DOCUMENT RESUME

ED 244 818 SE 044 543

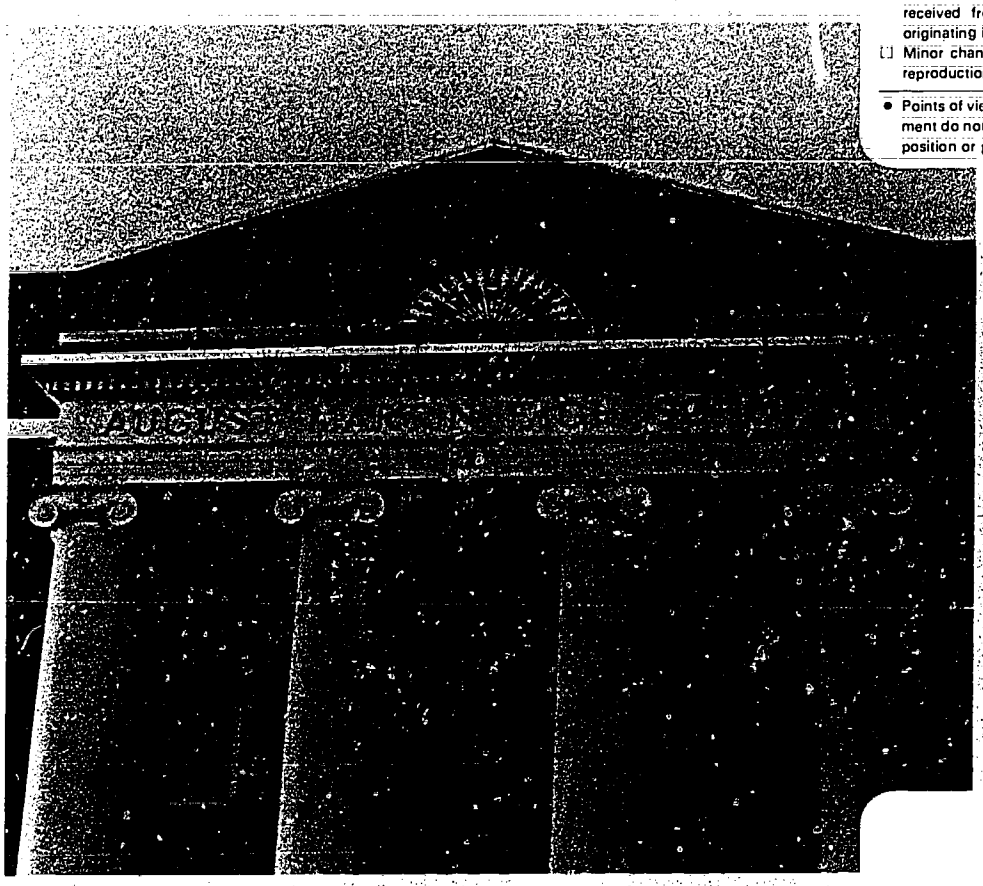
AUTHOR Strickler, Mervin K., Jr.
TITLE A Model Aerospace Curriculum: August Martin High School.
INSTITUTION Federal Aviation Administration (DOT), Washington, D.C. Office of General Aviation.
REPORT NO GA-300-143B
PUB DATE Aug 80
NOTE 60p.
PUB TYPE Reports - Descriptive (141)

EDRS PRICE MF01/PC03 Plus Postage.
DESCRIPTORS *Aerospace Education; Art Education; *Curriculum Development; Health Education; High Schools; Mathematics Curriculum; Music Education; Physical Education; *Program Descriptions; *Science Curriculum; *Secondary School Curriculum; Second Language Programs; Social Studies; *Thematic Approach
IDENTIFIERS *Aviation Education

ABSTRACT

This document presents an operational model of a thematic aerospace education school--the August Martin High School (New York). Part 1 briefly describes the nature of aviation/aerospace education and the background of the school. This background information includes how the school was formed, rationale for an aerospace thematic school, research evidence supporting aerospace education, proposed curriculum patterns, and projected elective courses. Part 2 describes the August Martin program, outlines the curriculum and examines a number of topics including: (1) innovative administrative and curriculum features; (2) such aerospace activities as the flying program and construction of the Wright Flyer replica; (3) annual PTA meeting at Eastern Airlines; (4) Port Authority activities; (5) aerospace careers day; and using John F. Kennedy airport facilities. Part 3 discusses the use of the aerospace theme in English, social studies, mathematics, foreign languages, science, music and art, and in health education. Part 4 provides conclusions and recommendations indicating that an aerospace or other thematic approach to education is not only feasible but also that the behavior changing impact of such programs yields remarkable benefits for both students and the community. (Lists of colleges accepting August Martin graduates and aerospace education resources are included in appendices.) (JN)

A MODEL AEROSPACE CURRICULUM



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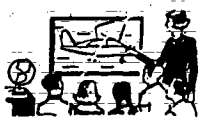

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AUGUST 1980

GA-300-143B

A MODEL AEROSPACE CURRICULUM

AUGUST MARTIN HIGH SCHOOL

Manuscript by

DR. MERVIN K. STRICKLER, JR.
Executive Director Federal Union, Inc.
1875 Connecticut Ave., N.W.
Washington, D.C. 20009

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TABLE OF CONTENTS

PART 1
INTRODUCTION

AVIATION/AEROSPACE EDUCATION

As you begin to read this publication, the questions of "What is aviation education?" and "Why is aviation education necessary?" undoubtedly cross your mind. An early definition of aviation education was formulated by Dr. Mervin K. Strickler, Jr. in 1951 (1)*:

> Aviation education is that branch of general education concerned with communicating knowledge, skills, and attitudes about aviation and its impact upon society.
>
> Aviation education may be formal or informal, that is, it may be organized in school and college curriculums or it may be undertaken by agencies devoted to informal rather than to formal education – agencies such as newspapers, magazines, the radio, television. One must therefore distinguish between formal aviation and informal aviation education.

A recent issue of the Directory of Aerospace Education (2) describes aviation and aerospace education as follows:

> WHY? When we consider that in the United States alone a half million people board commercial airlines on a typical day; or that scheduled airlines this past year carried well over 200 million people – the equivalent of the entire U.S. population; or that there are nearly 200,000 general aviation aircraft, 13,000 airports, and some 700,000 pilots; or that there are nearly one million people employed in the aerospace industry; or that aviation and space play a vital role in our national security; or that our aerospace foreign trade balance, which was $7.8 billion last year, was 10% of the total U.S. trade balance; or that the exploration and exploitation of space are benefiting mankind in so many more ways than anyone thought possible, then we begin to understand the sociological and technological importance of an aviation and space education.
>
> Aerospace education (3) is based on the belief that everyone – our students and the public at large – should: (A) understand and appreciate the enormous impact that aviation and space have on our lives; (B) understand and be aware of the many vocational and career possibilities related to the aviation and space industry; and (C) understand and appreciate the potential of aviation and space to serve mankind and to improve our daily lives and our growing society.
>
> WHAT IS IT? Aerospace education means many things to many people. To some, aerospace education means air age, aviation, or aeronautical education . . . to others, aerospace education means space or astronautical education . . . some see aerospace education as futuristic education. They propose that we utilize the energy of the young men and women who wrote over 4,000,000 letters to save the Star Trek television series and help them plan for their future . . . .

Others speak of aerospace education in terms of "specialized," "general," "basic," or "relevant" education. Some see aerospace education as *specialized education*, such as aerospace engineering or aerospace technology, or aerospace management. Still others see it as flight training or courses in aviation mechanics. Others see it as very specialized education, such as astronaut training. One national organization defined aerospace education as *general education* and excluded any specialized education or training efforts. In the general education programs, students visit airports and other aerospace facilities to learn more about aviation and space. They study the impact of aerospace on the social, economic, and political aspects of our society.

Other educators see aerospace education as *basic education*, or using aerospace as a motivating and meaningful medium through which to teach the basic academic subjects. They take advantage of the interests that students have in aviation and space to teach such basic subjects as geography, English, mathematics, science, physical education, music, industrial arts, business, and so forth. In a three-year research project in California, teacher and curriculum consultants developed useful aviation education materials at every grade level relating to the teaching of economics, sociology, and anthropology. Because aerospace is interlocked with so many areas of study, plans which emphasize aerospace in the curriculum at all age levels are valid.

* The numbers (1) thru (8) in parenthesis throughout this autobiography refer to "Footnotes and References" found on page 50 preceding Appendix A.

Finally, there are educators who agree that, no matter how aerospace education is viewed, it is *relevant education*. Comments such as the following illustrate this viewpoint: "Student enthusiasm for the aerospace course greatly outweighs anything I have experienced in any other class. This is particularly due, I believe, to something we are hearing a great deal about today—relevancy. Aerospace is a relevant course. Students relate to it because it is a practical application of the things they learn or are learning in their other subjects."

Still another viewpoint of aerospace education centers around *spontaneous pupil interest* in aircraft, rockets, and space vehicles—special interest that can lead them into exploratory enterprises that will help them understand their complex age and to assume responsibility for improvement of everyday living.

Aviation and space education is a means for the school to meet its responsibility to provide career guidance and education for vocational competence. The aerospace industries, government agencies, air transport industries, and general aviation (expanding because of aviation and space development) require the services of several million trained people (4).

Aviation and space education also serves as an integrated curriculum, organized around a major interest employed as a frame of reference. Through the enrichment approach, standard course offerings are supplemented with pertinent aspects of the aviation and space sciences, which are major factors in many general study units.

Aviation and space education have been established as proper disciplines of curriculum, meeting one or more of the seven cardinal principles of public education—by endorsement, by accreditation, and by experience. Every state has approved courses in aviation and space education or has given full authority for their inclusion in the curriculum.

As you can see, there are many definitions of the nature of aerospace education. This publication will not, of course, attempt to resolve the question of what is aerospace education rather it will present an operational model of a thematic aerospace educational school—August Martin High School.

PURPOSE AND OBJECTIVES

This publication briefly describes the philosophy underlying August Martin High School; how it came to be created, the techniques of its community involvement, and its curriculum approaches. Obviously, other school systems will want to look at this institution both as an inspiration and, either in part or in toto, as a model that can be duplicated in another locale.

The objectives of this publication are to: (A) Develop educators' awareness of the thematic approach to aviation education; (B) Provide guidance for the planning of a thematic aviation education program; (C) Provide an example of a thematic aviation education curriculum; and (D) Provide information for the implementation of a thematic aviation program.

BACKGROUND OF THE AUGUST MARTIN HIGH SCHOOL

August Martin-The Man

The Civil Air Patrol has developed an activity book and autobiography packet which includes many of the details of the life of August Martin in whose honor the August Martin High School was named. August Martin was born in Los Angeles, California on August 31, 1919. He graduated from New York City's DeWitt Clinton High School in 1938 and returned to California where he attended San Mateo Junior College and the University of California. While he was at San Mateo, he worked at the Oakland Flying Service to earn money for flying lessons. By the time he graduated from the University of California, he had achieved his Flight Instructor Rating. From his job as civilian flight inspector in the Navy V-12 program at Cornell (New York), he joined the Army Air Corps in 1943, receiving his flight training at Tuskegee, Alabama. He became a B-25 pilot, but World War II ended before he could be sent overseas.

Following World War II, August continued his aviation career. He took a job with Willis Air Service in Teterboro, New Jersey. Between 1946 and 1955 he flew part time for Buffalo Skylines, El Al Airlines, and World Airlines. Martin holds the distinction of being the first black captain of a U.S. scheduled airline—in 1955 he was hired by Seaboard World Airlines as captain of a DC-3. Between 1955 and 1968, Captain Martin flew the DC-3, DC-4, Lockheed Constellation, and Canadair CL-44 for Seaboard World Airlines.

Captain Martin felt strongly about helping the emerging nations of Africa and often used his vacation time to fly needed supplies to their struggling people. Typical of his dedication to helping others was the mercy mission that he was flying in Biafra on behalf of the Red Cross when he was tragically killed on July 1, 1968 (while trying to land on a highway during a rainstorm).

August was one of the pioneer black pilots employed by scheduled U.S. airlines. Few people in their lifetime have the opportunity to be of the service which August Martin demonstrated as he gave his life helping others. Equally significant, few find that their

efforts are memorialized in an institution which touches as many lives as August Martin High School, which is a living memorial that honors August Martin—the man.

Formation of the August Martin High School

In the early 1940's, Woodrow Wilson Vocational High School was opened in the Baisley Park section of Queens, New York. By 1948, the Woodrow Wilson School had more than 3,100 students in a main building and three annexes. Within seventeen years, by June 1965, enrollment had declined to 802 students officially listed on the rolls. Average daily student attendance had also declined from a high of over 80% to only approximately 50% of the students enrolled attending classes daily by the late 1960's. Woodrow Wilson High School students no longer took the State and Regional Examination in subjects based on city-wide tests in either academic, shop, or vocational courses.

In the late 1960's, parents, leaders from the aviation industry, community organizations, labor, and education formed a committee to see what could be done about the deteriorating Woodrow Wilson Vocational High School. It should be noted that the high school was located near John F. Kennedy International Airport; thus, the representatives of the aviation industry had an interest in helping assure that the program offerings took advantage of the rich vocational career and academic offerings of aviation. The key aviation leadership for evaluating Woodrow Wilson High School was provided by the Aviation Development Council of New York City. This organization represented the principal airlines and related aviation industries in the greater metropolitan New York area.

The committee, looking at solutions for remedying the problems at Woodrow Wilson High School, determined that a dramatic change had to be made. Thus, on October 3, 1969 this committee obtained a resolution from the New York City Board of Education permitting "the conversion of Woodrow Wilson High School into a comprehensive high school with emphasis on air-transport careers."

Immediately following this official action, a planning committee was created by the community of interests outlined above and a set of sub-committees was established to work on such topics as curriculum development, administrative selections, industry union relationships, work-study opportunities, needed plant expansions, program development, staff training, and public and community relations. The planning committee and the various sub-committees spent nearly two years of detailed intensive planning to create the new school.

One of the guidelines of the task force and planning committee was that the new comprehensive high school in Queens, New York, designed to replace the traditional Woodrow Wilson vocationally oriented high school, would be exciting for parents and students, but with an innovative and educationally sound program. Thus, the committee adopted aerospace first, as a magnet to attract interested students from throughout the city and, second, because aerospace by definition provided an outline related to all facets of the academic and occupational or career programs that it was anticipated the new high school would offer its students.

Rationale for an Aerospace Thematic School

Those responsible for planning the August Martin High School recognized that to be attractive the new school had to relate to the world of today and tomorrow while being tied to the real world of work. Thus, the group decided to use aerospace as the central theme, motif, or core running through the offerings.

Research Evidence Supporting Aerospace Education

Those planning the August Martin program were well aware of the landmark study that had been done in Richmond, California, where an elective junior high school conducted an educational experiment using a light, single-engine airplane to create basic instructional and behavioral changes in an inner-city junior high school class. In a report entitled *Learning Through Aviation* (5) by Lee Conway, dated March 19, 1969, the outline of the research study done on this class is stated as follows:

> "Evaluative research sought to determine the feasibility of an interdisciplinary aerospace program, under the direction of average teachers, in motivating this group of low and underachieving pupils, characterized by negative self-perception, behavioral problems, poor attendance, truancy, high rates of suspension, and grades too poor for college entrance."

Anyone interested in designing an aviation or aerospace thematic program would do well to consult this detailed report which verifies the assumption that motivated young people can indeed be turned around by an interesting, attractive, dynamic, and educationally sound program.

Further research evidence was used by the planners of the August Martin program as depicted in *The Second Report on Learning Through Aviation* (6). This

report documents the additional progress made by the students. It provides details of the gains which occurred in such areas as attendance, reading and math ability, behavior, holding power (not dropping out of school), and post high school plans. Clearly, these two reports demonstrated to the planners of the August Martin program that a thematic aerospace program is both attainable and works significantly in helping young people develop self awareness, self discipline, and an individual and career assessment and planning ability that is vital for a young person in today's world.

Follow On Research

Although the August Martin planners did not have the following research report available, their basic and program assumptions implied results such as those that were documented both by their own experience and the ten-year follow-up study of the Richmond, California, project.

Lee Conway wrote an article "Classroom in the Sky: A Power Trip for Disadvantaged Youth," which appeared in the May 1976 issue of the *Phi Delta Kappan*. It should be noted that the original Richmond, California, high school students in early interviews expressed little or no interest in or aspiration for college or university study following high school. In fact, most assumed that they probably would not complete high school.

> "The self-esteem of poor, stigmatized youths is continually, relentlessly attacked in the public schools. At the inception of the flight project, the majority of our 25 students had low self-esteem. When asked to respond to the statement, 'I do not have too much to be proud of,' one-third of the group agreed and almost as many were undecided. Only 38% disagreed with the statement.
>
> Questioned again in 1968, after one year in the project, only 10% of the flight group agreed that they did not have much to be proud of."

