Fred Hoyle after dinner speech after 1st Lunar Science Conference

HOUSTON 6 January 1970

Mr Mayor, Dr Frondel, Ladies and Gentlemen,

I am greatly honoured to be speaking to you tonight. Usually I find afterdinner speaking difficult, but with this cosy and intimate atmosphere which we have here tonight my task is an easy one.

'Feast, and your halls are crowded', says the poet,

'Fast and the world goes by'.

My old grandfather was a poet. One day he called me specially to him:

'My boy' he said, 'let me give you a word of advice that will stand you in good stead all your life. Always keep better company than what you are yourself'.

Well, I'm sure everybody here tonight will agree that I'm doing my best to follow my old grandfather's advice - to do him proud, as we say in Yorkshire.

Returning to this cosy and intimate atmosphere I see many familiar faces. Here close beside my is Harold Urey. I've learn't a lot of things from Harold, especially about chemistry. But one day, just like my grandfather, he said

'Let me give you a word of advice that will stand you in good stead all your life. Never make the mistake of admitting you're wrong too soon'.

I've worked hard at this advice and I've more or less got the hang of it. When it was first announced that Man would reach the Moon before 1970 I immediately said

'I'll bet he won't'.

In fact I didn't abandon this point of view until I saw Mr Armstrong's foot stretching down - and down - and down. And even then I took good care to rush over to the TV screen to make sure that the magic word SIMULATION wasn't written at the bottom of it.

When I was turning over in my mind what I should say tonight I naturally remembered that the craft which conveyed the astronauts of Apollo 11 to the lunar surface was named EAGLE. So I thought I'd look up a few resounding phrases about eagles.

I found a European proverb which says

'The eagle does not eat flies'.

Encouraged by this discovery, I consulted my volume of Chinese proverbs. Unfortunately the Chinese are thin on eagles. All I could find was

'The eagle does not eat flies'.

By this time I'd become convinced that eagles don't eat flies, but this seemed more in the nature of a useful piece of information than something suited to an occasion like this. So I decided to fall back on an utterance by one of your Senators :

'The American eagle' he said, 'will continue to guard whatever territory comes under the shadow of its wings - so long as it chooses to guard it'.

Ladies and gentlemen, I wish you all good luck in guarding the Moon, and long may you choose to go on guarding it.

My subject tonight is Apollo 11. But first, before I come to my subject I'd like to tell you a science fiction story about a journey to the Moon. And I'd like to emphasise that this story I'm going to tell you about was written long, long ago, soon after the dawn of time.

The author begins at the beginning - with the launch. His travellers ' were whirled aloft as if shot by a Cannon'. The engineers among us tonight will want to know the why and wherefore of this whirling aloft business. Our author has a ready answer for them. It was done by a spirit. The strong spirit stupified the travellers, he says, so that they might come through the first part of their journey alive.

Very good. The author says next that as soon as the travellers departed from the attractive sphere of the Earth the spirit departed - whereupon they awakened and flew of their own accord toward the Moon.

But at length, as they approached the Moon, the spirit returned. Instead of staying with them, as it had formerly done, it now hastened ahead, so that it might hold them back to prevent a hard landing.

Naturally you won't be thinking I'm making this story up - you won't be after questioning my mendacity, as the Irish say. So I can ask you to guess the author. Not Jules Verne. It was written long before Jules Verne. It was in fact written nearly 400 years ago - by Johannes Kepler.

Kepler had some interesting things to say about the inhabitants of the Moon. For your further information the creatures of the Moon are all either spherical or snakelike. Because of the great difference of temperature between night and day their bodies are covered with a thick protective layer. This consists of a scaly armour which in the course of two weeks in the hot sun peals off in charred fragments. At evening, apparently dead creatures - like pine-cones - lie about, slowly reviving under the mild earthshine. They

become completely restored during the night.

