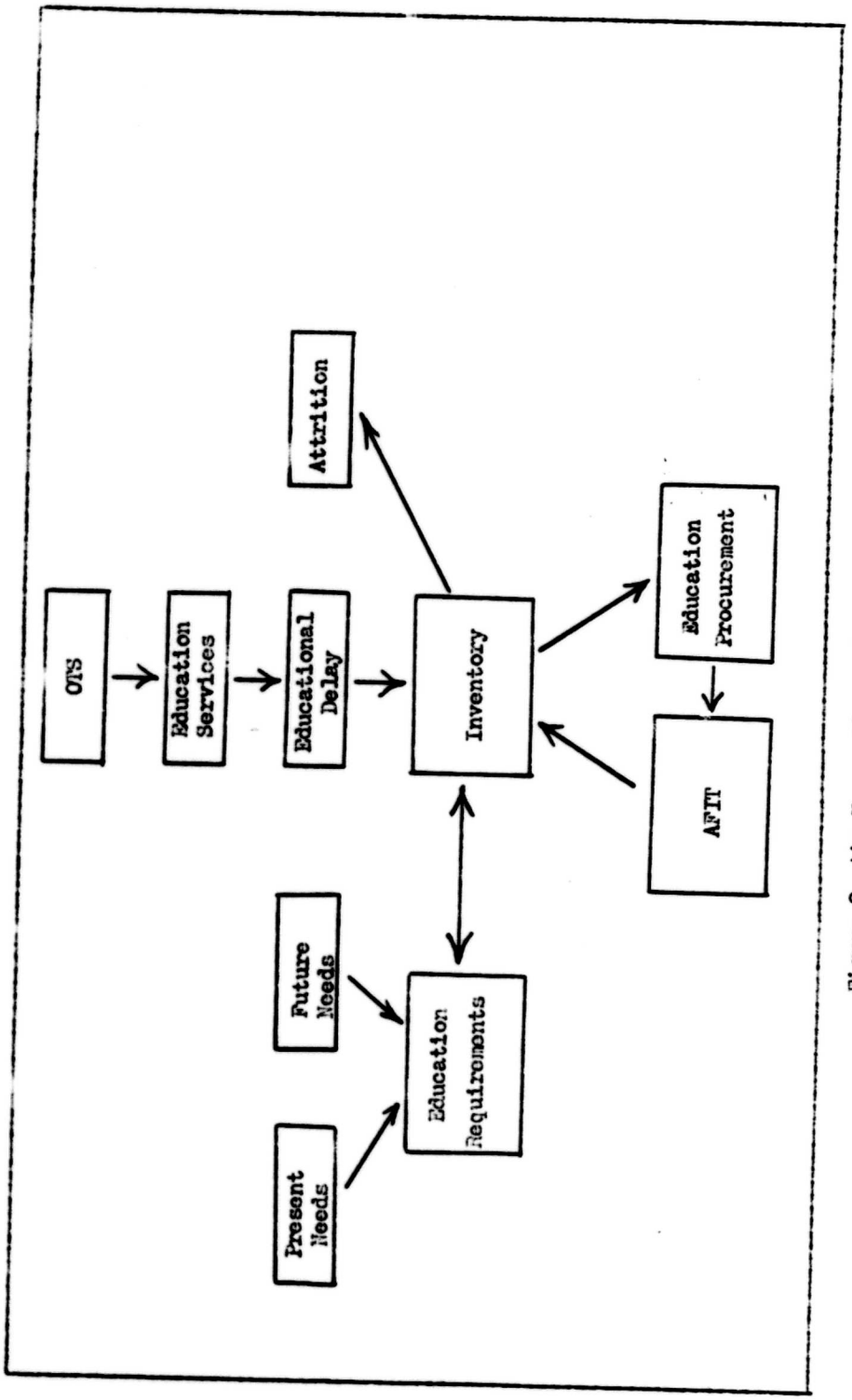

Figure 2 Air Force Advanced Education System

tion needs. The Officer Programs Branch at Hq. USAF identifies educational requirements based on present deficiencies and future needs. These requirements are the basis for development of programs to meet the system objectives. Implementation of Air Force programs is the prime responsibility of the Air Force Institute of Technology. Other sources for advanced degrees include Education Services, Officer Training School, and the Reserve Officer Training Corps Educational Delay program. Retention of highly educated officers is of special interest since educational requirements are directly related to the ability of the Air Force to keep officers with advanced degrees for a full career.

Objectives

The objectives of the Air Force advanced education system are twofold. Simply stated they are:

1. To identify and to satisfy specific Air Force needs for officers possessing advanced degrees.

2. To provide an integral part of an officer's career development plan.

The Air Force recognizes the need for maintenance of a high level of competence by Air Force officers. This requirement was responsible for the establishment of a baccalaureate degree as a minimun educational prerequisite for commissioning of new officers. The necessity for a highly competent corps of officers is attributed to rapid advances in human knowledge and an increasingly complex operational environment. It is recognized that some duty positions require the incumbent to possess a level of formal education at the master's or doctorate degree

level (Ref 15:1).

Air Force Manual 36-23 has as its central theme the essentiality of individual officer career development toward attaining maximum effectiveness in performance of current and future Air Force missions. There are eight formal programs that make up the total officer career development plan. These programs developed by Hq. USAF are Accessions, Skill Training, Professional Military Education, Advanced Degree, Force Distribution and Retraining, Rated Force, Promotions, and the Total Force and Financial programs. To attain maximum effectiveness, the Air Force has assumed the obligation of developing and exploiting fully each officer's intellectual potential and personal qualities (Ref 6:1.1-1.3). It is Air Force policy that career officers will be given priority in developing their potential (Ref 10:1).

Explanation of Terms

Career Development. The officer career development program directive defines career development as:

> The orderly growth and improvement of each officer's potential to meet professional and personal career objectives. This is accomplished by integrating his capabilities, needs, interests, and aptitudes into a planned, systematic program of training and development that is geared to meet Air Force requirements (Ref 10:2).

Doctor's Degree. The highest academic degree conferred for study at the graduate level is the doctor's degree (Ref 35:160). This degree normally requires at least three years of graduate study. There are two types of doctor's degrees, the practitioner or professional and the research. Practitioner or professional degrees are granted in medicine, dental, veterinary, and pharmacy. These degrees do not involve original research and are classified as first professional

degrees by the United States Office of Education. Research doctoral degrees usually require a dissertation which is designed to contribute to the existing state of the art. The Doctor of Education Degree is sometimes considered to be a professional degree, but it does require a dissertation. Research doctoral degrees conferred by ten or more institutions in the United States include the Doctor of Philosophy, Doctor of Jurisprudence, and Doctor of Business Administration (Ref 32:26-28).

The doctor's degree was first conferred in the middle of the twelfth century. It was first used by faculties of theology, law, and medicine; but during the nineteenth century, the Doctor of Philosophy had become the highest degree for all academic scholarship in German universities (Ref 71:165-166). The Doctor of Philosophy was first conferred in the United States at Yale University in 1861 to three men (Ref 32:27).

Graduate Study. Graduate study is formal study beyond the baccalaureate or first professional level. Graduate study is usually pursued for the purpose of obtaining an advanced degree. It is also known as postgraduate study (Ref 35:531-532).

Line Officer. An officer engaged in operational duties is referred to as a line officer (Ref 37:301).

Master's Degree. The master's degree is an academic degree granted for completion of a graduate level course of study. The master's degree ranks above the bachelor's degree and below the doctor's degree (Ref 35:160). It is given for a wide range of work which varies from one year to as much as three years. Standards vary between institutions and sometimes within a single department. In many fields, the master's

degree is a terminal degree; while in other fields, it is gained in the course of obtaining a doctoral degree (Ref 24:186).

The master's degree originated in the Middle Ages and ranked along with the doctor's degree. It was the highest degree granted in England until after World War I (Ref 71:166). The present form of the master's degree was initiated by Harvard University in 1869. Prior to that time, the master's degree was conferred almost automatically on baccalaureate graduates who were engaged in literary or professional pursuits (Ref 32:25-26).

Professional Military Education. Professional Military Education prepares officers for higher command and staff responsibilities. This education deals with the theoretical and applied knowledge of the profession of arms (Ref 17:1).

II. Advanced Degree Requirements

There have been five distinct periods in the history of Air Force advanced degree requirements. The present system with its Education Requirements Board and career area panels relies heavily on the quarterly position surveys. A key factor in the reporting of advanced degree requirements is the identification of academic qualifications required by the positions.

Past Systems

Prior to 1959. Since the Air Force first became a separate service, educational requirements have been the concern of many working groups and committees. A detailed history of this early development is contained in a research paper by A. T. Reid (Ref 64:3-18). Although there was discontinuity in those early efforts, much of the basic research and organizational structuring was accomplished. It is significant to note that requirements were stated as percentages of Air Force Specialty Code authorizations since this methodology was to be carried over to later systems.

1959-1965. In 1959 the first Education Requirements Board was established at Headquarters Air University. The Board was chaired by a general officer and membership consisted of eight officers representing the Air Force Academy, Hq. USAF, and the major air commands. The Board was assisted by a permanent secretariat and 13 panels of officers. The panels were charged with the specific responsibility of determining

advanced degree requirements in terms of percentages for each Air Force Specialty Code by level of degree and academic specialty. This first Education Requirements Board was discontinued in 1965. Reasons for its failure to survive were attributed to the belief by the commands that the Board was an Air University board and that the advanced degree requirements as determined by the Board were unrealistic (Ref 54).

In fiscal year 1962, the stated requirements for advanced degrees were 14,069 (Ref 22:2-3). Fiscal year 1963 needs were approximately 17,290. A breakdown by academic areas of the 1963 requirements is shown in Table I. Requirements for advanced degrees that were established by the original Education Requirements Board have no value for present statistical analysis due to the changes in methodology employed in computing the requirements. It will be shown later in this report that these requirements are considerably larger than later requirements that were determined by position surveys.

1965-1967. With the elimination of the Education Requirements Board in 1965, responsibility for determining advanced degree needs was assumed by the Education Plans Branch, Plans and Analysis Division, Directorate of Personnel Planning at Hq. USAF. The basis for the graduate degree requirements during the years 1965 through 1967 was the annual position survey of all officer manning document positions. The initial survey for fiscal year 1965 resulted in a total requirement for 11,350 advanced degrees. In fiscal year 1966, commands were instructed by Hq. USAF to report only those requirements which were considered to be vitally essential (Ref 54). As a result of the more restrictive instructions, the advanced degree requirements established by that survey were 7,763 (Ref 23:53).

Table I

Advanced Degree Requirements

1963

Area of Study	Masters	Doctors
Science/Engineering		
Physical/Biology Sciences	2340	260
Engineering	4550	260
Mathematics	130	*
Bus. Admin./Management	7540	130
Social Sciences	910	130
Human./Art/Education	910	130
Total (approximate)	16380	910

* Less than .1%

(From Ref 56:85-89)

Table II

Advanced Degree Requirements

As of 30 June 1968

Area of Study	Masters	Doctors
Interarea Specialization	208	11
Admin., Management	4,564	77
Arts, Human., Educ.	419	70
Biology, Agri. Science	22	11
Engineering	3,624	294
Mathematics	248	53
Physical Science	1,273	249
Social Science	476	115
Total	10,834	880

(From Ref 28)

As of 30 June 1969

Area of Study	Masters	Doctors
Interarea Specialization	205	11
Admin., Management	4,577	79
Arts, Human., Educ.	391	65
Biology, Agri. Science	20	11
Engineering	3,635	316
Mathematics	235	68
Physical Science	2,179	294
Social Science	467	132
Total	11,709	996

(From Ref 29)

1967-1969. The major change that occurred in the system during the period from 1967 to 1969 was the method by which commands reported their advanced degree requirements. The annual survey was replaced by a review of positions, by career field, on a two year cycle. The schedule of position reviews is contained in Appendix B. Position survey reports were due at the Military Personnel Center on the last day of the quarter being reviewed. Consolidated reports were forwarded to the Director of Personnel Planning at Hq. USAF for validation and use in the development of advanced degree programs for the Air Force Institute of Technology (Ref 15:1-3). Graduate degree requirements as of 30 June 1968 were 11,714 (Ref 28). As of 30 June 1969, the advanced degree requirements were 12,705 (Ref 29). See Table II for requirements by academic area of study and degree level.

Present System

An Air Force Education Requirements Board was established in 1969. The Board has the responsibility for identifying the advanced degree needs of the Air Force and providing for the full career development of the Air Force officer. The Board is composed of the Director of Personnel Planning as chairman and at least eight members appointed by the Chief of Staff. A panel of specialists from each career area meets once every two years. During the panel meeting, they validate current needs based on the position review of their career utilization field and make a five year projection of advanced degree needs. The panel meetings are held in the quarter following the position surveys (Ref 17:1-2). It is expected that each panel will meet for approximately two weeks. The Education Requirements Board is to meet five

times a year for one day each time. Four of the meetings will be to review panel reports and one meeting to review future oriented concepts (Ref 54).

The comptroller career field panel is the only one that has met and submitted a report to the Board under the new system. Results indicate few changes made in the requirements established by the major air commands. The five year forecast of needs was essentially the same as present requirements. The panel felt that the requirements for advanced degrees would increase but that those increases would be counterbalanced by reductions in manpower (Ref 49).