In terms of self esteem, most of the young people felt that they didn't have much to be proud of. Conway's *Phi Delta Kappan* article documents categories such as academic progress, parental backing, employment, self esteem, deviance, and a sense of mastery. His report in these categories shows the following facts herein reported at length (7):

FIRST-YEAR COMPARISONS

At the time the original flight group was chosen, a control group was also selected. Any available data on the control group were collected for comparative purposes. Important gains occurred in many areas in the first year:

1. *Attendance*. Flight group pupils had an absence rate averaging only three days. The control group averaged 14 days of absence. Teachers commented that the flight group boys came to school even when they were sick.

2. *Suspensions*. No project student was suspended, compared with 48% of the control group. Before beginning the project, 60% indicated that at some time they had been suspended before reaching the eighth grade.

3. *Behavioral competence*. At the beginning of the project year, the on-campus flight classes exhibited a high level of disruptive—at times chaotic—behavior. By January the instructional vice principal could state that profound changes had occurred: "Compared with September and October, the boys are a thousand percent improved, all around. They are mostly attentive and involved for the first time. I am generally elated at the change in the flight boys."

4. *Reading and math ability*. Reading ability increased remarkably for all flight-group students. One instructor commented: "The students now impress me with their ability to read rather complex adult-level material which I have given them in the form of Civil Air Patrol books and magazine articles on aviation."

At the inception of the project, the group was composed of nine slow readers, 13 average readers, and three boys who were considered to be retarded in reading. By the end of the second year of the project, none of these youths was considered a retarded reader and only three were deemed slow. As their grades in the table below illustrate, the flight group had made excellent progress:

Overall Grade-Point Average in Four Senior High School Solid Subjects
First Quarter, 1968

	A	B	C	D	F
Flight group – (Ninth Grade)	13%	25%	37%	25%	0%
Control group – (Ninth Grade)	0%	0%	59%	23%	18%

LONGITUDINAL STUDY OUTCOMES

In February, 1975, I began a followup evaluation of the project students and the control group. As the

data which follow indicate, the former flight group youths, now averaging 21 years of age, had made important gains. Remarkable transformation in the character and competence of these young men had occurred.

1. *Academic progress*. Fourteen (56%) of the flight group youths are presently enrolled either in institutions of higher education or armed forces training schools. Two are attending the University of California. Two are enrolled in state universities and six are in junior colleges. Three of the youths state that they are saving money so that they can return to college. Two have earned private pilot licenses since graduating from high school.

The group attending universities and colleges is presently averaging 3.0 - a B average. Three of the youths, with grade-point averages up to 3.5, have won scholarships because of superior work. By comparison, only 20% of the control group are attending junior colleges and none are at four-year institutions.

According to most recent census figures, 24% of the U.S. black male population age 20-21 is enrolled in school. Thus the flight project students are greatly exceeding academic expectations for their age group. In contrast to the flight group, the control students are in line with national averages.

Interest areas and specializations among the flight group are the following: biochemistry, economics, business administration, marketing, real estate management, education, special education, social science teaching, construction engineering, pharmacology, dentistry, and coaching. Five of the youths have no firm career aspirations as yet and are taking general courses.

2. *Parental backing*. Black males constitute 28% of all college dropouts in the 18 to 19 age bracket. This means that vast numbers of these youths are forced to quit short of graduation. A primary reason for this attrition is lack of money. The cost of attending college now runs to over $4,000 per year. This sum represents a little less than two-thirds of the median black family income in America and exceeds the total income of a third of all black families.

Flight project youths come from families similarly impoverished, yet they had a college dropout rate of only 12% from age 18 to the present. This low dropout rate appears to be attributable to their families' willingness to sacrifice financially to keep their sons in school, and of course it testifies to the high value these youths now place on education.

Parental participation in the flight project was encouraged from the beginning. At the inception of the project, all parents were invited to a meeting at the airport where they were able to discuss all aspects of the proposed program with flight personnel and take free rides in light planes. Later, parents were participants in the Project Advisory Committee which met regularly during the life of the project.

In interviews, parents appeared to be elated that the district had chosen their sons, feeling that there must be something special, indeed, about them. All the parents were enthusiastic and very positive about the flight program. Here are samples of their comments:

"I was very excited and thrilled about the program. All the neighbors and friends of ours were very happy for Elmer and wished their sons could have been chosen."

"Joe likes it. He does his homework steadily now. This is a new habit. . . . The neighbors and relatives envy us. We are very proud. . . . Joe writes his brother in Vietnam about his flying and his brother writes him back to do well because it's an opportunity he never had."

"The flying and all make a difference for Melvin. It kept him out of trouble all year. He is looking forward to being in the flight program again and wants very much to become a pilot. . . ."

"Kelly now wants to have an aviation job. My husband feels that his chances in life are greater now. He is more capable. The neighbors think it is great . . . but I think some of them are even jealous and act hostile to us."

3. *Employment*. As this is written (fall, 1975), young men, especially blacks, face a severely depressed job market. Yet, only two of these flight group youths (8%) are unemployed. By comparison, 40% of the control group youths are out of work. The table below shows the occupational and academic distribution of former project students:

Fall, 1975 Occupational and Academic Distribution of Former Flight Project Youths (N=25)

Armed forces		5
Air Force	4	
Army	1	
Higher education		10
University of California	2	
State universities	2	
Junior colleges	6	
Oil Companies		3
Steam plant operator	1	
Catalytic technician	1	
Operational specialist	1	
Mechanics		2
Automotive	1	
Heavy trucks	1	
Stock clerk (studying religion)		1
Musician	1	
Unemployed	2	
Unknown	1	

Those youths serving in the armed forces are participating in advanced training courses in the following areas: power plant specialist, communications specialist, pharmacology, and meteorology.

Former project youths attending college were found to be involved in the following kinds of part-time work: antibiotics research assistant, elementary teacher trainee, chemistry laboratory aide, turret lathe operator, grocery store clerk, janitor, and watchman.

Since graduation from high school in 1971, members of the group have had extensive job experience. Their overall employment history illustrates great industry and an overwhelming desire to succeed.

Last fall five of the students were involved in the aviation or aerospace industries. Four were with the Air Force and one was involved in rocketry. A large percentage of the flight project youths are still searching for their occupational niche in life. Of those who have found it, one is a catalytic technician, earning $22,000 per year. Another youth earns almost $20,000 as a diesel truck driver. A third is a cashier/clerk whose life goal is to become a religious elder in the Jehovah's Witnesses Church. And the fourth, an underemployed musician, wants to do nothing else for a living.

4. *Self-esteem*. The self-esteem of poor, stigmatized youths is continually, relentlessly attacked in the public schools. At the inception of the flight project, the majority of our 25 students had low self-esteem. When asked to respond to the statement, "I do not have too much to be proud of," one-third of the group agreed and almost as many were undecided. Only 38% disagreed with the statement.

Questioned again in 1968, after one year in the project, only 10% of the flight group agreed that they did not have much to be proud of.

When we questioned the former flight group students in the spring of 1975, only two stated that they did not have too much to be proud of. A dramatic elevation in self-esteem had occurred. By contrast, 36% of the control group presently state that they do not have much to be proud of.

In the spring, 1975 interviews, typical responses by former flight group youths were: "I used to feel inferior about books and academics. Now I feel an obligation to get the most out of myself." "I still remember the complete control I had over myself . . . my own life and death, when I flew the 150."

5. *Sense of mastery*. Closely related to self-esteem is a sense of control or mastery over one's fate. Again, the project youths indicated that they now definitely believe they possess a great measure of control over their future: "I'll never forget how to fly and the fantastic feeling that you can control things that goes with it." "My grades even improved after I got into the aerospace program. It was a big boost. It changed my attitudes toward education."

In the spring of 1967, we asked these youths to respond to the statement: "You should expect more out of life." Nearly half of the boys (48%) disagreed with the statement at that time, 39% agreed, and 13% were undecided.

In the spring of 1975, we asked these youths to respond to the identical statement. There was definite, positive response, a complete reversal in attitude. Now, 94% agree that indeed they should expect more out of life. Representative responses from these interviews included the following: "I can get what I want. I have a lot of confidence in my ability." "If I want to become something, I will." "I have the self-motivation now. I can accomplish my personal goals."

In the spring, 1975 follow-up interviews, both the flight group and the control group were asked to respond to the statement: "What is going to happen to me will probably happen, no matter what I do." In 1967, 45% of the flight group agreed with this statement, 43% disagreed, and 12% were undecided. Questioned again in 1975, none agreed, 86% disagreed, and 14% were undecided. By comparison, 37% of the control group voiced agreement, indicating their greater belief in fate, in forces beyond their control.

6. *Deviance*. Youths from impoverished subcultures, especially black males, must fight hard to avoid getting enmeshed in delinquent or criminal activities. Merely engaging in such victimless social acts as drinking or gambling can bring arrest. The middle- and upper-class individual is immune; he generally confines these activities to private clubs and residences.

Thus the highly vulnerable youth from a disadvantaged community must somehow rise above the normal tendency to get into trouble. Those incapable of escape will almost automatically become further stigmatized; a criminal record often closes off opportunity forever. As Kelly N. informed us: "My life since high school has been going in the wrong direction . . . toward crime. I want to turn it around. I know they let me in the Air Force because of the flight project. I know the Air Force will help me straighten out my life."

Melvin W. is regularly employed and a devout church member. He believes that he has won his struggle against the odds: "After high school I had a bad period. I broke my ankle and lost my athletic scholarship . . . then started drinking heavily. Get-

ting close to religion helped me out. But you know, I think the flight program could curb delinquency. Especially if it went on for, like, four years."

Although it has not been possible to obtain thorough interviews with control group youths, we believe they were concealing a high number of deviant activities. It was determined that their frequency of arrest was exactly twice as high as that of the flight group.

The ability of former flight project youths to overcome overwhelming pressures to commit deviant acts must constitute one of the most crucial of the positive outcomes of the flight project. Recognizing the terrible problems socially "different" individuals face, Gabriel Tarde said 70 years ago: "To innovate, to discover, to awake for an instant, the individual must escape, for the time being, from his social surroundings. Such unusual audacity makes him supersocial, rather than social."

CONCLUSION

Aviation experiences—in airport hangars and workshops, weather stations, flight lines, and cockpits—opened up a wide spectrum of imagery and opportunity to the flight project youths. As student pilots, these boys were involved in personal as well as job exploration while obtaining empirical training. They were exposed to new and basic techniques in the process of gaining image-building experiences. They could learn firsthand the types of talents and interpersonal competencies required to earn a living. And these boys could obtain direct contact with positive role models; if they could not identify with these models, they could at least imitate them. A 1972 interview with Butch, the pilot-instructor, identified some of the important flight-related experiences:

"When we first picked the boys up they were about 13 . . . just a bunch of good-natured kids, having a good time. Right? And then, as we had a chance to get into the actual flying of the airplane, their attitudes and concepts started to change. It wasn't a game anymore.

"Then there began a lot of keen competition to show me that they know why they're draining the dumps and everybody is kind of running on top of one another to point out a wire, a bolt, a cotter pin.

"Then, as we continued into the program our main objective was not to teach the boys how to fly, but to show a practical relationship—how an airplane fits into everyday life. The vehicle shows them the practical application of mathematics, science, communication. . . . [They learn] the reason for speaking very clearly on the radio when talking to the tower. And geography. You know, you are flying across country and you are looking down and there is a steel factory there . . . or a cotton field."

The many successes of the flight project and its unexpected positive results appear to be caused by the youths' involvement in a high-status activity, elimination of the fear of failure, changed expectations on the part of significant others in their lives, acquisition of unique skills, and the opportunity for significant achievement in the dominant culture.

This longitudinal study has produced considerable "hard" data as well as qualitative results supportive of the flight project concept. Former project youths are demonstrably better off than controls in the areas of employment, advanced education, and avoidance of deviance. Finally, project youths appear to have grasped the linkage between advanced schooling and career potential as their essential and available source of power.

Flight brought a sense of joy to these youths and overcame their pervasive feelings of alienation and worthlessness. Their flight instructor's noncritical, nonthreatening evaluation of their abilities gave them a sense of "specialness" which overcame the judgmental, negative attitudes to which they had grown accustomed.

Our evaluation data appear to prove that moral and imaginative capacity, not measured achievement or tested intelligence (IQ), are the real defining characteristics of human beings.

Are there other similar models? Probably, and they might include: soaring; mountain climbing and ballet; activities which feature risk, sensory stimulation, speed, spatial imagery, and the opportunity to master high-status, technically complex enterprises. But, clearly, for disadvantaged youth flight completely captures and captivates. It is a genuine power trip.

The authorities at August Martin High School—administrators and faculty as well as students, parents, and community leaders—all attest to similar successes.

Proposed Curriculum Patterns

The planners of August Martin High School developed patterns for a proposed curriculum. These patterns are shown in the following charts for the 9th and 10th years and the 11th and 12th years respectively in Charts 1 and 2.

CHART 1: 9th and 10th Grade

The Common 9th and 10th Years:

9th YEAR

PD	M	T	W	T	F
1	ENGLISH				
2	SOCIAL STUDIES				
3	9th YEAR MATH ALGEBRA				
4	GEN SCIENCE				LAB
5	* * * * * * * * * *				
6	LANGUAGE 1]				
7	LUNCH				
8	PRACTICAL 2]				H. E.
9	ARTS				

10th YEAR

PD	M	T	W	T	F
1	ENGLISH				
2	SOCIAL STUDIES				
3	10th YEAR MATH 3]				
4	ELEC SCIENCE				LAB
5	* * * * * * * * * *				
6	LANGUAGE 1]				
7	LUNCH				
8	TYPING				H. E.
9	ART-MUSIC 5]				

* Independent Study: may be used for special tutoring, make-up work, advanced study, or special electives, such as Instrumental Music or Student Government

1. Regents level or conversational
2. 10 week cycles will be offered in the areas of Wood and Plastics, Metalworking, Electricity, Transportation, Nursing, Foods, Clothing, Personal Grooming and Business Education. EACH student will elect four of the areas for study.
3. Tenth-year Math or the second half of Elementary Algebra
4. Students may select from among Biology, Physical Science, Earth Science and Chemistry
5. The cycle (10 weeks each) of Art Appreciation and Music Appreciation for all

plus

The cycles of Mechanical Drawing or Related Art

Chart 2: 11th and 12th Grade

Academic and Pre-Professional:

11th YEAR

PD	M	T	W	T	F
1	ENGLISH				
2	SOCIAL STUDIES				
3	H.E.	H.I.			*
4	* * * * * * * * * * * *				
5	LUNCH				
6	ELECTIVE				
7	ELECTIVE				
8	ELECTIVE				
9	ELECTIVE				

12th YEAR

PD	M	T	W	T	F
1	ENGLISH				
2	SOCIAL STUDIES 1				
3	H.E.	MUSIC			*
4	* * * * * * * * * * * *				
5	LUNCH				
6	ELECTIVE				
7	ELECTIVE				
8	ELECTIVE				
9	ELECTIVE				

* Independent Study

1. One-half year of Economics, plus one-half year of either a Social Studies elective or an elective from a different discipline

Proposed Elective Choices

English:	Journalism, Great Books. Creative Writing, Expository Writing, Advanced Placement English
Speech:	Public Speaking, Dramatics, Debate
Mathematics:	11th-Yr. Math, Intermediate Algebra, Trigonometry, Advanced Algebra, Math Analysis, Computer Math, Adv. Place. Math
Science:	Biology, Chemistry, Physics, Earth Science, Adv. Place. Biology, Adv. Place. Chemistry, Adv. Place. Physics, History and Philosophy of Science
Languages:	3rd-Yr. Language, 4th Yr. Language

The August Martin Opening

As previously indicated, the extensive planning and research data base made it possible for August Martin to open its doors to young people throughout New York City in December 1971. On Sunday, June 22, 1975, August Martin High School held its first graduation in a huge aircraft hangar at John F. Kennedy Airport. More than 2,000 friends and relatives witnessed the first August Martin graduates obtain their diplomas and credentials.

Since that time, August Martin High School graduates have gone on to careers and postsecondary education illustrating a remarkable percentage of high school completions and post secondary education. Furthermore, from the very beginning through 1980, August Martin High School attendance has been among the highest of any school in the metropolitan New York City area. Appendix A lists some of the colleges and universities that have accepted August Martin High School graduates as of June 1979. Previous experiences, according to the August Martin authorities, show a similar diversification of postsecondary study.

PART 2
THE AUGUST MARTIN PROGRAM

A COMPREHENSIVE HIGH SCHOOL

August Martin is a comprehensive high school. In the ninth and tenth grades, pupils take a heavy concentration of academic subjects. In the eleventh and twelfth grades they have an opportunity to continue in either college preparatory, business career, or aerospace occupational programs.

Curriculum

In the *ninth and tenth grades*, all students take the five major subjects (English, Social Studies, Science, Algebra and Foreign Language), plus Practical Arts (Ninth Grade), Typing (Tenth Grade), Independent Study, and Health Education.

In the *eleventh and twelfth grades*, students may follow either of the following tracks.

