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This book which is intended for children in grades 4 through 6 includes information concerning the space industry and career opportunities. Included are five separate chapters, a summary, and a bibliography of children's books. The book describes a sequence of events taking place in a hypothetical elementary school classroom in which a space scientist is conversing with youngsters. The students follow up the scientist's visit by participating in space science related activities during subsequent weeks. (BC)

ELEMENTARY (4-6) SCHOOL EDITION

Learning about space careers

By Herman J. Peters, Samuel F. Angus, James J. Vessels of the Ohio State University

for the NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

ELEMENTARY (4-6) SCHOOL EDITION

LEARNING ABOUT SPACE CAREERS

By

Herman J. Peters Samuel F. Angus James J. Ves'sells

THE OHIO STATE UNIVERSITY

In cooperation with

THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

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PREFACE

Grateful acknowledgment is made to all who permitted, encouraged, and participated in the several steps leading to "Learning About Space Careers." Special gratitude is due Mr. Victor M. Showalter, The University School of The Ohio State University and Mr. Lewis D. Evans, Franklin County Board of Education, for their excellent editorial work. To Miss Ruth E. Jewett, our secretary, we offer a sincere "Thank you." To all in the Educational Programs Division, Office of Public Affairs, National Aeronautics and Space Administration, we extend our deep appreciation. In particular, we are grateful for the leadership of Dr. Paul L. Gardner, Counseling and Career Guidance Officer.

We hope this booklet is helpful to children, teachers, and parents in vocational exploration activities. This booklet, with the assistance of an elementary school teacher or school counselor, may be helpful in choosing a career in this—the space age.

Samuel F. Angus

Herman J. Peters

James J. Ves'sells

HOW TO USE THIS BOOK

This book is intended to be an idea producer for the young mind. It is vocational guidance for the space age, and is to be given to the student to read, himself.

This guidebook includes information about the space industry and the world of work. The chapters present an overview of career choices related to the great opportunities in space science, engineering, and technology. The questions that arise are those that may have lasting career implications.

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CHAPTER 1

THINK ABOUT A SPACE CAREER

You are about to look in on an elementary school class and explore with them some questions and answers about space and space jobs. You might even imagine yourself as being in the class. You might ask questions other than the ones the members of this class ask. You may even be able to discover new ways of exploring the topics of space and space careers. Possibly your class might want to take on the project of writing a booklet to describe your explorations in space topics and space careers.

Now let us look in on a class at Allen School. This class had decided to learn more about space and space careers. One of the members of the class happened to live on the same street as Dr. Henry, who works at a nearby NASA (National Aeronautics and Space Administration) center. The class agreed to invite Dr. Henry to come to talk to them. They asked him to talk about space and space careers.

As we look in, Dr. Henry has just been introduced to the class by Mrs. Kent, their teacher. He is just starting his talk. "Picture yourself for a moment in the blockhouse of NASA's Marshall Space Flight Center at Huntsville, Alabama. It is T minus 25 seconds and counting. The launch vehicle is in place. Telemetry is sending information into the computers; scientists and technicians are making readings and checking panels of instruments. Now, it is T minus 20; the tension is building.

Each worker pays attention to the task of making final checks. Nerves are on edge. It is T minus 15 and counting; T minus 10; all is in order. T minus 5, 4, 3, 2, 1, ignition! The rocket engine of the Saturn booster is ignited. The vehicle does not move. This is just a test, a static test. This is one of the many tests in the Apollo Project."

When Dr. Henry said the spacecraft did not move, everyone seemed disappointed. They listened for his next words. He continued, "Let's think about what is behind this countdown. The goal of the Apollo Project is to put

men on the moon before 1970. For every vehicle that is launched, thousands of experiments, tests, and trial runs are carried out. This is to make perfect every part of the equipment and the activities of the men who run it. Anyone interested in launching a plan to prepare for a space career must know about this fact.

"Each time a space shot is made, a great deal of preparation is needed. Space scientists, engineers, and technicians are all working hard to see that everything is 'Go!' When you think about all of these preparations and what is needed to prepare for a job or career, it is nearly the same. A great deal of planning and training is necessary to enter a space career."

Dr. Henry looked right at Bill S. and said, "If you plan to point toward a space career, you will have to think about the great deal of preparation that is necessary."

This caused Bill to raise his hand. Dr. Henry nodded and Bill asked, "What should I know to be prepared?"

Dr. Henry answered, "That is a big question. Let us back up a little and I will try to answer it." Dr. Henry continued, "You see, a *technological revolution* is upon us. This means that more types of modern machinery and electronic equipment are being used than ever before. This means, also, that the need for skilled and professional workers is becoming greater, while the need for unskilled workers gets smaller. You see, the space industry is a part of this technological revolution. It is one of the fastest growing industries in the United States today. There is a great future for scientists, engineers, and technicians in the space industry. Right now there is a shortage of these trained people and there may be even greater shortages."

The NASA scientist added, "To give you an idea of the growth of the space industry, we might compare it with one of the Nation's largest industries—the automobile industry. The space industry is growing so rapidly that it may become larger than the automobile industry by 1970!"

The class looked questioningly at Dr. Henry, for they were not quite sure what this had to do with them. So the scientist continued, "You see, you may want to be a part of this great industry. And now is the time for you to begin your preparations."

The class was very much interested and wanted to know in detail about the steps necessary to become prepared for a career in space.

At this point the NASA speaker went on to tell about some steps they might follow to prepare for a career in the space industry. He said, "We have found that many people now in space work, and people in other jobs for that matter, have followed several steps. This does not mean that this is the only path, but it is one path."

The first step, Dr. Henry explained, was to *Think About a Space Career.* This means thinking about the different space jobs and learning more about what is going on in the United States' space program.

The NASA scientist's second step was to *Begin To Explore the Space Industry* by answering the questions:

Who works in the space industry?
Where is the space industry?
What is space and space exploration?
When did the space industry start?
How and why did space exploration get underway?

The third step given was to *Find Out About Jobs in the Space Industry.* What do the workers do?

The fourth step was to *Determine Pathways for a Job in the Space Industry* and explore what you need to know to get a job in the space industry. This step would include thinking about and getting started in activities that can help a person learn more about space. It would also include learning about the training and abilities a person should have to become a scientist, an engineer, or a technician.

The members of the class were a bit confused by all of this but they tried to write some notes on each of the steps explained by the scientist.

The speaker added the fifth step. He called it *Formulating Goals for Now and in the Future* and keeping up on new developments in the space industry. He said, "This step could be started by thinking about the plans you need to make and determining your goals. This would also mean keeping up-to-date on the changes in the space industry and the discoveries in space exploration."

The scientist stated, "These are five important steps that can help you get started thinking about and planning for a space job. I wish I had more time so I could talk about each one in greater detail, but since I will not have time, I have a suggestion. I will talk about the first step and you can explore the other steps on your own." The class seemed interested. They looked at one another and seemed to nod approval.