A permanent staff administers the Air Force Education Requirements Board affairs. This staff is primarily responsible for providing guidance and assistance to the Board and to the panels and to monitor the position surveys. A systems analyst position was originally authorized on the permanent staff. This position would have been responsible for application of analytical techniques in determining requirements, forecasting future requirements, and maximum quantification of the system (Ref 17:2-3). This position represented the most significant difference between the earlier Education Requirements Board and the present Board. It is not authorized under the present manning. The permanent staff is presently authorized two military and two civilians. One of the civilian positions is a secretarial position, and the incumbent of the other civil service position is primarily engaged in duties related to the Professional Military Education programs.

Position Evaluation

The position evaluations conducted by the major air commands are

the basic determinant of advanced degree requirements. Results of these evaluations are transmitted to Hq. USAF on standard 80-column data automation cards. Justification for establishment of an advanced degree requirement is contained in column 80 (Ref 4:7.13). The number punched into this space matches a decision criterion contained in Appendix C.

Within Air Force Regulation 53-7 is contained the following guidance for position evaluation:

> Many intangible factors, some largely subjective, will influence the commander's decision that incumbents in specific positions must have advanced degrees. However, to assure that the Air Force obtains the necessary competence with its available personnel and funds, his decision should be as objective as possible.
>
> The HAF P207 report identifies authorized manning-document positions that clearly need an increased competence normally obtainable only by an officer educated at the masters or doctoral degree level.
>
> Examine each position within the framework of the mission, organization, functions, and responsibilities of the activity to which it is assigned. Use considered judgement in each instance to determine the level of education incumbent will need to meet the professional and technical standards established by the activity. If several officer positions of similar grade and AFSC are authorized, all may not require the same degree level or academic specialty. A mixture of educational levels and specialty training may be required (Ref 15:1-2).

Air University has supplemented the Air Force directive (Ref 14). That command has directed that all authorized officer positions will be reviewed annually. Each new doctorate requirement must be documented on a modified Air Force form, and the concise job description contained on that form is used by an Air University working group to validate the requirement. Each Air University activity has been directed to appoint a monitor for the advanced degree requirements program.

Identification by Academic Specialty

The academic qualifications of an officer are contained in a four digit code. The four digits denote the:

1. Area of study.
2. Major academic field.
3. Specialization.
4. Subspecialization.

The areas of study are nine groupings of closely related fields plus an interarea specialization which contains academic specializations related to two or more of the general areas of study. Subdivision of the area of study is by major academic field. This indicates completion of at least 18 semester hours in the particular major academic field. Specialization is a subdivision of the major academic field and is awarded for completion of three related courses. Propulsion is an example of specialization in the major academic field of aeronautical engineering. Usually specialization is the closest identifier of academic achievement; however, the fourth digit of the code may be used to denote a group of courses or on-the-job experiences which relate to a specialization (Ref 5:1-2). Areas of study, major academic fields, and associated codes are shown in Table III. The medical and law areas of study are omitted since these areas are not of interest in this report. The complete listing of specializations and subspecializations in contained in AFM 300-4 (Ref 8).

Academic qualifications necessary for those positions requiring a master's degree or doctor's degree are transmitted to Hq. USAF by the major air commands through use of the first three digits of the academic code (Ref 4:7.13).

Table III

Air Force Areas of Study

and Major Academic Fields

Area of Study	Code	Major Academic Fields
Interarea Specializations	0	
Administration, Management, and Military Science	1	
	A	Business Administration and/or Management
	B	Military Science
Arts, Humanities, and Education	2	
	A	Chaplaincy and Pastoral Care
	B	Education
	C	Fine and Applied Arts
	D	Foreign Languages
	E	Humanities
	F	Language and Communicative Arts
	G	Philosophy
	H	Religion
Biological and Agricultural Sciences	3	
	A	Biology
	B	Agriculture
Engineering	4	
	A	Aeronautical
	B	Aerospace
	C	Agricultural

Table III--Continued

	D	Architectural
	E	Astronautical
	F	Ceramic
	G	Chemical
	H	Civil
	I	Electrical
	J	Engineering General
	K	Engineering Sciences
	L	Industrial
	M	Mechanical
	N	Metallurgical
	O	Mining and Petroleum
	P	Naval Architecture
	Q	Nuclear
	R	Safety
	S	Space Physics
	T	Systems
	U	Textile
Mathematics	6	
	A	Algebra
	B	Analysis and Functional Analysis
	C	Geometry
	D	Logic and Foundations
	E	Mathematics of Resource Use
	F	Number Theory

Table III--Continued

	G	Numerical Methods and Computations
	H	Probability
	I	Statistics
	J	Topology
Physical Sciences	8	
	A	Astronomy
	B	Cartographic Sciences
	C	Chemistry
	D	Earth Sciences
	E	Hydrosphoric Sciences
	F	Meteorology
	G	Photographic Sciences
	H	Physics
Social Sciences	9	
	A	Anthropology
	B	Economics
	C	Geography
	D	History
	E	Political Science
	F	Psychology
	G	Public Administration
	H	Sociology

(From Ref 8:22.107-22.140)

In addition to its use in matching requirements and resources by the Air Force Military Personnel Center, the academic code serves another important function. The academic code is used by the Air Force Transcript Repository to identify to the Air Force Institute of Technology Selection Board those officers academically qualified for specific advanced degree programs (Ref 53). An individual's academic code contained in his Uniform Officer Record and the code assigned by the Transcript Repository do not necessarily agree. Codes contained in the Uniform Officer Record are assigned by the individual's local personnel office. The code maintained by the Transcript Repository is assigned to the individual by Repository personnel when transcripts are received. The Uniform Officer Record contains information for two levels of academic achievement. If, for example, an officer has a bachelor's degree and a master's degree, the Record will contain an academic code for each level. Fig. 3 is an example of the Uniform Officer Record academic information in coded form and in clear text. The ability of the Uniform Officer Record to reliably reflect the academic qualifications of an officer is questionable. In a random sample of 100 officers with master's degrees, the Uniform Officer Record academic codes differed from the Transcript Repository codes in 26 instances. Areas of study and major academic fields were compared, while differences in specializations and subspecializations were ignored. If the Transcript Repository codes are assumed to be accurate, then a 0.95 confidence interval for the actual proportion of incorrect academic codes contained in the Uniform Officer Records is 18.4 percent to 35.4 percent. The computation of the confidence interval is contained in Appendix D.

The academic codes of 22 officers were obtained from a Military

Decoded Form

46164128Ø OHMAN NILS B

EBB ACAD-EDUC-LEVEL **BACH

EBC YR-HGHST-ACAD-LEVEL **7Ø

EBD HIGH-ACAD-SPEC **SYSTEMS ENGINEERING

EBE METHD-ACAD-EDUC-LVL-HIGH **RESIDENT INST

EBF HIGH-EDUC-SCHOOL ** AFIT SE

EBH 2ND-HIGH-EDUC-LEVEL **BACH

EBJ 2ND-HIGH-ACAD-SPEC **ASTRONAUTICAL ENGINEERING

EBK METHD-ACAD-EDUC-LVL-2ND **MIL SVC ACAD

EBL 2ND-HIGH-EDUC-SCHOOL **USAFA COLO

Coded Form

46164128Ø OHMAN NILS B

EBB **4

EBC **7Ø

EBD **4TYY

EBE **R

EBF ** AFIT SE

EBH **K

EBJ **4EYY

EBK **A

EBL **USAFA COLO

Figure 3 Example of Uniform Officer Record Education Data

Personnel Center Roster of USAF Officers (Ref 30). All 22 officers were graduates of the Air Force Institute of Technology School of Engineering, Graduate Systems Analysis program. The 21 month master's degree program completed by these officers was essentially the same. Coursework consisted of approximately 24 hours of mathematics and statistics, 12 hours of economic analysis, 18 hours of operations research, 7 hours of management, a formal thesis, and 15 hours of electives from the above areas. Eight of the officers were assigned the first code from Table IV. Two officers had code number two, and six officers had codes corresponding to number three from Table IV. Of the remaining officers, three were systems engineering, two in mathematics, and one in physics. Five of the graduates were not shown as having a master's degree.

The Uniform Officer Record academic codes of 17 officers currently enrolled in the Graduate Systems Analysis program were obtained. Thirteen of the officers were shown to be enrolled in a graduate systems engineering program (Code four, Table IV). Four of the students had codes that matched code number three.

Systems analysis was assigned the third code from Table IV until recently by the Transcript Repository. As a result of discussions with this author, the Repository is now coding systems analysis under the interarea specialization area of study with a systems analysis specialization (Code one, Table IV).

An academic field closely related to systems analysis is operations research. There are six possible codes for operations research involving five different areas of study. To summarize, operations research was coded in the following ways:

Table IV

Academic Codes and Qualifications Assigned to

Systems Analysis Graduates and Students

No. 1 Code - OYJY

Area of study - Interarea specialization.

Major academic field - No further breakdown.

Specialization - Systems analysis.

Subspecialization - No further breakdown.

No. 2 Code - 1AYY

Area of study - Business administration/management/ military science.

Major academic field - Management.

Specialization - No further breakdown.

Subspecialization - No further breakdown.

No. 3 Code - 1AMG

Area of study - Business administration/management/ military science.

Major academic field - Management.

Specialization - Logistics management.

Subspecialization - Systems analysis.

No. 4 Code - 4TYY

Area of study - Engineering.

Major academic field - Systems engineering.

Specialization - No further breakdown.

Subspecialization - No further breakdown.

1. A specialization of systems engineering.

2. A specialization of mathematics of resource use.

3. A specialization of the interarea specialization area of study.

4. A subspecialization of the industrial management specialization in the management academic field.

5. A subspecialization of operational analysis specialization in the major academic field of industrial engineering.

6. A subspecialization of physics (Ref 8:22.4-22.106).

To illustrate how it is possible for two officers with identical degrees to have different academic codes reflected on their Uniform Officer Records, the data processing academic field is examined. Electronic data processing is defined by AFM 300-4 as "a study of the method of obtaining information from a mass of numerical and alphabetic data by means of processing the data through electronmagnetic computer devices" (Ref 8:22.31). The manual similarly defines automated data processing systems as "a study of the methods of obtaining meaningful information from a mass of numerical or alphabetic data, by means of processing the data through electronic computers and mechanical devices" (Ref 8:22.10). Other topical titles with related definitions in the manual include:

1. Electronic computation.

2. Applications of data processing.

3. Computer theory.

4. Data processing.

5. Data processing in operations research.

6. Digital computers, coding, and programming.

7. Digital computer, logic, and design.

8. Digital data systems (Ref 8:22.4-22.106).

The academic codes were different for each of the titles resulting in 13 possible codes. The areas of study included business administration/ management/military science, engineering, mathematics, and medical. In all cases data processing was classified as a specialization or a subspecialization.

There is not a unique system of classifying academic specialties. The American Council on Education in reporting data on higher education uses a more abbreviated system than the Air Force (Ref 20:9186-9187). The United States Department of Health, Education, and Welfare uses the following two broad classifications:

1. Natural sciences and related professions.

2. Social science, humanities, and related professions.

Fields of study are then listed under the two categories (Ref 66:36-40). These two classification systems are shown in Appendix E and Appendix F.

The importance of the academic coding system cannot be over stressed. It must as a minimum accomplish the following:

1. Accurately describe the academic qualifications necessary for those positions requiring advanced degrees.

2. Minimize the interpretation of college transcripts required by personnel in the central base personnel offices.

3. Insure standardization in depicting an officer's academic qualifications.

III. Sources of Advanced Degrees

The advanced education system depends upon the Air Force Institute of Technology to satisfy specific graduate degree requirements of the Air Force. This source accounts for over half of the total input of advanced degrees into the system; while Education Services, Educational Delays, and the Officer Training School contribute the remaining degrees. The outputs according to numbers and types from each of the sources will be explored in this chapter.

Air Force Institute of Technology

The Air Force Institute of Technology mission is to provide education and training to meet Air Force requirements (Ref 16:1). To accomplish this mission, the Institute has established varied programs. This report will examine the outputs from those programs which contribute to the Air Force inventory of advanced degrees.

Civilian Institutions Program. The Civilian Institutions Directorate is the largest single source for advanced degrees. There are approximately 114 institutions currently utilized by the Directorate for officer programs (Ref 26:15-17). The enrollment in advanced degree programs as of 31 December 1969 was 1,569. Of these, there were 1,189 seeking master's degrees and 380 in doctoral degree programs. Enrollment in specific programs and areas of study is shown in Table V.

