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LANDSAT LANGUAGE AT OUR REACH.
FIRST SWEDISH SATELLITE.
CIVILIZATION DETECTORS

D. L. Wayne, V. Bravo

Translation of "Lenguaje LANDSAT a nuestro alcance. Primer Satelite Sueco. Detectores de Civilizaciones". Aeroespacio, November - December, 1980, pp 50-58

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16. Abstract

This document contains three short articles:

1) Information on the use of LANDSAT data by Argentina.
2) Details on a Swedish satellite to be completed in 1984 and to be called VIKING.
3) A discussion of attempts to contact other civilizations in space by the use of radiotelescopes.

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LANDSAT Language at our Reach

/50* If we reflect on recent space activities in our country, we can recall that, with the initiation of the Receiving Station for Information from LANDSAT in the CELPA for the Atlantic, we could say that it represented an era, important to be sure, of a more ambitious program because, based on it, it would be possible to receive satellite information that covered a vast region, including neighboring states within a radius of 1900 miles (3200 kilometers).

These orbital systems that became active in the 1960's and contributed to landing man on the Moon also make possible the study of the Earth in depth, and open up new research opportunities regarding the Earth's natural resources and diverse phenomena. The classic photo-interpretative methods are today supplemented by automatic processing of information by computers and thus speed up the processing, cut costs, and give more precise results about the surface of the Earth.

To extend the prospects of participation in this modern information system, the National Space Investigation Commission (CNIE) signed cooperative agreements with the State Secretary for Agriculture and Livestock, CONICET, INTA, National Antarctic Administration, Planning Secretariat, Subsecretariat for Environmental Planning, and Federal Council of Investments, all from our nation, and also with foreign organizations such as NASA, German Aerospace Agency, Italy's IILA, USA's NOAA, Peru's CONIDA, and the Organization of American States.

The numerous activities developed by the CNIE and its various branches point to the knowledge gained by Argentina in space research and support the studies which it is carrying out in Latin America. In line with this, on 13 October 1979 CNIE inaugurated the Center for Processing Satellite Information, Buenos Aires, located in the federal capitol.

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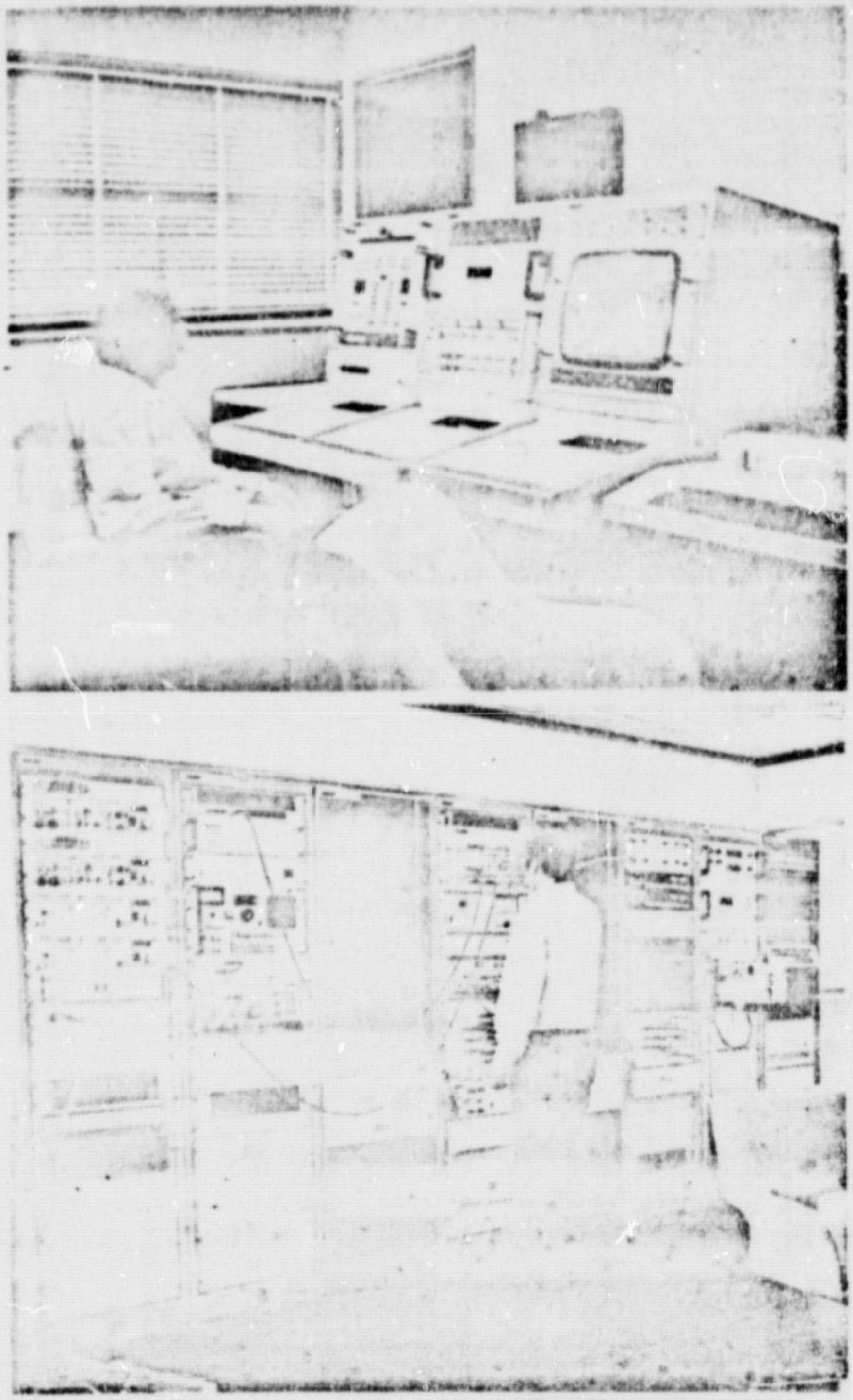
*Numbers in margin indicate foreign pagination.