Dr. Henry went back to his first step—*Think About the Possibility of a Space Career.* He said, "To bring out what I mean by this, I have a series of questions that I will ask and then try to answer. These questions are important in career planning. Some of you might try to help me answer them. You might want to jot the questions down. Then later you can do some reading and studying to answer them more fully. You might want to invite some other speaker to come and help you get better answers."

Dr. Henry's first question was, "Do you know what is going on in our space program?"

George raised his hand and said he knew that the United States' space program used different kinds of satellites.

Dr. Henry asked, "What are they used for?"

Bill said, "Meteorology or weather prediction."

Louise said she had heard of navigation satellites for guiding ships and planes. She had also seen television from England and Japan via satellites.

Dr. Henry added, "Satellites are being used for astronomy studies also."

Ed, who had been trying to get his ideas in for a long time said, "I think manned space flight is the most interesting. I have watched all the Project Mercury flights and Gemini flights on television."

Len spoke right out, "These projects are great, particularly the Apollo Project and sending men to the moon!"

The NASA scientist agreed it was all very exciting. The Apollo Project truly has the goal of sending men to the moon. Dr. Henry pointed out that this program must develop high-thrust booster engines for the Saturn rockets. He said that the guidance and control systems of the spacecraft really have to be perfect to do such a job. That is not all, he added, "We need more ground facilities for assembling, testing, and launching the space vehicles for these projects."

Then the scientist paused, and when he started again, it was with a louder voice, "The most important part of all this space activity is the people who do the research, study, design, testing, and perfecting of the equipment. Thus the space program depends on the students—from elementary school, junior high school, senior high school, colleges and universities, and technical schools—who study science, mathematics, and the technical skills that prepare them for space work."

The speaker then moved ahead to his second question, "How do these space activities affect you?" The class appeared to be a little puzzled, so the scientist began to answer his own question. He said, "You see, many developments that have to do with space exploration touch your life almost daily. Radio and television broadcasts report the latest happenings. Newspapers, magazines, and books report on the progress of the projects and discuss their many meanings. Isn't it true that your thoughts and conversations often turn to the latest space shots? You may even dream at times of what the future will bring."

Alice said, "I know exactly what you mean—space activities are important to my life. My father works where they make rocket engine nozzles for the big Saturn rockets."

Dr. Henry said, "Many new businesses, new jobs, and fresh products in the stores have all come about because of space activities. Also, remember that our space activities have provided us with better national defense, more vigorous health, improved education, and a better living in many ways."

Then Dr. Henry checked his watch and went on to his next question. "What part can each of you play in these space activities?"

Jerry said, "I want to become an astronaut."

The speaker agreed, "That is one way, and there are many others." He added, "Remember, the space industry is growing rapidly, and the need for scientists, engineers, and technicians will continue for many years. In the future you might find your job in the space industry. You may become the scientist who develops a new way of propelling spaceships. Imagine yourself as the engineer who designs a new type of space vehicle, or the technician who puts together the parts of a large space station."

Everyone in the class seemed to be thinking about his special place in space. Alice imagined herself as a nurse on a spacecraft on a voyage to the moon. Ed liked the idea of being an assembly technician for space stations. Rita pictured herself working as a geology technician at a research center on the moon.

Dr. Henry's next question brought them all back with a start. "What are the things to think about when you are pointing toward a space career?" The class was not sure what he meant. He asked these questions to make it clearer. "Do you know about yourself? Do you know how to set out to learn what you must know to be in a space career? Do you know about the world of work?" All of these questions caused the class to look first at the scientist and next at their teacher, Mrs. Kent.

The speaker started again, "I can give some ideas about how to answer these questions, but you are the only ones who can answer them for yourselves. What do you know about yourself? What are your interests and what can you do well (abilities)? You see, interests and abilities go hand-in-hand with career choice. It is usually true that if you have only interest but little ability, you cannot hope for success in a career field. On the other hand, if you have the ability to perform a job, but have little interest in that career, you again would make a poor choice if you made it your life's work. Thus, you must have both interest in and ability for the career field you choose." This seemed logical to everybody.

Terry asked, "If I have the interest, but little ability, how can I get the ability?"

"Well," the scientist answered, "your schooling plays an important part in preparing you for your work."

The speaker said, "Let us go back to interests. Have you though much about your interests? Why not stop for a moment now and ask yourself: What are my interests? What school subjects do you like best? What sports, hobbies, clubs, and odd jobs do you take part in? What kind of music do you like? What kind of reading do you do? Have you noticed that your interests have changed, or are they the same as last year? Has anyone you have known helped you to change your interests?" The lecturer suggested that the class jot down these questions and later this evening try to answer each one. He then read them again slowly.

Next Dr. Henry asked the class if they had thought much about their abilities. Teresa said, "Well, I'm not too sure what you mean by abilities."

The speaker said, "What can you do best?"

Tom asked, "How will I know?"

The scientist answered, "You might start by thinking about your report card. What are your grades in mathematics, science, and English? What are your strengths and where are your weaknesses? By looking over your grades and talking with your teacher you can start to get an idea of your abilities. Maybe you have taken some special tests, too, and your teacher might help you understand your scores. It is important to get an idea of your abilities so that you don't point toward a job you can't do. At the same time it is important to choose a job that will keep you busy. You see, people say they like their jobs better if the job is challenging to them."

Mary said, "My dad likes his job because it keeps him on his toes. I guess that is the same as being challenged."

Dr. Henry said, "That's right."

Then he said, "Another important question is: What about you as a person? As you look at yourself to get an idea about your interests and abilities; it is also wise to look at the kind of person you are. This can also make a difference in how successful you are in various activities. You might want to take note of how well you get along with your friends and teachers. You might want to consider your problems. Do you have many problems?"

The speaker continued, "Another thing to think about is leadership. Are you always a follower, or are you sometimes a leader? Another good question about you, the person, is: Do you get new ideas and do you tell others about your ideas? These are just a few of the questions that can be asked about you, the person. You will probably want to take time out to think about yourself from time to time to see if you are the kind of person you want to be. If not, you can make plans to improve or go to someone for help."

Tim asked, "To whom can I go if I want to talk about some of these questions?"

Dr. Henry answered, "Well, you could talk with your teacher and, of course, your parents. You might want to talk with your school counselor or the leader of one of the youth groups of which you are a member. If you talk with one of these persons and they cannot help you on your particular problem, they can tell you somebody else to see for help."

At this point the NASA scientist glanced at his watch. "I will have to hurry to complete the other questions I want to raise and then we can discuss them in the time that remains."

His next question was, "What training must

you have to enter a space career?" Then he answered it, saying, "You must have training in science, mathematics, and technical skills. Everyone in the space industry is not the best scientist, mathematician, or technically-skilled person. However, knowledge and training in science, mathematics, and technical skills make a difference in the type of career a person can have in the space industry. In other words, in the space industry there are places for men and women who have different amounts of training and skill in science, mathematics, and technical work. You see, some people may know a great amount in one of these fields; others may have a great amount of training and skill in all three areas; or another group will have varying amounts of training and skill in the three areas. People with wide differences in training are able to find jobs in the space industry."

