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FORUM:
Billingham on NASA and the Exploration of Space

Space scientist, pioneer SETI organizer and administrator, John Billingham views the future.


Billingham

This exclusive interview with John Billingham was made by Robert S. Dixon of ***COSMIC SEARCH****.*

COSMIC SEARCH What is NASA's Role in the Search for Extraterrestrial Intelligence (SETI)?

Billingham: I believe it to be central to an American role in SETI. There are three reasons:

(1) SETI is the type of enterprise which is likely to require a concentrated effort of a type which would probably not be put together by any one organization or society in the U.S.

(2) Also, it is the type of activity which inevitably is going to involve many questions in the international sphere. NASA has considerable experience in cooperative ventures, for example with the Soviets, and this could be put to good use.

(3) I believe NASA is the most suitable national organization to embark on SETI because (a) NASA is charged with a mandate for space exploration and this is space exploration par excellence. (b) The focal point of work on exobiology (non-terrestrial life outside the earth) has been in NASA for more than 15 years. SETI represents a logical extension of the existing work on the search for extraterrestrial life. (c) It is likely that a systematic technology development will be required. NASA has developed the management and engineering expertise to bring this type of endeavor to fruition.

COSMIC SEARCH: What are NASA's short and long range plans for SETI?

Billingham: The short range plan is already well-crystallized. It comprises a two year preparatory phase (Fiscal Years 1980 and 1981) under the cognizance of a SETI Project Development office which has just been established at the NASA-Ames Research Center and which includes scientists and engineers from Ames and the Jet Propulsion Laboratory (JPL), and the universities. Then, we will be submitting a SETI Project Plan for the Fiscal Year 1982 Budget as part of a broader enterprise which we call Life in the Universe. When the SETI Project actually begins, it will be a six-year project involving the use of existing antennas equipped with new and sophisticated data processing systems. The searches are to be carried out under the cognizance of a SETI Project Office and will, of course, include Ames, JPL and cooperating universities and observatories. The average expenditure rate for the six years would be about seven million dollars per year.

Long-term plans are difficult to generate at this time because of our lack of experience at doing a thorough and coordinated SETI program. However, it may be necessary in a few years time to contemplate the possibility of new telescopes, either on the ground or in space.

COSMIC SEARCH: If SETI were an ongoing program, how would it rank in importance among the other things NASA is doing?

Billingham: Recognizing that I am biased, it must rank very high for two reasons:

(1) The agency should always be undertaking new and exciting programs which have both scientific and popular appeal.

(2) Were the search to be successful, the results would constitute one of the great achievements of our own civilization.

COSMIC SEARCH: How many people work on SETI for NASA? Put this in perspective. What do they do?

Billingham: The number of people working on SETI is extremly small because SETI is still in the study phase and is not yet a formally approved NASA program.

So there are perhaps some six man-years being devoted to SETI at Ames and probably a comparable amount at JPL. At Ames we carry out extensive studies, and we prepare detailed plans of action to be ready to start the SETI project when funding becomes available. We are also undertaking a few preliminary SETI searches at a very parsimonious funding level, as are our colleagues at different colleges and universities.

Finally, we do spend some considerable time answering the very large number of requests from all over the world for information about SETI. It is very apparent that while a thorough SETI project is not yet underway, the level of interest among people from all walks of life is astonishingly high.

In comparison with the resources being applied to other NASA activities, the SETI enterprise is a very inexpensive program. If we succeed in getting support for the six year project, then it will become somewhat more visible, but it will be still very small in relation to other NASA projects.

COSMIC SEARCH: Can you give some perspective as to the amount of money NASA plans to spend on SETI, in comparison to other NASA programs, or to other things?