Because of the automatic processing possible, costs are reduced and precise data can be provided about the earth's surface.

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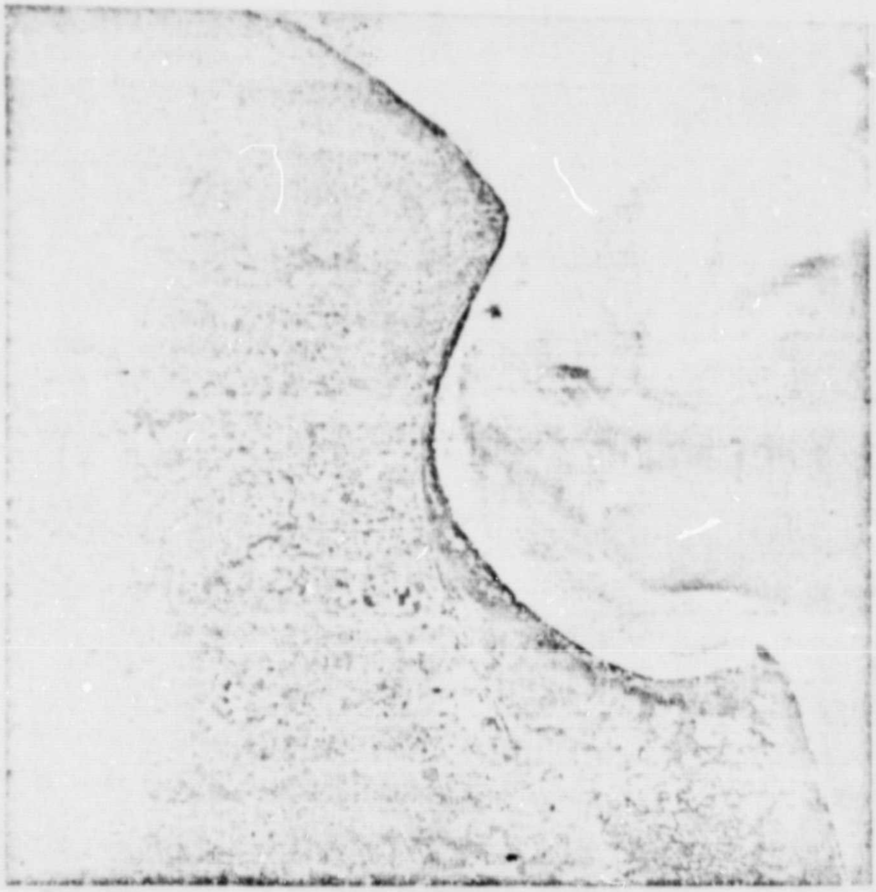
An area of 850 cubic meters contains an advanced computer center, a photograhphic laboratory, seminar rooms, administrative offices, storage space an archive for tapes and a sales area. Adjacent is an independent building with an emergency electric generator as well as storage batteries.

