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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."

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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.