- *The College Preparation Course*—continue academic subjects and electives, or
- *Business Education Program*—training in Accounting, Secretarial Work, or Data Processing. In addition, Martinites will have the chance to take Business Management, Passenger Servicing, Marketing, Advertising, etc., or
- *Occupational Training in such aerospace fields* as:
  Maintenance and Repair of Ground Support Vehicles
  Avionics
  Airport Maintenance
  Flight Planning and Instruction
  Aerospace Design
  Aerial Photography
  Aerospace Medical Technology
  Travel and Tourism
  Meteorology
  Pre-Flight Attendant Training
  Federal Aviation Laws and Regulations

Comprehensive Guidance Program

In seeking to help students make critical decisions regarding course selections, the school provides the following:

- Four guidance interviews a year for each student
- Group guidance sessions
- A concentrated tenth-grade program
- Career Day
- College Night

INNOVATIVE FEATURES

Administrative Features

The August Martin Advisory Commission and administration have sought to institute in the school tried and tested innovative administrative and curriculum features. Among the school's special administrative features are:

- A nine-period day of seven hours for all students (40 minutes longer than that enjoyed by almost all New York City high school students)
- A four-cycle year (school is reorganized four times a year when students receive new programs)
- Modular scheduling (time blocks of two or three 20-minute modules to permit a variety of teaching techniques)
- Students have a different program every day of the week
- A computer terminal, tied to the University Application Processing Center, provides the school with daily attendance information, cyclical scheduling, personnel information, etc.
- Contract or free busing to transport students living in the extremities of Queens and Brooklyn
- A daily bus for field trips to JFK Airport and the city's resources

Curriculum Innovations

Among the curriculum innovations are:

- Students take sequential subjects like mathematics and foreign language at *different levels* (4, 6 and 8 cycles)
- All students take *Elementary Algebra* and *Foreign Language*
- All sciences have a *lab period*
- All students take *Practical Arts* courses in the ninth grade

- All students take *Typing* in the tenth grade
- All students are required to take a cycle of the *Principles of Flight* (Science) and the *Air Age* (Social Studies) in their freshman year
- After completing required courses, students may choose from a *wide variety of hundreds of mini-courses*
- *Independent Study*, a part of every pupil's daily program, affords pupils an opportunity to take a Master Kit for either advance or repeat work under supervision and to obtain tutorial help. The school operates six resource centers and a multimedia library as part of the Independent Study program.

AEROSPACE ACTIVITIES

Supplementary to the school's aerospace curriculum, August Martin High School has developed special activities and programs which reinforce and expand upon the school's central magnet concept. Several of these activities are described below:

Construction of the Wright Flyer Replica

In 1976 August Martin High School and the Port Authority of New York and New Jersey were involved in a unique bicentennial celebration activity. With assistance from the Port Authority, the students and staff of August Martin High School constructed a full-scale replica of the original "Wright Flyer" from blueprints supplied by the Smithsonian Institution. The flyer was the airplane in which the Wright Brothers—Wilbur and Orville—demonstrated the feasibility of heavier-than-air aircraft in flight (December 17, 1903, at Kitty Hawk, North Carolina).

Constructed in one of the school's new shops, the plane (with a wing span of forty feet) was exact in every detail except for a simulated engine. The fabric and wood were treated to simulate the aging process of the original plane. The new vehicle had to be built in sections so that it could be transported from the school's shop to the International Arrivals Building at John F. Kennedy Airport. There it was reassembled; it replaced the huge Calder mobile that had been suspended from the rotunda ceiling at the International Arrivals Building.

In a dedication ceremony held at Kennedy Airport on June 11, 1976, the Wright Flyer was officially installed for all visitors to see. In addition the students and staff constructed a four-panel picture story depicting the story of the Wright Flyer replica project from its conception to the dedication; this was also placed on display on the mezzanine floor of the International Arrivals Building at John F. Kennedy Airport.

Flying Program

August Martin High School has conducted an ambitious flying program for its students since 1973. Started with Law Enforcement Administration funding and in cooperation with the State University at Farmingdale, the project has been continued with the aid of a mini-grant and federal funding. Students in the program have been organized into three main groups: Beginners, intermediates, and advanced.

A licensed pilot and flying instructor has been conducting the ground instruction courses at August Martin High School as a regular part of the school's curriculum. Qualified students have been taken to the State University at Farmingdale where the university's instructors have given them simulator time. They then take their flying lessons in university-owned planes at nearby Republic Airport. In 1977, some 140 Martinites had an average of six hours flying experience.

Both in June and January of each year, students have been encouraged to take the FAA private pilot's written examination. Students also have purchased flight jackets bearing the words *Martin Pilots* on the back. Several students have soloed, although the program's main aim has been to emphasize its motivational values in improving pupils' reading, mathematic, and learning skills.

Civil Air Patrol

In 1977 a Civil Air Patrol squadron was formed at August Martin High School. On March 21, 1977, a table of organization was developed and officers selected. To date, some fifty students have joined the squadron. The officers plan to gradually increase the membership and hope to soon have at the school one of the largest squadrons in the New York City area.

Among the program's objectives are the following: Training and instruction in aerospace education, civil defense, aircraft search and rescue, and customs and courtesies. Students' continued participation depends upon their response to the program's educational and disciplinary requirements and their ability to work up to capacity.

Inflight Excursions and Apollo 16

Before the fuel shortage crisis, every freshman had an opportunity to take part in an airborne geography-geology lesson over the metropolitan area in a 707 jet paid for by both American Airlines and Pan American World Airways. The trips generally took the students across Long Island and the Sound, up into Connecticut, above the Catskill Mountains, along the Delaware Water Gap and the Jersey shore, and then above the lower part of New York City. The ship's captain provided the pupils with pertinent in-

formation regarding the principles of flight and pointed out landmarks as well as geographical and geological features.

In 1972, with the help of the airlines and the Aviation Development Council, the school was able to send a group of students to Cape Canaveral for a special tour of the facility and to witness the launching of Apollo 16.

THE ANNUAL P.T.A. MEETING AT EASTERN AIRLINES

August Martin High School has been fortunate to have had an outstanding Parent-Teachers Association. One of the highlights of its annual program has been the general membership meeting that has been held at Eastern Airlines Terminal, John F. Kennedy Airport. Each year between 250 and 300 parents and staff members have met at Eastern Airlines to hold a brief business meeting, hear presentations by the school's musical groups, and listen to a special guest speaker.

The speakers, all of whom have played an important part in helping to launch and sustain August Martin, have included: Paul Gibson, Jr., Vice President of American Airlines and former New York City Deputy Mayor; James Plinton, Jr., Vice President of Marketing at Eastern Airlines; and Donald Burns, Assistant Manager for the Port Authority. These memorable evenings have concluded with refreshments and champagne provided by Eastern Airlines.

PORT AUTHORITY ACTIVITIES

Annually, August Martinites have taken part in the Port Authority's *Operation Safety*. The students have acted as the "victims" in a simulated plane crash staged by the Port Authority at John F. Kennedy Airport. The operation is staged to determine the most effective use of the Port Authority's vehicles, equipment, and personnel in case of a mishap to a DC-10 at the airport.

The school's Music Department, also presents an annual Christmas holiday program at John F. Kennedy and La Guardia Airports. The August Martin Band also provided the music at the Pan American Airways Dedication of the *747 Clipper Lindbergh* at its Fiftieth Anniversary Celebration of the Lindbergh Flight on May 20, 1977.

USING JOHN F. KENNEDY AIRPORT FACILITIES

One of the factors that made the adoption of an aerospace magnet logical and natural at August Martin High School was its closeness to John F. Kennedy Airport. The school has a bus available daily to take classes to the J.F.K. facilities. For example: Language classes visit Air France and Iberian Airlines; Career Education groups are taken to Allied Maintenance, the Pan American Airways shops, and the Federal Aviation Administration Air Route Traffic Control Center; and Business Education classes visit the administrative offices of various airlines.

DC-10 DEDICATION

On April 10, 1975, the school dedicated its new DC-10 facility and honored those individuals who had been responsible for helping the school secure and install a mock-up of the passenger section of the DC-10 aircraft. Mr. Paul Gibson, Jr. was instrumental in obtaining the facility from the McDonnell-Douglas Corporation in California. The crated sections and equipment were shipped by naval transport through the Panama Canal to the Bayonne Military Terminal. The crated facility was then transported on four flat bed trucks, first to the American Airlines cargo center and then to the school.

In order to get the three huge sections into a second-story room, a whole section of wall had to be removed. The borough shops then assembled the entire mock-up, which is complete from the galley facilities down to the carpeting. The mock-up has been used for orientation, meetings, and classes.

AEROSPACE CAREERS DAY

Periodically the school, with the help of its Guidance Department, has organized a Career Day. Students, parents, guests, and staff members attend some 25-30 career workshops that are conducted by personnel from the aviation industry. The event generally is followed by a luncheon prepared and served by the teachers and students for the guests and staff.

DEPARTMENT OF TRANSPORTATION AWARD

In 1973, August Martin High School was the first school to receive the John A. Hanson Award designed "to acknowledge achievement and to encourage outstanding public service in the field of transportation." Nominated by the Eastern Region, Federal Aviation Administration, for the coveted "Department of Transportation, New York Field Coordination Group Annual Unit Award," the school was selected because it had "become an asset to the community through its innovative and imaginative approach to education" and had implemented its "philosophy of 'learning through aviation'. . . . " At a banquet held on Governor's Island on Friday, November 30, the presentation was made.

STUDENTS STUDY THE EFFECTS OF TOURISM ON THE CARIBBEAN ECOLOGY

In 1972 and 1973, with the help of the airlines and Dr. Towle, President of the Island Resources Foundation, groups of students were sent on trips to the Caribbean Islands to study the effects of tourism on that region's ecology. The experience was both recreational and educational. The pupils were given orientation and training sessions, visited mangrove swamps, studied underwater life, visited the botanical gardens and national park, given snorkeling and scuba-diving lessons, and taken on plane and boat rides.

SPECIAL GUEST AT AUGUST MARTIN HIGH SCHOOL

Periodically, notable guests particularly interested in August Martin's aerospace program, have visited the school. On October 13, 1972, the school hosted a group of educators and officials from Washington, D.C., led by Dr. Mervin K. Strickler of the Federal Aviation Administration. The visitors were guests at a special assembly held for the occasion. This assembly featured a talk by Mr. Lloyd Haynes, then star of the television series, "Room 222," and a question-and-answer session. The following Friday evening's "Room 222" show was very timely entitled "Lift, Thrust, and Drag," and it dealt with the use of aerospace to motivate students. It also mentioned the Richmond, California, experiment and August Martin, the man.

On April 24, 1974, Mr. Charles Dobson of the F.A.A. flew five educators from Washington, D.C., to visit the school. On February 10, 1975, a distinguished group of educators from Yale, Clark, and Stony Brook Universities, led by noted Yale University psychologist, Professor Seymour Sarason, spent a day at August Martin High School. Representatives from the three universities, who were involved in the "Project Network," adopted August Martin High School as the special inner-urban school for study.

This relationship eventually led to August Martin's involvement in the Stony Brook "Minorities in Engineering Program."

On February 25 and 26, 1975, August Martin, because of its aerospace theme, was selected as the host school for the annual evaluation meeting of the National Advisory Committee involved in the Transportation Curriculum Project for the U.S. Office of Education. Eventually, August Martin staff members also became involved in the national curriculum project.

The above are illustrative of the many ways August Martin School has attracted visitors, scholars, and resource persons who have taken elements of the program back to their own locale. Also, such visits have helped prompt offers of cooperation from many sources of assistance to the August Martin program.

PART 3
THE AUGUST MARTIN AEROSPACE CURRICULUM

AEROSPACE CURRICULUM MATERIALS

This section includes highlights of the various curricular approaches used by August Martin faculty and staff. The material is excerpted from the publication entitled: *August Martin High School Program with Special Emphasis on Aerospace Education*, Dr. Lawrence Costello, August Martin High School (3). The areas covered are:

ENGLISH	SCIENCE
SOCIAL STUDIES	MUSIC-ART
MATHEMATICS	HEALTH EDUCATION
FOREIGN LANGUAGES	

Included are curriculum materials developed by the school's department chairmen around the August Martin aerospace theme. It includes a statement of each subject department's aerospace education philosophy, samples of model lessons, and instructional materials. The pages represent only a small part of the whole body of aerospace instruction matter that the school has prepared since its opening. Teachers are urged to use the material whenever applicable or relevant to a lesson. It should be noted that certain aerospace courses, such as "Principles of Flight" (Science) and "Air Age" (Social Studies), are required of all students.

Despite the importance of the central theme to the school's program, August Martin High School has found it increasingly advisable to introduce curriculum materials from areas closely related to aerospace, such as science and technology (the August Martin Institute of Science and Technology, or AMIST) and communications (August Martin Communications Center).

The following chairmen of academic subject departments have helped to develop the materials found in this section:

English	Noel Kriftcher Natalie Greenberg Steven Feldman
Social Studies	Arthur Kesselman Frederick Haines
Mathematics	Harold Baron
Foreign Languages	Samuel La Rocca
Science	William Bush
Music-Art	Rosemarie Castanza
Health and Physical Education	James H. Kearney

THE USE OF THE AEROSPACE THEME IN ENGLISH

The English/Communications Program

The aerospace theme in the English/Communications Department is incorporated in an indirect manner. Preparing students for basic competency in communications skills requires a multitude of courses which are tailored to students' interests and abilities. Realizing, however, that many young people have chosen to attend Martin because of its aerospace theme, several references to aviation and its tangential fields have been incorporated within the English curriculum.

The following list represents some of the aerospace-related features of English study at August Martin:

1. Vocabulary building lessons which include aviation-oriented words.
2. A communications studio which instructs students in the use and understanding of film, television, and radio—the communications media of the air age.
3. Implementation of a Career Bridges and Work Experience Program which places students in aerospace-related external learning situations.
4. Special English course work within the AMIST Program.
5. A course in College and Career Experience which prepares students for standardized examinations which they will be called upon to take during their high school careers.

Sample Lesson Plan

"An Irish Airman Foresees His Death" —Yeats

AIM: To learn how the airman views death

MOTIVATION: How many of you have ever seen a plane from WWI? Would you want to fly one? Why?Why did the pilots of WWI go up in those planes?

We're going to read a poem in which an airman expresses his feelings about being up in one of these planes. Let's look at the poem together and see if we can determine the pilot's attitude toward this dangerous work.

DISTRIBUTE POEM AND READ ALOUD AS CLASS READS SILENTLY.

DEVELOPMENT:

1. In the first line, the airman uses the word "fate." What does he mean by this? (death)
2. Why does he consider death his fate? What does this tell us about his attitude towards flying?
3. What are the reasons this airman gives for going to war?
4. How does he feel about those he is fighting? How does he feel about those he is guarding?
5. What does the airman mean by the last three lines of the poem?

SUMMARY: How does the airman view the possibility of his own death?

APPLICATION: If you were a fellow airman of the speaker in this poem, how would you feel about his attitudes toward flying? Those he defends? Those he fights?
Would you try to make him change his mind?
Why? Why not?

Aerospace Theme In Written Communications

CYCLE II

Course Title: WRITTEN COMMUNICATION II (Effective Expression In The Flight Age)

Mandatory for all pupils; however, each student will be programmed into *one* of the three courses listed for this cycle. The student will be recommended for the course which best meets his needs based upon an ongoing ten-week evaluation of his weaknesses and strengths in the areas of composition and interpretation of literature. Since students will return to heterogeneous groups for Cycles III and IV, in Cycle II the difference between the courses will be based upon the depth and sophistication with which the material will be approached. All students will study, basically, the same material.

English 132 — English Essentials Workshop — for students who need assistance in developing basic writing and interpretive skills

English 122 — Developmental Writing Workshop — for students who need assistance in organizing their ideas in composition writing and in developing their skills in narration, description, and persuasion

English 192 — Creative Writing Workshop — for students who need assistance in attempting a wide variety of creative writing activities

Basic Areas of Study:

I. Introduction to a Variety of Literary Types Through Reading
   - A. short story
   - B. essay
   - C. poem
   - D. play
   - E. biography (and autobiography)
   - F. novel
   - G. account of true experience

II. Vocabulary and Spelling
III. Oral and Written Interpretation of Literature
  A. flight age problems
  B. analysis of written styles and techniques
IV. Written Communication (Dependent upon the course in which a student is enrolled)
  A. The Diagnostic Composition (no numerical grade to be issued)
    For criteria, see Cycle I
  B. Short exercises for the following skills
    1. the narrative
    2. the descriptive passage
    3. supporting an opinion
    4. persuading a reader
    5. the character sketch
  C. Creative Writing Exercises—short story, poem, essay
  D. Written Report (based on outside reading of a full-length literary work)

NOTE: Readings are to be selected from the required textbook provided for the course *(Composition: Models and Exercises)*. Supplementary readings (short stories, essays, excerpts from longer works) are to be selected by each teacher to provide models for class discussion of writing techniques and communication of ideas. Ongoing in-class discussion based on readings and events are essential to exchange of ideas by students. Such concepts as critical listening (and thinking), questioning, and respect for others' points of view are to be taught and emphasized.