The Center is organized with two subsystems: one for processing and the other for the generation and distribution of final products. The first subsystem reproduces tapes with high density that contain multispace information and the S band unifies data such as the codification of the tines that originated from the reception system located in the little sea (Mar Chiquita). The information is treated by use of radiometric corrections and geometries that /51 are applicable and in this way the final products are obtained as black and white or color films, 70 x 240 mm. as well as magnetic tapes compatible with computers. The subsystem processor is high speed, that contains 128 thousand (K) word memory, disc with 300 million (M) bits each, a tape reproducer of high density, an image generator of high resolution and peripheral elements that are common to such conventional systems of computers.

The second subsystem receives the products of the processing subsystem as well as produces its own products as needed by its users. This part of the Center has as its main objective the orderly archiving of the products generated by the first subsystem, produce byproducts of the original material, prepare catalogues and microfiches. It also produces copies of the tapes that are compatible with computers.

The Data Processing Center is equipped to give users specialized information including cartographic date, geodesic control, aerial photography, and other options. The archives contain microfilms, assistance guides, as well as a projection of existing materials in a form that allows the user to select those materials that best suit his needs.

The Center was designed to give maximum access to help users exploit, in an integrated manner, all of the information received from the LANDSAT satellite. This is one reason why this facility was given such free access to all the heavy density tapes that are received from the little sea (Mar Chiquita). The human element is a first level consideration in this effort to provide adequate and proper information; however, there are limitations such as defects in the quality of the images received, the alignment of the satellite and other special problems.



Satellite images of the Samborombon Bay (State of Buenos Aires) taken by LANDSAT and processed by CNIE

A number of these errors could be corrected for this satellite; however, only with a substantial increase in weight and cost for fabrication and relaunching.

Technical Aspects

The heart of the Center is a high capacity computeer with a memory and discs. The program of the computer is designed to allow it to process the images received by the receptor installed in the CELPA (Atlantic) and other older NASA programs. With some reprogramming the Center will be able to handle the future satellite (French) SPOT) and also the Japanese MOS. In a similar fashion it can accommodate the new sensor TN (Thematic Maper (sic!)) that will shortly be incorporated into the new series of LANDSAT-D. To accommodate these future vehicles, it will be necessary to group various complementary equipments subsystems for reception at the Atlantic receiver station even though the antennae and the grand pedestal do not require modifications.

The launching of the series LANDSAT-D is projected for 1982 and 1983 and the sense data produced will be received during the 1980 decade. In /52 addition, the SPOT and MOS satellites will possibly be launched into orbit in 1984 and 1985. In actuality, in addition to Argentina, there are receiver stations for satellites LANDSAT in the United States, Canada, Brazil, Italy, Sweden, India and Japan; however, there are similar centers being constructed in South Africa, Australia, and Taiwan (China Popular). The new receiver station in China will receive LANDSAT-D data while the Brazilian station is negotiating to be able to receive data from SPOT.

The sales section of the Center offers to any client, private or public, negatives and slides in black and white in 1:1,000,000 scale; color slides in the same scale; enlargements in black and white or color in 1:500,000 and 1:1,000,000. These are mounted on paper 24 x 24 cm. and 50 x 60 cm. The photographic laboratory can produce 120 x 120 cm black and white or color photos at 1:250,000 scale. In addition, electronic amplifications can be made which contain much more data than the photographs. Finally, the tapes can be duplicated to give computor data with either radiometric or geometric-radiometric corrections.

Following a process of progressive development, the Center will, in the future, contain an auxiliary computer. This will enable the Center to process data within the requirements of each client, giving maximum-minimum frequency control and programming to meet the specific needs of each consumer.

Final Explanations

The increasing use of the data acquired from this computer-receiver system justifies the need and advantage associated with having the system available. Economic geography is benefitting from the material as well as the fields of agriculture, livestock, land studies, hydrology, drainage studies, underwater systems inferences, flood studies, geology, hydorcarbon prospecting, cartography, coastal geology, fish studies, river contamination, population growth studies and many other areas.