The speaker went right ahead to his next question, "Why is training so important?" His answer was, "In order to explore space, many problems must be solved. The answers to these problems are found by the use of science, mathematics, and technical skills."

The scientist next asked, "How does science help in solving problems?" His answer pointed out that science is a means of uncovering knowledge. The knowledge can be used to solve space exploration problems. He mentioned that there are many sciences that are important in space activity: for example, physics, chemistry, astronomy, psychology, physiology, and meteorology. He added that the ideas studied in each of these sciences may be different, but the ways of thinking and working in each of these science fields are similar.

For example, he said, "Being a scientist is more than just knowing the facts. A scientist has a special kind of ability that includes being curious, being careful to observe accurately, and being ready to change his mind when he learns that his way of thinking is not in agreement with the facts. You see, a scientist would probably be curious about how and why things happen. He would be genuinely interested in hearing and reading about things other scientists are doing."

The speaker added, "Remember, it is important not to forget that ideas and even so-called 'facts' have a tendency to be changed as new discoveries and breakthroughs occur. The scientist must try to keep up with changes and be ready to use the new knowledge in his work."

Dr. Henry then asked, "Do you know about the scientific method?"

He answered, "The so-called scientific method is used by scientists to solve problems. You may know a lot about the scientific method. You may have studied it in science. Did you know, though, that no one uses it in exactly the same way? Different types of problems require new and different ways of using the method; therefore, scientists use it in many ways to solve new problems."

The speaker continued, "Experts say that the scientific method is a formal approach to solving problems. They disagree about its having a certain number of steps, or steps at all in some cases. There are six steps, however, that are most often mentioned: (1) define the problem—get the problem clearly in mind; (2) state hypotheses—make statements of possible answers to the problem, sometimes called educated guesses; (3) experiment—come up with a way to test the answers to the problem; (4) gather the results of your experimenting—sum up the findings after your testing; (5) come to a conclusion; and (6) remain ready to change your mind if you can find a better answer."

The NASA scientist finished his remarks about the scientific method saying, "If we look at this method for solving problems and think of all the problems concerned with space, you can see that there is an unending opportunity to use this method. It is an extremely useful way to help solve problems." At this point the speaker paused and glanced quickly about the classroom. Then he asked, "Have you ever used the scientific method to solve a problem?" Some in the class nodded, but not many. He continued, saying, "You may have had a problem and then followed the steps of the scientific method to find an answer to it without knowing that you were using this method."

At this point the speaker went on to an-

other important question, "Why is mathematics important in a space career?" He answered, "Mathematics is also a science. It is sometimes referred to as the most exact science. Like the other sciences, mathematics is used to help find answers to the problems of space exploration."

The lecturer continued, "Remember, many engineers work in the space program. All of the fields of engineering include people who have studied mathematics. Mathematics is important for a space career, but the door is not completely closed to those who have a great deal of knowledge in certain other fields that do not depend quite so much on mathematics. Two of these are the study of living things and the study of the mind.

"How do you rank in mathematics?" he asked. "Today, the way things are changing, it is clear that more fields are requiring greater knowledge and skill in this area. It is certainly true that the student who knows a lot about mathematics will find greater and greater opportunity when looking for a job."

The speaker said, "Technical skills are also needed by those who work in the space industry. There are many technical skills required of those in space careers. The astronaut may be, among other things, the most highly skilled technician on the space team. Astronauts have had to fly practice missions to improve their skills in controlling the yaw, pitch, and roll of their space capsules. In fact, even eating becomes a technical skill in space. Other examples of technical skills include polishing of lenses by a technician, operating a computer, giving medication to a chimpanzee, drawing the plans for a satellite, using a slide rule, microwelding, and even sterilizing a satellite."

The NASA speaker continued, "Scientists have certain technical skills, as do engineers and technicians. For example, drafting is a technical skill which is often common to all three. Have you ever done any drafting or drawing? You might start doing some practicing now and later plan to study drafting in school."

He added, "To sum up my last remarks and also move to a new idea, let us remember that whether or not you can succeed in a career in space depends on your background in *science, mathematics,* and *technical skills.* To help you make a choice, however, you must know about what is called the world of work."

The next question was, "What do you know about the world of work?"

He explained, "The world of work includes everyone who has a job. It is important to remember that jobs don't always stay the same. Today, more jobs require special training than before. Because of this, more people are spending more time in school to prepare for their future jobs. Also, because of the new kinds of jobs, it is mighty important to think now about your future life and your place in the world of work."

The scientist went on, "It is also important to note how automation has affected jobs today. Automation and other new processing techniques have made it possible for more work to be done in less time. This has, in turn, brought about shorter working hours in many fields. The pressing question that is facing many people is what to do with their free time."

The speaker asked, "Do you have any trouble deciding what to do in your free or leisure time?"

He continued, "Many of the workers at the NASA center where I am located pursue hobbies during their free time. It is important for students to learn to use their leisure time while they are still in school. Many students, for example, find time to take extra subjects or become involved in activities such as photography, music, art, aviation, sports, camping, dancing, dramatics, and other special interests."

The scientist paused at this point. He then said, "If all of the questions I have been asking were changed into problems facing you, what one way could you begin to solve them?"

This certainly stumped the class, but they could have answered if they had had enough time. The speaker answered though, saying, "I think the best answer is by *planning ahead.*" Then he added, "For example, when you are selecting a career, you might start by learning about yourself; about the qualifications needed for a career; and about the world of work. However, unless you use this information to *plan ahead,* all this knowledge will be of little use. Thus, it may help you to take some time out to think about and do some planning ahead for yourself." The speaker suggested, "You might start by jotting down answers to each of the questions I have asked you this afternoon."

He pointed out that in the space program, planning ahead is called *Lead Time.* He said, "Remember, we have pledged ourselves as a nation to the peaceful exploration of space. This includes landing men on the moon and returning them safely to earth in this decade. To carry out such an extremely challenging, imaginative, and technical undertaking, we can't start in 1968. Before the actual manned shot to the moon, much activity and time must be spent planning, building, training, improving, and further improving. All of this involves both people and equipment. There must be a master plan to bring together all of the perfected equipment and the trained individuals at a certain time in the future. This undertaking involves thousands of people and billions of dollars. This is a very important project.

The NASA scientist said, "Let me close my remarks with this idea. If you look around today, it is easy to see one important characteristic of our world, and that is *change.* We are in the midst of science and knowledge explosions. This rapid pace of change means that more than ever before we must be able to change our ways of thinking and acting or we won't be prepared to live in our changed world. Space science and technology is one of these rapidly developing and changing fields. Therefore, if your plan is for a career in space science, you must have a plan that can be changed if necessary. So let me stress that it is important to plan ahead and have a plan that will provide you with a guide. But your plan must be one you can change and adjust as you change and the world about you changes!"

The class gave the NASA speaker a big round of applause. Mrs. Kent thanked him for coming. The scientist spent a little more time answering questions and discussing with the class the other points he had raised earlier. Finally he said, "Now I must stop, but I hope I have answered some of your questions about space and space careers." The class applauded again and the speaker said his goodbyes and left.