Advanced degrees obtained through the Civilian Institutions programs have steadily increased in recent years. Fiscal year 1969 was

Table V

Enrollment

In Civilian Institutions Programs

As of 31 December 1969

	Masters	Doctors	Total
Air Force Academy Instructors	61	59	120
Arts/Social Science	105	13	118
Biology/Physical Sciences	242	53	295
Engineering	329	138	467
Management	380	38	418
AFIT Instructors	0	31	31
Air University Instructors	7	29	36
Other	5	5	10
Fellowships/Scholarships	60	14	74
Total	1189	380	1569

(From Ref 26:1-10)

Table VI

Advanced Degrees

Obtained From Civilian Institutions Programs

		CY65	CY66	CY67	FY69
Air Force Academy Instructors	Masters	27	35	36	26
	Doctors	20	24	23	15
Arts/Social Science	Masters	41	46	70	64
	Doctors	5	6	9	5
Biology/Physical Sciences	Masters	141	142	133	119
	Doctors	20	23	33	10
Engineering	Masters	356	187	147	377
	Doctors	20	37	22	25
Management	Masters	248	373	203	412
	Doctors	3	3	1	3
AFIT/AU Instructors	Masters				4
	Doctors	1	9	5	5
Fellowships/Scholarships	Masters			34	56
	Doctors			5	2
Minuteman Education	Masters		21	234	19
Total Masters		813	804	857	1077
Total Doctors		69	102	98	65
Total		882	906	955	1142

CY65 (From Ref 58:39)
CY66 (From Ref 59:40)
CY67 (From Ref 60:56)
FY69 (From Ref 61:42)

the first year that the number of degrees in areas of study covered by this report exceeded 1,000 degrees. Table VI shows the annual production of degrees. Prior to fiscal year 1969, production summaries were computed on a calendar year basis; therefore, production during the period 1 January 1968 through 30 June 1968 is not shown. The table does portray the composition of the yearly outputs by area of study and special programs.

School of Engineering. The Air Force Institute of Technology School of Engineering became an accredited institution to grant master's degrees on 1 April 1960 by the North Central Association of Colleges and Secondary Schools (Ref 3:8). All graduate programs are from the engineering area of study with the exception of the systems analysis and systems management programs. The yearly production of master's degrees from the School of Engineering is shown in Table VII.

School of Systems and Logistics. The School of Systems and Logistics was accredited by the North Central Association of Colleges and Secondary Schools on 20 March 1963 to grant graduate degrees (Ref 67:23). The yearly quota of students has been set at 120 (Ref 68:18-19). The output from this source is shown in Table VII.

Education Services

The Education Services program provides academic opportunities for all Air Force members. It spans the range of studies from elementary education through graduate study. All Education Services programs are subject to the availability of funds, personnel, facilities, and changing priorities of emphasis. The objectives of the program are to provide opportunities for learning throughout an Air Force member's career and to provide the required educational background to meet

Table VII

Advanced Degrees

Obtained From Resident Programs

School of Engineering

Year	Masters	Doctors
Calendar Year 1963	146	
Calendar Year 1964	209	
Calendar Year 1965	216	
Calendar Year 1966	185 *	
Calendar Year 1967	151	
Calendar Year 1968	168	
Fiscal Year 1969	254 **	4

School of Systems and Logistics

Year	Masters
Calendar Year 1963	38
Calendar Year 1964	44
Calendar Year 1965	48
Calendar Year 1966	52
Calendar Year 1967	115
Calendar Year 1968	99
Fiscal Year 1969	99 ***

* Includes 57 Minuteman Education graduates.

** Includes 37 of the calendar year 1968 graduates.

*** Calendar year 1968 and fiscal year 1969 reflect the same graduates since graduation occurred in August 1968.

(From Ref 38:14)
(From Ref 58:39)
(From Ref 59:40)
(From Ref 60:56)
(From Ref 61:42)

(From Ref 39:14-15)
(From Ref 67:23)
(From Ref 63:18)
(From Ref 40:39)
(From Ref 41:133)

Air Force and National objectives (Ref 7:1-1).

The magnitude of the program can be seen from the 1969 participation in the college level programs. College course enrollment for officers was 33,124; while for enlisted men, the total was 133,762. Funds expended by the Air Force Education Services were more than $5 million in 1969. Most of the money was spent on college courses (Ref 33:1A). Officers who take off-duty college courses must have two years active duty remaining at the completion of the course or incur a two year commitment. Enlisted men do not incur a service obligation. Service members have the option of receiving three-fourths tuition assistance from Air Force funds, or they may elect to use Veterans Administration benefits. An Education Services technician with 12 years experience noted that the trend has been toward preparation for civilian occupations rather than for service requirements (Ref 48).

There were 722 graduate degrees earned by Education Services participants in fiscal year 1969. Of these, 644 masters and 8 doctorates were earned by Air Force officers. Courses of study offered at each base are subject to the interest of the participants and availability from local colleges (Ref 50).

A survey of all officers with advanced degrees in 1966 suggested that officers who obtained graduate degrees at their own expense or with minimum Air Force support were not being utilized (Ref 23:60). Education Services officers are not aware of Air Force advanced degree requirements under the present system. A proposal is currently being staffed at Hq. USAF which would provide Education Services with programming documents of advanced degree requirements. These documents would be used as guidance in establishing new programs. The proposal

would also defer permanent change of station (PCS) moves for officers nearing graduate degree completion through the Education Services program (Ref 49).

Table VIII shows the area of study and the major academic field of 142 master's degrees earned through off-duty or Bootstrap study by Air Force officers during fiscal year 1969. Data for off-duty and Bootstrap degrees was taken from AF forms 245 received by the Air Force Transcript Repository from Education Services Officers throughout the world. Shown also are the 120 advanced degrees earned by attendees at the Professional Military Education schools (Ref 42).

A 1966 Officer Education Study noted that all Services had an abundance of advanced degrees in the social sciences. They concluded that the officers were earning them by other than Service sponsored programs or had them on entry (Ref 23:53). The advanced degrees gained through the Education Services program in fiscal year 1969 show a preponderance of degrees in the social sciences and related professions. The number of business administration/management master's degrees added to the Air Force inventory during fiscal year 1969 is estimated to be 364 to 422. See Appendix G for confidence interval computation. This represents a sizable input into an area of study where requirements exist in the higher ranks. Of interest also is the fact that over half of the degrees in the sample of 142 were conferred by the University of Southern California which operates at many Air Force installations in the United States and overseas. Nearly all of the masters in education and all of the masters in aerospace operations management were granted by that institution.

The master's degrees from the Professional Military Education

Table VIII

Master's Degrees Gained From the
Education Services Program--FY 1969

Administration, Management, Military Science		
Business/Management	34	
Aerospace Operations Management	54	
Accounting	2	
Finance	1	91
Arts, Humanities, and Education		
Education	26	
Theology	1	
Music	1	
Speech	1	29
Biological and Agricultural Sciences		
Biology	1	1
Engineering		
Mechanical	2	2
Mathematics	0	0
Physical Sciences		
Chemistry	1	
Meteorology	1	
Physics	1	3

Table VIII--Continued

Social Sciences		
Economics	1	
International Affairs	1	
Government and Politics	3	
Public Administration	3	
Political Science	1	
Psychology	3	
History	1	13
Other		
Space Technology	2	
Computer Software Design	1	3
Air War College		
Political Science	31	
Business Administration	10	41
Air Command and Staff College		
Political Science	20	
Business Administration	59	79
Unknown		382
Total		644

Table IX

Master's Degrees Earned by Attendees

At Professional Military Education Schools

Year	Air War College	Air Command and Staff College
Fiscal Year 1962	88	
Fiscal Year 1963	72	211
Fiscal Year 1964	95	205
Fiscal Year 1965	60	231
Fiscal Year 1966	66	163
Fiscal Year 1967	74	116
Fiscal Year 1968	54	84
Fiscal Year 1969	41	79

(From Ref 42)

schools were earned by students at those schools who elected to pursue an advanced degree in conjunction with the service school program. Auburn University manages this program and offers programs in business administration and political science. Advanced degrees from this source have declined in recent years due to the reduced attendance at the Professional Military Education schools. Table IX shows the number of degrees from this source by fiscal year since 1963.

Educational Delay

The Educational Delay program enables an Air Force Reserve Officer Training Corps (AFROTC) graduate to defer entry to active duty after commissioning in order to obtain an additional degree, usually an advanced degree. This program is designed to help meet graduate degree requirements of the Air Force (Ref 13:2).

Interest in the program has steadily increased since 1962 as evidenced by Table X on this page. The number enrolled as of 31 December 1969 in areas of study excluding law and medical was 1,174, which is approximately half of the total enrollment. A breakdown of 31 December 1969 enrollment by area of study and degree level in contained in Table XI (Ref 26:23).

Table X

Educational Delay Enrollment

November 1962	778
November 1963	815
November 1964	974
November 1965	1,169
November 1966	1,351
November 1967	1,384
November 1968	2,035
November 1969	2,337
January 1970	2,347

(From Ref 47)

In fiscal year 1969, the Air Force gained 622 advanced degrees

Table XI

Educational Delay Program

Line Officers

Graduates--FY 1969

Area of Study	Masters	Doctors
Administration/Management	120	4
Arts/Humanities/Education	79	2
Biology/Agriculture Science	32	5
Engineering	151	26
Mathematics	22	2
Physical Science	35	20
Social Science	113	11
Total	552	70

Enrollment--31 December 1969

Area of Study	Masters	Doctors
Administration/Management	208	5
Arts/Humanities/Education	86	2
Biology/Agriculture Science	66	5
Engineering	290	50
Mathematics	63	12
Physical Science	136	54
Social Science	161	35
Total	1010	164

(From Ref 26:23)

from the Educational Delay program. Types of degrees by area of study are listed in Table XI. The Air Force will allow any course of study at the master's level, but approval to pursue a doctoral degree is subject to the needs of the Air Force (Ref 47).

In addition to the administrative costs involved in operating the program, the length of the delay results in higher salary costs. Time spent in delay status results in a higher base pay since the entering officer's pay is based on commissioned service and not active duty. Officers who receive a one or two year delay are promoted to first lieutenant after 12 months. An officer with a three year delay will enter the Air Force as a first lieutenant and will be promoted to captain normally after 18 months active duty (Ref 11:4-7).

Table XII compares the pay and allowances received during four years of active duty by officers with educational delays and officers without a delay. Pay and allowances for nonrated officers with dependents and current promotion policies were used in computing the salaries. Since the Air Force had the option of requiring active duty at the time of commissioning or allowing an educational delay, the differential pay is the cost of the advanced degree.

Officer Training School

The Officer Training School is a precommissioning program whereby college graduates are selected for the school based on their academic qualifications and the needs of the Air Force. School graduates are appointed second lieutenants in the Air Force and serve a minimum of four years active duty (Ref 18:2,17).

In fiscal year 1969, this source provided 113 master's degrees to

Table XII

Gross Pay and Allowances for

Four Years Active Duty

Officer Without a Delay	$32,097.24
Officer With One Year Delay	35,930.34
Officer With Two Years Delay	38,275.74
Officer With Three Years Delay	42,701.94
Pay Differences	
One Year Delay	$ 3,833.10
Two Years Delay	6,178.50
Three Years Delay	10,604.70

the Air Force. Table XIII gives the areas of study and major academic fields represented by these degrees. The number of advanced degrees from this source is small in relation to the other sources, but they represent considerable savings of education funds since they were gained at no expense to the Air Force.

Minuteman Education Program

The Air Force Institute of Technology manages the Minuteman Education programs at six Strategic Air Command minuteman missile bases. These programs offer an opportunity for an officer to earn a master's degree during his four year tour of duty as a launch control officer. Civilian schools under contract with the Air Force Institute of Technology offer either business administration, industrial management, or economics. There was a total enrollment of 662 officers as of 31 January 1970 (Ref 51).

Annual cost of contracting the Minuteman Education programs is approximately $1.3 million per year. Graduates from this source are expected to total 100 each year. Thus far in fiscal year 1970, there have been 37 graduates (Ref 46). Previous yearly outputs are cont' in the Air Force Institute of Technology production figures.

Although graduates from this source are included in the Air Force Institute of Technology production summaries, they are not programmed against specific Air Force advanced degree requirements.

Table XIII

Master's Degrees Gained From the
Officer Training School--FY 1969

Administration, Management, Military Science		
Business Administration	17	
Accounting/Finance	3	20
Arts, Humanities, Education		
Education	4	
Commercial Arts	4	
Language	1	9
Biology, Agriculture Science		
Biology	2	
Zoology	1	
Agriculture	6	9
Engineering		
Electrical	17	
Mechanical	6	
Astroengineering	1	
Chemical	1	
Aeronautical	8	
Civil	5	
General	4	42

Table XIII--Continued

Mathematics		8
Physical Sciences		
Physics	1	
Meteorology	1	
Chemistry	2	
Physical Science	1	5
Social Sciences		
Psychology	5	
Economics	5	
Sociology	1	
Social Science	1	
History	1	
Social Studies	2	15
Other		5
Total FY 1969		113

(From Ref 62)

IV. Retention of Advanced Degrees

The advanced education system must provide officers to satisfy newly established requirements; unfilled requirements; and, of equal importance, for the orderly replacement of advanced degrees lost through attrition. Since actual requirements are basically the difference between the inventory of officers with advanced degrees and the number of positions requiring a graduate level of education, the retention of an officer with a graduate degree is equivalent to producing one.

