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AEROSPACE EDUCATION
VS
AVIATION AND SPACE EDUCATION

Hal Bacon

There are many different organizations involved in developing programs and teaching materials which use aviation and space concepts in education. These entities include governmental agencies, private industry, aviation and space associations and lobbying groups, and private non-profit organizations. Each of them has a different vested interest in aviation and space, and therefore each has a different idea about what aviation and space education really is. Also, each uses different terminology for their programs. Some are called aviation education, while others use terminology such as air age education, aeronautical education, aviation science, space science education, aeronautics and space education, air and space education, aerospace technology, and aerospace education. Is it any wonder that the ultimate users of these programs--the education community--are confused about what aviation and space education is really all about?

These aviation and space education programs have almost as many goals and objectives as there are organizations involved in them. Some are designed to use aviation and space concepts to help teach traditional school subjects. Others have a goal of preparing pilots, astronauts, air traffic controllers, airport managers, or professionals for other aerospace related fields. Still others look at using a youngster's interest in aviation and space as a way to improve the math and science skills of the student. All of these are worthwhile goals, and there is a place for each of these programs in education today.

WHAT IS AEROSPACE EDUCATION?

My organization, Civil Air Patrol, also has its own terminology and its own definitions. We call our program Aerospace Education, a term which was coined by Civil Air Patrol in 1958. Our vested interest and the goal of Aerospace Education is to ensure that the American citizenry has an understanding of and an appreciation for the important part aerospace plays in every aspect of our nation's remaining a world power. This mission requires an understanding of the social, political, and economic impact of aerospace activities upon society. This makes our program a little different from all of the other organizations'. The only vested interest we have is to ensure that the U.S. maintains its place as the number one nation in the world in the field of aerospace.

The Civil Air Patrol aerospace education program began under our good friend Dr. Mervin K. Strickler in the early 1950s--although back then it was called aviation

education. He gave us our philosophy and our definition, and the only change that has been made in the intervening 40 years was to change the name from aviation education to aerospace education when the space age began. Let me spend a few minutes telling you why we believe aerospace education, as we define it, is so important.

AEROSPACE--A DEFINITION

The word aerospace is relatively new. It was coined by the United States Air Force in 1958 by the Air University at Maxwell AFB Alabama. The word "aerospace" was formed by combining the term "aero"--referring to air or atmosphere, and "space"--referring to that vast arena beyond the atmosphere. What this tells us then is that aerospace is, first of all, an environment--an environment that begins at the surface of the Earth and extends upward as far as you want to go. As our science and technology improve and our ability to look out into this

environment improves, we see that it seemingly continues forever. Not many years ago we were teaching that the universe was approximately 8 billion light years in diameter. But through improvements in radio astronomy and from scientific spacecraft flying in space, we now see that it is more than twice that size.

Secondly, aerospace is an area of activity. Mankind has begun to explore and to utilize this environment. We explore the aero part of this environment with aircraft and explore the space part with spacecraft. The act of exploring this environment, whether it is within the atmosphere or in the space beyond, is called "flying." We fly aircraft within the atmosphere and fly spacecraft into space beyond the atmosphere. Flight has always had a certain fascination for mankind. Millions of years ago, cavemen used to watch birds in flight and wish they could also fly. To them flight represented freedom--a freedom they did not possess. They were land bound, they had to walk wherever they wished to travel, but they watched the birds, and they dreamed about the freedom of being able to fly across the rivers and the mountains and the other barriers that barred their travel. To these ancient civilizations, there was something almost supernatural about flight, and so they endowed their gods with this supernatural ability they did not themselves possess. And so down through the ages mankind has dreamt about flight and even today we seem to all possess a kind of innate fascination about flying. But the interesting thing is that mankind's ability to explore and utilize the aerospace environment--mankind's ability to fly--is a very recent occurrence.

It first became a reality at 10:35 a.m. on December 17, 1903 at Kill Devil Hill, North Carolina, when two bicycle mechanics, Orville and Wilbur Wright, took a wooden and wire and fabric box kite, placed a gasoline engine on it, and for the first time in history made a controlled, sustained, and powered flight in a heavier-than-air craft.

*--and the world would never
be the same.*

Mankind had flown--mankind now possessed the freedom of the birds, and everything we know about aviation and space flight has all happened since that day

less than 90 years ago. Let's spend a few minutes looking at the different parts of the aerospace community that all play a vital part in aerospace education.

THE AEROSPACE COMMUNITY

All activity within the aerospace environment--all flying--can be placed into one of four categories. All flight within the aero portion of the aerospace environment falls into either military aviation or civil aviation. Military aviation, of course, is any flying done by either the Army, the Navy, the Air Force, or the Marine Corps, and civil aviation encompasses all other aviation. Civil aviation is further broken down into general aviation, air carrier aviation, and government aviation.

On the space side of the aerospace environment we have basically the same situation. We have a military space program and a civilian space program. The civilian space program is administered by the National Aeronautics and Space Administration (NASA) and is organized for "the peaceful exploration of space--for the benefit of all mankind." Our military space program is administered by the United States Air Force through the U.S. Space Command and is organized to ensure our national security in the space arena.

The next portion of the aerospace community I want to discuss is the aerospace industry, which is composed of the approximately 64 major companies that build the hardware used by the military and civilian aerospace users. This is the industry to which people refer when they use the term "high-tech" and is a valuable national resource. I will discuss this in more detail later.

The final part of the aerospace community and the most important part is the foundation upon which all of the other parts rest--aerospace education. In a democracy, the citizens ultimately decide the priorities of national programs, and history shows us that the American public will generally support those programs it understands. If this is true, the maintenance of our nation's leadership in aviation and space is dependent on the American public understanding and supporting our aerospace programs.