The discussion had certainly aroused a lot of interest in the class, as was indicated by the following turn of events. Bill raised his hand. Mrs. Kent acknowledged it and Bill said, "I would like to suggest that our class explore and study the other four steps the speaker didn't get to talk about today." A discussion followed and after a short time the class voted unanimously to take this on as a project.

CHAPTER 2

BEGIN TO EXPLORE THE SPACE INDUSTRY

The first time the class had free time, they asked their teacher if they could have a meeting on their project. Bill was appointed chairman. He brought out his notes from Dr. Henry's talk to the class. He wrote Dr. Henry's five steps for space career planning on the board.

Bill asked the class how they would like to begin their exploration and study of the last four steps not covered by the NASA speaker. Mark suggested dividing the class into four committees. The committees were chosen quickly and the rest of the time during this meeting was spent planning and doing library research. It was agreed that the first committee, which had step two, *Begin To Explore the Space Industry,* would report in two weeks.

Two weeks later. The first committee was ready to report. They took their places in front of the class. Their chairman was Tom and he wrote on the board, *Begin To Explore the Space Industry* by answering the questions: *What, Who, Where, When, How, and Why?*

Mary was first. She began to talk about the meaning of space. Mary asked, "What is space?" Then she proceeded to answer. "It depends on what you start with. Some say that space begins at the point where man can no longer breathe naturally, without having extra oxygen. This is high above the earth. Others say that space begins at an altitude of twenty miles. Still others say it is where spacecraft can no longer be affected by the atmosphere—this depends on the type of spaceship. Another definition is where meteors first appear, seventy-five miles out from the earth."

Mary continued, "The definition that seems best to me is 'space' is the upper atmosphere beyond the twenty-mile level or that part beyond earth's atmosphere. 'Space flight' then includes flight beyond the sixty-mile level above the earth."

Mary asked, "Are there any questions on my report?"

George asked, "What does aerospace mean?"

Mary said, "I read about that. Aerospace

means air and space, so an aerospace craft could be a ship that can travel both in air and space."

Now it was time to go on to the next person reporting.

Tom and George were all ready to talk about, "Who Are the Members of the Space Family? Where Do They Work?"

Tom started. "Most of the people in the space industry are civilians. They are highly skilled and semiprofessional employees of some industry. They do not work directly for the Government. People in these space industries come from various kinds of backgrounds. They possess many varied skills, talents, and experiences. They are both men and women who have different amounts of education or training, but they also have many things in common. They all have kept up with the changing times. They continue to train and increase their skills or learn new skills. There are scientists, engineers, and technicians and also military specialists from all branches of the service. The ones we know most about are the astronauts. But there are others who make the whole effort possible. Some of these are research people at universities, educators, contractors of every type, and subcontractors. There are also the people in administration who help make plans and see that they are carried out, and people who are concerned with supplies, repairs, and maintenance."

Tom paused, then he added, "You can be part of the space industry someday. Just think, a few years ago the astronauts and those now in training were in elementary school, just like us. Space travel then was mostly a dream. Now these people have become highly trained. They are exploring space—someday we might be able to continue the exploration. A lot of preparation though, both now and in the future, is needed to become an astronaut."

Tom nodded to George that he was finished.

George began by asking, "Where do the people in the space industry work?" Then he answered, "The space industry is on the East Coast, the West Coast, in Southern Florida and Alabama, in Texas, in California, and almost everywhere. The space industry may be located at an airport, on a campus, on a mountain top, on a desert, in a factory, at a rail or shipyard. Wherever research, study, construction, testing, and perfecting equipment goes on to help in the space effort, there we have part of the space industry. Also, when people think of the space industry, they naturally think of the National Aeronautics and Space Administration (NASA). Yet, much of the money that is spent for space work goes to private industry.

Mary said, "I would like to know more about NASA."

"I have some information about NASA," George said. "The National Aeronautics and Space Administration is an independent civilian government agency. It was established October 1, 1958.

"NASA's work includes all matters that pertain to research done in this country on civilian space and areonautics projects. The purpose of the research project may be to solve a particular problem. This is called *applied research.* Or the research may yield information that is not usable immediately. It may only add to our present store of knowledge. This is called *basic research.*

"Some of these basic and applied research projects may have to do with improving the usefulness, performance, speed, safety, or efficiency of space vehicles. They are sometimes concerned with adding to our knowledge about the atmosphere and space. There are projects to develop and improve the operation of vehicles that can carry instruments, equipment, and living things through space. All of this helps to preserve the role of the United States as a leader in aeronautical and space activities within and outside the atmosphere."

George answered more questions. Kent asked, "How many people work for NASA?"

"I'm not sure if I have the latest number," George said, "but I found that NASA employs approximately 35,000 people. Most of them are located in ten major research and development

centers. About one-third of the total are scientists and engineers. Over two-fifths are skilled craftsmen and technicians, and one-eighth do clerical work. About one-twelfth have administrative and management jobs."

George asked if there were any other questions. Mary said, "Where is the NASA Headquarters?"

"In Washington, D.C.," George answered. Then he went on to say, "That finishes my oral report, but I have some more information in my written report if you want to read it."

Bill took over. He said, "I think we had better define the space industry before we go on to talk about it. The space industry includes all of the work that is necessary for space exploration. This is done by the civilian and military agencies of the Government who work together with the universities and research centers." He added, "Most of the work actually takes place in privately owned (not government) companies."

Next he asked this question, "When and how did we get in the space industry?" He added that he had to become a sort of historian to answer it.

"Over seven hundred years ago the Chinese, after having invented gunpowder, used rockets to chase away the invading Mongols. In the centuries that followed, a more entertaining use was made of rockets in the form of fireworks. Much later the armies of England and France used rockets, but then they discarded them for cannons. From time to time they experimented with rocketry with mixed success. It was not until the twentieth century that scientists began to think about using rockets for space travel About this time the military began to develop a missile that could be controlled.

"In 1865, the French author, Jules Verne, wrote a science fiction story entitled, *From the Earth to the Moon,* in which a group of men traveled to the moon in a spacecraft launched from a cannon."

Bill said, "Russia played an important part in rocketry. In 1903, a Russian school teacher, Konstanin Tsiolkovsky, published an article on the possibility of sending a rocket into space as an exploration vehicle.

"Between 1914 and World War II, Dr. Robert H. Goddard, an American physicist, conducted extensive research on rockets. His main interest was to find a way to explore the earth's higher atmosphere. In 1926, he conducted the first successful test of a liquid fuel rocket, but these early efforts went largely unheeded.

"Considerable interest in rocketry arose in Germany in the early 1920's. In 1923, Hermann Oberth published the important work, 'Rockets In Interplanetary Space.' Starting on an amateur basis, the Germans eventually secured their government's support and during World War II brought forth the buzz-bomb (air-breathing jet) and the V-2 missile (true rocket). The V-2 marked a tremendous advance in rocket technology and made clear that space flight was possible. Foremost among German scientists was Wernher von Braun, now a United States citizen, who heads NASA's Marshall Space Flight Center."

