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THE EFFECTS OF POSITION AND DISTANCE IN UFO IGNITION-INTERFERENCE CASES

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Abstract

Some reports of UFO sightings involve events in which motorized land vehicles experience ignition or electrical system interference in the presence of a UFO; 276 such reports were collected from the UFO literature. These events were analyzed to determine the role played by position of UFO and distance from UFO to vehicle in the severity of the reported electrical system interference. A highly significant relationship (p .001) was found between position of UFO and severity of effect. A substantial majority of the cases experiencing complete engine failures (stalls) occurred when the UFO was reported either directly in front of or above the witness' vehicle. A significant inverse relationship (p .03) was found between reported distance from the UFO and severity of effect. A significant interaction between position and distance was discovered (p .04). UFOs appearing in front of or above the witness' vehicle were reported as being closer than those observed behind or off to one side. It was hypothesized that this interaction may be responsible for the correlation between position and severity of effect. Constructing a multidimensional contingency model to test for relative effects was not possible due to incomplete data. It was recommended that investigators of future events make a special effort to obtain distance and position estimates.

The analysis of close encounter cases of the second kind (CE-IIs), i.e., UFO cases involving reported physical effects, offer the potential of the richest rewards to scientific inquiry. Such cases offer the greatest promise for instrumental, quantitative data (Hynek, 1972). Even in cases where there are no lasting physical effects, it may still be possible to sort out physically meaningful information from the qualitative and general testimony of the UFO witnesses (McCampbell, 1976b).

Reports of motor vehicle electrical system interference during a UFO encounter usually involve no lasting physical effects or damage. However, there is one major advantage these reports have to reports involving simple close UFO observations: the presence of a physical device capable of serving as a measuring instrument, namely, the motor vehicle. McCampbell presents this argument in the following way:

> A common lament in ufology is the lack of so-called hard, or instrumental, data. Such information is generally lacking in the sighting report. But it should be observed that an automobile is merely an assemblage of components and circuitry that is reportedly responding to changes in the environment. In

other words, the automobile functions as an instrument notwithstanding its design for other purposes. (1976b, p. 164)

Viewed in this manner, the reported effect on the motor vehicle could provide us with the means to test certain hypotheses about the physical nature of the interference effect. An essential step is to notice the elements that are common to a large number of independent sightings.

The purpose of this paper is to investigate the role two variables--position of UFO and distance from UFO--play in the severity of the reported electrical system interference. These two variables were selected because they appear to have a role in the literature and because they relate to questions of physical causality of the reported effect.

Hall (1960) and McCampbell (1976b) both point to the same pattern in UFO ignition interference reports. The UFOs are reported as being directly ahead of the automobiles and at a low altitude at the time of electrical interference. McCampbell believes that this positioning plays a crucial role in headlight failures, and postulates that intense microwave radiation may be the cause. The radiation would collect on the headlight filament which would increase the resistivity of the tungsten in the filament, thereby reducing the flow of current and extinguishing the lights when the flow of the current becomes too low to keep the filament incandescent (McCampbell, 1976a). Position of the UFO would play an important role because the UFO would need to be within a narrow region directly ahead of the headlights in order for the microwave radiation to be focused by the parabola of the headlamp on the filament (McCampbell, 1976a).

Other hypotheses involving the possible effect of microwave radiation on the timing of the sparks in a standard ignition system vehicle and the resistivity of the tungsten alloy in the distributor points, are offered in explanation for the engine failures. Whether position would have any effect on the cause of these engine failures was not discussed by McCampbell. Nevertheless, there are a great many cases mentioned in the literature where engine failure alone is correlated with the UFO being directly in front or above the vehicle. We can hypothesize that a possible shielding effect occurs whenever too much shielding material (in the form of the roof, trunk, and passengers of the car) is positioned between the UFO and the engine of the motor vehicle.

This is only one hypothesis; other causal explanations could equally well be advanced. The intent of this paper is only to establish whether a statistically significant relationship exists, not to prove its causes.

If the cause of the interference effect is high frequency electromagnetic radiation, as McCampbell and some others contend (McCampbell, 1976a), then one should expect to observe an inverse relationship between distance and intensity of effect. This expectation would correspond to known physical parameters, such as the inverse-square law. McCampbell argues that such a relationship exists, and mentions some of the better documented cases which appear to reveal a gradational distance effect (1976a). On the other hand, Rodeghier (1978) could find no such relationship between distance and intensity of the interference effect in his analysis of automobile electromagnetic interference data. The lack of such a relationship could argue against a physical basis for the phenomenon, or it could be used to argue that the physical force involved is transient or only applied selectively. It is not clear, however, what type of statistical test Rodeghier applied to his data, or the number of cases on which he based his conclusion. An additional intent of this paper, therefore, is to determine whether proximity to the UFO at the time of the ignition interference plays a statistically important role in the severity of the effect noted.

A final intent of this paper is to shed light on the relative effects of these two factors by examining whether any interaction exists between position and distance, and what the strength of that relationship might be.

Method

A computer-generated listing of all possible cases involving electromagnetic effects in the vicinity of a UFO and also involving a motor vehicle was obtained from the Center for UFO Studies' (CUFOS) computerized catalogue of UFO reports (UFOCAT) in November 1978. This listing contained 570 cases. Working from this and other sources, an eventual file of 276 cases was compiled that involved confirmed reports of motor vehicle ignition or electrical system interference attributable by the witnesses to a close UFO encounter.

These cases involved headlights and engine near failure and complete failure, but were limited to cases involving land vehicles and did not

include reports of car radio interference. Because interference cannot be directly linked to a vehicle's electrical system, because it frequently results from a wide variety of mundane causes, and because the reports themselves were sometimes vague about the nature of the radio interference, it was felt it would be better to exclude these more ambiguous cases from the study.

Of the 276 cases, 154 were obtained from books or catalogues published by UFO researchers. The remaining 122 came from periodicals, newspaper accounts, and private investigators' files. Over 100 separate sources were consulted in compiling this file, and for the majority of cases, multiple references existed on the same report to check and compare. Table 1 breaks down the reports by their principal source.

Table 1

Principle Source for 276 UFO Events

books		periodicals	
Vallee	47	FSR	46
Hall	29	APRO	34
Lorenzens	17	ACOS(Australia)	15
Phillips	12	IUR	4
Ballester-Olmos	11	NICAP	3
Michel	9	other	11
Hynek	4		
other	25	Newspapers	7
	154	Files	2
			122

While making no pretensions about this list being totally exhaustive, nevertheless it would be safe to say that due to the extensive nature of the search and the powerful bibliographic assistance provided by UFOCAT, this compilation contains the great majority of cases ever reported.

No discussion or exemplification of particular cases will be presented in this paper. For such a presentation, the reader is referred to Chapter 9 of J. Allen Hynek's book, The UFO Experience (1972).

Description of the reports. The earliest reported case occurred in 1909 and the latest added to the file occurred in December 1978. Only seven cases occurred before 1954. Reports have been associated with every region of the world with the exception of Japan and the Far East. Table 2 presents the number of reports for each major region of the world.

Table 2
UFO Vehicle Electrical System Interference Reports by Region of World

US and Canada	145	E. Europe & USSR	2
Latin America	40	Africa	4
Great Britain	13	Australia & N.Z.	22
Western Europe	50		

All cases were coded in terms of the nature of the effect on the motor vehicle and the type of vehicle involved. Categories of vehicle included 219 (79%) involving automobiles, 36 involving trucks or vans, 12 involving motorcycles, 8 involving farm vehicles, and 1 incident with a snowmobile.

These cases involved collectively over 500 witnesses. Perhaps surprisingly, over 60% of the cases involved multiple witnesses. The number-of-witnesses per incident data can be broken down as: single witness, 112 cases; two witnesses, 73 cases; three witnesses, 28 cases; four or more witnesses, 32 cases; information not given, 31 cases.

For types of electrical interference noted there were 83 incidents where both the engine and headlights of the vehicle died, 124 cases where only the engine was reported stalled, 9 cases where the vehicle had not been in operation but could not be started, 31 cases where the engine faltered and lost power but did not stall completely, and 29 cases where only the headlights failed while the engine performance was unaffected. With the exception of only 16 cases, all of these effects were apparently temporary and in some cases, power returned spontaneously once the UFO had left the area. In many cases, multiple vehicles were involved in the same incident. In particular, on two separate occasions a diesel-powered and a standard-ignition-powered motor vehicle were involved together.[1] In both instances, the ignition-system-powered vehicle stalled while the diesel-powered vehicle continued to run. For the record, no case involving the failure of a diesel-powered engine has ever been recorded, although at least two more cases involving diesel-powered trucks had reports of headlight failures.

[1]The two cases referred to are the Forli, Italy case, occurring November 14, 1954 and involving two farm tractors, and the Fordingbridge, England case, occurring November 5, 1967, involving a diesel-powered Leyland truck and a Jaguar sports car.

Results

Of the 276 cases of ignition or electrical system interference reported in the UFO literature, a total of 176 contain some mention of the position of the UFO relative to the witnesses' vehicle. For these 176 cases, the evidence reveals 86 cases (48.9%) where the UFO was reported directly in front of the vehicle at the time of ignition interference, 51 cases (29.0%) where the UFO was reported as hovering above the vehicle, and 39 cases (22.2%) where the UFO was reported as positioned behind or off to one side of the vehicle. Of 18 cases involving headlight failure alone, only 5 occurred when the UFO was directly in front of the automobile. This seems to contradict McCampbell's contention that "UFOs hovering directly overhead, standing or maneuvering off to the side, or chasing cars seldom, if ever, have killed the lights . . ." (McCampbell, p. 168).

A 3x3 contingency table was constructed comparing position of UFO with effect on vehicle's electrical or ignition system. Interference effects were categorized in decreasing degree of severity as (1) incidents where both engine and headlights failure were reported, (2) incidents where only engine failure was reported (obviously encompassing all daytime reports), and (3) incidents where the engine missed or slowed but did not stall completely or where headlights failure was reported. The results are presented in Table 3.

Table 3

Vehicle Interference Effect by Position of UFO

	In front	Above	Behind or Alongside	
Engine and headlights died	36	13	11	60
Engine stalled	39	28	10	77
Engine missed or headlights only affected	11	10	18	39
	86	51	39	176

Pearson's chi-square = 21.14
Degrees of freedom = 4

$p < .001$

Position 39

Clearly, a highly significant relationship exists between the reported position of the UFO at the time of the ignition interference and the severity of the effect. The strength of the reported effect appears to be greatly enhanced when the UFO is either directly in front or directly above the motor vehicle. This relationship is even more clearly shown by reducing the number of categories to a 2x2 contingency table. Effect is then categorized as "stall" or "no stall," and position categorized as "in front or above" or "other." This new categorization is shown in Table 4.

With one degree of freedom, the chi-square value is 14.98, indicating a highly significant relationship ($p < .001$). In terms of measures of association, the phi coefficient, which for 2x2 tables is directly translatable into a correlation coefficient, is equal to .31. This indicates a moderately positive relationship between position and effect, with approximately 10% of the variance observed in the ignition interference effect (whether the vehicle stalls or not) attributable to the position of the UFO vis-a-vis the witnesses' automobile, truck, or motorcycle.

Table 4
Effect (Stall/No Stall) by Position
Above or In front/Other

	Position: Above or In front	Position: Behind or Alongside	
Stall	116	21	137
No stall	21	18	39
	137	39	176

Pearson's chi-square = 14.98 $p < .001$
Degrees of freedom = 1

We next turn our attention to the role that distance from the UFO plays in the severity of the ignition interference effect reported. It is well known among perceptual psychologists and other experts that humans are poor judges of distance, and our ability to estimate distances at night--when most of these incidents occur-is especially poor (Haines, 1979). Even under the best conditions, such estimates must be viewed as only rough approximations and not precise statements.

The difficulty in obtaining meaningful distance estimates probably discourages some witnesses from making any estimate at all, and probably further discourages investigators from recording and transmitting them. Only 56 cases contain an estimate (in feet or meters) of the distance from the observer to the UFO. This paucity of data is understandable.

However, estimates of distances, while only crude at best and certainly varying in accuracy from one observer to the next, can nevertheless provide some ballpark notion of whether the presence of the UFO was close by or far away. For this reason, reported distance in this study is treated as an ordinal variable with only three categories: close, intermediate, and far.

Close refers to all reported distances of less than 30 meters. In such instances, the observer should be able to rely on such distance cues as size and features of the UFO, as well as interpositional cues, for instance, if the UFO was observed between the witness and a nearby tall tree. Such encounters are usually regarded emotionally by the witnesses as close and immediate, and very impressive.

An intermediate distance would be from 30 meters to 120 meters. More cases fall into this category than any other. The observer perceives the UFO to be a close but not overpowering presence, usually no more than a stone's throw away. Interpositional or size cues allow the witness to approximate the distance to be within the length of a large soccer field. A "far" distance would refer to anything beyond 120 meters.

The cutpoints for these categories were derived in part experientially as described above, and in part by looking at the data to derive categories of approximately equal size. To check for any spurious effects caused by the choice of cutpoints in the results reported below, the data were recalculated at cutpoints of 15 meters and 200 meters. Practically identical results were obtained. The ignition interference effects were dichotomized as either a complete engine stall or not. The results are presented in Table 5.

Table 5
Distance as an Ordinal Variable Affecting Ignition Failure

	Distance: Close	Distance: Intermediate	Distance: Far	
Stall	16	18	9	43
No stall	2	5	6	13
	18	23	15	56

Jonckheere's S = 185 $p < .03$ (one-tailed)
z = 1.92

An appropriate test of significance, more powerful than the chi-square test which makes rank order distance from close to far, is the nonparametic statistic called the Jonckheere test with ties (Leach, 1979). For our data, we will regard our explanatory variable (distance) as having the three ordinal values we discussed. We will treat every observation within a category as a tie. The test statistic, S, is the same as used in the Wilcoxon Rank-Sum test, and it is evaluated--after a continuity correction is made--by approximation to the normal curve. Since our alternative hypothesis is that the data should conform to the "inverse square law" of effect over distance common to all physical forces, this will properly be a one-tailed test.

Our results show a significant relationship ($p < .03$) between severity of the ignition interference effect and the distance to the UFO. The likelihood of a vehicle stalling out consistently increases as the distance between the vehicle and the UFO becomes small.

As a measure of association, Goodman and Kruskal's gamma statistic was found to equal .48. This can be given a probabilistic interpretation by noting that the probability of a vehicle not stalling, given that it is further away from the UFO, is .74, while the probability that it would stall is .26. Gamma is then the difference of these two probabilities (Leach, 1979).

The logical next step in the analysis is to look for any interaction between position and distance which might further account for the association of both variables with severity of ignition interference effect. If no interaction is found, then we can conclude that each variable contributes to the interference effect independent of the other. If, on the other hand, a positive association between position and distance is found--"positive" defined in terms of close proximity being associated with advantageous positioning--then we must allow for the possibility that the position effect may only be an artifact caused by the proximity effect, or vice versa.

The test to use in this situation is again the Jonckheere test with ties. Since we are only interested in the alternative hypothesis that position and distance are positively associated, our test will legitimately be in the one-tailed direction only. The results are presented in Table 6 and we find that the relationship between position and distance is significant at the .04 level.

Table 6

The Interaction of Distance with Position

	Close	Intermediate	Far	
Directly in front or above	8	16	16	40
Behind or alongside	2	4	6	12
	18	20	14	52

Jonckheere's $S = 176$, $Z = 1.83$; $p < .04$ (one-tailed)

At this point we have conducted tests for all two-way interactions by summing over the third variable. Unfortunately, this method is not sufficient to allow any statements about the relative effects of position and distance on severity of effect. Indeed, to base our analysis solely on two-dimensional tables is risky, as situations of partial or conditional independence may arise where a two-dimensional treatment of the data alone could be misleading (Everitt, 1977).

The preferred course of analysis would have been to have developed a three-dimensional table of position x distance x effect. Such a multi-dimensional table would have allowed for testing the relative contributions of position and distance

to severity of effect as well as testing for the possibility of a second order or three-way interaction. Unfortunately, due to a great lack in the number of distance estimates reported in the literature, the number of cases remaining in the analysis (N=52) is too few to perform such an analysis. With a 3x2x2 table, a chi-square test of mutual independence, with seven degrees of freedom, fails to achieve significance (Pearson's chi-square = 10.66, $p < .20$). One concludes that further analysis of the table would be unfruitful.

Discussion

In reviewing the evidence for headlight failures only, we find that 13 out of 18 cases occurred when the UFO was situated somewhere other than in front of the car. It appears that we need to provide another causal model for these 13 cases, as McCampbell's tungsten resistivity hypothesis is not sufficient to explain all the evidence.

On the other hand, position of UFO seems inextricably linked to the phenomenon of vehicle electrical system failure. One hundred sixteen cases, or nearly two-thirds of those cases describing the position of the UFO, list it as directly in front or directly above the automobile. The criteria applied in coding these observations was quite strict and refers to a very limited area around the automobile: "directly in front" of the vehicle refers to exactly that, usually on or hovering low over the roadway and barring the way; "directly above" refers to the situation when the UFO hovers or passes directly over the hood or the roof of the car. Hall (1960) and McCampbell appear to have correctly alerted our attention to this relationship. Whether there exists a causal relationship between position and effect is difficult to assess, particularly since the position variable is confounded with proximity to the UFO. The position variable, however, might help explain those cases where a UFO passes in close proximity to a motor vehicle and no interference effect is noticed.

Distance and severity of ignition interference effect appear to have an established relationship in a manner compatible with what would be expected from a high frequency, electromagnetic force. The closer the UFO, the more likely the vehicle responds with complete engine failure. These conclusions are compatible with those observations of McCampbell (1976a) but contradict those of Rodeghier (1981). A possible reason for Rodeghier's conclusions could be that his test simply lacked statistical power due to inappropriate design, small sample size, or the choice of the wrong test statistic.

The most attractive interpretation of the interaction found to exist between position of UFO and distance to UFO, from the point of view of someone who would like to show that a physical force is responsible for the engine and headlights failures, is the viewpoint that ascribes all of the interference effect to the close proximity of the UFO. The position effect is seen simply as an artifact of proximity and of no real importance. This argument would hold that since UFOs appearing in front of cars are actually closer, there is no great mystery in why more of these cars are stalling.

This view would be in accord with the results. It should be pointed out that the distance effect might still someday be accounted for by the position effect (or another variable not even considered here). Or, as is usually the case, the truth may be somewhere in the middle.

One criticism that might be made of the data and of UFO reports in general is that the events are not independent. Put another way, the possibility exists that the witnesses fabricated their reports or colored their own testimony so that it would be in line with the commonly "known" description of how a UFO should look and behave. Lack of independence violates a critical assumption of the statistical tests we have employed.

At least two considerations argue against this type of interpretation. First, I had hoped to show by including the data on region-of-world that the phenomenon is global in nature. Reports were contributed by witnesses from a wide variety of educational and professional backgrounds from just about every major cultural language group in the world. It is unlikely that witnesses in one culture would be familiar with testimony of similar events in other areas of the world, particularly when the news has to cross language barriers. Surprising as it may seem to those unfamiliar with the field of UFO research, the details of these events are simply not considered newsworthy by the international press. One must also keep in mind that it appears there is little that could be gained from fabricating a UFO encounter.

Second, a wide range of descriptions are obtained about such variables as color, size, shape, number of objects, the lack or presence of noise, as well as such subjective assessments as inferred

intent on the part of the UFO. This seems to argue against the assumption that the witnesses are adopting a conventional story line.

An obvious direction for future research would be to compare ignition interference UFO events to other events involving UFOs with witnesses in automobiles where no electrical system interference is noted. Data for the variables position and distance would be compared.

In view of the findings of this report, it is recommended that all investigators conducting investigations of similar cases in the future make a special effort to obtain position and distance estimates.

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RELATIVISTIC LIMITS

TO RELATIVISTIC TRAVEL

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Abstract

Relativistic limits to interstellar and intergalactic travel for hyperbolic motion are summarized. Time dilation notwithstanding, the results indicate that within the limits of foreseeable technology such journeys are not feasible in any reasonable proper time scale.

Does the relativity of time mean, as some suggest, that commerce between galaxies is to be expected? Conversation seems out: The travel time for light to nearby galaxies like the Magellanic Clouds is 1600 centuries, making for awkward conversational pauses. It has been suggested, however, that relativistic effects can make the trip itself seem as short as desired to the travelers. For example, to accomplish the trip in one year of subjective time, a time dilation factor $\gamma = 1.6 \times 10^5$ is required, and relativity allows us to accelerate until such a time dilation occurs, though hundreds of millennia would have lapsed back home by our return.

This exposition summarizes the simplest relativistic theory of such trips and their fuel cost, without engineering. If there were no limits to the acceleration we could produce and withstand, the most economical way to travel, so far as fuel is concerned, would be to use infinite (positive and negative) acceleration at the beginning and end instants of the trip, and coast in between. Since in actuality there are limits to acceleration, we must use finite periods of peak acceleration, and accelerate longer for higher speeds. Finally, for the longest trips, the acceleration is maintained at the peak possible absolute value for the entire trip, with a change in sign at midtrip. Only this case, appropriate for the longest trips, is described here. It is considered by Misner, Thorne and Wheeler (1973) and my treatment is much like theirs, with some numerical cases worked out to illustrate these relativistic limits to space travel.

Relativistic Kinematics of Constant Acceleration

Consider a path of constant subjective acceleration. Then the kinematic quantities at the end of an interval of proper time $\delta\tau$ are obtained from those at the beginning by a Lorentz transformation with fixed boost. The kinematic quantities are:

The timespace coordinates x^μ (writing $x^0 = t$, $x^1 = x$, $x^2 = y$, $x^3 = z$, and $\vec{x} = (x,y,z)$, all having the units of time.*

* Indices are raised and lowered with the metric whose diagonal elements are (1, -1, -1, -1), and summation over repeated indices is understood. If times are in seconds, then distances are in lightseconds, so that the speed of light is $c = 1$, and 1 meter = 1 m = 3.3×10^{-9} sec. The terrestrial acceleration of gravity is then $g = 33 \times 10^{-9}$ sec^{-1}.

The world velocity $u^\mu = dx^\mu/d\tau$

The world acceleration $a^\mu = d^2x^\mu/d\tau^2$, ...

They obey:* (1)

$$u^\mu u_\mu = 1, \quad u^\mu a_\mu = 0, \quad a^\mu a_\mu = \text{const} \equiv -a^2$$

and under the infinitesimal Lorentz transformation with parameters $(U^\mu, A^\mu{}_\nu)$ they change by

$$\begin{aligned} \delta x^\mu &= U^\mu \delta\tau + A^\mu{}_\nu \, x^\nu \delta\tau, \\ \delta u^\mu &= A^\mu{}_\nu \, u^\mu \delta\tau, \\ \delta a^\mu &= A^\mu{}_\nu \, a \, \delta\tau, \ \ldots . \end{aligned} \tag{2}$$

$A = (A^\mu{}_\nu)$ is the boost. Then

$$d^2x^\mu/d\tau^2 = A^\mu{}_\nu \, dx^\nu/d\tau \tag{3}$$

which we abbreviate to

$$D^2x = ADx, \tag{4}$$

integrate once to

$$Dx = Ax + \text{const} = Ax \tag{5}$$

with four integration constants which are set to zero by translation, and once more to

$$x = e^{A\tau} x_0, \tag{6}$$

the subscript 0 meaning "$at\ \tau = 0$," with four more integration constants $x_0 = (x_0^\mu)$. That is, the coordinate vector x^μ undergoes the same finite Lorentz transformation $e^{A\tau}$ as the world velocity u^μ and world acceleration a^μ. Therefore, it too has constant Lorentz norm, and

$$\begin{aligned} x^\mu x_\mu &= t^2 - \vec{x}^2 = \text{const} \\ &\vdots \\ &\equiv -r^2 \end{aligned} \tag{7}$$

This is the equation of a hyperbola, and the motion is called hyperbolic motion. The point where we have put the origin is the center of the hyperbola. The motion is planar, and we may (and do) set $y = z = 0$.

It is pleasant that uniformly accelerated motion is as simple in relativity as in classical mechanics. It is merely hyperbolic (see Figure 1), with $x^2 = t^2 + r^2$, instead of parabolic

$$(x = \tfrac{1}{2} a t^2 + r)$$

The boost $A^\mu{}_\nu$ can be expressed in terms of the initial acceleration vector $\vec{a} = d^2\vec{x}/dt^2$:

$$A^\mu{}_\nu = u^\mu(0)\, a_\nu(0) - a^\mu(0)\, u_\nu(0) \tag{8}$$

where indices are raised and lowered with the constant metric tensor whose diagonal elements are (1, -1, -1, -1). Indeed, note that this A transforms $u(0)$ into $a(0)$ and hence $\vec{v}$ into $\vec{a}$, as required by (2); and nullifies the vectors orthogonal to u^μ and a^μ. In the initial rest frame

$$A = \begin{array}{|c|c|} \hline 0 & -\vec{a} \\ \hline \vec{a} & 0 \\ \hline \end{array} \tag{9}$$

In that frame, if the acceleration is along the x^1 axis,

$$\begin{aligned} x^0(\tau) &= r \sinh a\tau, \\ x^1(\tau) &= r \cosh a\tau, \\ x^2 &= x^3 = 0. \end{aligned} \tag{10}$$

The important constant r, measuring the distance from the rocket to the center of its hyperbola, is found by evaluating the world acceleration $a = d^2x^1/dt^2$ implied by (7) at $t = 0$. We find

$$a = 1/r \tag{11}$$

But for a factor 2, r is the distance it would take a Newtonian rocket to reach light speed under acceleration a. Let us call r the acceleration length, therefore. During the entire acceleration, the invariant interval of the rocket from the center of its hyperbolic motion never changes. For any inertial observer passing through this center, the rocket first becomes visible in the remote distance (infinity) when it is already at the point of closest approach in the spatial dimensions, just as a fast plane still sounds far off when it is already overhead and it is already too late to signal it; given any head start, it will not be overtaken by a light pulse from the origin.

The proper time τ required for a trip with $x >> r$ may now be estimated from (10).

$$\tau = r \cosh^{-1} \frac{x^1}{r} \to r \ln(2x/r). \tag{12}$$

For trips with $x >> r$, the logarithm is slowly varying, and the scale Tr is simply the time required to reach light speed at acceleration a in Newtonian kinematics. The trip distance is $x - r$ (see Figure 1).

