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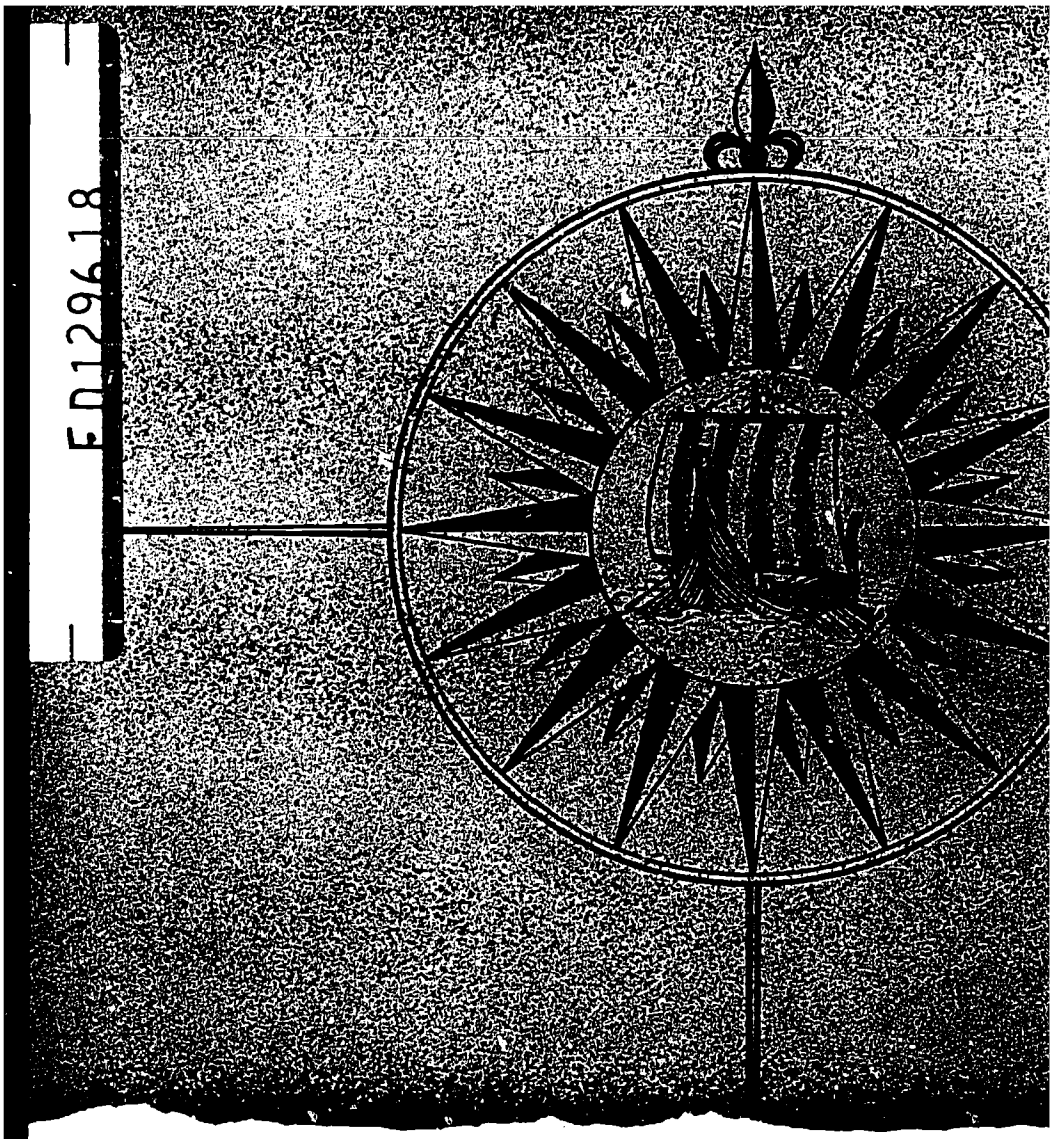
ABSTRACT

This document presents a transcript of a National Aeronautics and Space Administration panel discussion held on July 2, 1976, in conjunction with the Viking Mission to Mars. The panel consisted of Norman Cousins, Ray Bradbury, Jacques Cousteau, James Michener, and Philip Morrison, and the principal topic was a philosophical discussion of the question, "Why does man explore?" Also discussed are the implications of finding life on Mars and man's future. (SL)



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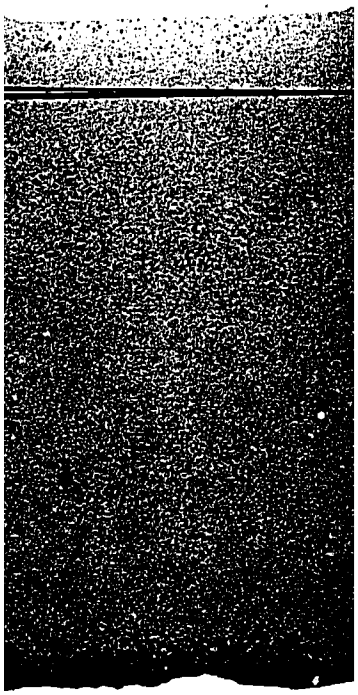

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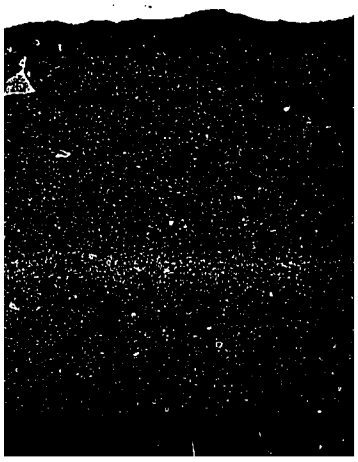

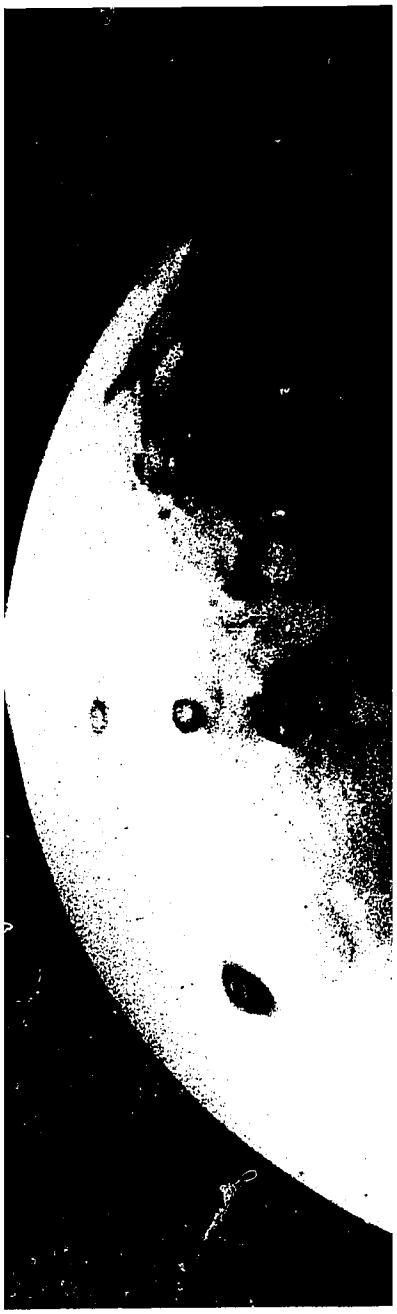

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Why Man Explores

Sponsored by

NASA

National Aeronautics and
Space Administration

LANGLEY RESEARCH CENTER

Hampton, Virginia

A symposium held at
Beckman Auditorium
California Institute of Technology
Pasadena, California

July 2, 1976

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Panel

Norman Cousins, *Moderator*

Ray Bradbury

Jacques Cousteau

James Michener

Philip Morrison

Foreword

This NASA Educational Publication (EP 125) was prepared from a transcript of a panel discussion held on July 2, 1976, in conjunction with the Viking Missions to Mars.

The members of the "Why Man Explores" panel were selected as authorities in classical disciplines relating to exploration. The panel discussions were not rehearsed, and the transcript was prepared from audiotapes made during the session. This report is formulated in the direct conversational style in order to retain the impromptu atmosphere and to best convey the thoughts developed during the discussion.

Donald P. Hearth
Director, Langley Research Center

Introductory Remarks

DONALD P. HEARTH

Good evening. NASA's Langley Research Center is pleased to sponsor this symposium. The United States has embarked on a truly historic step in man's exploration of our solar system with two Viking spacecraft. We feel that it is appropriate, at this point in time, to examine the basic reasons why man explores and why he has the urge to explore. When this event was scheduled, we recognized that it might not be possible to land the first Viking on Mars on July 4th because of technical problems or Martian surprises. After Viking I went into orbit on the 19th of June, the technical problems lessened and we began to learn some marvelous things about Mars. Last Saturday night, the Viking Project Manager made a prudent decision to explore the planet from orbit somewhat longer, and to look for a harbor somewhat safer than the original site. Yesterday, he found a safer harbor and the landing will be in the so-called "Northwest Territory." That name was selected in a very scientific way, by the way, because it is northwest of the planned landing site. Current plans are to land on the 17th of July at 3:00 in the morning, Pacific time.

That's what exploration is really all about. When one explores the unknown, one should look for surprises and be prepared to alter one's course. But, why does man explore at all? It is not just the exploration of the solar system that is the topic of this symposium but of our own Earth and indeed of the entire universe. We are here this evening to discuss this question.

I will now introduce the panel. Starting on your left is an author, philosopher, poet, Mr. Ray Bradbury. Next is an explorer, oceanographer, environmentalist, Captain Jacques Cousteau. Second from the right is an explorer, author, philosopher, Mr. James Michener. And, next to Mr. Michener is a physicist, a cosmologist, and indeed a humanist, Dr. Philip Morrison. Finally, the moderator for this evening, the editor of *Saturday Review*, Mr. Norman Cousins.

