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# Innovation and Creativity in Aviation and Space Education

J. A. Lauderbaugh  
*Aerospace Technical Institute*

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# INNOVATION AND CREATIVITY IN AVIATION AND SPACE EDUCATION

J. A. Lauderbaugh  
Aerospace Technical Institute  
Florida

## Summary

During the last year, numerous aviation programs have been introduced in many colleges and junior colleges in the United States. A need exists to identify academic preparation based on the job-task requirement, on the one hand, and methods to improve and develop the required human motor skills of the professional pilot, on the other hand. This paper attempts to identify a method for initiating the design of academic curricula for the professional pilot and suggests a specific curriculum for the training of the professional pilot based on the method proposed.

## Introduction

In view of the fact that flight is unnatural to man, he must be taught to develop a high degree of competency in learning new basic human motor skills and taught to perform a variety of mental exercises to enable him to maneuver and execute a programmed flight path.

When man first took to the air in controlled flight in 1903, and for many years thereafter, the emphasis was on sufficiently developing human motor skills to permit the pilot to maneuver the airplane into the air for a short period of time and then to return to the ground. As a result of this heritage, "learning to fly" has remained, essentially, a vocational skill.

The introduction of jets in the 1950's, followed by the space probes of the 1960's and the distinct possibility that man will find a way to use space in this generation, indicates the requirement not only for greater academic enlightenment but specific academic study through post-baccalaureate levels for the professionals who command tomorrow's airliners. The training of the professional pilot involves the development of basic motor skills, obviously. But, formal education in specific disciplines is essential to the development of the professional who will operate expensive vehicles at speeds of Mach 5 in the hostile atmosphere of space.

## Discussion

A confusing and misleading approach is made by the layman when he discusses the process of "learning to fly." He assumes that there is no essential difference in the type of training he needs and, on the other hand, the needs of the true professional. The manufacturers of airframes hawk such slogans as, "If I Can Fly, Anyone Can Fly" etc. The Federal guardian of the airways, the Federal Aviation Administration recognizes little essential difference between avocational and professional flight training. But inquiries directed to personnel officers of major airlines indicate that young professional pilots can expect little placement success unless they have some formal

academic training.

Although educational institutions recognize some need for academic training of the professional pilot, there is too little thought given as to what should comprise the training. In the last year, approximately 100 institutions have initiated college-level programs in aviation. In addition to the conventional English, Mathematics, Science and History, a "hodge-podge" of non-related professional subjects, including accounting and management courses, have been injected into the curricula. Is this the kind of academic preparation needed by a professional pilot who will sit in the cockpit for the next 30 years of his adult life?

Formal education "per se" is not, in itself, sufficient training for the professional pilot. Available evidence indicates that academic specialization, in some professional fields, may be harmful and not remotely transferable to requisite knowledge of the professional pilot. Among professionally-trained men who fly, doctors of medicine rate highest in the number of accidents. What might be concluded from the statistic is that classical medical education does not provide knowledge essential to an aeronautical profession.

Over a span of time, professions become obsolete and new professions are created through technological change. It is up to the professionals in education to recognize the change and provide for these educational needs. Aviation - at least the Air Transportation Industry - has reflected greater technological change than any other industry, including the chemical industry. Not only is there a critical need for academic training of the professional pilot; there is a need for constant change of curricula and introduction of new curricula consistent with the changes in requirements which are occurring in this industry.

Few will argue the need for professional specialization of the typical Polaris submarine commander, but few people really have exposure to the problems faced by this specialization. On the other hand, the engineer, the medical doctor, the lawyer, the businessman and the college professor, once they acquire 25 hours at the controls of an airplane, all become experts on pilot training. Few, if any, college programs available today for training pilots are managed by qualified professional pilots.

What kinds of curricula are needed to train the aspiring professional who will spend his adult life in the cockpit of tomorrow's space vehicles? A survey was conducted of 25 of the world's airlines and replies were received from 19. There was unanimity in declaring that some formal education was a requirement for hiring, but airline personnel managers become vague when specific course content is examined. Over 75%, however, indicated that future hirings may rely heavily on training in the engineering sciences and aeronautical engineering, in particular.

Among college graduates, flying hours is the major determinant in airline hiring, all things being equal. One airline, in an attempt to weigh formal education in its informal hiring process, equated one year of college training to 500 flying hours.

In my opinion, specific academic training must be integrated with the development of specific motor skills or formal academic training could be irrelevant. As an illustration, the training of a surgeon involves the repetitive technique of locating the organ in the cadaver, making the incision and effecting the repair. The task is time-related. It is difficult to imagine formal medical education not being integrated with development of the basic human motor skills required of a surgeon. Progress must be made in integrating formal education with development of those human motor skills required in the academic curriculum of the professional pilot.

#### The Curriculum

Figure I illustrates three separate modes of goal orientation for pilots. The private pilot mode is essentially avocational and is terminal.

Mode 2 reflects a normal progression of job opportunity for the professional pilot and increasing formal academic training requirements to fulfill successive job progression tasks.

Mode 3 is a professional pilot career field involving the quest for new methods and techniques which the professional pilot must apply in order to advance the state-of-the-art in his career field and to assure concurrency with technological change in manned aircraft. It is science-orientated in its quest for new knowledge and the training provided could have a considerable amount of transfer to the Mode 2 career field of Commercial Pilot. Post 4-year college training in a specific curriculum is required.