During Cycle II, the following topics will be studied (based on titles provided by the textbook)

1. Skills Of Descriptive Writing
2. Using Sensory Details
3. Skills of Narration
4. Selecting Events
5. Using Narrative Details
6. Using Dialogue
7. Point of View
8. Organization In Exposition
9. Description In Exposition
10. Narration In Exposition
11. Supporting An Opinion
12. Persuasion
13. The Character Sketch
14. Sentence Skills
    a. variety in sentence lengths
    b. parallel structure
    c. the compound-complex sentence
    d. gerund phrases
    e. appositives
    f. sentence skills in combination

SUPPLEMENTARY READINGS—CYCLE II

The poet often witnesses an event and then takes the reader to view the event as though he were watching it through the poet's eyes. This poem helps you to observe a fairly commonplace event, but the last six lines shift away from what you see to what the author feels.

SONIC BOOM by John Updike

I'm sitting in the living room.
When, up above, the Thump of Doom
Resounds. Relax. It's sonic boom.

The ceiling shudders at the clap,
The mirrors tilt, the rafters snap,
And Baby wakens from his nap.

"Hush, babe. Some pilot we equip,
Giving the speed of sound the slip,
Has cracked the air like a penny whip."

Our world is far from frightening, I
No longer strain to read the sky
Where moving fingers (jet planes) fly.
Our world seems much too tame to die.

And if it does, with one more *pop*,
I shan't look up to see it drop.

INTERPRETATION

1. How would you describe the state of mind of the author?
2. Why is he so relaxed, so fearless?
3. What effect do words like "boom," "clap," "whip," and "snap" have?
4. How do the first nine lines differ from the last six?
5. Why does he, at first, refer to sonic boom as the "Thump of Doom"?
6. Why does our world seem "much too tame to die"?
7. How do you feel about the couplet with which Updike ends the poem?

ENGLISH 251

SUPPLEMENTARY READINGS (NUMBER 4)

VOYAGE TO THE MOON by Archibald MacLeish

Presence among us

Wanderer in our skies,
dazzle of silver in our leaves and on our
waters silver,
O
silver evasion in our farthest thought—
"the visiting moon" . . . "the glimpses of the moon" . . .
and we have touched you!

From the first of time,
before the first of time, before the
first men tasted time, we thought of you.
You were a wonder to us unattainable,
a longing past the reach of longing,
a light beyond our light, our lives—perhaps
a meaning to us . . .
Now
our hands have touched you in your depth of night.
Three days and three nights we journeyed,
steered by the farthest stars, climbed outward,

crossed the invisible tide—rip where the floating dust
falls one way or the other in the void between,
followed that other down, encountered
cold, faced death—unfathomable emptiness . . .
Then, the fourth day evening, we descended,
made fast, set foot at dawn upon your beaches,
sifted between our fingers your cold sand.
We stand here in the dusk, the cold, the silence, . .
and here, as at the first of time, we lift our heads.
Over us, more beautiful than the moon, a
moon, a wonder to us, unattainable,
a longing past the reach of longing,
a light beyond our light, our lives—perhaps
a meaning to us . . .
O, a meaning!
over us on these silent beaches the bright
earth,
presence among us.

THE USE OF THE AEROSPACE THEME IN SOCIAL STUDIES

SOCIAL STUDIES DEPARTMENT

The Socal Studies Program Course of Study For Air Age And Related Subjects

- Geography and Aviation
- History of Flight
- Aviation History
- Military Aviation
- Aviation Categories
- Rocketry and Space Exploration
- Social, Economic, and Political Impact of Flight
- Aviation and Space Careers
- Lighter-than-air Flight
- Aerodynamics Development

The Social Studies Program

The prime objective of the Social Studies Department is to teach Social Studies. However, there are motivational devices one can use to kindle the flame of knowledge and get the students' attention. August Martin High School has adopted an aerospace thematic approach to achieve this objective.

As a means of orienting all incoming students, a special one-cycle (ten weeks) course in the Air Age is made mandatory for all ninth-year students. The course spans the areas from myths and legends to the present-day rocket age. In addition to the history of aviation, the pupils are made aware of the social, political, and economic impact of aviation.

In other areas throughout the four years at our school, every effort is taken to integrate aviation-oriented materials into the regular curriculum. In the study of geography, one not only deals with longitude and latitude, but with great circle routes. Students are made to realize that while on a plane surface a straight line is the shortest distance between two points whereas on a sphere an arc is the most direct way of getting from one place to another.

Every effort is made to stress and emphasize materials that lend themselves to our aerospace theme by discussing the great artists of the Renaissance. Copies of Da Vinci's aeronautical drawings are presented and discussed. From the Eighteenth Century on, there is a wealth of material that can be introduced to stimulate students' interest. In addition to the early experiments in lighter-than-air flight, the discussion of the use of balloons in the United States Civil War and the Franco-Prussian War give students insight into the fact that aircraft have been around and used for a long time.

Teachers in the Social Studies Department avail themselves of every opportunity to try and present interesting and informative materials that blend in with the school's aerospace theme. This approach not only adds interest to the course of study but, carried out over a four-year period and through all disciplines, generates enthusiasm and curiosity on the part of the student.

Sample Units In Social Studies

GEOGRAPHY AND AVIATION

I. *Geography Related to Aviation*

Objectives:

1) To review and reinforce basic skills in map reading.
2) To gather information through the use of graphs and charts.
3) To be able to attain information from cartoons and pictures.
4) To be able to listen and comprehend.
5) To be able to make generalizations based on information
6) To be able to draw conclusions from maps, charts, graphs, and reading selections.
7) To evaluate the material presented.
8) To develop an understanding of how the following are related to flight:
    a) topography
    b) climate
    c) weather
    d) time zones
    e) the great circle
    f) longitude and latitude
    g) projection

II. *Geography: Study of the Earth*

a) Environment
b) Topography
c) How man affects his environment
d) How environment affects man

HISTORY OF FLIGHT

I. *Introduction*—Difference between Aerospace Training and Aerospace Education

A. Why study the history of aviation?
    1) Man's roots in the past.
    2) Study of man's "total environment."
    3) Study of man's capability or ability to use the aerospace environment.
    4) Man's ambitions and initiative
    5) Man has always wanted to improve environment; to do so he felt he must explore and use the resources of the aerospace environment.

II. *Objectives*
    1) To develop an awareness of the inevitability of change as technology moves us ever faster should provide us with a degree of stability in the midst of revolution.
    2) To explore man's desire to expand his knowledge and his control over material things within any given period of time.

3) To understand that with space exploration there is the imperative need for written agreements and laws between nations so that we can forestall the conflagration that could result.

4) To instill an appreciation for the courage of the explorers and pioneers of the past and present.

5) To develop an understanding of the present from a look at the past.

III. *Folklore, Legends and Mythology about Flight*
Greek, Roman, Chinese, Northern Europe, African

A. *Man's need to fly (explored)*

1. *The Myth of Phaethon*
   a. how the sun moves across the sky
   b. why it once stood still
2. *Daedalus and Icarus*
   a. another journey through the sky
3. *Hermes—Mercury*
   a. winged messenger of the Gods
4. *Pegasus*
   a. the winged horse
5. *Emperor Shun*
6. *Ki Kung Shi*
7. *Lei Kung*
8. *Kites*
   a. discuss aerodynamics
9. *Hammer of Thor* (Northern Europe)
10. (Africa) *The Man Who Owned the Moon*
    a) why there are dark spots on the moon.
11. *Arabic*
    a) Magic carpet
12. *Judeo/Christian*
    a) Elyah's chariot
    b) winged angels

LIGHTER-THAN-AIR FLIGHT

Objectives

1) To understand the concept of lighter-than-air flight.

2) To explore the development of aerospace based on this theory.

3) To understand that practical application of one field of knowledge must sometimes be delayed until further discoveries are made.

4) To understand that secrecy about scientific principles sometimes develops the whole progress of mankind.

How did one idea lead to another? Use *overhead* and show pictures of each.

I. The Balloon Era (Dirigibles)
   a) What is lighter-than-air flight?
   b) How does it work?
   c) By whom was it developed?

   1. Francesco de Lana—1670—air gets thinner and weighs less as altitude increases.
   2. Henry Cavendish—1776—experimented with the lightness of heated air.
   3. Montgolfier—1782—hot air experiments.

4. Francois Pilatre de Rozier—1783—the first man to ascend in a balloon.
5. De Rozier and Marquis d'Arlandes—first free flight.
6. Charles and The Robert Brothers—12/1783—2 man hydrogen balloon
7. Jean Pierre Blanchard—1785—crossed the English Channel.
8. M. Henri Giffurd—1852—mechanical power for a balloon or dirigible.
9. Charles Renard—1884—improved the electric power propulsion technique.
10. Baumgarten and Wolfert—1879—benzine fueled internal combustion engine to power dirigibles.
11. Count Ferdinand von Zeppelin—rigid dirigible.

MILITARY AVIATION

Objectives:

1) To observe how wars had been fought prior to World War I.
2) To compare how wars were fought prior to the advent of the airplane with post observation developments (WWI-WWII)
3) To analyze why there is an imperative need for written agreements and laws among nations.
4) To determine whether the aerospace age has acted as a deterrent to another world war.
5) How have developments in aviation changed the way wars were fought?
6) Has the development of missiles acted as a deterrent to another major war?

AVIATION CATEGORIES

Objectives

1) To differentiate between civil aviation and military.
2) To investigate the impact of aviation on mankind.
3) To determine whether aviation has been a blessing or a curse.
4) To investigate the need for government regulating aviation.
5) To explore safety in air travel.
6) To analyze the general airlines organization chart (to see how an airline is organized).

Aim:

What has been the impact of developments in civil aviation on mankind.

Lesson Motivation: How have developments in aviation made it a "small world"?

I. *Civil aviation*
   A. Two main catagories
      1. General Aviation
      2. Civil Air Carriers—companies formed for the specific purpose of carrying passengers, cargo, or both.
   B. Several types of flying
      1. pleasure flying
      2. business flying
      3. commercial flying

II. *The Air Transportation Industry (pictures of their planes)*
   A. Convair 600
   B. Boeing 727
   C. Boeing 747
   D. SST (in the news)

III. *How the airlines are organized.*

IV. *Regulation of Civil Aviation Traffic*
A. 1958 – Federal Aviation Agency regulates: 1) Airways 2) Airports

V. *Problems created by the development of aviation*

VI. *Benefits reaped from the development in aviation.*

SOCIAL, ECONOMIC, AND POLITICAL IMPACT OF FLIGHT

Objectives

1. To determine how all explorations of each age have changed man's social relationships.
2. To evaluate economic policies of the past with economic policies of the space age.
3. To understand that social and economic changes require governmental adaptations.

I. *Exploration and Social Adjustment*
- A) Why man explored the unknown.
  1. curiosity
  2. dissatisfaction with current status
  3. "necessity the mother of invention"
  4. power
     - a) Hittites
     - b) Helenes
     - c) Tartars
     - d) Romans
     - e) Moslems
     - f) Spanish
     - g) French
     - h) English
     - i) Napoleon
     - j) Hitler
     - k) American
- B) Factors that stimulated exploration
  1. resources
  2. type of resources allocated toward this goal
  3. technology limits or enhances expansion
     - a) vehicle available
     - b) navigation systems
     - c) ability to cope with the environment
     - d) satisfying needs and wants
- C) Results of expansion
  1. conflict
  2. laws
  3. technology
  4. impact on the culture of the society

II. *Space exploration*
- A. Difference between space exploration and all other explorations
- B. Financing space exploration
- C. National goals
- D. New technology involved
- E. Effect on education

III. *Economic Policies of one age do not meet needs of a "New Age."*
- A. Effect of new transportation and communication on economic policy
  1. New World lack of fast communication – development of self-sufficiency and independence.

2. Civil War—demise of an economic system in the South that failed to keep up with technology.
3. 19th—early 20th century—laissez faire suffered w/telegraph lines and railroads. *Interdependence* of one area upon another realized.
4. Mid 20th century—Space reinforces interdependence among nations.

IV. *Social and Economic Changes Necessitated Governmental Adaptations*

A. Will basic unit of civilization be threatened by the increasing mobility of the air age?
B. Will Space Age affect our concept of "private property," and "national property"?
C. Why does the size of a governmental unit increase its complexity?
D. What happens to the individuality of the human being in a mechanical world?
E. Will educational practices of today need to be changed to meet the exigencies of tomorrow?
F. How would joint space explorations by major powers be financed?
G. Problems of international cooperation with regard to projected uses of the moon.

AVIATION AND SPACE CAREERS

The Course will include:

Films—Age of Man—Was Anything Done?
In Search of Lost Persons
Future Shock
Aeronautical Oddities
To Fly

Filmstrips
Myths and Legends
History of Flight
Careers in Aviation

Visual Aids
Pictures of balloons, airplanes, etc.
Reading Selections—Short Stories—Poems
Guest Speakers—Careers in Aviation
Weather affects Aviation—Storm Fields

Audio Aids
Records—Songs on Flying—Example—2001 Space Age War of the Worlds

Course Requirements

I. History of Flight (12 homeworks)
II. Book Reports
III. Oral Report on a Project—Describe and Illustrate
IV. Term Paper
A) Organizing
B) Researching
C) Writing

THE USE OF THE AEROSPACE THEME IN MATHEMATICS

MATHEMATICS DEPARTMENT

Mathematics Department Program
Thematic Aviation Applications
—Arithmetic Drill
—Tenth-Year Mathematics

Mathematics Department Program

Mathematics education has come under much criticism for not being application-oriented. It has been claimed that abstractions have not provided meaningful educational experiences for students and often resulted in low interest. To increase motivation for mathematics learning, aerospace has been introduced as thematic material. The wealth of information available and its possiblities for application at all levels of mathematics education make it a well-spring of motivational sources.

At August Martin High School, some of the areas of algebra that use aerospace applications include: Arithmetic drill, signed numbers, space, algebraic expressions, operations with signed numbers, verbal problems, functions, ratio and percent, Pythagorean theorem, proportions, similar triangles, trigonometry, literal equations, scientific notations, conic sections, evaluating formulas, and logarithms.

Aerospace applications in geometry at August Martin High School are included in the following topics: Angle measure, congruent triangles, alternate-interior angles of parallel lines, similar figures, Pythagorean theorem, trigonometry, angle of elevation, angle of depression, longitude and latitude, circumference of circle, area of circle, length of arc, area of rectangle, square, equilateral triangle, regular hexagon, circle, zone, sphere, cylinder, and volume of rectangular solid, sphere, and cylinder.

Thematic Aviation Application

ARITHMETIC DRILL

1. A certain airline bases its fares for tickets at the rate of 13¢ an air mile. Find the cost from New York to each of the following cities: (a) Boston (188 miles); (b) Atlanta (748 miles); (c) Dallas (1374 miles); (d) Los Angeles (2451 miles); (e) Moscow (4860 miles).
2. In 1889, Nellie Bly flew from New York around the world. The trip took 72 days, 6 hours, and 11 minutes. Find the number of minutes in the entire trip.
3. Major Robert M. White, of the United States Air Force, holds the world record for altitude in an aircraft. On July 17, 1962, he left Edwards Air Force Base, California, flying a North American X-15-1 and reached an altitude of 314,750 feet.
   (a) What was his altitude to the nearest tenth of a mile?
   (Note: There are 5,280 feet in a mile.)
   (b) What was his altitude to the nearest hundredth of a rod?
   (Note: There are 320 rods in a mile.)

The following table is to be used in answering problems 4-8.

Following is a table listing several bodies in space, the number of days each body takes to revolve about the sun, the surface gravity factor by which earth weight is multiplied to find weight on that body, and the average distance from the sun, in miles.

BODY	*PERIOD OR REVOLUTION*	*SURFACE GRAVITY*	*AVERAGE DISTANCE FROM SUN (in miles)*
Earth	365 days	1.00	93,000,000
Jupiter	11.9 years	2.64	483,000,000
Mars	1.88 years	.39	141,500,000
Mercury	88 days	.26	36,000,000
Moon	27 1/3 days	.17	—
Neptune	165 days	1.12	2,793,000,000
Pluto	248 days	Unknown	3,670,000,000
Saturn	29.5 years	1.07	886,000,000
Sun	—	28.00	0
Uranus	84 years	.91	1,782,000,000
Venus	225 days	.86	67,000,000

4. Using the preceding table, complete the following table by finding the number of hours it takes for one complete revolution about the sun for each of the listed bodies:

BODY	*PERIOD OF REVOLUTION (in hours)*
Earth	
Mercury	
Moon	
Neptune	
Pluto	
Venus	

5. Using the table above, complete the following table by finding the number of days it takes for one complete revolution about the sun for each of the listed bodies:

BODY	*PERIOD OF REVOLUTION (in days)*
Jupiter	
Mars	
Saturn	
Uranus	

6. Find your weight on each of the listed bodies whose surface gravity factor is given.

7. Below are listed the weights of several individuals as measured on different bodies in space. Using the table, complete the table below by finding their weights on earth:

Name	*Body*	*Weight on Body*	*Weight on Earth*
Richie Allen	Jupiter	501.6 lbs.	
Willis Reed	Mars	93.6 lbs.	
Mohammed Ali	Mercury	57.2 lbs.	
Ken Harrelson	Moon	25.5 lbs.	
Wilt Chamberlain	Neptune	291.2 lbs.	
Sherman Plunkett	Uranus	300.3 lbs.	
Dave Debusschere	Saturn	240.75 lbs.	
Tommy Agee	Sun	5,600 lbs.	
Frank Howard	Moon	47.6 lbs.	
Walt Frazier	Uranus	185.55 lbs.	
Joe Namath	Venus	172 lbs.	
Roy White	Jupiter	422.4 lbs.	