Factors Affecting Attrition

Factors affecting the attrition of officers with advanced degrees are largely due to forces outside the advanced education system. In the civilian sector, the three reasons most often given for changing jobs are:

1. Higher pay.
2. More chance for advancement.
3. More challenging work (Ref 55:38).

Reasons for leaving the Air Force given by Air Force Institute of Technology graduates of 1955 and 1956 were:

1. Promotions not on merit.
2. Better jobs.
3. Higher pay (Ref 36:36).

It is interesting to note the similarity between the two groups in reasons for changing jobs. The promotion and pay factors cannot be

directly altered by the system as defined by this report, but attrition rates can be changed by the system if "better jobs" is assumed to imply proper utilization of an officer's academic qualifications.

Compensation for Advanced Degrees

A study of military compensation by the Defense Department in 1962 addressed the specific problem of determining if special compensation was needed for officers with advanced degrees. The study concluded that special pay for advanced degrees was not warranted at that time (Ref 22:1-20). Another group that participated in the study concluded that the most logical solution to the officer retention problem appeared to be a substantial increase in basic pay and allowances (Ref 21:1-148).

An Air War College student (Ref 70:2,51) examined forms of compensation which could be used to recognize those officers possessing advanced degrees in areas of study needed by the Air Force. He concluded that a special education pay of $100 to $300 per month for master's degrees and $150 to $350 per month for doctoral degrees was needed. Rates of pay would be dependent upon years of service and grade. Only officers who had completed their obligated service and who were not receiving other forms of incentive and special pay would be eligible.

The Education Delay program may afford an opportunity to study the effects on retention of monetary compensation for advanced education. As pointed out earlier in this report, the delay results in higher pay for the advanced degree holder. The average monthly increase in salary for an officer after a two year delay is $128.71, and a three year delay gives an officer an average of $220.93 per month more than an

AFROTC graduate with a baccalaureate degree.

The retention rate for Air Force Institute of Technology graduates during the period 1959 through 1961 who had two years or less active duty at graduation was 20.38 percent (Ref 69). A sample of 165 educational delay officers whose total military service date fell between 1958 and 1962 resulted in a retention rate of 27.3 percent. The Personnel Research and Analysis Division at Hq. USAF, which computed the educational delay retention rate, offered the fact that a higher preference for economic security due to being older and more likely to have families may explain the higher rate (Ref 25:28-43). The higher monthly wages shown earlier must certainly be considered as an influence on the retention of educational delay officers.

Factors Affecting Retention

Graduates of the Air Force Institute of Technology programs during 1955 and 1956 gave the following reasons for remaining in the Air Force beyond their obligated service:

1. Retirement.
2. Job satisfaction.
3. Like military life.

Over one-half of the officers named the retirement incentive as the reason for staying in the Air Force (Ref 36:37).

The effect of the retirement benefit is reflected in the graphical presentation of loss rates by years service as shown in Fig. 4. To facilitate comparison, loss rates of bachelor's degree holders are also shown. Loss rates during fiscal year 1965 for all Air Force officers were used in the construction of the graph. All losses for the year

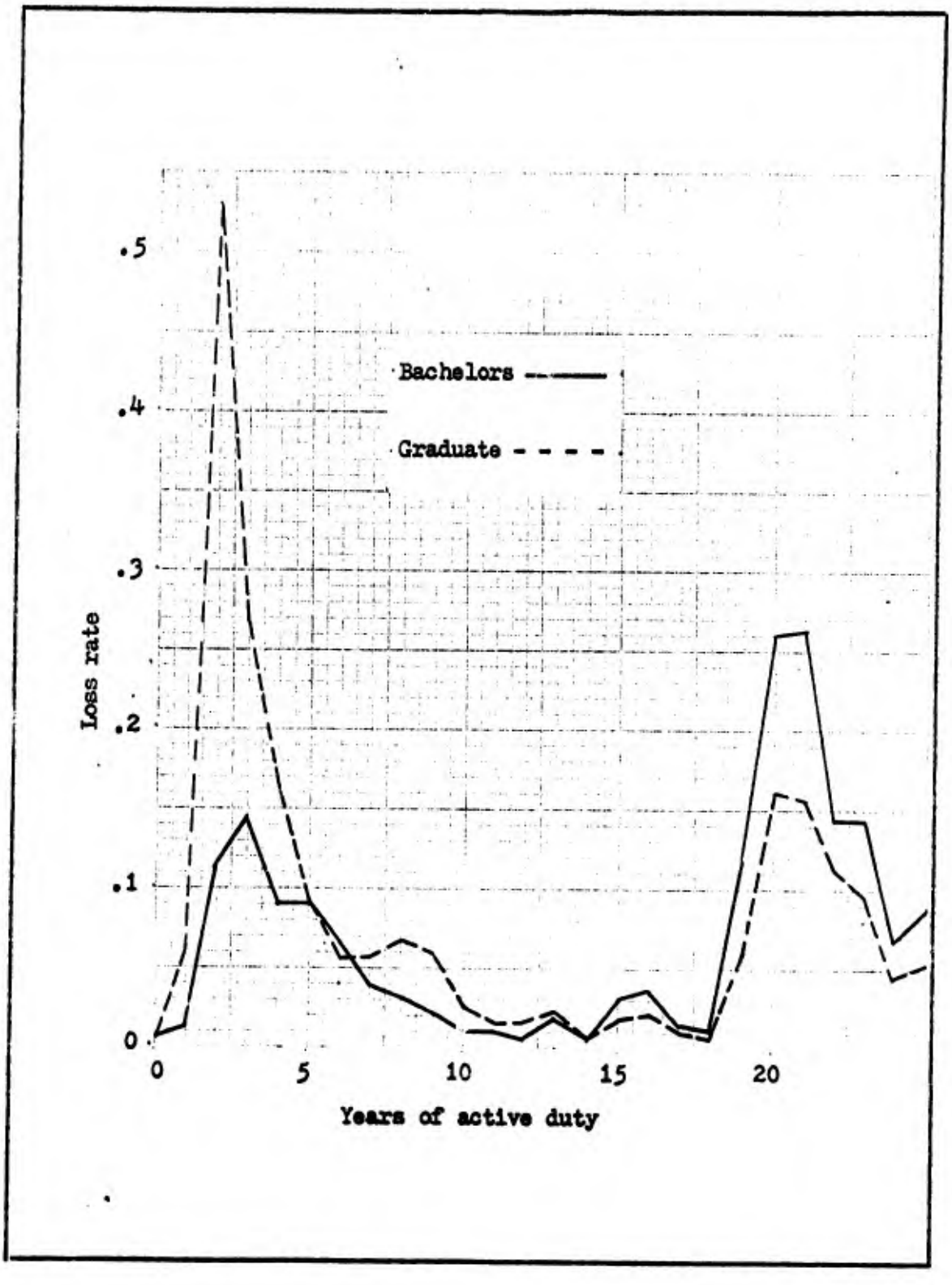

Figure 4 Loss Rates by Years of Active Duty and Academic Level

from a particular year group and educational level were divided by the sum of the fiscal year 1965 ending inventory of officers in this category plus the losses from this group during the fiscal year (Ref 57:21-25). See Appendix H for the table of loss rates.

The graph indicates the loss rates for officers with advanced degrees are higher than officers with bachelor's degrees for the first 13 years, the same for the fourteenth year, and lower thereafter. Losses are highest at the end of the initial commitment and at the 20-year point.

A questionaire survey (Ref 36) was made of all officers who graduated from the Air Force Institute of Technology from 1955 through 1956. Results of the study indicated that older, married, regular officers were more likely to remain in the Air Force while the younger AFROTC officer in a scientific or engineering field was less likely to stay in beyond his commitment. Identification of the advanced degree holders in this group by years of service was not possible since the study dealt with bachelor's degrees also. Of 673 advanced degrees conferred, 558 were still in the Air Force after the completion of obligated service which resulted in an 82.9 percent retention rate. The overall retention rate for graduate degrees granted by the Air Force Institute of Technology in fiscal years 1959 through 1961 was 62.31 percent. Of 1361 graduates, 848 were still in the Air Force in June 1967 (Ref 69). The difference in the retention rates is too great to have been caused by chance; however, exact causality for the difference cannot be determined from available data. See Appendix I. The latter group retention rate was greatly influenced by the high loss rate in the 0-2 year group of physical science graduates. Table XIV offers a possible

Table XIV

Survey of AFIT Civilian Institutions Program Graduates

FY 1959 Through FY 1961

Area of Study			Years of Service at Graduation							Total
			0-2	3-4	5-6	7-8	9-10	11-15	16+	
Admin., Mgmt.	Attrition	Number			2	2	9	26	25	64
		Percent			20.0	7.4	20.4	26.0	33.3	24.62
	Retention	Number		4	8	25	35	74	50	196
		Percent		100	80.0	92.6	79.6	74.0	66.7	75.38
Arts, Human., Educ.	Attrition	Number		1	1	1	1	4	3	11
		Percent		33.3	16.7	16.7	9.1	25.0	50.0	22.45
	Retention	Number	1	2	5	5	10	12	3	38
		Percent	100	66.7	83.3	83.3	90.9	75.0	50.0	77.55
Bio., Agri. Sci.	Attrition	Number					2			2
		Percent					50.0			22.22
	Retention	Number	1			1	2	3		7
		Percent	100			100	50.0	100		77.78
Engineering	Attrition	Number	5	13	24	18	13	13	14	100
		Percent	45.4	43.3	23.8	20.7	24.5	29.6	70.0	28.90
	Retention	Number	6	17	77	69	40	31	6	246
		Percent	54.6	56.7	76.2	79.3	75.5	70.4	30.0	71.10

Table XIV--Continued

Area of Study			Years of Service at Graduation							Total
			0-2	3-4	5-6	7-8	9-10	11-15	16+	
Mathematics	Attrition	Number		2	6	4	2	5	4	23
		Percent		33.3	35.3	25.0	13.3	27.8	80.0	29.87
	Retention	Number		4	11	12	13	13	1	54
		Percent		66.7	64.7	75.0	86.7	72.2	20.0	70.13
Physical Science	Attrition	Number	245	4	12	6		13	9	289
		Percent	81.7	17.4	18.5	9.7		32.5	60.0	55.79
	Retention	Number	55	19	53	56	13	27	6	229
		Percent	18.3	82.6	81.5	90.3	100	67.5	40.0	44.21
Social Science	Attrition	Number		1		2	1	11	9	24
		Percent		25.0		6.9	5.9	40.7	60.0	23.53
	Retention	Number	1	3	9	27	16	16	6	78
		Percent	100	75.0	100	93.1	94.1	59.3	40.0	76.47
Total	Attrition	Number	250	21	45	33	28	72	64	513
		Percent	79.6	30.0	21.6	14.5	17.8	29.0	47.1	37.69
	Retention	Number	64	49	163	195	129	176	72	848
		Percent	20.4	70.0	78.4	85.5	82.2	71.0	52.9	62.31

(From Ref 69)

explanation for the different rates. Retention varies by area of study as well as years of service at graduation.

Salaries as an Influence on Retention

Under the assumption that salaries influence retention more than any other factor, this area will be explored in considerable detail. A comparison of salaries is subject to error since indirect pay is often ignored. The utility of fringe benefits will differ among individuals, and assignment of a dollar value to these benefits is difficult.

Wages in Industry. Average starting salaries in industry are shown in Table XV on this page. The starting salary for a lieutenant is $6,532.56, which is approximately $1,300 below the lowest average starting salary of industry. Average starting salaries shown in the table are for baccalaureate degrees; however, they do represent a conservative estimate of salaries for master's degrees since the employing policy of industry indicates the major distinction is between masters and doctors and not between bachelors and masters (Ref 24:186). The situation is different for doctoral degrees. Graduates with doctorates in science are receiving near $15,000 per year soon after

Table XV

Average Starting Salaries in Industry 1969

Field	Average Salary
Engineering	$9,816
Physics	9,360
Chemistry	9,048
Mathematics	8,892
Accounting	8,844
Economics	8,304
Bus. Admin.	8,016
Liberal Arts	7,884

(From Ref 55:38)

graduation, and most graduates expect to receive a minimum of $12,000 (Ref 1:A19).

Civil Service Salaries. College graduates entering civil service careers without previous experience generally start as a GS5. Persons with master's degrees may qualify for a GS9 rating, and doctoral graduates may enter at the GS12 level provided they demonstrate superior abilities in graduate school (Ref 9:8).

The Civil Service Commission has developed a special intern program for outstanding college graduates (Ref 12:1-2). The objective of the program is to select outstanding men and women in various occupational fields for development and advancement in either an administrative or a professional career. Recent college graduates and other qualified people including Air Force employees can qualify for the program through the Federal Service Entrance Examination or the Junior Administrator Development Examination.

Mr. David Weisman, Career Development Officer at the Wright-Patterson Air Force Base Civilian Personnel Office, states that the intern program at that base has 20 participants (Ref 43). Beginning salary for an intern is $7,639; after one year $9,320; at the end of two years $11,233; and at the completion of the three year program, the employee is awarded a GS12 rating at a salary of $13,389 per year. An outstanding college graduate commissioned as an officer in the Air Force is normally promoted to the rank of captain at the end of three years at a salary of $10,170.36 per year.

