

GCI was tracking the F-94 and the unknown simultaneously and that, concurrently, the F-94 was in radar contact with the unknown. To suggest that this could be "anomalous propagation" is simply absurd, and I believe I need not take space to cite detailed reasons for that view. The very fact that the F-94 first picked up the unknown on a radar line of sight 10 degrees below the horizontal would strain an anomalous-propagation hypothesis to the breaking point, but the fact that the unknown was steadily ground-tracked through two orbits and then tracked with an F-94 in radar pursuit, seems to me to rule out decisively the explanation offered to the reader of the Condon Report.

Both the Shiroi GCI controller and the F-94 radarman are quoted in the intelligence file as describing the unknown as "a bona fide moving target," of cross section slightly under that of a jet. Attitudinal cross section changes may be implied in other testimony not given the reader in the Condon Report: "The blips on the CPS-1 were described as small and relatively weak, but sharply defined. The brightness varied somewhat, and at one time appeared very bright as the object appeared to be in a fairly sharp turn at higher speed than previously noted. Both recorded orbits were in approximately the same position, with the object moving and occasionally hovering in one position for several sweeps (4 rpm)..." And note that the latter remark implies hovering for something like 40-50 seconds, in between movements estimated at several hundred mph, and evidently reaching values in excess of F-94 speed (about 400 mph) in the final phases. Anomalous propagation!

So much for one illustrative case. I assert that many more could *very readily* be cited, based on my own recent extensive review of case material in the Condon Report. The study is seriously deficient in precisely those areas most essential to the basic mission of the Colorado Project. Only an Academy panel that was rubber-stamping, not independently and vigorously cross-checking, could have endorsed such a report. Unfortunately, the total number of scientists who are even slightly informed about UFO case material is still minute; so present general acceptance of the negative conclusions of the Condon Report is probably an almost inevitable short-term response. But, in the longer run, it is my belief that this Report and its high-level acceptance will come to seem almost incredible. For the real nature of the UFO phenomena seems so scientifically challenging and cries out for such top-caliber attention that a major study which led only to downgrading it to even lower levels than it had enjoyed in all preceding years

seems hard to understand. I cannot understand it.

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**The Condon Report, Scientific Study of Unidentified Flying Objects.** E. P. Dutton & Co., New York, 1969. 967 pp. Price \$12.95; also Bantam Books, New York, \$1.95.

The issue of unidentified flying objects, conceived in the crucible of sensationalistic journalism, eventually grew to become a national issue. In 1966, enthusiasts of UFOs finally managed to force the Federal government to take serious steps in the matter. A sum of 2 million dollars was granted to a group of respectable scientists under the leadership of Dr. Edward U. Condon, a noted atomic scientist, to form a team at the University of Colorado to study in a scientific manner, whether the UFOs reported by many sighters were indeed spaceships from beyond the solar system.

The study period lasted two years, a time span which is long enough for some meaningful conclusions to be reached and yet short enough to prevent most members of the team from feeling that the search for UFOs has or will become their life career. In addition, Dr. Condon's group has "been able to place aside all prejudices" and to proceed with the study of the UFO reports with a scientific attitude. If harsh questions were asked, it is because that was the only way that unbiased answers could be obtained.

The study resulted in a voluminous report, containing nearly 1000 pages of fine printed material and presented in seven sections. The introduction is written by Walter Sullivan, New York Times science editor and author of the book, "We Are Not Alone," describing recent scientific efforts to find extraterrestrial civilizations in our universe.

Section I presents the main conclusion and recommendations for a future approach to the UFO problem. The conclusion is plain enough: "...Nothing has come from the study of UFOs in the past 21 years that has added to scientific knowledge. Careful consideration of the record as it is available to us leads us to conclude that further extensive study of UFOs probably cannot be justified in the expectation that science will be advanced thereby." The statement that "...further extensive study...cannot be justified..." probably will enrage those who have

decided to make ufology a lifetime study; their chances of getting support from federal agencies or from respectable private foundations have certainly been lowered, if not completely nullified. But Condon did not preclude further respectable UFO research. His report is actually an examination of the evidence presented so far to support the idea of UFOs. His conclusion is that evidence does not indicate the presence of any alien objects which can be classified as spacecraft from extraterrestrial civilizations. Indeed, the report continues: "...we believe that any scientist with adequate training and credentials who does come up with a clearly defined specific proposal for study should be supported." In this respect, one is reminded of Project Ozma (an attempt to listen to two stars,  $\tau$  Ceti and  $\epsilon$  Eridani, for possible intelligent radio transmissions) as a very good example of respectable and valid research relating to UFOs that can receive acceptance by the scientific community.

Section II of the report is a formulation of the UFO problem in scientific terms. Here the origin of the Colorado project, the definition of UFO, and the source of reports are discussed. Most important is the evaluation of the quality of the reports of UFO sightings. Contrary to what might be expected, fabricated UFO reports occupied only a small fraction of the total. The report says: "...the persons making reports seem in nearly all cases to be normal responsible individuals. In most cases they are quite calm, at least by the time they make a report. They are simply puzzled about what they saw and hope that they can be helped to a better understanding of it..."