8. If light travels at the rate of 186,000 miles per second, find, to the nearest second, the length of time it takes for light to travel from the sun to each of the bodies listed in the table in item 7.

Signed Numbers

9. Explain the meaning of "NASA Control" using the numbers "minus ten, minus nine, minus eight, minus seven, minus six, minus five, minus four, minus three, minus two, minus one, lift-off."

10. Consider a vertical lift-off of a spaceship:

    (a) Set up a number line to represent its height at any time following lift-off.

    (b) Choose a point on the number line to represent zero.

    (c) Assign directions to the number line.

    (d) Find the coordinate associated with a height of 4,392 feet.

    (e) Interpret the meaning of negative numbers on the number line.

    (f) What, if any, should be the limits on the positive and negative directions on the number line? (*Note:* the diameter of the earth is approximately 7,900 miles.)

Algebraic Expressions

11. The speed of sound at sea level and a temperature of 59 degrees Fahrenheit is 760.0 miles per hour.

    (a) If the rate of speed of a plane, in miles per hour, is indicated by the variable R, what is the domain of R if the fastest rate of the plane is the speed of sound?

    (b) If the letter s is used to represent the speed of sound at sea level and a temperature of 59 degrees Fahrenheit, is s a variable or a constant?

12. If RT represents the distance covered by a plane flying at R miles per hour for T hours, find the distance covered by a plane whose rate is 650 mph, in 4 hours.

13. How many seats are there in a plane containing n rows with 6 seats in each row?

14. If a plane is flying at an elevation of 10,000 feet and the pilot begins to increase the elevation of the plane at the rate of f feet per second, what will the elevation of the plane be after 20 seconds?

15. The number of "g's" pulling a body refers to the number of times the force of gravity is pulling on a body. The weight of a body is equal to the number of g's pulling on it multiplied by the "normal" weight of the body under 1g.

    (a) Write a formula relating the weight of a body, W, under n g's, to the weight of the body, w, under 1g.

    (b) In the first two minutes from the launching of John Glenn's "Friendship 7" Mercury spaceship the force of gravity built up to 6.7 g's. If John Glenn's weight on the ground had been 170 pounds, what was his weight under 6.7 g's? (Answer to the nearest pound.)

Addition of Signed Numbers

16. A ticket agent at Martin Airlines was given a list of 114 reservations for a group flight to Nigeria and then was notified of 27 cancellations. How many reservations remained on the list? (Use signed numbers.)

17. A weather balloon was testing air turbulence while being controlled by an operator on the ground. The balloon was originally flying at an altitude of 7,000 feet. The operator, wishing to test the turbulence at different altitudes, first raised the balloon 4,000 feet, then lowered it 6,000 feet, then raised it 9,000 feet. What was the altitude of the balloon after these three changes in elevation?

Multiplication of Signed Numbers

18. If an airline ticket office had 3 cancellations a day for one week what was the relationship between the number of reservations it had at the end of the week and the number of reservations it had at the beginning of the week? (Use signed numbers in answering this question.)

Subtraction of Signed Numbers

19. How much time has elapsed between "lift-off − 10" and "lift-off + 10"?

20. What is the difference between a plane flying at 25,000 feet altitude and a helicopter flying at 200 feet altitude?

Verbal Problems

21. A plane is flying into the wind. If the plane's velocity is 300 m.p.h. more than the wind velocity and the difference between the plane and wind velocity is 250 m.p.h., find the wind velocity.

22. The wingspan of a plane is 10 feet more than the length of the plane. The sum of the wingspan and the length of the plane is 130 feet. Find the length of the plane.

Functions

23. In air travel Mach 1 represents the speed of sound, Mach 2 represents twice the speed of sound, Mach 3 represents thrice the speed of sound, etc. A vehicle is said to be flying at subsonic speed if its velocity is less than Mach 0.75, transonic speed if its velocity is between Mach 0.75 and Mach 1.2, supersonic speed if its velocity is between Mach 1.2 and Mach 5.0, and hypersonic speed if its velocity is greater than Mach 5.0:

    (a) Represent this information as a function of velocity f(v).

    (b) What is the domain of this function?

    (c) What is the range of this function?

    (d) According to the definition, what are the values of f(.75), f(1.2), f(5.0)?

    (e) How can this definition be improved?

24. Two airplanes start from the same airport at the same time and travel in opposite directions. One airplane travels at 300 m.p.h. and the other airplane travels at 350 m.p.h.

    (a) Express the distance between the two airplanes as a function of time.

    (b) What is the domain of this function?

    (c) What is the range of this function?

Angle Problems

25. If wind direction is considered to be horizontal the angle of attack of an aircraft is the angle between its airfoil (such as its wing) and the wind direction. If this angle is too great the aircraft will not be able to fly. This angle, called the critical angle of attack (or burble point) causes turbulent flow of air and will produce no lift. If the burble point of an airfoil is 42 degrees which is 4 more than twice the angle of attack, what is the angle of attack?

26. A spacecraft is being prepared for launching. Maintenance men, making last-minute check-ups on the vehicle have placed a long ladder from the ground up against the craft. The angle between the ladder and the spacecraft is 6 degrees less than 5 times the angle between the ladder and the ground and the angles are complimentary. Find both angles.

Uniform Motion Problems

27. Two aircraft flying in opposite directions pass each other in flight. If the first aircraft was flying at 350 m.p.h. and the second was flying at 500 m.p.h. in how many hours will they be 3,400 miles apart?

28. Two aircraft are flying in the same direction. The faster plane passes the slower plane at 1400 hours. If the faster plane were flying at 500 m.p.h. and the slower plane was flying at 350 m.p.h., at what time will the planes be 375 miles apart?

Mixture Problems

29. A pilot has his plane filled with fuel from two different pumps. In one pump the price of fuel was 35¢ a gallon and in the second pump the price of fuel was 40¢ a gallon. If his total bill was $13.05 for which he received a total of 34 gallons of fuel, how many gallons of each type of fuel did he receive?

30. The radiator of an airport passenger bus contains 32 quarts of a mixture which is 80% water and 20% alcohol. How much pure alcohol must be added to produce a mixture that is 30% alcohol?

Area Problems

31. The length of a rectangular runway is 940 feet more than its width. It is discovered that the area of the runway would be the same if the width was decreased by 20 feet and the length was increased by 500 feet. Find the original dimensions of the runway.

Work Problems

32. A man can send 100 coded messages in a day. A machine can send 700 coded messages a day. How long would it take both working together to send 1,400 messages?

Verbal Problems Involving Quadratic Equations

33. The length of one rectangular glider of a biplane is 35 feet more than its width and the area of the glider is 200 sq. ft. Find the dimensions of the glider.

34. A man in freefall will cover a distance, d, according to the formula $d=16t^2$, where t represents the time, in seconds, he is falling. How long will it take a man to fall 256 feet?

35. An airplane flew a distance of 600 miles. On its return trip its speed was increased by 40 m.p.h. The return flight took 30 minutes less than the original flight. Find the original speed.

Ratio and Percent

36. Air is made up of many gases according to the following composition (rounded off to the given accuracy): 78.0% nitrogen, 20.94% oxygen, 0.94% argon, 0.03% carbon dioxide, 0.03% hydrogen, 0.0012% neon, and 0.0004% helium. Find the amount of each of its constituent gases in 500 cubic feet of air. (Answer to the nearest hundredth of a cubic foot)

37. The ratio of fuel to air is the most important single factor in determining the power output of an engine. This ratio is controlled by the pilot. If there are 17 parts of air to 1 part of gasoline, by weight:

    (a) Find the fuel-to-air ratio.

    (b) Find the percent of air in the mixture. (Answer to the nearest tenth of a percent)

    (c) In 120 pounds of mixture, find the number of pounds of fuel. (Answer to the nearest tenth of a pound.)

38. The federal excise tax on domestic flight is 8%. Find the total cost of a domestic flight where the cost of the ticket is $135.00.

Interest Problems

39. In order to raise the money to purchase a private plane a man had to borrow $6,300. He was able to obtain one loan from a bank charging 6% interest. He obtained the balance of the money from a bank charging 7 1/2% interest. The total amount of interest paid was the same in each bank.

    (a) How much money did he borrow from each bank?

    (b) What was the amount of interest paid to each bank?

Verbal Problems Involving Two Variables

40. In order to profitably run a particular flight an airline calculated it would have to receive $9,900 in fares. However, passengers complained that the plane was too crowded. The airline discovered it could still receive the $9,900 for the flight while reducing the number of passengers it carried by 10, if it raised its fare by $9. Find the original number of passengers it carried and the original fare.

41. An airplane flew back and forth between two cities that are 2,400 miles apart. It took 6 hours on the initial flight flying against the wind and 4 hours and 54 minutes on the return flight flying with the wind. Find the rate of the plane in still air and the rate of the wind.

Pythagorean Theorem

42. An airplane is on a flight from city A to city C with a stopover in city B. The distance from A to B is 80 miles and the distance from B to C is 150 miles. If the paths between A and B, and B and C are at right angles, find the distance the airplane would cover on a direct flight from A to C.

Proportions

43. If 7 airplane flight tickets cost $784.98, find the cost of 9 tickets.

Similar Triangles

44. If a vertical rocket 150 feet in height casts a shadow of 40 feet, how high is a nearby building that casts a shadow of 15 feet?

Trigonometry Problems

45. Find the height of a flight control tower if the angle of elevation from a point 50 feet from its base to the top of the tower is 65 degrees.

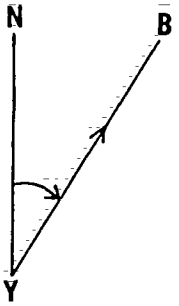
46. An airplane is flying low over the ocean at an elevation of 3,000 feet. Find the angle of depression from the airplane to a ship at sea that is 500 feet away from a point directly below the airplane.

Evaluating Formulas

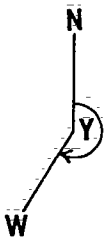
47. The formula for changing from degrees on the Centigrade scale to degrees on the Fahrenheit scale is $C = 5/9 (F-32)$, where F is the temperature in degrees Fahrenheit, and C is the temperature in degrees Centigrade. The temperature on the surface of the planet Mercury on the side facing the sun is believed to be about 430 degrees Centigrade. Express this temperature on the Fahrenheit scale (to the nearest 10 degrees).

TENTH YEAR MATHEMATICS

1. A pilot flying from New York to Boston must follow the direction represented by ray $\overrightarrow{YB}$. The clockwise angle NYB, between a true north ray from New York and the direction of flight, is called the *course* of the plane. Find the angle measure of this angle with a protractor to determine the course the pilot would follow.



2. A pilot flying from New York to Washington would follow the direction represented by ray $\overrightarrow{YW}$. The clockwise angle NYW, as indicated in the diagram, would be the course the plane would follow. Use a protractor to determine his course.



The magnetic compass is used to show the direction of flight. There are 360 degrees in the compass circle. North is 0 degrees. East is 90 degrees. South is 180 degrees. West is 270 degrees. Express the following directions in degrees of the compass:

3. Northeast.

4. Southeast.

5. Southwest.

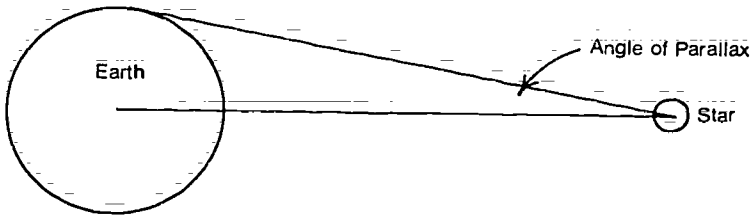
6. Northwest.

Magnetic forces in the earth and in each aircraft affect the magnetic compass. The difference between true north and magnetic north is called *variation*. Compass error caused by magnetic forces in the aircraft itself is known as *deviation*. If, for example, a pilot desires to fly a true course of 90 degrees in an area where the variation is +10 degrees and his compass variation is − 5 degrees, he must fly a compass heading of 95 degrees to achieve his true course, since 90 + 10 − 5 = 95. Determine the magnetic and compass headings for each of the following flights:

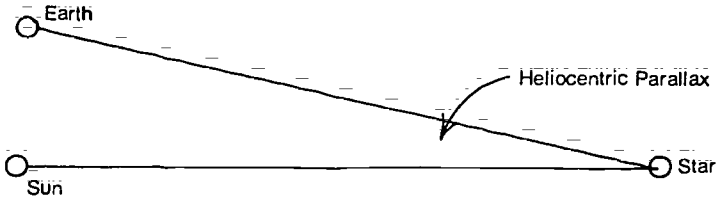
	True Course	*Variation*	*Magnetic Heading*	*Deviation*	*Compass Heading*
7.	082°	− 4°		+2°	
8.	274°	+9°		− 5°	
9.	350°	+7°		− 4°	

Congruent Triangles

An *angle of parallax* is the change in direction when a star is viewed from two different points. It may be the angle subtended at the star by the radius of Earth.



For distant stars a *heliocentric parallax* is used. This is an angle formed by rays from the Sun and Earth.

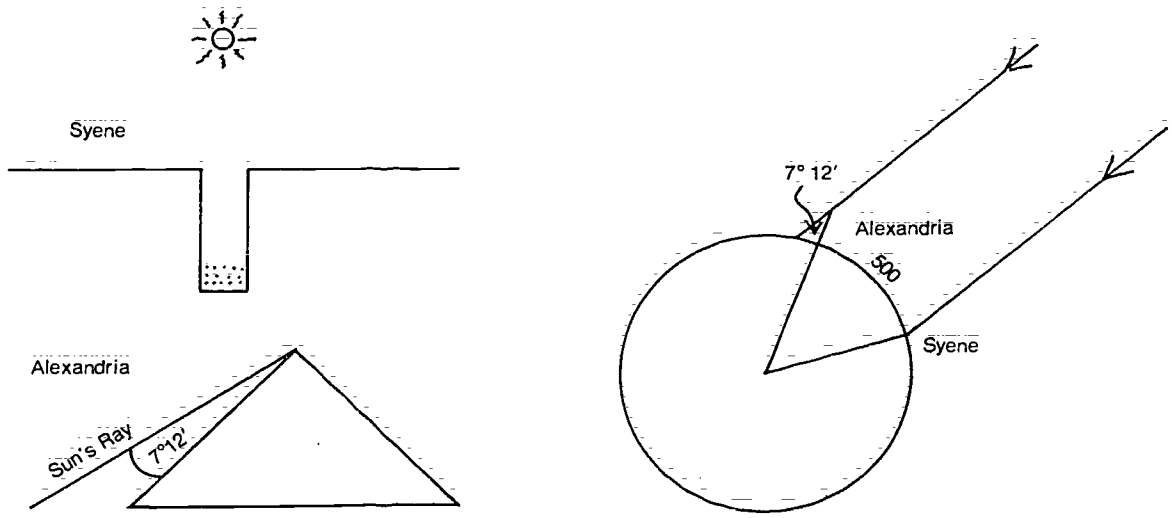


10. If the heliocentric parallax of a star is 2° on September 1, what will it be on March 1, six month's later? Assume the orbit of Earth about the Sun is circular.

Alternate-Interior Angles of Parallel Lines

Many people claim that Columbus proved that Earth is round. However, a Greek scholar, Eratosthenes, who lived about 200 B.C., which is almost 1700 years before Columbus, did more than that. He found the approximate circumference of Earth.

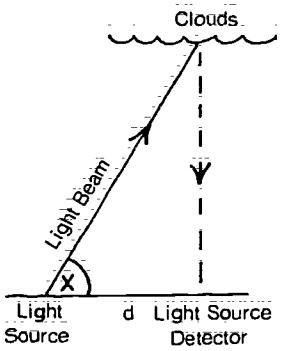
Eratosthenes first selected two places in Egypt to gather his information. One of these places was a well in Syene (now the city of Aswan). The other place was a pyramid in Alexandria. The well in Syene and the pyramid in Alexandria were approximately 500 miles apart. He waited until a certain day of the year when he knew the Sun was directly overhead because he could see its reflection on the bottom of the well. On that same day an observer in Alexandria noted the shadow cast by the pyramid and measured the angle formed by the Sun's ray and the pyramid as approximately 7° 12′.



