GENERAL SCIENCE

Saturn V Is Modern Caravel

Forays by Saturn rocket and Apollo space vehicle exploring space likened to exploits of Henry the Navigator's sailing vessel which penetrated unknown oceans 500 years ago.

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Address at the Awards Banquet of the 23rd Science Talent Search for the Westinghouse Scholarships and Awards, March 2.

➤ OVER FOUR DECADES AGO, Mr. E. W. Scripps saw the necessity of taking science to the people, and inspired SCIENCE SERVICE, and provided the funds which were effectively used by the most prominent scientists of the time to found this great organization. You have heard his grandson tonight emphasize his dedication and its importance. Mr. Charles E. Scripps, of Scripps Howard, has been joined by Mr. Charles Weaver of Westinghouse to carry forward for this 23rd year the recognition of 40 of the most talented young scientists in America. It is a privilege to participate with the Director of SCIENCE SERVICE, Dr. Watson Davis, in this important ceremony.

Venture Into Unknown

For thoughtful students of history, interested in the future as well as the past, and who believe that the future of the human race will be determined in some substantial measure by the kind of talent we recognize here tonight, and the capability, the application, and the dedication of men and women, as well as the use of machines, it may be well to look backward 500 years to man's first venturesome thrust out into the oceans, far from land—the time when Henry the Navigator encouraged bold and venturesome spirits to use a new much improved kind of sailing vessel, the caravel, to penetrate the unknown, fearsome and hostile vastness of the oceans west and east of Africa, to bring back knowledge to provide understanding of the universe beyond the known horizon, and seek for an ocean route to the Indies.

While Henry's major objective was knowledge, and his instrument was a more efficient utilization of the energy of the wind, there resulted quite practical and tangible additional benefits. The first two shiploads of pepper, which was then worth its weight in gold in Europe, more than paid for all the previous expeditions. And, of course, the early penetrations into the unknown oceans of earth were followed by deeper ones until the Cape of Good Hope was rounded.

Some hundred years later, Copernicus was able to build on his inherited base of knowledge and the concept that the earth was round, the geometric concepts which were to prove some of the most valuable tools of the human mind.

Between Copernicus and Galileo a hundred years elapsed and another hundred between Galileo and Newton. But the restless, insatiable search for new knowledge, and the increasingly ingenious utilization of energy, continued and absorbed the lives of many of the world's most talented men and women.

Today, 500 years after Prince Henry and his use of the caravel to initiate the oceanic age, 400 years after Copernicus presented his theories about the solar system, talented men and women of this mid-twentieth century period have at their disposal and are using a modern caravel.

Science today has at its disposal rocket ships that can leave the earth. They have already traveled to the moon and Venus. We have improved navigation systems to guide them out and bring them back, and to make steadily more accurate measurements of the environment of space—that environment through which Gagarin and Glenn and others traveled, and through which our home planet, Mother Earth, is also traveling around the sun at the relative speed of 67,000 miles per hour.

If today's talented men and women of all ages are utilizing and projecting forward the new knowledge gained and the new concepts which are coming at such a fast and furious pace from modern tools of space exploration, which is certainly true, it is also true that it is the younger generation of most talented young men and women—some of us still think of them as boys and girls—who are moving with the greatest rapidity, personally and vicariously to sail on this new ocean of space. They are also eager to invent new ways to apply what is learned here on earth.

What Excites Hopes of Youths?

What have we learned, and what is it that so excites the hopes and dreams of these young men and women and stimulates the application of that talent, in this new space age era?

Let's look at the examples of which we already know.

As the earth speeds through space its magnetic field captures and holds in place great belts of charged particles, which produce radiation dangerous to unprotected human beings, and to unprotected electronic components of space machines. Discovered in 1958 by a brilliant scientist at the State University of Iowa, Dr. James Van Allen, who is still youthful in years although a veteran of the space age, these belts have already been measured, mapped, and understood.

At lower levels of the atmosphere, ultraviolet light from the sun produces electrons which are useful as huge mirrors to reflect the waves which carry radio messages between nation and nation around the world. In some measure like Henry's two ships of pepper, over two million dollars each year is being saved on our nation's worldwide communications system because we have learned to use these reflecting layers of the ionosphere more efficiently than was possible before.