Panel Members' Presentations

NORMAN COUSINS

Norman Cousins has been editor of *Saturday Review* magazine, except for 2 years, since 1942. He first came to the magazine in 1940, 4 years out of Teachers College at Columbia University. He was previously education reporter for the *New York Evening Post* and literary and then managing editor of *Current History*, a monthly journal of world affairs. During World War II, he was editor of *U.S.A.* magazine.

During his editorship of *Saturday Review*, the magazine expanded its readership from the original 20 000 to a present circulation of 500 000.

Cousins has written and edited more than a dozen books on many subjects, from biography to politics to philosophy. His latest book is *Celebration of Life* (1974), a dialogue of immortality and infinity. He has lectured on American history throughout the world, often under the auspices of the U.S. State Department.

He has been active in organizations working for world peace since the end of World War II. He is President of the World Association of World Federalists and Honorary President of World Federalists, U.S.A.

He has received many awards for his work in journalism and for the cause of peace, including the personal medallion of Pope John XXIII, presented for his participation in negotiations with Russia for the release of two Catholic leaders from Iron Curtain prisons.

He was awarded the Peace Medal of the United Nations by Secretary-General U Thant. He is the recipient of honorary degrees in humane letters, literature, and law from 31 colleges and universities.

Cousins and his wife live in New Canaan, Connecticut. They have four grown daughters and an adopted daughter from Hiroshima, who now has a son. Cousins has a deep interest in photography, pursues active sports, enjoys chess, and, when no one is around, likes to play the piano and organ.

NORMAN COUSINS

Thank you, Mr. Hearth.

The question, "why explore?" pertains less to the Viking I expedition in particular than to the nature of the human mind in general. We are here to consider not just the phenomenon of a journey to Mars but the phenomenon of intelligence. The fact that we can conceive of the inconceivable, and comprehend the incomprehensible, is perhaps the highest exercise of the human brain, symbolized so dramatically by the exploration of Mars.

It is a terrible thing, Tolstoi said, to watch a man who doesn't know what to do with the incomprehensible, because generally he winds up playing with a toy named God. Pasteur saw nothing particularly terrifying or unsatisfying about this situation, saying that the only thing to do in the face of the incomprehensible is to kneel before it. But that which is most incomprehensible of all is not a distant planet but the human mind itself; kneeling under these circumstances may represent the ultimate vanity. But the attempt to comprehend the mind, rather than to worship it, is an exercise devoutly to be consummated, if not wished.

This is the direction in which Viking is taking us. Where is it likely to lead? Darwin contemplated his work and thought and considered the possibility that his theory of life could only lead to the existence of a deity. But he drew back from this line of thought by asking himself whether the mind of man, which has been developed from the lowest mind conceivable, could be trusted when it draws such grand conclusions. The answer, perhaps, is that in the very act of raising the question, Darwin proved the human mind capable of rising above the limitations he thought inherent in a supposedly unflattering evolutionary history. His question may be reminiscent of a remark attributed to Groucho Marx, who was invited to join a country club but declined, saying he didn't want to belong to any country club that would admit a man like himself.

Our question tonight, therefore, involves not just science but philosophy, for our answer has to come out of our view of life, out of our concept of history, out of our understanding of human progress, and mostly out of instinctive awareness that we can always do better than we are doing if we emancipate ourselves from our fears in order to search the horizon for new prospects. So we look to our traditions and our philosophy as we expand the human presence in the universe.

Some historians see history as an accumulation of error. But history is also the story of the defiance of the unknown and of what happens when man tries to extend his reach. Such defiance is necessary because conventional wisdom has never been good enough to run a civilization. Not all problems are old problems; therefore, new approaches and new truths have to be discovered.

In order to answer the question, "why explore?," then, it becomes necessary to refer to the phenomenon of human progress. I have a theory that progress is what

is left over after one meets an impossible problem. The reason it is safer to travel in a Boeing 747 than to sit in your bathtub is that adequate thought has been given to all the things that can go wrong when you are in a 747, and not enough thought to what can go wrong in a bathtub. When you are in a 747, the experts relieve you of the responsibility for making correct decisions. This is something that does not happen in your bathtub. What I am trying to suggest is that the more difficult and complex the undertaking, the more likely it is that knowledge will be gained that can be applied more fruitfully far beyond the undertaking itself. Viking I is such an undertaking.

Seven years ago, almost to this day, I was in war-torn Biafra. We were in a jeep. A plane loomed behind us out of the Sun and dove down on the jeep in a strafing run. We plunged into a ditch, face down in the mud. I could contemplate that even as we were pressing our faces into the muddy Earth in safety from our brothers, men found it possible to walk erect on the Moon. That evening, the war suddenly came to a halt, at least for a few hours. The word had spread through Biafra that human beings were setting foot on the Moon for the first time. Suddenly everyone had a new perspective. It didn't last long enough to cause the war to end altogether, but for a few moments at least we could contemplate the possibilities of human grandeur and to meditate on our station in infinity. In that sense, the most significant achievement of that lunar voyage was not that man set foot on the Moon but that he set eye on the Earth. He was able for the first time to develop a true perspective on that beautiful wet blue ball, as Archibald MacLeish described it, which possessed the millions upon millions of conditions that existed in precise and exquisite combination that made life possible.

And, from that station in space, what was most striking of all to the human mind was that human beings themselves held the price of life so cheaply.

Despite the gift of intelligence, the gift of mobility, the gift of historical perception, the gift of anticipation, human beings are preoccupied with undertakings that can make life on Earth uninhabitable. Nothing we make on Earth is in greater abundance than destructive force. We have amassed 30 000 pounds of destructive force for every man, woman, and child on Earth. We don't have 30 000 pounds of food in reserve for every human being on Earth, or 30 000 pounds of medicines, books, or any of the things that ennoble life. But we have an infinity of force to use against one another. In the middle of a forest of bombs on Earth, it is difficult to see the tree of life.

Bertrand Russell once said that man can never resist any folly of which the human mind is capable. It is quite possible that the folly we have known on Earth has existed elsewhere in the universe. It is quite possible, however, that there are answers, better answers, than we have been able to find to our problems and our delusions. Ultimately, I think the question

that must ignite the human mind in connection with the Viking trip to Mars has to do with our loneliness in the universe. We are transported by the notion that there may be other humans out there too. It is almost unscientific to think that life does not exist elsewhere in the universe. Nature shuns one of a kind. Infinity converts that which is possible into the inevitable. The fact that we are attempting to find out where and how may be the answer to the question, "why explore the universe?"

It is almost ironic that we should have to ask this question because it is almost as though we have to apologize for our highest attributes, almost as though we have to remind ourselves we are, by nature, creatures of exploration. To have a rendezvous with infinity will be the ultimate in human achievement.

On our panel tonight are people who for many years have been asking why, not just about the universe, but about life itself. They have asked that question from different vantage points. I look at your right, extreme right, at Philip Morrison, the atomic physicist whom I first met, I think, in 1945 or '46, in those early days after the bomb was dropped when the atomic scientists were trying to get through to the American people, trying to talk about the implications of what they had done. Ever since then, Phil Morrison has been as much concerned with philosophy as he has been with science. It's difficult for a man to live close to those things that can fragment our planet without asking why about everything, including the whys about some things many of us have not even been able to define or identify. Phil Morrison, what came to your mind when you were invited to join this panel?

PHILIP MORRISON

Dr. Philip Morrison is Institute Professor and Professor of Physics at the Massachusetts Institute of Technology. He is a distinguished theoretical physicist and scholar-philosopher, whose ecumenical intellectual interests embrace the sweep of human and scientific history, from the origins of the universe to the origins and definition of life.

Professor Morrison has made many professional contributions to theoretical physics, most recently in astrophysics. He is a specialist in cosmology and the author of detailed theories aimed at explaining such celestial phenomena as supernovae, cosmic X-rays, and quasars.

He was one of the first scientists to predict that knowledge concerning the existence of life on other planets may not be beyond our reach. He is a frequent contributor to literature on the discovery of life elsewhere in the universe.

Morrison was born in Somerville, New Jersey, in 1915. He received a bachelor of science degree from the Carnegie Institute of Technology in 1936, and a doctorate in theoretical physics from the University of California at Berkeley in 1940. For 2 years, he taught physics at San Francisco State College and the University of Illinois.

He was associated with the Manhattan Project from 1943 to 1946. In 1945, he rode in the back seat of an automobile with the plutonium core of the first atomic bomb from Los Alamos to the New Mexico desert site of the bomb's first test.

He became Institute Professor at MIT in 1973, a rank the Institute reserves for its most outstanding scholars.

Morrison is the author of several books and of popular scientific articles in many magazines, including participation in a special series of *"Courses by Newspaper,"* sponsored by the National Endowment for the Humanities and administered by the University of California at San Diego. He lectures extensively throughout the world.

PHILIP MORRISON

The question, "Why man explores," was put very literally to us, and I found in myself an answer of the most old-fashioned kind, which I would hesitate to produce except that it is surely an essential piece of the story. I characterize my answer the following way: If you ask, Why do human beings explore? I would answer as I think the Greeks would answer, "Because it is our nature." Now I am anxious not to make the mistake of thinking that the term "human nature" is explanatory, that it covers every activity of our species, the most diverse ethnographies, the artifacts that grace the museums, and the publications that crowd the newsstands of Los Angeles. "Human nature" is an impoverished description of all that diversity; but there is one feature—for me it is perhaps the only feature—which does define human nature, which parts our species (and a few vanished species of our family related to us) and has parted us from other creatures for surely tens of thousands of years, maybe for a few hundred thousand years. We are beings who construct for ourselves, each separately and singly, and as well together in our collectivities, internal models of all that happens, of all we see, find, feel, guess, and conjecture about our experience in the world.