To question whether a visual study is better than a computer analysis is to create an erroneous dilemma. It is essential to conduct the visual study before the computer analysis. The visual study is a basic experience that provides the researcher with a base for his subsequent computer analysis. Only when the visual data is inadequate does one go directly to a computer analysis, except in cases such as agriculture where such a step may produce unpredictable results.

Satellite images do not replace aerial photographic work; they complement each other. Photographic work is of particular value where specific locations are of interest. In cases where the area is not extensive, color photographs of the area are the best source of information; in addition, infra-red or special filter shots can be obtained for a relatively low cost.

The CNIE is equipped to conduct studies in open spaces with monitors that pick up the TRANSIT satellite and can thus pinpoint geographic locations with great precision (within meters) as well as elevations. The Center for Teleobservacion (t.n. - could be an observatory) that is located in Vicente Lopez, state of Buenos Aires, is equipped with a computer to produce automatic analyses. These institutions and groups do not belong to the LANDSAT system but do give important complementary service to reinforce the data received by the system.

In summary, we have focussed on the various areas accessible to CNIE and have given special attention to the fact that the results gathered have been made accessible to the general public, public and private, without limitation. The populations served have included members of the scientific community, professionals, teachers, general citizens, and they have received information at a low cost in the form of reproductions of the data received by the CNIE. In this way, the CNIE has closed the circle, from the obtaining of data to its dessemination to users, from the LANDSAT. We are thus in the circle of nations that can benefit from the products produced by this satellite.

This resource has given us the opportunity to evaluate our economic resources, particularly those that are renewable, without having to depend on the good will or the selective dissemination of data from other nations. Thus we feel that CNIE is an effective and efficacious instrument to strengthen our presence in an area which will be decisive in the next century.

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FIRST SWEDISH SATELLITE

Don L. Wayne

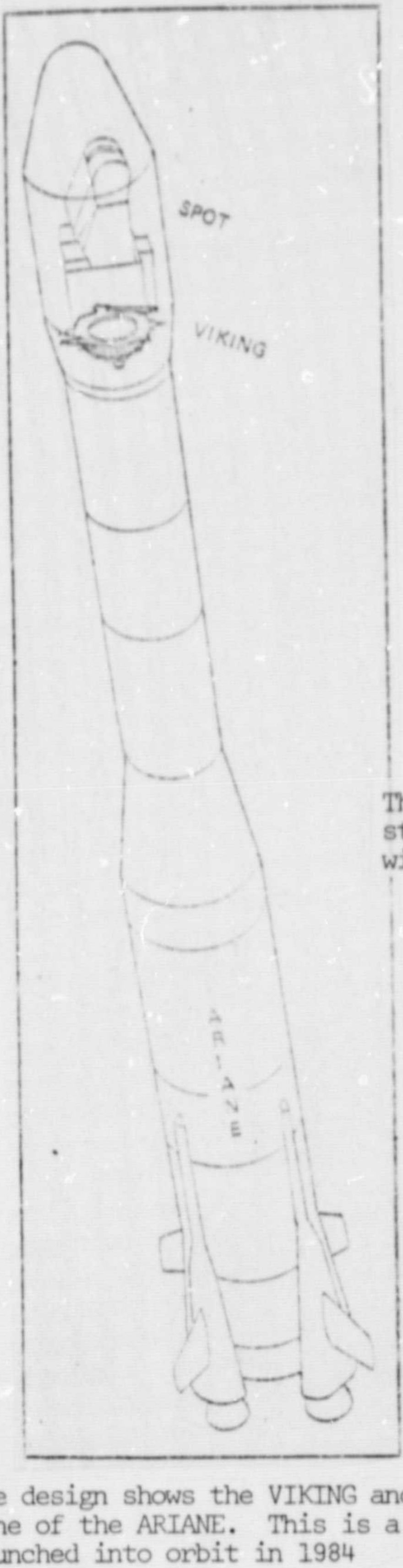
The space vectors can be used for two basic objectives: to transport an object of military interest or one of civilian interest. However, since the scientific and economic forces require that a cargo of considerable weight be developed, results are important. In addition, space missiles are no longer the exclusive area of development by the United States and the United Socialist Socialist Russia and many non-superpowers recognize the need to develop their scientific-technological potential for possible applications in the near future. Thus, some countries have given priority to developments in the missile area. /53

As we enter the era of "rent-a-missle", special cargo has been developed by different nations. Although there may exist different "space taxis" it is possible to contract space on the ARIANE that is currently under test or, with patience, use the Spacelab that will shortly be launched by the United States (Space Shuttle).