Our deep space probes have proven that as energy streams from the sun, forming a kind of solar wind, and as the earth speeds around the sun, the magnetic field of the earth, about 40,000 miles out in front, interacts with this solar wind to form a kind of shock wave, which in some ways is analogous to what happens when a very high-speed aircraft is driven through the atmosphere. But the forces at work are in a very different relationship than those between the airplane and the atmosphere.

The shock-wave condition is not really out in front of the earth in the direction of its travel through space, but rather on the side toward the sun because the energy streaming from the sun is more powerful than the energy of the earth's motion just as a comet's tail is not behind the line of travel, but rather on the side of the comet away from the sun.

New Knowledge From Space

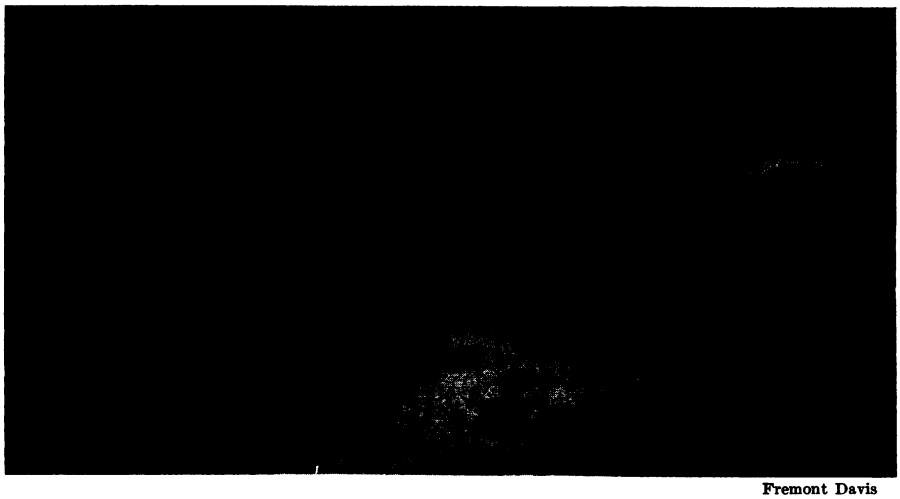
What do such things have to do with conditions here on the earth, and our mastery, control and use of the forces of nature, for the benefit of mankind? The answer is, a very great deal.

New knowledge achieved through the use of satellites, sounding rockets, high altitude balloons, and other space-age tools is adding substantially and at a rapid rate to our knowledge of the interior of the earth, its electromagnetic and gravitational characteristics, and the energy systems which generate our weather.

It is also contributing to the efficiency with which we can engage in the large-scale organized efforts covering many scientific disciplines and fields of engineering, which are essential to utilize the very precisely constructed machines and systems, the new sophisticated understanding of the atomic processes, and to some extent the life processes, on which our existence and welfare is based.

Within the past three years, the technology for an entirely new kind of worldwide communications system, based on repeater or relay satellites, has been developed. Governmental actions have already been taken to create the Communications Satellite Corporation to exploit this technology.

The successful launching and experimental development of the first seven Tiros weather satellites has given us the basic technology for a worldwide weather system, and infra-red measurement system, and also added vastly to the research capability of meteorologists around the world. The eighth Tiros satellite, now in orbit, carries the unique feature of an automatic



Fremont Davis

MEETING OF THE MINDS—STS'ers (left to right) Stephen L. Coy, Steven I. Glazer, Robert F. Sproull and Stephen H. Sinclair listen intently to Rev. Francis J. Heyden, S. J., director, University Observatory, Georgetown University (seated, right) and Dr. Edward F. Knipling, director, entomological research division, Agricultural Research Service, U.S. Department of Agriculture, at a panel discussion on future problems of science held during the Science Talent Institute.

picture transmission system which permits any nation over which it passes to obtain directly from the satellite the pictures of its own cloud cover.

Perhaps more than any other satellite yet launched, this Tiros VIII demonstrates the fundamental nature of this new working tool of the space age—a machine that by its very nature must continue to circle the earth continuously and has the capability of providing useful work for any country over which it passes.

No such machine has ever been available to the human race before. And no nation other than the United States has made one available to all others.

What of manned space flight? With all the marvelous ingenuity built into modern instruments, the exploration of space still requires man's ability to observe and size up the unknown. In developing the use of the air, the earliest aeronauts were balloonists, and they knew so little of the characteristics of the upper atmosphere that many died by the trial and error method, but they learned things they could not have visualized or prepared instruments to report.