A clear context in which this was put for me is a beautiful ethnographic work by a woman called Edith Marshall Thomas, who lived for many seasons among a small group of the wandering peoples of the Kalahari whom we call Bushmen, people whose inventory of physical goods is very small indeed. They own nothing that sits still. They carry all that they have, all that they make, in a pouch of hide which they bear on their shoulders. They wander forever through life, stopping now here, now there, to sleep in a kind of nest, to try the fruit of this tree, to scratch up that waterhole, to meet for a ritual encounter with their wandering friends, and so on. These people, whose minds are full, though absent writing, absent crowds—in fact they are few—live in small bands of extended families. Each band tends to stay within a region about like that of Los Angeles County, an area of a thousand square miles or two, in quite desert country. From their point of view they are by no means poor; they manage to make an excellent living, as the time-and-motion study people have demonstrated to us, while working rather less hard than the Harvard anthropologists who watched them. Their skill is so great, their understanding and their wants are so well controlled in the environment, they are so beautifully adapted to their situation, that they need not work harder.

The one need they constantly discuss as they wander through the cool mornings, the cool evenings, and as they rest in the heat of the day, is to know exactly where they are. They discuss it always. They note every tree, they describe every rock. They recognize every feature of the ground. They ask how it has changed, or how far it has been constant. What story do you know about this place? They

recall what grandfather once said about it. They conjecture, and they elaborate; their minds are filled; their speech elaborates exactly where they are. You see they have built an intensely detailed, brilliant, forever reinvigorated internal model of the shifting natural world in which they find their being. What that simplified case suggests I dare to extrapolate to all human beings everywhere. I see in it, I think, my own behavior; I hope it will be so for others. It is fair to say that our language, our myth and ritual, our tools, our science, indeed our art, are all expressions translated in one way or another by the symbols of our communication or otherwise of certain features of this grand internal model. The presence of that internal model and its steady need for completion, the obviously adaptive need of its leading edges to have continuity, not to fade off into the nothing or the nowhere: this is the essential feature of human exploration, its root cause deep in our minds and in our cultures.

For me exploration is filling in the blank margins of that inner model, that no human can escape making. Of course, we can rest content within the margins; then we live with a shadow of uncertainty at the edge of the map. Indeed a culture is free to do that, as many cultures have done it—I should say a little more about that later. I want to make quite plain that an internal model is not the only way in which complex accomplishments can be produced. I suspect that we are not the only creatures to show this quality, although we show it in quantitatively distinct form; but we need not fear comparison with other creatures. There is another way to construct even complex architecture without ever having an internal model; were we built that way, we might yet in the course of sufficiently long time evolve all the complexities we have, even if we would not explore. It's conceivable, save only that the universe might not last that long. It is the speed, which is our way to change, that eventually marks us.

When I was a schoolboy, I learned (from a very bad book, I am now sure) that one of the distinctions of truly high civilizations is the ability to construct the true arch, that curved arch with the keystone that holds everything together—not the lintel beam which the Mayans had—but rather those things which Greeks and Romans and other proper countries had which made them high culture and restricted the others to the first chapter of the book. I soon grew away from this kind of provincialism, which was more common a hundred years ago when the man who wrote the book was trained.

I was most forcefully struck by the work recently reported by some French entomologists who have studied in South Africa the work of certain species of large termites. Termites, of course, are social animals of considerable power and prowess. The structures these particular forms build are great things. They are 15 and 20 feet high on some occasions; they dot the landscape like so many termite skyscrapers. They are large and enduring architecture. Layer

upon layer hidden within this termitary which rises out of the ground, are true arches, curved arches which support the next floor, and then more arches for the next, and so on, exactly like the crypts of a building somewhere in Italy. You have to ask yourself the question, Are termites then such thinkers and philosophers as we? That would be the most fallacious view; the reason is not that we can dismiss their accomplishments. As with the qualities of human beings, you cannot judge only by what they have done. You have to judge them in the sense of potential, because what they have not yet done, what is contained in the internal model, is the key.

The termites, of course, always do the same thing. They have done their thing now for twenty million years without changing very much. Mind you, they build the true arch—in the dark. Blind animals building arches in the dark! There is no architect, there is no building-code inspector, there is no critic. All there is is a little hollow in the ground and a thousand termites milling around in the dark making pellets. There is a built-in instruction: "Make pellets out of the discarded leaf matter, the fecal matter, which lies around on the floor." They form lots of pellets. Each one by himself makes pellets. If it should so happen that the density of pellet construction in some region is greater than that in the neighboring region—of course, it must happen that way sooner or later by the laws of chance—then the instruction is: "Leave your pellets which are few and go to where there are more fragrant pellets, a few inches over." Pretty soon they divide themselves into little groups of pellet builders, all making piles of pellets. In between they have stopped making them, those termites gather around the larger piles. Now the piles grow to columns; they stick them together. The next instruction says: "If, as your pillar gets pretty high, you detect another pillar higher still, stop yours and go to work on one that has crossed a certain limit." (We reconstruct these rules by watching their behavior.)

Pretty soon you have many half-finished stumps of pillars, but you have also a few rather high pillars sitting on the floor. The next instruction is: "If two high pillars chance to be reasonably close together, get on top and build each toward the other." That's exactly what they do. So, of course, in each layer the number, size, and placement of arches is different. No great architect has seen where they will be, no one has counted them, no one has decided on them; but the work overall is adaptive, improves the termitary, its strength and its ventilation. So they go on building arches; they will do so for tens of millions of years on end. There is no internal model within any termite, or even in the collectivity, for how those arches should be built. There is in the DNA, in the chromosomes, some kind of simple rules that tell them how to make arches in a broad general way—not the making of the arch itself but the giving of rules of the kind described. There is never an arch present until one appears by chance; whereas when we build

arches, or anything else, the arch is in some sense present before it ever exists. That is what I mean by an internal model. Now the need to complete that internal model—to extend and fill in its fringes—is, I think, what we mean by exploration.

I recognize that this deep need to complete the internal models is certainly expressed differently in different cultures. Sometimes it lies very quietly. The pioneer Alpinists who came in the early 19th century to Switzerland found villagers who had lived there all their lives and never had searched their peaks. But once the visitors raised the idea that it might be worthwhile, it turned out that among the villagers there were a few young men who had quietly ventured into the peaks even before the English gentlemen came to hire them. They became the first guides. Climbing wasn't celebrated, it didn't butter any parsnips or feed any goats, but it was needed somehow to complete a model. I believe those cultures which manage to show some public concern for filling in the edges of that model, for extending the margin of the map, are those in which we now live, and those in which we shall live for most of the time of human history. Democritus said, "I would rather find one cause than be emperor of Persia." That is a statement which a physicist can beautifully adhere to; were we to lose that feeling, it would indeed be a heavy loss.

There is one problem which Viking, the prototype of what I am describing, does not solve, that is, access for a wider number of persons to this scheme of filling in the edge of the incomplete internal map. We have founded such great social structures to pyramid our exploration upon that those at the base often do not get to see the stars shine above the apex. This problem, a gathering like this, like the television screen, will step by step come to solve. Finally, for me, human beings explore because in the long run, time after time, when we wish to adapt to the world as our inner nature has evolved, both by genetics and by culture, we can do nothing else.

COUSINS.

Phil Morrison, in your reference to the Kalahari I found echoes of Lawrence van der Post's book about the same people. You refer to them as people who really want to know where they are. We're told by A. L. Rouse, the English historian, that the one thing that all great events in history have in common is that the people who are caught up in those events never really know what is happening to them. And I just wonder, James Michener, whether people today have a sense of what is happening to them or what will happen to them. Do they know that their lives will never be the same after that robot lands on Mars? Isn't it the job of the writer to take this vast incomprehensibility and to convert it into the comprehensible? You write about the human situation. We met in India once; I don't know whether you remember it or not. We also met in Madison Square Garden once when the Knicks were playing. We met on a tennis court once. You were in Iran last week; you were in the South Pacific; now you're going off to Maryland, where the oysters will become your world. And all of us here tonight, Jim Michener, look to you as someone who wanders not just through space but time, who understands history and human experience, and who can tell us whether Viking can be made comprehensible to human beings.

JAMES MICHENER

James A. Michener, world-renowned novelist and travel writer, has led a life of adventure and exploration since his teens, when he began to travel across the United States, visiting all but 3 states before he was 20.

Born in New York City in 1907, he moved to Doylestown, Pennsylvania, at the age of 10. He was graduated from Swarthmore College with highest honors, and went to St. Andrew's University in Scotland. He then taught at the George School in Pennsylvania, Colorado State Teachers College and, as Assistant Visiting Professor of History, at Harvard University. He later became a textbook editor for a New York publisher, a position interrupted by World War II, when Michener joined the Navy.

The Navy introduced him to the Pacific Ocean. He mailed his first book *Tales of the South Pacific* anonymously to his former employer. Published in 1947, the book won a Pulitzer Prize, Michener won back his job as a textbook editor, and the stories were adapted into the musical play *South Pacific*, which ran for many seasons on Broadway and still enjoys frequent revivals.

Michener later crossed the Pacific many times, gathering material for the novels *Sayonara*, *Return to Paradise*, and *The Bridges at Toko-Ri*. He moved to Honolulu in 1949 and became active in Hawaiian civic affairs. His novel *Hawaii* was completed 10 years later, on the day the U.S. Congress voted Hawaii into the Union.

Michener has visited most countries of the world, finding material for his imagination wherever he goes. Afghanistan provided the background for the novel *Caravans* (1963). *The Bridge at Andau* (1957) is a nonfiction account of the 1956 Hungarian uprising. *The Source*, a novel of Israel as the birthplace of the three great world religions, was published in 1965.

His most recent novels are *The Drifters* (1971), *Iberia* (1973), and *Centennial* (1974). A nonfiction book, *Sports: A Program for America*, was published in June of this year.

JAMES MICHENER

I have always believed that an event has not happened until it has passed through the mind of a creative artist able to explain its significance. I suppose that is why from the earliest times we have had the narrators who sat around campfires at night to recount the heroic adventures of that day. Because those adventures really did not happen until they were crystallized into words and comprehensions.

It is therefore understandable that our first great epic, the Homeric dual poem, dealt primarily with man's earliest adventure in exploring. There is no figure in literature more heroic and permanent than Ulysses. He epitomizes the adventuring characteristic in all of us: the ever searching, the onward probing, the grappling with ancient myths, converting them into present reality, the quest for lands that have been mentioned but never seen. It is not by accident that our opening epic deals with the explorer in mankind, because exploring is one of his permanent and attractive characteristics.

