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INTRODUCTION

We all watched as Neil Armstrong took that historic first step on the moon. We were able to see that "giant leap for mankind" because the men and women of the Space Program have brought us the technological miracle known as the communication satellite. Ultimately, the Space Program will benefit each American in a unique and personal way. It will continue to save lives, make life safer and enrich the existence of every citizen of this country for years to come.

The United States sent men to the moon because we, the citizens of these United States, are a curious people, reaching out further and further in order to uncover the mysteries of the world about us. We sent men to the moon because the moon was there to be explored, just as centuries ago man explored the seas, the continents, and in the future will explore the solar system. The people involved in the dreams of space exploration were aware that many practical benefits would be realized by the program. But like many ventures into the unknown, the Space Program has realized results beyond the wildest imagination of these early men and women of vision.

We have described on the following pages, through a few of the many examples available, how we as American citizens have benefited from the Space Program.

MEDICAL

Health is of vital interest to each person and each family. Every person who has ever endured the trauma of a heart attack will be able to thank the Space Program for a small device known as the "Telamedic" device. It is designed for immediate electrocardiogram checks after a heart attack. It can be used in the home, hospital or doctor's office. This battery-powered system includes a transmitter and receiver, each about the size of an alarm clock.

To use this equipment, the patient attaches the transmitter to his chest, telephones his doctor and places the telephone on the transmitter. The doctor places his telephone on his receiver set and gathers the data from the patient. Now you can be at home and, at the same time, the doctor can be monitoring your medical progress.

A wireless patient monitoring system with central display from 64 hospital beds has been developed. This system, developed originally for the astronauts, monitors heart beat, body temperature and blood pressure continuously, thus potentially saving lives that might need immediate attention before a nurse can make routine "bed checks".

A device called the lunar gravity simulator was developed for the purpose of acquainting astronauts with gravity conditions on the lunar surface where the force of gravity is one-sixth that found on earth. This device has now been adapted to suit the needs of the Texas Institute for Rehabilitation and Research and is called the "sling". Any family with a handicapped child will be interested in the advantage of using this device. It simply reduces the gravitation pull of the earth upon the body. The training period of the handicapped and the rehabilitation period required for accident victims will be significantly reduced through its use. Also, the many frustrations of learning and relearning will be lessened.

Infants and children, as well as adult patients, sometimes require surgical implantation of a tracheotomy tube in the windpipe to ease breathing. If the tube becomes clogged, breathing will stop and brain damage or death can result within two to four minutes. Now, integrated circuitry developed for the Space

Program has been modified for use in the tracheotomy tubes. As air passes through the tube, any differences in breathing will trigger an alarm. This alarm can be heard or seen by a nurse in a hospital or mother in the home within ten seconds of any change in breathing. This will eliminate the need for full time supervision of the patient, yet provide for immediate corrective action when necessary.

AGRICULTURE

The American farmer has always been at the mercy of the elements. His major enemies have been hail, flood, unexpected freezing temperature, and high winds. Through the use of weather satellites, early detection of threatening weather can be predicted. These satellites provide a means by which timely warning can be made available. This information will save the farmer untold expense. Early detection of flood or hurricane conditions will allow ranchers to move livestock out of low lying areas. An anticipated freeze will allow fruit growers to react in a timely manner to put out smudge pots to protect his groves. Also, these satellites will provide him with weather information that would indicate to him that an expensive task need not be necessary to protect his crops or livestock.

For the farmer who uses irrigation systems, significant contributions have been made toward improving piping and hydraulic pumps through the Space Program. Space-sponsored processes have been used to make a new, lightweight, high-strength plastic pipe. This pipe reinforced with fiberglass is physically suited for irrigation and other numerous agricultural applications.

In order to provide the pumping capability required for the boosters which place man in space, extensive research and development was performed to increase the efficiency as well as improve the design of hydraulic pumps. The features found to improve these pumps have been made available to pump manufacturers so they can produce better irrigation pumps used by farmers.

Another major problem of the American farmer is marketing his product. How does he get his product to the consumer without major amounts of spoilage ruining his profit? An aluminum foil developed for a communications satellite is now being used for packaging quick-freeze-dried foods. By doing so, these freeze-

dried foods, many of which are produced by farmers, now can be marketed much more extensively, thus improving the farmer's economy.