Unfortunately, the frightful environmental conditions on the Moon make all lives tragically short - most creatures are born and die within a single Moon-day - that is to say in about three Earth-weeks. I imagine a light begins to dawn on you. As George Frederick Handel says in Messiah

'A great light shines on the heathen'.

You will of course have noticed the uncanny accuracy of Kepler's dynamics. So you will understand why NASA took his biology so seriously. Three weeks, a life-cycle of three weeks. There at last you have the rationale of those three weeks in quarantine. Until now the matter has been classified, but now I can state that NASA was waiting for the charred fragments to peel off the black lunar rocks and for the Moon creatures, to become restored in the gentle radiance of the lunar receiving laboratory. I expect the creatures are here amongst us tonight.

Ladies and gentlemen, I don't want to cockroach too much on your time, as the foreigner said, but sooner or later I must get a little serious. Otherwise things will be getting like the well-known stage actor on tour in the country. One day in a small city he was being distracted by a wailing child in the audience. After suffering to the end of his patience he stepped forward and said

Ladies and gentlemen, unless the play is stopped the child cannot possibly go on.

Suppose Kepler's spirit could somehow have made him aware of the Apollo 11 flight. What you may wonder would have astonished him most ? To the disappointment of the engineers, not I think the rocket dynamics. Not I think the actual lunar surface. Kepler was clever enough to swallow all this. The bewildering thing to Kepler would have been the fact that some hundreds of millions of people all over the Earth were able to watch events as they took place - in real time.

In Europe a very large number of people sat up throughout the night. I watched with a friend. Our reactions were as different as you might imagine. My friend had this in common with the astronauts - he too had depended for a life-giving oxygen supply - high above the South Col on Mt. Everest. He was aching to be there on the Moon, which I must admit was a thought far from my mind. As. Col. Aldrin and Mr. Armstrong kangarooed back and forth, my friend kangarooed in spirit with them, while I kept muttering

'For God's sake, pick up some rocks'.

I wanted to find out whether the Moon was covered by lava flaws or by loose debris. What I never expected as I watched the lunar rocks being stowed away was the remarkable chemical analysis that appeared in the September 19th issue of SCIENCE. If you had planned a dramatic effect, something to give the witch's broth a real stir, you could hardly have devised a more

suitable chemistry for the Moon. (Since we shall be hearing a great deal about this matter in the next two days, you will not want me to say more tonight about this analysis - except possibly to remark that NASA really does have the luck of the devil.) But then us poverty-stricken, ground-based astronomers would never have had such luck.

'Poverty isn't a vice, it's something much worse,' as we say in Yorkshire. You have to be rich to be lucky. We have another saying,

'Even devils run after the rich with trays of cake'.

The tray of cake is whether going to the Moon will make it possible to understand how our system of planets originated. I used to say

'Let them go to Coney Island and see if they can understand how the planets originated'.

But astonishingly enough, it begins to look now as if the claim might be true.

At some stage you will want me to say what the future of space exploration holds in store. Well, I've just touched on one important thing - the origin of the planets. If the biologist can make as much progress in understanding the origin of life as the astronomer can in understanding the origin of an environment in which life can flourish - I mean in the whole galaxy now, not just in our own solar system - the concept of life elsewhere in the Universe will pass from the realm of science-fiction into soundly-based prediction.

This touches on popular beliefs and even on religion. The extent to which cosmology and the concepts of space and time are intertwined with religion is most remarkable.

You may remember that from his studies of mathematics and physics Sir James Jeans become convinced that he had understood the nature of God. Jeans married a distinguished organist, and this led him to attend church more frequently than had been his wont.

As it happened, Jeans was at a dinner party together with the Bishop of London shortly after the Bishop had preached a sermon on the question : Does God exist ? As they were being introduced, Jeans remarked : 'It is indeed fortunate, my Lord Bishop, that if there be a transcendent deity, it will be many millions of light years before those unfortunate remarks of yours reach his attention'.

