

[REDACTED]

**UNCLASSIFIED**

Incident #232 — Newark, New Jersey — 13 November 1948

The information available concerning this incident is entirely insufficient to serve as a basis for analysis.

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[REDACTED]

[REDACTED]

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Incident #238 -- near Jackson, Mississippi -- 1 January 1948

There is nothing in this incident that can be said to have an astronomical origin.

The object sighted is described as resembling a tow target, but with no towing plane seen. No one else reported seeing the object after this one sighting by several persons.

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Incident W234 -- Oak Ridge, Tennessee -- July 1947

Inasmuch as independent analysis has determined the object on the photographs to be a flaw, there is no need for further investigation. Object was never seen visually.

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[REDACTED]

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Incident #23 -- Indiana County, Pennsylvania -- probably early  
December 1950

There appears to be no astronomical explanation for  
this incident.

The object seen was most likely a balloon.

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[REDACTED]  
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Incident #233 -- near Hickam field, Hawaii -- 4 January 1948

There is clearly no astronomical explanation for this incident.

The account given seems trustworthy, even though only one person saw the circular disc. This report differs from many others in that the description of maneuvers executed by the object is definite, rather than vague.

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Incident 1367 -- Bourbon County, Kentucky -- 17 January 1966

There is some confusion as to whether the object or the smoke trail reported in this incident was visible for fifteen minutes. If the object itself was, it could not have been a meteor, but the gist of the report seems to indicate that only the trail was visible for any length of time. In that case, it could have been either the trail from a meteor or the vapor trail from an aircraft: the description is not sufficient to distinguish the two. Other observers (not those reporting the incident) indicated that the object was a high flying plane with a vapor trail, but this does not necessarily exclude the meteoric hypothesis, because of the general unfamiliarity of the public with such phenomena.

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Incident #233 -- Indian House Lake, ~~WA~~ -- 21 January 1948

From the limited information ~~in~~ the report of  
this incident, the object observed ~~is~~ ~~likely~~ to have  
been a fireball.

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[REDACTED]

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Incident #286 -- Phoenix, Arizona -- 24 October 1948

This incident as described is not amenable to any astronomical explanation. The object took 75 minutes to cross the sky.

The witness apparently is not a very critical observer (i.e., there could be no possible physical connection between the object's brightness and its apparent distance from a star).

The object could have been a lighted balloon; speed and maneuvers check.

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Incident #240 -- near Hood River, Oregon -- 11 December 1946

The gist of this incident is that a flash of light was seen and a continuing sound of explosion heard at about 7:00 on a rainy evening. Clearly this description could apply to any large explosion, such as that of an ammunition dump or factory; however, it is true that when a solid explodes a blinding flash of light is seen, and tremendous sounds are sometimes heard for many seconds. Since the sky was overcast at the time of this incident, and a light rain was falling, the earlier part of the trail of the fireball (if that is what it was) was, of course, not visible; only the flash from the final explosion, which would have appeared essentially stationary, was seen.

In the absence of positive evidence of any other type of explosion occurring in that vicinity at the time, it is the opinion of this investigator that a solid explosion was observed.

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[REDACTED]

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Incident #261, a, b -- Los Alamos, New Mexico -- 31 December 1948

Mr. Lucas, who has interviewed the various observers of this incident, has stated that the object seen was not a falling meteorite. He had access to more detailed information than is contained in the typed reports offered here, and he is an expert in these matters.

It should be noted, however, that the reports available to this investigator show many contradictions concerning the color and trajectory of the object: One observer gives the angle of fall as 45°; another states that the trajectory was horizontal. Most observers indicate a bluish-white light; only one mentions the color green, which is so predominant in the New Mexico "tree flashes."

It is not at all certain that the object observed here belongs to the "green flash" family of incidents:

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Incident #242 -- Los Alamos, New Mexico -- 5 January 1948

The information offered concerning this incident is meager, and there was only one observer. According to the description, a brilliant green incandescent light was seen low on the horizon for about two seconds; speed was "high" but slower than that of a meteor. In view of this scanty evidence, no definite conclusion can be drawn.