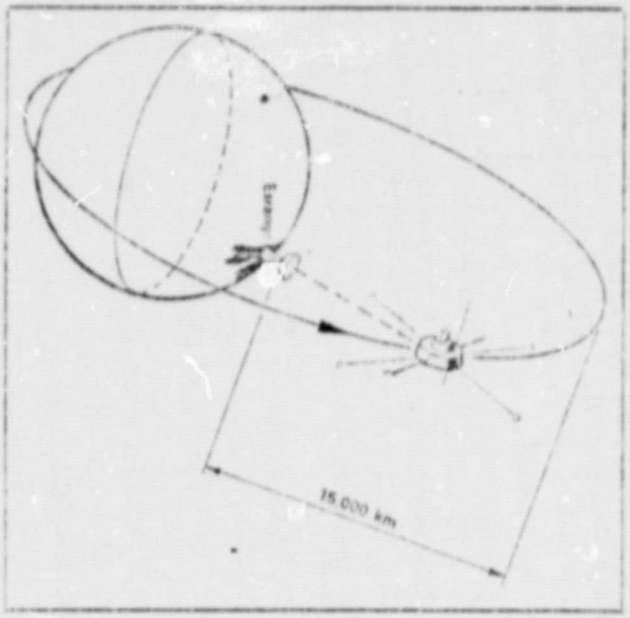
The Swedish Space Corporation (Corporacion Espacial Sueca) has chosen the first alternative to benefit, with maximum amplitude its participation in the production of the first European launch vehicle (multi-national). It has contracted with SAAB-SCANIA the development and construction of a scientific satellite which, naturally, is to be called VIKING.

The Swedish group will be the prime contractor and assume the responsibility for the engineering systems, the scientific cargo and the telemetry necessary. The Boeing Aerospace Company will be a subcontractor for the fabrication of a space platform and rocket motor with multiple capacities as well as the complementary parts. The SAAB-SCANDIA company will control the general program of VIKING including the testing systems, with a projected budget of Kr 80 M which is equivalent to 19.27 million dollars.

The foundation work was completed in 1979 and the contract calls for submission of the completed satellite to the Swedish Space Corporation by the beginning of 1984. The project for launching ARIANES is fixed to make possible the inclusion of the SPOT satellite of French origin. The SPOT satellite will be used for natural resource studies. Sweden has accepted



The design shows the VIKING and SPOT located in the cone of the ARIANE. This is a European rocket to be launched into orbit in 1984



The diagram shows the location of the Swedish launching station (Esrange) and of the satellite VIKING whose orbit will be inclined 98.7° relative to the equator.

a percentage participation in this venture and the two satellites should be placed in their respective orbits simultaneously in 1984. /54

The Swedish company that will prepare the VIKING has already had previous experience in the fabrication of subcomponents for space craft, specially in the area of telemetry, tracking and command instruments, and onboard computers. However, this will be the first time it assumes full responsibility for the development and complete production of a satellite.

Characteristics of VIKING

The basic role of VIKING will be the minute exploration of the earth's magnetosphere. It will examine the wide variety of electromagnetic particles trapped by the earth's field. Swedish scientists are interested in studying the transfer of solar energy with the magnetosphere as well as examining the borealis which, in Sweden, represents an area of intense scientific interest (aurora borealis)

These studies require observations from high altitudes (above 15,000 km. 9,000 miles above the earth). The satellite orbit will have an inclination of 98.7° with respect to the earth's equator, an apogee of 15,000 km (9,000 miles) and a perigee of 822 km (493 miles). Taking into account the fact that the launch will take place in Kourou (French Guyana), it will be necessary to make some trajectory corrections for the satellite. These corrections will be achieved by use of an auxiliary motor, which will function once the VIKING is separated from its launcher.