Whether the United States remains the world leader in building commercial jet airliners--whether we build the C-17 transport to replace the ageing C-141 Starlifter, and the F-22 fighter to replace the F-15--depends on whether the citizenry understands why such airplanes are needed.

More and more the voters are faced with making decisions about what programs are most important. Do we need a new airport or should we use that money to build a new school? Should we spend more money on research in aerospace or should the money be spent on research on a cure for AIDS? These are all legitimate questions, and the choices are all difficult. The important thing is that the voters make informed decisions--and that's not possible unless people know something about aerospace and its importance to our society. I want to spend the rest of my time talking about some of the aerospace issues facing our nation today because the issues in aerospace education are the same as the issues in aerospace.

ISSUES IN AEROSPACE

At the end of 1989, there were more than 13 million people in the United States who were either directly or indirectly employed in the field of aerospace. Of these, more than 8 1/2 million were employed in the civil aviation area, and the other 4 1/2 million were employed in either military aviation or in the space program. This segment of our nation's work force brought \$.75 trillion into our economy, and their payroll exceeded \$266 billion. In anybody's eyes these are big numbers which make a tremendous impact on our nation's economy. However, as you know, in the last three years there have been some large scale reductions in this area. One of the reasons is because we won the cold war. Ever since 1945 we have been engaged in the so-called cold war with the Soviet Union. This has been the major impetus behind our defense build-up and our space program, and civil aviation advances all spun-off our effort to keep ahead of the Russians.

With the collapse of the Soviet Union our national leadership began talking about a "peace dividend" which would be available because we no longer needed to continue our defense spending at such a high level. Combined with this reduction in orders from the Department Of Defense, the industry also got hit with a cut back in orders for commercial jets from the airlines. Between 1970 and 1990, the passengers carried by the world's commercial airlines doubled. This increase in passenger travel caused the world's airlines to place large orders for new aircraft from the manufacturers. In 1990,

a worldwide recession coupled with increases in fuel costs and a reduction in flying because of the Gulf War suddenly changed all that. The airlines began to lose large sums of money. For example, the U.S. airlines lost almost \$8 billion. That was more than all the profits made by all the airlines since they began operation in 1927. To counteract these losses, the airlines began streamlining their operations and laying off employees, eliminating flights, and cancelling or deferring delivery of many of the new aircraft they had on order.

The aerospace industry had no choice but to also begin laying off employees. In 1989, employment in the aerospace industry peaked at 1,314,000 workers. At the end of 1992 that had been reduced to 1,128,000--a loss of 186,000 jobs in three years. This jobs reduction will continue through 1993 and probably 1994 and should bottom out at about 1,050,000. This represents a loss of about \$2.6 billion to the communities where these industries are located. On January 1, 1993, Boeing Aircraft had 1,250 aircraft worth \$82.6 billion on order. More than 59% of those orders were from foreign airlines. On January 29, because of continued deferment in deliveries, Boeing announced another round of production cuts, their fifth production cut since 1991. They estimated that these actions will result in additional layoffs of 30,000 employees. Of course, the cutbacks will also impact all of the other industries that provide parts for the aircraft. These same cutbacks are having an effect on the foreign aerospace manufacturers such as Airbus Industry but not to the extent that they impact U.S. manufacturers. Most foreign manufacturers are state-owned which means that they do not have to make a profit or make their stock-holders happy. The state also underwrites most of their research and development, which also puts our manufacturers at a disadvantage when competing against them. In the past, this has not been serious because U.S. technology was so far ahead of the foreign manufacturers that most aircraft sold worldwide were made in the United States. During the past decade, the foreign manufacturers have really begun cutting into the technology lead of the U.S. Today, many of the foreign manufacturers are producing aircraft that are very competitive with the aircraft built by Boeing or McDonnell Douglas--and in many cases an airline can get

better financing and other incentives to purchase foreign airliners. Most forecasts indicate that the airlines will return to profitability during 1993, and long-range forecasts are that airline travel will increase at a rate of 4-6 percent a year after that time. If this is true, airline travel will double by the year 2010. The International Civil Aviation Organization's (ICAO) long-range forecast projects a market for 11,000 new transports worth \$800 billion by 2010. There are currently about 14,000 commercial aircraft in service in the world's airlines. With this kind of market and given the reputation the U.S. has always had in manufacturing airliners, we must do all we can to ensure that our manufacturers remain viable and competitive in the near future. Many people say that we don't have to worry about the U.S. losing its position as the world's leader in manufacturing commercial airliners. This is exactly what people were saying ten years ago about our general aviation manufacturers. At that time, Cessna, Piper, and Beech were the world's leaders in the manufacture of single-

engine general aviation aircraft. Today, that area of their business has completely disappeared. Although they were manufacturing 15,000 plus aircraft a year then, now they are building fewer than 2,000 per year. France, Japan, Brazil, and other foreign manufacturers have completely taken that market away from us.

SUMMARY

This, then, is what aerospace education is about and how it differs from other aviation and space education programs. The issues that aerospace faces are the same issues that we in aerospace education face. As the very dynamic aerospace world changes, we must remain informed about the changes and have the flexibility to respond to them. It is absolutely vital that the American citizenry remain informed about and supportive of our nation's aerospace activities, whether they be in civil aviation, in military aviation, or in the space arena. Our very survival--in more ways than one--depends on it. This is our challenge as we enter the 21st century.□

Harold R. Bacon earned a Master's degree in Science Education from Pennsylvania State University and a Bachelor of Science degree from Montana State University. Involved in aerospace education since 1963, Bacon is currently serving as Chief, Aerospace Education Division at National Headquarters of the Civil Air Patrol, United States Air Force.□