Bill concluded that since World War II, rocket engineering has advanced rapidly. With greatly improved launching vehicles, both the Soviet Union and the United States have been able to place satellites above the earth, and to send instrumented packages to the moon and beyond.

Bill yielded to Phil. Phil asked, "Why are we interested in space?"

He then answered, "We are primarily interested in space to gain knowledge. In addition, the space program provides many jobs for people who work in industry. Then Phil said, "I have some statements from important people which answer this question. I won't read them

all, but here are several of the more important ones.

"President Lyndon B. Johnson, former Chairman of the National Aeronautics and Space Council, stated that the whole economy would be enriched by space development and that space exploration and industry can lead to new knowledge and new jobs to share in America's goal of higher standards of living. He indicated that soon space science will reach into every home, every business, and the life of every family.

The late President John F. Kennedy said that we are setting sail on a new sea because there is new knowledge to be gained and new rights to be won, and that they must be won and used for the progress of all people. Now is the time to prepare to take longer strides. He also stated that this nation should commit itself to achieving the goal, during this decade, of landing a man on the moon and returning him safely to the earth. No single space project would be more impressive to mankind or more important for the long-range exploration of space. He concluded that none would be so difficult or expensive to accomplish.[1]

"Dr. Wernher von Braun, says that he thinks space development is the wisest investment America has made, because it is the kind of stimulus the economy needs. The real payoff, he indicated, does not lie in the mining of the moon, but enriching the economy and our sciences in new methods, new knowledge, new procedures and technology.

"Dr. Edward Teller, one of America's leading scientists has said that before the century is over we will have explored our entire planetary system reasonably well. We will have found out how to influence weather, how to make use of the ocean. A cure for cancer and heart disease will be found and we will learn to produce materials to order, synthetically. He states that a scientific career is more than a duty to society. It is an opportunity—unequaled."[2]

Phillip said, "The fact that this Nation has just entered into an unending task of scientific exploration is of the greatest importance to us as elementary students. For by careful consideration and deliberate preparation you can choose a lifetime career that will be rewarding by every measure of our desire."

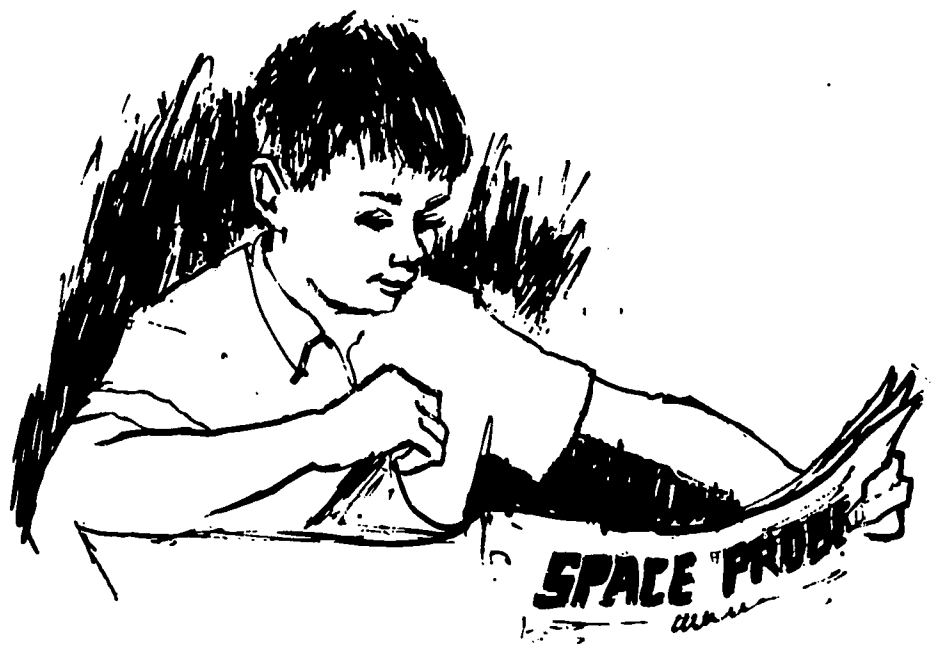
This concluded the report of the first committee and the class continued with a discussion for twenty minutes. Everyone was excited about the report and said they hoped the next report on jobs in the space industry would be as interesting.

[1] *The G E Forum*, July-September, 1962, Vol. V, No. 3, p. 7.

[2] *Career Opportunities*, New York Life Insurance Company, 1963, p. 352.

CHAPTER 3

FIND OUT ABOUT JOBS IN THE SPACE INDUSTRY



After another week has passed, we look in once again on the class. Mrs. Kent has turned the class over to Committee Two.

Joe, who had been selected to be chairman of the group, came forward. He explained that his committee had written to NASA to get information about jobs in space. He said, "Our whole group has learned a lot about jobs, but there is so much to report that we will not have time in the committee's class hour. We decided to write out something about space jobs to give each one of you. This way we can save time for class discussion. Mrs. Kent helped us by running them off on the duplicating machine."

Joe continued, "Have you ever stopped to think that there are thousands of different jobs from which you will choose in the future? There is a book called *Dictionary of Occupational Titles*[1] which lists every job that people do. Can you imagine reading every one of these job titles (over 24,000) to pick those you might like to do? Well, you don't have to, because the jobs are listed in nine different areas. You have only to read from the area in which you are interested. These are all mentioned in your booklets, but some examples are salesmen, office worker, factory worker, and manager. I am telling you about this because as we talk about jobs, it will help you to remember which ones might interest you. You will want to learn more about these jobs, and find out what you will have to do to get some of these jobs in the future. They say it's never too soon to begin!"

[1] *Dictionary of Occupational Titles,* Division of Occupational Analysis, U.S. Employment Service, Washington, D.C.: U.S. Government Printing Office, 1949.

The class was surprised to learn that there was such a wide variety of jobs. They discussed the many different jobs that their families and friends had. It did not take them long to realize what a wide open field lies ahead when they begin to choose their careers. They were eager to learn more about space jobs, so the committee continued its report.

Jean told them, "I didn't know where to begin to learn about space careers, so I wrote to NASA. They sent me some information which we have written in your booklets. They divide all the jobs in the space industry into ten groups, and we have explained a little bit about what you might do in your job if you select any one of these groups. Remember, in each group there are many jobs. There are scientists, engineers, and technicians working within each group. I will tell you just a little about what each one of them does, and then the next committee will talk more fully about them.

"A scientist does two kinds of things—either he does many tests and experiments just to find out more about things, *all* things (basic re-

search); or, he does many tests and experiments to find the answer to a particular problem (applied research). An engineer might work with and design the complicated equipment to carry out an idea that the scientist has discovered. Technicians often test and keep records of all tests of the equipment that has been designed by the engineer."

Here is what the committee wrote in their booklets about the ten groups of jobs in the space industry:

1. Space Sciences Group

If you worked in this group, you would be trying to learn as much about space as you could. You would invent equipment that could be sent into space so you could learn more about it. You would figure out new ways to use older space equipment and information. You would study very carefully all information gathered about space.