Systems Command Career Guide. The Air Force Systems Command has prepared a career guide for scientists and engineers (Ref 65). This guide segments the career pattern into five phases. The initial orien-

tation phase is a period of assisting more experienced personnel in ongoing projects. During the developmental phase, the employee performs more advanced and complex research. The performance phase contains the bulk of the project officers. Work is accomplished with a minimum of supervision. It is during this phase that employees choose whether to advance to further technical specialization or to assume managerial responsibilities. The management/senior technical phase and the director phase are the highest levels of the career progression.

The career phases with applicable civilian and military grades are shown in Table XVI. Maximum and minimum salaries have been added to permit evaluation of the possible effects of salary differences on retention rates for officers at the different points in the career guide. The young officer who enters the Air Force with an advanced degree or who earns one within the first four years of service would reach the decision point of whether to remain in the Air Force at the end of the developmental phase or at the midpoint of the performance phase. The succeeding progression in either case offers less monetary incentive than other steps in the career progression since the maximum military salary at both steps of the performance phase is less than the minimum civilian salary. An officer who enters an advanced education program in his third or fourth year of service would probably be in the highest step of the performance phase at the end of obligated service. The pay difference in the succeeding phase still favors the civilian employee but not as significantly as in the previous phase. Retirement is another factor which will have a stronger influence at this point on retention since the officer is now at or beyond the ten year point of his career.

Table XVI

Air Force Systems Command Career Guide for Military and Civilian Scientists and Engineers

Grades		Grades	
Orientation Phase			
GS9		Lieutenant	
Max. salary	$12,119	Max. salary	$ 9,711.36
Min. salary	9,320	Min. salary	6,532.56
Developmental Phase			
GS9		First Lieutenant	
Max. salary	$12,119	Max. salary	$ 9,711.36
Min. salary	9,320	Min. salary	7,410.96
GS11		Captain	
Max. salary	$14,599	Max. salary	$12,312.36
Min. salary	11,233	Min. salary	10,170.36
Performance Phase			
GS12		Captain	
Max. salary	$17,403	Max. salary	$12,312.36
Min. salary	13,389	Min. salary	10,170.36
GS13		Major	
Max. salary	$20,555	Max. salary	$14,630.76
Min. salary	15,812	Min. salary	12,999.96
Managerial/Senior Technical Phase			
GS14/15		Maj./Lt. Col./Col.	
Max. salary	$28,069	Max. salary	$21,170.16
Min. salary	18,531	Min. salary	12,999.96
Director Phase			
PL313/Super Grades		Colonel/General	

Note: Military salaries assume officer to be nonrated, with dependents, without prior service.

(From Ref 2)
(From Ref 43)
(From Ref 65:1-4)

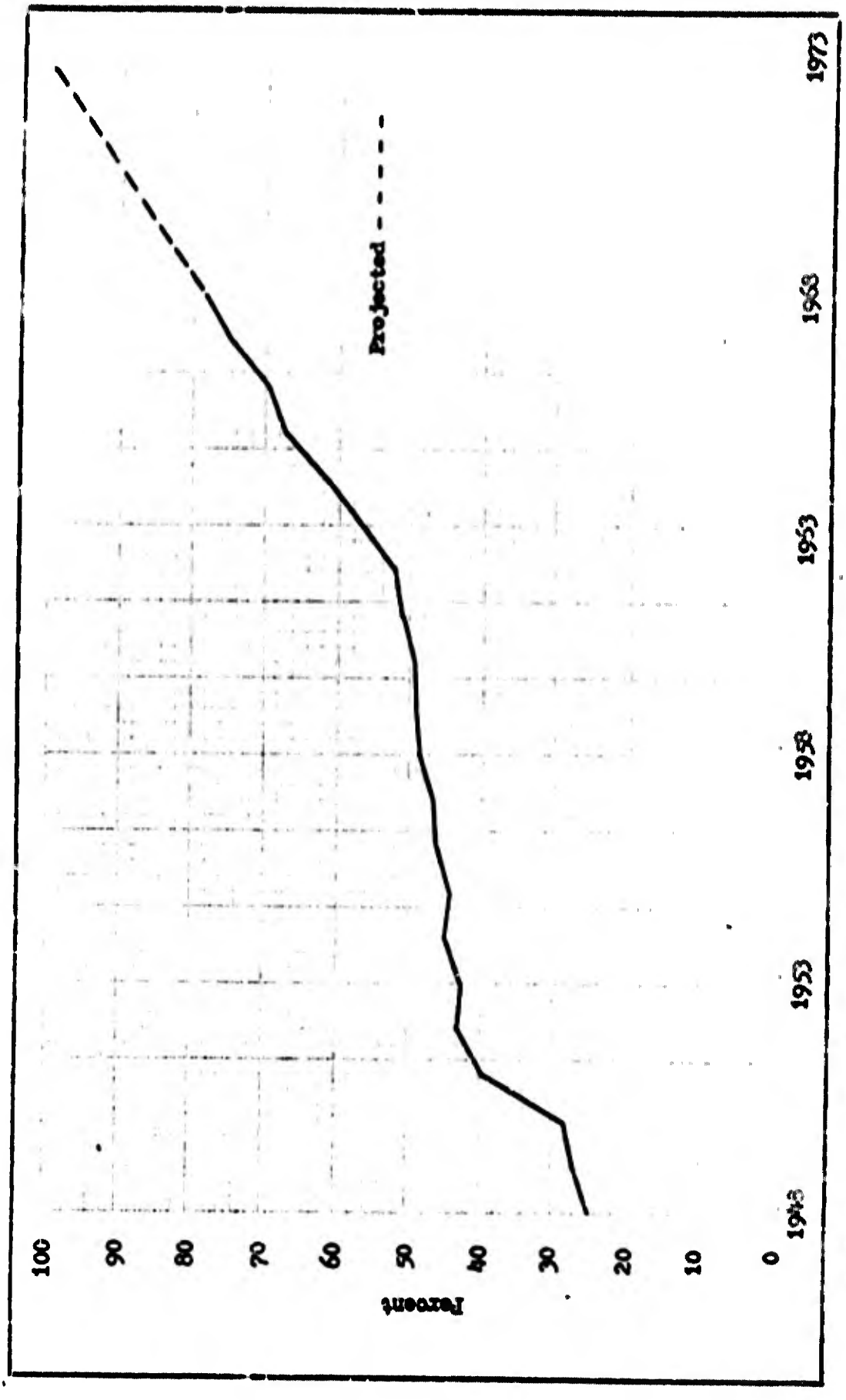

Figure 5 Percentage of All Air Force Officers With College Degrees

V. Advanced Degree Resources

The academic level of Air Force officers has shown rapid growth in the past 20 years. The number of college graduates rose from 12,186 in 1948 to 107,944 in 1968; and if the present trend persists, the total officer corps will approach the 100 percent college educated level in 1973. A graph showing the growth in the percentage of officers with at least a baccalaureate degree is contained in Fig. 5. Appendixes J and K contain the historical data on officer academic levels and the computation for predicting future levels respectively.

Advanced education status of line officers for the fiscal years 1964 through 1969 in shown in Table XVII. The inventory of doctorates is below the 1964 level even though the number has shown increases during the past four years. Master's degrees have increased in each of the years.

Status of Resources

At the end of fiscal year 1969, the inventory of master's degrees was 13,727 and is predicted to be 17,717 in five years. See Appendix L for the computation of the five year forecast. As shown in Table XVIII, the interarea specialization and physical science areas of study reflected fewer degrees than required. The engineering, business/management, and mathematics areas of study ranged from 104 percent manned to 151 percent manned. Excessive numbers of master's degrees were indicated in biology/agriculture science, arts/humanities, and the

Table XVII

Educational Status By Grade

FY 1964 Through FY 1969

Line Officers

Doctors

Grade	1964	1965	1966	1967	1968	1969
Colonel	90	83	77	75	75	69
Lt. Colonel	81	78	99	141	120	134
Major	158	142	87	122	167	173
Captain	127	81	12	62	61	117
Lieutenant	115	73	73	102	112	52
Total	571	457	348	502	535	545

Masters

Colonel	1105	1141	1295	1392	1399	1367
Lt. Colonel	1718	1757	2267	2825	2870	3027
Major	2718	3217	3181	3301	3958	4217
Captain	3138	2678	2848	2874	3015	3488
Lieutenant	1063	1059	1300	1384	1433	1628
Total	9742	9852	10891	11776	12675	13727

FY 1964 Data (From Ref 19)
FY 1965 Data (From Ref 49)
FY 1966 Data (From Ref 49)
FY 1967 Data (From Ref 49)
FY 1968 Data (From Ref 28)
FY 1969 Data (From Ref 29)

Table XVIII

Master's Degrees--Required vs. Assigned--Line Less JAG

As of 30 June 1969

Area of Study	Col.		L. C.		Maj.		Capt.		Lt.		Total	
	R	A	R	A	R	A	R	A	R	A	R	A
Interarea Spec.	21	0	35	2	79	2	40	0	30	0	205	4
Admin., Mgmt.	1199	485	1486	1318	1376	1724	443	1114	73	450	4577	5091
Arts, Human., Educ.	59	79	129	385	122	433	81	360	0	251	391	1508
Bio., Agri. Sci.	0	7	6	16	4	38	7	27	3	50	20	138
Engineering	346	220	666	623	921	1255	1323	1225	379	444	3635	3767
Mathematics	7	10	29	57	54	84	121	132	24	72	235	355
Physical Science	172	62	611	185	583	274	718	282	95	91	2179	894
Social Science	99	504	118	441	133	407	111	348	6	270	467	1970
Total	1903	1367	3080	3027	3272	4217	2844	3488	610	1628	11709	13727

(From Ref 29)

social science areas of study.

There were shortages of doctoral degrees in all areas of study except the biology/agriculture science area. As Table XIX indicates, the total inventory at the end of fiscal year 1969 was 545 doctors compared to a requirement for 996.

Evaluation of Changes in Fiscal Year 1969

Tables XX and XXI contain the beginning inventory of advanced degrees for fiscal year 1969. A comparison of manning percentages between the beginning and ending inventories is shown in Appendix M. Decreases in manning percentages for master's degrees occurred in the interarea specialization and physical science areas of study. Largest gains were made in the biology/agriculture science, arts/humanities, and social science areas of study. The number of masters in engineering during the year rose above the number required. Increases in doctoral degree manning occurred in the interarea specialization, business/management, and biology/agriculture science areas of study. All other areas reflected a lower percentage of manning.

An accounting of accessions and attrition is contained in Table XXII. The Air Force gained 2,739 master's degrees and 147 doctorates from all sources during the year. Losses of 1,687 master's degrees and 137 doctorates resulted in a net gain of 1,052 masters and ten doctors. Due to increased advanced degree requirements, the gain for master's degrees was less than one percent. Doctoral manning percentage decreased six percent.

Utilization of Resources

Proper utilization of advanced degree resources is essential to

Table XIX

Doctor's Degrees--Required vs. Assigned--Line Less JAG

As of 30 June 1969

Area of Study	Col.		L. C.		Maj.		Capt.		Lt.		Total	
	R	A	R	A	R	A	R	A	R	A	R	A
Interarea Spec.	5	0	5	1	1	1	0	0	0	0	11	2
Admin., Mgmt.	23	2	36	10	19	7	1	4	0	3	79	26
Arts, Human., Educ.	18	8	26	23	29	18	12	11	0	2	85	62
Bio., Agri. Sci.	0	2	1	2	2	3	7	3	1	3	11	13
Engineering	16	26	42	42	84	69	107	48	67	12	316	197
Mathematics	3	1	16	4	16	9	23	4	10	4	68	22
Physical Science	34	10	64	19	61	34	77	33	58	16	294	112
Social Science	16	20	30	33	41	32	38	14	7	12	132	111
Total	115	69	220	134	253	173	265	117	143	52	996	545

(From Ref 29)

Table XX

Master's Degrees--Required vs. Assigned--Line Less JAG

As of 30 June 1968

Area of Study	Col.		L. C.		Maj.		Capt.		Lt.		Total	
	R	A	R	A	R	A	R	A	R	A	R	A
Interarea Spec.	21	0	41	2	76	3	42	0	28	0	208	5
Admin., Mgmt.	1165	500	1518	1258	1383	1527	425	897	73	424	4564	4606
Arts, Human., Educ.	63	90	132	378	130	440	91	322	3	225	419	1455
Bio., Agri. Sci.	0	9	6	17	3	34	10	31	3	39	22	130
Engineering	336	222	670	594	922	1167	1314	1105	382	331	3624	3419
Mathematics	6	12	30	50	71	88	117	118	24	78	248	346
Physical Science	111	59	300	159	404	287	363	258	95	76	1273	839
Social Science	99	507	124	412	92	412	155	284	6	260	476	1875
Total	1801	1399	2821	2870	3081	3958	2517	3015	614	1433	10834	12675

(From Ref 28)

Table XXI

Doctor's Degrees--Required vs. Assigned--Line Less JAG

As of 30 June 1968

Area of Study	Col.		L. C.		Maj.		Capt.		Lt.		Total	
	R	A	R	A	R	A	R	A	R	A	R	A
Interarea Spec.	5	0	5	1	1	0	0	0	0	0	11	1
Admin., Mgmt.	28	2	31	5	18	8	0	1	0	2	77	18
Arts, Human., Educ.	26	10	22	26	15	16	7	6	0	3	70	61
Bio., Agri. Sci.	0	1	2	3	5	3	3	1	1	4	11	12
Engineering	16	26	43	34	65	67	103	26	67	35	294	188
Mathematics	2	2	14	2	5	9	22	3	10	2	53	18
Physical Science	28	13	53	21	41	30	71	18	56	42	249	124
Social Science	12	21	21	28	47	34	30	6	5	24	115	113
Total	117	75	191	120	197	167	236	61	139	112	880	535

(From Ref 28)

Table XXII

Analysis of Changes in Resources

During FY 1969

Source	Masters	Doctors
AFIT CID	1077	65
Residence	353	4
Education Services	644	8
Educational Delay	552	70
Officer Training School	113	0
Total	2739	147
Beginning Inventory	12675	535
Accessions	2739	147
Total	15414	682
Attrition	1687	137
Ending Inventory	13727	545
Net Increase	1052	10
Beginning Requirements	10834	880
Ending Requirements	11709	996
Net Increase	875	116
Net Increase (Resources)	1052	10
Net Increase (Requirements)	875	116

the accomplishment of the system objectives. A simple breakdown of degree allocations to the commands as depicted in Table XXIII does not provide a useful measure of utilization. The table does give a general distribution of the advanced degrees throughout the Air Force. An indication of the impact of the war in Southeast Asia on the system may be seen in the overages of advanced degrees assigned to the Pacific Air Force.