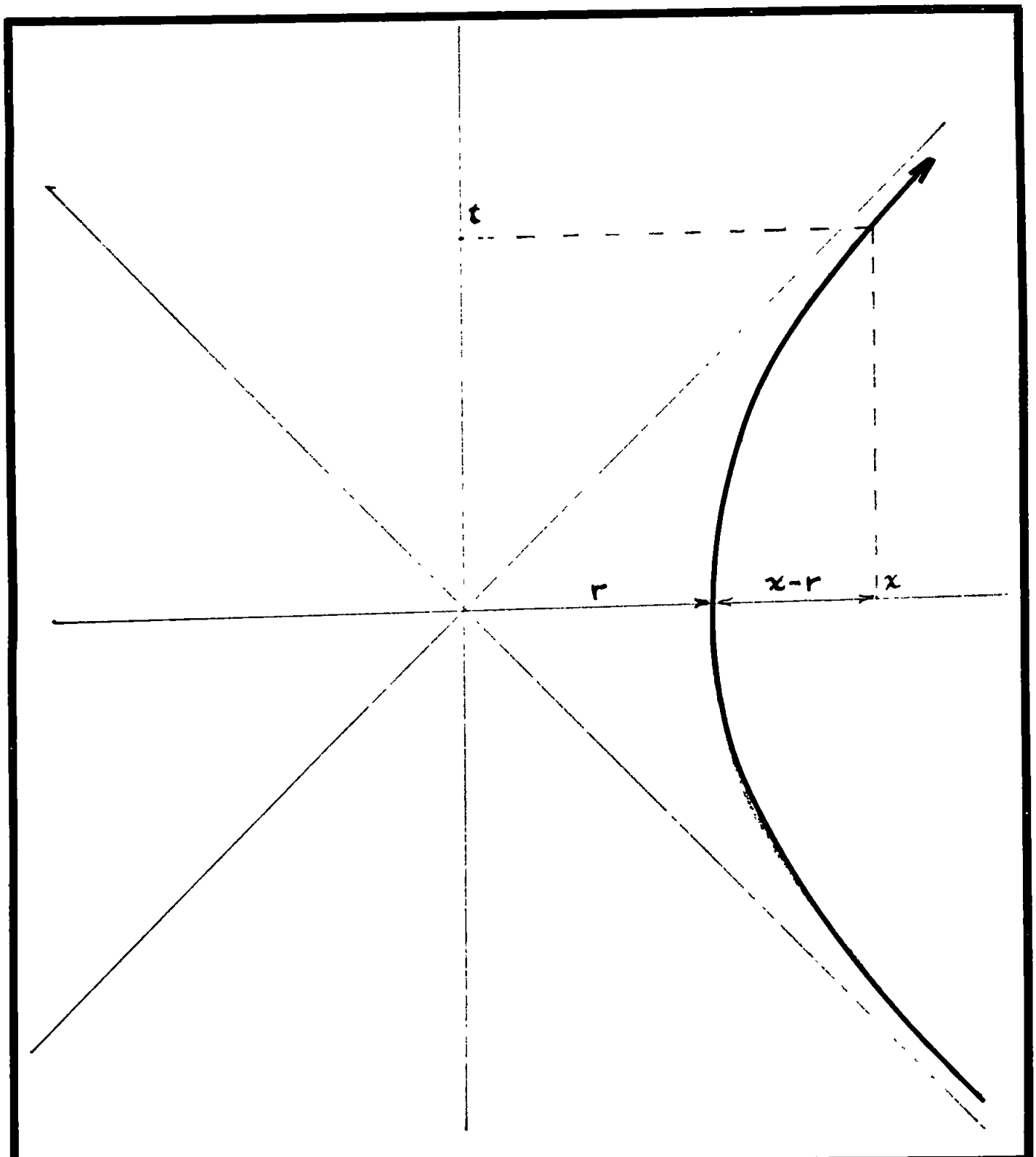

Figure 1. Hyperbolic motion. The hyperbola represents the motion of a rocket undergoing constant proper acceleration. Asymptotes and the t- and x- axes are shown. The acceleration length is the distance r.

Dynamics

What forces are needed for this motion? For simplicity, suppose the rocket ejects light (sternward at first, forward later). The energy-momentum carried off by the light per unit may be written as $(dM/d\tau)w^\mu$ where M is the rest-time mass of the rocket at proper time τ and w is a null vector ($w^\mu w_\mu = 0$) in the direction of the light, normalized by

$$w^\mu u_\mu = 1, \quad \therefore \; w^\mu = u^\mu - a^\mu/a. \tag{13}$$

Momentum balance tells us the rate of change $\frac{dM}{D\tau}$ of the rocket mass obeys

$$0 = -\frac{dM}{d\tau} w^\mu + \frac{dM}{D\tau} u^\mu + M a^\mu. \tag{14}$$

Multiplying both sides by a_μ and using (1) and (11) shows that

$$\frac{dM}{D\tau} = -M/r. \tag{15}$$

Therefore, the acceleration length has a second meaning: it is the time constant of the exponentially decaying rest mass of the rocket:

$$M = e^{-\tau/r} M_0. \tag{16}$$

This gives the mass ratio for a trip of duration τ and distance $x - r$:

$$M_0/M = e^{\tau/r} \sim 2x/r \tag{17}$$

for $x >> r$. For round trips without refueling, square the mass ratio, double the time.

For Newtonian rockets with exhaust speed c, the above equality holds, provided τ is replaced by t. Since t is exponentially related to τ, this is an enormously greater mass ratio, for given acceleration and distance. Relativity saves.

More realistic but still highly idealized photon rockets convert a fraction of their fuel mass f to radiant energy that imparts impulse, leaving the remainder $1-f$ in the form of low-velocity ashes along their trajectory. For nuclear rockets, say, the fuel utilization factor f will surely be less than .001. It is easy to satisfy our curiosity about the effect of this ash on the mass ratio. The time-constant is now f-fold more:

$$\frac{dM}{d\tau} = -\frac{M}{fr} \tag{18}$$

Equations (1-13), being purely kinematic, apply also to the ashy rocket. Because of (18), the mass ratio for a given trip is no longer (17) but

$$M_0/M = e^{\tau/(rf)} = e^{\tau a/f} \sim (2x/r)^{1/f} \tag{17'}$$

This means that for longer trips, the mass ratio of even an ideal nuclear photon rocket is the $1/f$ power (more than the 1000th power) of the mass ratio for the ideal matter-antimatter photon rocket.

Application

For a rocket trip, we suppose that the final velocity is about the same as the initial. Constant acceleration is followed by equal constant deceleration. The trajectory is then composed of two congruent segments of hyperbolae smoothly joined at one point, the overall mass ratio is still given by (17), and the proper time is twice the value of (12) for half the distance:

$$\tau = \frac{2}{a} \cosh^{-1}(x/2r) \sim \frac{2}{a} \ln(x/r) \tag{19}$$

Nearby stars. For example, let us consider the effects of relativity on a trip to a star about 30 lightyears away, with $x - r = 3 \cdot 10^{17}$ m.

A. Acceleration = 100 g. This far exceeds our tolerance and provides an upper bound for the mass ratio, a lower bound for the time. The acceleration length is

$$r = 9.10^{16}/10^3 = 10^{14} \text{m}.$$

We see that $x >> r$ and the asymptotic forms may be used. The mass ratio (the initial rest mass divided by the final rest mass) is by (17)

$$M_0/M = 6000$$

and the proper time is by (19)

$$\tau = 6\cdot10^5 \ln(3000) = 5\cdot10^6 \text{ sec} = 2 \text{ months}$$

compared to the time lapse of over 30 years assigned to the trip by people back home. The round-trip mass ratio is 36,000,000.

B. Acceleration = 1 g. This is the comfortable acceleration. Now the acceleration length is $r = 10^{16}$m, still much less than $x = 3\cdot10^{17}$ m, and the mass ratio and proper time are

$$M_o/M = 60$$
$$\tau = 6\cdot10^8 \ln 30 = 2\cdot10^8 \text{ sec} = 6 \text{ years}$$

For the round trip, square the mass ratio and double the proper time.

C. Choose the acceleration so that $x = 2r$ for a weakly relativistic trip; then by (11) $a = .3$ m/sec^2 and $r = 10^9$ sec. Now the proper time and mass ratio are

$$\tau = \frac{2}{a}\cosh^{-1}2 = 2.6\times10^9 \text{ sec} = 80 \text{ years}$$
$$M_o/M = \exp(a\tau) = 14$$

Other galaxies. Now let us consider three similar trips to the Magellanic Clouds about 50 kiloparsecs away; $x - r = 1.5\cdot10^{21}$m.

A. $a = 100$ gravity again. For this acceleration, the acceleration length is

$$r = 9 \times 10^{16}/10^3 \approx 10^{14}\text{m}.$$

Therefore $x >> r$, and the asymptotic formulae hold. The mass ratio is, by (17), enormous:

$$M_o/M \approx 3\times10^7$$

and the proper time is, by (12),

$$\tau \approx 6 \times 10^5 (\ln 1.5 \times 10^7) \text{ sec}$$
$$= 10^7 \text{sec} \sim 4 \text{ months}$$

B. $a = 1$ gravity. This is the comfortable acceleration. Its acceleration length is 10^{16}m, still small compared to the distance traveled. The asymptotic formulae may be used. The mass ratio is still huge:

$$M_o/M = 3 \times 10^5,$$
$$\tau = 6 \times 10^7 \ln 1.5\times10^5 \sim 7\times10^8 \text{ sec} \sim 20 \text{ years}.$$

C. For a more imaginable mass ratio, take $a = 6 \times 10^{-6}$ gravity, so that $r = 1.5\times10^{21} = x - r$. Then $\tau = \frac{2}{a}\cosh^{-1}2 = 1.3\times10^{13}$ sec $\sim .4\times10^6$ years, $M_o/M = 14$ again.

Discussion

While the proper times and mass ratios for the relativistic rocket are enormously smaller than for a classical one, when the proper times are not prohibitive the mass ratio is, and when the mass ratio is not prohibitive, the proper time is. Mass ratios like 60 or 30,000,000 suggest the controlled conversion of twin planetoids of matter and antimatter into directed radiation in a short time, creating an appallingly inhospitable environment, even if such antiplanetoids are found, and a quite conspicuous object. For simplicity, we have based our calculation on a pure photon rocket with no thermodynamic limit to efficiency, assuming total conversion of fuel to light. The actual conversion factors attainable by merely nuclear devices, fission or fusion, are less than several MeV per many GeV, thousands of times poorer, and this would make for mass ratios larger by a power in the thousands. This is not the way for us to make quick trips to other stars or galaxies in the foreseeable future.

While it is sensible to use the laws we know to set the bounds to our ambitions, it is not quite as sensible to use them to bound advanced extraterrestrial life. Our laws still undergo several drastic evolutionary changes per millenium, and an extraterrestrial civilization could be many millennia older than we are, and operate in domains where our present time and space concepts do not work. A little humility is in order. What we can say on the basis of these calculations is how such travel will not take place. Time dilation not withstanding, relativistic rockets are not a plausible way to come here from another galaxy in a short time.

Acknowledgement

This expository note was done at the request of Allen Hynek, and I thank him for enjoyable discussions.

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RESULTS OF SOUND SPECTRUM ANALYSIS OF THE METALLIC NOISES OF A TAPE-RECORDED RADIO TRANSMISSION BETWEEN CESSNA VH:DSJ AND THE FLIGHT SERVICE OF MELBOURNE, AUSTRALIA

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Introduction

A twenty year-old Australian pilot disappeared with no trace of any kind on the night of Oct. 21, 1978 while flying by himself in a Cessna model 182L from Melbourne's Moorabbin field to King Island via Cape Otway. Approximately six minutes before his last radio transmission on 125.9 MHz using his Narco-Con model 11A VHF transmitter, the pilot reported seeing strange lights apparently approaching him and somewhat above his own altitude of 4500 feet.

The pilot, Frederich Valentich, described the aerial object as a long shape, appearing metallic with a green light on it and performing a number of flight maneuvers around and above him.[1] The object allegedly approached him several times, apparently from different directions, passed over him at high speed, orbited in a tight circle[2] above him, suddenly disappeared from his view, and was in full view when his engine began to malfunction. The end of his radio transmission (beginning at 0912:28 GMT) began with the pilot's last known words, which were his aircraft's call sign "Delta Sierra Juliet..." and concluded with a seventeen-second long period of an unusual reverberating metallic type of sound. This report summarizes results of a spectral analysis of this final period on the tape as well as analyses of several "control" sounds which the author made in flight in a similar type of aircraft under comparable flight conditions.

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Method

Radio Tape Studied. The analysis reported here was made on a copy of the original radio transmission between Cessna VH:DSJ and Melbourne's Flight Service located at the primary commercial airport (Tullamarine) NW of Melbourne. It is not known how many times this tape had been copied nor what type of equipment had been used so that it is quite possible some of the frequencies recorded were artifactual, i.e., not present on the original version.

Analysis Approaches. Two separate activities were undertaken to analyze this tape: (1) a "control baseline" sound tape was made under conditions as similar as possible to the original, and (2) both the copy received by the author and the control baseline taped sounds were subjected to frequency spectrum analysis.[3]

The baseline control sounds were generated by the author while in a Cessna 182 type aircraft on the ground with the engine off, on the ground with the engine running at idle power, flying at a cruise indicated air speed of 120 knots (2400 RPM, 23 inches manifold pressure) and 4,500 feet altitude, and flying at an indicated air speed of 145 knots (2600 RPM, 25 inches manifold pressure). Many different things were tried with the press-to-talk handheld microphone and various sound-effects apparatus to duplicate the metallic sounds on the tape in question. Several are listed here. The microphone was tapped lightly on various parts of the cockpit structure and control wheel, was held against the vibrating window while transmitting, and the spring-loaded press-to-talk switch was pressed and released rapidly and at irregular intervals during a transmitting period (Figure 1).

A carefully prepared script was followed in making each type of sound in each of the four testing conditions (on the ground and in-flight). All transmissions from the aircraft were made on 123.3 MHz using the aircraft's new 10 watt VHF (King model; electrovoice differential microphone) radio. Timing and other communication between the aircraft and the two ground receiving/recording stations was done by means of a 2m band, simplex channel transceiver and "Handy-Talkee" unit.

Two ground receiving sites were used. Site A was at the San Jose Municipal airport south hangar area where the radio receiver's speaker output was recorded on a General Electric model 3-5105C tape recorder operated on 120 VAC. The receiver was a Pilot II model (Novatech Corp.). Figure 2 shows this ground site. Ground site B was in Cupertino, California, about seven miles SW of the airport and about sixteen miles from the San Jose VOR. A TEAC model 2300S reel to reel tape unit operated at 3.75 ips was connected to the short-wave radio receiver. Two tape recorders were also used on board the aircraft. One was connected directly to the radio's transmit circuit so as to record a high fidelity copy (only) of what was transmitted, while the second simply recorded the cockpit sounds throughout the flight. All four recorders were turned on simultaneously at the beginning of the test and not stopped until the end. Ninety minute duration, previously unrecorded Ampex audio recording cassette/670 tape was used in all recorders. Each recorder was calibrated by the author prior to the various radio transmissions by means of a 525 Hz tuning fork struck directly in front of the microphone of each recorder. The same tuning fork was also struck in front of the aircraft's microphone periodically on the ground and in flight to check on possible frequency shifts due to transmitting or receiving equipment.

The tape in question containing the unusual metallic sounds and the control sounds were then analyzed using a Ubiquitous Sound Spectrum Analyzer. This device digitizes the taped sounds after using certain selective filters to eliminate unwanted noises. In the results to be presented, frequencies from 50 Hz to 2.4 KHz are displayed.

Results

The spectral (frequency) content for the metallic sounds and three candidate "reconstructed" sounds are presented in Figure 3.

The top horizontal tracing (A) is for the metallic sounds from Cessna VH:DSJ. The lower three tracings (B,C,D) were selected (primarily) on the basis of their sounding to the author most similar to the metallic sounds of Valentich's plane compared to all of the other sounds that were generated during this test.

Figure 1. R.F. Haines with hand-held, press-to-talk microphone.

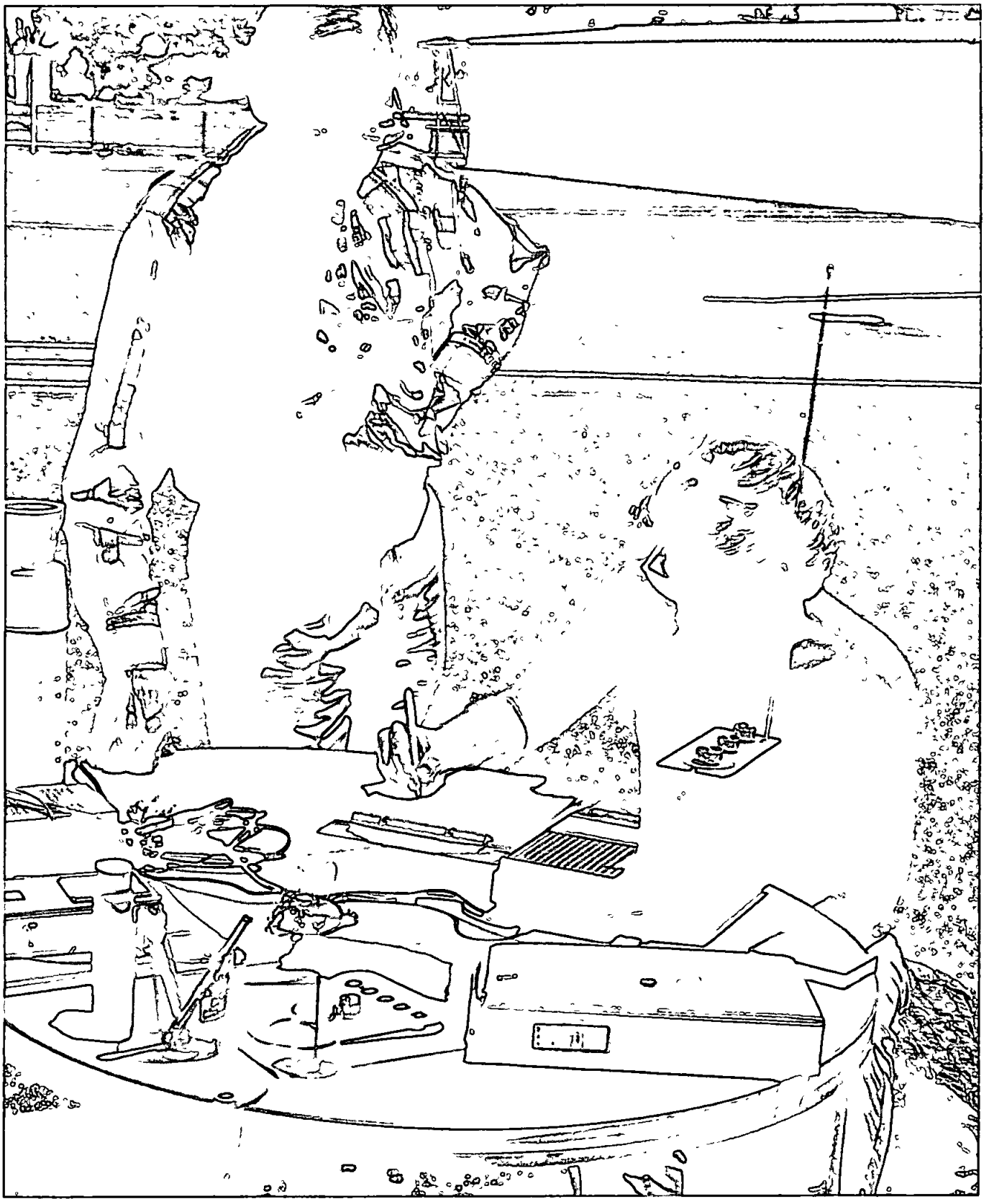


Figure 2. Ground site A with Dr. Peter Sturrock, standing; Richard Henry sitting.

The lower three tracings are: (second from the top, B) engine off, microphone transmit switch depressed rapidly at random intervals; (third from the top, C) engine running at 2400 RPM while still on the ground, microphone transmit switch depressed approximately as before; and (bottom tracing, D) aircraft in flight at 4,400 feet altitude, 2100 RPM (21 inches manifold pressure), on 232 deg (magnetic) heading from the north end of Anderson Lake in Santa Clara County, some eighteen miles SE of the San Jose airport and twenty miles ESE of ground site B.

Analysis Results for the Metallic Noise

Several general observations are in order before turning to the spectral analysis results. First, there is no evidence whatsoever of any voices during the seventeen-second-long period of metallic noise even though the pilot held the microphone transmit switch down continuously after saying, "Delta Sierra Juliet - Melbourne." Second, a relatively pure tone of 1,350 Hz (± 10) runs through the entire tape. Since it also includes the author's voice (where an identification leader was added, this tone must have originated in the author's tape recorder4). Third, the seventeen-second-long period could be subdivided into the following basic sections. The name assigned to each section is arbitrary and only for descriptive purposes. They include:

Table 1

Basic Sections of 17-Second Metallic Noise Section of Recording

Interval	Name	Duration (sec.)
1.	Pre-noise background	1.8
2.	First group of metallic noises	10.4
3.	Pause	0.84
4.	Second group of metallic noises	4.04
5.	Post-noise background	*

*Note: This period is not included as part of the total period of radio transmission. It lasts 4.88 seconds. Interval 2, 3, and 4 are shown in Figure 3.

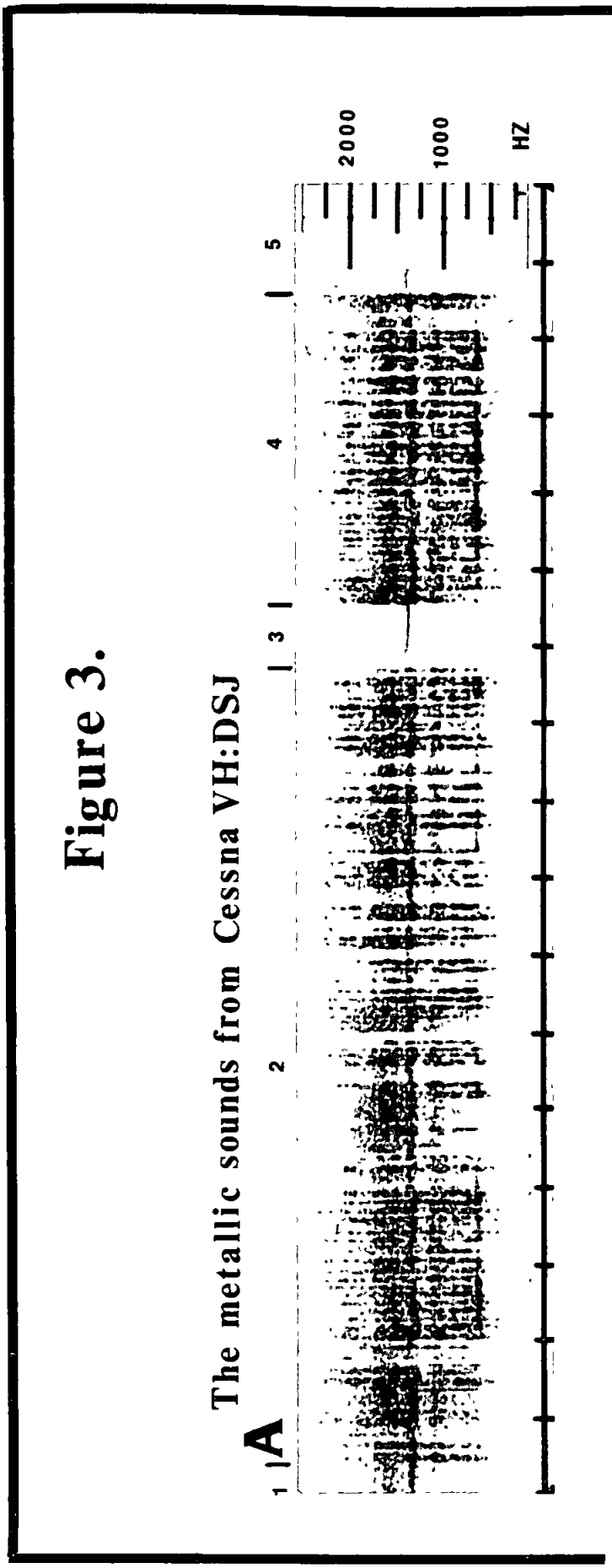
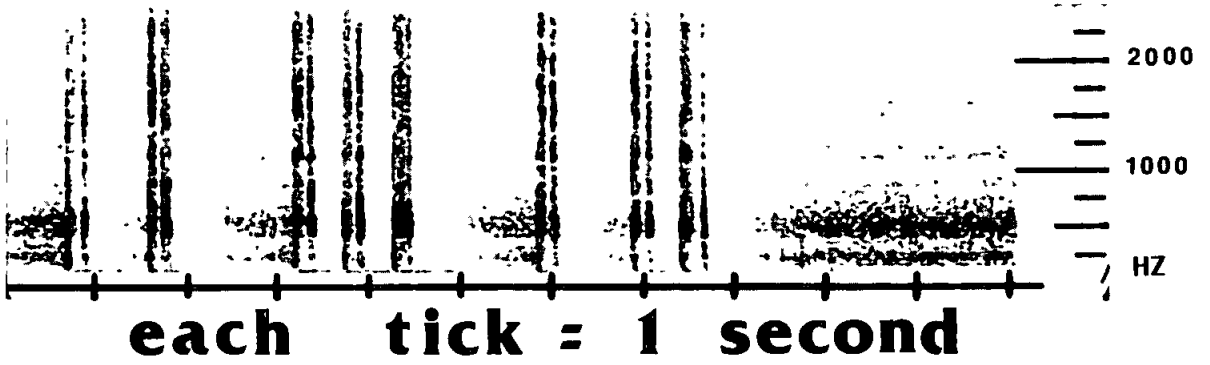
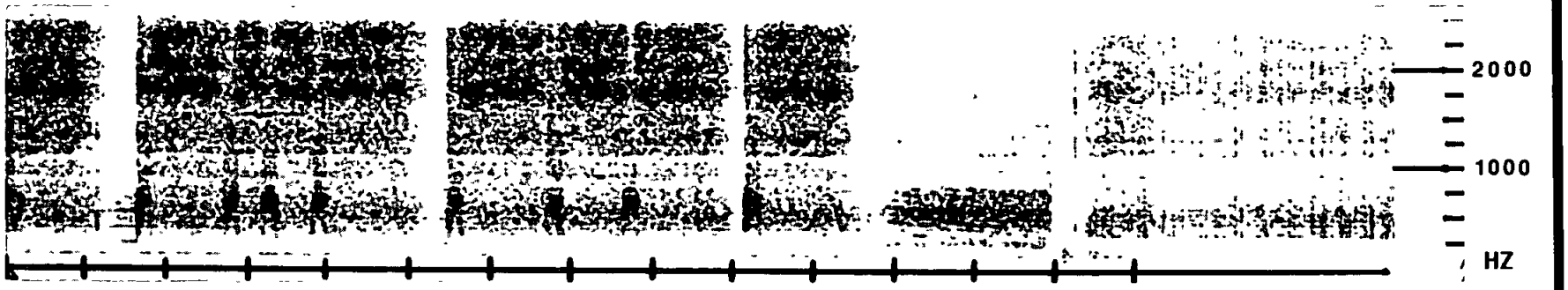


Figure 3.

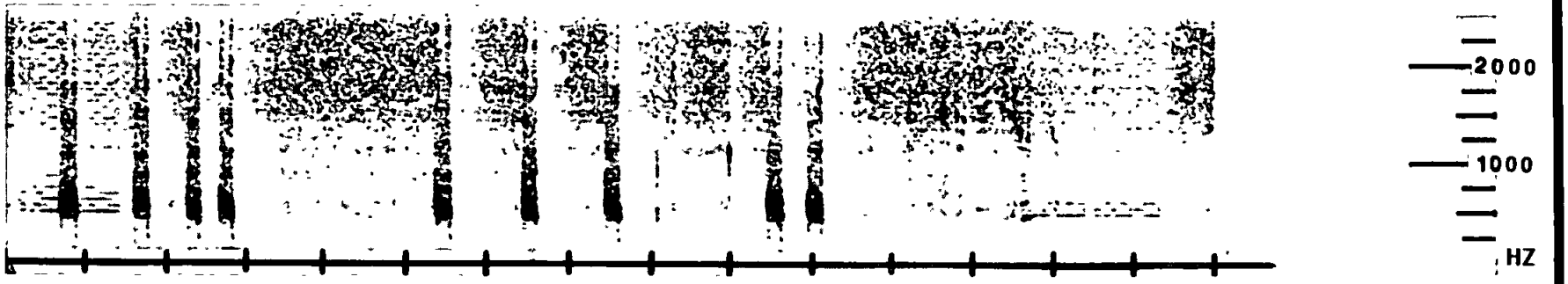
B Engine off, microphone transmit switch depressed rapidly, at random intervals



C Engine running at 2400 RPM, switch depressed as before



D Aircraft in flight at 2100 RPM, switch depressed as before



Interval 1 Characteristics. Referring to Figure 3, the long axis of each tracing represents time with one-second tick marks shown beneath each tracing. Frequency is shown on the vertical axis with lower frequencies at the bottom. This scale is from 50 Hz to 2.5 KHz (each vertical tick mark represents 250 Hz). Darkness of the tracing represents a concentration of frequencies.

Frequencies making up interval 1 are of moderate intensity from about 1 to 1.75 KHz with peak intensity at about 1.55 KHz. No intensity fluctuations are apparent during this interval which may generally be characterized as typical radio static or "white noise." In addition, there are two very brief (0.08 sec) click sounds separated by about 0.04 second. They are not of the same timbre as the "bursts" which follow. That is, the clicks do not have a "reverberation" type sound character as most of the (following) bursts do.