I also find the Bible, one of our second or third epics, essentially a story of a tribe motivated by different goals and different gods, moving to explore the area into which they had been called. True, their exploration is as much moral and spiritual as it is physical, but it is always that forward thrusting into Syria, into Egypt, into the Mediterranean, that characterized the second great work.

But it seems to me that if one wants to look at the supreme epic dealing with exploration and come to grips with it, there is no better place to start than the poem of Luis de Camoes, the Portuguese master (usually pronounced Camoens in English). His great work, "The Lusiads," extols the explorations done by the men of Lusitania. The poem deals with Vasco da Gama, setting out to explore the hidden corners of the world, a man of extraordinary quality. The book is a paean to the glory of the explorer. It is the noblest statement I know of about why men go forth and what they accomplish when they do so. But the highlight of the book, and I commend this to you above everything else I will say, comes in Book 4, verses 94 to 104, in which, as the great caravels set forth on this immortal exploration, the old man of Belem appears, sitting by the side of the bay to watch as the ships go down. He utters a most marvelous lament for the insatiable appetite of all who are lured to the horizon. He predicts that this great expedition can come to no good end. The Portuguese will explore new lands but they will give those lands no new light. The ships will go forth but they will not carry any goodness with them to the new lands. The expedition must end in futility and folly and he continues for 10 wonderful verses, summarizing the arguments that will later be thrown at space exploration: that explorers always take on more problems than they solve.

But at the end, even this old man who is so pessimistic, so against

the grain of all Portugal, is forced to concede:

"There is no high or fateful enterprise
By fire, steel, flood, heat, cold though it may be
That sons of man have ever left untried.
Desperate condition, fate unsanctified."

There is no way to halt this exploration. Portugal will not gain from it, but the knowledge of the world will be extended, the implacable onward thrust of mankind will have been continued. So, with the old man's implicit, though grudging, blessing the great enterprise goes forward.

I cherish these 11 verses of Camoes because they epitomize the problem of exploration: We never gain as much from it as the wild enthusiasts promise; we invariably gain more than the frightened old men predict. And regardless of predictions, the exploration must go on because it is in man's nature to explore. These verses are a corrective to either kind of excess in talking about exploration, and I particularly must keep them in mind because I have spent the bulk of my life in exploring and have often put my conclusions in writing.

When I was a little boy in a small town in Pennsylvania, past my door ran a remarkable road. To the east it went a quarter of a mile and stopped dead. To the west it was limitless. It went all the way to the Pacific, and from there to Asia and the entire world. As a child I looked at that road and understood its two directions—limited and unlimited—and thought how craven it would be for a human being to devote his life to the exploration of the eastern portion, which could be exhausted in an afternoon, and how commendable to turn westward and thus enter upon a road and a complexity of roads that would lead to the very ends of the Earth. I chose the western road.

Four years ago, when I was 65, I drew up a memorandum of work still to be done and I remarked upon the fact that I had been fortunate in being able to visit every place on Earth that I had wanted to see except three. I had never been to Peking, which my fellow Asian experts told me was the greatest city of the world, particularly in the old days when it captivated the imagination. Nor had I ever seen the Amazon River. Nor had I been to the South Pole. And I reflected then that perhaps it was proper for a man who had seen so much to leave three unsatisfied targets.

And then, within 2 weeks of my having written that memorandum, I was by the sheerest accident possible at the Amazon, and a week later in Peking. That leaves the South Pole. I still feel as I did. It is proper that there should always remain one target over the horizon.

I was in Christchurch 2 weeks ago and went to pay my homage to that marvelous monument to Robert Falcon Scott, the great explorer who raced Amundsen to the South Pole. Amundsen went south to the Pole almost as if he were on a weekend picnic. Everything went right; he got there first; he left his flag; he returned without incident.

But Scott and his crew struggled south with everything conceivable going wrong, and on the way back, as you remember, they perished one by one. Scott, by some miracle, was the last left alive—certainly not because he shied away from the ultimate tests, but maybe because he was in superb psychological condition. And as he lay freezing to death, he wrote that remarkable letter to James Barrie in which he recounts what it is like to be an explorer at the moment of defeat, when everything has gone against you and the other man has got there first and you watch your companions die off one by one. Again, there is no finer statement concerning the nature of exploration than Scott's letter to Barrie. I commend it most highly.

I think, however, that when one deals with exploration, one has got to be aware that in every generation one field of exploration ends. We have done it. We have exhausted the possible. With Darwin we explored the beginning of life and the characteristics which modify it. As that epoch ends, we start something new. We are always at the end of something, always at the beginning of something else. This is true not only of societies, not only of total culture, but also of individuals. If we have no accomplishment, if we never know success, we lead embittered lives. But if we stop with one success and do not recognize that it stands merely as a threshold to something greater, more complex, more infinite, then I think we do only half our job.

Tonight, as we contemplate Mars, I feel as if I were standing on a threshold of immense dimension. All my life I have followed the explorations of Mars intellectually, philosophically, imaginatively. It is a planet which has special connotations. I cannot recall anyone ever having been as interested as we are in Jupiter or Saturn or Pluto. Mars has played a special role in our lives, because of the literary and philosophical speculations that have centered upon it. I have always known Mars.

But to be here tonight, to have seen that remarkable series of photographs which has come from that remote planet, and to realize what a weight of information they are bringing, what a freight of imagination and possible solution, is a moment of such excitement for me that I can hardly describe it. If the photographs I have seen do indeed show riverine action—I mean those marks which look like possible river terracing or the benchmarks customarily made by rivers—then I, for one, will have to admit that a major segment of my inherited knowledge has been shattered. Much of what I have believed about space will have to be revised, for we will now have in Mars a planet which once had a liquid component, which means that it had a substantial atmosphere, which means that it once had illimitable possibilities. Imagine living in the days when a discovery of such fundamental significance is possible!

The Moon never caused me much trouble. I had to revise few of my concepts. After all, getting there

was merely a technical problem. Scientists had already taught me as much about the Moon as I needed to know. It was a minor appendage attached to Earth; it was egocentric. But when you move out to a planet which is a creation comparable to our own and which has similar propensities and possibilities, then you are moving into a whole new orbit of speculation. The realization that in these very days, we are getting information from the threshold of our particular galaxy, an information which we can then apply to the billionth galaxy in farthest space, is to me an overwhelming experience. If subsequent photographs do produce evidences of riverine action, then we are faced with the question: Why did the water leave? What caused the great change? Is such change inevitable in all such successions? What does such evidence mean concerning life on other comparable planets, the billions upon billions of other stars that are in this galaxy alone and the billions of galaxies beyond them?

It is this kind of threshold that has always made the explorer's life exciting. And it is only one of the small number of thresholds that we live on right now: What are the ultimate capacities of the mind? How do cells operate? Which organizations of society are better than the ones we sponsor? I am much like the old man of Belem, apprehensive about the explorations, yet absolutely certain that they will go forward and that the triumphs and defeats that go with them will form a basic characteristic of man, and one of the best characteristics. As a one-time explorer I wish I could conform to Tennyson's statement in his poem "Ulysses." He was an older man when he wrote this, and he spoke of Ulysses, an older explorer:

"Come, my friends,
'Tis not too late to seek a newer world.
Push off, and sitting well in order smite
The sounding furrows; for my purpose holds
To sail beyond the sunset, and the baths
Of all the western stars, until I die.
It may be that the gulfs will wash us down;
It may be we shall touch the Happy Isles,
And see the great Achilles, whom we knew.
Tho' much is taken, much abides; and tho'
We are not now that strength which in old days
Moved earth and heaven, that which we are, we are—
One equal temper of heroic hearts,
Made weak by time and fate, but strong in will
To strive, to seek, to find, and not to yield."

COUSINS:

Jim, there was excitement in your voice and manner when you spoke about the way your mind was affected by the landing on Mars, but I must say that there was even more excitement in your voice when you spoke about the human spirit. I just wondered whether, when you described the old man of Belem, you also thought of Hemingway's *Old Man and the Sea*.

MICHENER:

I think that the human spirit, as it manifests itself in some six or eight billion people, will always have that capacity to explore. To kill that off at any point would be disastrous . . . disastrous.

COUSINS:

It has been my privilege for at least 6 months now to be associated with the gentleman at my right, Captain Cousteau, in the sense that we both work for the same magazine. And I would hope, Captain Cousteau, that we can come to you in your role as an explorer. Why do you do it? What leads you to these vast watery wastes? What is it in your soul that makes you want to do things that have never been done before?

JACQUES COUSTEAU

Jacques-Yves Cousteau has dedicated his life to the exploration of Earth's seas and oceans for the past 30 years.

Born in St. André de Cubzac, Gironde Province, France, in 1910, he entered the French Naval Academy in 1930. After several naval assignments, including campaigns in the Far East, he began a series of diving experiments in his spare time.

Investigations began in 1936 with various prototypes of breathing apparatus, leading to the conception of the aqualung in 1943 with Emile Gagnan. This invention made possible, for the first time, a more extensive exploration of the oceans by mankind.

During World War II, Cousteau participated in the French Resistance, helping organize the French Navy Experimental Diving Unit at Toulon. He also helped de-mine the harbors of several areas.

In 1950, Cousteau acquired the ship *Calypso*, a minesweeper of American construction that was transformed into an oceanographic research vessel. Scientific investigations aboard the *Calypso* include expeditions off the coast of Greece; in the Red and Black Seas; and in the Atlantic, Indian, and Antarctic Oceans. Famous among these exploits are the archeological digs at the site of an ancient wreck near Marseille. Cousteau also created a nonprofit research and development association through which to conduct his experiments.

In 1950, Cousteau, collaborating with Andre Laban, was the first person to perfect underwater camera equipment for television transmission. A year later, he created two companies for the manufacture of underwater equipment.

He was elected Director of the Musée Océanographique of Monaco in 1957. He left the French Navy with the rank of Captain of Corvette.