If it were not for the fact that the incident appears to belong in the family of New Mexico "green flashes," the object could be considered to have been a slow meteor, even though the time of night of the sighting does not favor that hypothesis. It is much more probable, however, that this incident falls into the pattern of those dealt with in detail in the report on incident #223. See that report for further discussion.

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[REDACTED]

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Incident #243 -- Los Alamos, New Mexico -- 28 December 1941

The object described here seems to belong to the spectroscopic family of "New Mexico green flashes." See report on incident #223 for detailed discussion.

It can be said, however, that, if this is regarded as an isolated incident, the description is not very different from that of a fireball. It is the occurrence of these incidents in a seemingly definite pattern that argues very strongly against the meteoric hypothesis.

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[REDACTED]

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incident #244 -- Airfield, Albuquerque, New Mexico -- 12 November 1947

The evidence given concerning this incident does not seem to be physically possible. If the object was a bright white light, diamond-shaped and two feet long, and only a third of a mile away, then it seems incredible that it should have been observed over only a 500' trajectory. And a bright light, that close, in a populated area, surely would have attracted the attention of more than one person.

The whole report suggests a psychological optical illusion rather than a real object in the sky. The evidence is incomplete: time in sight is not stated, nor is the elevation or bearing of the object even implied. The manner of disappearance is not told: did the light simply go out abruptly, or did it fade out gradually, or what?

There is a remote possibility that the observer saw a daylight meteor over a very short part of its trajectory, but if this had been the case, there should have been some sort of a trail.

The method of reporting and interrogation in this incident is very poor. It would seem that if the observer was aware enough to note a length of 2' and a trajectory of 500', he would also have known the bearing and elevation of the object and its manner of disappearance.

The whole incident lacks a sense of physical reality.

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The preceding pages complete the analyses required to fulfill the terms of Contract No. W33-038-1118 (Ohio State University Research Foundation Project No. 364)

Note: In submitting this report it is understood that all provisions of the contract between The Foundation and the Cooperator and pertaining to publicity of subject matter will be rigidly observed.

Investigator Dr. Allen Henrik Date May 1, 1949  
Laboratory Supervisor George H. Harding Date May 1, 1949

For the Ohio State University Research Foundation

Executive Director James S. Owens Date 5/9/49  
J.S.O.

[REDACTED]

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APPENDIX C-1

Headquarters Air Weather Service

Analysis of Incidents Nos. 1-172

B/Ltr from AMC  
dtd 5 Jan 1949  
Subj: Project  
"SIGN"

AWS DSS

1st Ind

24 Jan 1949

HEADQUARTERS, AIR WEATHER SERVICE Andrews Air Force Base, Wash-  
ington 25, D. C.

TO: Commanding General, Air Materiel Command, Wright-Patterson  
Air Force Base, Dayton, Ohio  
ATTN: MCLAXO

Investigations by this headquarters reveal that a synoptic  
weather balloon could have been at the location where sightings  
were reported in the following incidents. In compiling this  
list consideration was given to the wind direction and speed at  
the surface and aloft at the scheduled time of balloon release, and  
the location of the nearest weather station making balloon obser-  
vations.

2	52	91	126
3	72	93	146
4	73	94	155
25	78	105	166
28	81	113	169
36	87	115	172

FOR THE CHIEF AIR WEATHER SERVICE

2 Incls:  
n/c

/s/ W. A. West  
W. A. WEST  
Lt. Col., USAF  
Adjutant General



HEADQUARTERS  
AIR MATERIEL COMMAND  
Wright-Patterson Air Force Base  
Dayton, Ohio

MCIAXC-3/HWS/rn  
Jan 5 1949

MCIAXC

SUBJECT: Project "SIGN"

TO: Chief, Air Weather Service,  
Andrews Air Force Base,  
Washington 25, D. C.  
ATTN: DSS

1. Project "SIGN" is responsible for the collection, investigation and interpretation of data relative to sighting of unidentified flying objects. Attached Incident Summaries 1 thru 172 from the files of Project "SIGN" are forwarded for study and recommendations as to which of the incidents may be eliminated as balloons released on routine synoptic ascents by the Air Weather Service, the Navy Aerological Service or the United States Weather Bureau. The summaries attached may be retained in your headquarters for working and reference purposes.