Interval 2 Characteristics. The frequencies making up this interval may be characterized as being background static (as above) with the addition of approximately twenty-four separate "bursts" of noise. This term is used only for convenience and should not be interpreted in any specific way. It is extremely difficult to describe sounds with words. Each burst lasts about 0.16 second and begins and ends with a broad range of frequencies from about 400 to 2,300 Hz. This very brief but broad frequency noise which begins and ends each burst is called a "start" and a "stop pulse," respectively. Each start and stop pulse lasts about 0.04 second. Between each start and stop pulse is found a fairly homogeneous band of frequencies ranging from 625 to 1,750 Hz. Additionally, fourteen of the twenty-four bursts possess a relatively pure tone of 685 Hz. These fourteen bursts are numbers 1 through 5, 7, 8, 10 through 12, 17, 19, 22, and 23. The duration between adjacent bursts varies from a minimum of 0.03 second to a maximum of 0.23 second. Also, there are as many as five bursts per second which, if these bursts are produced by the pilot depressing the microphone transmit switch, would represent an extremely rapid reaction rate. Each burst (depress/release response) would have to occur in less than 180 milliseconds.

This rapid a manual response is possible to achieve by humans but only with difficulty. Numerous scientific studies have shown that one may be able to achieve this response rate for a short period of time, but not over a prolonged period of time of (say) 10 to 20 seconds or more. Interestingly, the five-burst sequence just mentioned is found during the period from 3.4 to 4.4 seconds into the transmission under study. Thus, it is within the realm of possibility that this metallic noise (burst) could have been produced by an extremely rapid manual keying of the aircraft's microphone press-to-talk switch, at least on the basis of its temporal features. The author has learned that the pilot was known to have the habit of depressing the microphone switch irregularly in flight for some reason.

Interval 3 Characteristics. For some unknown reason, there is a pause lasting 0.84 second that occurs between adjacent transmissions of bursts. The only frequency present during this interval is the 1,350 Hz tone mentioned above which (probably) originated in the author's tape recorder. Thus, the third interval represents a "closed microphone," i.e., one which was not transmitting anything or a period which was somehow removed from the original radio transmission (in flight) or after the tape recording was made.

Interval 4 Characteristics. In general, the frequencies and their temporal distribution are very similar to those found in interval 2. However, in addition there is a repetitive tapping sound present. Each tap lasts about 0.02 second with a frequency of from 700 to 1,300 Hz. Taps are separated by 0.52 second, sounding to the author like a scratch on a record; they occur just before, during, and after the fourth interval. In fact, ten taps are heard after interval 4 is over. It is interesting to question why they would appear during the fourth interval (of bursts) but not during the second interval which also included bursts. It is intriguing to speculate about their source. Is it possible that before the copy of the tape the author analyzed was made, a section had been removed for some reason, then during the final portion of the unusual bursts another recorder or taping process had introduced these repetitive tapping sounds? Analysis of the original tape recording would likely provide an answer to this question.

Concerning the bursts that occur during the fourth interval, there are at least twelve discernible (possibly thirteen), each of which has the same start and stop pulses and duration characteristics as were found during interval 2.

Thus, it is very likely that they represent the same basic phenomenon as occurs during interval 2.

Interval 5 Characteristics. The last interval begins at the end of the last burst and ends 4.88 seconds later. During this period, it is clear that the microphone switch had been released to stop the transmission since the volume of the background static increases regularly as is typical of time constants used in squelch circuits.5

Analysis Results For the "Control" Condition Noises

It should be pointed out that of all the sound effects produced by the author in the cockpit, the only ones that sounded at all like the metallic noises from Cessna VH:DSJ were those produced by a rapid manual keying of the microphone. Three separate sets of such tape recorded sounds were subjected to sound spectrum analyses identical to that of the "original" metallic noise tape recordings. It should also be pointed out that the tuning fork "control" frequency showed that all of the tape recorders used had no measurable flutter or "wow" and that the laboratory equipment was accurately calibrated for time and frequency.

The first control noise analyzed is the second tracing from the top in Figure 3(a). While sitting in the aircraft with its engine off (and the radio operated off the battery), the microphone transmit switch was pressed and released eight times within the 8.4 second-long transmit period. Comparing the top tracing with this tracing, the "bursts" produced in each tracing differ in the following ways: (1) the duration of each start pulse (found at the beginning of a single burst) transmit period is variable, lasting from 0.04 to 0.15 second in the second tracing. Additionally, each start pulse is made up of a variable range of frequencies of from 175 to 2,400 Hz; (2) the duration of each stop pulse (found at the termination of an individual burst) transmit period is fairly constant in duration (approximately 0.07 second) but with the same wide range of frequencies as for the start pulse; (3) the radio receiver at ground site A appeared to possess about the same squelch circuit time constant as on the original tape; and (4) the start and stop pulses each contained a relatively high proportion of low frequencies of from 375 to 720 Hz. To the author's ear, this first control recording does not sound very much like the metallic noises in question.

The second control noise analyzed is presented in Figure 3 as the third tracing from the top (c); here the aircraft's engine was running at 2400 RPM while still on the ground at San Jose airport. A total of eight microphone switch activations were made (as before) within a 12.8 second-long transmission period. The duration between the start and stop pulses were fairly constant at 0.17 second. Each of these transmit reponses from the aircraft's radio cancelled a portion of frequencies that originated from the background sounds at the airport where this recording was made. The prominent characteristic of each transmission was background static predominantly from 1.7 to 2.35 KHz which started with each stop pulse and lasted until the following start pulse. It is possible that the static sounds originated from electrical interference produced by the aircraft's own electrical system since the aircraft was located only about 150 yards from ground site A. Also, the start and stop pulse of each switch activation is characterized by a wide range of frequencies of from 250 Hz to 2.5 MHz. Again, to the author's ear, these noises did not sound like those heard on the copy of the tape from Cessna VH:DSJ.

The bottom tracing in Figure 3(d) is from the in-flight part of the testing while flying at 4400 feet altitude with the engine set to 2100 RPM (21 inches manifold pressure) in order to try to approximate the conditions of the original taped radio transmission. Here a total of nine microphone switch activations were made within an 11.5 second period. A visual comparison of these bursts with those of the top tracing shows that they are not very similar. However, to the ear, they are reasonably the same in their overall noise characteristics. Each burst is characterized by the same start and stop pulse as has already been described for the preceding two control runs.

Discussion

Had the young pilot somehow become unable to talk during this period of the taped radio transmission and did he try to tap out some kind of coded message? Had he, in fact, said something while holding the transmit switch down which the Australian authorities had not mentioned? The best answer to each

of these questions is no on the basis of the tape analyzed. But what about the possibility that the pilot had held his transmit switch down for the full seventeen seconds (or more?) and the pilot of another aircraft flying within the reception range of the ground receiving system had keyed his microphone rapidly and irregularly while transmitting on the same frequency? After discussing this possibility with numerous knowledgeable people, the author discovered that this was, indeed, a possibility although it would probably have a low probability of occurrence. Related to this possibility is evidence that there had been another private aircraft in the vicintiy of Cessna VH: DSJ that night whose pilot had listened as the young Valentich spoke to the ground controller at Melbourne. Apparently this is how the story first leaked to the press.

The metallic noises on the tape analyzed do not sound like the normal static one hears during a thunderstorm or when there is a poor electrical connection within an older radio; it sounds far more regular in terms of being made up of apparently individual events or bursts that occur in a long first stream (interval 2) and then a second, shorter stream (interval 4). It is not possible to determine whether these noises were caused by some intermittent electrical emission on-board Cessna VH:DSJ, some intermittent circuitry problem like a loose bonding strap, or some event totally external to the aircraft like atmospherically produced interference (or shielding?).

What is fairly certain to this writer is that this seventeen-second-long period of so-called metallic noises was not produced as the aircraft allegedly broke up upon impact in the sea. Two reasons are offered to support this contention: first, due to earth curvature, the aircraft's radio signal would not have reached the Melbourne antenna at the relatively great distance involved, and second, it is highly unlikely that any crash would last seventeen seconds for an aircraft of this type.

As is true with so many reports of anomalous aerial phenomena, the present evidence leaves one with a sense of frustration and despair. No conclusive evidence was uncovered which would tie the metallic noise to some other known noise. The correlational evidence is marginal at best. And, while we now know a little more about the frequencies involved and their time course from Cessna VH:DSJ, we still are no closer to a definitive explanation of what caused them. Of course, it is both dangerous and unwarranted to study any phenomenon too far from its larger context. Sometimes apparently unrelated events which occur before or after a period under study can unlock that period. Such might be the case here as well. Consequently, other segments of the six-minute-long original tape also have been analyzed and are being prepared for publication.

Conclusions

The seventeen seconds of radio transmission from Cessna VH:DSJ on October 21, 1978 off Cape Otway in Australia which have been referred to as a period of "metallic" noises have been analyzed and found to contain a total of thirty-six separate bursts with fairly constant start and stop pulses bounding each one. There are no discernible patterns in time or frequency to these bursts such as might suggest that the pilot were trying somehow to communicate through them. Also, there is no evidence of speech patterns at any time during this period. An attempt to recreate the same sounds in flight under basically the same flight conditions was not particularly successful. A somewhat similar start and stop pulse-like effect was achieved using a press-to-talk handheld microphone during various control tests, but the frequency versus time characteristics of these radio transmissions were noticeably different from those on the original tape.[6]

NOTES

1. The many other details of this case have been reported elsewhere: (a) W.C. Chalker, "The Missing Cessna and the UFO," Flying Saucer Review, 24 (March 1979), 3-5; (b) Anon., "Pilot Lost At Sea," International UFO Reporter,

3 (December 1978), 2-10; (c) E. Jensen, "UFO Arsag Til Flyforlis?" UFO-NYT, 3 (May-June 1979), 87-97; (d) P. Norman, "The Bass Strait Flap," Australian UFO Bulletin (February 1979), 7-11; (e) Anon., "Pilot Disappears After Reporting UFO," MUFON UFO Journal, 129 (August 1978), 3-5; (f) P. Norman, "Mystery Deepens in Pilot Disappearance Case," MUFON UFO Journal, 141 (November 1979), 5-7; (g) R.F. Haines, "Delta Sierra Juliet-Melbourne," book length documentary report in final editorial review, 1981.

2. The term "orbiting" to an Australian pilot means making a small diameter turn which requires a high bank angle and increased "g" loading on the pilot. Valentich reported that he was ". . . orbiting below" the object as it orbited above him.

3. The author is indebted to Drs. Peter Sturrock and Chung Park as well as Jerry Yarbrough for their assistance in arranging for this analysis at Stanford University on November 13, 1980.

4. General Electric, model 3-5312A, date code 3731, battery operated with ALC condenser microphone.

5. The time constant for the squelch characteristics of the tape in question was estimated on the basis of analyses of several aircraft to ground radio transmissions where it is clear the microphone transmit switch had been released. Since the squelch characteristics are determined in the ground receiver circuitry, it seems reasonable to assume that they would at least remain constant over the course of this tape recording.

6. The author wishes to thank the following persons for their very able help during the collection of the control sound tapes and photographs of the different activity phases: Ray McWard (aircraft pilot); Bill Harrison (photographer); Gordon Gerten (radio operator at site B); Irwin Wieder (radio operator at site B); Peter Sturrock (radio operator at site A); and Dick Henry (radio operator at site A). These tests were made on July 12, 1980, between 11:58 A.M. and 12:52 P.M. PDST.

SCIENTIFIC INVESTIGATION OF UNIDENTIFIED FLYING OBJECTS

Part II

Naval Surface Weapons Laboratory, White Oak, MD

Bruce Maccabee

SUMMARY: PART I (Published in Volume I of this Journal)

Dr. Maccabee has presented a detailed summary of what he describes as the "most scientific study of the UFO phenomenon so far," in order to illustrate how scientific principles can be utilized to study a mass of UFO data.

He relates how the investigators of Project Blue Book Special Report #14 (BB#14) assumed that statistical analysis would be useful in determining whether or not unexplained UFO reports were different, in general, from explained reports. They found that there are some differences, and reported their analysis in the text so that future investigators could make up their own minds.

Dr. Maccabee disagrees with their conclusions and thinks that their statistical analysis can be interpreted as indicative of the existence of some so-far-unidentified phenomenon, although the data are not sufficiently accurate for a precise identification.

ABSTRACT: PART II

APPENDIX A: ON THE RELATIVE RELIABILITIES OF UFO REPORTS. A comparison of Knowns, Unknowns, and Insufficient Information reports, using the tables in the BB#14 appendix in order to obtain a better view of these three categories than that shown in the BB#14 text.

APPENDIX B: ON THE GEOGRAPHICAL DISTRIBUTION OF UFO REPORTS. An attempt to answer the question, "Is the incidence of UFO sightings related to the incidence of conventional aircraft activity?"

APPENDIX C: REVISED AND NEW CHI-SQUARED TESTS. A comparison of Knowns and Unknowns, using only cases marked "certain" for the Knowns.

APPENDIX D: ANNUAL PERCENTAGES OF UNKNOWNS. Time-development of the percentages of Unknowns, including percentages of Insuff. Info. and Psychological cases for comparison.

ADDENDUM: SIGHTING AT ROGUE RIVER, OREGON, MAY 24, 1949. A detailed account of a UFO sighting which had been mentioned briefly in the Blue Book #14 text, according to reports in the files of the Air Force Office of Special Investigations (AFOSI).

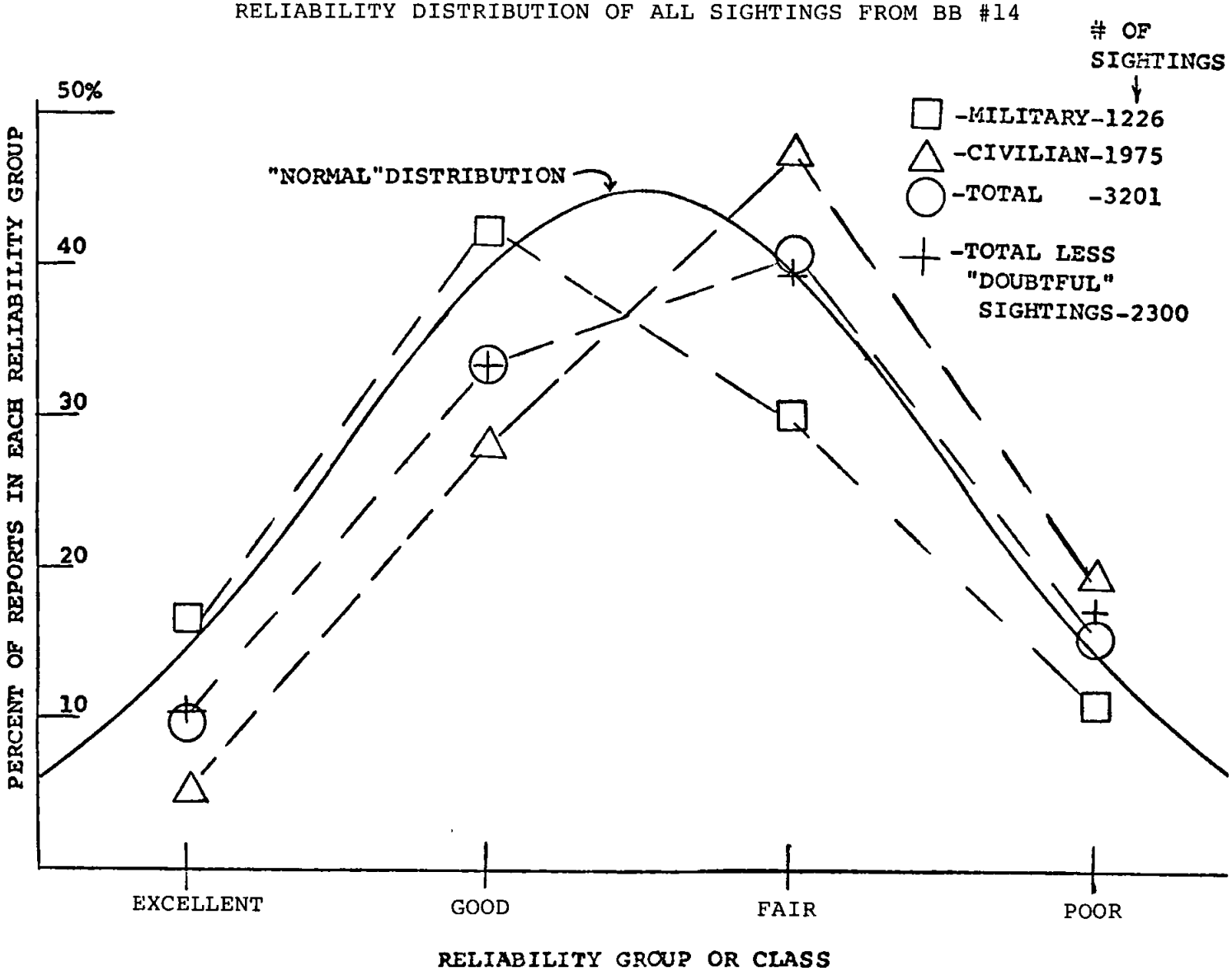
APPENDIX A: ON THE RELATIVE RELIABILITIES OF UFO REPORTS

The sighting reliability distributions presented in FIGURES 5 and 6 in the text of BB #14 include the reports with Doubtful as well as Certain identifications. In order to obtain the best comparison between reports of objects which were "definitely" identified with the reports which weren't identified because of insufficient information or because the objects were Unknown, I have used the tables in the appendix of BB #14 to obtain new reliability distributions for which all Doubtful identifications have been left out. This reduces the overall number of reports by one-third, but allows for more accurate comparisons between Unknowns, Insuff. Info., and Knowns.

Figure A-1 does, however, contain Doubtful as well as Certain identifications. It illustrates the distribution of reports into the four groups called Excellent, Good, Fair (called Doubtful in BB#14), and Poor. For comparison, a "normal" statistical distribution is included. As expected, most UFO cases lie in the Good and Fair ranges, with noticeably fewer being in the Excellent and Poor ranges. Such a distribution is expected in any random population; whether or not UFO reporters truly form a "random" population may be debatable, but the reliability distributions are similar to the expected normal distribution.

Figure A 1.

RELIABILITY DISTRIBUTION OF ALL SIGHTINGS FROM BB #14



Of course, one must realize that this distribution is the opinion of BB#14 investigators and includes their evaluation of the credibility and experience of the observers and of the completeness and accuracy of the reports. Presumably, an Excellent case represents a combination of a credible and experienced observer with a complete and (apparently) accurate report, while a Poor case involves a much less credible observer with little or no experience and an incomplete and (apparently) inaccurate report. Good and Fair cases would lie in between.

Note that the military sighting distribution is weighted toward Good and Excellent reliability, while the civilian sighting is weighted toward Fair and Poor. Since there were more civilian than military reports, this weighting carries over to the distribution when all observers are added together. Nevertheless, despite the slight skewness of the reliability distribution, it appears that the reports analyzed by BB#14 have an essentially random reliability distribution. Presumably then, any other large random sample of UFO reports, when analyzed the same way as was done in BB#14, would yield the same or similar statistical results.

Figure A-2 illustrates the identification distributions for the reliability groups. Doubtful identifications have been left out. Military and civilian distributions are treated separately for comparison. Note that in all cases, the military reports have higher percentages of Unknowns and lower percentages of Insuff. Info. than the civilian reports.

Consider now what would be expected if there were no "true" Unknowns. Then the cases classified as Unknown must contain mistakes, either on the part of the observers or on the part of the analysts. Since the analysts have had (presumably) sufficient time and have devoted (presumably) sufficient effort to identifying things described in the Unknown cases, it must be that identifications were not possible because of certain details in these cases. (Note: If the analyst felt that there weren't sufficient details to rule out a Known phenomenon, then he or she could file the case in Insuff. Info.). The only way the details within a case could be incorrect is if the person reporting included the incorrect details, either by intent or because of incorrect observation. The inclusion of incorrect details by intent is equivalent to creating a hoax. Although there were some proven hoaxes, most Unknown cases were not in this category. Therefore, if there are no "true" Unknowns, most Unknown cases must arise because of observational mistakes on the part of the observers.

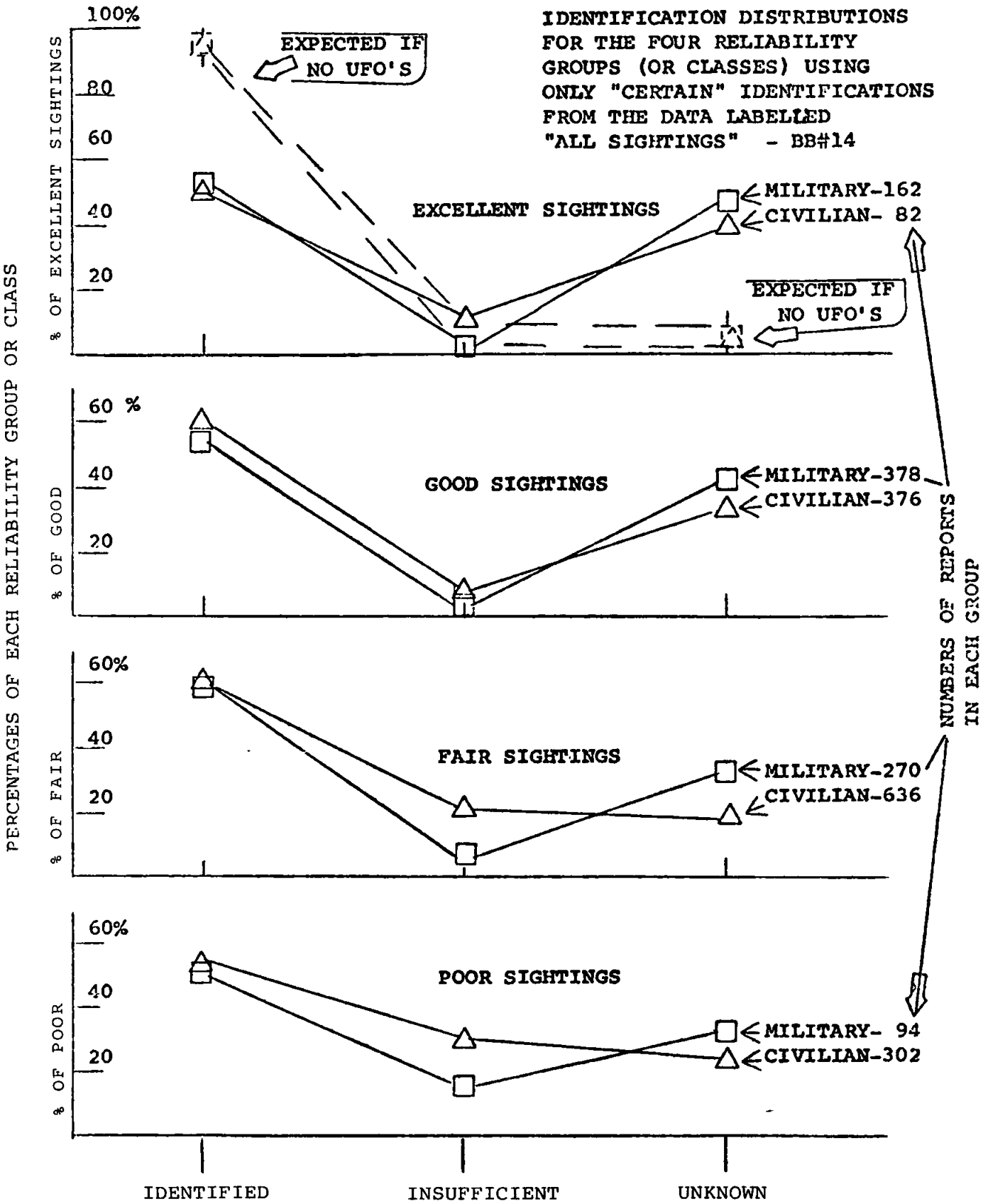
In the identification distributions for the reliability groups, we find that for the Poor reliability reports about 32% of the military and about 22% of the civilian reports were Unknown. Thus, as "expected," poor observers make Poor reports with lots of mistakes. We note also that about 30% of the Poor civilian reports and about 16% of the Poor military reports contained Insuff. Info. for a decision between Identified and Unknown. About 50% of the Poor reports were identified with "certainty."

Now look at the group of reports called Excellent. The percent of Insuff. Info. reports has dropped noticeably to 10% or less, which is what we would expect from reports that are more detailed and come from better observers. However, surprisingly, the percent of Identified has remained the same while the percent of Unknown has increased! Thus, if there are no "true" Unknowns, we conclude that the observers who fall into the class labeled Excellent are more likely (as a class) to make observational errors (because they produce, as percentages, more unidentifiable observations) than are the observers who fall into the class labeled Poor!

Does this seem reasonable? Are Excellent (and Good and Fair) observers more likely to make mistakes than Poor observers? I don't think so. Instead, the data presented in Figure A-2 can be used as evidence for the existence of "true" Unknowns. In fact, graphs such as these are what would be expected if observers were indeed seeing things that cannot be identified.

Note that the percents of Unknowns, Insuff. Info., and Identified are somewhat different from the corresponding values presented in FIGURES 5 and 6 of the BB#14 text. These differences arise from (a) the use of All Sightings instead of Object Sightings, and (b) the deletion of reports with Doubtful identifications.