You would study the planets (what they are made of, their atmospheres, what lies between them); the sun (what happens there and why); the stars (where they came from, all that lies between earth and the stars); and how and why all this is changing.

2. Life Sciences Group

This group studies the problems of life and how to keep man alive during space travel.

People who work in these jobs plan and test equipment here on earth in specially built places made to be as near like conditions in space as they can make them. This way they can tell what will happen in an actual flight before it takes place. They do many, many small tests and experiments before they put them all together for larger tests. Then, many larger tests are carried out before actual flight takes place.

If you worked on one of these jobs you would study what man has to take with him for long space flights. You would try to answer questions about food and oxygen supplies. You would also study the problem of what man can do to keep busy and not feel so alone on long flights.

3. Flight Group

If you wanted to work in this group, you would study about how to make spacecraft. You would have to figure out ways to correct problems of capsules or other vehicles launched into space. One of these problems was associated with the retro-rocket burn-up and keeping the heat shield in place when John Glenn's space capsule re-entered the atmosphere.

You would also be working on how to control the direction of the spacecraft both in the atmosphere and in space. Tiny mistakes in control can become mistakes of hundreds or thousands of miles later in flight. A knowledge of mathematics is necessary to figure out what is going to happen before you actually launch the space vehicle.

4. Materials Group

The spacecraft is made of different materials, and if you worked in this group, you would have to know metals, plastics, and other materials used in making spacecraft. You would have to test to see what is best to use, for example, for the astronaut's chair, for the nose cone, for the fuel pumps, for the windows. You would have to ask questions such as: Will it melt? Will it be too heavy? Will radiation damage it? Will it keep the astronaut cool enough?

5. Power Group

Naturally, the spaceship must get off the ground, and this group works with launching problems. Cars use gasoline for their "get-up-and-go"; people use food; and rockets use many different fuels. Four of these are liquid, solid, electrical, and nuclear. The first two are being used. The second two are being carefully studied. These people must learn all they can about rocket engines, and how different fuels can give power to the spacecraft.

6. Flight Systems Group

This group studies the flight vehicle and everything that makes it work. It wants to

make sure that the entire system will work as well as it can for as long as it can. It checks the building of all parts of the space vehicle and equipment.

7. Measurement and Instruments Group

This group knows about the instruments that are so necessary for successful space flights. These workers plan, make, and control equipment that keeps track of spaceships, records all information from the vehicle, actually controls the vehicle, and keeps radio and television contact. If a satellite is built to help us learn about weather conditions, the people working in this group must make instruments to find out exactly what they want to learn about the weather.

8. Data Systems Group

These people are mostly mathematicians who work with instruments called computers. Computers supply answers to problems by using information that has been given to them by people. The computers can take information from tapes that have been put into the machine, and use it to solve problems. If the computer has been given enough correct information by the workers in this group, it can be a big help, because it can tell if something is going to work without actually building it.

9. Facilities Group

There must be buildings and equipment for all these people, and designing them would be your job if you worked in this group. They make special rooms such as wind tunnels, and design the launch towers. Test pilots are also included in this group, working both in the air and on the ground.

10. Management Group

As other managers do, this group of people watches over all that is done in the space industry. They know about all the projects that are going on, the cost of each, and when each is to be finished. They must stop and start building often because of new discoveries. These workers are supposed to see that the deadline is met. They must plan ahead. AND SO MUST YOU!

The class looked over their booklets and had many questions to ask and ideas to discuss about the many different space jobs.

Bonnie suggested, "Why don't we all go to a space center or aircraft plant to get a better idea about these jobs?"

Jean answered, "That would be a wonderful idea. Some of us can talk with Mrs. Kent to see if we can make plans for such a trip, and we'll let you know. In the meantime, read our booklet about space jobs, and be thinking about what you might like to do in the future. It sounds exciting, doesn't it?"

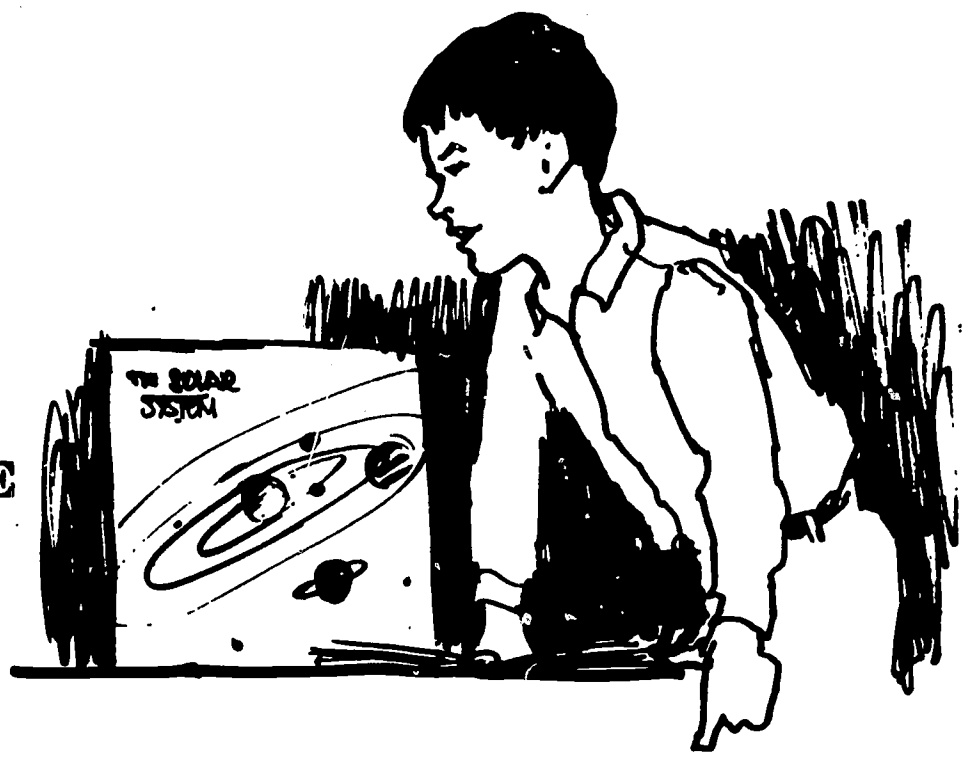
The boys talked more about space jobs, while many girls as well were talking about what jobs they were most interested in. They began to wonder what they were learning now in science and mathematics that would help them in space jobs. They wanted to learn as much as they could.

They decided that people in space jobs had to know a lot about science and mathematics. The question that came to their minds was, "How would you learn all you needed to know to get a job in space?"

NOTES

CHAPTER 4

DETERMINE PATHWAYS AND EXPLORE BACKGROUND FOR SPACE CAREERS



Another week had passed, and it was time for Committee Three to give its report to the class. This committee was supposed to tell the class about ways in which they might prepare themselves for a career in space. They planned to tell the class what would be expected of them if they already had a space job. Mrs. Kent asked Judy, the committee chairman, to begin her report.