Cousteau helped develop a highly maneuverable two-man submarine, the *Diving Saucer*, and has conducted several saturation diving experiments: Conshelf I in the area of Marseille (1962), Conshelf II in the Red Sea (1963), and Conshelf III (1965), a version that permits six men to live and work for 3 weeks at a depth of 100 meters.

JACQUES COUSTEAU

If I want to answer your question, I have to turn the clock quite a bit, because of the 40 years that this has been going on, at the beginning as an amateur and then as a professional. Then, I shall recall a story. This is the story. After an exhausting day that was interrupted by two air raid alarms in our Marseille apartment, my wife and I had hastily packed all our belongings in trunks and suitcases. Our two boys, aged 6 and 4, were fast asleep. We were to leave the next day for Lisbon, where I had been commissioned as an assistant naval attache. Suddenly, over the radio we heard the announcement that close by in Toulon the French fleet had been scuttled rather than have it fall in the hands of the invading Germans. Our tears were for the loss of our fleet—the last trace of independence, of pride, and of hope. The next day my nomination to Lisbon was canceled, my diplomatic career was aborted, and I became a sea explorer. In my case, I could simplify the answer to the subject of this symposium, "Why Man Explores": I was cut out for exploration by tragic events. Others become explorers by rivalry, by despair, or to get away from their wives. And I wonder if anyone can seriously pretend that he always steered his life the way he wanted it to go.

One of the most exciting expeditions of my life to date is the current archeological exploration of Greek waters, where we are looking for remains of lost civilizations as well as looking for archeological lessons from antiquity generally. I am going to recall this because I think it is typical of the mental mechanism of exploration. Our research vessel *Calypso* arrived in Crete and we docked in the harbor of Heraklion on the north coast of Crete near Knossos. A violent North Sea storm, the wind named "Meltem," made our situation almost intolerable inside the harbor, in spite of the fact that we were sheltered by a modern jetty built of concrete. Then as a sailor I started reasoning that in antiquity the tiny primitive harbor of Knossos could not have protected the ships of King Minos from Meltem. Looking at a map, I deducted that the only safe anchorages in case of Northern winds were to be found on the south coast of Dhia, a small island lying only 8 miles north of Crete. That was a deductive standard mental process called vertical thinking.

We explored the waters around Dhia, in depths ranging from 20 feet to 300 feet, with divers and our exploration submarine. We discovered six ancient shipwrecks ranging from the 16th century A.D. to the first century A.D. The ships were carrying bronze guns, copper and silverware, hundreds and even thousands of amphorae, and dozens of large blocks of marble, some of them ornate or sculptured. They may have been the remains of a stolen palace or a stolen temple transported in parts, like the famous Hearst Castle.

We were about to leave when my chief diver, Albert Falco, asked me to let him have a last swim near shore. He snorkeled in the bay of St. George in Dhia while we were

warming up the motors to sail away. He came back reporting that he found a strange heap of stones of colossal stature – nothing much after all, a few stones or maybe . . ., maybe something unexpected. This last-minute find, vague and dubious, did not fit into our program. We were to explore the southern coast of Crete. I hesitated for one minute and then I stopped the motors. There was no committee I had to report to for a change of program.

There was no logic for abandoning our initial program. Falco's hesitant report appeared to be uncorrelated with our aims. Forty years of exploration had repeatedly proven to me that the deductive process of thinking – vertical thinking – although it is a powerful tool, rarely leads to a breakthrough discovery. Independently, lateral thinking, the process by which the mind scans events or facts that are apparently uncorrelated to investigate whether in reality they could be even remotely correlated, has often led us and many others to important breakthroughs. What followed is endless. The heap of stones proved to be a large submerged manmade harbor of probable Minoan origin. Then – back to vertical deduction this time – we thought that if there had been a harbor on that desolate piece of rock (the island of Dhia), then there also necessarily had been human settlements. Our helicopter made a photomosaic coverage of the island, revealing several villages or towns and a huge Cyclopean fortification system, totally erased today – we could only see traces of its foundations on the photographs, taken with low Sun for contrast. Minoan fragments of pottery and at least one Minoan idol on land were found before an excavation was made.

A full-scale underwater excavation of the harbor – a 3-month effort – confirmed all our theories. Five thousand years ago the island of Dhia was a paradise covered with woods and refreshed by large rivers, a paradise where Theseus eloped for a famous honeymoon with Ariadne, daughter of Minos, after he killed the Minotaur. Then the island was progressively deforested to build or repair ships and to cook dinners in the thousands of homes. Dhia succumbed, probably 4000 years ago, from overpopulation – a lesson of ecology from antiquity. Then 500 years later, the explosion of the volcanic island of Thera, better known as Santorini, raised a 300-foot-high tidal wave that washed clean the island from its fortifications, villages, towns, walls, harbors. Ever since, Dhia has remained a desolate rock. This major discovery is going to lead, certainly, to decades of very difficult and systematic excavations on land. Then it was no more our business and we went on to some other discoveries.

When man explores for resources, his motivations are clear. They are what we call, superficially, logic. But why would we spend one full year of our lives and over $2 million just to raise a tiny corner of the veil concealing a few episodes of our past? What is the origin of the devouring curiosity

that drives men to commit their lives, their health, their reputation, their fortunes, to conquer a bit of knowledge, to stretch our physical, emotional, or intellectual territory? The more I spend time observing nature, the more I believe that man's motivation for exploration is but the sophistication of a universal instinctive drive deeply ingrained in all living creatures. Life is growth — individuals and species grow in size, in number, and in territory. The peripheral manifestation of growing is exploring the outside world. Plants develop in the most favorable direction, which implies that they have explored the other orientations and found that they are inadequate.

Some plants send feelers at great distances; they send avant-garde shoots before they invade the space that has been acknowledged propitious. For young animals the world is to be explored and discovered from their birth on, and that exploration only ends with death; for the young fox, wilderness is unlimited; for a tuna, the oceans are infinite. Still in the animal world, the physical need for exploration develops as well in individuals as in collectivities — tribes, schools, swarms, packs. In fact, if the baby human being shows the same motivation as a young cat, to explore with all his sensors the strange environment he was born into, the big difference is that the little baby soon stands erect. That radical change came in evolution the day described so well by Ovid, a few years after Christ was born. "God elevated the forehead of Man," wrote Ovid, "and ordered him to contemplate the Stars." Nobody has better described the advent of the mind. The little boy's drive for exploration is soon curtailed temporarily by language. The human species is the only one that has the ability to transfer to the new wave of men, through language, printed material, and electronic media, the results of the exploration of the world performed by previous generations.

Most individuals find their hunger and their thirst for discovery satiated by learning. Learning and experience are factors that often extinguish curiosity, but for those who suffer from an unquenchable intellectual thirst, of course, learning is a fabulous springboard. The exploring part of a plant, of a creature, of a crowd, is always the most vigorous, the most enterprising. When the shoots of a plant, a wisteria, for example, slowly creep over a wall, they are the privileged parts of the plant — those that are favored with the largest circulation of sap. From a purely physiological standpoint, in the American conquest of the West, the American pioneers, who often were originally European outlaws or very rough adventurers, were biologically the cream of Europe; and it took Europe more than a century to recover from that loss of substance.

When the impulse to explore built in each individual human being is confined or antagonized by a rigid social or familiar structure, it may be forced into unnatural drives — exploring alcohol, drugs, or sexual perversions. Drug addicts are perverted explorers. Today, most of the modern explorations are

projecting the mind inside out. They need collective efforts, being no more at the scale of an individual. When the tools are not there – money, technology, instruments – some human minds, on the contrary, turn themselves outside in, looking towards immediate knowledge through contemplation. The exploration drive, pure and natural, is associated with risk, freedom, initiative, and lateral thinking. The enemies of the exploration spirit are mainly the sense of security and responsibility, red tape, and exclusive vertical thinking.

To conclude, if you allow me, as a man who has dedicated his life to exploring the water world, it is a special satisfaction for me to turn to the etymology of the word "to explore": from ex-plorare – to make to flow.

COUSINS:

Captain Cousteau, we're all in your debt for the privilege of being able to explore that junction where science, philosophy, and poetry meet in the modern world.

Ray Bradbury, when on July 20, 1969, we got the headlines about the Moon, I thought it was a terrible injustice that they did not at least run the subhead, "Ray Bradbury, Vindicated." You've been at the head of this parade a long time, Ray Bradbury, so I think it's natural for us to ask you, What next? What do you see ahea :?

RAY BRADBURY

Ray Bradbury is a prolific writer in a field of literature, often called science or futuristic fiction, that seeks to extend man's present into what may or may not be his future.

Bradbury has published more than 500 short stories, poems, novels, and plays in the past 35 years. His work has appeared in almost all major U.S. magazines, from the *Saturday Evening Post* to *Playboy*, and from the *New Republic* to *Harper's*. His work has also appeared in *Weird Tales*, *Amazing Stories*, and *Dime Detective*.

Novels by Bradbury include *The Martian Chronicles*, *Something Wicked This Way Comes*, and *Dandelion Wine*.

Films have been made of his novels *Fahrenheit 451* and *The Illustrated Man*, and his stories *The Picasso Summer*, *The Beast From 20,000 Fathoms*, and *It Came From Outer Space*. He wrote the screenplay for John Huston's 1954 film version of Herman Melville's *Moby Dick*.

Bradbury formed his own stage group, The Pandemonium Theatre Company, in 1964 to produce his plays *The Anthem Sprinters*, *The Wonderful Ice Cream Suit*, *Dandelion Wine*, *Any Friend of Nicholas Nickleby's is a Friend of Mine*, and *Leviathan 99*.

He spent 35 years writing his first book of poetry, *When Elephants Last in the Dooryard Bloomed*, that was recently published. His latest book is *Pillar of Fire*, three one-act future time plays. He is finishing work on a book concerning creativity, entitled *How to Keep and Feed a Muse*, and his next volume of short stories, *Long After Midnight*, will be published this year.

