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## Paper Session III-C - Space Studies Curriculum Proposal for Local Graduate Students

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# **Introduction of a Space Studies Curriculum at the Embry-Riddle Aeronautical University Resident Center, Patrick Air Force Base, Florida**

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## **Abstract**

Embry-Riddle Aeronautical University introduced the Space Studies curriculum as part of the Master of Aeronautical Science program at the Daytona Beach campus in 1992. With the large population of professional aerospace workers employed at Kennedy Space Center and Cape Canaveral Air Station, it is a likely assumption that Space Studies would fit the needs of many of those workers, and thus would be a viable candidate program for introduction at the Patrick AFB Resident Center. Data for this research was obtained through the use of a survey of current ERAU students. The survey results have indicated that there is enough interest locally to introduce and promote the Space Studies curriculum to Kennedy Space Center area graduate students.

## **The Problem and its Setting**

### Introduction

Embry-Riddle Aeronautical University is an independent, non-profit, coeducational institution with a history dating back to the early days of aviation. In addition to its campuses in Daytona Beach, Florida and Prescott, Arizona, the university maintains an extensive network of resident centers throughout the United States and abroad to serve civilian and military working adults. The Daytona Beach and Prescott campuses have a combined enrollment of approximately 6,800 students. Additionally, approximately 13,000 part-time students are enrolled throughout the 116 worldwide resident centers. (Erickson, L. K. 1995) It is the stated purpose of the school "to provide a comprehensive education that prepares graduates for productive careers . . . to support the needs of aviation, aerospace engineering, and related fields" (ERAU 1997, Graduate Catalog). In support of that purpose, Embry-Riddle instituted the Space Studies curriculum as part of the Masters of Aeronautical Science program at the Daytona Beach campus in 1992. The Space Studies program, while non-technical in nature, was designed to give the student a firm background in the workings of modern spaceflight with courses dealing in subjects such as launch operations, earth observations, and space habitation. Currently, the graduate level program is not being offered at any campus or resident center at ERAU. Lack of enrollment is the reason the program is no longer offered at the Daytona Beach campus.

### Importance of the Study

ERAU has invested a sizable amount of time, effort and budget in developing the Space Studies curriculum for the MAS program. With so much groundwork completed, it would not seem prudent to completely abandon the program simply because of low enrollment at one of the university's many locations.

There are geographic locations around the country which have an unusually large aerospace workforce involved primarily with space exploration. The many NASA space and research centers, and the various major launch sites would be considered the prime examples. Of these, the Florida sites of the Kennedy Space Center, the adjoining Cape Canaveral Air Station, and nearby Patrick AFB, together form by far the largest concentration of workers involved in space exploration and its associated disciplines. It would seem, then, that with such large numbers upon which to draw, the university would have little trouble maintaining enrollment in a space studies program.

The primary focus of this research will be to determine if the ERAU/PAFB student population currently in place is sufficient to support the introduction of the Space Studies curriculum as part of the Masters program already being offered.

## Problem Statement

In an effort to broaden the scope of program offerings at the Patrick AFB ERAU Resident Center, an analysis based on survey results of the ERAU/PAFB population will be performed to determine if the graduate level Space Studies curriculum can maintain viable enrollment levels.

### Sub-problem 1

Determine from the current student population at ERAU/PAFB, the likelihood of near-term enrollment in the graduate Space Studies curriculum.

### Sub-problem 2

Determine from the current student population at ERAU/PAFB, the likelihood of long-term enrollment in the graduate Space Studies curriculum.

## Hypotheses

1. From the current population at ERAU/PAFB who are pursuing graduate studies or who are about to pursue graduate studies, a minimum of 16 students will express at least a high level of interest in immediate enrollment in a graduate level Space Studies curriculum.
2. From the current population at ERAU/PAFB who are in the early or mid stages of undergraduate studies, a minimum of 12 students will express at least a high level of interest in enrollment in a Space Studies curriculum once they become eligible for a graduate program.