I suppose I could go on rambling like this all night, or I could go on to talk about special problems in space astronomy. But you will very likely say this is not the hour of the day for space astronomy. In any case NASA itself has recently covered the future of space astronomy in a series of giant plans for the future. I am sure you are all familiar with this remarkable volume :

'A Long-Range Program in Space Astronomy,' if indeed you didn't write it yourselves.

It is important to recall that the physical sciences started with astronomy - with the

observations of Tycho Brahé and the theory of Kepler and Newton. The mathematical methods we use today springs directly from these first developments - as we all know. I say all in the broad sense. I recall a physics test in my schooldays. We were asked the inevitable question

'What is Newton's law of gravitation ?'

My own answer has been long-forgotten. It has passed into oblivion. What I have not forgotten is the answer of one of my class-mates :

'Newton's law of gravitation states that the grass in every churchyard must be cut once a year'.

Then with desperate ingenuity he added :

'It is also a speed limit of 10 miles an hour'.

But let me return doggedly to Tycho Brahé and Kepler. The first phase of the physical sciences depended wholly on observations of events outside the Earth. It was akin to the modern era of space exploration. Intervening between was the great age of the terrestrial laboratory. The main structure of modern physics has been constructed from experiments carried out here on Earth, not from observations outside the Earth. It is an interesting question to ask :

How are things going to be in the future ?

Will the terrestrial laboratory continue as the mainspring of physical discovery, or will it be necessary to look outside the Earth in order to make further substantial progress in the physical sciences ? It seems to me that our judgment of space exploration, of astronomy and indeed of physics depends on how we answer this question.

My own view is that today we are in a transition era, not back to observation entirely outside the Earth - like Tycho Brahé - but to a situation in which the observation of the world outside is combined with the assets of the terrestrial laboratory. This indeed is what this particular conference is all about.

We can't manage with the outside world alone. Nor can we manage with the laboratory alone, for the very good reason that a profusion of things are happening outside that can't be reproduced in the laboratory. You can't make a quasar in your laboratory for instance. What I am saying is we have to gather the full totality of information local and non-local, in order to grapple with the problems as they are now developing.

You may be inclined to say this is all very well so long as we are content with a voyage of discovery, a voyage of discovery in which we are simply concerned to interpret the outside world in accordance with known laws of physics. But how if we wish to extend our understanding of the laws themselves. Surely we can only do this by working in the terrestrial laboratory

Well, I am not so sure. This issue depends on whether the laws of physics are wholly local or whether they contain a non-local component. What do I mean by this ? That properly speaking there may be no such things as a closed box, in the sense of the terrestrial laboratory, inside which events take place independently of what is happening outside the box. It could be that however carefully you set up such a box something always comes in from outside through the walls. Of the past we know this can be true. Light comes into the astronomer's observatory from the past. But I am not concerned with this trivial kind of opening up of the local box - after all, the astronomer can always shut the dome of his observatory - he can shut out the past - if he likes. I am concerned with something coming through the walls that cannot be shut out, however much we might try - something that depends on the large-scale cosmological structure of the Universe, something that comes from the <u>future</u>, not from the past. My point is just this :

Signals entering our local terrestrial box from the past give us information about history, about what happened in other places at other times - in stars and in galaxies. Signals entering our local terrestrial box from the future control the laws of physics as we understand them.

I am not seeking to extend this strange idea further tonight, because the issues are technical. The why and the wherefore is not relevant just now. What is relevant is whether the idea is right or not. If it is right, the case for studying the world outside the Earth becomes overwhelming. By doing so we become involved not just in a voyage of discovery but in a deeper understanding of physics. If it should turn out that you cannot engage in the simplest activity, like eating your dinner or smoking a cigar, without signals from the future as a controlling influence, then our whole philosophical attitude to the world outside the Earth will be changed. My belief is that it will indeed be changed - markedly I believe over the next two decades. The issue I think will be as important culturally as it is scientifically.