Figure A 2


IDENTIFICATION DISTRIBUTIONS FOR THE FOUR RELIABILITY GROUPS (OR CLASSES) USING ONLY "CERTAIN" IDENTIFICATIONS FROM THE DATA LABELLED "ALL SIGHTINGS" - BB#14
PERCENTAGES OF EACH RELIABILITY GROUP OR CLASS
% OF EXCELLENT SIGHTINGS
100%
80
60
40
20
EXPECTED IF NO UFO'S
EXCELLENT SIGHTINGS
MILITARY-162
CIVILIAN- 82
EXPECTED IF NO UFO'S
% OF GOOD
60 %
40
20
GOOD SIGHTINGS
MILITARY-378
CIVILIAN-376
% OF FAIR
60%
40
20
FAIR SIGHTINGS
MILITARY-270
CIVILIAN-636
% OF POOR
60%
40
20
POOR SIGHTINGS
MILITARY- 94
CIVILIAN-302
NUMBERS OF REPORTS IN EACH GROUP
IDENTIFIED
INSUFFICIENT
UNKNOWN

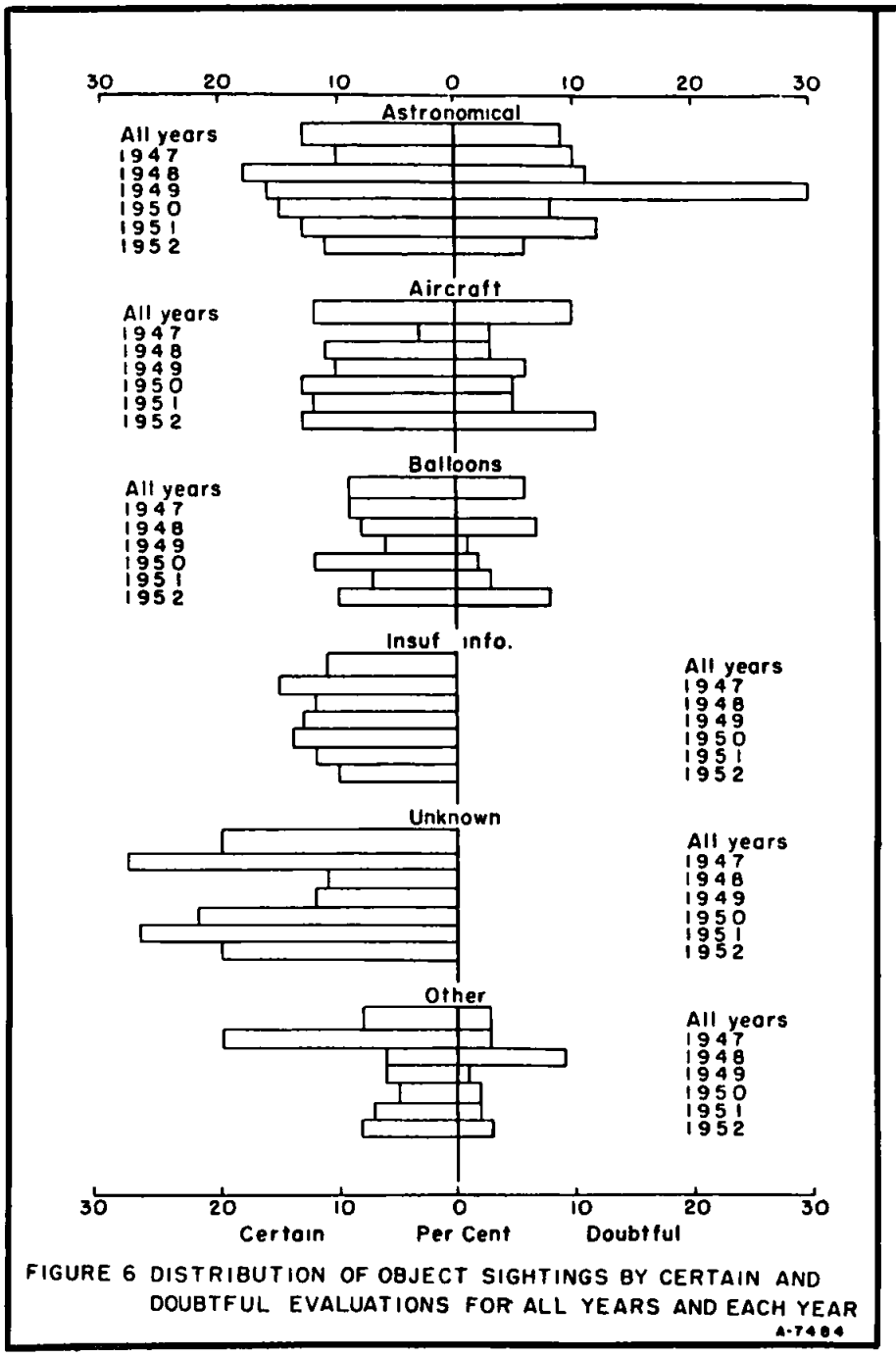


FIGURE 6 DISTRIBUTION OF OBJECT SIGHTINGS BY CERTAIN AND DOUBTFUL EVALUATIONS FOR ALL YEARS AND EACH YEAR

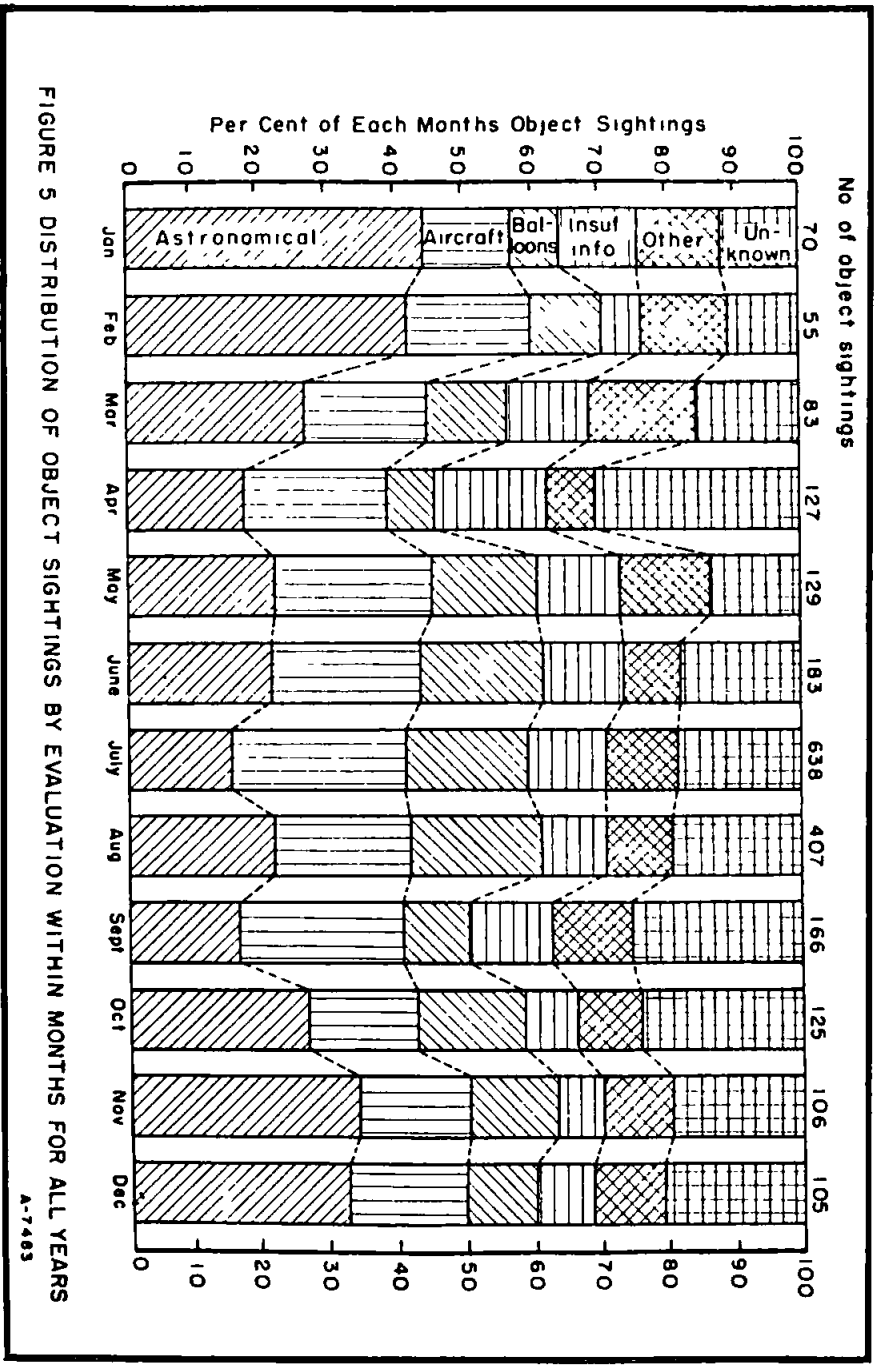
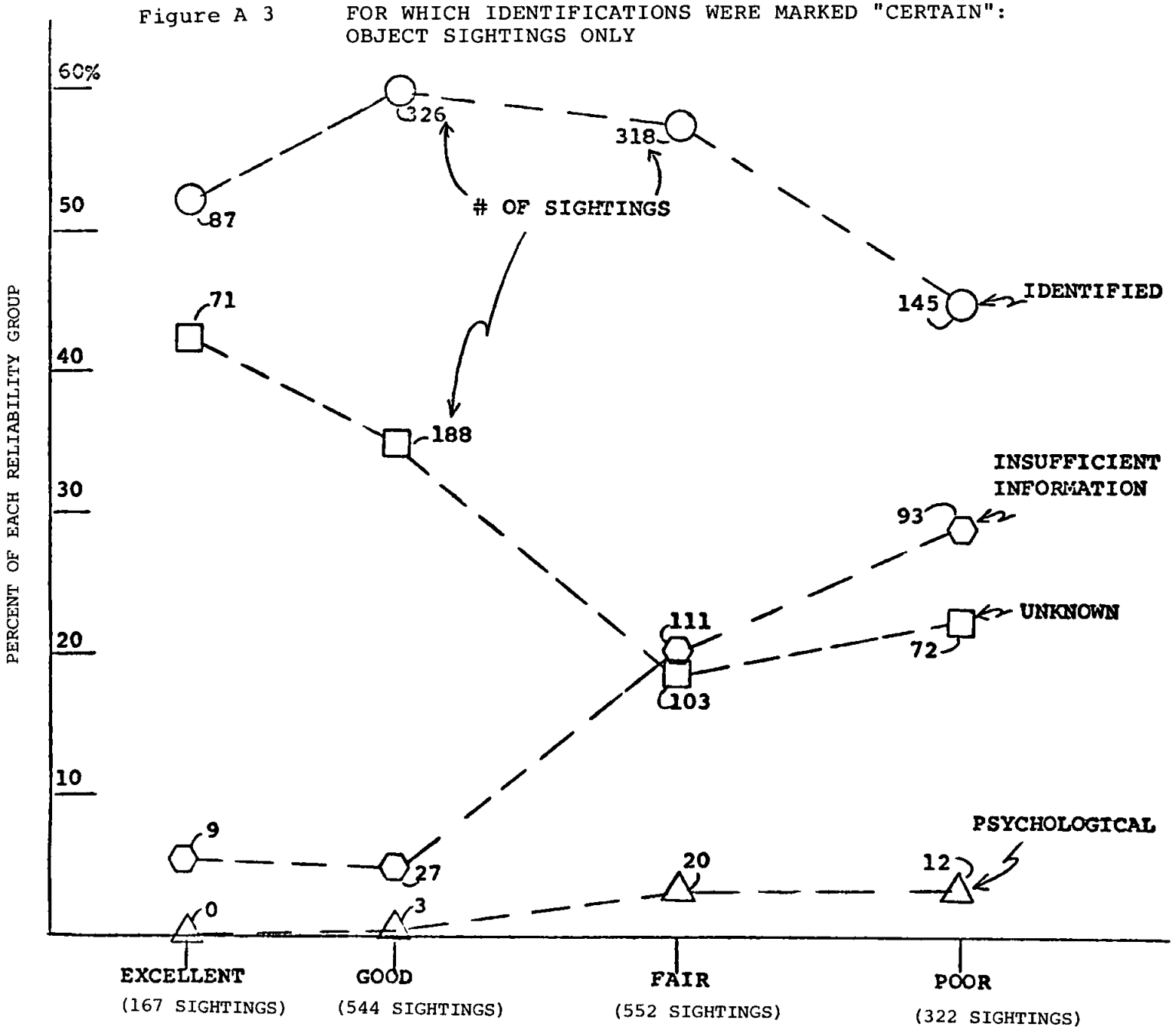


FIGURE 5 DISTRIBUTION OF OBJECT SIGHTINGS BY EVALUATION WITHIN MONTHS FOR ALL YEARS

Figure A-3 presents the reliability data using Object sightings in the same form as in FIGURE 6. However, the Doubtful identifications have been left out so the percents are somewhat different. Also, the reports identified as arising from "psychological" problems of the observer have been segregated to show their small percent (0% in the Excellent reliability group). Note that the percents on Figure A-3 (and FIGURE 6) are summed vertically on the graphs to reach 100%. Thus, in the Excellent group, we have 0% (psychological) + 6% (Insuff. Info.) + 42% (Unknown) + 52% (Identified) = 100% of the sightings in the group.

In Appendix C, I present a Chi-squared test of the reliability distributions of sightings groups as Knowns and Unknowns to further emphasize the dissimilarity evident in FIGURE 6 and Figure A-3.

Figure A 3 RELIABILITY DISTRIBUTION OF UFO REPORTS FOR WHICH IDENTIFICATIONS WERE MARKED "CERTAIN": OBJECT SIGHTINGS ONLY



APPENDIX B: ON THE GEOGRAPHICAL DISTRIBUTION OF UFO REPORTS

In the text of Volume I of this Journal, I presented the geographical distribution of Object Sightings and showed that when the populations of the 1-degree squares were taken into account, the number of sightings per square was essentially independent of the population per square. This means that the number of Object Sightings (presumably the number of objects) reported in any relatively small area does not depend or is weakly dependent, upon the population in the area. On the other hand, the map of the U.S. with the numbers of sightings in each square, clearly shows that the sightings are not uniformly distributed, but are concentrated around "critical areas," to use the phrase of Captain E.J. Ruppelt in a briefing for the Air Defense Command (ADC) given on January 24, 1952. Perhaps the most noticeable critical area includes the squares around White Sands, New Mexico.

Because of the concentration of sightings around certain areas, I wondered if there were something besides population which could affect the distribution of sightings. Since most sightings were made of things in the air by the military, I considered the geographical distribution of military bases from which planes are flown. I also was aware of previous claims going back into the 1950s that UFOs have visited all our military installations and wondered if there were any data to support this.

Further generalizing the study to include squares with a lot of air activity, I have also included the squares (8) which have large airports but no military airports. This study is an attempt to answer the question, "Is the geographical distribution of sightings related to the geographical distribution of conventional aircraft activity?"

In maps and lists of military airports, I found 128 1-degree squares with military air bases (MABs), 8 squares with large airports (LAs) but no MABs, and 762 squares with neither LAs or MABs. (Many with MABs also had LAs in them.) The estimated total 1950 population of the squares with MABs is 75 million; that of the 8 squares with LAs but no MABs is about 12 million; and that of the 762 squares with no MABs and no LAs is about 69 million. (These estimates were obtained by adding the populations of each square--a tedious chore.) Thus we have the following ratios of interest:

$$\frac{\text{Population of Squares with MABs and/or LAs} = 87 \text{ million}}{\text{\# of squares with MABs and/or LAs} = 136} = 644{,}444$$

$$\frac{\text{Population of Squares w/o MABs or LAs} = 6.0 \text{ million}}{\text{\# of Squares w/o MABs or LAs} = 762} = 90{,}551$$

The larger ratio is the number of people per square where there is a great deal of conventional air activity; the smaller ratio is the number of people per square where there is little (or zero) air activity. The combined ratio 644,444/90,551 is about 7.0, which means there is about seven times the population per square in squares with air activity as in those without air activity. This is to be expected, since all LAs and most MABs are located in densely populated areas.

To relate these data to UFO reports, I have used data shown on the U.S. map in the text of BB#14. On this map are the numbers of objects (Object Sightings) in each square (Figure 8 in the previously published text) and also the numbers of reports (All Sightings) in each square. On this map there are 135 squares with MABs and/or LAs with a total of 1773 reports which refer to the sightings of (presumably) 1188 objects (about 1.5 reports per object). There are also 762 squares with no MABs and no LAs for a total of 973 reports which refer to the sightings of 661 objects (again about 1.5 reports per object). From these data, we can form the following ratios:

$$\frac{\text{\# of reports from squares with MABs and/or LAs} = 1773}{\text{\# of squares with MABs and/or LAs} = 137} = 13.1$$

$$\frac{\text{\# of reports from squares with MABs and/or LAs} = 973}{\text{\# of squares w/o MABS or LAs} = 762} = 1.28$$

The ratio of these two ratios is 13.1/1.28 = 10.2, which means about 10 times as many reports were made in squares with large air activity as in squares with little or no air activity. Can this be accounted for by the increased population in squares with air activity? The previous calculations involving population per square shows that part but not all of this ratio of ten can be accounted for, since the population in squares with large air activity was 7, not 10 times the population in squares with little or no activity.

Of course, the mere suggestion that population ratio could account for the report ratio runs counter to the observation expressed in the text of Part I that the number of objects reported in a square seems to be hardly, if at all, related to the population in a square. This observation is reiterated in Figures B-1 and B-2, which show the numbers of reports (All Sightings) in 1-degree squares vs. the populations in the same squares. (The populations in these figures are plotted along linear scales instead of the logarithmic scale in Figure 9.)

Figure B-2 is a blowup of a small section of Figure B-1. Note the random scatter of the sightings, but note also that the squares with large numbers of reports almost always contain air force bases. (Figure B-2 does not contain all the data points possible since it would be too crowded.) Thus, the hypothesis that the large population ratio (7) accounts for the large report ratio (10) does not seem completely consistent with the available data and must be held in abeyance, if not rejected outright.

Using the previously given numbers of objects per square with and without MABs and LAs, I find (1188 objects/136 squares) = 8.8 objects per square with air activity and (661 objects/762 squares) = 0.87 objects per square with little activity. The ratio 8.8/.87 equals about 10, so regardless of whether one considers objects or reports, the "UFO activity" is much greater in areas of large air activity.

Another obvious hypothesis for the ratio of 10 just referred to is that the UFO reports (and objects) are actually aircraft, since aircraft activity is so much greater in the squares with large numbers of reports. Thus, one might guess that a large percentage of the reports from squares with MABs and LAs should be ultimately identified as aircraft. Unfortunately, there is no way to determine the numbers of objects which were identified as aircraft in each square from the information given in BB#14; the BB#14 investigators had this information but did not publish it. Therefore, I will present indirect evidence concerning the fraction of UFO reports that the investigators decided involved aircraft sightings.

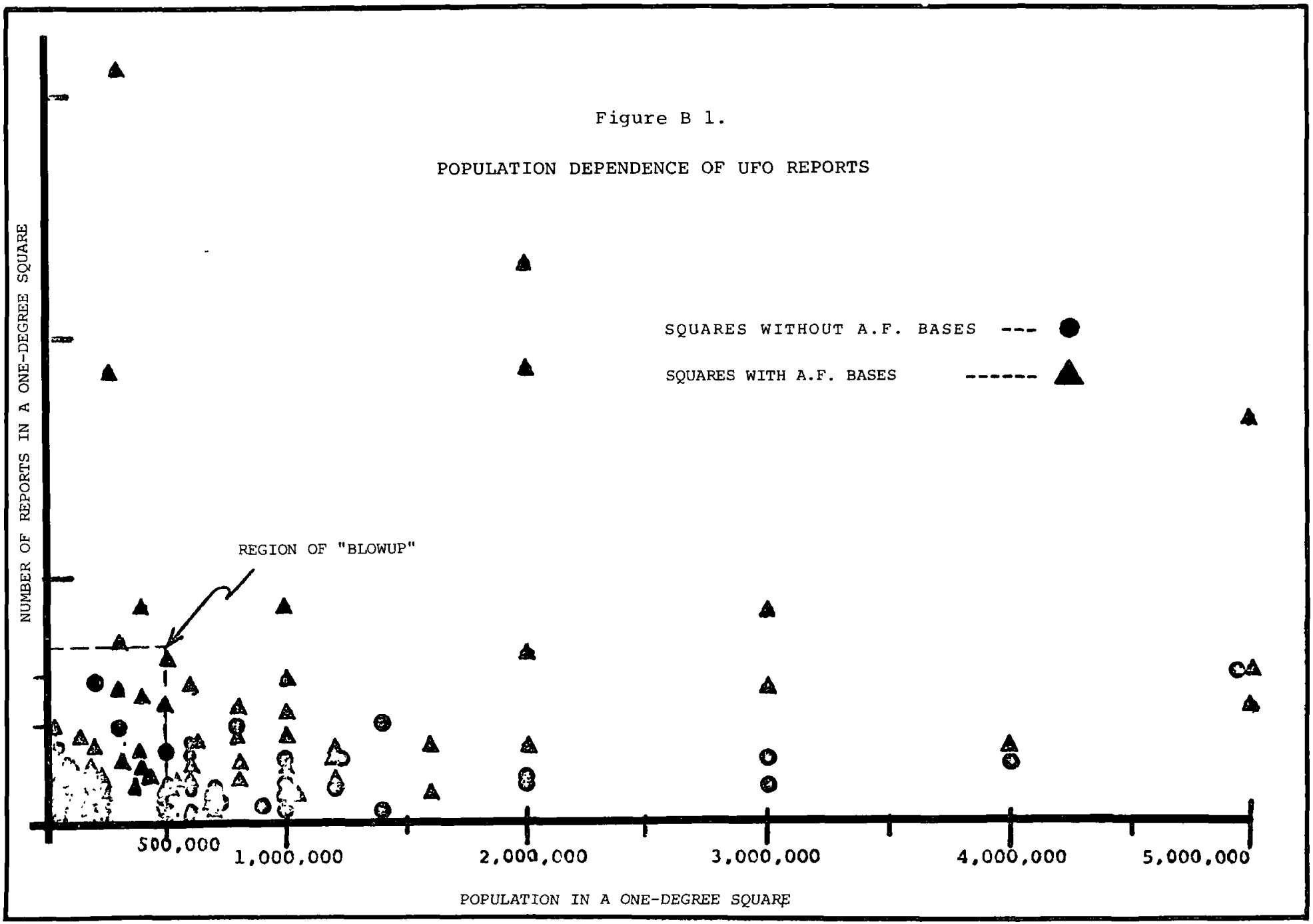
First, note that of all the reports (All Sightings) from all over the world, 20.1% were identified as aircraft and 21.5% were left Unknown. (BB#14 lists the following report distribution: 2969 from North American with 21.5% Unknown; 10 from South America with 10% U; 80 from Europe with 17.5% U; 115 from Asia with 27.8% U; 25 from Africa with 16% U; and two were from unknown locations, for a total of 3201 reports.)

With respect to objects (Object Sightings) from all over the world, 21.6% were identified as aircraft and 19.7% were left Unknown. (The geographical distribution was: 2034 from North America with 19.4% Unknown; 8 from South America with 12.5% U; 61 from Europe with 16.4% U; 75 from Asia with 32% U; 20 from Africa with 20% U; and two were from unknown locations.) As for the United States (continental) alone, there were 2795 reports with 21% aircraft and 20.8% Unknown. These reports referred to 1916 objects of which 22.6% were aircraft and 18.7% were Unknown. It is these last figures for the continental U.S. alone which are of main interest here, although the previous figures showing the global distribution are also interesting since they show that there are no great fluctuations in the percentages of Unknowns and aircraft when large areas are averaged together.

Now, if the number of UFO reports (and by inference, the number of objects) depends upon the number of aircraft in the air because aircraft are being reported as UFOs, then one would expect that in the areas where there is a lot of aircraft activity, the percentages of reports (and objects) identified as aircraft should increase over the percentages in areas where there is little aircraft activity. Stated another way, one would expect that the percentages of aircraft in areas of large air activity should exceed considerably the average percentage when all areas are grouped

Figure B 1.

POPULATION DEPENDENCE OF UFO REPORTS



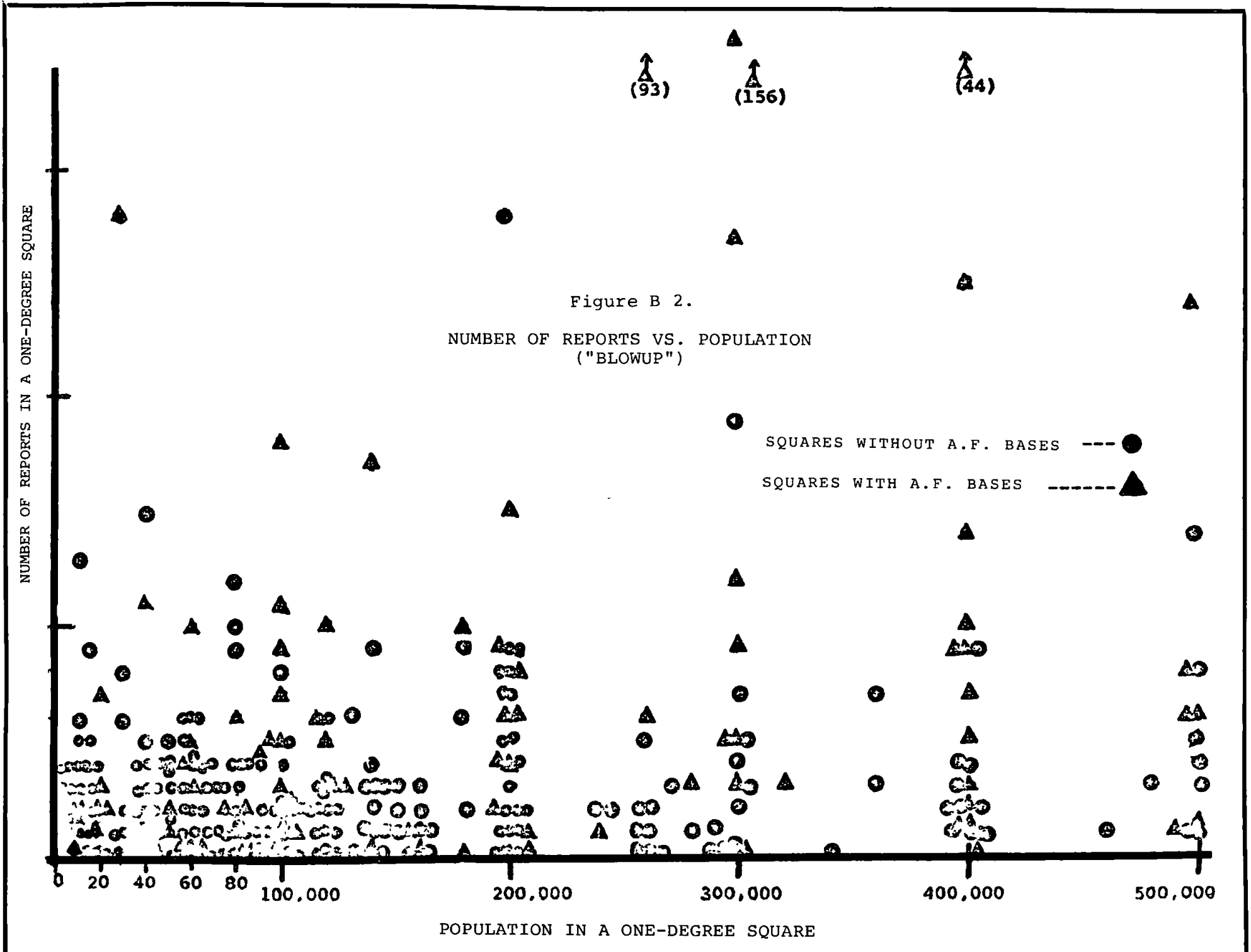


Figure B 2.

NUMBER OF REPORTS VS. POPULATION
("BLOWUP")

together (e.g., should exceed 21% which is the average over the continental U.S.). Although the information is not available to test this expectation for each 1-degree square, it is available for 11 groups, of 12 or 13 squares each, which were called "strategic areas" by the BB#14 investigators (any resemblance to the "critical areas" referred to by Ruppelt is purely intentional), who claimed that these areas were "strategic" only because of the concentrations of sightings in them.

One notes, however, that each of these areas contains one or more MABs and LAs. The areas are listed in Figure B-3 along with the estimated populations of the areas, the numbers of reports (All Sightings), the numbers of objects (Object Sightings), and the percentages of Unknown, aircraft, balloons, and astronomical sightings for the Object Sightings and the All Sightings. The listing for balloons is included, since balloons are man-made and often associated with airports (for weather data). The listing for astronomical reports is also included. The percentages of these reports should be independent of the area (though perhaps dependent upon the population until the population gets so large that astronomical objects can't be seen because of light pollution).

In Figure B-3, we see that the populations of the areas range over a factor of 30, and that the numbers of reports are not related to the populations by any simple mathematical formula; note in particular that areas B and H have the same number of sighting reports but vastly different populations. We also see on Figure B-3 that although the percentages of Unknowns, aircraft, balloons, and astronomical reports and objects fluctuate considerably from area to area, the averages over the strategic areas are essentially the same as the averages of the continental U.S. Since these areas have much greater air activity on the average than does the continental U.S. on the average, one concludes that misidentified aircraft (and balloons) did not contribute noticeably to the number of Unknowns.

Referring to the astronomical reports and objects, Figure B-3 illustrates the anomalously large percentages of astronomical sightings in the Albuquerque and Waco areas. This increase in percentages is probably due to the influx of anomalously localized "green fireballs" that plagued the southern Midwest in the late forties and early fifties.

In summary, I believe that the geographical distribution of sightings is either not related to or is only slightly dependent upon population and conventional aircraft activity. This is the answer to the question raised in the first paragraph of this appendix. However, the study thus far leaves open an explanation for the fact that most UFO reports in the BB#14 study came from certain "strategic" or "critical" areas of the U.S. As a last resort explanation, one might suggest that this is because most reports came from the Air Force itself and that "naturally," these reports are then associated with air bases. This is a weak explanation, however, if the BB#14 investigators are to be believed, because according to them the geographical location of each sighting was preserved in their study. The location of a sighting was not determined by the air base to which the sighting was reported, but rather the location was listed as where the sighting actually took place.

Another explanation for the geographical concentrations is the one offered by Ruppelt himself at the ADC briefing referred to before. His suggestion is as good as any (barring such bizarre explanations as "'they' have been intentionally observing our air bases"). According to Ruppelt, "One explanation might be that the people in these areas are aware of the fact that they are in a critical area and are more aware of unusual things" (underlining by this author).