To determine the utilization of advanced degree resources, command requirements by career field, area of study, and major academic field were compared to the officers assigned with these qualifications. As seen in Table XXIV, there were 5,168 properly filled master's degree positions and 311 doctorates. By defining a properly filled position as one filled by an officer possessing the previously stated qualifications plus the grade indicated in the manning document results in 4,154 and 217 properly filled positions respectively. See Table XXV. There are certain factors which must be considered when viewing these figures as indicative of resource utilization:

1. These figures indicate the number of officers with the specified qualifications assigned to a command. Data was not available to show if the officers were actually assigned to the exact manning document positions requiring advanced degrees.

2. Academic qualifications are not uniquely coded in some specialties; therefore, some requirements which appeared to be unfilled may in fact have an academically qualified incumbent.

3. The grade requirement is too restrictive in some cases since manning document grades do not always match the grade of the officer assigned to the position.

Table XXIII

Advanced Degrees

Required and Assigned by Commands

As of 30 June 1969

Command	Masters		Doctors	
	R	A	R	A
Alaskan Air Command	0	64	1	0
Aeronautical Chart and Info. Center	18	10	1	0
U. S. Air Force Academy	338	497	249	136
Aerospace Defense Command	139	395	10	2
Air Force Acct. and Finance Center	2	15	0	0
U. S. Air Forces in Europe	152	491	0	3
Hq. Air Force Reserve	0	35	0	0
Air Training Command	435	463	5	4
Air University	1141	644	121	59
Air Force Communications Service	133	186	7	0
A. F. Data Systems Design Center	0	56	0	1
Headquarters USAF	712	1157	47	57
Headquarters Command USAF	822	1873	49	47
Air Force Logistics Command	774	478	2	1
Military Airlift Command	1155	897	69	21
Office of Aerospace Research	150	190	107	37
Pacific Air Forces	101	1788	0	33
Air Reserve Personnel Center	0	4	0	0
Strategic Air Command	1007	1065	3	4
USAF Southern Command	54	56	0	0
Air Force Systems Command	4150	2568	323	133
Tactical Air Command	221	608	0	1
USAF Security Service	205	182	2	1
Total	11709	13727	996	545

(From Ref 27)

Table XXIV

Advanced Degree Requirements

Satisfied by Command, Career Field, Area of Study

and Major Academic Field

Command	Masters	Doctors
Alaskan Air Command	0	0
Aeronautical Chart and Info. Center	1	0
U. S. Air Force Academy	206	89
Aerospace Defense Command	48	0
Air Force Acct. and Finance Center	0	0
U. S. Air Forces in Europe	71	0
Hq. Air Force Reserve	0	0
Air Training Command	148	0
Air University	232	34
Air Force Communications Service	65	0
A. F. Data Systems Design Center	0	0
Headquarters USAF	483	16
Headquarters Command, USAF	624	16
Air Force Logistics Command	263	0
Military Airlift Command	438	15
Office of Aerospace Research	104	24
Pacific Air Forces	85	0
Air Reserve Personnel Center	0	0
Strategic Air Command	219	0
USAF Southern Command	11	0
Air Force Systems Command	2014	117
Tactical Air Command	77	0
USAF Security Service	79	0
Total	5168	311

(From Ref 27)

Table XXV

Advanced Degree Requirements

Satisfied by Command, Career Field, Area of Study,

Major Academic Field, and Grade

Command	Masters	Doctors
Alaskan Air Command	0	0
Aeronautical Chart and Info. Center	0	0
U. S. Air Force Academy	131	72
Aerospace Defense Command	29	0
Air Force Acct. and Finance Center	0	0
U. S. Air Forces in Europe	50	0
Hq. Air Force Reserve	0	0
Air Training Command	74	0
Air University	198	20
Air Force Communications Service	42	0
A. F. Data Systems Design Center	0	0
Headquarters USAF	400	8
Headquarters Command, USAF	486	14
Air Force Logistics Command	160	0
Military Airlift Command	390	11
Office of Aerospace Research	79	18
Pacific Air Forces	65	0
Air Reserve Personnel Center	0	0
Strategic Air Command	120	0
USAF Southern Command	6	0
Air Force Systems Command	1857	74
Tactical Air Command	23	0
USAF Security Service	44	0
Total	4154	217

(From Ref 27)

Manning Factor

A useful device for measuring the utilization of advanced degree resources is the manning factor. It is the ratio of total resources available to the total resources that are properly assigned. A Defense Study of Military Compensation (Ref 22:4) concluded that the services needed a manning factor of 3.0 in order to man the positions identified as requiring advanced degrees. The Navy determined that a manning factor of 2.0 or 2.5 was essential (Ref 23:51-53). The Air Force manning factors as of 30 June 1969 were 3.3 for master's degrees and 2.5 for doctorates. If the grade constraint is removed, the manning factors decrease to 2.7 for master's degrees and 1.8 for doctor's degrees.

VI. Proposed Advanced Education Model

The proposed advanced education system has essentially the same basic structure as the present system. It does not contain proposals which are beyond the capability of the system to institute.

Establishment of Needs

Career area panels are the key elements in the advanced degree requirements process. The effectiveness of the panels could be enhanced by effecting certain changes in the appointment procedures and in the frequency of the meetings.

Notification of appointment to a panel should be at least three months prior to the initial panel meeting. This would allow time to research and study those aspects of the international, national, and defense environment which affect graduate education requirements. In the fast changing world of today, the time lag between career area panels is too long under the present policy of convening panels every two years. Panels for each career area should meet on an annual basis. In order to take advantage of the experience gained during the panel meetings, appointments to the board would be for two years. Composition of the initial panel would be divided between two year and one year appointments.

The position evaluations will continue to be the primary instruments in determining the advanced degree requirements. Current requirements should extend beyond these evaluations to include a sufficient

base in each preceding grade level to meet the validated requirements in the higher grades. Requirements must also reflect sufficient numbers of master's degrees in each area of study to support the programs for supplying doctorates. Career area panels are introducing another source of error into the forecast by attempting to estimate the officer strength in five years as well as the advanced degree needs; therefore, the forecast of future requirements should be reported in terms of percentages rather than numbers.

Development of Programs

The development of future procurement programs is dependent upon:

1. Future position requirements.
2. An estimate of future resources.

Future position requirements as previously discussed are furnished by the Air Force Educational Requirements Board. The future advanced degree resources must be computed from the best available information.

The following iterative procedure, which incorporates all sources of advanced degrees, is a possible method of computing future resources. To obtain a workable unit, total resources will be subdivided by area of study and by rank. Lieutenant and captain resources will be considered jointly due to the relatively short time an officer has the rank of lieutenant and due to the substitutive nature of these ranks. The number of advanced degrees in a unit at the end of a fiscal year depends upon the following:

1. The beginning resources.
2. Gains from a lower rank.
3. Gains from all sources of advanced degrees.

4. Losses to a higher rank.

5. Losses due to attrition.

Let B denote the beginning inventory of advanced degrees in the unit and a_i indicate the expected output from source i such as the following:

1. a_1 = Officer Training School.

2. a_2 = Education Services.

3. a_3 = Educational Delay.

4. a_4 = Air Force Institute of Technology.

5. G_1 = Advanced degree holders gained from previous unit.

Let g_i indicate the percentage of source a_i expected as input into the unit during the year. If L_1 is the expected loss to attrition and L_2 is the expected loss to the next highest grade, then the end-of-the-year position E is simply the linear relation

$$E = B + g_1a_1 + g_2a_2 + g_3a_3 + g_4a_4 + G_1 - L_1 - L_2$$

The L_2 of unit one becomes G_1 of unit two, and successive iterations will give additional year-end estimates of resources in the area of study by grade.

Determination of advanced degree requirements becomes a matter of comparing future needs and future resources. At this point in the planning process, the manning factor becomes important since true requirements are the product of the manning factor and the difference between needs and resources. This iterative procedure does not eliminate the necessity of further refinement of requirements by major academic field; however, it does help to accomplish the following:

1. The effects of varying the inputs from the different sources

can be tested.

2. It incorporates all sources of advanced degrees into future planning.

3. In areas where resources are greater than requirements, the effect of reducing or eliminating more costly sources can be tested.

4. It brings attention to the manning factor which is the ultimate measurement of system effectiveness.

5. It provides an aid in the selection of Air Force Institute of Technology entrants.

6. It may point out the need for increased advanced degree requirements in certain grades in order to provide a base from which to meet the needs of a higher grade.

Cost Effectiveness

Graduate education is not amenable to normal cost effectiveness practices. One master's degree may cost less than another; yet the more expensive degree may be more cost effective if it has more value. As an example, consider the aerospace operations management master's degree earned by many Air Force officers through the Education Services program. In fiscal year 1969, at least 54 of these degrees were added to the inventory. This degree does not meet the necessary requirements to permit the holder to become eligible for an Air Force Institute of Technology doctoral program. The value of this degree is, therefore, diminished since it fails to contribute to the establishment of a base for the doctoral program.

The differences in degrees can be attributed to the decentralized nature of the Nation's college system and the freedom enjoyed by the

institutions. As pointed out by Paul Woodring,

> Anyone with the necessary funds--an individual, a private group, a religious body, or a unit of government--has been able to establish a college or, if it preferred, a "university". Each institution has been free to establish its own entrance standards, decide for itself what kind of a faculty it wished to recruit, make its own curriculum, and invent its own degrees (Ref 71:3-4).

This thesis does not purport to be a cost effectiveness study; however, it is essential to know the relative costs of the different sources. The least expensive source of advanced degrees is the Officer Training School program. All costs associated with this program are the same for a baccalaureate trainee as for the advanced degree holder.

Costs of advanced degrees earned through the Education Services program can vary considerably. They range from degrees earned during off-duty time with funds furnished by the Veterans Administration to the more expensive full-time Bootstrap program. The Educational Delay program costs as shown in Table XII are dependent upon the length of the delay. Although the costs are shown for the first four years of active duty, the educational delay officer will continue to receive a higher monthly income than the nondelay officer but at a lower amount. There is a possible overlap between the costs of the degrees gained from the Education Services program and the Educational Delay program due to the Bootstrap program. The bulk of the advanced degrees gained by the system from the Education Services program is from off-duty study; therefore, this source is adjudged to be more cost effective than the Educational Delay program.

Air Force Institute of Technology programs vary in cost depending upon the annual salary of the student and whether enrolled in the resident schools or in a civilian institution. The Air Force Institute

of Technology Comptroller (Ref 45) was unable to furnish a cost analysis of each program. Even though a cost ratio between the sources is indeterminable, an ordinal ranking of sources from lowest to highest cost such as the following is possible:

1. Officers Training School.
2. Education Services.
3. Educational Delay.
4. Air Force Institute of Technology.

VII. Summary and Conclusions

This research effort is directed at the problem of establishing a framework from which decision-makers in the advanced education system can assess the effects of their actions on the accomplishment of system objectives. These objectives as defined by this report are:

1. To identify and to satisfy specific graduate degree requirements.

2. To provide an integral part of an officer's career development plan.

The framework of the system is found to consist of requirements, sources, resources, and utilization as its key elements. The text of this thesis allows conclusions to be drawn concerning certain elements as they are viewed in relation to the entire system and to the system objectives.

Academic Codes

The necessity for having a method of stating the educational requirements of a position and the academic qualifications of an individual in a concise, accurate, and unique form exists. All evidence examined in this report indicated the present academic coding system is either inadequate or improperly used.

The academic codes of 39 officers from the first two classes of the Air Force Institute of Technology Graduate Systems Analysis program were reviewed. Fourteen of the graduates from a class of 22 had

incorrect academic codes reflected on their Uniform Officer Records. An entire class of 17 officers currently enrolled in the program had incorrect academic codes assigned to them. The proportion of incorrect academic codes contained in the Uniform Officer Records is estimated to be in the interval from 18.4 percent to 35.4 percent.