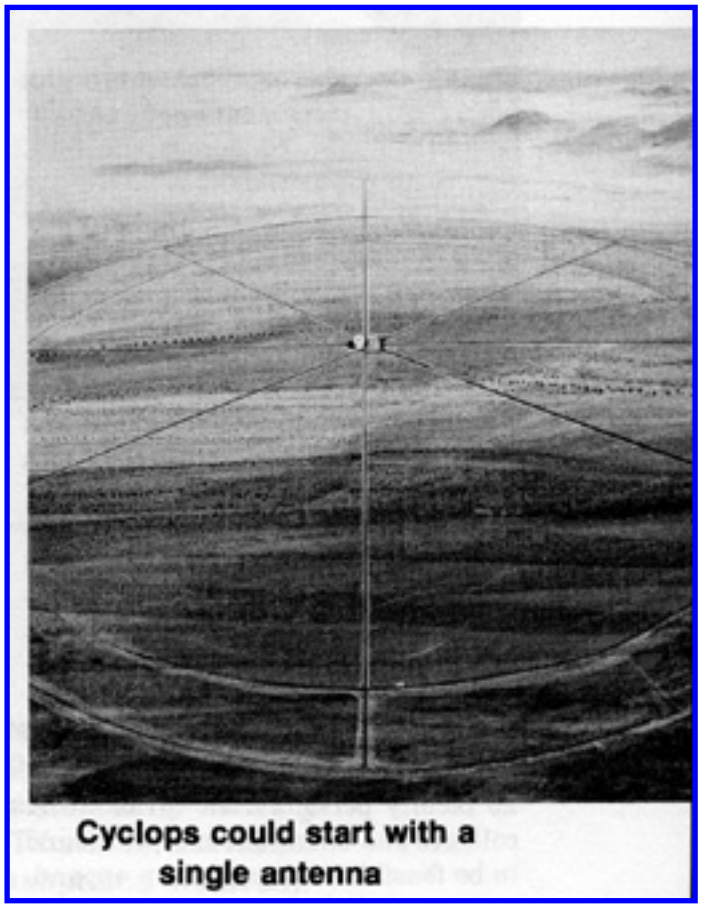
Billingham: The amount of money is very modest by comparison to other NASA programs, and other coordinated projects such as particle accelerators. If NASA is in fact supported by Congress for SETI enterprises, then we would plan to spend a total of some 45 million dollars over a six year period. This represents a sum of just over three cents per year per person distributed across the total American population.

"SETI is space exploration par excellence."

COSMIC SEARCH: Are any other government agencies involved in SETI besides NASA?

Billingham: No.

COSMIC SEARCH: Please tell us about Project Cyclops.



Cyclops could start with a single antenna

Billingham: Project Cyclops was the first major endeavor that the Ames team carried out, with "Barney" Oliver as Director. The idea was simply to ask the question: "What would one actually do if one wished to construct and operate a system for conducting a comprehensive search for other civilizations?"

It was a summer engineering system design study carried out by about 25 faculty persons from various U.S. colleges and universities. It was found to be feasible to construct an expandable system of conventional radio telescopes, phased together and equipped with a very sophisticated data processing system. As the years went by the search would be extended further and further into the galaxy as the number of telescopes, and hence the sensitivity of the system, increased. I would like to clarify a few things about the Cyclops project. First, it was a study only; and second, no one is proposing at this time to implement Cyclops. Third, I would like to correct an unfortunate but widespread impression that Cyclops is necessarily a large system consisting of 1500 antennas of collecting area three square kilometers and costing many billions of dollars. It is in fact not possible to say that Cyclops is of any given size and that its cost would be any given figure. The size and cost are whatever is necessary to detect a signal of extraterrestrial intelligent origin. This could be one telescope, or it could be a large number of telescopes. The strategy is clearly to begin with one telescope in order to be quite sure that we are not missing a strong signal.

COSMIC SEARCH: Tell us about the Science Workshops.

Billingham: The reception given the Cyclops report was of sufficient magnitude to encourage us to pursue SETI further. With the support of NASA Headquarters and

under the chairmanship of Phillip Morrison, a series of Science Workshops on SETI were held during 1975 and 1976. The idea was to go back to square one and examine the fundamental scientific rationale for embarking on SETI, to re-examine all possible approaches to the detection of other intelligent life and to explore in more detail any particular approaches that seemed reasonably promising. The workshops came up with four *conclusions* as follows:

> (1) It is both timely and feasible to begin a serious search for extraterrestrial intelligence.
>
> (2) A significant SETI program with substantial potential secondary benefits can be undertaken with only modest resources.
>
> (3) Large systems of great capability can be built if needed.
>
> (4) SETI is intrinscially an international endeavor in which the United States can take a lead.

The workshops came up with one *recommendation*, namely that a search for extraterrestrial intelligence be initiated now.

COSMIC SEARCH: Does NASA coordinate any of the ongoing searches? Should they? Should anyone?

Billingham: Since SETI is not yet a formally established and well-organized program, it is not possible to attempt to coordinate at this time. We feel, however, that some form of coordination will be important as soon as SETI is under way. In preparation for this time, the Ames Research Center and JPL have already coordinated their own approaches to SETI and the Ames Research Center has begun to establish a data bank of all existing SETI searches or radio astronomy surveys of any magnitude. Any coordinated program in the future would, of course, involve not only NASA, but universities and observatories interested in carrying out SETI observational projects and those data processing groups in industry and elsewhere who have the capability of developing advanced multi-band spectrum analyzers and signal characterization systems.