FIGURE B-3

PERCENTAGES OF UNKNOWNS, AIRCRAFT, BALLOONS, AND ASTRONOMICAL SIGHTINGS
IN THE "STRATEGIC AREAS" OF THE CONTINENTAL UNITED STATES

Strategic Areas	Estimated Population	No. of Reports	No. of Objects	Percentages of Reports				Percentages of Objects			
				Unkn.	Air.	Bal.	Astr.	Unkn.	Air.	Bal.	Astr.
San Antonio, TX area	0.4	61	36	34%	18%	15%	23%	22%	28%	11%	28%
Albuquerque, NM area	0.6	210	98	25	14	8	39	21	16	8	43
Waco, TX area	3.3	144	82	6	8	6	67	7	12	10	56
Atlanta, GA area	3.4	87	63	15	24	21	23	14	21	21	25
San Francisco, CA area	4.7	112	93	20	25	23	13	19	24	23	12
Dayton, OH area	5.7	188	144	10	29	16	29	10	26	16	22
Harrisburg, PA area	5.8	84	61	18	29	18	24	12	30	21	26
District of Columbia area	7.3	210	146	25	24	15	24	27	30	16	15
Los Angeles, CA area	8.5	115	84	27	17	27	11	17	19	29	13
Chicago, IL area	9.5	88	66	14	22	8	32	14	27	11	17
New York City area	12.0	178	105	15	37	14	15	11	31	14	16
Averages over strategic areas:				19%	22%	16%	27%	16%	24%	16%	25%
Average over continental U.S.:				21%	21%	14%	26%	19%	23%	16%	22%

APPENDIX C: REVISED AND NEW CHI-SQUARED TESTS

As pointed out in the text, the BB#14 investigators used a C^2 test to determine the statistical equivalence of the group of Object Sightings called Known with the group called Unknown. Since they were not able to demonstrate this (C^2 values were too large), they argued that the results of the test were inconclusive. One may speculate that if C^2 values had been uniformly low, the investigators would have claimed that the test "proved" that Unknowns were essentially the same as Knowns. One might also speculate that in this case the results of the C^2 test would have been explicitly mentioned in the summary and conclusion of the report, as well as in the subsequent press release.

A fundamental criticism that can be leveled against their C^2 tests is that the characteristics of the Unknowns were compared with characteristics of objects which the investigators thought were known. In principle, the characteristics of the Knowns should have been obtained from absolutely verified sightings only. Otherwise, it is possible (I would guess probable) that the distributions of the characteristics of the group called Knowns was somewhat (unintentionally) modified by the presence of Unknown sightings within the group labeled as Known. For example, of the Object Sightings in which the speed was listed as 400 mph or greater, the investigators had 36 cases identified as balloons and 5 cases identified as birds (road runners?). They also had eight aircraft going at "meteor-like speeds."

Although we can't satisfy this criticism entirely because it is no longer possible to verify the identifications of the cases listed in BB#14, we can partially satisfy this criticism by using only the Object Sightings for which the identifications were marked "certain" to produce the characteristic distributions for the Knowns. This decreases the total number of sightings listed as Known, but it should produce a better approximation to the actual relative distributions of characteristics of Knowns.

The following tables present the results of the new C^2 tests. In these tests, I have left out Doubtful identifications and any reports in which a "value" of the characteristic was listed as Not Stated. Not Stated is not a characteristic of an object, although it may be a characteristic of the observer or his or her report. Since the number of Not Stated reports varies from characteristic to characteristic, the overall number of reports treated also varies, as will be seen by referring to the totals in each table.

I have also included all of the "values" of each characteristic for which tabular data was presented. One effect of deleting all Not Stated reports and of using all of the tabular "values" of each characteristic is a change in the number of degrees of freedom of the characteristic from the number found in the BB#14 tests. For example, in the BB#14 tests, color had 8 degrees of freedom; in the new tests, it has 10.

Comparing Table C-8 with the corresponding portion of Figure 11, we see that the C^2 for color increased tremendously when the Doubtful identifications were removed. The C^2 values for number, shape, speed, and brightness also increased somewhat. However, the value of total C^2 for shape decreased. The overall effect of removing the Doubtful identifications from the collection of sightings from which astronomical cases had already been moved was to decrease the probability of a match between Knowns and Unknowns in four out of six cases.

I conclude from these revised tests that the probability of statistical equivalence as far as the preceding characteristics are concerned is even less than has been suggested in the text of BB#14 (and of this paper).

TABLE C-1

CHI-SQUARED TEST FOR COLOR:
OBJECT SIGHTINGS--"CERTAIN" IDENTIFICATIONS ONLY

"Values" of the Characteristic	No. of Knowns (K_o)	Adjusted No. of Knowns (K)	No. of Unknowns (U)	$Chi^2 = \frac{(K-U)^2}{K}$
White	195	89.4	112	5.87
Metallic	177	81.2	76	0.33
Not Stated----------LEFT OUT----------				
Orange	87	39.9	49	2.07
Red	84	38.5	33	0.79
Green	58	26.6	14	5.97
Yellow	72	33.0	31	0.12
Blue	43	19.7	26	2.00
Black	21	9.6	7	0.72
Violet	2	0.92	1	0.01
Grey	2	0.92	1	0.01
Light glow, indeterminate color	70	32.1	22	3.19
TOTALS	811	371.8	372	21.08

No. of degrees of freedom = 11 - 1 = 10
Chi^2 for 5% probability of statistical equivalence: 18.3
Chi^2 for 2% probability of statistical equivalence: 21.2

CONCLUDE: About 2% probability that the characteristic colors of the Unknowns are statistically the same as those of a random sample of the Knowns.

TABLE C-2

CHI-SQUARED TEST FOR NUMBER

"Values" of the Characteristic	No. of Knowns (K_o)	Adjusted No. of Knowns (K)	No. of Unknowns (U)	$Chi^2 = \frac{(K-U)^2}{K}$
One object	704	340.5	297	5.55
Two objects	79	38.2	37	0.04
Three to ten	84	40.6	70	21.25
More than ten	20	9.7	25	24.29
TOTALS	887	429.0	429	51.13

No. of degrees of freedom = 4 - 1 = 3
Chi^2 for 5% probability of statistical equivalence: 7.8
Chi^2 for 1% probability of statistical equivalence: 11.3

CONCLUDE: Much less than 1% probability that the characteristic numbers of the Unknowns are statistically the same as those of a random sample of the Knowns.

TABLE C-3

CHI-SQUARED TEST FOR SHAPE

"Values" of the Characteristic	No. of Knowns (K_o)	Adjusted No. of Knowns (K)	No. of Unknowns (U)	$Chi^2 = \frac{(K-U)^2}{K}$
Elliptical	425	188.5	195	0.22
Rocket or aircraft	40	17.7	33	13.22
Meteor or comet	32	14.2	4	7.33
Lenticular, conical, or teardrop	58	25.7	22	0.54
Flame shaped	59	26.2	10	9.98
Other	103	45.7	54	1.51
TOTALS	717	318.0	318	32.80

No. of degrees of freedom = 6 - 1 = 5
Chi^2 for 5% probability of statistical equivalence: 11.1
Chi^2 for 1% probability of statistical equivalence: 15.1

CONCLUDE: Much less than 1% probability that the characteristic shapes of the Unknowns are statistically the same as those of a random sample of Knowns.

TABLE C-4

CHI-SQUARED TEST DURATION OF OBSERVATION

"Values" of the Characteristic	No. of Knowns (K_o)	Adjusted No. of Knowns (K)	No. of Unknowns (U)	$Chi^2 = \frac{(K-U)^2}{K}$
Less than 5 seconds	127	59.8	27	17.99
6 - 10 seconds	49	23.1	21	0.19
11 - 30 seconds	76	35.8	33	0.22
31-60 seconds	57	26.8	42	8.62
1 - 5 minutes	137	64.5	99	18.45
6 - 30 minutes	171	80.5	71	1.12
Over 30 minutes	84	39.5	37	0.16
TOTALS	701	330.0	330	46.75

No. of degrees of freedom = 7 - 1 = 6
Chi^2 for 5% probability of statistical equivalence: 12.6
Chi^2 for 1% probability of statistical equivalence: 16.8

CONCLUDE: Much less than 1% probability that the characteristic durations of the Unknowns are statistically the same as those of a random sample of the Knowns.

TABLE C-5

CHI-SQUARED TEST FOR SPEED

"Values" of the Characteristic	No. of Knowns (K_o)	Adjusted No. of Knowns (K)	No. of Unknowns (U)	$Chi^2 = \frac{(K-U)^2}{K}$
Stationary	142	72.7	53	5.34
Less than 100 mph	86	44.0	26	7.39
100 - 400 mph	106	54.3	58	0.26
Greater than 400 mph	203	103.9	145	16.23
Meteor-like	45	23.0	16	2.16
TOTALS	582	297.9	298	31.38

No. of degrees of freedom = 5 - 1 = 4
Chi^2 for 5% probability of statistical equivalence: 9.5
Chi^2 for 1% probability of statistical equivalence: 13.3

CONCLUDE: Much less than 1% probability that the characteristic speeds of Unknowns are statistically the same as those of a random sample of the Knowns.

TABLE C-6

CHI-SQUARED TEST FOR LIGHT BRIGHTNESS

"Values" of the Characteristic	No. of Knowns (K_o)	Adjusted No. of Knowns (K)	No. of Unknowns (U)	$Chi^2 = \frac{(K-U)^2}{K}$
Sunlight on mirror	25	11.8	14	0.40
Sun on aluminum	76	36.0	28	1.76
Sun on plaster	27	12.8	11	0.25
Sun on stone	4	1.9	5	5.08
Sun on soil	4	1.9	0	1.90
Brighter than moon	134	63.4	61	0.09
Like moon	10	4.7	11	8.31
Duller than moon	15	7.1	10	1.19
Barely visible	3	1.4	1	0.12
TOTALS	298	141.0	141	19.10

No. of degrees of freedom = 9 - 1 = 8
Chi^2 for 5% probability of statistical equivalence: 15.5
Chi^2 for 1% probability of statistical equivalence: 20.1

CONCLUDE: About 1.5% probability that the characteristic brightness of the Unknowns are statistically the same as those of a random sample taken from the Knowns.

The values of the total C^2 for each of the tests is compared with the BB#14 values in the table below.

TABLE C-7

COMPARISONS OF VALUES OF CHI-SQUARED

Characteristic	Total C^2 From BB#14	Total C^2 From New Tests	Comment
Color	26.15	21.08	C^2 decreased slightly; the increase in the number of degrees of freedom in the new test caused the probability to be about 2%.
Number	40.73	51.13	C^2 increased somewhat; the probability is much less than 1%.
Shape	29.05	32.80	C^2 increased slightly; the probability is much less than 1%.
Duration	49.49	46.75	C^2 decreased slightly; the probability is still much less than 1%.
Speed	37.93	31.38	C^2 decreased slightly; the probability is still much less than 1%.
Light brightness	5.85	19.10	C^2 increased considerably; the probability is now about 1.5%.

As can be seen from the table, the new C^2 values are sometimes higher and sometimes lower, with the most important change being in the Light Brightness test where C^2 increased to a value large enough so that the probability of statistical equivalence is now only 1.5%.

When the astronomical sightings are deleted from the collection, as was done in BB#14, one obtains the following table.

TABLE C-8

CHI-SQUARED TESTS WITH ASTRONOMICAL SIGHTINGS DELETED

Characteristic	Total C^2	C^2 for 5%	C^2 for 1%	Conclude
Color	54.95	18.3	21.2	C^2 increased; much less than 1% probability.
Number	25.67	7.8	11.3	C^2 decreased; still less than 1% probability.
Duration	12.01	12.6	16.8	C^2 decreased; about 6% probability.
Shape	9.14	11.1	15.1	C^2 decreased; about 10% probability.
Speed	52.62	9.5	13.3	C^2 increased; much less than 1% probability.
Light brightness	35.60	15.5	20.1	C^2 increased; much less than 1% probability.

There are other data in BB#14 which are amenable to C^2 tests. Most notable are the data on the reliability distribution and on cross-correlations. The C^2 test for reliability will be presented below. However, first is a summary of C^2 tests for the cross-correlation data given in the BB#14 appendix (but not referred to in the text). The BB#14 investigators supplied two types of cross-correlation statistical tables: number of sightings of a given color for a given duration, and number of sightings of a given number of objects (one object, two objects, etc.) for a given duration. The characteristic color had seven values (white, metallic, orange, red, green, yellow, and other); the characteristic duration had seven values (less than 5 sec., 5-10 sec., 11-30 sec., 31-60 sec., 61 sec.-5 min., 6 min.-30 min., and over 30 min.); and the characteristic number had four values (one, two, three-ten, and more than ten).

I found that in the test for the number of sightings vs. color for a fixed duration, only the 11-30 sec. duration group has a statistical probability of match between the Knowns and the Unknowns that is less than 1%; all others have greater than 1% probabilities of match. In the test for the number of sightings vs. duration for a fixed color, only the white color group of sightings has a probability of match that is less than 1%. In the test for the number of sightings vs. the number of objects per sighting for a fixed duration, I found that only the 11-30 sec. and 31-60 sec. duration groups of sightings have greater than a 1% probability of match; the other duration groups have less than 1% probability. Finally, in the test for the number of sightings vs. duration for a fixed number of objects per sighting, I found that the one, two, and 3-10 objects per sighting groups have much less than 1% probabilities of match, while the 11 or more objects per sighting group has more than a 1% probability of match.

Unfortunately, these tests may not be statistically significant since the numbers of sightings in each small group (e.g., the group of white objects with a duration of 31-60 sec., etc.) is not large. However, they do provide further evidence that there are some differences between the characteristics of the Knowns and those of the Unknowns.

The C^2 test for reliability is more significant, statistically, than the cross-correlation tests because there are more sightings per value of the characteristic Reliability than there were for the cross-correlation characteristics. The C^2 test for reliability is especially interesting because the characteristic measured here is not one of the sighted object(s), but of the witness(es). Specifically, this C^2 test answers the question, "Is the reliability distribution of those who make reports that are ultimately classified as Unknown different from the distribution of those who make reports that are ultimately classified as Known?" This C^2 test merely emphasizes the disparity between the two reliability distributions that is illustrated in Figures 6 and A-3. The C^2 has been calculated for reports (All Sightings) using only the certain identifications and leaving out the Insuff. Info. cases.

TABLE C-9

CHI-SQUARED TEST FOR REPORT RELIABILITY

"Values" of the Characteristic	No. of Knowns (K_o)	Adjusted No. of Knowns (K)	No. of Unknowns (U)	$Chi^2 = \frac{(K-U)^2}{K}$
Excellent	124	65.0	108	28.4
Good	439	230.4	282	11.5
Fair	553	290.2	203	26.1
Poor	197	103.4	96	0.5
Totals	1313	689.0	689	66.5

No. of degrees of freedom = 4 - 1 = 3
Chi^2 for 1% probability of statistical equivalence: 11.3

CONCLUDE: Much less than 1% probability that the reports evaluated as Known have the same reliability distribution as the reports evaluated as Unknown.

Note that the value of the C^2 is larger than for any of the previously listed tests. Note also that the largest contribution to the C^2 comes from the Excellent value of Reliability (28.4). There are simply too many Excellent Reliability Unknowns; the number of Good Reliability Unknowns (282) also exceeds the number which would be expected (230) if the distributions matched. Thus, once again I conclude that either Excellent and Good Reliability reports contain more than their fair share of mistakes (leading to evaluations as Unknowns) or else the E and G reports describe phenomena which are not Known.

Note: I thank Brad Sparks for checking my C^2 test values and for pointing out some errors in the associated probabilities.

APPENDIX D: ANNUAL PERCENTAGES OF UNKNOWNS

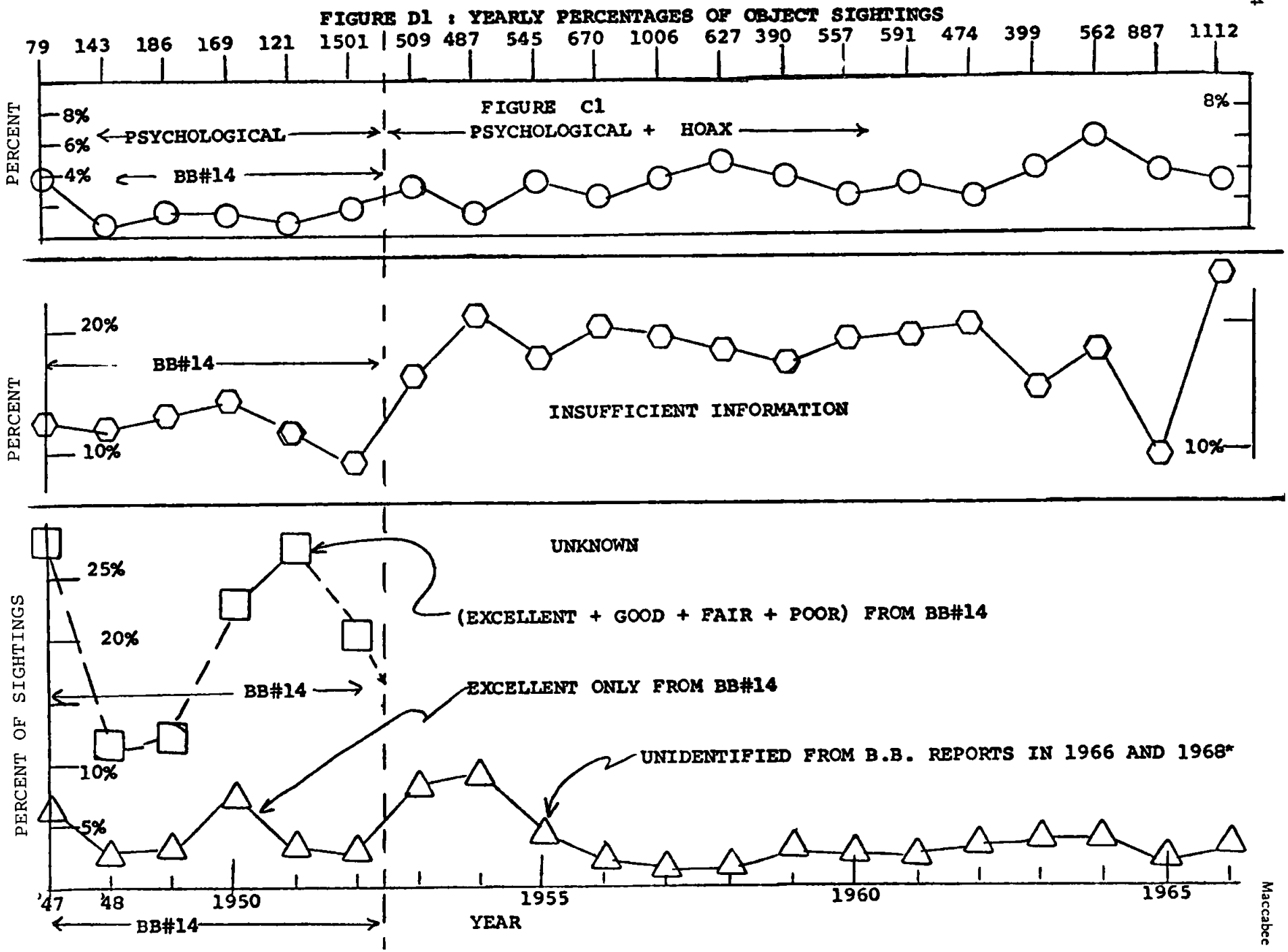
The time-development of the percentage of Unknowns is illustrated in Figure D-1, I have also included the percentages of Insuff. Info. and Psychological for comparison, as well as the total numbers of reports for each year. After the end of the BB#14 study, the amount of analysis that went into the study of individual UFO reports decreased considerably. Therefore, the data after 1953 are not considered to be as accurate as those before 1953. Several interesting features are noted. We see, for example, that despite all the notoriety about hoaxes, the sum of hoax plus psychological cases was always less than 6%, and typically, about 3% (if one believes that the BB investigators correctly identified the hoax cases).

In the summary of the BB#14 study, the person(s) who wrote this section pointed out the reduction with time of the percent of Unknown. They claimed that this was due to better reporting and more information. In Figure D-1, we see that indeed there was an apparent reduction if one compares the total percentages of Unknowns per year before 1953 (20 $\pm$ 10%) with the percentages of Unknowns per year after 1953 (less than 6% and generally around 3%; these percents refer to Object sightings). However, if one looks at only the Excellent Object sightings before 1953, one finds approximately the same percentages of Unknowns before 1953 as after. This observation suggests that the residue of Unknowns after 1953 actually consisted of sightings which the BB#14 investigators would have called Excellent Sightings!

Note also that there is a rise in the percent of Insuff. Info. cases after 1953. This is surprising in view of the better reporting procedures predicted in the summary of BB-#14. However, it is what would be expected if certain percentages of cases that the BB#14 investigators would have classified as Unknown were actually being called Insuff. Info. after 1953. That this was actually the case has been reported to me by Stanton Friedman (private communication), who has claimed that sometime in the late 1950s it was decided that all cases labeled Unknown, in which there was only one observer, would be relabeled Insuff. Info. on the grounds that a single observer observation is "like an experiment that wasn't repeated."* Such a policy would be very understandable for the BB boys to instigate, since it would reduce the number of Unknowns--the reduction of the percent of Unknowns was a major goal of BB. However, with this bit of information we can now look at the Unknowns after 1953 or 1954 as being multiple-observer sightings, which is further evidence that they belong to the BB#14 class known as Excellent Sightings.

*This decision is explicitly referred to in a 1961 press release from Project Blue Book.

FIGURE D1 : YEARLY PERCENTAGES OF OBJECT SIGHTINGS



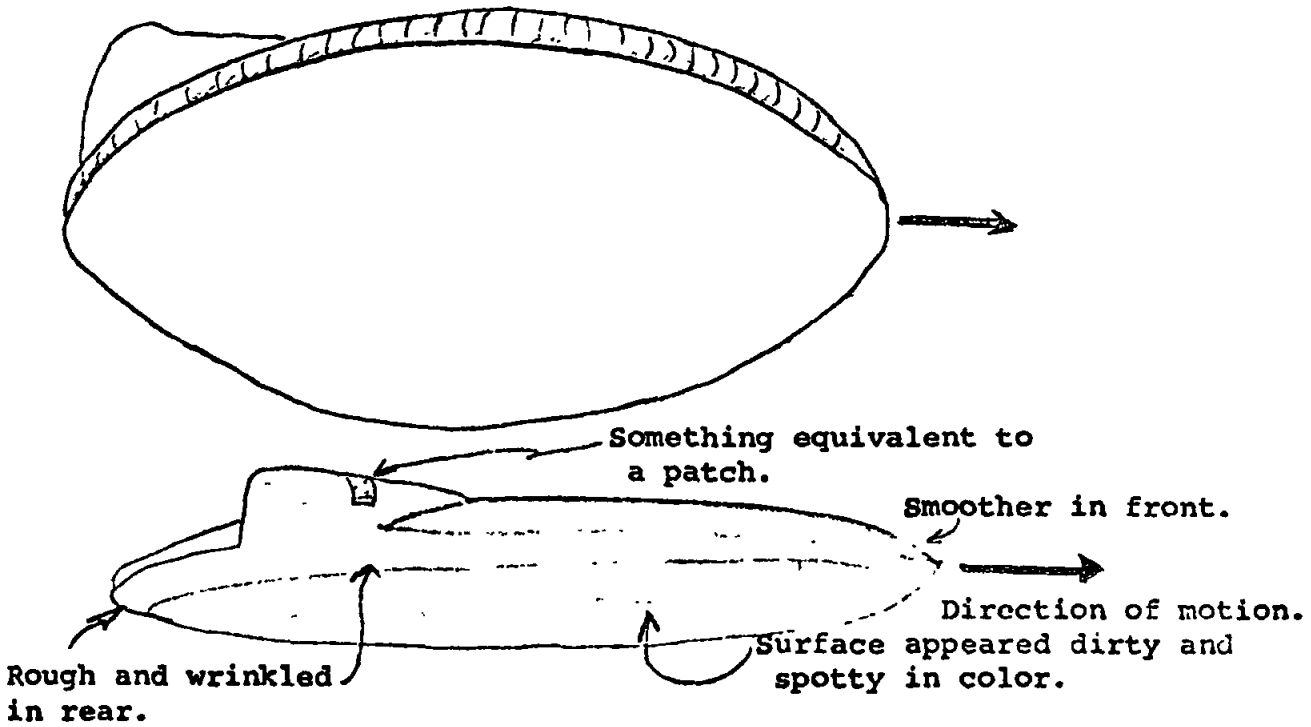
Maccabee

ADDENDUM: SIGHTING AT ROGUE RIVER, OREGON, MAY 24, 1949

I have chosen to describe this case, which was referred to in the text published in Vol. I, because it seemed the most interesting of the "12 Good UFO reports" in BB #14. According to BB #14, it was a multiple witness sighting which lasted over a minute to several minutes, and in which one of the observers watched the object with binoculars. The drawing presented in BB #14 is rather detailed, and certainly does not resemble a conventional aircraft. The summary of the report and the sketches, as given in BB #14, are presented below.

> An employee in the supersonic laboratory of an aeronautical laboratory and some other employees of this lab, were by a river, 2 1/2 miles from its mouth, when they saw an object. The time was about 1700 hours on May 24, 1949. The object was reflecting sunlight when observed by the naked eye. However, when the witness looked at it with 8-power binoculars, there was no glare. [Did glasses have filter?] It was of metallic construction and was seen with good enough resolution to show that the skin was dirty. It moved off in a horizontal flight at a gradually increasing rate of speed, until it seemed to approach the speed of a jet before it disappeared. No propulsion was apparent. Time of observation was 2 1/2 to 3 minutes. (Below are tracings of the sketches and the descriptive comments that appear in BB#14.)

Clearly, if this report is taken at face value, something unusual was present in the skies of someplace (to be revealed shortly) on May 24, 1949. However, in the UFO business, one quickly learns not to take reports at face value but to dig as deeply as possible. It's not that I wouldn't "trust" the Battelle Institute investigators who reported this case, but the summary is so short that certainly some details have been left out. In order to recover these details, I have searched the files of Project Blue Book and the Office of Special Investigation (OSI) of the Air Force. (These UFO-related files have all been collected by the National Archives, Washington, D.C., and are available, with names of witnesses deleted, on microfilm.) The Blue Book (BB) files are in



chronological order, and a chronological list of all cases is available. On this list are two reports dated May 24, 1949. Specifically, in the case list, one finds the following information:

(from the list of 15-31 May, 1949 sightings)

Date	Location	Observer #	Evaluation*
24	Rogue River, Bend, Oregon (missing)†	XXXXXXMultiple	Other (Kites)
24	Rogue River, Oregon	(deleted)	AIRCRAFT

* the evaluation is the object that was sighted according to the BB staff. This evaluation was certainly not binding on the Battelle investigators.

† Here I have handwritten in the word "missing" to duplicate the situation actually found on the case list.

When a personal name was given it was crossed out before the microfilm copy was made. The X s preceding the word "Multiple" may cover up the name of one of the witnesses.

As indicated in the list, the multiple witness sighting of that date was missing from the case files. The single observer sighting evaluated as "aircraft" is not missing, however. This pair of cases posed an interesting problem (which was not resolved until I had found the case in the OSI files because the time given in the "aircraft" sighting was listed as "approximately 1700 hours" and the location given was 1 1/2 miles up the Rogue River from (i.e., east of) Gold Beach, Oregon. This distance would be about 2 1/2 miles from the mouth of the river where it empties into the Pacific Ocean. Because of the coincidence in time (1700 hrs) and place, I could not decide at first whether or not this case reported an independent sighting of the same object as reported in the first case (which was presumably the one referred to in BB#14--multiple witness, 2 1/2 miles up a river, 1700 hrs).

Of course, the most puzzling thing about the listing of these two cases was the difference in identifications ("kites" vs. "aircraft"). If these cases referred to the same sighting of a single object, how could the identifications be so widely diverse? The second case, which was in the BB files, contained a copy of an OSI investigation of a Mrs. (name deleted, call her Mrs. A) who lived in Gold Beach. In her interview, she stated that "at approximately 1700 hours, 24 May 1949, she and four other persons (underlining by this author), while fishing on the Rogue River near Elephant Rock approximately 1 1/2 miles above the highway bridge near Gold Beach, sighted an object described as being round in shape, silver in color, and about the size of a C-47 aircraft.

When first brought to Mrs. A's attention by one of the other witnesses, the object appeared to be three or four miles away. It was coming from the east, but later turned to the southwest. It appeared to be traveling at the same rate of speed as a C-47. It made no noise, left no exhaust trail, and made no maneuvers. The interviewee stated that she was not familiar with aircraft; therefore, she could not estimate with any accuracy the speed or altitude at which the object was traveling. Mrs. A made the comparison between the object and a C-47 because she is familiar with that type of aircraft; her son has pointed out C-47s as they flew over Gold Beach.