The world's population is growing at a high rate. In some underdeveloped countries, the population is doubling every 20 years. In order to feed, clothe, and shelter the expanding population, crop losses must be minimized. Two of the major causes of crop loss are plant disease and insect attacks. Through the use of satellites designed to watch the world's crop growth, plant disease and insect attacks can be found earlier. Using this system, the problem can be solved more quickly at less cost with less crop loss. This will save the United States Government \$2,000,000 annually. In addition, a 1 percent reduction in crop loss would result in a \$74,000,000 annual savings for the farmer.

FORESTRY

By using satellites, a method of automatically detecting forest fires is being developed. This fine detection method will cause a tremendous reduction in the loss of our wooded regions as well as add protection to housing, animals, and people.

BANKING, ACCOUNTING

Development of communication satellites, which the Space Program initiated as long ago as 1958, has led to a network of communication satellites. Through the use of these satellites, many banks now have nationwide data networks, thus providing more efficient and economic services to their customers.

The exploration of space placed tremendous requirements on the computer industry to develop very large computer systems of great complexity, size, and speed. With the present population explosion, the need for such large computer systems in business and industry is very evident. It is difficult to estimate the savings which are being passed on to the average American through the use of computers to perform banking, billing and other various accounting tasks.

TRANSPORTATION

Americans spend a large part of their lives in their automobiles. These cars must be made safe to drive and they must be driven on safe highways.

A shock absorber mechanism used in the astronauts' couches of the Apollo spacecraft has been tested by the Bureau of Public Roads. This shock absorber, when used in highway guard rails, will cut a 60-mile-per-hour impact down to the equivalent of a 5-mile-per-hour impact. This device is rugged, cheap, and reusable. In addition, a large automobile manufacturer is developing this device for use as an automobile bumper. (One well-known insurance company will soon offer a 20 percent reduction in collision premiums for automobiles equipped with this bumper.)

A 93 percent reduction in damage, injury, and death from accidents on wet highways is no longer a dream but a feasible reality. Aerospace test pilots discovered that the tires of high speed airplanes skid severely when water builds up under their tires. A grooving technique has been developed which allows water to drain off a wet runway and prevent skidding.

This same grooving technique has been used on several dangerous sections of highways in 18 states. The result was a 93 percent reduction in injury, death, and damage from accidents during wet weather, when compared to other normal highway surfaces. Better tire tread design to improve highway safety has also resulted from this discovery made by aerospace test pilots.

DISASTER DETECTION

Earthquakes can cause damage to dams, buildings, and bridges increasing the danger in a disaster. Stress devices developed for measuring the thrust of rocket engines have been installed in the New Castaic Dam in South Central California. The stress devices are used to locate weakened areas in dams, buildings, and bridges caused by earthquakes, faulty construction, and age and have provided warning of impending disaster which may save lives through evacuation.

POLLUTION

Virtually all of us, especially children who play vigorously and men who work hard in the outdoors, breathe sulfur dioxide gas, a major air pollutant, which is expelled from many industrial plants. This air pollutant, when combined with air and water, forms harmful sulfuric acid in our lungs and can cause sickness, deteriorate health, and make breathing difficult. In addition, when the pollutant combines with water in the atmosphere, sulfuric acid is formed and causes metal corrosion.

Space research has found a method to remove the sulfur dioxide gas before it can escape from the industrial plant. The method will enable the industrial plants to trap the gas before entering the air and convert it into sulfuric acid, a valuable product worth millions of dollars to industry each year.

INDUSTRY

Today some of the expert teams of aerospace personnel are applying their knowledge to the problems of electric power distribution and water control. The complexity of these problems are continuing to increase as the demand increases. It is likely that the computer systems approach, developed for space programs such as Apollo, can provide the solutions to these problems and perhaps prevent the massive power blackouts this country has experienced in recent times. The system's approach will distribute power and water to residential and commercial areas in a more efficient manner and thus provide these necessities at a lower cost.

COMMUNICATION

We are in the midst of a communication explosion. Americans made 200 billion telephone calls in 1969 compared to 18 billion calls in 1960. The Space Program has developed communication satellites that will economically solve this urgent domestic problem.

This communication explosion is not limited to the United States. It is a world-wide problem. Transoceanic cables are expensive. This problem can be

solved by using communication satellite networks instead of laying more under-sea cables. Mankind will be able to send and receive information from any point on Earth.