The satellite's position will enable scientists to study the interaction of the cold and hot plasmas as well as the zone where the particles that make up the aurora borealis have their maximum acceleration which, it is believed, is what is responsible for the phenomena itself.

Once the space vehicle is in its orbit, its batteries will be able to provide the power necessary without refueling; they are rechargeable. To achieve this end, solar panels are built into the satellite, to be expanded once the satellite is in its orbital position.

The satellite will have a maximum height of .80 m (31.5 inches) without the platform engine (See Above) and 1.20 m (47.2 inches) with the engine; its transverse sections, depending on level, will vary between 1.8 m (70.8 inches) and 2.2 m (86.6 inches) with the solar panels enclosed. The VIKING will have an internal rotation about its vertical axis of 50 rpm.

The total weight will be approxiamately 550 kg (1210 lbs.) and the tracking and telemetric equipment will be handled by the earth station at Esrange (Sweden). With this satellite, it will be possible to measure the following parameters: geomagnetic field, electrostatic field, magnetic waves, electric waves, density and temperature of cold and hot plasmas, the functions of the distribution of hot plasmas from one to various hundreds of keV and the ultraviolet images of the aurora borealis.

Civilization Detectors

Victor Bravo /56

The exciting possibility that intelligent life exists on other planets near our own solar system led Lee DuBridge, President of the California Institute of Technology to observe: "What is surprising is not that we may be able to detect life on other planets but the surprise we would experience if we did not find it." However, the task may be difficult as we note that the Professor of Astronomy and Director for the Ionosphere Observatory of Arecibo, D.E.B. Drake estimates that the nearest potential planet for such life may be 1,000 light years away!

The moderated optimism of Dr. DuBridge is darkened a bit by the thought that although we are in a "space age" and feel that our rockets are effective instruments for the projection of man within his planetary system, rockets, for travel among the stars are not the most attractive alternative. This realization comes home to us when the distances, in hundreds of light years, are translated into human lifetimes. If we are to achieve this next step, we must produce crafts which can attain speeds near the speed of light if we are to attain our objectives within the known span of a man's life. /57

If we attempt to approach the speed of light, we must contend with the laws of physics that will dictate the construction of craft of such a size and cost that may be monstrously expensive. At present, such a projection would lead us to believe that, to achieve, by nuclear power, the 99% level of the speed of light, the original vehicle , to reach the most proximate star and carrying a ton of load would weigh 100 million tons at the time of launching.

Thus, based on these limitations as we know them, it is not possible, at present, to consider the possibility of such a flight from the earth's surface. We are limited to the attempt to send out information to seek out intelligent life on other planets. Such an approach will be dependent upon the receipt, from such intelligent life, of a response that we can understand and identify.