This interview of Mrs. A was carried out on August 8, 1949 by Special Agent R. Hauser. The BB case card, which includes a short summary of the case, stated the following conclusion (or evaluation): "No data presented to indicate object could NOT have been an aircraft." Although the sighting time and the rough description of the object seen by Mrs. A matches the time and general description reported in Case X of BB#14, there is no way to positively connect these two reports from the evidence in the BB files alone.

What about the missing case? A search of the OSI files turned up the original references on the missing case: the interviews of the witnesses, including Mrs. A. Moreover, infor-

mation in the OSI files essentially establishes the credibility of this case and shows that the BB staff erred significantly in its analyses. The two cases should be combined into one and should be listed as Unidentified (as the Battelle Institute investigators realized).

The first report of this sighting was made on or just before June 14, 1949, to the Security Officer of the National Advisory Committee for Aeronautics at Moffett Field in California. This officer requested an investigation, which was subsequently carried out by Special Agent C.E. Brooks and others during the following months.

On June 24, Agent Brooks interviewed a Mr. (name deleted, call him Mr. B) in the Drafting Section of the National Advisory Committee, Ames Laboratory, Moffett Field. This interview revealed the following information:

"On Tuesday, 24 May 1949, at 1700 P.S.T., Mr. B and four other persons, while fishing two miles upstream (east) of the mouth of the Rogue River, at approximately the same direction and distance from the town of Gold Beach, Oregon, sighted an object which is described as follows: When first sighted it appeared to be a glitter about four miles away laterally, at some 5000 feet above the ground which, at that point, was at sea level or approximately so. The object was then examined through a pair of 8-power, Navy-type binoculars. Observation time about 90-120 seconds. Object appeared round and shiny, something like a 50-cent piece, viewed from below and to one side. Object's color was silvery and it appeared round in plan view. The object seemed to be solid with no visible openings and was about 30 feet in diameter, as nearly as could be judged.

"Just before Mr. B handed the glasses to Mr. [name deleted, call him Mr. C] , the object made a turn on its vertical axis with no tilting or banking and started to move in a southeasterly direction. There was no sign of exhaust or propeller; no driving force could be seen or felt, and no sound was heard. The object at no time contacted or came any closer than 5000 feet, approximately, to the earth, and when last seen was disappearing in a southeasterly direction, accelerating to an approximate speed of a jet plane. There were no protuberances other than a slight fin which seemed to start amidship and come back flush with the trailing edge viewed as the ship drifted. No radio antenna or windows, portholes, or any other protuberances, gaps, or openings were visible. The only landmark near the sighting point was a rock formation locally known as Elephant Rock [underlining by present author] , approximately 700 yards northeast of the boat in which Mr. B and party were anchored."

On June 24, Agent Brooks also interviewed Mr. C, a mechanic on a 1-by-3 foot Supersonic Wind Tunnel at Ames Laboratory. This interview revealed the following information:

"On 24 May 1949, at 1700 P.S.T., approximately two to two and a half miles upstream from the mouth of the Rogue River, in a boat anchored approximately midstream, about the same distance east of the town of Gold Beach, Oregon, an object was sighted about 5000 feet above the ground in a direction approximately 60° clockwise from north. Object appeared to be about one or two miles away. Mr. C observed the object about 30 seconds with the naked eye at which time he could see only a bright glitter, like a round mirror standing on edge with no apparent motion.

"Just as the object began to move, Mr. B handed Mr. C a pair of 8-power, Navy-type binoculars through which Mr. C viewed the object. With the binoculars, the object resolved into a pancake-like shape, somewhat thicker in the center than the edges, perfectly flat on the bottom with a small fin or vane arising about midship and growing gradually higher to the rear, ending flush with a trailing edge as the object traveled. Flat surface was parallel to the earth. The object appeared to be made of aluminum or some other shiny metal, and while it appeared to be oval, it could have been perfectly round in plan section. There appeared to be no opening or protuberance of any sort other than the fin already described.

"Object appeared to be roughly 25 to 30 feet in diameter. It was traveling in a southeasterly direction, about 170° clockwise from north. It executed no maneuvers; no lights, no propellers, no landing gear, or any method of propulsion could be seen or heard. There were no clouds and the sun was at Mr. C's back at the time of the sighting. The

trailing edge of the object as it traveled appeared to be somewhat wrinkled and dirty-looking. Mr. C ventured that these might have been vents but he said he could not see them well enough to say for sure. With Mr. B and Mr. C in the boat at the time of the sighting was Mrs. D, wife of a druggist at Ione, Calif; Mrs. A, wife of a Standard Oil distributor at Gold Beach; and Mrs. X." [I believe this is in error: Mrs. X should have been Mr. D, the husband of Mrs. D, as further interviews revealed.]

"Note: Mr. B and Mr. C stated their attention was drawn to the object by its glittering as at the time they were engaged in looking upstream to see if they could spot any feeding fish on the surface. It appeared to this agent that [either B or C] was a very reliable person, not at all easily excited, in fact, prone to be rather blase or indifferent. Mr [C or B] appeared to be a sober, well-rounded person, very mature and not easily swayed by someone else's opinion."

Agent Brooks was not satisfied with the information in the above "casual interviews" and on August 2, 1949, obtained the following signed statements:

(Mr. B) "On 24 May 1949, at approximately 5:00 p.m., while fishing with several friends about two and a half miles up the Rogue River from Gold Beach, Oregon, my attention was drawn to an object in the sky by Mr. D, one of the members of the party. To the naked eye this object appeared circular and standing on edge. I then focused a pair of 8-power, Navy-type binoculars and saw that it was indeed circular and that we appeared to be looking upward at the bottom side of it. As nearly as possible to tell, the object appeared about 5000 feet in altitude, and not more than a mile away.

"When I first observed it, object was moving very slowly. As I put the glasses on, it made a turn to the south, with no banking or leaning, and picked up speed. I then handed the glasses to Mr. C in order that he might see the object. Observed through the glasses, the object appeared to be made of silvery metal, either completely circular or somewhat oval. It was thin near the edges and thicker in the center. A triangular fin appeared to arise amidship and extended to the trailing end of the object viewed as it traveled. There were no openings visible and no sound was heard. There appeared to be no engines or motors, no landing gear, no other protruding parts other than the fin already described. The object was in sight for approximately one (1) minute. Sun was at our backs and there were no clouds."

(Mr. C) "While fishing with a party of friends about two and a half miles up the Rogue River from its mouth at Gold Beach, Oregon, at approximately 5:00 p.m., 24 May 1949, my attention was called to an object in the sky. The object was to the east of us about one (1) mile, at approximately 5000 feet altitude. With the naked eye, little but a glare and a silvery glint could be seen. But after watching it for approximately one minute and a half, I was handed a pair of 8-power binoculars by Mr. B. It was then possible to see that the object was roughly circular in shape and appeared to be 30 to 35 feet in diameter. It had somewhat the cross-sectional appearance of a pancake, being thicker in the center than at the edges. A small triangular fin started in the middle and grew gradually higher to the rear as the object traveled.

"When first sighted, it was moving very slowly. As I watched it through the glasses, it picked up speed and when it vanished from sight approximately 90 seconds later, it was traveling as fast or faster than a jet plane. As far as could be seen, it had no openings or protuberances of any kind other than the fin, and there was neither sight nor sound of any driving force. It was a clear day and no clouds in the sky, and the sun was at our backs as we watched the object which vanished in a southeasterly direction, mostly south."

Agent Brooks also obtained statements from six other people who had known one or the other of the witnesses for periods of time ranging from several months to several years. These character references concluded with statements such as "inclined to take seriously any statement Mr. ___ might make," "inclined to place considerable reliability in anything Mr. ___ might have to say," etc.

The above interviews and signed testimonials were obtained by Agent Brooks at Moffett Field and Sunnyvale, California, on August 2, 1949. Several days previously, July

26, 1949, in a completely separate interview, Agent T.H. Kelley obtained the following signed statements from Mr. and Mrs. D. of Ione, California:

(Mr. D) "During the latter part of May 1949, at approximately 1630 in the afternoon, while fishing in a boat on the Rogue River near Gold Beach, Oregon, together with [list of people deleted; assumed to be Mrs. A, Mr. B, Mr. C] and my wife, my attention was attracted by a silvery object in the sky, traveling at a height of approximately 5000 feet in a southerly direction. The object, circular in formation as a silver dollar, traveled without sound at a speed greater than a high speed or jet plane. Mr. B and Mr. C used a binocular to view the object, which was visible to the naked eye for approximately two minutes. Not using binoculars, I could not make out any irregularities of formation, or whether the object had a motor or motors, landing gear, or other items usually connected with a plane. It had no appearance of the conventional plane but in size would be of the diameter of the fuselage length of the DC-3 plane. I have fished in the general area a number of years and have observed various type planes flying in this area, but have never observed anything of this nature before."

(Mrs. D) "While on vacation near Gold Beach, Oregon, during the latter part of May 1949, and while fishing from a boat in the Rogue River in the late afternoon, my husband, Mr. D, called the attention of the group to a silver object, circular in shape, crossing the sky at a high altitude and at a high rate of speed. I could not estimate its height and its size was as large as a large passenger plane though shaped like a shiny circular disk. No sound was heard and it crossed our range of vision in two or three minutes. The day had been clear, visibility was good, and the sun was just setting. Other occupants of the party who observed the object were [names deleted; assumed to be Mrs. A, Mr. B, and Mr. C] and my husband. There was no sound and the object traveled on a direct course."

Several days after Agent Brooks obtained the signed statements from Mr. B and Mr. C, he compiled the documents he had so far received and sent copies to the OSI headquarters, several other places, and to Wright-Patterson AFB, the headquarters of Project Blue Book--actually Project Grudge at the time of the sighting. He had marked his file "closed," even though he had not at that time obtained a statement from Mrs. A. Several days later, on August 8, Agent Hauser interviewed Mrs. A in Gold Beach, obtaining the information given earlier in this addendum. Although this interview was subsequently included in the file compiled by Agent Brooks (and is to be now seen on the microfilm copy of that file), the Blue Book (or Grudge) investigators didn't realize the connection between the sighting of Mr. B, Mr. C, and Mr. and Mrs. D, and that of Mrs. A, even though the estimated times were the same (about 1700 hours) and the locations were virtually identical (near Elephant Rock in the Rogue River, Oregon)!! Thus, in the BB files these two cases should be combined into one, and moreover, the identifications should be deleted!!! (It certainly couldn't have been both an aircraft and a "kite.")

During his investigation, Agent Brooks compiled the following supplementary information: The weather charts for the area indicated the coast was clear on the date of the sighting; the San Francisco Civil Aeronautics Authority (CAA), the Oakland Airport, and the San Francisco Airport all agreed that there were many local carriers (about 160) that could have flown over the Gold Beach area but that less than 1% of these file flight plans, so it would be useless to try to locate a flight that could account for the sighting; the Sixth Army and the Twelfth Naval District Intelligence did not possess radar installations near enough or powerful enough to have recorded anything at Gold Beach at that time; the Air Force Early Warning Radar Stations in the Bay Area were not powerful enough to reach as far north as Gold Beach and these stations did not report anything as unidentified on the date of the sighting; the 505th Aircraft Control and Warning Group at Silver Lake, Washington, did not have Gold Beach under radar coverage.

Of all the above listed supplementary information, the only part of direct interest, since there was evidently no radar coverage, is the confirmation of the witnesses' claim that the weather was clear.

However, Agent Brooks did dig up an interesting bit of information which led to the "final identification," according to Project

Blue Book (or Grudge). Quoting Brooks' report:

"On August 2, 1949, Air Force radar installations at Treasure Island and the military reservation at Fort Baker, both in the San Francisco area, send aloft radar testing devices known as "kites" twice each day, at around 1000 and 1600. These devices are of aluminum sheet, approximately five feet on a side, roughly diamond-shaped and containing a double set of triangular fins on the top side. These are carried aloft by gas-filled balloons approximately two feet in diameter when they leave the earth. When these devices reach high enough altitude, the expanding gases cause the balloons to burst and the devices known as "kites" fold and drift earthward. It is possible that one of these "kites" may have blown as far north as Gold Beach, Oregon on 24 May, 1949."

Apparently the BB (or Grudge) investigators accepted the "possibility" that one of these devices could have drifted northward about 340 miles on May 24, 1949. (Note: Typical balloon ascension rates put a balloon at bursting altitude within an hour after launch.) If the 1600-launched balloon had reached Gold Beach by 1700, it would have traveled about 340 miles an hour. If the 1000-launched one had reached Gold Beach, it would have only had to travel one-sixth as fast. Of course, if a balloon launched on a previous day had reached Gold Beach (without bursting and without leaking sufficiently to drop to the ground), it could have moved quite slowly. The investigators "only" had to ignore the statements of four witnesses, two of whom used binoculars (Mrs. A was not included in the report identified as "kites"), that the object was circular to accept the kite explanation. A radar kite is a carefully folded aluminum sheet like a cube with its corners pushed inward. This folding turns the cube into a collection of "corner reflectors" for radar. The outline of such a device could be square, rectangular, or hexagonal (probably a distorted hexagon), but not circular.

From the statement that the radar kites were carried aloft by two-foot diameter balloons, and from data on balloon lifting capabilities (about 0.07 lb/ft3), we can calculate that the corner cube weighed about 0.3 lbs. An object of this weight could not remain above ground without support, so if such a kite reached the Rogue River, it would have to be supported by the balloon for the whole distance. The balloon would keep the kite at a high altitude (over 30,000 ft), assuming the balloon did not burst, unless it had a slow leak. Thus, in order for such a kite to have been low enough to be seen over the Rogue River, we have to assume that it was carried by a leaky balloon. Of course, the balloon would be visible if the kite were visible since they were of comparable dimensions. The lack of a report of anything seen over the unknown object provides another argument against the radar kite hypothesis.

Of course, the argument that the witnesses saw a radar kite launched in San Francisco presupposes that the wind directions and speeds at balloon altitudes were correct. Upper altitude data from reporting stations at Medford, Oregon (about 80 miles east of Gold Beach), and Oakland, California, were obtained from the National Weather Center in Ashville, North Carolina. No winds listed were as high as 50 mph, so neither the 1000- nor the 1600-launched kite could have made it to Gold Beach on the same day as the sighting. Moreover, the data for late May 23 and all day May 24 show that the prevailing upper altitude winds were from the west and northwest, with occasional winds from the southwest at certain altitudes and times. Therefore, even if a balloon and kite could have remained in the air long enough to cover 340 miles, they would have been blown inland rather than northward.

To aid in the study of this sighting, I have compiled a table of certain features of the various statements and interviews. The reader will note that the estimated times (durations) and distances varied somewhat, but all were comparable. All witnesses agreed on the general shape and color. Apparently the object was of an angular size that was large enough so that the witnesses could determine its circular shape even without binoculars.

The size estimates are subjective but suggest angular sizes comparable to 0.1 to 1 degree (0.0017 to 0.017 radians; the sun or moon is about half a degree in angular size). At the very least, it must have been a minute or two ($1/60^0$ = 0.017 radians to $2/60^0$ = 0.034 radians) since the normal resolution of the daylight-adapted eye is on the order of one-half to one minute of arc, and the object was

TABLE A ROGUE RIVER, OREGON, 24 MAY 1949, 1700 PST

Person and Place	Direction To Object	Distance To Object (Estimate)	Height (Estimate)	Shape	Size (Estimate)	Speed (Estimate)	Duration Of View	Color	Other Details
INTERVIEW, JUNE 24									
Mr B, Moffett Field	east to southeast	4 miles	5000 feet	round, like 50¢ piece	30 feet diameter	slow to fast	90-120 seconds	silvery	Turn with no tilt or banking, no protrusions other than fin near trailing edge, no ports Used binoculars
Mr C, Moffett Field	N60°E to S10°E	1 to 2 miles	5000 feet	like pancake	25-30 feet	not moving to moving	30 sec naked eye, then with binoculars	shiny metal	Binoculars resolved round object into pancake shape with fin. Thicker at center Apparently wrinkled or "dirty" trailing edge, no sound, etc
SIGNED STATEMENTS, AUGUST 2.									
Mr. B, Moffett Field	east to southeast	not more than 1 mile	5000 feet	circular or oval	----	slow, then sped up	approximately 1 minute	silvery metal	Same details as in interview
Mr C, Moffett Field	east to SSE	about 1 mile	5000 feet	like pancake	30-35 feet	slow to fast	90 sec. naked eye, then with binoculars for 90 secs.	silvery	Same details as in interview
SIGNED STATEMENTS, JULY 26									
Mr. D, Ione, Calif	traveling in southerly direction	----	5000 feet	silver dollar	length of DC-3 fuselage	fast	2 minutes	silvery	Didn't use binoculars, no sound or irregularities of formation
Mrs. D, Ione, Calif	----	----	high altitude	circular	passenger plane	fast	2 or 3 minutes	silver	No sound.
INTERVIEW, AUGUST 8.									
Mrs A, Gold Beach	east to southeast	3 or 4 miles	----	circular	C-47 over Gold Beach	fast	----	silver	No sound; no exhaust.

apparently resolved by the eyes of five people. The 8-power binoculars would have made details down to one-eighth or so of the diameter of the object apparent to the viewers using binoculars (Mr. B and Mr. C).*

An object that is one minute of arc in angular size would be 1/60 of a degree or (1/60) of 0.017 radians or 0.00028 radians in angular size. This corresponds to 0.28 feet in linear size if 1000 feet away, about 1 1/2 feet if one mile away, and about 6 feet if four miles away.

These sizes calculated above are based upon the minimal expected angular size for resolution of the object into a circular shape with the naked eye. However, if the estimates of Mrs. D and Mrs. A are more nearly correct, then we should use an angular size comparable to 0.1 degree or 0.0017 radians. The linear size estimates are now about 1.7 feet if 1000 feet away, 8.4 feet if one mile away, and 33 feet if about four miles away. This last size estimate agrees with the numbers given by Mr. B and Mr. C, and probably with the fuselage length estimate given by Mr. D. However, their estimates were purely qualitative since they had no distance estimates to work from. It is unfortunate that the interviewers didn't think to obtain rough angular size estimates (such as the size of a pea at arm's length) from the witnesses.

Despite the difficulty or impossibility of obtaining size estimates from the data presented in the OSI files, it seems clear that the object seen by five people was not an ordinary aircraft, and moreover, the detail reported by two observers who used binoculars (not just one as implied by the BB#14 summary) rules out other readily identifiable aerial phenomena. Thus, I believe that this case must remain unexplained.

*Note: Relatively recent studies by military investigators in visual detection and recognition of military targets and other studies concerned with the presentation of visual information on TV-type displays have shown that detection of a target against a somewhat "contrasty" background requires that the angular size of the object subtend roughly one "eye resolution element," which is about one minute of arc or about one-third of a milliradian. For the shape of an object to be barely recognizable requires about 1.5 to 2 resolution elements along any major axis of the object (if it is square or circular it has no major axis; in any other case, the orientation of the object will be barely detectable with 1.5 to 2 resolution elements along its major axis). For objects with non-simple surfaces (such as projections), it is barely possible to differentiate between classes of comparable non-simple surfaces if there are about four resolution elements along any major extension. Thus, for example, to distinguish between a plane and a blimp seen at great distances would require that the plane be seen in such a way that the fuselage subtends several resolution elements and the wings subtend several resolution elements. An object with a structured surface can usually be identified (either by the observer or by an analyst studying an accurate report by the observer) when there are 6 to 8 resolution elements along any major extension and several elements along any minor extension.

The requirements for typical visual detection, determination of object orientation, object class differentiation, and object identification are of interest in analyzing this report because here we have a case of an object for which the angular size was sufficient that not only could the observers detect it, but they were also able to assign a general shape (circular or oval) with the naked eye. The ability to make this statement about its shape with the naked eye implies that the angular size of the object was such that it subtended at least two resolution elements in its major dimension. It probably subtended more, but two is sufficient to allow me to make the following point: With the binoculars, the angular size was "amplified" by a factor of eight, meaning there were at least 16 resolution elements across the major dimension of the object, many more than necessary for identification if identification were possible!

PERCIPIENT STUDIES

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Australian Centre for UFO Studies*

Abstract

A growing proportion of researchers have begun to realize the importance of investigating the psychological and sociological aspects of UFO experiences "Percipient studies" can be defined as the in-depth study of the human aspects of anomalous experiences, utilizing the methods and knowledge of psychology, sociology, medicine, and parapsychology where relevant Previous studies are reviewed, with emphasis on the procedures and methodologies employed. The aims and proposed methodologies of the Percipient Studies Project (PSP) are outlined, namely to research the human factors involved in anomalous experiences in order to increase our understanding of (1) UFOs and other anomalous phenomena, and (2) human experience and behavior in general. The initial project of the Percipient Studies Project is the setting up of an Australian capability for the in-depth psychological and physiological study of UFO percipients. Three stages are envisaged: To (1) compile a standardized package of psychological and medical tests; (2) locate appropriate and cooperative subjects for in-depth study; and (3) compare groups of percipients, non-percipients, and other controls. A preliminary package of psychological tests is presented, listing name, form, and aims of each test The application of the percipient studies methodology to percipients of other anomalous phenomena (such as poltergeists and apparitions) is explored. Researchers are invited to contribute suggestions on potentially useful procedures and methodologies which could be incorporated in percipient studies.

Introduction

In the field of UFO research, there has been an historical emphasis on researching the alleged technological aspects of the subject. UFO phenomena have been viewed as physical manifestations which sometimes leave unusual physical traces, sometimes interfere with vehicular systems, and perhaps may even involve some kind of advanced system of propulsion. UFOs may or may not have a physical and/or technological existence. But they certainly have a psychological and sociological existence.

The UFO experience is the reported perception of an unexplained aerial phenomenon. As such, the experience involves the processes of perception. Other psychological processes such as altered states of consciousness may also be involved in some cases. On a social level, UFO experiences have been reported by many people from many cultures. The collective impact of such experiences, and society's reactions to reports of such experiences, leads to a consideration of the sociological implications of UFO reports. Over recent years, a growing proportion of researchers have begun to appreciate the importance of considering the psychological and sociological aspects of UFO phenomena.

Percipient studies can be defined as the in-depth study of the human aspects of anomalous experiences, utilizing the methods and knowledge

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of psychology, sociology, medicine, and parapsychology where relevant. The aims of this paper are to examine methods for researching the psychological and physiological aspects of UFO and related anomalous experiences, and to present an outline of the aims and proposed methodologies of the Percipient Studies Project.

Previous Studies

While the study of the human aspects of UFO experiences has been till recently largely ignored, some previous studies have produced useful data. The work of several researchers will be briefly reviewed, with emphasis on psychological and physiological areas of research, and on the methodologies used.

Probably the first researcher to engage in the in-depth psychological study of UFO percipients is American psychiatrist, Berthold E. Schwarz, M.D. His method has been to conduct detailed psychological and psychiatric evaluations of UFO percipients on a case study basis. For example, Schwarz has conducted a detailed, long-term study of UFO contactee Stella Lansing who claims to have had a number of UFO experiences and also to have filmed UFO-like phenomena (Schwarz, 1972).

Procedures used to obtain data on the percipient included detailed interviews probing her personal history and social background (including job history, hobbies and interests, drug usage, prior medical complaints and psychiatric history); medical questionnaires (Periodic Health Examination History, Cornell Medical Index Questionnaire); psychological questionnaires (Rotter Incomplete Sentences test, MMPI); and corroborative interviews with other family members ("modified collaborative investigation"). Due to the percipient having had two loss-of-consciousness experiences, hypnotic regression and electroencephalographic studies were also undertaken. Because she claimed to have had a number of paranormal experiences (telepathic, precognitive, and psychokinetic), these claims were documented via interviews and the Ehrenwald test for psi was given. Finally, because Mrs. Lansing claimed repeated UFO experiences, the investigator was able to conduct several field trips accompanying her and ended up observing a number of unusual nocturnal lights.

Alvin H. Lawson, professor of English at California State University, and hypnotherapist William McCall have been researching UFO "abduction" reports (cases where the percipient alleges he or she was physically abducted aboard a UFO "craft" and subjected to a medical examination by UFO entities). The experimenters hypnotically regressed both "real abductees" (subjects who claimed a real-life abduction experience) and "imaginary abductees" (subjects with no previous conscious recollection of an abduction experience) (Lawson, 1977). Comparison of the two groups showed many accounts were actually subjective experiences (fantasies) incorporating imagination, general UFO information within the culture at large, and distorted memories of past real-life surgery events such as hospital surgical examinations.

Lawson's work generates two main implications for percipient studies. First, the probable unreliability of hypnotic age regression as a tool in gaining a "truthful" account of allegedly strange events. Second, it illustrates the application of the two groups method (experimental and control). While the case study method can give valuable insights into a single case, a research design involving the rigorous comparison of several standardized groups of cases has more scientific validity and gives greater confidence when trying to draw generalized findings.

In Austria, Dr. Alexander Keul has conducted some interesting and controversial studies using the case study and two groups methods. In one study, Keul and an undergraduate psychologist visited the percipients involved in ten physically unidentified cases (i.e., unexplained in terms of natural or human-made phenomena). Biographies including social and medical records were noted and a battery of psychological tests administered: the Rorschach projective personality test,, the Benton short-term memory test, two sub-tests of the Wechsler Adult Intelligence Scale (WAIS), a suggestibility test, and the psychoanalytically-oriented Giessen questionnaire which yields the self-picture of the percipient. A doctor of clinical psychology then corrected the field test evaluations without having seen the UFO percipients or read their reports. The witnesses were then labeled as X = reality-oriented, psychic stable witness; Y = moderate psychic disorders; and Z = severe psychopathological disorders.

Results of the study as conducted were nil X, seven Y (typical problems including hysterical reactions, neurotic fears, and confabulation tendency), and three Z (one organic cerebral involution and two socially retarded, psychopathic characters on the border of schizophrenia). From this

study, the author concludes that "it seemed a valid hypothesis that psychopathology plays a considerable role in Austrian UFO cases" (Keul, 1981). In a further study, Keul compared the Rorschach test results of 19 UFO percipients and 6 non-UFO percipients (who saw conventional astronomical phenomena) with the finding that the non-UFO group had a greater proportion of "positive" reporter profiles compared to the UFO group.

Not surprisingly, Keul's studies have generated controversy as they suggest that UFO percipients tend to be psychologically disturbed--a finding that contrasts with some other studies. In such a study, one has to be very careful on how psychological normality versus psychopathology are defined, on how the percipient profiles are judged and assigned to any particular group, and on the possible influence of investigator bias. While Keul's findings have yet to be supported or disconfirmed by studies using the same methodology, his research designs are good examples of the sorts of data which can result from the application of the case study and two groups methodologies in percipient studies.

Another approach to percipient studies is the survey method. R. Leo Sprinkle, Ph.D., director of the Division of Counseling and Testing at the University of Wyoming, has conducted questionnaire surveys of UFO percipients and non-percipients. In the first survey conducted in 1968, 63 people responded to published invitations to participate in the survey. The subjects completed the Adjective Check List (a personality inventory), the Strong Vocational Interest Blank, and a questionnaire form which requested personal information about each participant, including experiences and opinions of UFO observations and ESP processes. The majority of participants claimed to have had a UFO experience. In a second study, a further 19 subjects were surveyed, some of whom also completed the 16PF Test and MMPI.

Taking the subject groups as a whole, Sprinkle concluded:

> . . . the scores were obtained from a sample of persons of average or above average education, with professional and academic interests, with an interest in human behavior, and with no obvious psychoneurotic or psychotic reactions. The results are similar to those of the "upper middle class" who are viewed as intellectual, creative, and productive. . . . (Sprinkle, 1976, p. 317)

An advantage of the survey method is that a potentially large number of people can be studied. But this may be at the expense of more detailed and more reliable data which might be obtained by supervised psychological testing conducted in a face-to-face situation. Sprinkle also mentions the limitations of generalizing results from a small sample of participants, and the influence of the investigator's personal biases. These are important factors which need to be kept in mind when evaluating all psychological studies.