Prior to the Colorado project, a number of federal agencies had undertaken some research regarding UFO reports. The two agencies with the greatest interest were, naturally, the Air Force and the Central Intelligence Agency. The Air Force was interested in UFOs for fear that "UFOs might represent flights of a novel military aircraft of some foreign power". Presumably the CIA got interested in UFO reports for the same reason. Because of the security aspects, all studies were shrouded in some type of secrecy; but whatever information seeped through to the public only added to the mystery of the UFO problem. This, in the reviewer's opinion, is partially responsible for the growth of the UFO cult.

The responsibility must be shared by the newspapers. Most newspapers are responsible enough to correct the erroneous impressions of the initial sightings, but the corrections usually occupy a much less significant corner of the newspaper than the original story. Distortion often resulted as UFO enthusiasts further propagated

the news of sightings. Says the report: "In January 1968 near Castle Rock, Colo., some 30 persons reported UFOs, including spacecraft with flashing lights, fantastic maneuverability, and even with occupants presumed to be from outer space. Two days later it was modestly reported that two high school boys had launched a polyethylene hot-air balloon."

"Locally that was the end of the story. But there is a sequel. A man in Florida makes a practice of collecting newspaper stories about UFOs and sending them out in a mimeographed UFO newsletter which mails to various UFO journals and local clubs. He gave currency to the Castle Rock reports but not to the explanation that followed. When he was chided for not having done so, he declared that no one could be *absolutely* sure that all the Castle Rock reports arose from sightings of the balloon. There might also have been an UFO from outer space among the sightings; no one would dispute his logic, but one may with propriety wonder why he neglected to tell his readers that at least some of the reports were actually misidentifications of a hot-air balloon."

Section III presents the scientific procedures utilized in the UFO program. The past 21 years have seen a fantastic accumulation of UFO reports. Obviously some selection must be made before a study can be carried out; otherwise the manpower needed will soon exponentiate. The first step is to screen the UFO reports for obvious fakes. Says the report: "It is obvious that not all UFO reports are worthy of investigation. What kinds of reports should be investigated? Persons who have lengthy experience working with UFO reports give varying answers to this question. NICAP discards unsubstantiated tales of rides in flying saucers, on the basis that their investigators have found no evidence to support these claims but have found considerable evidence of fraud (NICAP 1964). Air Force practice is to neglect reports of mere lights in the sky, particularly around air bases or civil landing fields, for experience has shown the UFOs in such reports to be lights or aircraft or other common lighted or reflecting objects."

Photographic evidence is usually regarded as hard evidence by scientists. Much astronomical knowledge is derived from photographs of celestial objects. But can a photograph bearing the image of a flying saucer convincingly imply the existence of extraterrestrial UFOs? Unfortunately, even an amateur photographer knows how to fake a photograph. Moreover, even photographs that have not been faked often carry spurious information due to plate defects or other distortions. (A most common spurious

image is that of a light source formed by multiple reflections on the lens.) Just as all astronomical photographic discoveries have to be confirmed by additional plates, it was decided that the existence of several photographs of the same UFO taken by several individuals unknown to each other, must be established before photographic evidence of UFO can be accepted. None of the photographs submitted to the Colorado project for analysis could satisfy this criterion. (As far as the reviewer knows, no astronomical photographs taken in observations with telescopes designed to search for extremely faint objects have ever recorded any image carrying the least resemblance to UFOs.)

Although no photographic evidence could be used to identify UFOs positively, it was still felt that all photographs submitted deserved some attention. Unfortunately the quality of UFO photographic data is usually too poor to be of any value. The report says: "Many of the photographs are blurred, usually due to poor focus. Many are badly processed or light struck. Many, usually because they are fabrications made with small models too close to the camera, show, against sharp backgrounds, objects that are hopelessly out of focus. Many photographs do not give the subjective impression of a metallic or luminous entity flying through the air at some moderate distance from the observer."

Analysis of these photographs also showed a number of spectacular natural phenomena. To illustrate how nature could deceive the eye as well as the camera, a number of photographs of known natural meteorological or celestial phenomena are shown in the report. The reviewers were particularly impressed with a photograph showing a group of lenticular clouds of unusually symmetrical shape. If the true nature of these meteorological phenomena were not known, a viewer could easily accept the interpretation that these objects are UFOs flying in formation.

From time to time, direct physical "evidence" of "visits" by UFOs has been produced to emphasize the authenticity of the extraterrestrial origin of the UFOs. Among the most common pieces of "evidence" are scraps of metals or other materials allegedly fallen or torn from the spacecraft. These materials are often touted for their unusual purity, crystalline structure, or composition, compared with ordinary terrestrial materials. Although our terrestrial technology cannot produce material with the alleged property, earthling scientists do have accurate and reliable methods to test the truth of these claims. These methods include neutron activation analysis (which is capable of telling the purity of a sample to a great degree of accuracy), mass spectroscopy

(which is capable of giving accurate composition of an alloy), and X-ray diffraction (which is capable of giving a precise description of the crystalline structure of the sample). When samples were analyzed, in no case did a piece of "exotic" material fail to show evidence of terrestrial origin.