RAY BRADBURY

Everything, the Universe of course, and it remains tremendously exciting. The one question that is asked time and again by people who think they are being practical is, "Haven't they caught up with you?" Well, of course not, because we haven't caught up with the Universe yet. We're at the rim of the cave, and I'm the maker of metaphors – I've discovered this along the way. I can service the cause by trying to find metaphors to fit what we're doing. We survive in so many ways. I'm reminded rather facetiously of this and I give you a humorous example. I have a friend, Chuck Jones, the cartoonist, who calls me all the time with revelations he finds in dictionaries and all kinds of reference books he is reading. He called me on the phone and said, "Ray," and I said, "What?" He said, "Did you know?" I said, "No, tell me." He said, "Did you know that when they were building the Trans-Egyptian Railroad across Africa 100 years ago and they ran out of fuel, they would stop the locomotive, run into the nearest graveyard, steal mummies out of the tombs, bring them back, shove them into the firebox of the locomotive, and use them as fuel to go across Egypt late at night?!" I said, "That's great!" I threw down the phone, ran to my typewriter, and wrote a poem called "The Nefertiti-Tut Express"! Well, *there's* a metaphor of survival, isn't it? If a mummy works, you burn it. And all the Egyptian gods and goddesses haunt you across the desert forever after that. This metaphor reminds me of Nietzsche's old saying, *"We have art that we do not die of the truth."*

We Americans suffer from too much data, too many facts, at times. We are bombarded by it on our television. One of the problems we've had the last few years, that NASA has had, is that we have seen almost too much Space and have seen the wrong kind. We have been given the facts over and over again, and they are always diminished by what I call the aesthetic of size. Television diminishes everything it touches and makes it small. It takes a rocket that is 300 feet high and crushes it down to a 14-inch image. I have used this sort of comparison time and again over the years; I've told my friends that one of my favorite films is King Kong, that everyone should go see it, it would be good for them. And people see it on television and come back to me and say, "What are you talking about? I saw Kong and it wasn't that much." I said, "No, no, you mustn't see it on TV, there you hold Kong in *your* hand. You've got to go to the theatre where Kong holds you in his hand and drops you off the side of the Empire State Building." So it is with the Space program.

The first time I went to Italy, I saw the real Renaissance paintings, a real Botticelli, a real da Vinci, or whatever it was, or a Tintoretto. These things were larger than myself. A really fine Botticelli is bigger than ourselves, and as we stand before it, an incredible light comes out of the frame and we are changed. We've been raised on

a culture where we hold things in our hands – books – they're smaller – they can be shut. And you're bigger than Botticelli. We are raised on TV, which we treat as children. Anything that we are larger than, we have contempt for. The TV is smaller than ourselves, so anything we see on TV must be contemptible because of that aesthetic. Now, as soon as the screen gets larger, we begin to sell the Space Age again, because the Space Age is titanic; it's a whole Universe we are talking about. But we've been doing it all wrong; we're data oriented when we should be poetry and symphony oriented. That's my business – to find the metaphor that explains the Space Age, and along the way write stories.

Let me give you an example of the sort of thing I do. I'm going to be repeating these metaphors again and again during the evening that sum it up for me. I wrote a story about a year ago about a spaceship going off into Deep Space. Everyone else onboard the spaceship has gigantic lady toys to take along and wind up – robot women for the journey. But I, as a frivolous intellectual, take along on the journey a special old robot that I summon to life every night. I go down below by the great engines and I speak into the dark and this old man intellectual robot wakes and – How do I wake him? – I say, "Shaw, Mr. Shaw, Mr. George Bernard Shaw?" And this robot blinks his eyes and sits upright and says, "By God, I do accept it." I say, "What?" He says, "The Universe. It thinks; therefore I *am!*" And we are off and running. How would you like to fall through Deep Space in the arms of George Bernard Shaw? I can't think of anything better, so I wrote a story.

Along the way, I take my robot Shaw up above and we look at the stars together and we begin to talk of the Future and we look at the great Universe and the great Milky Way, and we drink in the night together. And he points his beard at the Pleiades and we talk great talk and finally I say to him "Say it, Mr. Shaw," and he says, "What?" I say, "You know what I want to hear, say it." He turns to me and he begins to explain everything that he is looking at and he says, "What is this Thing? What is the Life Force in the Universe? What is this remarkable thing that we are? We are matter and force changing ourselves over into intelligence and will. Into imagination and will! Matter and force that does not know itself, changing itself in the long night of the Universe into imagination and will, willing itself to survive." These words are from Shaw's religious science fiction writings of 50, 60, and 70 years ago that I put in a story to explain just what we are doing in Space in the first place.

And after I had finished a story like that, I finally wound up going down to Kennedy Space Center 4 weeks ago for the first time. I am taken to the vehicle assembly building, I walk in and they take me up in the strut-works, 500 feet above the hangar floor, and I look down at the great rocket engines, the great containers of Saturn components waiting to be filled with energy to go off to the

Moon on another journey. I am in tears the whole afternoon. I am looking down 500 feet at this and I look at the hangar itself. I try to find the metaphor to explain this titanic thing I am looking at and the only thing I can think of is that I am walking around inside Shakespeare's head. That is the metaphor. And then you come down out of all of that and you write a poem. Now that I have you trapped here, here is the poem:

"Othello's occupations, here they lie
In countries where the space men flow in fire
And much desire the Moon and reach for Mars
And teach the fiery atoms how to sing
And bring intemperate blood to God-lost lands
To warm his snow-frost lunar sands
And never ask To Be or Not To Be
For here All Is
And is again at our behest.
Man's quest makes footfall here
for transfer across space
To lift mankind. Here blind
We catwalk breadths and heights,
Fix sights in rare assembly shops
As vast as Shakespeare's mind
And think that Melville once drowsed here
And dreamt the Beast awake,
Pumped Lox for blood
And with one quake of God's triumphant voice
Made rocket blast
Thus rousing lunar whales to swim in star tides vast.
But this too solid flesh will fall,
Resolve itself into a dew.
No, ask this solid flesh to rise,
Resolve itself into a fire,
Conspire to see and know and build and try,
For if God's dead
Then Man will surely die. But all being one –
It is, it is! God, Man, Ghost takes as bride,
Entire comet Universe, to yoke with pride.

Put out the light
And then put out the light?
No, No, rekindle night!
And then rekindle night.
Othello unemployed, now reemployed
To summon racial memory from Jung and Freud
And in genetics marrow.
Seek God's Will, to find lost man
And send him up the hill of stars
To change the dreadful dates of 1984 and
send them up with shouts
To make a score man could not dream or hope or
care to do.
Make Orwell laugh in year 2002.
Grand Things To Come? Yes. Cabell stands here,
the towering son of Wells, who saw a sea of
wheeling orbs and sparks and cried,
'Which shall it be,'
Sink back to dust and tomb, to worms and grave,
Or onward to lost Mars and mankind save?
And star-blown winds then echo endlessly,
Which shall it be?
Oh wandering man, which shall, which shall it be?

I tread this place and read his time and dream,
his corridors of night,
His islands lost in time. His thunders, rumors,
Questionings of self
To be or not to be on Saturn's shelf.
I measure our vast journeys in his head
And find alive what was considered dead.
From ear to ear tread halls of fire blood
Where room in room like chambered Nautilus lost
man makes neighborhood
Of Kennedy-Canaveral – Avon's birthing place.
Not lost? No no, not lost in dust
Or rain or falling down of years.
From Yorick's skull, God's manifesto peers.
From graveyard dirt he shapes a striding man
To jig the stars and go where none else can.
What pulls him there in aeroflights of ships?
A birth of sons that fall from Shakespeare's lips.
Not dumb dull TV news inspires lost man
But will,
Who turned in sleep earthquakes are plan
And answers Job
Whose agonies and sulks ask why
This fragile flesh is thrust forth cold
To sink and die

'Not so!' says Pleiades for tongue,
'Not so, not so!'
From Stratford's fortress-mind we build and go
And strut-work catwalk stars across Abyss
And to small wondering seedbed souls do promise this:
To Be is best
and Not To Be far worse
And Will says What?
Stand here, grow tall, rehearse.
Be God-grown-man,
Act out the Universe!"

Open Discussion

COUSINS:

In just a minute or two, all of you will be invited to recite verse to the panel. But before we turn this meeting open to general discussion, I wonder whether any members of the panel would like to comment on what has been said so far.

MICHENER:

We have been discussing exploration as if it were always the product of individual action . . . an individual responsibility. I wonder what responsibility society at large has for the sponsorship of exploration.

MORRISON:

Well, isn't it clear it is really a social exploration? The men who stood on the Moon were the point of a tremendous company of people who thrust them there. Now we send our instruments out. Here locally there are 1000 persons, more or less, who must read and mark what the instruments see and feel. That makes a world very different from the time when a ship's band circumnavigated the globe. True, they too were mounted by the yards who supplied ships and stores. But it seems to me the imagination has not yet succeeded in conveying to people in general what kind of role one can have in today's complex exploration. Very many are the indispensable porters, and only very few are the intrepid mountaineers.

COUSINS:

In the brief exchange we had before we came out, Ray Bradbury had a comment on just that point. Ray, would you care to talk about your pyramid.

BRADBURY:

Yes. Well, again we are talking about making the metaphor to show to ourselves what we are doing. We have already led up to it here. NASA should make a 3-minute film showing the base of the pyramid, 100 000 workers. This would be a giant rocket structure. Actually build a rocket as your metaphor. The bottom of it is 100 000 people that have been active in building the Apollo rockets or the spaceships that have taken the Lander off to Mars, and the second level of that rocket is 50 000 people. The next one is 25 000 people, the next is 10 000, then it is 1000, then it is 2 dozen, and then it is 1/2 dozen. Finally, it gets to the three men who landed on the Moon. You take that whole metaphor, build it in a structure, and shoot it up into space. Thus, you create the metaphor of all the men and all the women in our society who built the Apollos and fired them off. I have never seen this done by NASA. Again, we are so data-oriented that we have not bothered to find the metaphor.