Turning to physiological reactions, physician Richard C. Niemtzow, M.D., is conducting an investigation of medical injuries associated with alleged UFO close encounters. He has classified the injuries into three categories:

> The first category is of a temporary nature dealing with paralysis, dizziness, temporary blindness, headache, perception of odors, audio frequency sounds, and parapsychological activity. The second category deals with the more chronic effects usually associated with skin lesions, gastrointestinal disturbances, and abnormal psychological manifestations. The third category is slow healing and a return to normal health. The stigma of the experience may cause long-term lifestyle and sociopsychological changes that may or may not be tied to the medical injuries. (Niemtzow, 1982, p. 24)

According to the experimental design, a medical doctor of the percipient's choice interviews and evaluates, with Niemtzow acting as consultant to the primary physician. The medical procedures of the project include a clinical evaluation with complete medical and psychiatric history, and physical examination (including weight), as well as laboratory tests covering complete blood count with differential serum and urine electrolytes (sodium, potassium, chloride, calcium, and phosphorus), serum glucose, serum cortisol to determine 24-hour peak, urine ketones, chest x-ray, biopsies of skin lesions, and photographs of external injuries.

By carrying out the above experimental design, the project intends to "assist in a better understanding of the phenomenon as it interacts both physically and psychologically with man. It may be feasible to describe physiological mechanisms that are repetitive with the phenomenon" (Niemtzow, 1982).

In the past, there have been only a few UFO percipients who have undergone a medical examination following their UFO experience, and most of these studies have been incomplete and uncorrelated. Hopefully, the adoption of a research strategy along the lines proposed by Niemtzow will lead to a thorough documentation of medical injuries and other physiological reactions associated with some UFO experiences. The data obtained may indeed assist us in a better understanding of the phenomenon.

In a protocol which intends to combine psychological and physiological evaluation techniques, physician Richard M. Neal Jr. is studying close encounter percipients, including those who have experienced a time lapse, and has developed a detailed self-report questionnaire (Physiological/-Psychological Survey). Neal proposes to carry out the following procedures in association with hypnotic regression sessions:

1. EEG (electroencephalogram), EKG (electrocardiogram), tactile skin sensors, blood pressure studies before, during, and after each session.
2. Blood studies (brain-chemistry profile, metabolic screen profile), CBC (complete blood count) before, during, and after each session. Urine studies (particularly proteins).
3. Tape recordings of all sessions.
4. Documentation of all personnel present.
5. PSE (Psychological Stress Evaluator) to evaluate truth of encounter through voice patterns.
6. MMPI, VPI, 16PF (psychological screens).
7. Possible biopsies of any skin lesions.
8. Photographs of any new or old external injuries.
9. Closed circuit TV or audio-visual taping of each individual.

Richard Neal has contributed a useful protocol which promises to give helpful data on psychological and physiological reactions, and to provide a firmer basis for evaluating the data produced from hypnotic regression sessions.

Having examined a number of research designs which have been followed by other researchers, it is now time to consider what further work can be done in the area of percipient studies, particularly in Australia.

Percipient Studies Project

In 1982, the Percipient Studies Project (PSP) was initiated by the author with the aim of researching the human factors involved in anomalous experiences. The project will examine the psychological, sociological, physiological, and alleged parapsychological aspects of UFO experiences and related phenomena. The aims are to increase our understanding of UFOs and other anomalous phenomena, and human experience and behavior in general. To achieve this, the Percipient Studies Project plans to involve behavioral scientists and other interested researchers in the in-depth study of individual percipients to anomalous experiences, the comparison of groups of percipients and non-percipients, and any other studies deemed relevant.

An initial project of the PSP is the setting up of an Australian capability for the in-depth psychological and physiological study of UFO percipients. It is intended to establish a set of standardized psychological and medical testing procedures which will produce useful data of the least ambiguous nature. It is envisaged that these techniques would be especially relevant to UFO cases involving strong psychological reactions, "repeater" percipients, and PSI/UFO phenomena. The involvement of psychologists, psychiatrists, hypnotherapists, and medical personnel as field investigators or consultants would be desirable.

Specific issues which are being investigated include:

1. The most effective and objective interviewing techniques
2. Psychological tests which give the most relevant and valid information about the percipient
3. Medical examination procedures which are useful in documenting physiological and/or psychosomatic reactions (e.g., headaches, eye irritations, insomnia, rashes, stigmata)
4. Techniques which distinguish between physically-induced and psychologically-induced physiological reactions

5. Procedures to be followed during the hypnotic age regression of a UFO percipient

6. Factors or variables by which groups of percipients and non-percipients can be distinguished (e.g., recent stress, "psychic" background, personality characteristics)

7. Application of the "percipient studies" methodology to percipients of other anomalous phenomena (e.g., poltergeists and apparations)

It is the premise of this project that important findings about anomalous phenomena, and about human experience in general, can be gained by the in-depth psychological study of anomaly percipients.

There will be three stages in the initial research program of the Percipient Studies Project: (a) compile a standardized package of psychological and medical tests; (b) locate appropriate and cooperative subjects for in-depth study; and (c) compare groups of percipients, non-percipients, and other controls.

Psychological Tests and Procedures

The following table lists psychological tests and procedures which could be useful in percipient studies. (Most of these tests are described in Anastasi, 1976, unless otherwise indicated.)

Psychological Tests and Procedures

Name of Test	Form of Test	Aims of Test
Biographical Interview	Interview or inventory (questionnaire)--life history data	Personal adjustment, personality characteristics, social background
Wechsler Adult Intelligence Scale (WAIS)	Verbal and performance tasks	General intelligence in adults
Wechsler Intelligence Scale for Children (WISC)	Verbal and performance tasks	General intelligence in children
Minnesota Multiphasic Personality Inventory (MMPI)	Self-report inventory (questionnaire)--true/false/cannot say responses	Personality traits, detect psychopathology
California Psychological Inventory (CPI)	Self-report inventory--true/false statements	Personality traits
16 Personality Factors Questionnaire (16PF)	Self-report inventory	Personality traits
Rorschach	Projective technique--inkblots	Personality--global appraisal
Holtzman Inkblot Technique (HIT)	Projective technique--inkblots	Personality--global appraisal, standardized
Thematic Apperception Test (TAT)	Projective technique--picture cards	Personality characteristics

Psychological Tests and Procedures (continued)

Name of Test	Form of Test	Aims of Test
Rotter Incomplete Sentences Blank	Projective technique--sentence stem completion	Personality characteristics, psychological adjustment
Bender-Gestalt Test	Design copying	Detect brain damage
Strong Vocational Interest Blank (SVIB)	Self-report inventory--like/indifferent/dislike responses	Occupation-related interests, self-concept and personality characteristics
Adjective Check List (ACL)	Self-concept inventory--self-descriptive adjectives	Personality in terms of self-concepts
Role Construct Repertory Test (Rep Test)	Personal construct test--people who fit certain role titles compared and contrasted	Personality in terms of personal contrasts
Semantic Differential	Self-concept/personal construct inventory--bipolar adjectival scales	Personality in terms of self-concepts and personal constructs
Twenty Statements Test	Self-concept inventory--answers to question "Who am I?"	Personality in terms of self-concepts
Sociogram	Social map of relationships among members of a group (Chaplin, 1975)	Interpersonal relationships and interactions
Pendulum Technique	Questions answered by ideomotor responses--motions of hand-held pendulum (LeCron, 1970)	Information from subconscious mind (Sprinkle, 1978/79)
Hypnotic Susceptibility Tests	Spiegel Eye-roll Test, The Hand Clasp Test, Chevreul's Pendulum Test (Hall and Grant, 1978)	Rough estimate of hypnotic susceptibility
Hypnotic Age Regression	Induction of hypnotic state with suggestion to "relive" prior events	Relaxation and reduction of anxiety release of subconscious information (Sprinkle, 1976)
Electroencephalogram (EEG)	Measurement of brain's electrical activity with scalp electrodes; evoked responses produced by repeated stimuli (Schatzman, 1982)	Detect unusual or abnormal brain activity, e.g., epilepsy; detect hysterical versus physical blockages of perception centers

Out of the above tests and procedures, the researcher can select several to form a package of relevant psychological tests which can be practically and realistically administered in a case study. Tests may be added, deleted, or replaced from the standard package as appropriate to the aims of the research program, the percipient's educational, psychiatric or medical background, and the resources (time, equipment, personnel) available. Tests may be administered over several sessions so as to both gain the subject's confidence and to avoid unduly tiring the subject. Full documentation of the testing circumstances, including the subject's psychological state and physical health at the time of testing, and the identification of personnel present, should be undertaken.

Research Package

The following questionnaires, tests, and procedures are suggested to form a preliminary package of research procedures:

UFO Questionnaires
- UFO report form (general
- Specialized UFO report forms
  - PSIUFO Phenomena Questionnaire
  - Entity Report Form
  - Questionnaire for Awake/Asleep Interface cases

Psychological Tests and Procedures
- Biographical Interview
- Wechsler Adult Intelligence Scale (WAIS)
- Minnesota Multiphasic Personality Inventory (MMPI)
- Rotter Incomplete Sentences Blank
- Strong Vocational Interest Blank (SVIB)
- Adjective Check List (ACL)
- Role Construct Reportory Test (Rep Test)
- Twenty Statements Test

Medical Procedures
- Medical history
- Psychiatric history
- Physical examination by medical doctor
- Photographs of external injuries

Other Applications

The percipient studies methodology can also be applied to percipients of other anomalous phenomena such as poltergeists and apparitions.

To a certain extent, this has already occurred. For example, in the Stella Lansing case, the percipient claims to have had a number of paranormal experiences in addition to her UFO experiences. The psychological and medical tests administered by the investigator (Schwarz, 1972) are thus equally applicable to elucidating an understanding of both the paranormal and UFO aspects of the case. There are many other examples of PSIUFO cases where the percipient is the focus for both UFO and paranormal phenomena of various types (see Moravec, 1981).

In his investigation of "The Miami Poltergeist," parapsychologist William G. Roll arranged for Julio, the person around whom the object-throwing poltergeist events centered, to undergo psychological testing. The MMPI, IQ test, TAT, Rorschach inkblot test, and a word association test were administered. Additionally, an EEG was carried out (which did not show anything unusual). The results of the personality tests indicated that the percipient had aggressive feelings and impulses which were disturbing and unacceptable to him but which he controlled and did not directly express (Roll, 1972). Psychological examinations of other poltergeist agents have echoed these findings and support the hypothesis that poltergeists are caused, in part, by the repressed hostility of the individual being unconsciously expressed through psychokinetic means.

Psychiatrist Morton Schatzman has researched the interesting case of a woman named Ruth who was persecuted by repeated, involuntary apparitions of her father. Gradually, through psychotherapy, Ruth was able to reduce the fear associated with the apparition, to control its appearance, and to voluntarily create apparitions of other people (Schatzman, 1982). The Wechsler Logical Memory Test Form I and Ray-Osterrieth Form II Test were administered to Ruth to see if brain damage had affected memory (results were normal). Personality tests such as the Rorschach, Semantic Differential, and Twenty Statements Test were administered to see if they could distinguish between the individual personalities of Ruth in the normal state, Ruth as the apparition of herself, and Ruth as a child during her self-induced "memory trances." (They could, but a number of explanations are possible, e.g., role-playing.)

An EEG was used to record Ruth's brain electrical activity. A visual-evoked response was elicited by getting Ruth to stare at a TV screen that displayed a constantly changing checkerboard

pattern. When Ruth produced an apparition which blocked the screen, her visual-evoked response was completely eliminated. In other words, Ruth's brain was responding to the apparition as if it was an actual physical object which blocked the screen.

These examples show that percipient studies methodology (specifically psychological tests and evaluation) can be usefully applied to the study of percipients to other anomalous phenomena as well as UFO experiences.

Conclusion

Percipient studies can be defined as the in-depth study of the human aspects of anomalous experiences, utilizing the methods and knowledge of psychology, sociology, medicine, and parapsychology where relevant. The aims of percipient studies, and of the Percipient Studies Project in particular, are to increase our understanding of UFOs and other anomalous phenomena--and of human experience and behavior in general. In Australia, a priority is to set up an Australian capability for the in-depth psychological and physiological study of UFO percipients.

If any researchers have suggestions on potentially useful procedures and methodologies which could be incorporated in percipient studies, I would be interested to hear their ideas. Input from both Australian and international researchers is welcomed. If you can assist, please contact the project coordinator: Mark L. Moravec, 26 Minnamurra Place, Pymble NSW 2073, Australia.

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DIMENSIONAL CONCEPTS IN RELATION TO UFOs, BIGFOOT AND THE LOCH NESS MONSTER

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A popular alternative to the ETH in regard to UFOs, Bigfoot and Nessie is that they come from other dimensions in space-time. (ETH's equivalent for Bigfoot and Nessie is that they are natural animals, but elusive.) I owe a debt to the magazine Science 80 (July/August issue) for an important lesson on what dimensions are and how they interact. Kenneth Engel (and recently, Carl Sagan) points out that if living beings could exist in different geometric systems, such as a two-dimensional system vs. a three-dimensional system, the appearance of the being existing in the larger system would appear to be miraculous to the being in the more restricted system. He gives as an example a flat being, a sort of Mr. Square, living in a plane "world." When Mr. Square is visited by Mr. Sphere, the plane registers only the area of intersection, which seems to Mr. Square to be a point, then a growing circle, then a shrinking circle, and then finally a point. Ultimately, both sudden appearance and disappearance takes place.

To ufologists and Forteans, this should have a familiar ring. We live in a three-dimensional world. Beings, craft, or objects that exist in a four-dimensional or five-dimensional state, can register only a portion of their reality to our senses in our limited three-dimensional world. Hence, UFOs appear and disappear suddenly, Bigfoot leaves tracks that suddenly "end" or strangely "start" with no explanation (such as in snow), and Nessies--which one might expect would need to breathe, and often, if they were conventional, albeit prehistoric, reptiles--manage to stay unseen for days and weeks at a time, despite continual scanning by cameras and observers.

ETH and the natural animal concepts do not seem to explain these phenomena as well, in my view, as does this explanation of dimensionality. Of value here is being able to view dimensionality in two ways: 1) the old idea of alternative dimensions, a hairbreadth away, along with parallel universes, and 2) as an occasional interaction of existence systems that have differing numbers of limiting dimensions to them, e.g., two-dimensional interfacing with three, three with four, etc.

Thus, the next time we read of a UFO suddenly "winking out," or of a Bigfoot being photographed while not being seen, or of Nessie diving down not to surface for a month, let's consider how a water strider insect views a rock being thrown in his pond. It sees not the flight of the rock, nor the sinking of the rock to the bottom--all it sees in its plane of existence is the splash at entry. Are we much different?

SCIENTISTS' SELECTION OF NEW RESEARCH TOPICS: UFOs vs SETI

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Abstract

This report is concerned with scientists' decisions to search for extraterrestrial intelligence (SETI) while rejecting the analysis of unidentified flying objects. The two topics seem similar: both imply knowledge and power superior to our own, and origins outside the familiar world. Thirty years ago neither was a reputable field of study; today SETI is while UFOs are not. Yet there are thousands of UFO reports, including some by reliable observers, but none of ETI. Discussions with scientists and reviews of books and other printed materials indicate several factors present in one field and absent in the other. Sensationalism and intense public interest, government manipulation of public opinion and ridicule were prominent in the history of UFOs. In contrast, several positive aspects of the search for ETI made it attractive to scientists: location within a traditional discipline, compatibility with present theories, ease of measurement, use of existing methods and equipment, and control over decisions as to when, where, and how to examine the phenomenon.

Why do scientists study some topics and avoid others? The tremendous impact of science on our lives makes this question far from academic. Two of many possible examples --- disease control and nuclear weapons --- indicate that scientists' interests can be a life or death matter for us all. What then are the factors which influence scientists' choice of research topics?

Some insights may be gained by analyzing scientists' responses to reports of unidentified flying objects. Their reaction has been strongly negative. Mention of the subject has generally elicited embarrassment, ridicule, rage --- or silence. Most scientists don't want to have anything to do with UFOs.

Such responses are even more noteworthy when contrasted with another apparently similar subject: extraterrestrial intelligence. This area, which seems as "far out" as unidentified flying objects, has recently elicited a very different reaction from scientists: it is considered respectable and even fashionable. The search for extra-terrestrial intelligence is endorsed by superstars such as Carl Sagan and Isaac Asimov, supported by the National Aeronautics and Space Admin-

istration, and examined in prestigious facilities such as the Jet Propulsion Laboratory in Pasadena.

In contrast, there are no similar resources dealing with UFO reports. NASA rejected President Carter's request to investigate UFOs. The Center for UFO Studies is a privately funded operation on a far smaller scale than JPL. J. Allen Hynek is the leading scientific advocate of UFO study; although he was chairman of Northwestern University's astronomy department, he lacks the visibility enjoyed by Sagan in scholarly and public circles.[1]

This difference in attitudes toward ETI and UFOs becomes even more interesting when we compare the evidence for the two phenomena. There are far more reports of UFOs than of ETI. In spite of ETI's respectability, not a single reliable observer has claimed contact with it.[2] In contrast, there are tens of thousands of reports by people who claim to have seen UFOs; many of these reports have come from responsible observers including astronomers, meteorologists, air traffic controllers, engineers, military and commercial aviators, police, and even President Carter.[3]

The United States Air Force accumulated 13,134 UFO reports over two decades.[4] In spite of its attempts to explain away UFOs as misidentifications of aircraft, balloons, satellites or other natural phenomena, and in spite of dismissing many other reports on the basis of "insufficient information," hundreds of cases remain unexplained.[5] The Center for UFO Studies has a computerized data bank containing 100,000 entries from all over the world.[6] Five percent of the members of the American Astronomical Society, when assured anonymity, admitted seeing aerial objects they could not identify.[7] UFOs have been photographed, tracked on radar, and pursued by interceptor aircraft.[8] Some reports claim that they have interfered with automobile ignition and lights, or have left imprints on the ground.[9]

In short, there are thousands of reports about UFOs, including a number from professional observers, while there are no claims by similarly qualified observers of communication from extra-terrestrial sources. Yet the UFO problem is shunned by scientists while the search for ETI is acceptable and fashionable. Why?[10]

The possible reasons fall into three categories. First are the non-operative factors: those which might logically be expected to attract scientists' attention but have not. Next are those which turned scientists away from UFO study. Finally, there are factors which attracted scientists to the search for extra-terrestrial intelligence.

Non-operative Factors

First, evidence for the existence of the phenomenon was apparently not a deciding consideration. The thousands of UFO reports, including some from colleagues in their own professions, have not sufficed to enlist the interest of many scientists. True, no UFOs have landed on the White House lawn and no UFO fragments have been found. Nevertheless, however inadequate the evidence for the existence of UFOs, it exceeds the non-existent evidence for ETI.

Proximity of the phenomenon was also not a decisive factor. Searchers for ETI look far out into space, dozens or hundreds of lights years away. By contrast, UFOs --- at least the reports of them --- are here with us now, from every state of the United States and from all other parts of the world, from cities in Europe and South America to African villages and the jungles of New Guinea.[11]

Immediate benefit from increased knowledge is also not a factor. One of the main arguments given by the advocates of the search for ETI is that revelations we might gain from a superior civilization would easily repay our initial investment in the program. Yet those advocates are not interested in the possibility that representatives of these superior civilizations might be here now. Instead, the possible locations of ETI currently suggested for scrutiny are so far away that there would be little chance for much communication with their inhabitants. Even traveling at the tremendous speed of light, our radioed questions would take many years to reach them, and even if these distant civilizations detected our queries and chose to answer immediately, their reply would take an equal number of years to return to us. In contrast, UFO occupants --- who might be in the same county, city, or even outside the observatory --- could perhaps carry on a

"face-to-face" conversation, with the possibility of immediate answers to our questions.

If we can rule out these considerations --- evidence, proximity, and the possibility of prompt revelations --- what other things might influence selection of research topics? I turn now to four factors which may have prejudiced scientists against UFOs.

Barriers to UFO Research

Lack of a Disciplinary Base

First, the name of the phenomenon is itself significant. UFOs are by definition "unidentified". As such, they do not obviously belong in any specific discipline. It is not even clear whether they are in the domain of natural science or of social science, so varied are their manifestations, ranging from lights in the sky to reports of abductions remembered only under hypnosis. Even people who agree that UFOs should be studied have differing explanations for what UFOs are and how they should be studied. While many persons think they are extra-terrestrial spaceships, this hypothesis is not the only one. Energy fields, psychic phenomena, manifestations of another space-time dimension or holographic projections are among the alternate explanations. Who should study such things --- astronomers? Sociologists? Physicists? Psychiatrists?

Because UFOs do not fit readily into any particular branch of science, they fall into the cracks between the disciplines, and therefore have no ready-made scientific constituency to encourage their study.

This creates several problems, one of which is funding. The lack of an established constituency, the absence of a link to a particular branch of science, makes it difficult to get money for studying bizarre phenomena like UFOs. Funding for research is controlled by people in recognized disciplines. They have ideas about the kinds of topics that are significant to science, and they decide which applications will be approved and which won't. Because the availability of money influences selection of topics for research, UFOs and other orphans of science are unlikely to receive much serious attention.[12]

However, even if a scientist had funds and was willing to devote his time to the UFO puzzle, he would have no assurance that solving the problem would enhance his professional status. Modern science, like many other aspects of life today, is highly specialized, and professional rewards accrue mainly for discoveries within a scientist's own discipline, not in others. A scientist who solves a problem outside his field might win some recognition from the public, but his colleagues are likely to dismiss him as a dilettante, superficial or "not really serious" about his field, because in their opinion, he should have been working on problems of physics or sociology or whatever their subject might be instead of wasting his time on UFOs. This attitude was exemplified by one of the astronomers in Sturrock's survey who wrote: "I think the whole subject is a bore, and that serious scientists should not become involved in it unless they have nothing better to do."[13]

A related problem is the absence of scholarly journals in which to publish UFO research. Standard scientific periodicals print only material related to their particular field. Because there is no discipline which accepts UFOs as its legitimate concern, there is no reputable established journal in which a scientist could publish his research on UFOs, even if he was willing to spend time studying them.

This leads to an additional complication. Scientists distrust information which appears in non-scientific publications, yet UFO research is not carried in the established scientific journals. Therefore, scientists have no reliable reputable source from which to learn about significant developments in UFO research, should any occur. The result is the quandary documented by Sturrock's survey of astronomers. Many expressed interest in UFOs and said they would like to learn more about them, but when asked about the form in which they wanted to receive such information, their preference was overwhelmingly a scientific journal.[14]

A similar situation exists with respect to conventions, another potential means of communication. Here, too, a paper must first be approved by a screening committee, and relevance to the discipline is a primary consideration. Since the people who decide which papers will be permitted on the program are appointed by conference officials, established in the discipline, there is little chance that "weird" topics will be accepted for formal presentation. Consequently, scientific orphans such as UFOs are unlikely to be discussed on their own merits. About the

only chance that such topics have of sneaking onto the program is if they can be fitted into some standard concept of that discipline, such as plasmas, hysteria, or social stratification.

Of course, informal communication occurs between individuals who know each other. Grapevines transmit news of recent developments through letters or conversation, but these lack the broader audience, credibility, and legitimacy of recognized scientific journals.

Without access to such journals, scientists who may be thinking seriously about UFOs have little incentive to write about their work --- why bother if it won't be published? And colleagues who might be interested have little chance of hearing about it and responding to it. Thus the absence of a base within a recognized discipline hinders the entry of UFOs and other fringe phenomena into the mainstream of science.

Sensationalism and Public Interest

Second, the sensational nature of many UFO reports generated intense public interest and made sober scientific appraisal difficult.

The modern era of sightings in the U.S. began in 1947 with the story that a pilot near Yakima, Washington told of seeing nine discs flying at the then unheard of speed of 1700 miles per hour. They were in a loose formation and made an undulating motion which he compared with "a saucer skipping over water."[15] The press took up the story, and the public has been interested in flying saucers ever since, at times putting great pressure upon various arms of the government for action or explanation.

For example, in July 1952 a series of UFOs were reported over Washington, D.C., even in the restricted zones over the White House and the Capitol. Ground observers and military and civilian pilots observed unidentified lights while strange blips appeared on radar scopes at both nearby airports, hovering motionlessly, then suddenly moving off at great speeds. The objects followed and passed airliners and were often seen by pilots and crews. They played tag with interceptors scrambled to investigate them, and when they surrounded the F-94 of Lt. William Patterson, he nervously asked ythe ground controllers what to do. On the morning of July 20th, the Air Route Traffic Control Center at Washington National Airport informed Andrews Air Force Base that it had a target which seemed to be directly over Andrew's radio tower. The radio operators rushed out and saw "a huge fiery orange sphere" hovering directly above them.[16]

During the displays, which extended over a two-week period, radar operators also reported seeing the results of a mild, one degree temperature inversion on their scopes but said they could easily tell the difference between these and the UFOs.[17]

These reports made headlines across the nation, even replacing front page news of the Democratic National Convention. The Pentagon was swamped with questions from Congress and newsmen and for several days its telephones were completely tied up with UFO inquiries. The Air Force, concerned about the dangers of having its communications center jammed, held the largest and longest press conference since World War II on July 29th.[18] The director of Air Force Intelligence, Major General Samford, said that the radar sightings probably resulted from temperature inversions but he could not explain why some airline pilots had actually seen the objects and he admitted that the Air Force had received reports from "credible observers of incredible things."[19]

Another high point in the public interest occurred in 1966. After months of increasing UFO activity throughout the nation, a hundred people including two policemen and a civil defense director saw glowing objects over two Michigan marshes. The ensuing "swamp gas" theory caused such a furor that Congressman Gerald Ford requested a Congressional hearing, saying that "the American public deserves a better explanation than that thus far given by the Air Force."[20]

The hearing led to the government financed study at the University of Colorado, directed by physicist Edward Condon. The project was intended to be a sober and scientific study which would put an end to the clamor about UFOs. Instead it generated more controversy. Condon's comments kept it in the news, a confidential memorandum from his project coordinator leaked out, 9 of the 12 original members of the project resigned or were fired, one wrote a book condemning Condon's handling of the project, and the May 1968 LOOK magazine criticized the study. Two months later UFOs again were

the subject of Congressional hearings. Condon's final report was published in 1969, and soon afterward the Air Force ended its 22 year involvement with UFOs.[21]

Nevertheless, public interest has continued, spurred on by a steady flow of "ordinary" reports and by occasional spectacular incidents, such as the alleged abduction of two Mississippi fishermen who said they were "floated" into a glowing flying saucer by strange humanoid creatures.[22] Even military journals have helped to maintain interest in UFOs by articles such as the following which appeared in ARMY RESERVE MAGAZINE, published by the Department of the Army:

> "On the night of October 18, 1973, a U.S. Army Reserve chopper was on a routine flight from Columbus to Cleveland, Ohio. The helicopter was flying at 90 knots at 2500 feet on a heading of 030. In the air, traffic was normal. The sky was clear, visibility in excess of 15 miles. The copilot had the controls.
>
> At 2305 one of the crew spotted a red light on the east horizon. According to the pilot, Major Larry Coyne, commander of the 316th Medical Detachment (Helicopter Ambulance) and flight facilities supervisor at the Cleveland Hopkins Airport, it looked like an obstruction light.
>
> Within a few seconds it became obvious that the light was pacing the helicopter, flying parallel with it. It was no obstruction light. It had to be another aircraft, more likely an F-100 Air Guard fighter flying out of nearby Mansfield airfield.
>
> The copilot keyed his mike and called Mansfield control. The latest transmission from Mansfield said, "Go ahead Army 15 triple 14." At about the same time, according to Coyne, "the light began converging on the helicopter at a speed somewhere in excess of 600 mph. I took the controls from the copilot and began evasive action. As the crew braced for impact, I shoved down the collective to take us down. It looked like a torpedo or missile locked on to us."
>
> The evasive action didn't work, and within fractions of a second the aircraft was alongside the chopper. "It looked like a symmetrical air-foil," reported Coyne matter-of-factly, "except for the trailing edge which was indented. It was illuminated with bright red, green, and white lights, lights much brighter and bigger than aircraft marking lights."
>
> Members of the crew agree that as they looked out into the clear night sky, they saw a gray metallic, cigar-shaped aircraft about 60 feet long, with no wings, no landing gear, and no vertical or no horizontal stabilizers. A dome-like affair 12-15 feet in diameter was on top of the craft. Its shape blotted out the bright nighttime stars.
>
> "The collective was down and we were still descending when it moved over us," said Coyne. "The instruments were still working, but the radios weren't." As the copilot continued to switch from VHF to UHF in an attempt to contact someone, the red light on the airfoil, now over the chopper, swung 90 degrees aft, throwing its powerful beam into the cockpit.
>
> "The red instrument lights went green. The entire cabin was glowing bright green," said Coyne. "Yes, I know the plexiglas over the cockpit is green, but the light was coming through the clear front plexiglas. My eyes were still on the instruments and the collective was still down, but we were going up. We were going straight up at 1000 feet a minute, and a Huey can't do that. We were at 3000 feet when the foil moved westerly. I pulled the collective back up and pushed it back down. There was a bumping sound and we started descending. It took the chopper back down to 2500 feet as the airfoil moved away. We watched as it went into a 45 degree turn, maintained altitude, then did a 45 degree climb-out and disappeared."
>
> The entire incident from original sighting to the UFO's departure lasted approximately two minutes. Ten minutes later, the chopper was able to establish radio contact with Akron-Canton approach control for a position report.
>
> When the crew landed, the General Aviation District Office of the FAA went through some routine checks. The FAA records all tower-to-aircraft conversations, but when its tape was searched, it was blank Not even the initial contact, acknowledged by Mansfield control, "Go ahead Army 15 triple 4" was there. Radar didn't confirm the sighting either. Cleveland radar sees targets only above 3500 feet in the Mansfield area and the entire incident had taken place at under 3500 feet.
>
> Major Coyne and his entire crew filed Army OHRs -- Operation Hazard Reports. The FAA told the crew to report the incident to the Air Force and the Air Force said send it through local channels. The reports were sent and Aviation Safety notified.
>
> When an FAA examiner-inspector inspected the aircraft, everything was found functioning normally. In fact, the bird didn't even show any signs of stress which, considering its record-setting climb rate, might have been expected.
>
> What shape was the crew in that night? The pilot, a veteran chopper jockey with over 2000 hours, and his crew had just completed a thorough flight physical -- that same night. That was the reason for the flight to Cleveland in the first place. And what about the crew; what kind of men saw a UFO that night in October? Lieutenant Arrigo Jezzi, the co-pilot, has about 500 hours flying time and is a chemical engineer. The medic aboard that night is detective John Healey, a member of the Cleveland Police Department's police intelligence unit. And the crew chief, Bob Yanasek, is an IBM repairman when not wearing Army green.
>
> Spook story. That same night, at 8:19, the Ashland Sheriff's office got a call from Kathy Caine in the village of Sullivan

> some 15 to 20 miles northeast of Mansfield airport. She was calling to report a brightly glowing object hovering over the trees about a quarter mile southwest of her farmhouse. Belle Whitt and Becky Whitt were with her and saw the same thing.
>
> The Sheriff's department dispatched a car already close to the Caine house to check it out. Traveling north on county road 391, deputies Steve Caudill and Cal Reese reported sighting the glowing disk to their left aobut 300 feet over the trees They jumped out of their car to listen for engine noise and heard none. Then they turned their cruiser's light on the object "As the light hit it," reported Caudill, "it angled and dived toward the car, then angled up and disappeared in a vertical ascent." Again that night Caudill and Reese reported seeing the object.[23]

Unidentified flying objects have been the subject of television panel discussions and network specials, and a regular weekly series of semi-documentaries. A 1973 Gallup Poll found that 54 percent of American adults believed that UFOs were real, and 11 percent thought they had seen one. More than 95 percent of the adult population had heard or read about UFOs, one of the highest awareness levels about anything in the Gallup Poll's history.[24] By 1978 those believing UFOs were real had climbed to 57 percent.[25]

Perhaps the final indication that UFOs are firmly embedded in public awareness is provided by the movie "Close Encounters of the Third Kind." Unlike low budget sci-fi films which for decades have appealed to limited audiences, this $20 million dollar "blockbuster" was produced in full confidence that the mass public was intrigued by UFOs.