2. The Air Weather Service is the only agency of its type that has been asked to assist in the accomplishment of Project "SIGN" except that the United States Weather Bureau has provided information on ball lightning. Research projects in which balloons are used and which are conducted or sponsored by the Army, Navy or United States Air Force are checked by the Intelligence Department of this Command. These checks are usually made direct from the Project "SIGN" Office, MCIAXC-3. These checks are distinct from the check of synoptic balloon flights made by weather service stations of the Air Force, the Navy and the Department of Commerce. (U. S. Weather Bureau) requested of Air Weather Service.

3. It is the opinion of this office that the below listed incidents are those having the greatest possibility of being balloons. This list does not eliminate the possibility that many of the remaining incidents are balloons.

2	24	50	91	113	155
3	25	52	92	115	156
4	28	72	96	126	157
11	30	73	104	141	159
14	31	81	105	148	163
16	32	87	107,8,9	151	167
22	33	89	112(See 122)	154	169
23	48				

T-84461-A

Hq AMC, Chief, Air Weather Service, Washington 25, D. C.  
Subj: Project "SIGN"

4. The form used in interrogating witnesses to sightings is inclosed as a matter of interest. Comment as to possible improvement of the "Essential Elements of Information" in regard to routine synoptic balloon flights is invited.

5. It is requested that correspondence be forwarded to the Commanding General, Headquarters, Air Materiel Command, attention MCIAXO-3.

FOR THE COMMANDING GENERAL:

2 Incls:  
Summaries 1-172 incl  
"SEI"

/s/ W. R. Clingerman, Col, USAF  
for H. L. McCoy  
Colonel, USAF  
Chief, Intelligence Dept

Copies furnished:

APOIR, Eq. USAF  
Capt Trakowski, Geophysics Lab  
Major Kodis, MCREEP  
Colonel Neal, MCLANS

T-84451-A

APPENDIX C-2

Headquarters Air Weather Service  
Analysis of Incidents Nos. 172-233

HEADQUARTERS  
AIR WEATHER SERVICE  
Andrews Air Force Base  
Washington 25, D. C.

In Reply  
Refer To: AFS DSS

11 May 1949

SUBJECT: Unidentified Flying Objects

TO : Commanding General  
Air Materiel Command  
Wright-Patterson Air Force Base  
Dayton, Ohio  
ATTN: MCIAKO-3

1. Reference is made to letter from your headquarters, MCIAKS, dated 9 March 1949, subject "Unidentified Flying Objects," and first indorsement thereto by this headquarters, dated 31 March 1949.

2. The incident summaries 173 through 233 have been checked against routine weather-balloon ascents made by the Air Force, Navy and Weather Bureau. Comments based on this review are inclosed.

3. It is recommended that the "Guide To Investigation Of Unidentified Aerial Objects" be changed as follows: Item 13, "Direction of Flight of Object," should be clarified so that vertical and horizontal motions are distinguished if possible, and so that motion is specified as the direction towards which the object appears to move. "Relative to Radar Settings" should include a statement of the type of radar set used.

FOR THE CHIEF, AIR WEATHER SERVICE

2 Incls:  
1 - Incident Summaries  
2 - Comments 173 thru 233

/s/ W. A. West  
W. A. WEST  
Lt. Col., USAF  
Adjutant General

No. 173: Rawinsonde released from Barksdale AFB at 1500 CST. Shreveport under influence of very tight low of a local nature which extended through the 500 mb. level. In all probability, rawinsonde balloon path was circular following isobar curvature around Shreveport, hence balloon was seen approximately two hours later in the same area. Assuming a balloon leak, not altogether uncommon, the rawinsonde could have remained low enough to be seen. Winds reported as high as 70K account for speed. Conclusion: Rawinsonde balloon.

No. 174: Nearest pilot balloon sounding release was at Lake Charles at 0300 CST. Wind flow WNW in lower levels, changing to SSW with altitude. No winds of high enough velocity to carry pilot balloon sounding from Lake Charles to New Orleans in time interval were reported. Only other release in the area was at Biloxi, North of New Orleans. Winds aloft were WSW. Speed stated by observer of 300 M.P.H. is approximately 15 times greater than any wind reported for that area. Conclusion: Not a balloon.