COUSINS:

Captain Cousteau, can that pyramid ever take shape and the people inside it ever be inspired to do something except as the result of a

few words from a single individual to start the process?

COUSTEAU:

I'm a true believer of two contradictory things, the importance of the inspiration from a leader and the necessity of a collective enthusiasm. They seem contradictory because inspiration cannot come from the mass – it has never come from the mass – but inspiration can do nothing without the mass. Thus, the types of things that we were talking about today in flight explorations have to be inspired and triggered by a leader, but they have to meet with the acceptance and the enthusiasm of all the crowd. That was the case for the first years of space exploration. One of the reasons why it cooled off a little was a certain amount of poor public relations. There was nobody like Ray Bradbury to force NASA to make really striking films; 3-minute films would be enough, and they – my friends at NASA, I can criticize them very gently – were turning out 3-minute films. But all the films that have appeared as public service spots were terrible. I mean they are boring to death, and this is partly due to what I called organization and red tape and all the enemies of exploration that are there immediately as soon as a big exploration tries to organize. I am strongly against organization charts. I think that people have to build their own rectangle in the chart by depth qualities and this rectangle moves; it does not stay there. As soon as you begin to organize something, it is dead. An exploration cannot die; it has to be alive. There is one phrase that we use that I don't like: whose responsibility is it. I hate the word "responsibility" on exploration. But I don't think that there is a social responsibility for exploration. I think that there must be social enthusiasm for exploration. It is very different.

COUSINS:

Jim, do you agree . . . ?

MICHENER:

No, I don't agree at all. Not at all. I think that society goes forward not only with the bright insights of individuals but with a general consensus among the population that great things are afoot and that they will support it. I find this in most of the great exploring societies: Portugal in the 1450's, Spain in the 1490's, England in the age of Elizabeth, and the United States for the past 15 or 20 years. I don't want to see this base eroded in any way. I am fully convinced that in exploration as in so much else society progresses only with good leadership supported by a vital, committed public.

COUSINS:

Questions from the floor please.

COUSTEAU:

That's exactly what I said. We don't disagree.

FLOOR:

Captain Cousteau.

COUSINS:

Could you identify yourself please?

FLOOR:

I am Jerry Soffen, the Project Scientist. Your concept of vertical deductions and horizontal scanning is very new and very provocative to me. We are about to embark on this marvelous adventure in Viking. How can I sensitize myself and the other Viking workers to take advantage of those concepts?

COUSTEAU:

There are books about lateral thinking. The best ones I know are by a British author called De Bono, and I recommend them to you. He gives a very striking example of lateral thinking: There is a doge in Venice who, like all doges, too old and ugly, falls in love with a 16-year old beautiful maid – a classic story – and he proposes himself to the maid. The maid laughs it off, "How could I get married to a man of your age?" The doge is furious and pleases to follow the maid, the story continues. Finally, after enough adventures he offers to make a deal with the maid. He said, "Look, okay, let's put in a bag two spheres, two little spheres, one white and one black. We will shake the bag. You'll pick up one of the balls. If it is white, I free your father and you are free. If it is black, you marry me." The maid thinks a little while, and says, "okay," and she gets close to the window over the canal in Venice. The doge hands over the bag to her. She picks up one ball and without looking at it throws it quickly into the canal. "What did you do?" asked the doge. "Why, it's so easy. Look at the ball that remains in the bag; it's black." So that's lateral thinking. She had anticipated that the doge would have put two black balls in the bag.

COUSINS:

Next question, please.

FLOOR:

I have a question for anyone, I can't select between all of you. What do you think or dream or hope will be the effect on all of us if, perchance, we find any form of life on Mars or elsewhere?

COUSINS:

Phil, would you like to begin?

MORRISON:

Well, I'll begin. The enthusiasm for Viking is an old one, of course, it began with that particular dream. I remember the days before it was quite well established that it would happen, and we were all saying that all we really needed to reduce our presence here from what it now appears to be – an interventionist miracle of the most extraordinary kind – was any kind of counterpart, however faltering, however tenuous or incomplete. Given one new start of life, we could say at least we had become a statistic. (I don't know whether statistical thinking is not the third kind, besides vertical and horizontal; probably it is.) If I have to argue vertically, I would say, mind you, we will probably not find it. We will find some fascinating things that we will be worrying about for another 5 years. Still there's a chance, a real chance. I hate to speculate so late

in the voyage; we ought to wait for a month or two until we see those pictures. The donkey has almost caught the end of the stick. Surely he should get to taste the carrots before we speculate whether they are real or false!

If there were life in any way, it would release a great deal of imaginative force. For me, at least, it would assure another kind of search we can make, another kind of exploration, staying here physically, but looking for signals, hoping to find somewhere out there our own venerable counterparts. They are much beyond us, modifying their world, making signals, making their stars shine up brightly in some unknown frequency in some unknown directions. Maybe we should start looking for that too, I am sure that the best possible support for that would be finding a strange Martian clam shell in the old delta that we are going to explore. Even if it is not there, that isn't going to end my enthusiasm for the next exploration. But I admit it will slow me down!

COUSINS:

Jim Michener.

MICHENER:

In my comments I didn't speculate about finding life on Mars; that's beyond my capacity. I did speculate upon finding evidence of riverine action of some magnitude in past times. Well, obviously, I'm dodging the question, because if you have riverine action, what was in the river? And we know enough about the action of water to realize it carries a presupposition of burgeoning life. However, at this moment I don't require life on Mars to excite me. All I require is a knowledge that Mars at one time had the capacity for it. Because if Mars had that capacity, and we have the capacity, we've become not guesswork but a statistic, a sample of two! We can project that statistic out to the infinity of the universe, and my mind dwells on life out there, not on Mars.

MORRISON:

I must say that an hour and a half ago at a little gathering here, I asked a very well-informed person what was flowing long ago in that river, and he said, "Well, perhaps it was hydrochloric acid!"

COUSINS:

Captain Cousteau.

COUSTEAU:

Well, if there were oceans, apparently they are dried out. So I'll . . .

COUSINS:

No place for you to go?

COUSTEAU:

It's not my cup of tea. But if there is life, it is extremely different from life on Earth. So if there is any life, then we know that it will be worthwhile going there to study seriously. And at that time it will raise all the problems of preventing the astronauts and the ships, when they come back, from contaminating the Earth with unknown germs. But, learning from entirely new forms of life would

be, for biology, I think, something entirely fascinating, very fruitful, and would accelerate the sure drive that we are making the world's immortality.

COUSINS:

Ray Bradbury.

BRADBURY:

I would like to turn to someone like Nicholas Kazantzakis, and remind you of his writings at this opportunity. He wrote a remarkable book called *The Saviors of God* – it's available in paperback. It's unusual for one writer to plug another on an evening like this.

COUSINS:

He's dead.

BRADBURY:

And a bestseller. But he goes into many of the things we've been discussing tonight. I hope that a lot of you will leave here and go and get Kazantzakis' book *Saviors of God*, because he speaks again of the Life Force. If we find even the smallest bacilli or green forms on Mars, that means life in the Universe, one more part of ourselves, no matter how small. It's very important that we discover this.

But I would like to shift gears here for a moment. I wanted to say something earlier on this. People are always saying – and I am tired of hearing this – I'm going to strike the next person that asks me this, "With so much to be done in the world, why are we spending all this money on space exploration?" If I hear it once again! Heavens! It's *still* being asked!

I did some research down at Cape Canaveral. I got out the figures on what we've *actually* spent on Space. It is so small! You wouldn't believe the *small* amounts! In any one year in the last 15 years, we've spent 1/50 of 1 percent of the military budget – 1/50 of 1 percent! In the biggest year when we spent $500 million, that is only about 1/2 of 1 percent of the military budget for that year. This year we are going to spend $118 billion on weapons we cannot use, do not *dare* to use. Next year it is going to be up to $140 billion. *There's* where the money is! For Pete's sake, stop asking me about Space money, and go to the Pentagon with me and grab all *that* money! O.K.?

COUSINS:

I find it difficult to resist getting into the act here. I would say that I would hope that the certain knowledge that life exists elsewhere in the universe, would produce a desire to make life on Earth safe and fit for human habitation. I'd also hope that out of it might come increased respect for the fragility of life right here. Are there any other questions?

It's hard for us to see you, but perhaps you can step forward to the microphone. Is anyone saying anything? One more.

FLOOR:

I wonder what your predictions are at the Tricentennial. Are we likely

to be celebrated, we Vikings, or are we likely to be forgotten? Does it depend on our discoveries, or does it depend on our energy?

COUSINS:

Will there be anyone left to celebrate, sir? Jim, would you like to respond to this question?

MICHENER:

Well, as a member of the commission responsible for the celebration of the Bicentennial – we accomplished so little – I can only say that I have thought for some time that the United States has enough kinetic energy to carry it through the next 75 years successfully . . . and conspicuously successfully. I think we have enough educated people, I think we have enough intellectual leaders, I think we have enough raw materials. I think we have an absolutely stunning system of tripartite government which most of the nations of the world either don't have or are not able to operate. So I would think that our energy and being will carry us through another 75 years. I do not foresee the collapse of the United States in any conceivable form. I can see the loss of cities through enemy action, a hydrogen bomb here or there, but even then I do not see the end of American civilization. I cannot conceive of this within the next 75 years.

Beyond that, I am apprehensive. I think that we are a fragile society. I think we have the capacity for self-destruction. For example, I would expect to see Canada fragmented in the next hundred years, part of it coming with the United States, part elsewhere. I am very apprehensive about Central America, because of their extreme growth of population. And I think this sort of inevitability might overtake us by the Tricentennial, and we might by then be in very serious trouble. How we would look back upon this period I don't know because I would suppose that coincident with our troubles, there would be other great forces coming up in the world; there would be other hegemonies and we would be forced to operate in relation to them.

I have every confidence that as long as this planet stays warm, there will be sentient human beings who will be fighting the kinds of battles that we are fighting tonight . . . with greater or less success. I think the knowing people in those days will have to look back upon our generation as one of great exploration, the way we look back upon the Portuguese, the Spaniards, and the British. In their days of intellectual adventure, we were not a craven society.