11. Assuming the rays of the Sun are parallel, what was Eratosthenes' measure of the circumference of Earth?

Trigonometry

A sweeping light beam is used with a light source detector to determine the height of clouds directly above the detector, as illustrated in the diagram.



The light beam sweeps from the horizontal (angle x = 0°) to the vertical (angle x = 90°). When the beam illuminates the base of the clouds directly above the detector, the angle x is read, and with d, the distance between the light source and the light source detector, known, the height of the clouds can be computed.

12. If the light source is 1,000 feet from the light source detector and the light beam is reflected from clouds when angle x = 63°, find the height of the clouds.

13. Find angle x if the clouds are 1,200 feet high and the light source is 900 feet from the light source detector.

At many United States National Weather Service stations two light sources are used to gain more reliable data. One light source is 800 feet from the detector and the other light source is 1,600 feet from the detector.

14. If the angle at the 800-foot light source is 51° when a cloud is 1,000 feet high, what is the angle at the 1,600-foot source?

THE USE OF THE AEROSPACE THEME IN FOREIGN LANGUAGES

FOREIGN LANGUAGES DEPARTMENT

Foreign Language Program
Samples of Foreign Language Materials

Foreign Language Program

The supersonic jet and swifter forms of worldwide communications have contracted the globe; consequently the need to communicate with our neighbors abroad has become all the more imperative. Our international relations are constantly expanding as we endeavor to build and maintain alliances for securing the peace, to provide technicians and material assistance to underdeveloped countries, to engage in international cooperation in science, technology, and business, and to promote large-scale cultural exchanges of students, teachers, artists, musicians, and leaders in many fields. The importance of acquiring a working knowledge of foreign languages is constantly increasing as our far-flung activities and our destiny grow more and more intertwined with those of other peoples.

In foreign languages, each student is permitted to work at his own pace. After a first "common cycle," students are screened and placed into one of the three separate tracks: A "fast" track where students will be able to cover the year's work in three cycles; an "average" track where four cycles will be needed; and a "slower moving, more conversational" track where students will cover the year's work in six cycles. The rewards of such an arrangement are apparent. There is no failure attitude but rather a moving forward constantly at the student's own rate of speed. Success is guaranteed!

The use of modular scheduling techniques in class programming will provide the time flexibility for a wider variety of instructional approaches; the teachers and students will be able to engage in skits and dialogue routines and variations; there will be greater time available for the use of the language laboratory; and visual aids will become an integral part of classroom activities.

In all foreign language classes at August Martin High School, the students have the opportunity to engage in off-campus laboratory work at airport facilities and will be additionally rewarded via field trips to the world's largest airport where the languages they are studying will "come alive" as the youngsters hear and speak with the many people who speak the very languages the Martinites are learning.

Personal Interests

1. *Vocational*

In a world where travel by jet plane is a reality, the demand for men and women with training in a foreign language is ever increasing. There is a growing need for government employees, diplomatic and consular representatives, and industrial personnel who are bilingual or who have a working knowledge of two or more languages. American-trained skilled workers with a good foreign language background are always sought by companies involved in business and industrial enterprises in foreign languages. There is a need for engineers, scientists, teachers, bankers, military men, and businessmen who can travel and live abroad. To make them more effective in their work, a knowledge of foreign languages is essential. There is every indication, therefore, that opportunities for employment are greater and more varied for the individual who has mastered a language other than his own. Some fields in which a knowledge of foreign languages is advantageous are:

Diplomatic service
Aerospace medical technology
Careers on operatic and concert stage
Import and export trade
Passenger servicing
Foreign banking
Newspaper and magazine editing
Museum work
Stewardess
Teaching of foreign languages
Scientific research
Avionics
Publishing
Library science
Airport vehicle technician
Travel and tourist agencies
Intelligence and security agencies
Translating and interpreting
Bilingual stenography
Radio broadcasting
Employment at the United Nations Headquarters or specialized agencies

2. *Avocational*

Even when the study of foreign languages is not a requirement for a specific career or job, the ability to understand and speak it may be an asset to any individual. Many personal interests and leisure time pursuits are associated with an appreciation of the language, life, and customs of the people whose language is studied. Some avocational activities involving a knowledge of a foreign language are:

Travel
Speaking the language of the country visited makes the trip more worthwhile
Reading literature in its original form
Enjoyment of foreign language films, plays, opera, etc.
Listening to foreign language broadcasts
Communicating with visitors from foreign lands
Engaging in "Pen Pal" correspondence

Aims of Foreign Language Instruction

General Aims

The general aim of instruction in foreign languages is to develop in pupils the skills needed for effective communication in the foreign language. A concomitant aim is to develop in pupils an understanding of the foreign people, of their country, and of their culture.

Linguistic Aims

To understand the foreign language when spoken by a native at normal tempo and on a topic within the pupil's experience. To speak the foreign language on topics within the pupil's experience with sufficient cla.'ty to be understood by a native. To read with direct comprehension material within the pupil's experience. To write in the foreign language on topics within the pupil's experience.

Cultural Aims

To develop an enlightened understanding of the foreign people through a study of their contemporary life, their patterns of behavior, and their national customs and observances. To acquire specific knowledge regarding the geography, history, economic life, and educational and political institutions of the foreign people. To acquire attitudes conducive to intercultural harmony through a study of the contributions of the foreign people to the development of the United States and of world civilization. To develop cultural and esthetic appreciations through a study of the foreign country's art, music, literature, science, and contemporary art forms, such as drama, film, dance, and design. To promote growth in the language arts through the development of language consciousness.

Samples of Foreign Language Materials

Viaje en avión

El avión es un medio rápido de transportación aérea en nuestros días. Los aviones cruzan los cielos, a grandes alturas, para ir de una nación a otra en el mundo, en pocas horas.

Casi todas las naciones del mundo poseen sus propios aviones nacionales; unos van de ciudad a ciudad, y otros se dirigen hacia naciones extranjeras. En todas las capitales de las naciones existen modernos aeropuertos donde aterrizan aviones procedentes de todos los países. Hoy podemos ir a cualquier nación del mundo en muy pocas horas.

Los aviones, en nuestros días, llevan equipos y sistemas modernos de control que les permiten despegar y aterrizar con mucha facilidad. Los paneles de control de los aviones están equipados con sistemas de radar y de computadores. Con ellos los pilotos están en comunicación constante con las torres de control de los aeropuertos; conocen la altura a que va el avión, la velocidad y la ruta marcada para el vuelo.

Los aviones de largas distancias llevan ordinariamente cuatro potentes motores reactores. Son aviones grandes que pueden transportar un gran número de pasajeros.

La tripulación de los aviones son personas muy bien preparadas. Los pilotos reciben un largo entrenamiento, a veces de muchos años. Muchos de ellos han sido pilotos de aviones de guerra con una larga experiencia.

Las azafatas explican a los pasajeros cómo usar los equipos de emergencia. Por si fuera poco todo pasajero puede leer en una cartulina lo que debe hacer en un caso de emergencia.

Los asientos de los aviones son reclinables para poder dormir durante el vuelo. A horas determinadas, las azafatas sirven comidas y bebidas a los pasajeros; ellas están pendientes de otras necesidades de los pasajeros. El pasajero puede incluso afeitarse con maquinilla eléctrica en los baños, tan limpios y tan higiénicos. En muchos de los aviones de larga distancia el pasajero puede oír música, ver una película o pedir una revista para leer.

En nuestros días es muy fácil conseguir un boleto para un viaje en avión. Todas las compañías de aviación tienen oficinas en las ciudades; Ud. puede ir personalmente a la oficina; puede además reservar el boleto con muchos días de anticipación. Es muy fácil también conseguir los boletos de viaje por medio de otras agencias de viajes.

El pasajero debe estar en el aeropuerto una hora antes de la salida del avión. En el aeropuerto le recibirán las maletas, y le entregarán un comprobante. Las maletas van en el mismo avión, aunque en compartimiento distinto. El pasajero puede llevar consigo una pequeña maleta de mano o un bulto. Si lleva un peso mayor del fijado tendrá que pagar un sobrepeso. En las compañías hispanoamericanas el peso de las maletas es de 20 kilos aproximadamente.

Al llegar al lugar de destino, el pasajero recogerá su maleta en el departamento de equipajes. Ya hay señales de dirección en todos los aeropuertos que le llevan hasta donde el pasajero encontrará su maleta. Estas vienen por correderas movibles y Ud. puede identificar la suya mediante el número de comprobante que lleva fijo en su boleto.

En todos los aeropuertos el pasajero tiene facilidades de transportación hasta el centro de la ciudad. Puede elegir entre taxis, autobuses, o transportación facilitada por la misma compañía de aviación.

Hoy, el viajar en avión es rápido, fácil, cómodo y sobre todo es seguro.

aterrizar *to land*
despegar *to take off*
tripulación *f* personas que van en un avión o en barco, dedicadas a su servicio y maniobra

Preguntas sobre la lectura. Escriba la respuesta.

1. El avión, ¿es el medio rápido de transportación terrestre?

2. ¿Adónde van los aviones cruzando los cielos?

3. ¿Qué poseen casi todas las naciones del mundo?

4. ¿Adónde van unos y adónde van otros?

5. ¿Qué existe en casi todas las capitales del mundo?

6. ¿Adónde podemos ir, hoy día, en avión?

7. Los aviones, en nuestros días, ¿qué llevan?

8. ¿Con qué están equipados los paneles de control?

9. ¿Para qué les sirve a los pilotos el radar y los sistemas de computadores de los aviones?

10. ¿Cómo son ordinariamente los aviones de largas distancias?

11. Los pilotos, ¿reciben un corto entrenamiento?

12. ¿Qué les explican a los pasajeros las azafatas?

13. ¿Qué puede leer todo pasajero, en una cartulina?

14. ¿Qué sirven las azafatas, a horas determinadas?

15. ¿De qué están pendientes las azafatas?

16. ¿Qué puede oír, ver o pedir el pasajero?

17. Las compañías de aviación, ¿qué tienen en todas las ciudades?

18. ¿Puede el pasajero reservar su boleto con anticipación?

19. ¿Cómo puede conseguir también el boleto, el pasajero?

20. ¿A qué hora debe estar el pasajero en el aeropuerto?

21. ¿Qué le recogerán en el aeropuerto, al pasajero?

22. ¿Qué puede llevar consigo el pasajero?

23. ¿Cuántos kilos permiten las compañías de aviación?

24. ¿Dónde recogerá su maleta, el pasajero?

CONVERSACION 23

VOLANDO A ESPAÑA (PRIMERA PARTE: EN EL AEROPUERTO)

Al fin Domingo Ocasio va a hacer el viaje de sus sueños. Va a visitar a todos sus amigos y familiares en España. Hace mucho tiempo que no los ve. Ahora está de vacacciones y tiene la oportunidad. Va al aeropuerto Kennedy en Nueva York para comprar los billetes.

El señor Ocasio—Quisiera dos billetes de ida y vuelta a Madrid.

El dependiente—¿Para qué dia, señor?

Ocasio—Bueno, tengo que estar en España el próximo sábado, a más tardar.

Dependiente—Está bien. Tenemos un vuelo directo, con destino a Madrid, este viernes.

Ocasio—¿A qué hora sale?

Dependiente—Sale a las nueve de la noche, y llega al aeropuerto Barajas a las nueve y media al dia siguiente.

Ocasio—Perfecto. Necesito dos billetes. ¿Hay mucha diferencia en el precio entre el billete de primera clase y el de turista?

Dependiente—Claro, pero vale la pena si viaja con una persona importante.

Ocasio—Bueno, déme dos billetes de turista. Viajo con mi mujer.

VOLANDO A ESPAÑA (SEGUNDA PARTE: EN EL AVION)

La Azafata: Muy buenos dias señoras y señores. Bienvenidos al vuelo 635 de Iberia. Su piloto es el Capitán Miranda. Volamos a velocidad de 1.000 (mil) kilómetros por hora. Delante de sus asientos hay una máscara de oxigeno en caso de emergencia. Durante el despegue, abróchense los cinturones de seguridad y favor de no fumar. Muchas gracias.

Seis horas más tarde . . .

El señor Ocasio: Hace seis horas que estamos volando. ¿Cuándo vamos a aterrizar?

Señora de Ocasio: Siempre te quejas. Estos vuelos por avión a chorro son magnificos y la comida y el servicio excelentes.

El señor Ocasio (llamando a la azafata): Señorita, ¿cuánto va a durar este vuelo?

La azafata: Ya falta poco. No tardaremos más que media hora en llegar.

El señor Ocasio: Gracias a Dios. Antes de comenzar el descenso quiero tomar un refresco y algo que comer.

La azafata: Lo siento señor. Es demasiado tarde. Vd. estaba durmiendo durante la comida.

EXERCISES

I. Do you know the answers to these questions?

1. ¿Qué va a hacer el señor Ocasio?
2. ¿De dónde va a salir el avión?
3. ¿Qué clase de billete va a comprar el señor Ocasio?
4. ¿Cuándo sale el avión de Nueva York?
5. ¿Qué clase de vuelo es?
6. ¿Quién saluda a los pasajeros al entrar en el avión?
7. ¿Cómo se llama el piloto?
8. ¿A qué altura está volando el avión?
9. ¿Qué hay delante de los asientos?
10. Durante el despegue, ¿qué tienen que hacer los pasajeros?

II. Complete the statements with an appropriate word:

1. Este verano voy a hacer un_____a España.
2. Tengo la_____de visitar a mis_____ .
3. Voy al_____Kennedy en Nueva York para comprar dos_____de ida y vuelta.
4. Bienvenidos al_____de Iberia.
5. Volamos a una altura de diez mil_____ .
6. En caso de emergencia, hay una_____de oxígeno.
7. Durante el_____ , es necesario abrocharse los_____de seguridad.
8. Los vuelos por_____a chorro son magníficos.
9. El avión va a comenzar el descenso, y va a_____en quince minutos.
10. Durante el descenso, la azafata les informa a los pasajeros que no se permite_____ .

THE USE OF THE AEROSPACE THEME IN SCIENCE

SCIENCE DEPARTMENT

The Science Program
Sample Science Materials

—Biology
—Principles of Flight

The Science Program

Science educators have long held the belief that they hold an advantage over their colleagues in other disciplines because students come to school with an innate interest in science. Youngsters grow up fascinated with the physiology of the human body, space travel, astronomy, life in the oceans, and the planet Earth itself.

With this inherent pupil interest in mind, the science staff at August Martin High School was ecstatic with the thought of using aerospace as a motivational theme—a golden thread with which to link various topics in the science curriculum.

Our view of the motivational theme concept is that it is mulitfunctional in nature. It serves to:

(a) unify all subject areas within the school
(b) relate subject matter to potential career opportunities
(c) enrich the course of study
(d) heighten pupil interest in education

Our task was to first provide basic interdisciplinary instruction in aviation or aerospace technology early in the student's high school experience, preferably in the ninth year. This was accomplished through such mandatory courses as "Principles of Flight," "History of Aviation," "The Air Age", and "Aircraft Model Building."

Equipped with this basic knowledge the student, in subsequent grades, could be expected to relate the experiences of an aircraft pilot to a scientific principle. For example, the mechanical process of external respiration can be presented in the classroom within the framework of a pilot's physiology as his aircraft rises from sea level to an altitude of fifteen thousand feet.

How does a reduction in atmospheric pressure effect the process of breathing? How does atmospheric pressure at sea level compare with atmospheric pressure at high altitudes? Is sufficient oxygen available at high altitudes to carry out internal respiration? What is the role of oxygen in internal respiration? Can Kreb's Cycle possibly be affected by a deficient oxygen supply at high altitudes? How is blood pressure and pulse rate affected by high altitude flight? The answer to one question suggests another question.

Our overall appraisal of the use of aerospace as a motivational theme, wherever possible in science instruction, is that the excitement, glamor, and magnetic appeal of this subject has grasped the imagination of the vast majority of our students and has enabled a substantial number to achieve a level of success in strictly academic subjects that had not previously been attained.

We heartily endorse and recommend its inclusion in high school programs.

Sample Science Materials

BIOLOGY

Lesson 1

AIM: Physiological Problems in Flight: Respiration

OUTCOMES:
1. As altitude increases the air becomes colder, thinner and lighter.
2. Atmospheric pressure decreases as altitude increases.
3. A partial reduction in the amount of available oxygen can cause serious illness.

MOTIVATION: Review the composition of air. (Nitrogen 78%, Oxygen 21%, all other gases 1%) Using models, charts, etc., review the structure and function of the human respiratory system. Ask, "What force causes air to move from outside the body into the respiratory system?"

DEVELOPMENT

1. Respiration is possible because, at sea level, atmospheric pressure is high enough to drive oxygen through the membranes of the lungs into the blood. Atmospheric pressure is reduced at high altitudes.

2. At altitudes above 10,000 feet the effects of hypoxia (partial lack of oxygen) become increasingly visible. At altitudes of 15,000 to 25,000 feet prolonged exposure to hypoxia results in paralysis, unconsciousness, and eventually death.

3. Ask: What causes hypoxia at high altitudes?; What affect will a reduced supply of oxygen have on the mitochondria in the cells of the body?; How will the pilot be affected by a reduction in the number of ATP's produced?