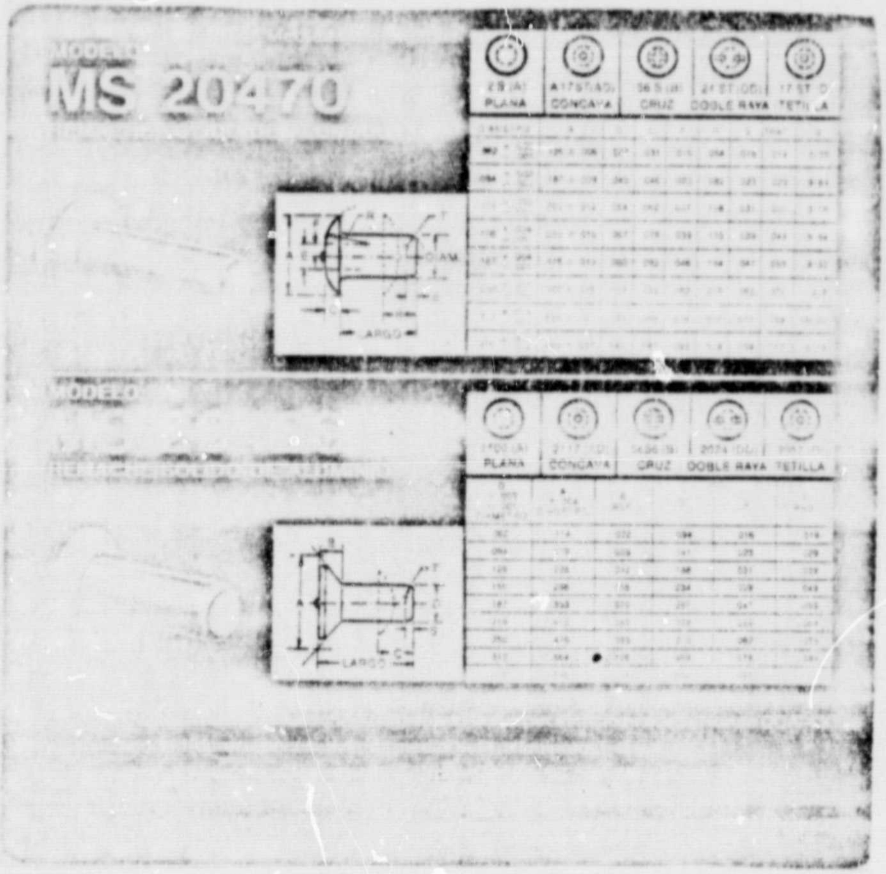


Table of rivets used for military specifications (Aluminum)

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Dr. Drake suggests that "since we are in diapers from a technical point of view, we can, within our capabilities, send out a message of 70 words that will reach 10s of light years for an electrical energy cost of a dollar. This is a great benefit in comparison to the fantastic cost of a space vehicle to attain the same result. Since the laws of physics are involved, we feel that the electromagnetic waves represent the most productive route for communication with life on other planets."

In 1960, radio signals from the radiotelescope of the National Observatory for Radioastronomy, Green Bank, West Virginia, were analyzed to determine their origin. This station has an antenna with a 90 m. diameter (280.8 feet). The object was to detect signals from the most proximate stars, particularly those that were independent and most like our sun. These were Tau Ceti and Epsilon Eridani, each a minimum of 11 light years away.

This experiment was called Project OZMA and related to radio frequencies from each star in the area of 1,420 MHz/s. No significant signals were detected. This frequency is that which is emitted by the hydrogen atom and since these atoms are dispersed in interstellar space, could be known to other life. It was adopted for radio-astronomical communication since it represented the only common set of vibrations for all elements in space, and should thus be recognized by intelligent life on other planets.

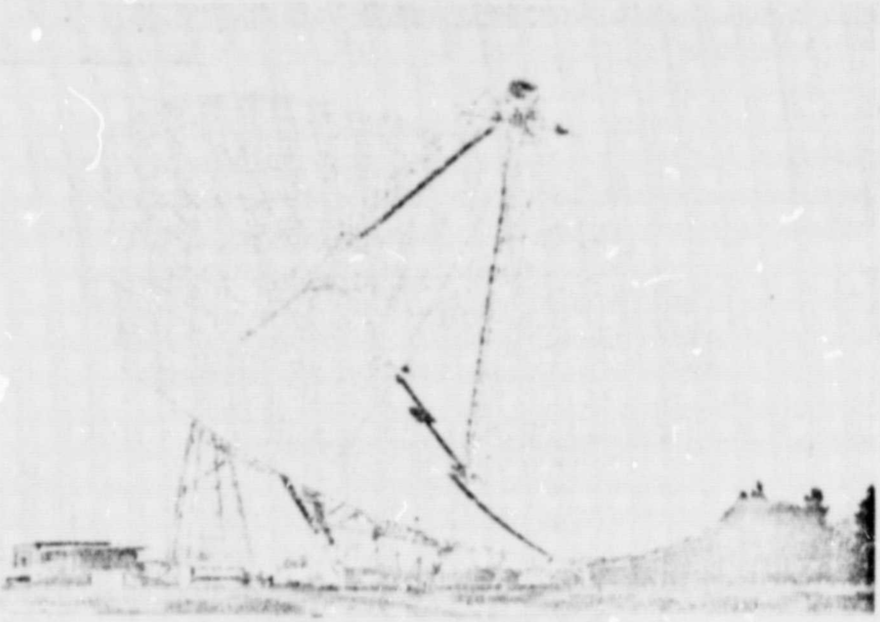
The absence of any satisfactory result, til now, points out that the search will not be easy, for, within a radius of 1,000 light years, there exist 10 million stars of which, perhaps only one has the conditions necessary to have produced intelligent life. We shall need to continue this search, recognizing that, from the other side, there may be life that is also seeking to reach out to us.