No. 175: Pilot balloon sounding released from Albuquerque at same time as observation. Upper winds show WNW flow hence could not have been the AB balloon. Great differences of opinion exist as to speed and shape of the object. One observer states that the object was not a weather balloon. All evidence indicates that this is true. Conclusion: Not a balloon.

No. 176: Navy rawinsonde and Weather Bureau pilot balloon sounding were released approximately one hour prior to sighting. Wind flow, however, was WNW at all levels from the surface to 15,000 feet which would seem to preclude the possibility of either balloon drifting North to the San Pablo area. Both witnesses also agree that the object was travelling at high speed. Winds for that region did not exceed 25 K. Conclusion: No balloon.

No. 177: Crack-pot report; insufficient information to evaluate.

No. 178: No weather balloons were released in the vicinity on the date mentioned.

No. 179: Crack-pot report; insufficient information to evaluate.

No. 180: No date given hence no analysis possible.

No. 181: This obviously inaccurate report says in effect that the object was seen about 30 minutes after pilot balloon sounding and rawinsonde release time. From the known release points, wind direction and speed at the level mentioned, this object or objects could not possibly have been a weather balloon.

No. 182: No balloons released within 120 miles of this position, but if wind were from west it could have been a leaking balloon from Norfolk or Hatteras which was not rising as it should. However, the date of incident cannot be read from the questionnaire, hence no definite conclusion can be drawn.

No. 183: Purely a radar report. If this report is accurate, couldn't possibly be a balloon.

No. 184 - 185: Very controversial accounts of speed (0 - 3 times that of a Jet); description sounds like burning pilot balloon sounding with lantern. However, nearest release was two hours earlier at St. Cloud. Could have been this pilot balloon sounding assuming a leaky balloon to keep it at a low altitude. Not at all probable, but possibly a balloon.

No. 186: Object reported moving directly into headwind of 20%. Only possible weather balloon would have been moving SE from Salt Lake City. If speed is any criterion, this was definitely not a balloon.

No. 187: A heavenly body, Venus.

No. 188: No actual sighting; a radar report, if accurate, definitely no weather balloon.

No. 189: Rawinsondes released at Montgomery and Atlanta 1 1/2 hours earlier and would have been blown into sighted area by upper winds. Only a faulty balloon, however, could have descended to that low altitude. From description, balloon is most unlikely.

No. 190: Every indication seems to point to this object being a rawinsonde balloon. Rawinsonde scheduled to be released from Munich approximately one hour previous to sighting. Very light winds in Munich area. Definitely a balloon.

No. 191: Only balloon released in wind pattern that would carry it over Junction City was released at Dodge City approximately one hour before sighting time. If reported direction and speed of object were at all accurate, balloon not possible.

No. 192: Balloons released from St. Cloud and Duluth just prior to sighting. Wind perfect for carrying balloon into observer's path. Wind

reported at 30K at about 80° to 110°. Steadily rising is also indicative of weather balloon.

No. 193: No date given; very little information; cannot determine object.

No. 194: Definite identity established by M.I.T.

No. 195: Very little information, only radar pipe; cannot determine if weather balloon or not.

No. 196: Radar scope observation only; object travelling directly into wind. Cannot determine if balloon, but unlikely.

No. 197: Almost certainly the comet discovered by the Sydney astronomer. No balloon could have reached Richmond at the time the object was sighted inasmuch as the sighting time and release time were almost simultaneous.

No. 198: No visual observation; radar blip moving at high speed and constantly changing direction. If radar report is accurate, couldn't possibly be a balloon.

No. 199: Wind, time and number of objects sighted rule out possibility of weather balloons.

No. 200: Definitely not weather balloon. Course southerly, wind almost due North at all levels. Only station releasing balloon in this area is North of Crescent City.

No. 201: Pilot balloon sounding released from Azores station at 0300 Z. Time of sight "about" that time. Description sounds very much like lighted pilot balloon sounding. Only discrepancy is speed which is reported from 25 M.P.H. to 800 M.P.H. If the lower speed is correct, object may be almost certainly assumed to be a weather balloon.