Then there is the indirect evidence—the most common of which deals with burned markings allegedly due to the landing and taking off of UFOs. Again, gas chromatography is the most useful tool for analysis. Analysis of soil samples in the burned area versus that in an unburned but adjacent area can tell what kind of fuel has been used. In many cases the fuel used is simply a hydrocarbon—which is the constituent of common gasoline and petroleum products. It is unthinkable that a spacecraft designed to bridge the gap of interstellar space relies on the chemical energy of hydrocarbons for take-off.

Other more exotic types of indirect evidence, such as unusually strong radiation or allegedly strong magnetic fields, were reported from time to time: An automobile was stalled "because of the effect of very strong magnetism on the spark coil." When the spark coil was removed and tested for any residual magnetism, nothing unusual was found. The same spark coil, placed inside a magnet, was found to need a magnetic field strength of about 20,000 gauss to prevent it from functioning. If such fields were present around an automobile, it would be crushed beyond recognition. Yet the automobile in question did not show any sign of strain. It was thus concluded that the automobile stopped functioning because of reasons other than magnetism.

Case after case was studied, and some of the more distinguished ones are presented in Section IV. All cases reported give this reviewer the impression that the study procedure was very thorough and without any bias. (I would invite any person who feels that the scientists have been against UFO respondents to attend a scientific meeting and see how much more stringent the scientists are towards themselves.)

Section VI discusses some possible explanations for the UFO sightings. I find this section very enjoyable to read. One cannot fail to see how treacherous Nature can be, especially to the naked eye. This section should provide a great deal of joy for a naturalist to read; even the inorganic world of clouds, atmosphere, and oceans come alive under the action of light.

Section VII presents a number of miscellaneous items of various value under the title of "appendices," containing articles ranging from "The Natural Philosophy of Flying Saucers" by R. V. Jones, to a form designed for use in reporting

UFOs. Each reader may find his own favorite among the rich collections presented here.

After reading the entire volume, the reviewer feels that this report did not, contrary to the impression of many, sound the death knoll for UFOs. It merely presents the impression and opinions of a group of competent and responsible scientists on the evidence presented so far in support of the existence of UFOs. These scientists have found that none of the evidence presented so far has passed the basic tests for being acceptable as scientific evidences. It is upon this conclusion that this group declared that in the past twenty-one years of time "nothing has come from the study of the UFOs...that has added to scientific knowledge." In other words, UFOs cannot be regarded as scientific phenomena. More properly, ufology should be regarded as a pseudo-science. The propagation of ufology has caused many to accept the phenomena, and scientists who object are called upon to prove that "UFOs cannot exist." The burden of truth is thus shifted, through manipulation and propaganda, from being able to prove something to having to disprove something. Surely this is not science. The disproving of a pseudo-science often calls for an extremely heavy investment of scientific talent. Despite Dr. Condon's report, the voices of dissenters will not remain silent. Those who have invested a great deal of time on UFOs will certainly find the truth a bitter pill; they will undoubtedly continue their ufological career, perhaps with even greater vigor and bitterness toward scientists. Dr. Condon's report can always be criticized as being inconclusive (and in the strictest sense of the word, this is so). But no one can say that scientists have not taken the matter of UFOs seriously and have not studied the UFO reports with the same spirit as in the study and search for quarks, monopoles, elementary particles, and (by listening to the two stars  $\tau$  Ceti and  $\epsilon$  Eridani) possible existence of extraterrestrial civilizations.

Finally, I would like to add a postscript to what has already been said.

If we have indeed been visited by intelligent beings from outer space in spaceships, then a sizeable fraction of heavy elements of our galaxy must be found in these spaceships. It is unthinkable that the Sun would be favourably selected, among the  $10^{11}$  similar stars in our Galaxy, as the most desired star to visit. After all, there is nothing to distinguish us from the background noise of the Galaxy. The inhabitants of the Earth learned to use the radio only a bare seventy years ago, and atomic energy was discovered just two decades earlier. It is only reasonable to suggest that, if the Earth has been frequently visited by intelligent beings travelling in UFOs, then the same species must at the same time, also explore other stars in our Galaxy. At least  $10^{12}$  spaceships must be dispatched per year in order to cover all stars in our Galaxy at least once per year, assuming that the velocity of travel is the velocity of light. A total of  $10^{22}$  spaceships from the birth of our Galaxy to the present must have been dispatched. Even if a starship weighs only a modest million tons (as compared to the weight of the Apollo craft at lift-off,  $10^4$  tons), the total weight of the spacecraft would have to reach five solar masses! If all sightings of UFOs are genuinely true starships, then this figure has to be boosted by a factor of 1000, to a figure of 5000 solar masses. The concentration of spacecraft material (selected heavy elements) in the Galaxy is about 1%. To derive these 5000 solar masses of heavy elements, 500,000 solar masses of stellar matter (about 500,000 stars) or the star content of a globular cluster would have to be processed. This is sheer impossibility.

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