We must take into account the possibility that other life, on other planets, may not be seeking us out. We should consider ways to monitor /58 possible communication systems operating within a planet as a secondary but necessary way to determine the presence of other life forms in our universe.

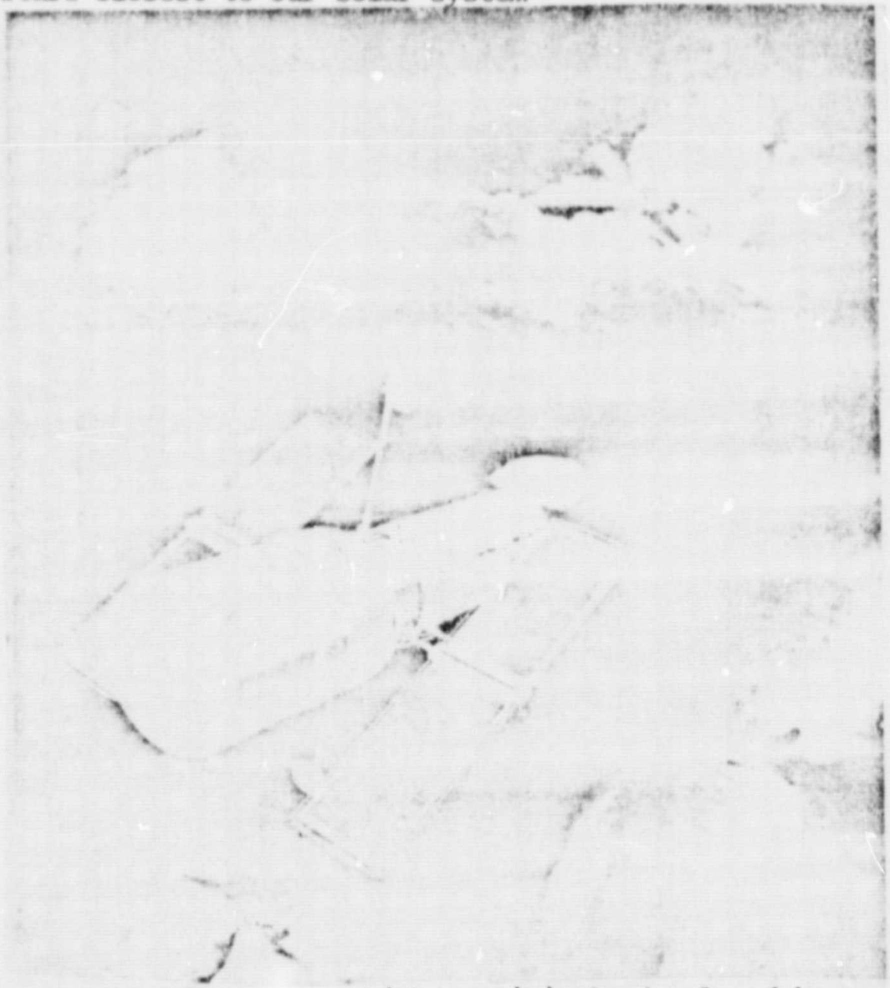
There exist ways whereby it is possible to monitor various wavelenghts of electromagnetic signals that come in via our radiotelescopes. They are stored in computers and can be subject to mathematical model analysis with the hopeful end of discovering a logical language structure.

Such techniques can be called "civilization detectors" and would need to be applied with great skill to be effective. The studies would involve over 10 million stars with their respective satellite systems. A gigantic radiotelescope would be needed with a 100m (312 feet) diameter antenna as well as a receiver, a computer which would be needed for a minimum of 30 years. The cost of the program would be of the order of 60 million dollars.

Even though this proposal is costly in time and money, it is modest in comparison with studies already made of our solar system. The results are of such importance that the project should not be dismissed lightly. If such a project could have results before the end of this century, its impact and importance would bring benefits for the present civilization on a world-wide basis.



USA radiotelescope in Green Bank, West Virginia; 90 m. (280.8 feet) in diameter; begun in 1960 the identification of signals from outer space from the stars closest to our solar system



The Space Telescope which was jointly developed by Lockheed and NASA will be launched in 1983. It will allow scientists to "see" for the first time galaxies formed billions of years ago.

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