## **Review of Relevant Literature and Research**

### History of Space Studies at Embry-Riddle

The university began developing a non-technical space studies curriculum by introducing an undergraduate minor in 1990. Careful planning of the curriculum and favorable student interest in the space subjects assisted in the success of the nine-course program. The success of the minor allowed the university to undertake the development of a graduate level program in 1991. (Erickson, L. K. 1995)

The masters program proved to be a more difficult undertaking than the undergraduate program, principally because of the need both for supporting courses and experienced faculty members. The structure and delivery of the graduate Space Studies curriculum was developed within an already existing program, the Masters of Aeronautical Science (Erickson, L. K. 1995). MAS is structured around four core courses (which are all required no matter what the area of specialization is): The Air Transportation System, Aircraft and Spacecraft Development, Human Factors in the Aviation/Aerospace Industry, and Research Methods and Statistics. Four courses are required in the area of specialization, which currently includes the following:

- Aeronautics
- Aviation/Aerospace Education Technology
- Aviation/Aerospace Management
- Aviation/Aerospace Operations
- Aviation/Aerospace Safety Systems
- Human Factors in Aviation Systems

Note that not all areas of specialization are offered at all Extended Campus locations (for example, PAFB offers all of the above except Education Technology). Between two and three elective courses are required, depending on whether a six-credit thesis or three-credit Graduate Research Project is selected. The thesis option is not available at Extended Campus locations such as PAFB. Dual specialization is also an option whereby the elective courses are eliminated and eight specialization courses are taken (four from each area). Dual specialization results in a 39-credit program vs. the standard 36-credit program.

While undergraduate Space Studies has experienced healthy enrollment numbers since its inception, the masters program has not fared so well. During the 1995 - 1997 time period, average enrollment at Daytona Beach fell below eight students for each of the three years. The Fall 1997 term saw the final graduate Space Studies class



faculty availability, Veterans Administration approval, and existing programs at other institutions which may parallel the proposed program. (Bridgham, J. 1998)

A minimum of eight students is required for a program offering—probably the most difficult obstacle to overcome, and which lies at the very heart of this research project. Anything less than eight students ready to enroll, would cast serious doubt on introducing any new program. (Bridgham, J. 1998)

Finding qualified instructors is an important consideration, and in the cases of smaller resident centers, it can pose a real problem (Bridgham, J. 1998). For the Patrick AFB center, and in the area of Space Studies, it is not a major concern. The workforce population is such, that qualified instructors would be easy to locate.

The Veterans Administration requires that certain qualifications must be met for schools such as Embry-Riddle, which offer veterans benefits. Proposed programs must be of value to students. It stands to reason that if the VA was to pay out thousands of dollars in tuition, it would want some assurance that the money would not be wasted on a program that would ultimately be worthless to the student. Since the Space Studies program has already been offered at Daytona Beach, it is believed that VA approval would not be difficult for PAFB. (Bridgham, J. 1998)

The Air Force requires that educational institutions located on its installations do not unnecessarily compete against each other. If the school's introduction of Space Studies at PAFB would mean that all the Florida Tech students would jump to Embry-Riddle, that would most certainly put a stop to any such proposal (Bridgham, J. 1998). That is not foreseen, however (at least by the researcher) because the FIT program is technically based and the ERAU program is less so. While the subject matter is similar, the programs are really targeting students with different goals.

## **Methodologies**

### Overview

In order to determine the level of interest in (and therefore the viability of) the Space Studies curriculum, a survey was conducted of the ERAU/PAFB student population. The survey determined which respondents were the most likely candidates for a masters program, both in the near-term and the long-term, and sought their evaluation of the Space Studies curriculum.

### The Survey

Preliminary questions determined the educational level and level of interest in pursuing graduate studies. A brief overview of the ERAU-MAS program, along with the Space Studies specialization, was then presented to each survey subject, following which, a series of statements were provided whereby he or she could indicate the level of interest (see Appendix). A description of the four Space Studies course offerings was also provided to further assist in the program evaluation (see course descriptions on p. 3 of this report).