The inadequacy of the coding system as a means of uniquely identifying an individual's academic qualifications is shown by the following:

1. Operations research can be coded six possible ways involving five areas of study.

2. Data processing can be coded 13 possible ways involving four areas of study.

Integration of Sources

In order to satisfy specific Air Force advanced degree requirements, the Air Force advanced education system will require the integration of all sources of advanced degrees into the Air Force educational requirements plans, to include a directed duty assignment and the awarding of an appropriate Air Force Specialty Code. The Air Force Institute of Technology Resident School and Civilian Institutions Division cannot satisfy the Air Force requirements for advanced degrees if the production of graduate degrees in fiscal year 1969 by these sources is assumed to represent an upper bound for production in future years.

The total inventory of advanced degrees would have declined in fiscal year 1969 by 188 degrees without the other sources of degrees. Doctorates from other sources prevented that portion of the inventory from decreasing by 68 degrees. The importance of the Educational Delay,

Education Services, and the Officer Training School as sources for advanced degrees can be seen by comparing the beginning and ending inventories in Tables XVIII through XXI and noting the effects of their inputs on each area of study.

Integration of the Educational Delay and Officer Training School resources into the requirements program would furnish the bulk of the required advanced degrees for lieutenant positions. Currently there are excessive numbers of master's degrees in the inventory at the lieutenant level, while shortages exist in the higher ranks. As an example, consider the management area of study where there is a requirement for 73 lieutenants with master's degrees. In fiscal year 1969, the Air Force gained 120 lieutenants from educational delays with degrees from this area of study.

Officers who obtain advanced degrees through the Minuteman Education program and Education Services are normally in the grade of captain or higher. Integration of these degrees into the education requirements system is an economical method of satisfying requirements since there is considerable cost involved in sending these officers through a full-time education program.

The three to four year production cycle of the Minuteman Education program allows ample time to program graduates against specific requirements. Integration of the Education Services program into the advanced education system would add a source which produces approximately one-half as many advanced degrees as the Air Force Institute of Technology. There are inherent difficulties involved in the total integration of Education Services production of degrees into the advanced education requirements system, but the contribution to the system can be consid-

erably improved by the following:

1. Education Services offices should be aware of specific Air Force advanced degree requirements and priority of funds given to officers seeking advanced degrees needed by the Air Force.

2. Civilian institutions that conduct graduate degree programs on Air Force installations should be required to up-grade or revise their programs to provide useable advanced degrees.

3. Officer Programs at Hq. USAF should be informed by Education Services of officers enrolled in graduate programs by type of course, rank, Air Force Specialty Code, and expected completion date.

4. Students at the Professional Military Schools who elect to earn a master's degree while attending the schools should only be offered a course in the business administration/management area of study. Of 41 master's degrees earned by students at the Air War College in fiscal year 1969, 31 were in the political science academic field and ten master's degrees in business administration. Yet there is a shortage of colonels and lieutenant colonels with master's degrees in business administration and excessive numbers of officers at that rank with master's degrees in the social sciences.

Retention

The Air Force advanced education system can affect the retention rate of officers with advanced degrees. Forces which cause an officer to leave the Air Force at the end of obligated service are largely beyond the direct control of the system; however, the retention rate can be affected by the system through the process of student selection for advanced degree programs. The years of service at graduation have

a considerable effect on retention. As seen in Table XIV, the retention rate is greater for the 7-8 year group and extremely low for the 0-2 year group. In Fig. 4 the loss rates for advanced degrees show that retention of officers with advanced degrees is higher than officers with baccalaureate degrees after 14 years of service.

Officers from the Educational Delay program have a higher retention rate than Air Force Institute of Technology graduates in the 0-2 year group. The higher salary received by the Educational Delay officers is believed to offer a possible explanation for this higher retention rate.

The career guide prepared by the Air Force Systems Command, which has the greatest requirement for advanced degrees, offers a possible explanation for the low retention rate of officers who enter the Air Force with an advanced degree or who earn one by their fourth year of service. These officers must make the decision to remain in the Air Force either at the end of the developmental phase or in the middle of the performance phase. The disparity of salary between the officer and his civilian contemporary is greatest during this period.

Utilization

The number of validated advanced degree positions with academically qualified incumbents is unknown. From available information, it was determined that 43 percent of the required advanced degree positions were filled. The use of this percentage as an estimate of satisfied requirements is questionable. It is affected by the following:

1. The academic coding system with its ambiguities may have caused a considerable number of errors in the identification of

resources. Thus, an unfilled requirement may, in fact, have an academically qualified incumbent. The opposite situation may also exist.

2. The data reflected the possession of the resource by the command. It does not indicate the assignment of the resources to the position that requires the advanced degree.

3. This estimate of satisfied requirements is computed without regard for grade requirements. In some cases, the difference between assigned and required grades tended to indicate an unsatisfied requirement.

The manning factor is a useful device for measuring the ability of the system to properly utilize its resources. The optimal manning factor is 1.0; but due to higher priority commitments, change of stations, service schools, and other factors, a manning factor of perhaps 1.5 or 1.75 is more realistic.

Areas for Future Research

An academic coding system is required which will meet the needs of the Air Force advanced education system. Research is required to formulate a coding system which will facilitate the matching of requirement to resource. Such a system must accurately portray the formal education possessed by an officer to include the increasing numbers of officers who have attained lateral advanced degrees.

A cost effectiveness study is needed to determine the optimal selection process for students to attend Air Force sponsored education programs. Such a study must consider the objectives of the Air Force advanced education system in determining the optimal selection policy.

Research into the determination of Air Force advanced degree

requirements is needed. The present system which relies heavily on the position evaluations must be expanded to include sufficient requirements in each academic field, career area, and grade level to support succeeding requirements. Stated requirements must reflect a realistic manning factor.

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Appendix A

Table XXVI

Earned Degrees: United States

1957-58 to 1977-78

Year	Bachelor	Master	Doctor
1957-58	363,502	65,586	8,942
1958-59	382,904	69,559	9,360
1959-60	392,440	74,435	9,829
1960-61	398,710	78,228	10,575
1961-62	417,846	84,855	11,622
1962-63	447,622	91,366	12,822
1963-64	498,654	101,050	14,490
1964-65	535,031	112,124	16,467
1965-66	551,040	140,555	18,237
1966-67	584,000	147,300	19,800
1967-68	685,000	148,800	22,200
	Projected		
1968-69	749,000	160,000	25,100
1969-70	746,000	190,400	26,500
1970-71	760,000	211,000	27,000
1971-72	785,000	212,000	29,200
1972-73	821,000	217,700	34,900
1973-74	860,000	226,900	38,900
1974-75	898,000	239,500	39,300
1975-76	931,000	253,200	40,600
1976-77	955,000	263,700	42,000
1977-78	980,000	273,700	43,900

(From Ref 66:31)

Appendix B

Table XXVII

Schedule for Reviewing and

Reporting Positions

	Even Fiscal Years
1st Quarter	Comptroller
2nd Quarter	Electronics and Maintenance Engineering; Materiel
3rd Quarter	Scientific and Development Engineering; Systems Program Management
4th Quarter	Personnel Resources Management

	Odd Fiscal Years
1st Quarter	Civil Engineering
2nd Quarter	Weather Utilization Field; Audio-Visual
3rd Quarter	Operations; Security
4th Quarter	Information; Intelligence

(From Ref 15:2)

Appendix C

Criteria for Establishment of Advanced Educational Degree Requirements

1. Positions which are required by law, DOD policy, or AFM 36-1 to be filled by individuals possessing graduate level education in a relevant field of study.

2. Positions in which the primary duties of incumbents cannot be satisfactorily performed except by individuals possessing qualifications that are normally acquired only through graduate level education in a definite field of study. These positions are those where a direct relationship exists between the primary duty to be performed, the relevant educational field, the individual's occupational specialty or subspecialty and the organizational function to be performed. Examples are positions which require assignment of qualified physical, biological or social scientists, engineers, designers, analysts, teachers and statisticians.

3. Positions which require the incumbents to exert direct technical supervision over military and/or civilian personnel who are required to possess graduate level education. This technical supervision requires knowledge that is normally acquired only through graduate level education. These positions are exclusively supervisory in nature. There must be a general relationship between the positions, the educational field, and type of organization. These positions will tend to be in the field grades but some may be in lower grades. Generally, level and type of organization supervised will be of more significance than the grade authorized to the position. Examples are chiefs of laboratories, detachments, sections, branches, division, and similar organizations of a technical, analytical, developmental or research nature.

4. Positions in which the direction, control or evaluation of large, complex, or critical activities are involved and that must be filled with individuals possessing comprehension, analysis and evaluation abilities normally acquired only through graduate level education. Positions include those which AF experience has indicated the need to establish related graduate educational programs at Wright-Patterson AFB, Ohio. Examples include positions such as specialized directors, key managers, or specialized commanders.

5. Positions which, for optimum effectiveness, must be filled by individuals who possess knowledge of a specific field of study to permit effective staff planning, coordination, and command advisory functions. This knowledge would normally be acquired only through

graduate level education. Such knowledge would include the capability to comprehend theories, principles, terminology, process, and techniques which are necessary for effective appraisal and evaluation of complex programs.

6. Positions which are located in a joint or unified or unified command organization or a government agency outside the DOD. These positions are in a unit which may be supervised, regularly or on a rotational basis by an officer of a military service or government agency other than the Air Force.

(From Ref 8:22-142.1)

Appendix D

Proportion of Incorrect Academic Codes in the Uniform Officer Records

For a large sample of size n, the binomial distribution can be approximated by a normal distribution.

A random sample of 100 academic codes contained in the Uniform Officer Records indicated 26 codes were incorrect.

To obtain a 0.95 confidence interval for the actual proportion of incorrect academic codes in the population of line officers who possess master's degrees requires the following computation.

Let $Z = 1.96$ (Standard normal deviate)

$n = 100$ (Sample size)

$x = 26$ (Number of incorrect codes)

The upper and lower limits of the actual proportion of incorrect codes are given by

$$\frac{x + \frac{1}{2}Z^2 \pm Z\sqrt{\frac{x(n-x)}{n} + \frac{1}{4}Z^2}}{n + Z^2}$$

$$= \frac{26 + \frac{1}{2}(1.96)^2 \pm 1.96\sqrt{\frac{(26)(74)}{100} + \frac{1}{4}(1.96)^2}}{100 + (1.96)^2}$$

$$= \frac{27.9208 \pm 1.96\sqrt{19.24 + .9604}}{103.8416}$$

$$= \frac{27.9208 \pm 8.8092}{103.8416}$$

This results in a confidence interval of .184 to .354.

Appendix E

Table XXVIII

Classification of Academic Qualifications

by the American Council on Education

Humanities

Art

English

Linguistics

Modern Foreign Languages

Music

Philosophy

Religion

Speech and Drama

Education

Elementary Education

Educational Administration

Social Sciences

Accounting

Anthropology

Business and Commerce

Economics

Geography

History

Political Science

Public Administration

Sociology

Table XXVIII--Continued

Biological Sciences

Agriculture

Bacteriology

Biochemistry

Biology, General

Botany

Forestry

Psychology

Zoology

Physical Sciences

Chemistry

Geology and Earth Sciences

Mathematics

Oceanography

Physics

Engineering

Aeronautical

Chemical

Civil

Electrical

Industrial

Mechanical

Miscellaneous

(From Ref 20:9186-9187)

Appendix F

Table XXIX

Classification of Academic Qualifications by the U. S. Department of Health, Education, and Welfare

Natural Sciences and Related Professions

Mathematics and Statistics

Engineering

Physical Sciences

Biological Sciences

Agriculture and Forestry

Health Professions

Science, General Program

Social Science, Humanities, and Related Professions

Fine Arts

Philosophy and Religion

English and Journalism

Foreign Languages

Psychology

Social Sciences

Education

Library Science

Social Work

Other

(From Ref 66:36-40)

Appendix G

Estimate of Business Administration/Management Master's Degrees From Education Services in FY 1969

The computation of a confidence interval for the number of business administration/management master's degrees from the Education Services program in FY 1969 is as follows:

Sampling fraction (f) is 41 percent.

Population size (N) is 644.

Sample size (n) is 262.

Sample percentage of business administration/management degrees (p) is 61 percent.

Standard normal deviate (Z) for a 95 percent interval is 1.96.

Estimated standard error of the sample percentage is s.

Since the population percentage of business administration/management master's degrees is unknown, p will be used to estimate this value.

The confidence interval = $p \pm Zs$

where $$s = \sqrt{1 - f}\sqrt{\frac{p(100 - p)}{n}}$$

$$= \sqrt{1 - .41}\sqrt{\frac{(61)(39)}{262}} = 2.31$$

The confidence limits are

$$61 \pm (1.96)(2.31) = 61 \pm 4.53$$

Therefore, the confidence interval is 56.47 percent to 65.53 percent at the 0.95 confidence level.