"There is something special about working in the space industry that makes it hard for us to tell you exactly what you have to do to get a job in space. This special thing is that new jobs are being born all the time, because of new discoveries of how to do things. We decided that the best thing to do was to tell you some things to do that will help you succeed in all space jobs. We will also tell you where to go to learn about and keep up with the changing jobs in space."

Tom began, "Some things we can all do now are to learn all we can about the different space jobs, and what we will have to know to get them. We will always have to keep in mind what we are able to do when we are thinking about what we want to do when we grow up. We are lucky that we have begun in elementary school to think about this, because we now have a head start in our planning and learning."

Tom turned around and pointed to something he had written on the board before school had begun. This is what the class saw.

Teachers
School Counselor
Parents and Friends
Library
Colleges

Tom said, "Here are some people and places where we can go so that we can get help in our planning. These people can help us find out more about ourselves. They can tell us what courses to take in junior and senior high school and beyond so that we can be prepared for a space job. They will be very glad to help us. The library will have books that can keep us up-to-date on new space jobs. I have even started a library of my own that will help me in a space job."

The committee chairman, Judy, then turned to Rita and said, "Rita will begin our discussion about what we can do to get ourselves ready for a space career."

"Thank you, Judy," Rita began. "I have an idea that may not be a problem for anyone in this class, but I have heard a lot about it. It is about the importance of staying in school. To take a job someday, we must learn all we can. We must *stay in school*—elementary school, junior high school, high school, college, and beyond, maybe technical school, flying school, or some other type of training."

Rita continued, "Major Robert White, a pilot for the X-15 high altitude research aircraft, said, 'The stairway to the stars is built of school books and there is no short-cut.' He says that there is no such thing as knowing too much about what we might need or find useful on our hard climb to the stars."

Judy had something to add to what Rita had said, "We can do a lot on our own to learn about space. We can take trips to aircraft factories; we can plan visits by jet pilots, engineers, or scientists; we can get more films at school; and we can watch all the television programs that will help us."

Chester could hardly wait to say what he had thought of, "I think that it is very important to learn all the new words about space. That way we can understand the books, movies, and television programs that we see. We have to learn as much as we can about science, so that we can tell what is really true and what is just made up. If we believed some of these science fiction stories that we see on television or movies or read in books, we would really have some mistaken ideas about the world and universe we live in. That is why it is a good idea to look up new words and ideas whenever we come across them in our reading."

Judy introduced Teresa by saying, "Remember, the last committee told you a little about what scientists, engineers, and technicians do. We thought we would tell you what is expected of each of them on their space jobs and a little about their training. That way you will learn more about what might be in your future as you prepare for your space job. First, Teresa will talk about scientists."

Teresa began, "Scientists do tests and experiments, often to find out the answer to a problem. When they do this, they find out more and more about what makes up our world and all space. Scientists are curious—they always seem to be asking the question: Why? Are you this kind of person? A scientist must see everything that goes on and be able to remember easily. He is interested in a lot of things, and usually has one or two things he is especially interested in. He is able to pay attention for quite a while. He knows a lot of mathematics and, of course, he knows science. Are you interested in becoming a scientist? Do you think that you would be able to do it?"

Arthur went on to talk about what engineers are like. "An engineer is concerned with designing equipment to be used in space. He must test and experiment to make better designs. He must be like the scientist Teresa told you about. More often than the scientist, the engineer knows exactly what he wants to end up with when he is finished with his experimenting. He makes a plan that tells how the equipment should work, and he must stick with it until everything works perfectly. Are you interested in becoming an engineer? Do you think that you would be able to do it?"

Terry told the class about what is expected from technicians. "A technician must know something about science, and must know very much about his particular job. For example, a technician might be in charge of checking launch rockets during countdown. Technicians do not have to know as much mathematics as engineers or scientists. They do not have to have a college degree, but they often go to school two to three years after high school. They must keep records of everything they do. Sometimes technicians work on solving very special problems that have to do with their jobs. Are you interested in becoming a technician? Do you think that you would be able to do it?"

Judy said, "That is all that our committee has to tell you. We hope that you have learned as much as we have about what we can do now to prepare ourselves for a space career. We also hope that you learned a little about what will be expected of you as a scientist, engineer, or technician. Don't forget all the people and books that can help you in your 'climb to the stars.' "

CHAPTER 5

MAKING GOALS AND KEEPING UP WITH TRENDS

The fourth committee walked in front of the class and began writing on the board. This is what they wrote.

What are goals; are they important?
Should you make a plan for your future?
What are the secrets of doing well at home, at school, or on your job?
When should you set goals for your life?

Florence began to answer the first question for the class. "To tell you what goals are, imagine yourself on one side of a river and you see one of your friends on the other side. Your biggest goal is to get to the other side of the river. There are a lot of rocks in the river, and you set out to cross the river by stepping on the rocks. When you first begin, your first goal is to step on the first stone, and to step on each stone after that so that you can get to the other side of the river. This is what we mean by goals. You know what you want to do in the end (like getting to the other side of the river), and you figure out what things you have to do to reach your big goal. These stepping stones are also goals. Do you think they are important?"

Steve raised his hand. When Florence called on him, he said, "It seems to me, that if you picked the wrong stepping stones, or goals, then you wouldn't end up at your big goal. You may be a long way from it. I think goals are very important, and we really ought to have some big goals in mind."

Florence noticed that the rest of the class agreed with Steve, so she went on to the next question.

"Should we make a plan for the future?" Florence read from the board. "Our future seems so far off. I suppose that there are goals that all of us hope to reach. We would like to have a house, clothing, and food. We would like to get along well with other people. We would like to work at tasks that make us feel good because we are doing them. We would like to be able to have fun. I'm sure that all of us are thinking of things that are important to us. Do you suppose that it would help us to plan ways that we can reach these goals?"

Mary, who had been thinking about what she wanted as her goals, answered, "Yes, I think it is something like crossing the river. Planning will make it easier for us to reach our goals."

George wondered, "What if we change our minds about what we want as our goals? Should we still try to plan ahead?"

Florence tried to answer by saying, "It is natural for goals to change, so your plans should make room for any changes that come about as you grow older and learn more about life and yourself. We need to set goals for short periods of time, and practice reaching those goals. For example, we might set goals about the way we act with our friends, or about our school work for several weeks, and see if we can reach them. It takes practice to reach goals all of the time."

Florence turned the committee over to Jeff, who began discussing the next question. "The Boy Scout motto, ' Be Prepared,' can help us do well in all that we do. In school, if we have learned well what we have studied in the past, we are prepared to learn what we study today. The same goes for today—if we learn well today, tomorrow's tasks will come easier. At home, or with our friends, if we think ahead as to how our actions will make the other person feel, we are prepared and will get along better with people. We will be more successful in everything if we know ourselves better—know what we really enjoy doing, what we do well and what we don't do so well, know what our biggest worries are. Our teacher last year in another school suggested that we write a story about ourselves, telling as much as we could about ourselves. We never had to hand it in to that teacher. It was just to help us know ourselves better. It helped me a lot, so I'm suggesting that you try it. This way you will be better prepared for living.