### Data Collection

Oftentimes, one of the most difficult and challenging elements of survey research is data collection. The researcher's original approach to data collection was to survey samples of the KSC/CCAS/PAFB employee base in the hopes of determining (through inferential statistics) that there was sufficient interest in the ERAU graduate Space Studies curriculum to warrant its offering at the PAFB Resident Center. In the case of this project, the researcher had some fortuitous circumstances presented which greatly simplified the data collection process. The researcher was able to obtain permission from the ERAU/PAFB Resident Center Director to survey the entire enrolled Graduate and Undergraduate population. The surveys were conducted during normal scheduled classes, and were collected during the same session, thus insuring nearly 100% participation.

## Analysis of the Data

A survey of virtually the entire enrolled ERAU/PAFB graduate and undergraduate population was conducted to determine if there is enough interest to introduce and sustain enrollment in the Space Studies curriculum.

Definition of terms:

X total respondents expressing interest in the near-term

Y total respondents expressing interest in the long-term

### Sub-problem 1

The first sub-problem is to determine from the current student population at ERAU/PAFB, the likelihood of near-term enrollment in the graduate Space Studies curriculum. Questions B2 and A1 will determine the validity of the hypothesis: that among current ERAU/PAFB graduate students and undergrads nearing completion of their degree requirements, at least 16 are ready to enroll.

$H_1: X \geq 16$  or  $H_0: X < 16$

### Sub-problem 2

The second sub-problem is to determine from the current student population at ERAU/PAFB, the likelihood of long-term enrollment in the graduate Space Studies curriculum. Questions B2 and A1 will determine the validity of the hypothesis: that among current ERAU/PAFB undergrads who are in the early or mid stages of their degree program, at least 12 are interested in the graduate Space Studies curriculum and are likely to enroll once their undergraduate requirements are completed.

$H_1: Y \geq 12$  or  $H_0: Y < 12$

In the case of Sub-problem 2, the decision value will be lessened from 16 to 12 for two reasons. First, the long-range educational plans for new undergraduate students often are not firmly defined. Graduate school is a distant consideration for many of these students, so trying to make a long range educational decision could prove to be a difficult one (at best) for many undergrads. Second, the pipeline for graduate students will most certainly come from other schools, in addition to Embry-Riddle (as evidenced by the current complement of ERAU/PAFB graduate students). Fewer respondents indicating a long-term interest in the program would not necessarily indicate a drop-off of enrollment in later years.

Since a survey of virtually an entire population was conducted, a simple tally of students responding positively to the selected questions will determine if interest is sufficient to introduce the graduate Space Studies curriculum.

## Results

Table 1 contains a breakdown of all responses from all surveys. Reference Appendix for survey questions. Tables 2 and 3 give more relevant meaning to the data in that they reveal some key demographics of those who expressed high or intense interest (responding with a 4 or 5 to question B2) and represent the two responses which are of the highest importance to the study. During the survey, each class was briefed on the significance to responding with either a 4 or 5 to question B2. A response of 4 would indicate a high level of interest in the program and a high likelihood of enrolling in the program as soon as the opportunity presented itself. A response of 5 would represent an intense level of interest with a virtual 100% likelihood of enrolling in the program as soon as the opportunity presented itself.

Table 1

Comprehensive Survey Results

Total respondents: 100

Question A1

Response Number	N/R*	1	2	3	4	5
Frequency of Responses	2	44	17	11	22	4

Question A2

Response Number	N/R	1	2	3	4	5
Frequency of Responses	0	5	8	14	27	46

Question B1

Response Number	N/R	1	2	3	4	5
Frequency of Responses	0	14	14	23	23	26

Question B2

Response Number	N/R	1	2	3	4	5
Frequency of Responses	0	19	23	17	22	19

\*N/R = No Response (indicates the participant either refused or neglected to answer the question).