Ships, aircrafts, and business offices throughout the world are already utilizing this amazing scientific discovery. One can telephone from commercial airplanes and ships to shore.

Not much imagination is needed to visualize the usefulness of communication satellites to locate ships in distress, downed aircraft, lifeboats, and exploration parties who may need assistance through this twentieth century marvel.

WEATHER

The benefits of the Space Program in weather prediction and warning have touched the lives of many people. For example, early warning by weather satellites is estimated to have saved 50,000 people through evacuation from the devastating hurricane Camille. But a severe freeze in Florida a few years ago damaged citrus and other agricultural crops valued at \$100 million. Although the freeze could not be avoided, advanced warning would have provided time to prepare and to save many of these crops from damage. Dr. Glen Seaborg, in a speech in 1966, stated that man could save as much as \$60 billion a year if weather could be accurately predicted even 3 days in advance. The development of more and better satellite weather detection devices in the future will save countless lives and billions of dollars in damage that would have been caused by floods and wind. Some day, satellite observations may even provide the climatic information necessary for man to partially control weather.

SUMMARY

The manned lunar landings in 1969 and 1971 have been acclaimed as the most important events in this generation in which the United States has earned the admiration of the world. This, during a time when American prestige was otherwise at a low ebb, when issues such as Southeast Asian intervention, the Bay of Pigs invasion, the success of the Russian pioneering in space, and the

hijacking of the Pueblo threatened to topple the United States from the highly esteemed position we had acquired throughout our history. Furthermore, today we are closer than ever to unifying portions of our Space Program with that of the Soviet Union -- a venture which may do more to end the cold war than any attempted thus far.

The scientific objective of exploring space to further our knowledge of the solar system, its composition, and its origin has required technological advances in virtually every field of engineering. Americans had experienced technological advances of this magnitude before, but only in times of war through the development of weapon systems. But the dedication to a national objective and the challenge to man that is provided by the United States Space Program is now the driving force for peaceful expansion of scientific knowledge and advanced technology for the betterment of all mankind.

Critics have questioned the economic value of the program. Statements such as "The money could be spent better elsewhere" and "The United States spent 24 billion dollars for the Apollo 11 rocks" are, of course, misleading. The United States did not travel to the moon, hand over 24 billion dollars to some unidentified moon creature in exchange for 60 lbs of his rock samples, and return. This money was spent here on earth, primarily within the United States and had a healthy effect on the economy of the country as well as virtually every American. The salaries earned by workers in the aerospace industry were spent in department stores, in grocery stores, for homes, for services, and for medicine. A large percentage of this money went into local, state, and federal taxes which in turn, was used to build schools, improve cities, and provide for the underprivileged.

And how much does the Space Program cost you? The current budget is 1.4 percent of the total federal budget -- roughly 15 dollars per person in one year. Compare this with the \$400 per person we spend on social programs, \$400 on defense, \$35 on alcoholic beverages, \$17 on tobacco, or \$16 on cosmetics. It is quite clear that the benefits of the Space Program, both direct and indirect, are providing each American with an excellent return on his investment.

But will the Space Program continue to provide this return through future activities? If present plans for future programs become realities, the answer is NO. Instead, the benefits received per dollar spent should dramatically INCREASE! The Skylab Program in 1973 will use the existing Saturn launch vehicle and Apollo spacecraft to allow astronauts to live and work in space for up to 56 days, obtaining medical and scientific data through experiments. The space shuttle and space station will make repeated use of the same launch vehicle and orbiting space station, thereby reducing the average cost of a space mission by 90%.

Our exploration program will continue to provide the pieces of the puzzle necessary to understand the origin and history of the moon, the earth, and the solar system, just as man has explored the unknown since the beginning of time. The remaining Apollo moon flights, the unmanned landing on Mars, and the grand tour whereby we have a once-in-200 years chance to send unmanned spacecraft to visit the planets Jupiter, Saturn, Uranus, Neptune and Pluto can be accomplished in this decade.

These programs plus our earth resources, communications, and weather satellite programs are expected to produce extra, unplanned benefits for mankind, just as the applications of space technology by business, industry, commerce, government, our medical profession, and our schools have in the past. These goals are not overly optimistic. History has shown that our predictions often fall short of what actually happens. Consider the progress that has been made in America's first 13 years in space!