This brings me to the point of justifying scientific activity, whether in space or in other parts of science. Nowadays every university professor is asked to justify himself. Most of us are not unduly worried by this demand. In fact in the hurly-burly of modern life we're rather flattered to be noticed at all.

In former times scientists sometimes had recourse to soothsaying and astrology to keep themselves afloat. Even the great Leibnitz, the rival of Newton, earned his living by casting horoscopes.

Perhaps I might tell you the story of a certain medical doctor. After examining a lady patient he gave as his opinion that she would die in 8 days, which was exactly what she did. Now this lady happened to be a particular favourite of the King. On being told of her death the King was therefore much aggrieved. In sorrow he retired to a tower, not unlike the Empire State Building, in the grounds of his palace, saying to his servants :

'Bring the soothsayer to me. And when I am done with him fling him instantly out of the window'.

The servants did as they were bidden. They escorted the doctor up a long , long flight of stairs, which gave him much food for thought. When he was brought into the King's presence he bowed, and the King addressed him thus :

'You pretend to understand astrology, as well as medicine and science. Tell me, Quack, how long have you to live ?'

Without hesitation the doctor raised his arms high above his head and said :

'Exactly to the minute, Sire, I shall die three days before your revered Majesty'.

No doubt when NASA is called on to justify space exploration there is sincere regret that the technique of the doctor is no longer apposite. But as I say NASA is not alone here. We are asked :

What use is it to build a telescope ?
What is the use of the Ω^- particle ?
What is the use of climbing Mt. Everest ?

This kind of question has been going on for thousands of years and - if you'll permit me - I'd like to take up a few final moments by answering it.

Notice how everything turns on an emotional interpretation of the word 'use'. We're expected to accept ground rules which define 'useful' things as good, and by inference things that are not obviously useful are classified as bad. Once upon a time this was quite alright. Useful things were necessary for survival. But nowadays this old linguistic association is meaningless, at any rate in developed countries where survival is no longer in question.

Overwhelmingly things are judged useful nowadays if they have been done before. The human species has become programmed to do certain things - to make automobiles for instance and to ride around ceaselessly in them. This kind of activity has no survival value - in fact quite the reverse.

You can see this is right by taking a look at history. Our judgment of what were the significant issues in past times differ tremendously from contemporary judgment. In the middle of the 18th century the English celebrated victory at the end of a 7-year European war. Someone had the idea of getting George Frederick Handel, who was then an old man, to write a suite of music to celebrate the famous victory. An astute commentator, two centuries later, remarked that the whole meaning and purpose of this 7-year war had now been lost, and that in retrospect it appeared like an elaborate device to get old man Handel out of retirement and to get him to write his Music for The Royal Fireworks.

I'm going to end by recalling a prediction I made in 1948 - and by making a new prediction for the future. The prediction in 1948 was (and I quote):

'Once a photograph of the Earth, taken from outside, is available - once the sheer

isolation of the Earth becomes plain, a new idea as powerful as any in history will be let loose'.

Well, we now have such a photograph, and I've been wondering how this old prediction stands up. Has any new idea in fact been let loose ? It certainly has. You will have noticed how quite suddenly everybody has become seriously concerned to protect the natural environment. Where has this idea come from ? You could say from biologists, conservationists and ecologists. But they have been saying the same things as they're saying now for many years. Previously they never got on base. Something new has happened to create a world-wide awareness of our planet as a unique and precious place. It seems to me more than a coincidence that this awareness should have happened at exactly the moment Man took his first step into space.

I was saying a few moments ago that people in the future will not see the presentday in the same way that we do. It isn't easy to look at ourselves with the eyes of the future. But on one issue I feel confident. It is safe to predict that as the centuries roll by people will still remember that at some time near the middle of the 20th century Man first reached the Moon. It is also safe to predict that by then most of the troubled aspects of our day and age will have been long forgotten.

'Everything that is past died yesterday', says the poet.

'Everything in the future was born today'.