MORRISON:

Could I add a remark appropriate to your last sentence? It is true and amply documented, but very little known. It has to do with the time of the discoverer, the hero of Camoens, Vasco da Gama. When Vasco da Gama sailed around the Cape and up the coast of East Africa, he landed finally in Malindi, a little port, rather sleepy now and partly in ruin, but still a working place, a small town not far from the big port, Mombasa. There he negotiated to find a skillful Muslim pilot who would

take him to the ports on the coast of India where he was bound. Having made the Cape, he knew he could get there. But he wanted local pilotage. He hired the best pilot. In fact, there was a family of persons who lived in that port, who were all great pilots up the coast to the Arabian Gulf, and down the coast of India. He hired a man, and that man's diary, his journal, is in our hands — an able and literate professional navigator and pilot. Now the remarkable thing that I want to tell is not that fact; that's just the context. But that pilot's grandfather, that very man's grandfather, had been hired in the same port 50 years before as a pilot, by a *Chinese* fleet that had come the other way bound for the unknown Cape of Good Hope, but never quite got there. The Chinese admiral was making successive voyages just as Henry did later, until the political situation back home in China changed. We cannot find great treasure fleets of the Chinese farther down the coast than somewhere around Mombasa. But there's a feeling that maybe one junk tried it. On the famous Fra Mauro map, it actually says that — "A junk of the Indies crossed the Cape in 1460 — something." But that's still conjectural. We don't have the documents. Both in Lisbon and in Peking the succeeding bureaucrats in large part destroyed the files. We have a very hard time reconstructing those times. All this is to say in the first place that we of the West have no monopoly on discovery. Ours is the discovery that happened to remain continuous; it doesn't really depend so much upon what you do but depends on what happens afterwards, whether what you do is part of a visible continuous stream, or is looked at only by the scholars later on who try to put the unfamiliar pieces together.

COUSINS:

You'll have to forgive us if we can't see your hands because of the lights, so if you would just stand up and speak, we'd be grateful. Are there questions, please? Yes, sir.

FLOOR:

I'd like to ask the members of the panel. In the past, exploration has usually been followed by other members of society following in the paths of the explorers; for example, Captain Cousteau started people underwater swimming and diving and now it's a very popular pastime. I would like to ask a kind of two-folded question here: What do you think in the future, in the same kind of time period we are discussing toward the next centennial of the United States, might be the role of the widest section of society in following the footsteps of the explorers into the solar system? And then a second question, How far do you think our exploration might range? Also: Are there any limits? Can we reach the stars? Can we colonize the galaxy? Can we travel between the galaxies?

COUSINS:

Thank you very much sir. The words that stand out from that question, of course, are "the future" and "What do you think?"

That points to Ray Bradbury, first of all.

BRADBURY:

Do you want the 10-minute or 2-hour response? First of all on the earlier question I'll tell you a fascinating thing that is going on right now that I'm helping out on. One of the reasons that I am optimistic is that there are lots of people in the world, including all of us here on the platform tonight, who are doing things to try to change the future. We really *care* about that future. So during the last several months I've become involved with the Disney organization that is going to build a small city of the future in Florida during the next 10 or 12 years, a prototype which will hold about 50 000 people and will bring in students from all over the world. It will be a college community, actually. And if the city works, if we can look at it, we can put in 12 kinds of transportation instead of being locked into the automobile. We can put in solar energy. We can put in hydrogen energy. We can use all the energy sources we haven't yet used. That prototype city will be one more of what Schweitzer called the Example. Set an example, point to it. Then between now and the end of the century, build 300 more small towns across your country and save the people. We would begin to airlift people out of New York City, airlift them out of Detroit, airlift them out of Chicago! The poor things are dying there! We are busy airlifting people out of *other* countries, but we haven't begun to do it *here!*

Now this is a practical thing in which many large groups of people will be involved. If we do it right, it will be a true example and we can change the fates of our world. I think we can do it. I'm sure going to try! Now, what was the *other* question? Oh the future? Well, yes! We are going *out* into the Universe, of course. We go there because we love life. We go there because we are terrified of death. We go there because as Ahab said, "This was rehearsed by thee and me a billion years before the oceans rolled." It's in our genetics. We are set by genetics to do this thing. So we are going out. I'm essentially optimistic about it, and we will make it. I don't know how far out into the galaxy we will make it, but indeed we will.

COUSINS:

One more question, please.

FLOOR:

Gentleman, my name is Richard Rody. I'm from Palm Springs. It took all the exploratory energy I could muster to get myself from there to here. But aside from that I was wondering what do you think the significance will be of the findings of next week — not three hundred years from now, but next week — as far as the future extension of the space program is concerned? You feel that if we find life on Mars that this is going to inspire our country to do more or accelerate the rate of exploration?

COUSINS:

Any volunteers?

MICHENER:

I would like to reiterate that for me it does not all depend upon finding life on Mars. I think that we can explore whatever is there and then build from it and go on and on; I see no diminution of this exercise. I think we may have a drop in public support for the time being. That's why I'm so excited, so interested, about public support, because I don't want to see it drop. But if you go back to 1960 and counterlog everything that has happened since 1960, the rate is so tremendous that I can't see stopping it. We may stop it in the United States, but then China will pick it up; there are very bright people over there. If they drop it in China, Russia will pick it up. We are not bound to one group in the Los Angeles area at all.

COUSINS:

Captain Cousteau . . .

COUSTEAU:

There was one question of the previous inquirer that has not been answered. He specifically asked if we would be capable of going far out into the universe. Ray Bradbury has said, "Yes" without saying how. I'm sure he has thousands of solutions. But let me tell you what my solution is. I believe very much that in the course of three billion years of evolution, some species, a great number of species, have been created immortal because the aging process and death are the only way yet that the species could adjust to changes in our environment. Those species that were born immortal disappeared at the first changes in our environment. So I believe that biological immortality is possible and I think that we are going to learn soon how to achieve it for ourselves. When I say very soon, of course, it may be several hundred years. But biology is now in full throttle and is already beginning to manipulate genes with very great care. In a number of hundred years we will be able to create immortal man. That doesn't mean that he will not die, because there will always be accidents. He could be crushed and destroyed. He will not age and he will not die. For that reason he will be able to travel for thousands of years, if necessary, to reach other galaxies.

COUSINS:

We will make an exception. I believe you want to ask a question, sir.

FLOOR:

Okay, my name is Mike Van Ness. I'm a student and I was wondering about the theological implications of, well not only the results that will come back from Viking, but also behind the spirit of this question of why man explores about challenging absolutes. What is this going to do for man's future?

COUSINS:

In theological terms?

VAN NESS:

Yes.

BRADBURY:

May I try that?

COUSINS:

Certainly.

BRADBURY:

Happen to have another poem with me. I wrote about a robot priest in a play several years ago. This electronic priest stands up before the starship men before they go out into Space. He makes a speech similar to that of Father Mapple in Moby Dick. And the robot priest says:

"'Is God dead?' An old question now,
But once hearing it I laughed and said,
'No, not dead, but simply sleeping until
you chattering bores shut up.'

"A better question is, 'Are you dead?
Does the blood move in your hand?
Does that hand move to touch metal?
Does that metal move to touch Space?
Do wild thoughts of travel and migration
move behind your flesh?' They do.
You live. Therefore, God lives.
You are the thin skin of life upon an
unsensing Earth.
You are that growing edge of God which
manifests itself in hungers for Space.

"So much of God lies vibrantly asleep.
The very stuffs of worlds and galaxies,
they know not themselves.
But here God stirs in His sleep. You
are that stirring. He wakes.
You are that wakening.
God reaches for the stars. You are His hand.
Creation manifest, You go in search. He goes
to find. You go to find Himself.
Everything you find along the way, therefore,
will be holy.

"On far worlds you will meet your own flesh,
terrifying and strange, but still your own.
Treat it well. Beneath the shape you share the
Godhead.
You Jonahs travelling in the belly of a new-made
whale,
You swimmers in the far sea of Space,
Blaspheme not against yourself or the frightening
twins of yourself you find amongst the stars.
But ask to understand the miracle which is
Space, Time, and Life in the high attics and lost
birthing places of eternity.

"Woe to you if you do not find all life most holy
And coming to lay yourself down cannot say,
'Oh, Father God, you waken me, I waken thee.
Immortal We then walk upon the waters
of Deep Space in the new morn which
Names itself Forever.'"

COUSINS:

To the gentleman who asked the question: I don't think that, when Viking goes to Mars, it will be on a collision course with theology. Science at its best provides us with better questions, not absolute answers. The more we know, the more informed we are in our speculations; but the speculations will continue. Tonight we have attempted to ask ourselves, "Why explore?" I think we have attempted to express the view that the liberation of human beings from Earth gravity has enabled the species to become less theoretical about and less detached from the universe. As a result of these explorations, we have been able to perceive larger relationships. I think we will have an increased sense of human uniqueness.

The effect is philosophical. To be able to rise from the Earth; to be able, from a station in outer space, to see the relationship of the planet Earth to other planets; to be able to contemplate the gift of life unencumbered by proximity; to be able to meditate on journeying through an infinity of galaxies; to

be able to dwell on the encounter of the human brain and spirit with the universe — all this enlarges the human horizon. It also offers proof that technology is subordinate to human imagination. We went to Mars not because of our technology, but because of our imagination.

So long as human beings do not persuade themselves that they are creatures of failure, so long as they have a vision of life as it ought to be, so long as they can comprehend the full meaning and power of the unfettered mind, so long as they can do all these things, they can look at the world and, beyond that, the universe with the sense that they can be unafraid of their fellow humans and can face choices not with dread but with great expectations. Don Hearth.

HEARTH:

It is very hard to conclude this evening, but we must. I would just like to express to Norman and to the rest of the panel my appreciation for their coming this evening and sharing their thoughts on a very difficult question. Thank you very much. That concludes the program.

NASA-Langley, 1976

The first photograph taken on the surface of Mars obtained by Viking 1 minutes after successfully landing on July 20, 1976.