

ographer finds that he can see a great deal from space, and here I have a photograph taken from near the coast of Africa looking over almost the entire Indian Ocean, from one of the Gemini studies (figure 4).

"There are many opportunities to learn much more about the weather from space.

"Sometimes the meteorologist would like to have greater detail which can be supplied from actual color film or the record of observations of other otherwise invisible portions of the electromagnetic spectrum.

"Here we have a photograph of the Indian sub-continent which shows, I believe, quite clearly the influence of the convective action of the atmosphere as it approaches the continent itself, and you will see the clouds are held away from the continent by this action. Certainly an observation that could only be made in space.

"At very high altitudes an orbit synchronized with the earth's rotation, the view from this vantage point can encompass a much wider area and follow step by step, minute by minute, the life history of a developing storm.

"I have here three pictures taken from the Advanced Technology satellite in quick succession, and you can see in each of these three pictures the development of a storm system of over almost half of the whole earth's surface.

"One problem in our atmosphere, of course, is the effects of man's activity upon it. As we become increasingly aware, air pollution is a major and increasing problem in heavily populated and industrial areas.

"Of course, this problem can extend far from the most populated areas and here is an interesting picture of two forest fires which are creating heavy pollution in the area of development in the Gulf of Mexico, near Tallahassee and Apalachicola.

"In all such research, it will be important to measure carefully the costs and the benefit's to be obtained by alternative methods of obtaining data. In some cases, the needed information can be obtained with aircraft, or with sounding rockets, or simple unmanned spacecraft. In others, the presence of a man in space to do such things as selecting the targets, calibrating and directing instruments will justify the additional cost.

"But space offers the opportunity to do many things that just cannot be done in any other way. I'm reminded for example, of the fact that on my first expedition to the Antarctic with Admiral Byrd in 1928, we flew some six hours to discover the Rockefeller Mountains only a short distance from Little America One.

"I look forward with pleasure to the day when a Polar orbiting Apollo will be able to sweep and map the whole continent in a single orbit."

Dr. Eugene Shoemaker, U.S. Geological Survey: "The Geological Survey is carrying out a major program of Geologic investigation of the moon. The first step in this program is Geologic mapping of the moon from earth-based telescopes. You see here on this frame the one-to-one million Geologic maps which have been prepared for the lunar equatorial belt. The next step in the investigations will be the detailed Geologic investigation of Ranger impact sights for Ranger 7, 8, and 9 from the very high resolution pictures obtained on the Ranger missions. Next we will be studying in great detail the lunar equator from high resolution pictures obtained from the unmanned lunar orbiter. The Apollo Applications program will offer us the opportunity to extend these studies over the entire sphere of the moon, and to study in even greater detail areas of special interest such as the Crater Alphonses and the Crater Copernicus which may be the targets for Manned Lunar Landing.

"Our first detailed information obtained directly from the Lunar surface will come from the unmanned spacecraft Surveyor. From the pictures obtained from the two cameras, it will be possible to prepare very detailed maps of a region extending out about 100 feet from the spacecraft, which is an area about the size of this model.

"In the first manned lunar landing, it will be possible to extend these observations to distances of about a thousand feet, and in the Apollo Applications program, we will have the opportunity to look at features several thousand feet across.

"Finally, we are studying the methods by which this information is to be transmitted to the earth and the techniques for reducing this information primarily by photogrammetry and photometry. Our objective in studying the moon is to compare the Geology and History of the moon with the Geology and History of the earth. And by this comparison, we hope to solve some of the age-old questions of Geology."