Table 2

Question B2 Respondents Who Indicated "4" as Their Level of Interest

Total respondents: 22

Question A1

Response Number	N/R	1	2	3	4	5
Frequency of Responses	1	8	4	3	5	1

Question A2

Response Number	N/R	1	2	3	4	5
Frequency of Responses	0	0	1	2	7	12

Question B1

Response Number	N/R	1	2	3	4	5
Frequency of Responses	0	0	0	1	14	7

Table 3

Question B2 Respondents Who Indicated "5" as Their Level of Interest

Total respondents: 19

Question A1

Response Number	N/R	1	2	3	4	5
Frequency of Responses	1	7	4	2	5	0

Question A2

Response Number	N/R	1	2	3	4	5
Frequency of Responses	0	2	0	0	2	15

Question B1

Response Number	N/R	1	2	3	4	5
Frequency of Responses	0	0	0	0	2	17

Sub-problem 1 is to determine from the current student population at ERAU/PAFB, the likelihood of near-term enrollment in the graduate Space Studies curriculum. Tables 2 and 3 contain the data needed to test the validity of the hypothesis. The hypothesis and its corresponding null will be tested.

$H_1: X \geq 16$  or  $H_0: X < 16$

Table 2: 13 individuals who have completed or nearly completed undergraduate work responded as having a high level of interest in the program and a high likelihood of enrolling in the program as soon as the opportunity presents itself.

Table 3: 11 individuals who have completed or nearly completed undergraduate work responded as having an intense level of interest in the program and a likelihood of immediately enrolling in the program as soon as the opportunity presents itself.

Total respondents expressing at least a high level of interest equals 24, thus  $H_1$  can be accepted.

Sub-problem 2 is to determine from the current student population at, ERAU/PAFB, the likelihood of long-term enrollment in the graduate Space Studies curriculum. Tables 2 and 3 contain the data needed to test the validity of the hypothesis. The hypothesis and its corresponding null will be tested.

$H_1: Y \geq 12$  or  $H_0: Y < 12$

Table 2: 8 individuals who are in the early or mid stages of their undergraduate work responded as having a high level of interest in the program and a high likelihood of enrolling in the program as soon as the opportunity presents itself.

Table 3: 7 individuals who are in the early or mid stages of their undergraduate work responded as having an intense level of interest in the program and a likelihood of immediately enrolling in the program as soon as the opportunity presents itself.

Total respondents expressing at least a high level of interest equals 15, thus  $H_1$  can be accepted.

## Discussion

As the survey effort of the ERAU/PAFB student population drew to a close, It became apparent that the hypotheses for both Sub-problems 1 and 2 would be proved without the need to survey additional subjects. It was at this point that the researcher decided to forgo any further survey administration, and proceed with the data analysis.

The responses show both a near-term interest and a long-term interest in the offering of a Space Studies curriculum at PAFB. Those who are in the early to mid stages of a baccalaureate program, but who still indicated a high or intense interest (responding with a 4 or 5 to question B2) are categorized as representing a long-term interest in the program. Based on the survey, there are 15 Undergraduate students in the early to mid stages of their program who wish to continue on with graduate work in the Space Studies curriculum. Since it will be perhaps two or three years before many of these students complete their undergraduate work, they represent interest in Space Studies over the long-term. Even more important to the issue of introducing the program, are those students who are undergraduate degree holders (or who are about to graduate) and have expressed an interest in immediate enrollment. Based on the survey, there are 24 students who are likely to enroll in the graduate Space Studies curriculum in the near-term, and of those, 11 have virtually committed to enrollment.

Also worthy of note were the many respondents who rated the program highly (response of 4 or 5) regarding its value to their career development (Question B1), but rated it 3 or below regarding the likelihood that they would enroll (Question B2). Nine individuals responded as such. These data points are important in that they serve to further reinforce the value of the Space Studies curriculum, even though the nine respondents are less likely to enroll. Reasons for this type of response could range from economic considerations to time commitments/availability (although these reasons are speculative on the researcher's part).