Figure II summarizes the professional pilot functional-educational relationships by recognizing specific tasks of the pilot and an attempt is made to identify academic and professional preparation. Figure III describes a specific curriculum for the training of a limited Commercial Pilot, as defined in Figure II, at the 2-year college level, Mode 2 as described in Figure I.

The curriculum described in Figure III has been introduced in the past year. It is not an adaptation or modification of existing programs but was conceived and introduced to assure that an academic foundation could be laid to undertake subsequent comprehension of aeronautical subjects in Aeronavigation; statics and dynamics in preparation for follow-on subjects in aircraft performance, control and stability; weather and climate; principles of electricity and computer applications as applied to flight management. The Aero sequence is an integration into the academic program to enable the student to meet the Federal qualifications for a commercial pilot with instrument rating. Some 190 flight hours are provided to develop human motor skills involving the technique of control about the principle aircraft axes.

#### Conclusion

Review of the hiring criteria of those companies employing young professional pilots at low experience levels, indicates that formal academic training is a requirement for employment. All other things equal, an employer will pick the employee with the education that best fits the job. In view of the fact that pilot employment in the future will be based largely on education, there should be more thought given to relevancy in designing professional and academic programs for the training of professional pilots.

Level	Mode I	Mode II	Mode III
High School Level	Private Pilot		
2-Year College Level		Commercial Pilot (Limited)	
Post 2-Year College Level		Commercial Pilot (Unlimited)	
4-Year College Level		Airline Pilot	
Post 4-Year College Level			Space & Engineering Test Pilot

Figure I

PILOT FUNCTIONAL-EDUCATIONAL RELATIONSHIPS		
SPECIALIZATION	TASK	ACADEMIC & PROFESSIONAL PREPARATION
Private Pilot	Operate small aircraft under generally ideal conditions.	None ("anyone can learn to fly")
Commercial Pilot (Limited)	Operate aircraft under varying environmental conditions, generally favorable. Limited equipment capability.	Specialized 2-year preparation in natural and physical sciences and professional subjects. Development of motor skills.
Commercial Pilot (Unlimited)	Operation of aircraft under hostile environmental conditions of weather and climate. Operation of complex aircraft. Flight management.	Post 2-year preparation in the natural and physical sciences and professional subjects in aviation operations, maintenance and management. Development of appropriate motor skills.
Airline Pilot	Operation of aircraft under hostile environmental conditions. Operation of complex and new "state-of-the-art" aircraft.	Specialized preparation at the baccalaureate level in the natural and physical sciences and sophisticated preparation in aeronautical subjects. Development of motor skills and response monitoring.
Space and Engineering Test Pilot (Research Pilot)	Operation of special aircraft or space vehicles under hostile environmental conditions, involving new knowledge. Interpretation of observations. Control of specialized vehicles involving new techniques.	Research and investigation oriented, involving new knowledge of the natural and physical sciences. Specialized preparation at the post-baccalaureate level in science and aeronautics. Development of human motor skills to extremely fine degrees.

Figure II

DEGREE OF  
ASSOCIATE OF SCIENCE  
FLIGHT TECHNOLOGY

6 quarters — 11 weeks quarter

<u>1st Quarter</u>			<u>4th Quarter</u>		
<u>Number</u>	<u>Subject</u>	<u>Credit</u>	<u>Number</u>	<u>Subject</u>	<u>Credit</u>
Eng 114	English Composition	3	Dr 245	Graphic Science	3
Math 115	College Algebra	3	Mech 246	Statics & Dynamics	3
Aero 113	Princ. Navigation	3	Met 111	Weather&Climate II	3
Aero 103	Federal Air. Regu. I	3	Phy 243	Physiology-Flight	3
Aero 102	Flight I	6	Aero 202	Advanced Flight I	6
		<u>18</u>			<u>18</u>
<u>2nd Quarter</u>			<u>5th Quarter</u>		
<u>Number</u>	<u>Subject</u>	<u>Credit</u>	<u>Number</u>	<u>Subject</u>	<u>Credit</u>
Eng 124	Report Writing	3	Elect 119	Prin. of Electricity	3
Math 125	Trigonometry	3	Chem257	Chemistry	3
Met 101	Weather&Climate I	3	Chem258	Chemistry Lab.	1
Mech 121	Engines & Systems	3	Aero 253	Feder. Air Regu. II	3
Aero 112	Flight II	6	Aero 204	Aviation Seminar	3
		<u>18</u>	Aero 212	Adv. Flight II	4
					<u>17</u>
<u>3rd Quarter</u>			<u>6th Quarter</u>		
<u>Number</u>	<u>Subject</u>	<u>Credit</u>	<u>Number</u>	<u>Subject</u>	<u>Credit</u>
Sp 134	Public Speaking	3	Aero 262	Acft. Performance	3
Phys 135	General Physics	3	Comp265	Intro. Computers	3
Phys 136	Physics Laboratory	2	Elect 261	Aircraft Electrical	3
Aero 241	Adv. Aeronavigation	3		Systems	3
Aero 122	Flight III	6	Ind 222	Industrial Safety	3
		<u>17</u>	Aero 226	Instrument Flight	4
					<u>16</u>

TOTAL CREDIT HOURS    104

Notes:    F.A.A. Commercial Pilot examination at conclusion of 5th Quarter.  
             F.A.A. Instrument Pilot examination at conclusion of 6th Quarter.

Figure III