"Another very important way to do well in school is to learn how to study so that you can learn all you can. I've found that it helps to study at the same place every night. For me, it's the kitchen table after everyone has gone. I read in a book a good way to study, and I think we should all try it. First, look over part of your assignment or homework in, let's say, geography. Try to get an idea of what it's all about. Then ask some questions (using the darker printed side headings is helpful) and try to answer them when you read. Then look up from your book and try to remember the main points and answer the questions. It might help to make some notes. Later in the evening, try to answer the questions again, and check the main points. It may take more time, but it sounds like it would work! Wouldn't it be worth it if we could learn and remember more easily?"

The class decided to try it during their social studies period, just after the committee finished its report.

Jeff brought up the statement that *to get something you have to give up something.* To succeed, it takes hard work. Jeff admitted, "I know how hard it is to ask questions until we find out something on our own, and how much nerve it takes to stand up and talk about it. But these are things we *must* and *can* do, with a lot of energy, to succeed."

Greg continued with the report, saying, "I think that we have already answered the last question. We said that you should set goals for your life right now. This does not mean that they cannot change, speed up, or slow down in the future. At least, they give us some help in deciding what to do every day."

Greg went on to discuss keeping up with the changes in the space age. "For hundreds of years, people believed there was nothing new to learn. It's hard to realize how much has been discovered in recent years, especially after so many years passed without many big breakthroughs in knowledge. We have to be always looking ahead in our changing world if we are to keep from becoming old-fashioned.

"I thought it was interesting to learn that machines took over some two million jobs in 1963. Of course, they made new jobs necessary, but people had to have more training and education to get these new jobs."

Bill had something to say. "I imagine that with the space industry changing so much, people still have to go to school while they are working on a job, just to keep up with new ideas.

They may even move from job to job once they have learned the necessary skills. Is that right?"

Greg answered, "Very good, Bill! That very thing does happen. I'd like to share with you some of the great things that lie ahead of us in science and in space exploration and development. Dr. Wernher von Braun has predicted that soon (probably in 10–15 years) we will have a permanent moon base with dozens of people living there all year round. He also predicts a manned flight to Mars by 1983."

"Wow!" Phillip exclaimed. "I want to keep up with the changes in our world. I don't want to spend lots of time and money studying for a job that won't be needed in twenty years. I'm going to find out all I can about science, mathematics, and the changing world of the space industry."

Rita said, "Me, too!" This brought to a close the series of reports on space jobs and space. But it certainly did not stop the discussion, study, and continued activity of the class. In fact, it really just launched them into their own type of space exploration.

Has it helped to launch you onto your own branch of space exploration?

SUMMARY

RENDEZVOUS WITH YOUR OWN BRAND OF SPACE EXPLORATION

When two space-flight vehicles come close enough to each other in space to be attached together and orbit on together, this is called rendezvous (ron' day voo). This is extremely difficult to do. The reason is that a careful plan must be made so that the second vehicle's flight path will bring it very close to the first vehicle. Sometimes the flight path of the second vehicle must be corrected. It can be corrected if the mistake is not very big, and it is very important that the mistake be corrected as early as possible. If it is not corrected early, the distance between the two vehicles will become greater and greater. Very small errors can be corrected as the vehicles come close to one another in flight.

This view of rendezvous of space vehicles is something like the way you choose your job. Think of the space careers as spacecraft orbiting around the earth. The vehicles travel around and around, and you might not even be aware of their being there, just as you do not know of certain jobs and how to get ready for these jobs. One day, *today,* you are alerted to the presence of these orbiting careers (with new ones going into orbit and old ones coming out). This means that if you want to rendezvous with a space career, you have a difficult job to do.

You decide to go ahead and you *Begin To Explore the Space Industry.* You learn about who is in it, where it is, and its history. If you are to come together with a space career someday, you must learn about the flight path of the job (know the course or path you must take to come together with it). To do this, you have to *Consider the Job Fields of the Space Industry.* It is important that you know the kinds of things that people in space careers do and the kinds of problems they must solve. Once you have found out about the course of some space jobs that interest you, you must think about yourself and what you are able to do. It is now time to *Determine a Pathway* (flight plan) that will bring you together with a career in space. To do this, you have to find out more about different educational and training programs.

Suppose it so happens that your flight plan had already begun when you became alerted to space careers. The question is now, can you change your flight path enough to come together with the orbit of a space career? You must check your flight path to see if it is high enough in what you are able to do to reach the level of scientist, engineer, or technician. You must check your interest and the kind of person you are to see if you are on a flight plan to bring you together with

a space career. What about your launch speed, or your skill in science, mathematics, and reading? Remember, you can correct your flight path for mistakes, but large corrections must be made early. So if you are to know what you should, you must get the science and mathematics while you are still in elementary school, junior high school, and senior high school, so that you can "be prepared" for more study.

You can make some small corrections later on in your flight, but usually only small changes can be achieved if you wait long. To make these small changes, you will have to start early to think about your plan. To change your flight plan, more information will likely be needed. Thus you will want to study more carefully the orbits of the space careers, or in other words, you will want to *Examine Job Requirements in the Space Industry.* As the gap between your path and the orbiting space career narrows you will want to keep making corrections in your flight plan. This will require that you *Formulate Your Goals for Now and in the Future,* in terms of your objective(s) in life, as you see them more clearly.

Once you get close or have *Rendezvoused with a Space Career,* you will be in a position to get a better view of the *Glowing Horizons.* At this point, though, those who have gone into orbit are reporting back the likely trends for space careers. They have reported *Glowing Horizons* and they also point farther out in space to no horizon. This means the opportunities and expansion in space careers is expected to go on growing without end. Other career fields, such as certain mining fields, certain metal industries, and certain transportation industries, have begun either to decline or are expected to do so in the future. Space career opportunities are expected only to rise. Will you rise with them toward an orbiting career in space?

MORE BOOKS TO HELP YOU

Jobs in Science, Science Research Associates, Job Family Series, No. 1. Chicago: Science Research Associates, Inc., 1958.

This revised, 1963, job series describes the careers of scientists, physicists, chemists, bio-scientists, geologists, and other advancing careers. It shows the relation of each of these jobs to each other and how they function in industry.

My Educational Plans, by Harold L. Munson. Chicago: Science Research Associates, Inc., 1959, 68 pp.

A booklet that sets forth a logical approach to planning. It starts by helping the reader focus on the past, next look at the present, and finally develop a plan for the future.

Projects: Space, by Judith Viorst. Washington, D.C.: Washington Square Press, 1962.

This book is designed for the student and amateur scientists. It shows how boys and girls have become actively engaged in important space science projects while in school. The book was produced by Science Service in cooperation with the National Aeronautics and Space Administration.

The Space Guidebook, by William J. Weiser. New York: Coward-McCann, Inc., 1963.

The book answers the questions students have about space science. The book gives the details of the orbital flights, Van Allen radiation belts, nuclear propulsion, weightlessness, and other phenomena.

What Does an Astronaut Do? by Robert Wells. New York: Dodd, Mead and Company, 1961.

This book contains dramatic photographs and accurate information of the technical activities of the astronaut. The text describes the control systems of space ships and how they operate.

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