## Conclusions and Recommendations

It is abundantly clear that the level of interest within the ERAU/PAFB student population is sufficient to warrant the introduction of the Space Studies curriculum. What started out as anecdotal evidence on the part of the researcher has now been proven with tangible, meaningful data. The likelihood that non-ERAU students in the local area would also find the program of value to the extent that they would enroll, could also be considered high.

The researcher recommends that the administration at ERAU/PAFB poll its current student population and identify by name, those who are ready to enroll in the Space Studies curriculum. Additional Space Studies candidates could be identified by placing announcements in local publications which are typically read by aerospace industry personnel. At least three would publish announcements at no charge to the university. They are: the "KSC 10 O'clock News", the "KSC Bulletin", and the Patrick AFB "Missileer".

The reasons to offer the graduate Space Studies curriculum are compelling. The research clearly has proven an adequate level of interest. The coursework has already been developed by the university's main campus. There is little doubt that qualified instructors exist within the KSC/CCAS/PAFB community. The Space Studies curriculum could be in place and serving the needs of area graduate students within a few short months.

## References

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## Embry-Riddle Aeronautical University Space Studies Interest Survey

The purpose of this questionnaire is to solicit responses from current or potential KSC/CCAS/PAFB employees who have completed (or have nearly completed) a bachelors degree and are considering post-graduate study.

- A1. Please indicate the level of your education:
- 1 = more than three classes away from completing bachelor's degree
  - 2 = within three classes of completing bachelor's degree
  - 3 = three or less classes completed in master's program
  - 4 = more than three classes completed in master's program
  - 5 = master's degree, or higher

1 2 3 4 5

- A2. Please indicate your level of interest in pursuing graduate studies.  
(1 indicating the lowest level of interest and 5 the highest)

1 2 3 4 5

Please review the following information:

The Master of Aeronautical Science (MAS) degree program at ERAU is designed to provide the aviation/aerospace professional with a rigorous academic approach to a generalist education oriented degree. It provides an unqualified opportunity to enhance knowledge and pursue additional career opportunities. Entry into the MAS program requires possession of an undergraduate foundation in the areas of college-level mathematics, computer operation fundamentals, economics, behavioral science, and aviation rules and regulations. Students in the program must complete the Advanced Aviation/Aerospace Science core consisting of twelve credits. They then complete twelve credits which make up the selected specialization. Nine credits are obtained as electives and a three-credit graduate research project completes the program for a total of thirty-six credits.

Under consideration is the offering of a Space Studies specialization in the MAS program to graduate students at the ERAU/PAFB Resident Center. An overview of the program follows:

Advanced Aviation/Aerospace Science Core	12
MAS 602      The Air Transportation System	
MAS 603      Aircraft and Spacecraft Development	
MAS 604      Human Factors in the Aerospace Industry	
MAS 605      Research Methods and Statistics	
Space Studies Specialization	12
MAS 511      Earth Observation and Remote Sensing	
MAS 512      Space Mission and Launch Operations	
MAS 513      Space Habitation and Life Support Systems	
MAS 601      Applications in Space: Commerce, Defense, and Exploration	
Electives	9
May include, but are not limited to the following:	
MAS 509      Advanced Aerodynamics	
MAS 515      Aviation/Aerospace Simulation Systems	
MAS 607      Advanced Aircraft/Spacecraft Systems	
Required Project	3
MAS 690      Graduate Research Project	
Total Credits	36

- Notes: 1. All classes listed are three credits each.  
 2. Space Studies related classes from other institutions may transfer as electives.  
 3. Electives are not required to be Space Studies related.

Based on your review of the information provided:

B1. Please indicate your assessment of the value of such a program to your career development. (1 indicating the lowest value and 5 the highest)

1 2 3 4 5

B2. Please indicate the likelihood you would enroll in such a program. (1 indicating the least and 5 the greatest)

1 2 3 4 5