In 1903 with the harnessing of the internal combustion engine to the body of aerodynamic knowledge which had accumulated over generations, the stage was set for man's penetration into and utilization of the air. In the sixty years since the Wright brothers flight, man has developed a technological capability to use but a very thin layer of the air up to about twice the height of his tallest mountain.

This powerful technology, applied to this thin layer of the atmosphere, has permitted him to link the world with fast jet transportation, and has given also the power to bi-polarize the world with competing political ideologies—something no previous technology could do on a worldwide basis.

Now, before we can assimilate the meaning of such tremendous changes in so short a time, we are moving rapidly into the space age. Through the Saturn V space booster and the Apollo three-man spacecraft, the United States is developing the technology which will permit man to travel, explore, and use the space around the earth outward to the moon. We are developing an efficient body of technology that will permit not just the use of a thin layer of the air but the far reaches of our vast universe.

Young men and women of talent like those here tonight can find here every facet of the challenges that have inspired the utilization of talent through all the ages—that moved mankind from the Stone Age to the Bronze Age, on to the oceanic age, and in this century through the air and nuclear ages to the space age.

The Modern Caravel

What is this modern caravel, this Saturn V space booster? The first stage is a cluster of five engines, each of which consumes three tons of fuel and oxygen per second to lift six million pounds against the earth's gravity, and to speed the Apollo spacecraft, together with the upper stages of the booster, up to 6,000 miles per hour. The five engines of the first stage then drop off, and fall into the ocean this side of Africa.

The second stage—five smaller but very powerful engines which burn liquid hydrogen, will take over and speed the spacecraft up to 15,000 miles an hour, and then drop off into the Pacific between Africa and Australia.

The third stage is composed of one liquid hydrogen burning engine which will inject the remaining part of the Saturn rocket and Apollo into earth orbit, and after it has coasted around the earth once, fire up again to send off to the moon an expedition weighing about the same as Columbus' Santa Maria, a caravel, when he sailed to America.

The spacecraft will be made up of the Apollo, with three men in it, a landing module which will detach from the Apollo when in orbit around the moon, and then drop down to the moon so the astronauts can explore it, and with the power to blast off from the surface of the moon. This specialized lunar landing vehicle will then rejoin the Apollo spacecraft and return to the earth.

So it can get back home, an essential part of the Apollo spacecraft is a heat shield heavy enough to absorb and dissipate the very high temperatures which will be generated when this spacecraft with three men inside plunges back into the earth's atmosphere at 25,000 miles per hour. This kind of heavy heat shield, a necessary capability to return to the earth from a space age voyage is, in some ways, the kind of new technical advance which enabled the oceanic age caravel to sail around the Cape of Good Hope and return to home port.

500 Years of Evolution

Some would say that the Saturn/Apollo combination is a result of 500 years of evolution since the caravel of Henry the Navigator. It is the largest and most complex machine ever put under construction by the human race. It has the same potentiality for opening up vast vistas in man's understanding and utilization of the great oceans of space as did the caravel, with respect to the oceans of the earth—a potentiality that when realized so excited and expanded the mind of man 500 years ago.

In this new age, the space age, the world, and particularly the talented young people of the world, are fortunate that President Johnson believes in the Saturn and Apollo as Henry the Navigator believed in the caravel.

The late President Kennedy also believed in it. He had a great capacity to marry the present with the future and to see the opportunities which must be seized by this generation. Of space exploration he had this to say:

"Those who came before us made certain that this country rode the first waves of the industrial revolutions, the first waves of modern invention, and the first wave of nuclear power, and this generation does not intend to founder in the backwash of the coming age of space.

"We mean to be a part of it. We mean to lead it, for the eyes of the world now look into space, to the moon and to the planets beyond, and we have vowed that we shall not see it governed by a hostile flag of conquest, but by a banner of freedom and peace."

• Science News Letter, 85:165 March 14, 1964

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TALENTED YOUNG SCIENTISTS—Scholarship winners and alternates are shown with their exhibits at the Science Talent Institute. Top, left, Robert E. Bowen; right, Robert F. Sproull with Dr. Glenn T. Seaborg, chairman of the U.S. Atomic Energy Commission, one of the STS judges. Center, left to right, Lee R. G. Snyder, Joseph D. Locker, Henry M. Jaffin. Bottom, left to right, Stephen M. Winters, Richard A. Linke.