Appendix H

Table XXX

Loss Rates for Fiscal Year 1965

All Air Force Officers

Years of Active Service	Nondegree	Bachelor's Degree	Advanced Degree
0	.065	.007	.007
1	.190	.013	.064
2	.217	.115	.531
3	.076	.143	.269
4	.121	.090	.164
5	.102	.092	.093
6	.059	.064	.059
7	.053	.040	.058
8	.071	.033	.069
9	.040	.023	.059
10	.044	.009	.025
11	.016	.010	.018
12	.017	.005	.016
13	.014	.021	.023
14	.018	.007	.007
15	.050	.030	.017
16	.027	.037	.022
17	.013	.013	.010
18	.007	.007	.005
19	.168	.119	.063
20	.374	.260	.160
21	.383	.264	.156
22	.219	.144	.113
23	.214	.143	.096
24	.106	.069	.045
25	.102	.088	.052
26	.130	.151	.099
27	.204	.119	.117
28	.182	.149	.125
29+	.351	.252	.243

(From Ref 57:69)

Appendix I

Test of the Difference Between Retention Rates

The retention rate for Air Force Institute of Technology graduates of 1955 and 1956 was tested against the retention rate of graduates during 1959 through 1961 to determine if the difference in the rates was due to chance.

Notation used in the computation is as follows:

Sample size of 1955-1956 graduates (n_1) is 661.

Sample size of 1959-1961 graduates (n_2) is 1361.

Retention rate of 1955-1956 graduates (R_1) is 83.6 percent.

Retention rate of 1959-1961 graduates (R_2) is 62.3 percent.

Estimated standard error of the difference between the two sample percentages is $S_{R1 - R2}$.

The standard normal deviate is Z.

The true population retention rate is unknown; therefore, an estimate (R_p) will be obtained by averaging the two sample percentages.

$$R_p = \frac{553 + 848}{661 + 1361} (100)$$

$$= \frac{1401}{2022} (100)$$

$$= 69.2 \text{ percent}$$

$$S_{R1 - R2} = \sqrt{\frac{R_p(100 - R_p)(n_1 + n_2)}{n_1 n_2}}$$

$$= \sqrt{\frac{(69.2)(30.8)\ 661 + 1361}{(661)(1361)}}$$

$$= \sqrt{\frac{(2131.36)\ 2022}{899621}}$$

$$= 2.1887$$

then $$Z = \frac{R_1 - R_2}{S_{R1 - R2}} = \frac{83.6 - 62.3}{2.1887} = 9.73$$

The hypothesis that the difference between the retention rates is due to chance is rejected.

Appendix J

Table XXXI

Academic Level of All Air Force Officers

Year	Total Force	No College Degree	College Graduate	% College Graduate
1948	49,395	37,209	12,186	24.7
1949	60,770	44,228	16,542	27.2
1950	56,779 (a)	40,633	16,146	28.4
1951	119,081 (a)	70,653	46,990 (b)	39.5
1952	129,792 (a)	74,171	55,621	42.8
1953	120,610 (a)	69,323	51,287	42.5
1954	130,430 (a)	71,731	58,699	45.0
1955	138,314	72,744	61,319 (c)	44.3
1956	137,393	69,375	63,011 (d)	45.9
1957	131,174	70,354	60,820	46.4
1958	129,141	66,583	62,558	48.4
1959	127,398	65,167	62,231	48.8
1960	125,555	63,785	61,770	49.2
1961	128,989	62,011	65,772 (e)	51.0
1962	130,770	62,684	68,086	52.1
1963	131,101	56,532	74,569	56.9
1964	131,499	50,823	80,676	61.8
1965	131,877	43,835	88,042	66.8
1966	127,932	39,479	88,453	69.1
1967	133,078 (f)	33,620	99,458	74.7
1968	138,199	30,255	107,944	78.1

(a) General officers not included.
(b) Status of 1,438 officers unknown.
(c) Status of 4,221 officers unknown.
(d) Status of 5,007 officers unknown.
(e) Status of 1,206 officers unknown.
(f) Warrant officers not included.

Years 1948 through 1964 (From Ref 19)
Years 1965 through 1968 (From Ref 49)

Appendix K

Forecast of a Total College Educated Officer Corps

The forecast is based on only those years where Air Force policy has been aimed at an all-degree officer force.

The following notation is used in the computation:

D_i is the total number of line officers with a college degree in year i.

P_i is the total population of line officers in year i.

Y_i is the percentage of line officers with a college degree in year i.

One unit of X is equal to one year with the origin at year 1965.

Computation required for fitting a least squares straight line is as follows:

$D_1 = 68086$	$P_1 = 130770$	$Y_1 = .52065$
$D_2 = 74669$	$P_2 = 131101$	$Y_2 = .56955$
$D_3 = 81296$	$P_3 = 131499$	$Y_3 = .61823$
$D_4 = 88042$	$P_4 = 131877$	$Y_4 = .66761$
$D_5 = 88453$	$P_5 = 127932$	$Y_5 = .69141$
$D_6 = 99901$	$P_6 = 134968$	$Y_6 = .74018$
$D_7 = 107944$	$P_7 = 138199$	$Y_7 = .78108$

Year	X	Y	XY	X^2
1962	-3	.52065	-1.562	9
1963	-2	.56955	-1.139	4
1964	-1	.61823	- .618	1
1965	0	.66761	0	0
1966	1	.69141	.691	1
1967	2	.74019	1.480	4
1968	3	.78108	2.343	9
	0	4.589	1.195	28

$$a = \frac{\sum Y}{n} = \frac{4.589}{7} = .656$$

$$b = \frac{\sum XY}{\sum X^2} = \frac{1.195}{28} = .043$$

$$Y = .656 + .043X$$

Thus, 1973 is the year when the total officer force will be college educated.

Appendix L

A Five Year Forecast of Master's Degrees

Computation necessary for fitting a straight line to the yearly inventory of line officers who have obtained master's degrees is as follows:

Year	X	Y	XY	X^2
1964	-2.5	9742	-24355.0	6.25
1965	-1.5	9852	-14778.0	2.25
1966	- .5	10891	- 5445.5	.25
1967	.5	11776	5888.0	.25
1968	1.5	12675	19012.0	2.25
1969	2.5	13727	34317.5	6.25
Total	0.0	68663	14639.5	17.50

The actual observations are as of 1 July of each year which results in the third and fourth years being 0.5 years away from the origin.

The line $Y = a + bX$ is derived as follows:

$$a = \frac{\sum Y}{n} = \frac{68663}{6} = 11443$$

$$b = \frac{\sum XY}{\sum X^2} = \frac{14639.5}{17.5} = 836.543$$

then $$Y = 11443 + 836.54X$$

where 1 January 1967 equals zero and a unit of X is equal to one year.

The forecast of line officers with master's degrees for 1 July 1974 is determined to be 17,717.

Appendix M

A Comparison of Manning Percentages

FY 1968 and FY 1969

Table XXXII

Master's Degrees--Net Change Between FY68 and FY69

Area of Study		Col.	L. C.	Maj.	Capt.	Lt.	Total
Interarea Spec.	PCT FY68	0	4.88	3.95	0	0	2.40
	PCT FY69	0	5.71	2.53	0	0	1.95
	Net Chge	0	+ .83	- 1.42	0	0	- .45
Admin., Mgmt.	PCT FY68	42.92	82.87	110.41	211.06	580.82	100.92
	PCT FY69	40.45	88.69	125.29	251.47	616.44	111.23
	Net Chge	- 2.47	+ 5.82	+ 14.88	+ 40.41	+ 35.62	+ 10.31
Arts, Human., Educ.	PCT FY68	142.86	286.36	338.46	353.85	750.00	347.26
	PCT FY69	133.90	298.45	354.92	444.44	*	385.68
	Net Chge	- 8.96	+ 12.09	+ 16.46	+ 90.59	*	+ 38.42
Bio., Agri. Sci.	PCT FY68	**	283.33	1133.33	310.00	1300.00	590.91
	PCT FY69	**	266.67	950.00	385.71	1666.67	690.00
	Net Chge		- 16.66	-183.33	+ 75.71	+366.67	+ 99.09
Engineering	PCT FY68	66.07	88.66	126.57	84.09	86.65	94.34
	PCT FY69	63.58	93.54	136.26	92.59	117.15	103.63
	Net Chge	- 2.49	+ 4.88	+ 9.69	+ 8.50	+ 30.50	+ 9.29
Mathematics	PCT FY68	200.00	166.67	123.94	100.85	325.00	139.52
	PCT FY69	142.86	196.55	155.56	109.09	300.00	151.06
	Net Chge	- 57.14	+ 29.88	+ 31.62	+ 8.24	- 25.00	+ 11.54

Table XXIII--Continued

Area of Study		Col.	L. C.	Maj.	Capt.	Lt.	Total
Physical Science	PCT FY68	53.15	53.00	71.04	71.07	80.00	65.91
	PCT FY69	36.05	30.28	47.00	39.28	95.79	41.03
	Net Chge	- 17.10	- 22.72	- 24.04	- 31.79	+ 15.79	- 24.88
Social Science	PCT FY68	512.12	332.26	447.83	183.23	4333.33	393.91
	PCT FY69	509.09	373.73	306.02	313.51	4500.00	421.84
	Net Chge	- 3.03	+ 41.47	-141.81	+130.28	+166.67	+ 27.93
Total	PCT FY68	77.63	101.74	128.46	119.79	233.39	116.99
	PCT FY69	71.83	98.28	128.88	122.64	266.89	117.23
	Net Chge	- 5.85	- 3.46	+ .42	+ 2.85	+ 33.50	+ .24

* All requirements deleted; AF inventory of 251; an increase of 26

** No requirements; 9 assigned FY68; 7 assigned FY69

Table XXXIII

Doctor's Degrees—Net Change Between FY68 and FY69

Area of Study		Col.	L. C.	Maj.	Capt.	Lt.	Total
Interarea Spec.	PCT FY68	0	20.00	0	*	*	9.09
	PCT FY69	0	20.00	100.00			18.18
	Net Chge	0	0	+100.00			+ 9.09
Admin., Mgmt.	PCT FY68	7.14	16.13	44.44	**	***	23.38
	PCT FY69	8.70	27.78	36.84	400.00	****	32.91
	Net Chge	+ .56	+ 11.65	- 7.60	+400.00		+ 9.53
Arts, Human., Educ.	PCT FY68	38.46	118.18	106.67	85.71	****	87.14
	PCT FY69	44.44	88.46	62.07	91.67	***	72.94
	Net Chge	+ 5.98	- 29.72	- 44.60	+ 5.96		- 4.20
Bio., Agri. Sci.	PCT FY68	**	150.00	60.00	33.33	400.00	109.09
	PCT FY69	***	200.00	150.00	42.86	300.00	118.18
	Net Chge		+ 50.00	+ 90.00	+ 9.53	-100.00	+ 9.09
Engineering	PCT FY68	162.50	79.07	103.08	25.24	52.24	63.95
	PCT FY69	162.50	100.00	82.14	44.86	17.91	62.34
	Net Chge	0	+ 20.93	- 20.94	+ 19.62	- 34.33	- 1.61
Mathematics	PCT FY68	100.00	14.29	180.00	13.64	20.00	33.96
	PCT FY69	33.33	25.00	56.25	17.39	40.00	32.35
	Net Chge	- 66.67	+ 10.71	-123.75	+ 3.75	+ 20.00	- 1.61

Table XXXIII--Continued

Area of Study		Col.	L. C.	Maj.	Capt.	Lt.	Total
Physical Science	PCT FY68	46.43	39.62	73.17	25.35	75.00	49.80
	PCT FY69	29.41	29.69	55.74	42.86	27.59	38.10
	Net Chge	- 17.02	- 9.93	- 17.43	+ 17.51	- 47.41	- 11.70
Social Science	PCT FY68	175.00	133.33	72.34	20.00	480.00	98.26
	PCT FY69	125.00	110.00	78.05	36.84	171.43	84.09
	Net Chge	- 50.00	- 23.33	+ 5.71	+ 16.84	-308.57	- 14.17
Total	PCT FY68	64.10	62.83	84.77	25.85	80.58	60.80
	PCT FY69	60.00	60.91	68.38	44.15	36.36	54.72
	Net Chge	- 4.10	- 1.92	- 16.39	+ 18.30	- 44.22	- 6.08

* No requirements, none assigned

** No Requirements, one assigned

*** No requirements, two assigned

**** No requirements, three assigned

Vita

Carlton Eugene Thorne [redacted] graduated from high school in Wilson, North Carolina, in 1952 and enrolled in Lees-McRae Junior College from which he received the degree of Associate of Arts in 1954. In October 1954, he entered the United States Air Force. He has attended Centenary College, the University of Wyoming, and is a graduate of the University of the Philippines where he received the degree of Bachelor of Arts. His recent Air Force duty was as a Minuteman missile launch control officer. He entered the Air Force Institute of Technology Graduate Systems Analysis Program in September, 1968.

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11. SUPPLEMENTARY NOTES	12. SPONSORING MILITARY ACTIVITY

13. ABSTRACT

The report systematizes graduate education in the United States Air Force and examines all elements of the system as they relate to the system objectives. It covers the establishment of advanced degree requirements, the sources of graduate degrees, and the utilization of advanced degrees. The report contains the annual production of advanced degrees by sources with emphasis on gains and losses during fiscal year 1969. The factors which affect the retention of officers with advanced degrees are examined. A proposed advanced education model is presented which will incorporate all sources into the system.

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doctor's degrees						

END