(a) pulse rate, breathing, and blood pressure all increase
(b) sense of touch and pain become dull
(c) vision is seriously impaired
(d) muscular control is decreased
(e) movement is slow and awkward

4. DANGER: The pilot is in a state of drunkeness and has a feeling of well-being and is quite relaxed.

Lesson 2

AIM: Physiological Problems in Flight: The Eye

OUTCOMES:
1. Vision is fundamental to flight
2. Certain vision skills can be improved
3. Advances in Aviation Medicine have helped to alleviate some visual problems.

MOTIVATION: Ask students: Of all the organs in the body which one, if only slightly impaired, would preclude the possibility of flight?

DEVELOPMENT

1. Using models, charts, etc., review the structure and function of the eye. Define and discuss the following: iris, lens, pupil, retina, optic nerve, rods, and cones.

2. Define Depth Perception—ability to judge distances. Since depth perception depends upon learning and experience it can be improved.

3. Night Flying—Review function of rods and cones.
   (a) Night vision depends largely upon rods
   (b) Strong light has a deleterious effect upon rods and must be avoided
   (c) Pilots are urged to wear red-lensed goggles 30-40 minutes prior to night flights. These lenses permit cones to see while rods regain full efficiency after exposure to strong light. (Dark Adaptation—process which prepares eyes to see under low illumination.)

4. Discuss the dangers of night flying.
   (a) tendency to rely on vision rather than instruments
   (b) mistaking stars for lights
   (c) no definite horizon

PRINCIPLES OF FLIGHT

Suggested Topical Outline

Topic I—*The Atmosphere and Theories of Flight*

1. The Atmosphere—Its Composition and Behavior
2. The Atmosphere—Pressure, Weight and Density
3. The Atmosphere—Temperature and Humidity
4. The Atmosphere—Wind and Air Currents
5. The Atmosphere—Effects of Altitude and Relative Wind
6. Flight Theory—Bernoulli's Principle
7. Flight Theory—Newton's Action and Reaction Theory

Topic II—*Forces of Flight*

8. What forces act upon a plane in flight?
9. How is an airfoil especially designed?
10. Lift: Angle of Attack, Relative Wind, Air Density, Wing Area
11. Lift: Flaps, Slots, Spoilers, Boundary Area
12. Drag: Angle of Attack, Boundary Layer
13. Drag: Aspect Ratio, Velocity

Topic III—*Aircraft Design and Structure*

14. Aircraft Materials: Wood, Aluminum, Steel, Titanium, Nickel, Magnesium, Ceramics, Plastics
15. Aircraft Design: Fuselage, Tail Assembly, Wings (subsonic—supersonic)

Topic IV—*Stability and Controls*

16. Stability: Positive, Neutral, Negative
17. Stability: Sensitivity of Controls, Dynamic and Static

18. Longitudinal Stability: Relative Wind, Thrust, Drag
19. Lateral Stability: Dihedral, Keel Effect, Sweepback
20. Directional Stability: Vertical Tail Surfaces, Center of Gravity, Throttle
21. Flight Controls: Ailerons, Rudder, Elevators, Trim Tabs

Topic V — *Aircraft Instruments*

22. Engine Instruments: Oil Pressure, Fuel, Manifold Pressure and Carburetor Temperature Gauges
23. Aircraft Instruments: Air Speed Indicator, Magnetic Compass, Altimeter
24. Aircraft Instruments: Turn-and-Bank Indicator, Rate of Climb Indicator, Artificial Horizons
25. Operating Principles: Electrical Instruments, Mechanical Instruments

Topic VI — *High Speed Flight*

26. The Nature of Sound: Transmission, Variations in Speed
27. The Nature of Sound: Mach Number, Subsonic, Transonic, Supersonic, Hypersonic
28. Transonic Zone: Air Compression, Variations in Airstream Pressure and Velocity
29. Transonic Zone: Shock Wave Formation (effect on flight)
30. High Speed Design: Thickness-to-Chord Ratio, Aspect Ratio, Structural Strength
31. High Speed Design: Drag-Lift, Sweptback and Delta Planforms, Geometric Wings
32. Solutions to High Speed Heat Problems

Topic VII — *Man in Flight*

33. Effects of Altitude and Pressure: Man's Ability to Adapt
34. Hypoxia: Symptoms, Prevention, Effect on Breathing
35. Effects of Altitudes: Body Gases, Middle Ear, Eustachian Tube, Sinuses (relief of problems)
36. Decompression Sickness: Causes, Effects, Prevention, Relief
37. High Altitude Flight: Oxygen Requirement, Pressure Problems, Emergency Equipment
38. Vision: Illuminated, Night, Central, Peripheral, Improving Perception
39. What factors affect man's tolerance of "G's," increased acceleration
40. Other Flight Problems: Illusion, Equilibrium (eyes, muscles, inner ear)

Lessons

How can we classify aircraft by their flight principle?

Outcomes

1. Aircraft can be classified as
   A. Lighter-than-air
   B. Gliders
   C. Propeller-driven aircraft
   D. Jet-powered aircraft
   E. Helicopters
2. Different types of aircraft serve the various needs of individuals, business, and government.

Learning Activities

1. Exhibit picture and models of various types of aircraft. Have students group the aircraft by their flight principle.
2. Elicit how the various types of aircraft serve different purposes based on their flight principle.

Supplementary Information for Teachers

1. *Lighter-than-air*—Weather observations, astronomy, advertising.
2. *Gliders*—Pleasure flying
3. *Propeller driven aircraft*—Transportation, airmail, air express, patrol and survey, crop dusting, wildlife management, forest fire control, aerial photography, prospecting, air rescue, business flying, recreation flight training, military functions.
4. *Jet-powered aircraft*—Commercial aviation, business flying, military functions.
5. *Helicopters*—Interairport flights, industrial flying, disaster relief, law enforcement work, airport to city center service.

What factors determine the amount of lift a wing will produce?

Outcomes

1. An increase in the relative wind increases lift. Increasing the angle of attack causes a decrease. The pressure on the upper surface of the wing also increases lift.
2. If the angle of attack becomes too great, air moving over the upper surface of the airfoil will break away from the surface and lift will be decreased.
3. When lift is decreased so that it cannot support the weight of the airplane, the airplane is said to be in a "stall."

Learning Activities

1. Using the airfoil on the balance from the previous lesson, increase the velocity of air striking the airfoil.
2. Point out the meaning of "angle of attack"; slowly increase the angle of attack of the airfoil. Obtain data on the amount of lift in relationship to the angle of attack.
3. By means of diagrams, show what happens to the flow of air if the angle of attack becomes too great. Introduce the term "stall."

Supplementary Information for Teachers

1. Angle of attack is the angle between the chord of an airfoil and the relative wind.

   Relative
   wind
   Angle of attack

2. Other factors that influence the amount of lift force are the design of the airfoil, surface area of airfoil, and density of air.

What is the relationship between velocity and the presssure of fluids?

Outcomes

The pressure in a moving fluid is less when the velocity is high and greater when the velocity is low.

Learning Activities

1. Establish that both gases and fluids are called liquids.
2. Students will do laboratory worksheets P-1 (appendix).

3. Discuss the applications of Bernoulli's principle in spray devices, passing a large trailer truck in a car, standing near the edge of a subway platform when a train passes.
4. Demonstrate Bernoulli's principle by using a venturi and a manometer.

How is an airplane controlled in flight?

Outcomes

1. The airplane is controlled in flight by the moveable control surfaces.
2. The ailerons control movement about the longitudinal axis.
3. The elevator controls movement about the lateral axis.
4. The rudder controls movement about the vertical axis.
5. The pilot controls these moveable surfaces from the cockpit.

Learning Activities

1. Point out, by the use of models, the location of the ailerons, elevator, and rudder. Demonstrate that they are hinged to the trailing edges of the wind, and horizontal and vertical stabilizers.
2. Elicit that a movement of any one of the control surfaces changes the shape of the airfoil it is attached to.
3. Demonstrate, with a wind tunnel and model, various positions of the control surfaces and how the model reacts.
4. Discuss how the pilot uses a stick or wheel and pedals to operate these control surfaces. Point out that, to properly execute a turn, a pilot must use all 3 control surfaces simultaneously.

Supplementary Information for Teachers

1. The ailerons are so arranged that as one moves up the other automatically moves down.
2. In order to effect a turn, the airplane must be banked as well as pointed in the desired direction, just as highway curves are banked to prevent skids.

THE USE OF THE AEROSPACE THEME IN MUSIC-ART AND HEALTH EDUCATION

Music and Art Department	*Health and Physical Education Department*
—Sample Art Lesson	—Family Living
—Sample Music Lesson	—Drug Education
	—Health

Music and Art Department

Through the development of aerospace, many parts of the world have become easily reachable within shorter periods of time. As a result, the people of the world have become closer, and there is a constant interchange of culture and ideas. Music and art can be considered universal languages with a similar purpose—bringing the people of the world together and developing a better understanding of each other's cultures.

By taking an imaginary flight, we can land in different countries and study the music and art which are a part of the heritage in each place, thereby instilling a sense of appreciation for the cultures and backgrounds of different people. For example, through the years, many composers and artists have expressed their nationalistic feelings through their works. Smetana's "The Moldau," Grieg's "Norwegian Dances," Respighi's "Fountains of Rome," Villa Lobos' "Train to Caipira," Sibelius' "Finlandia," and Tschaikovsky's "1812 Overture" are some of the musical works which can be used to give some insight to people's political and social conditions as they

travel through the countries. Goya's "Disasters of War," Picasso's "Guernica," Daumier's "Uprising," and Diego Rivera's "Murals" are examples of art works which can be studied as part of a unit on imaginary travels to study the cultures of the world.

Folk music and folk art are other areas to be incorporated into the music and art curriculum. Taking a journey through different countries, the conditions of the people as reflected by the layman can be studied through their songs and art works. These works have been inspired by many events in their lives, such as tragedy, war, romance and occupations.

From the performance level, or "active" involvement of the students, many songs and works of art can be created using aerospace as a means of motivation to develop skills and discover talents. For the vocal and instrumental classes, songs such as "Up, Up and Away," "2001 Space Odyssey," "Fly, Robin, Fly," "Fly Me to the Moon," "Lucky Lindy," and "Star Wars" can be taught. The school song, "Upward Bound," is based on the theme of aerospace. In art, aerospace is an excellent theme. Aircraft, missiles, and space vehicles are popular subjects for painting, crafts, and sculpture classes. Issues that surround the aerospace community are appropriate subjects for painting, cartooning, and advertising design classes. Noise pollution, aircraft mishaps, baggage mishandling, and traffic jams are excellent aerospace themes available for exploration in the art class. In ceramics, it is possible to create aerospace-oriented ash trays, dishes, and pottery. In fashion design classes, clothing of airline personnel can be studied. The architecture and interior design of airplanes and buildings at airports are other aerospace subjects to be studied by the students. They can study what has been created by artists already, as well as create new ideas of their own.

SAMPLE LESSON: ART

AIM:

1. To relate art to everyday activities.
2. To develop a specific skill by learning to render distance in a realistic manner through one-point perspective.
3. To use buildings and runways at an airport as a means of teaching perspective.

MOTIVATION

1. Show slides of buildings drawn in perspective by the artist Utrillo.
2. Show pictures of buildings drawn in perspective by architectural draftsmen.
3. Demonstrate the process on the blackboard.

METHOD

The class is instructed to draw a complex of buildings and runways as imagined by them at an airport. Give students 15 minutes for the creative work. Then spend five minutes making comments and showing them samples of what is being done by others. Then permit students to complete their work.

MATERIALS

Rulers, pencils, erasers, and white paper.

SUMMARY

Evaluate the student works at random.
Why are some works successful in showing one-point perspective?
Why did some students fail to show this perspective?
Does a building or runway look realistic if it is out of perspective? Why?

SAMPLE LESSON: MUSIC

As part of a unit which involves an imaginary flight around the world to study the different musical cultures, we arrive in Russia.

AIM:

1. To show how national traditions have enriched musical literature.
2. To reveal certain characteristics which are typical of Russian music.

MOTIVATION

1. Give the historical background which inspired Tchaikovsky to write this music. Discuss the war between France and Russia and how the French were defeated primarily by the Russian winter. "1812" is Tchaikovsky's gesture of homage to his homeland.

METHOD

1. Teach the Russian and French national anthems. When they can recognize the melodies, they will be able to hear how Tchaikovsky used them in the Overture.
2. Discuss the sequence of events which are depicted in the music and the themes used for each. For example, the Chorale in the beginning is like a prayer in time of need. Then a military theme is used to symbolize the Russian army. At the end, there is a blaze of glory represented by the bells and cannons.
3. Play the recording, asking students to raise hands as they recognize different themes and anthems discussed.

MATERIAL

1. Recording of the "1812 Overture" by Tchaikovsky
2. Rexograph sheets with main themes written

SUMMARY

1. How did Tchaikovsky represent both the French and Russian in the music?
2. What effects in orchestration did he use to create the feelings of need? of strife? of victory?
3. What melodic and rhythmic idioms did he use?
4. Which musical characteristics seem typical of Russian music?
5. What are some of the reasons for a composer to write nationalistic music?

Health and Physical Education Department

The fields of Health and Physical Education are perhaps the more difficult curriculum areas in which we may effectively utilize the aerospace motivational theme. If the premise is correct, use of the aerospace theme should prove effective in stimulating the student to put forth a greater effort in the active educational process.

In Physical Education, we have utilized the Canadian Royal Air Force exercise program with success. We have also begun use of the Air Force Aerobic jogging/running program to improve the cardio-respiratory endurance of our student body.

Initial screening of our incoming freshmen and sophomores has revealed a particular weakness in general fitness levels. A primary cause of this poor general fitness level is our growing cultural aversion to daily exercise. Our students are a valid reflection of this general social malady. To motivate them to *want* to improve their general fitness level, we embarked upon the aforementioned fitness programs.

In the area of Health, we have also incorporated the aerospace theme in our lesson development whenever feasible. Several topic areas have been effectively explored as valid aerospace theme topics. For example, the areas of jet lag, drug abuse (and the causative agent—stress), environmental education (the effect of noise pollution, as in the case of the SST), and social adjustment (divorce among the members of aviation occupations) are several of the areas in which we have achieved success with the aerospace motivational theme.

LESSON - HEALTH - FAMILY LIVING

I. Topic: Divorce among the aviation occupations

II. Aim: Why do airline pilots and air traffic controllers have such a high divorce rate?

III. Objective: To have students learn the problems that are inherent in the aeronautic occupations and what they might do to better the situation.

IV. Motivation: Captain's salary—$70,000, Air Traffic Controller's salary—$38,000

Why aren't these individuals who have all this money per annum able to be happy and live a stable life?

V. Pivotal Questions

1. How might we define divorce?
2. What problems lead to divorce?
3. How can a certain occupation affect the stability of a marriage?
4. How might traveling constantly affect a marriage?
5. How might we prevent or cut down on the high divorce rate among aeronautic occupations? (Suggestions)

VI. Reasons for divorce

1. Shift work and the marriage
2. Traveling and the marriage
3. Why would you become a pilot if you were married?

VII. Homework

1. What are the requirements in order to become a pilot? flight attendant? air traffic controller? etc.
2. What are the benefits of working in the aeronautics field?
3. Would you think going into an aviation occupation worth the possibility of getting a divorce?
4. How might open communication and trust fit into a successful marriage?
5. What else is important in a stable marriage?

Information from *The Family*, J. Ross Eshlemian
Human Sexuality, J. L. McCarey

LESSON - HEALTH - DRUG EDUCATION

I. Topic: Jet Lag and the Pilot
Introduction to drug unit (causative agent - stress)

II. Aim: How does jet lag affect a pilot over a period of time?

III. Objective: To have students understand how the body adjusts to an outside stimulus and how drugs may be harmful to individuals.

IV. Motivation: The change of time in the spring and fall calls for an adjustment in the life-style and functions of the body. What changes do we have to make for this one-hour change?

V. Pivotal Questions

1. What might a pilot do in order to offset the feeling of jet lag?
2. How does jet lag affect the body?
3. How does the body react to a foreign substance being introduced into the body?
4. How efficiently can an individual function under the influence of any drug?
5. What other stressful situations might a pilot experience?

VI. Summary

Stress — — — body reacts — — — ? ? ? ? ? — — — normal condition
(How do we offset condition)

VII. Homework

1. List the different ways an individual might deal with stress in both a healthy and harmful manner.
2. Why are there warnings on bottles today more than ever?

3. Read Chapter 8 - Drugs—Tune into Health

A. do words for review
B. questions

Information—*Tune into Health*, Drug Curriculum Guide

LESSON - HEALTH

I. Topic: Environment education, noise pollution, air pollution, collisions, fuel economy

II. Aim: How dangerous is it being close, either living or working, to an airport?

III. Objective: To have students understand the nature of pollution and its effects on the body (mentally, physically and psychologically)

IV. Motivation: The Concorde will be landing at Kennedy Airport. What problems do you foresee? Improving air travel is important for mankind, but let's examine the positive and negative results to this improvement.