COSMIC SEARCH: Is there any international coordination? Should there be?

Billingham: There is no formal regular coordination. However, a meeting between the U.S. and Soviet academies of science was held in 1971 at Byurakhan in Armenia, with attendance also from other countries. The meeting established a small group to maintain liaison and I would guess that a second meeting might well occur in the next few years. Informal exchange of SETI ideas and studies constantly go on through normal scientific channels, particularly at international meetings.

COSMIC SEARCH: How does the JPL program differ from the Ames program?

Billingham: It is not different. It is the same. Ames and JPL are both contributors to a single NASA SETI enterprise.

COSMIC SEARCH: From the standpoint of the typical American taxpayer, how could he expect to benefit from NASA's SETI activities?

Billingham: He should perhaps reflect on the fact that it is an activity which is keeping America in the forefront of new ventures in science and exploration, which is something that very much enhances the image of the United States throughout the world. This is something that is seldom realized. If a contact should be made, there will be the achievement of it having been made by American scientists. There may be things we can learn from other civilizations which could be of great benefit to American taxpayers and indeed to anyone else.

COSMIC SEARCH: What are they?

Billingham: I will mention one and leave the rest to the imagination. The important thing to point out first is that the other civilization is likely to be very much older and therefore more advanced in its culture in general. One thing of some importance is that we will know for the first time that it is possible for a civilization to pass through the sort of troubles that we are experiencing at our present stage of evolution, and live perhaps millions of years into the future under what must be conditions of some stability. This would perhaps give many people (particularly the pessimists), a more positive and hopeful outlook with regard to our own prospects as a civilization.

It is probably up to each one of us to imagine other benefits which might result

from the detection of a signal, since all thoughts in this direction can only be speculation.

COSMIC SEARCH: How did you get into SETI, since you're an M.D.?

Billingham: Having been at Ames in the Life Sciences Directorate since 1965, I have been constantly exposed to the exciting research being carried out there in exobiology. In 1969 I read Shklovsky and Sagan's book on intelligent life in the universe and it occurred to me that one crucial question had not been asked. The question was, if one wanted to conduct a serious and thorough search for evidence of the existence of intelligent life outside the earth, how would it be done? I was lucky enough to be able to pursue this question over the next several years, beginning in 1971 with the Ames-Stanford Engineering Systems Design Study, Project Cyclops, directed by "Barney" Oliver, and the latest development being the formulation of NASA ideas on how to approach SETI over the next several years, and with the publication of NASA special publication (SP-419) entitled "SETI" — the results of three years of deliberations by a series of Science Workshops under the chairmanship of Phillip Morrison.

COSMIC SEARCH: Where could readers write to get more information about NASA's activities in general and SETI in particular?

Billingham: For information about SETI, write to me at: SETI Program Office, Mail Stop: 204-2, NASA-Ames Research Center, Moffett Field, California 94035. Copies of Project Cyclops and of the NASA special publication on SETI, SP-419 are available. For information about NASA activities in general, write to the Public Affairs Office, Code LF-6, NASA Headquarters, Washington, DC 20546; or to the Public Affairs Office at any of the NASA field centers.


Billingham

John Billingham was born in 1930 in Worcester, England. He received his M. D. in 1954 from Oxford University Medical School, and subsequently served as Medical Officer of the Royal Air Force Institute of Aviation, specializing in aviation medicine and physiology. In 1963 he came to the United States to join NASA at the Lyndon B. Johnson Space Center in Houston, Texas. There he served as Chief of the Environmental Physiology Branch. In 1965 he moved to the NASA Ames Research Center and became Chief of the Biotechnology Division in 1970. In 1971 he served as co-director of Project CYCLOPS, and since 1975 he has been Chairman of the Annual International Astronautical Congress Review Session on Communication with Extraterrestrial Intelligence.

Since 1976 Dr. Billingham has been Chief of the Extraterrestrial Research Division and Acting Chief of the Program Office for SETI at NASA Ames. He is a Fellow of the Royal Society of Medicine, Senior Member of the American Astronautical Society and Academician of the International Academy of Astronautics. He holds two patents related to temperature-controlled pilot garments. He is author of nearly 70 technical articles ranging from "The Human Aspects of Space Fight" to "A Review of the Theory of Interstellar Communications."

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