Popular interest in itself would not necessarily have turned scientists away; in fact, it might even have encouraged them by making funding available for research. But the sensationalism surrounding UFOs has kept public interest at such a high pitch that calm, scholarly contemplation would be difficult. A scientist who openly admitted interest in flying saucers was likely to receive phone calls from reporters looking for stories, or from individuals seeking information or offering their own views. Scientists did not have a chance for quiet preliminary exploration of the subject to see if it merited further study. Instead, the topic was thrust upon them and the rest of the world by the media.

Government Intervention

A third factor dampening scientists' interest was the government's attempt to reduce public concern about UFOs. Government involvement with UFOs was motivated by national security rather than scientific curiosity. When UFOs first appeared in the 1940s, they were suspected of being enemy secret weapons. By the early 1950s, however, officials had decided that they were not a direct threat to national security. Thereafter UFOs were treated simply as a public relations problem. Intelligence agencies and the armed forces were not interested in their true nature, but merely in defusing public anxiety.[26]

Thus the presence of scientists on UFO panels and committees was intended to allay public concern rather than to discover what UFOs really were. Of course, this intention was not generally known. Most people assumed that the Air Force and other federal bodies were seriously studying unidentified flying objects. Scientists as well as laymen believed that scholarly scrutiny had been applied and that all saucer sightings were satisfactorily explained.[27]

One of the most significant instances of the use of scientists to legitimize already determined government policies occurred in 1953. After five years of flying saucer reports, the Central Intelligence Agency convened a panel of eminent scientists under one of its employees, H. P. Robertson, formerly of Princeton and Cal Tech. The panel concluded that UFOs were not hostile, but recommended that they be "debunked," lest reports of these phenomena lead to mass hysteria or clog intelligence lines and obscure a real enemy attack. To reduce "the current gullibility of the public and consequently their susceptibility to clever hostile propaganda"[28] the panel advised that the government should hire Walt Disney, Arthur Godfrey, and psychologists such as Hadley Cantril who were familiar with mass psychology. The panel also suggested that the two major private UFO research organizations should "be watched because of their potentially great influence on mass thinking if widespread sightings should occur.[29]

In addition to debunking, the government tightened security over UFO reports. Air Force Regulation 200-2, issued in August, 1953, prohibited the release of any information about a sighting except in those cases which

were positively identified. Security was increased still further in December, when the Joint Chiefs of Staff issued Joint Army Navy Air Force Publication (JANAP) 146, making the release of any information about UFOs to the public a crime under the Espionage Act, punishable by up to ten years in prison and a $10,000. fine. JANAP 146 applied not only to military personnel but to anyone who knew it existed, including commercial airline pilots.[30]

The government obscured the situation even more by grossly mislabeling thousands of UFO reports in its files. These reports were viewed as public relations problems rather than as opportunities for scientific analysis. "It can't be, therefore it isn't" was the principle guiding the evaluations,[31] according to Hynek, the Air Force's scientific consultant for its UFO Project Bluebook. He recalls the perfunctory process by which reports were explained away, not by careful investigation but simply by bookkeeping procedures:

> "In the evaluation of cases it has been the custom to employ the terms 'possible' or 'probable' as modifiers to a given evaluation; thus, 'possible aircraft' or 'probable meteor' are often used. However, in the year-end compilation of cases thse modifiers are quietly and conveniently dropped. Thus 'possible aircraft' becomes simply 'aircraft' ...and the public will be led to believe that there was no possible question involved but that some poor citizen had 'one too many', or simply had been overexcited or suggestible.[32].....so ingrained is the hypothesis of the 'deluded observer' in Bluebook thinking that any other possibility is not examined for.[33]

> We had some landing cases, but time and again, what I today would regard as a good physical trace case they would have marked as 'hoax'.....and if it weren't a landing this was simply automatically labelled...-..'psychological'.....You couldn't look openmindedly at a case and say that it might be this or that; no, the guy had to be a nut."[34]

Perhaps most misleading of all was the Air Force's treatment of the many cases which lacked adequate information for making a judgment:

> "All cases evaluated 'insufficient information' were considered by Bluebook to be 'known'.....Clearly, the 'insufficient information' cases should have been excluded from the statistical computations altogether. Instead these cases were treated statistically as if they had been solved!"[35]

Through such procedures the "unknowns" in the Air Force files were reduced drastically from 19.3% in 1952, the year before the Robertson Report, to 1.5% in 1956. For the rest of time the Air Force was openly involved with UFOs, the mean for "unknowns" stayed around 2.0%.[36]

In short, the government withheld information, distorted facts, and discouraged witnesses from reporting their UFO experiences. Consequently scientists who might have taken a serious look at unidentified flying objectes were unaware of the number and nature of the reports, and could only consider them, as did many members of the public, as hoaxes, hallucinations, or misidentifications.

Fear of Ridicule

Fear of ridicule is a fourth factor. UFOs, in addition to being unidentified, seem undignified. Although scientists may be annoyed by them and people who actually see them are likely to take them seriously, a common public reaction is laughter. For example, referring to the two deputies who reported a UFO at the time of Major Coyne's helicopter adventure, ARMY RESERVE MAGAZINE noted:

> "Ever since, both men have been teased unmercifully about it. Caudil now says offhandedly, 'It's the biggest damn frisbee I ever saw.'"[37]

UFOs seem ludicrous to many people. Their movement, appearance and the name "flying saucer" make it difficult to take them seriously. As historian David Jacobs noted:

> "The idea of saucers flying on their own volition was absurd. The term allowed people to laugh at the very notion of an unusual object in the sky without having to confront the circumstances behind the event."[38]

Perhaps the ultimate blow to the UFO's dignity was its linkage with "little green men." In popular thinking the two

concepts are practically synonymous and both imply absurdity.

People do not enjoy being laughed at and scientists in particular have a stake in maintaining a reputation for clear thinking. This reputation had already been challenged during the anti-Communist hysteria of the Cold War, when intellectuals were suspected of being susceptible to subversive influences; the fate of Robert Oppenheimer demonstrated that even the most distinguished scientists were vulnerable. It is not surprising then that scientists were cautious about involvement in questionable causes, and few were willing to jeopardize their reputations -- and perhaps their careers -- by acknowledging interest in something as zany as "flying saucers".

It wasn't simply a matter of scientists versus the public; an impressive array of eminent scientists opposed the study of UFOs. For example, H.P. Robertson, who chaired the 1953 CIA panel, was a noted physicist and relativity expert. The other members of the panel were Samuel Goldsmit, an associate of Einstein; Luis Alvarez, who later received the Nobel Prize; Thornton Page, deputy director of Johns Hopkins' Operations Research Office; and Lloyd Berkner, one of the directors of Brookhaven National Laboratories.39 Although the panel, according to Hynek, only looked at a handful of reports selected for them by the Air Force, their pronouncement carried great weight in the scientific community as well as with the public.40

Another influential critic of UFO study was Harvard astronomer Donald Menzel, who for many years offered explanations of sightings in terms of mirages, refractions, meteors, and the like.41

Perhaps the most formidable of all UFO "opponents" was Edward Condon, world reknowned physicist and former head of the National Bureau of Standards. In addition to his scientific credentials, he had earned the respect of liberals by his battles with Richard Nixon, the House Committee on Un-American Activities and other boards which had challenged his loyalty.

In 1966, as soon as he was appointed to head the Air Force sponsored study at the University of Colorado, he publicly expressed his doubts that UFOs were worth studying; he attributed them to meteorological or psychological origins, and emphasized their crackpot aspects. In after-dinner speeches he related anecdotes about contactees -- people who claim to be in personal contact with beings from other planets. He even appeared at one of their conventions, standing up in the audience to take a bow.42

In his completed report, published in 1969, Condon again stated that all sightings could be explained in everyday terms if enough information could be obtained. Further support for this view came from an 11-member panel of the National Academy of Science which reviewed the Condon study and praised its scope, methodology, and conclusions.43

Critics observed that 30 of the 91 cases examined in the report remained unidentified, but the prestige of Condon and the NAS inundated the criticism. Headlines across the nation commended Condon's work, and editorial writers breathed sighs of relief that the silly season was over at last, predicting nevertheless, as did the Washington Post, that there would continue to be a "handful of borderline dingalings who insist that our planet is being given the once over from outer space."44

Similar sentiments are held by rank and file scientists. An astronomer responding to Sturrock's questionnaire offered his opinion of ".....'experts' in the UFO field. I am convinced that 99.9% of them are crackpots, psychopaths, or otherwise unstable characters."45

Faced with such attitudes, most scientists are cautious about expressing interest in UFOs. As Hynek observed:

"A scientist will confess in private to interest in a subject which is controversial or not scientifically acceptable but generally will not stand up and be counted when 'in committee.'46

Scientists are deathly afraid of voicing support for anything that might make them look foolish in the eyes of their peers, anything that might be considered 'unscientific.' Thus the decisions reached by the various panels and committees which have met from time to time to consider UFOs were, in a sense, predictable. The panel members voted for the 'safe' decision every time, which was, of course, anti-UFO."47

Corroboration for these remarks is found in Sturrock's survey. Almost all (1322)

of the 1356 astronomers who replied to the questionnaire signed it, yet only two offered to waive anonymity for publication.[48]

Thus, along with the previously discussed factors, the desire to avoid ridicule is another deterrent to the study of UFOs.

These deterrents are particularly intimidating to the younger scientist. Not yet established in his profession, he is more vulnerable than his older colleagues, whose opinions of him can affect his career at several important points. He has to think about getting a good job, tenure, and promotion. These depend largely upon one's research and this in turn may require outside funding. However, two prime considerations in granting research funds are the proposal's scientific significance and the applicant's track record of previous accomplishments. All of these require approval by other scientists.

Consequently, it may be hard for a recent Ph.D. to get money for a project which does not fit easily into a recognized discipline. It will also be difficult if he is not yet known in his field, or if his reputation is tarnished by association with "kooky" topics.

Age is important in this discussion because younger scientists are likely to be more open to new ideas. For instance, Sturrock found that the younger members of the American Astronomical Association were the ones who expressed most interest in learning about UFOs.[49] Yet, as we have seen, they are the most vulnerable members of their profession, the ones most dependent on favorable evaluation by older, established scientists who are the gatekeepers of their discipline. Thus the irony of the situation is that the scientists most openminded about UFOs are also the least able to study them.

In spite of the pressure, there were a few scientists who publicly advocated studying UFOs, and some who privately expressed interest, but most played safe and avoided the subject entirely.[50]

It may be illuminating to speculate how the search for extraterrestrial intelligence might have fared if it had received the same treatment accorded UFOs. What would have happened if, for thirty years, amateur radio operators reported strange signals, and if television viewers of good repute experienced unearthly sights and sounds emanating from sets that had not malfunctioned before or since? To these events add government statements that the signals were hoaxes or hallucinations or were caused by misperceptions of weather balloons, planes, or meteors. Bring in cultists who claim they had received messages from our space brothers on Arcturus. Publicize this by media which thrive on shallow sensationalism. The ETI situation would then approximate the climate of the UFO. Would scientists still be interested in searching for extraterrestrial intelligence?

Factors Favoring ETI Study

The search for extraterrestrial intelligence has been relatively free of the handicaps associated with UFOs.

ETI has not been burdened with sensationalism and intense public interest. Its career has been far more tranquil than that of the UFO. Though sometimes a topic for sunday supplement articles, ETI seldom makes headlines. The one possible exception that comes to mind was Orson Welles's Martian scare of 1938, but that was actually closer in character to present day UFO sightings than to the search for extraterrestrial intelligence. His Martians were supposedly here on Earth and the only divergence from typical UFO sightings was that Welles's objects were identified: they were invaders from our neighboring planet. They are not radio signals detected by sophisticated instruments and originating far outside our solar system.

Without a high level of popular interest tinged with apprehension, there has been no need for government concern, and therefore, no need for attempts to manipulate public opinion.

Ridicule of the search for ETI has been minimal, probably due in large part to the lack of sensationalism. True, a senator has bestowed his Golden Fleece award on NASA for what he claims is a waste of taxpayers' money, but this did not receive the media treatment nor public attention that would be given to a spectacular UFO report. Television news is geared to eyecatching, entertaining aspects of current events, but the senator's action was not much different from other daily happenings in Washington. It was not particularly photogenic. If TV covered it at all, it was likely to be limited to a couple of sentences read by the newscaster.

In contrast, UFO sightings are more dramatic, offering more opportunity for camera coverage: the puzzled policeman

standing by his patrol car, the housewife pointing to the window where "it" appeared, or the prototype farmer indicating the spot in his pasture where the UFO supposedly landed.

Perhaps another reason for ETI's relative freedom from ridicule is its lack of a negative image. Public opinion about ETI has not been prejudiced by unfavorable stereotypes such as little green men in silly saucers. In fact, the absence of any clearly defined popular image of ETI leaves us uncertain as to how people do perceive it. Of course, media depictions of life in outer space range from maidens to monsters, but life and intelligence are not necessarily the same. What connotations does "intelligence" have? Is it favorable? Without studies of public opinion we can only speculate.

At any rate, it is apparent that the search for extraterrestrial intelligence has been relatively free of the sensationalism, public interest, government intervention, and ridicule which has plagued UFOs.

Moreover, the search for ETI falls within the recognized boundaries of an established discipline. Consequently it has the support of a natural constituency in the scientific community. Astronomers and specialists in radio telescopes approve of, and gain from, the search for ETI, so they legitimize it as a worthwhile endeavor, and lobby for funding. They have some chance of success because funding decisions are influenced by consultants from the same field.

In contrast, UFOs lack a natural, ready-made constituency to champion their study. They do not fit readily into any one science and therefore fall into the cracks between disciplines.

Still other factors favor the search for extraterrestrial intelligence. Familiar equipment and methods could be employed. Astronomers can use existing types of hardware while looking for radio signals from outer space. Present technology and procedures, operated by today's personnel, will suffice. For studying UFOs, however, new approaches and technologies would be needed and, most significantly, new personnel to use them. Radio telescopes, with their allied hardware and software, would be far too cumbersome. Instead, lighter portable equipment might be required and UFO researchers would have to use different methods in hunting for these nearby but elusive phenomena. Such changes would provide an opportunity for new people to gain power in the world of science, technology, and federal funding. They would be threatening to established scientists, many of whom would be unable or unwilling to adapt readily enough to the new techniques.

The absence of pressure from the public and the media allowed scientists interested in searching for ETI to take the initiative, proceeding at their own pace and according to their own research plans. A particular telescope would examine a designated sector of the sky at times chosen perhaps months or years in advance, to suit the requirements and convenience of the scientists and the installations they use. This would not be the case with UFOs. These frustrating objects, or whatever they are, seem to appear when and where they please. They have the initiative and we can only react to them. We cannot, at least at present, decide the conditions under which we will study them.

Ease of measurement is another advantage of the search for extraterrestrial intelligence. ETI has been operationally defined as radio waves having certain frequencies and other characteristics. Signals from space would be detected by radio telescopes and would appear as numbers or lines on a computer printout. By contrast, UFOs do not fit such neat patterns. Aside from being unpredictable, they are varied enough to make plans for measurement difficult.

Still another element in the scientists' choice of topics is compatibility with established theories. Radio signals from extraterrestrial civilizations could be fitted easily into our present ideas about the universe and how it works. Those far away beings would use means of communication we are familiar with. Their signals could be accommodated into our equipment and our theories and would not force us to drastically revise or even discard our assumptions about physics, mathematics, biology, and so forth.

UFOs, however, might challenge such assumptions and not all scientists would be open to this questioning. Their favorite theories have played an important part in their careers, first as students, then as scientists and teachers, conducting research and writing textbooks and scholarly reports. To be a staunch supporter of a theory suddenly

rendered obsolete is not pleasant, and many scientists would not welcome such a situation. The search for ETI seems to be a safe area in which new information can be carefully gathered and analyzed at a pace determined by the scientist. UFOs, however, in questioning current assumptions, may be perceived as threatening to the scientist's reputation and livelihood.

Conclusions

This report has been concerned with scientists' decisions to study one of two phenomena which, at least at first glance, appear very similar. Both imply intelligence and power far superior to our own. Thirty years ago neither was a reputable field of study. Today ETI is, while UFOs are not. In examining the differences between the two, we can now understand, among other things, a point which puzzles some people: how can scientists who advocate searching for ETI reject the evidence for UFOs?

These scientists seem very open to new ideas but actually they may not be. The search for ETI evolved out of the already existent field of radio astronomy, which in turn is part of the ancient and honorable science of astronomy. As Edge and Mulkay reported in their study of radio astronomy, this evolution occurred smoothly.[51] In contrast, UFOs did not fit readily into any established discipline and were tainted with controversy, deception, and ridicule, exacerbated by public attention.

McCarthy documented the obstacles faced by a scientist who tried to persuade his colleagues to study UFOs.[52] Referring to Kuhn's terminology, the study of ETI did not require a change of paradigm, while the superficially similar study of UFOs would threaten many accepted assumptions about the universe and ourselves.[53]

Comparison of the UFO and ETI situations raises more general questions about science's relation to other unconventional topics. The specialization of science is especially worth considering: it may be presenting a paradox. The tendency to delve ever deeper into a particular aspect of nature has contributed to centuries of spectacular achievement, but it could also limit future development by cutting off possibly fruitful new fields of investigation.

In this respect the specialized nature of modern science is a conservative force, discouraging the study of phenomena which do not fit into an established discipline. Consequently, anomalous topics would be more likely to receive serious scienctific attention if they fell within or could be brought within the boundaries of existing disciplines. Since research grants are controlled by established and establishment scientists, exploratory studies in unconventional fields will have difficulty getting money. As McCarthy asks, how can one get funding for a fishing trip if the scientists controlling the funds say there are no fish?[54] And, as we have seen, there are other factors -- promotion, tenure, professional reputation, etc. -- which must also be considered before wandering too far from the main paths of science.

Skeptics may argue that this is all for the good, but until there is serious, open-minded scrutiny, topics ignored by scientists may live for decades in an intellectual limbo, beckoning seductively to the gullible. And, if there is some nugget of truth buried beneath the mountains of misconceptions, science may be the poorer for having overlooked it.

If investigation of anomalous phenomena is deemed desirable, ways must be found to make such investigation a legitimate scientific activity, so that scholars would be willing to engage in it. One approach might be to establish refereed journals devoted specifically to analysis of fringe phenomena. Sturrock's study indicates that there are scientists who would read such a journal.[55]

As it now stands, a combination of factors may hinder the examination of unconventional topics. Sensationalism, lack of scientific constituency, fear of ridicule, and even government meddling may take their toll, going a long way toward explaining scientists' reluctance to get involved with bizarre subjects. While other factors may also be operating, it is not necessary to postulate, as some UFO enthusiasts do, direct threats by "men in black" or similar sinister forces. Instead, mundane social processes are at work; and most people alert enough to get a Ph.D. are able to figure out that interest in fringe phenomena may be hazardous to their careers.[56]

NOTES

1. For example, see the cover photo and six-page story on Sagan, Newsweek August 15,1977.

3. Sixty-two members of the American Astronomical Society reported events which they could not identify and which they thought might be related to the UFO phenomenon. Sturrock, P.A., Report on a Survey of the Membership of the American Astronomical Society Concerning the UFO Problem, Institute for Plasma Research, Report no. 681, Stanford University, 1977, p. 3.

4. Hynek, J. Allen, The Hynek UFO Report, New York: Dell Publishing Co., 1977, p.8.

5. Hynek, J. Allen, The UFO Experience, New York, Ballantine Books, 1972, pp. 288-93.

6. Hynek (1977) p. 8 states 50,000. Later personal communication from the author lists 100,000.

7. Sturrock, p. 3.

8. Two photos of a UFO taken by Hynek are reproduced in Hynek and Vallee, The Edge of Reality, Chicago: Henry Regnery, 1975, photos 10 and 11. Other reports are described later in this present study.

9. Hynek (1972) pp. 129-56 and photo no. 6.

10. Two social scientists have studied the responses of scientists to the UFO situation: McCarthy, Paul, Politicking and Paradigm Shifting: James E. McDonald and the UFO Case Study, unpublished Ph. D. dissertation, University of Hawaii, 1975; and Ron Westrum, "Social Intelligence About anomalies: The Case of UFOs", Social Studies of Science, 7 (1977) pp. 271-302.

11. Vallee, Jacques and Janine, Challenge to Science: the UFO Enigma, Chicago, Henry Regnery, 1966. The Vallees emphasize "the global nature of the phenomenon" and present many cases from outside the U.S.A. See also Hynek (1972) p. 251.

12 The former executive secretary of the American Sociological Association has commented on "... the extent to which the scientific enterprise these days is actually influenced, in choice of research agendas, by where federal dollars go. If the federal government will not fund research in some areas, and particularly when costly research is involved as would be the case, I imagine, with UFOs, it will take a hardy breed of scientist to pursue research in those areas on their own." Letter from Edmund Volkart, June 4, 1978.

13. Sturrock, p. 197.

14. Ibid., pp. 37-8.

15. Jacobs, David Michael, The UFO Controversy in America, New York: Signet Books, 1976.

16. Jacobs, pp. 65-7. For additional details see The UFO Evidence, Washington D.C., The National Investigations Committee on Aerial Phenomena (NICAP), 1964, pp. 159-62.

17. Jacobs, p. 67.

18. Ibid., pp. 67-8

19. Ibid., pp. 68-9.

20. Ibid., pp. 177, 181.

21. Ibid., pp. 182-84, 200-27. Robert Low's memo was written in August 1966, while the University of Colorado was trying to decide whether to accept the project. Low had expressed his premise that UFOs were neither unique nor extraterrestrial, and had no physical reality. His staff would be composed of "non-believers". This, however, posed a public relations dilemma in which:

> ...the trick would be to describe the project so that, to the public, it would appear a totally objective study but, to the scientific community, would present the image of a group of nonbelievers trying their best to be objective but having almost zero expectation of finding a saucer.

He felt this could be achieved by putting emphasis upon "...the psychology and sociology of persons and groups who report seeing UFOs ...rather than on examination of the old question of the physical reality of the saucer." Ibid., p. 203.

22. Ibid., pp.247-9.

23. Army Reserve Magazine,20 (Sept.-Oct. 1974) Washington D.C.: Dept. of the Army, pp. 10-12.

24. Jacobs, pp. 263-4.

25. The Gallup Opinion Index, Report #158 (Sept. 1978) p. 26.

26. Hynek (1977) pp. 20-2.

27. Ibid., pp.20-1.

28. Robertson report, quoted in Jacobs, pp. 83-4.

29. Ibid.

30. Ibid., p. 92.

31. Hynek, (1977) p. 61.

32. Hynek, (1972) 289-90.

33. Ibid., p. 290. (Italics in original)

34. Hynek and Vallee, pp. 196-7.

35. Hynek (1977) p. 259. (Emphasis in original)

36. Ibid., pp. 258-59.

37. Army Reserve Magazine, p. 12.

38. Jacobs, p. 32.

39. Ibid., pp. 79-80.

40. Hynek (1972) p. 121; (1977) p. 21.

41. Menzel, Donald, Flying Saucers, Cambridge, Mass.: Harvard University Press, 1953.

42. Jacobs, pp. 187-8, 201-2.

43. Ibid., pp. 211-3.

44. Ibid., pp. 213-6, 222; Washington Star, January 10, 1969.

45. Sturrock, p. 197.

46. Hynek (1977) p. 24.

47. Ibid.

48. Sturrock, p. 1.

49. Ibid., pp. 21, 35.

50. One of the most vocal proponents of UFO study was Dr. James E. McDonald of the Atmospheric Physics Dept., University of Arizona. He suggested that UFOs posed the "greatest scientific problem of our times". Title of his speech to the 1967 annual meeting of the American Society of Newspaper Editors, Washington DC, April 22, 1967 (mimeographed).

51. Edge, David O. and Michael J. Mulkay, Astronomy Transformed: The Emergence of Radio Astronomy in Britain, New York: Wiley, 1976.

52. McCarthy.

53. Kuhn, T.S., The Structure of Scientific Revolutions, Chicago: University of Chicago Press, 1970.

54. Note on a draft of this paper, March 1978.

55. Sturrock, pp. 37-38.

56. Paul McCarthy and Jacques Vallee provided much useful information for this report. The comments of other scientists in several fields have also been helpful: astronomer Dale Cruikshank, biologist Sanford Siegel, physicist Peter Sturrock, and sociologists Earl Babbie and Edmund Volkart.