V. Pivotal Questions

1. How does the arrival of the SST affect you in your personal lives?
2. What benefits do you see from having the SST arrive at Kennedy?
3. What negative effects might there be with the arrival of the SST?
4. How might the body respond to the extra burden placed upon it?
5. How can we adjust to an environmental change?

VI. Summary

Review positive and negative results of the SST's arrival.

VII. Homework

Take a poll of people in your neighborhood and find out how they feel about the arrival of the SST. Make up at least five good questions to ask.

Information

—noise pollution
—air pollution
—hydrocarbon emissions and ash
—collisions
—fuel economy
—depressurization in Concorde

Books: Health Ed curriculum
Tune into Health

PART 4

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

This publication has presented an operational model of a thematic aerospace educational school—August Martin Comprehensive High School; it has in the process illustrated the role of the thematic approach to education.

Clearly, the August Martin program gives eloquent testimony to the practical value of using a pervasive theme around which to build an educational program. Aerospace in this instance is a means to educational ends. Obviously, other themes can be used successfully. For example, following the early success of the August Martin program, a Marine Science High School—Beach Channel School—was developed using the environment of the local water-marine influence on Long Island. It was not a coincidence that the assistant principal of August Martin High School became the principal of Beach Channel School. In Washington, D.C. a secondary school, located within the flight path for Washington National Airport and near the Potomac River, designed an aerospace and marine science program that was called the Randall Aerospace/Marine Science (RAMS) Program. Similar thematic programs have been developed in Boston, Massachusetts, and in other parts of the country.

By consulting the listing of sources of information (Appendix B) one may obtain details of programs such as herein described. The key point to consider is that an aerospace or other thematic approach to education is feasible. Moreover, the behavior changing impact of such programs yield remarkable benefits for the students as well as the total community.

RECOMMENDATIONS

Designing an Aerospace Program

Any school system that feels there is an opportunity and need to design either a part of an aerospace oriented program or a portion of it, will do well to look at the experiences gained in planning and operating August Martin Comprehensive High School. While not all of the community, industry, and motivational factors that combined to make the program successful exists everywhere, clearly the Richmond, California, experiment proves that much can be done with few resources if the initiative, motivation, and determination are present.

Where To Get Help.

The administration and staff of August Martin High School have regularly made available time, recommendations, reports of projects, curricula, and other relevant data. The Aviation Development Council is one of the major planning and communications catalysts in furthering aerospace education in general and the August Martin program in particular. Organizations that have resource personnel, curriculum materials, aerospace and related source material, and professional advice and assistance include: Civil Air Patrol (CAP), the Federal Aviation Administration (FAA), and the National Aeronautics and Space Administration (NASA). Appendix B lists some suggested sources of information.

FOOTNOTES AND REFERENCES

1. Strickler, Mervin K. Jr., *The Air Center as a Means of Implementing Aviation Education,* "Chapter 2: Definition." Unpublished Doctoral Dissertation, Stanford University, April 1951.
2. The American Society for Aerospace Education. "Aerospace Education Why? What? How?", *The Directory of Aerospace Education, 2nd Ed.*, 1977-78, p.4.
3. *Aviation education* and *aerospace education* are used interchangeably in this publication.
4. *Aviation and Space Education:* "An Overview," p. 6.
5. Conway, Lee. *Learning Through Aviation.* Washington, D.C.: Federal Aviation Administration, March, 1969.
6. Conway, Lee. *Second Report on Learning Through Aviation.* Washington, D.C.: Federal Aviation Administration, May, 1970.
7. Conway, Lee. "Classroom in the Sky: A Power Trip for Disadvantaged Youth," *Phi Delta Kappan.* May, 1976. pp. 570-574.
8. Costello, Lawrence. *August Martin High School Program with Special Emphasis on Aerospace Education.* New York: (undated).

APPENDICES

Appendix A

College Acceptances of August Martin High School June, 1979 Graduates

PRIVATE INSTITUTIONS

School	*No.*
Academy of Aeronautics	7
Adelphi University	4
Barnard College	1
Boston University	2
University of Bridgeport	1
Brown University	1
Bryant College	1
C. W. Post	1
Central State University	1
Cheyney State College	1
University of Chicago	1
Clarkson Institute of Technology	1
University of Colorado	1
Columbia University	2
Daniel Webster College	1
Delaware State College	1
University of Denver	1
Dowling College	3
Eisenhower College	1
Embry Riddle Aeronautical University	3
Emerson College	1
Fordham University	5
Florida Institute of Technology	7
Franklin Pierce College	1
Friendship College	1
Georgetown University	1

School	*No.*
Hamilton College	2
Hampton Institute	5
University of Hartford	1
Hartwick College	1
Harvard College	1
Hofstra University	4
Howard University	4
Indiana State University	1
Johnson and Wales College	1
Keuka College	1
Lincoln University	1
Long Island University	5
University of Maryland	1
Miami-Dade Community College	1
Morehouse College	3
Morgan State University	2
Nathaniel Hawthorne College	7
New York Institute of Technology	4
New York University	3
North Carolina Agricultural & Technical State University	1
North Carolina University	1
Northrop University	1
Nyack College	1
Ohio University	3
Pace University	1

School	No.
University of Pittsburgh	2
Polytechnic Institute of New York	3
Pratt Institute	1
Princeton University	3
Rensselaer Polytechnic Institute	1
Siena College	1
St. John's University	5
Skidmore College	1
Southampton College	1
Stevens Institute of Technology	1
Swarthmore College	1
Syracuse University	6
Tuskegee Institute	2
Utica College	1
Vassar College	1
Virginia State College	3
Wagner College	1
Winston-Salem University	1
Yale University	1

PUBLIC INSTITUTIONS

SUNY—State University of New York

School	No.
Albany	1
Alfred	1
Binghamton	2
Brockport	7
Buffalo College	1
Buffalo University	2
Farmingdale	4
Fashion Institute of Technology	1
Genesco	1
New Paltz	4
Old Westbury	3
Plattsburgh	3
Purchase	1
Stony Brook	3

CUNY—City University of New York

2 Year Schools	64
4 Year Schools	75
7 late applications	

Appendix B

Aerospace Education Resources Guide

SOURCES OF ASSISTANCE

The single best aerospace education resource for teachers is *The Directory of Aerospace Education* which is published biennially by:

The American Society for Aerospace Education
1750 Pennsylvania Ave. N.W. Suite 1302
Washington, DC 20006

FEDERAL AVIATION ADMINISTRATION REGION OFFICES
For FAA publications and speakers. NOT FOR FAA FILMS

Alaska Region, DOT/FAA
632 Sixth Avenue
Anchorage, AK 99501
Serves: Alaska

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601 East Twelfth Street
Kansas City, MO 64106
Serves: Iowa, Kansas, Missouri, Nebraska

Eastern Region, DOT/FAA
JFK International Airport
Jamaica, NY 11430
Serves: Delaware, Maryland, New Jersey, New York, Pennsylvania, Virginia, West Virginia

Great Lakes Region, DOT/FAA
2300 East Devon
Des Plaines, IL 60018
Serves: Illinois, Indiana, Michigan, Minnesota, Ohio, Wisconsin

New England Region, DOT/FAA
12 New England Exec. Park
Burlington, MA 01803
Serves: Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont

Northwest Region, DOT/FAA
FAA Building, Boeing Field
Seattle, WA 98108
Serves: Idaho, Oregon, Washington

Pacific Region, DOT/FAA
PO Box 4009
Honolulu, HI 96813
Serves: Hawaii, Guam, Samoa, Wake Island

Rocky Mountain Region, DOT/FAA
10455 E. 25th Ave
Aurora, CO 80010
Serves: Colorado, Montana, North Dakota, South Dakota, Utah, Wyoming

Southern Region, DOT/FAA
Box 20636
Atlanta, GA 30320
Serves: Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, Puerto Rico, South Carolina, Tennessee, Virgin Islands

Southwest Region, DOT/FAA
PO Box 1689
Fort Worth, TX 76101
Serves: Arkansas, Louisiana, New Mexico, Oklahoma, Texas

Western Region, DOT/FAA
PO Box 92007
World Way Postal Center
Los Angeles, CA 90009
Serves: Arizona, California, Nevada

NASA REGION CENTERS
For NASA publications, speakers, and films.

Education Office
NASA, Ames Research Center
Moffett Field, CA 94035
Serves: Alaska, Arizona, California, Hawaii, Montana, Nevada, Oregon, Utah, Washington, Wyoming

Education Office
NASA, George C. Marshall Space Flight Center
Marshall Space Flight Center, AL 35812
Serves: Alabama, Arkansas, Iowa, Louisiana, Mississippi, Missouri, Tennessee

Education Office
NASA, Goddard Space Flight Center
Greenbelt, MD 20771
Serves: Connecticut, Delaware, District of Columbia, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont

Education Office
NASA, John F. Kennedy Space Center
Kennedy Space Center, FL 32899
Serves: Florida, Georgia, Puerto Rico, Virgin Islands

Education Office
NASA, Langley Research Center
Langley Station, Hampton, VA 23365
Serves: Kentucky, North Carolina, South Carolina, Virginia, West Virginia

Education Office
NASA, Lewis Research Center
2100 Brookpark Rd.
Cleveland, Ohio 44135
Serves: Illinois, Indiana, Michigan, Minnesota, Ohio, Wisconsin

Education Office
NASA, Lyndon B. Johnson Space Center
Houston, TX 77058
Serves: Colorado, Kansas, Nebraska, New Mexico, North Dakota, Oklahoma, South Dakota, Texas

FILM GUIDE:

AIR FORCE FILMS (USAF)
Central Audio Visual Library
Aerospace Audio Visual Service
Norton AFB, CA 92049

ARMY FILMS (USA)
Training Aids Management Agency
Training Materials Support Division
Tobyhanna, PA 18466
or
Contact your nearest Army Recruiter

FAA FILMS (FAA)
Film Library, ACC-44E
Federal Aviation Administration
PO Box 25082
Oklahoma City, OK 73125

NASA FILMS: (NASA)
Order from the NASA Region Center serving your area.

NAVY FILMS: (USN)
See your local Navy Recruiter

NON-GOVERNMENT FILMS:
Air Transport Association of America (ATA)
Public Relations Department
1709 New York Ave NW
Washington, DC 20006

Aviation Distributors and Manufacturers Association (ADMA)
1900 Arch St.
Philadelphia, PA 19109

Business Aircraft Association
425 13th St. NW Suite 401
Washington, DC 20004

Champion Spark Plug Co.
Film Section Dept M.
PO Box 910
Toledo, OH 43661

General Aviation Manufacturers Association (GAMA)
Suite 1200-A 1025 Connecticut Ave., NW
Washington, DC 20035

General Dynamics
Chief of Photographic Services
Fort Worth Division
Box 748
Fort Worth, TX 76101

General Motors Corp.
PR Staff-Film Library
GM Building
Detroit, MI 48202

Goodyear Tire and Rubber Co.
Public Relations Film Library
1144 East Market St.
Akron, OH 44316

Hughes Aircraft Co.
Public Relations and Advertising
Bldg 100 Mail Station C-680
PO Box 90515
Los Angeles, CA 90009

Kitt Peak National Observatory
Films Public Information Office
PO Box 26732
Tucson, AZ 85726

Lockheed-Georgia Co.
Motion Picture Film Library
Lane 30, B-2 Bldg.
Marietta, GA 30063

McDonnell-Douglas Corp.
Film Distribution
2525 Ocean Park Blvd.
Santa Monica, CA 90405

Shell Film Library
1433 Sadlier Cir. W. Drive
Indianapolis, IN 46239

Sikorsky Aircraft
Division of UTC
Public Relations Dept.
Stratford, CT 06602

SPERRY UNIVAC
Advertising and Sales Promotion
PO Box 500
Blue Bell, PA 19422

TRW Systems Group
Motion Pictures
Bldg E2, Rm B147
One Space Park
Redondo Beach, CA 90278

Thiokol Corp. Film Library
PO Box 1000A
Newtown, PA 18940

Western Airlines
PO Box 92005
World Way Postal Center
Los Angeles, CA 90009

CAP/USAF REGION OFFICES

For speakers, workshops, curriculum consultation.

Director of Aerospace Education
USAF/CAP Northeast Liaison Region
PO Box 9
Garden City, NY 11530
Serves: Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont

Director of Aerospace Education
USAF/CAP Middle East Liaison Region
Andrews AFB, MD 20331
Serves: Delaware, District of Columbia, Maryland, North Carolina, South Carolina, Virginia, West Virginia

Director of Aerospace Education
USAF/CAP Great Lakes Liaison Region
Attention: MCLGLR
Wright Patterson AFB, OH 45433
Serves: Illinois, Indiana, Kentucky, Michigan, Ohio, Wisconsin

Director of Aerospace Education
USAF/CAP North Central Liaison Region
Bldg. 751 Minn-St Paul Int'l. Arpt.
Minneapolis, MN 55450
Serves: Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, South Dakota

Director of Aerospace Education
USAF/CAP Southwest Liaison Region
USNAS Bldg 1239
Dallas, TX 75211
Serves: Arizona, Arkansas, Louisiana, New Mexico, Oklahoma, Texas

Director of Aerospace Education
USAF/CAP Rocky Mountain Liaison Region
Lowry AFB, CO 80230
Serves: Colorado, Idaho, Montana, Utah, Wyoming

Director of Aerospace Education
USAF/CAP Southeast Liaison Region
PO Box 3117
Dobbins AFB, GA 30060
Serves: Alabama, Florida, Georgia, Puerto Rico, Mississippi, Tennessee

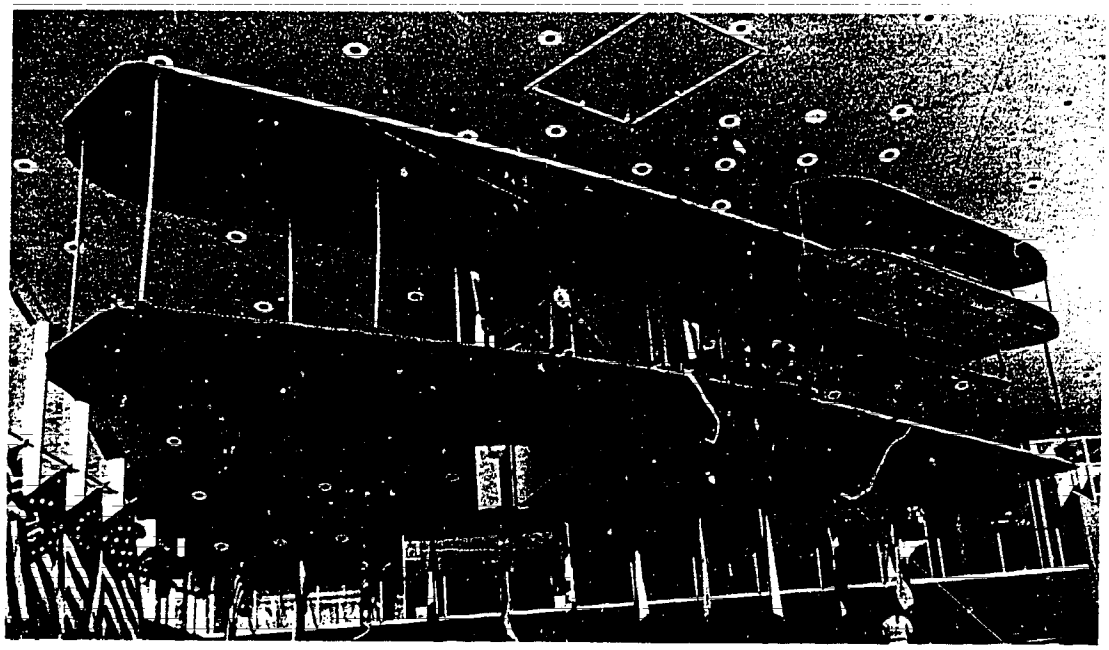
Director of Aerospace
USAF/CAP Pacific Liaison Region
Mather AFB, CA 95655
Serves: Alaska, California, Hawaii, Nevada, Oregon, Washington

OTHER CURRICULUM RESOURCES

The following references are provided as sources of further information regarding curriculum:

- *Randall Aerospace and Marine Science Program Curriculum Guide*, July 1976, D.C. Public Schools, Washington, D.C. Available through FAA.
- Mervin K. Strickler, Jr. (ed.) *An Introduction to Aerospace Education*, New Horizons, 1968, Chicago. (See especially Chapter 7—High School Programs, Section III—Enrichment Techniques and Section IV—Sources of Aerospace Assistance.) Copies available at many libraries or from FAA.

Financial or material support for the program might also be sought through the U.S. Office of Education, airlines, aircraft, industries, and business and civic organizations.



WRIGHT FLYER MODEL BUILT BY AUGUST MARTIN HIGH SCHOOL FOR THE 1976 BICENTENNIAL PROJECT. HOWARD KELEM, A TEACHER, WAS THE "PROJECT OFFICER."