No. 202: Time of sighting was five hours after last scheduled release time for any rawin or pilot balloon sounding, thus discounting a balloon leak, would put it far too high for easy sighting. Definitely not a weather balloon.

No. 203: Again last scheduled release was over five hours prior to sighting. Only possibility, and a definitely unlikely one, is a lighted balloon falling in flames from an extremely high altitude.

No. 204: Venus.

No. 205: No date given on this, therefore, impossible to check wind flow pattern. Time, two hours after scheduled release time for Kansas City, Columbia, and St. Louis, Mo. balloons.

No. 206: If description is accurate, i.e., wings on fuselage, roar of engine, circling object, possibility of weather balloon is remote. Also, latest time of release for Clark Field was four hours prior to sighting. Also, note F.B.I. note on character of observer.

No. 207: Definitely not a weather balloon.

No. 208: Object sighted about four hours after last scheduled release time. Upper air flow pattern gives no indication of possibility of weather balloon drifting in from another station. Also balloon would have to have leaked to remain at 30,000 feet.

No. 209: Determined to have been twin-engine bomber.

No. 210: Summary sheet missing; no altitude given; time incompatible with scheduled balloon release times. If direction is correct, objects were flying into the wind. Cannot be determined conclusively. Inclined to believe objects were Jet aircraft.

No. 211: Very Pistol.

No. 212: Object sighted three hours after release time of Indianapolis and Ft. Wayne balloons. Defective balloon could have remained low enough to be seen and upper winds indicate that such a balloon would have been in the Dayton area at the time sighted. All other statements of observers seem to indicate that the object was a weather balloon.

No. 213: Evidently refers to the same object as in Incident No. 212, but with entirely different description which, if accurate, makes conclusion on No. 212 obviously incorrect. If not same object, certainly not a weather balloon, as definite pattern of motion, as described, not possible under existing wind flow conditions.

No. 214: No information whatsoever.

No. 215: Very high winds 60-70 M.P.H. from SW at all levels, definitely would have prohibited any balloon from making any southerly motion. Also, last scheduled released time was three hours prior to sighting at 1,000 feet. No time in sight given so cannot compute rate of climb to 20,000 feet. Fairly conclusive, not a balloon of any kind.

No. 216: Object reported moving directly into 70 M.P.H. head winds at an estimated 350 M.P.H. Observer is a professional weather observer and should know a weather balloon. Also, reported sighting was four hours after scheduled release time.



No. 217: Object reported moving into winds of 20-30K velocity and going faster than C-47 doing 130 M.P.H. The speed and direction are apparently very accurate since the C-47 was paralleling the object's course and several readings were made of the compass and air speed indicator. If report is true, definitely no balloon.

No. 218: No date given, consequently no check could be made of surface or upper-air data. As stated by observer, a flare is probable answer.

No. 219: Time of sighting coincides within a few minutes of the release time of the USAF rawinsonde at Newburgh and a pilot balloon sounding at New York. Very little description given that can be interpreted as either being a burning balloon or a meteor. One negative remark was that the object moved from East to West, an impossible situation for a balloon since winds at all levels were westerly.

No. 220: Wind at all levels W. to WNW; object reported flying directly into these winds. Also made definite turn from flying due North to North Northwest. Sighting time  $4 \frac{1}{4}$  hours after scheduled release times at Alameda, Sacramento and McClellan AFB.

No. 221: No information.

No. 222: Winds aloft charts not available on this one. Object sighted  $2 \frac{1}{2}$  hours after scheduled release time at which time it was plotted by a radar DF station to be at 27,000. A short time later the same station reported the object circling at 40,000; speed estimated at between 200-500 M.P.H. Most likely not a balloon.

No. 223: Definitely not a scheduled release balloon since it was seen to rise from the ground one hour before release time at Albuquerque and was seen by various persons as late as four hours after its original sighting. Seventeen individuals saw and reported this object as definitely a green flare. All commercial and governmental airfields were questioned concerning balloon releases with no success.

No. 224: Described exactly as that in No. 223, only at an altitude of 13,500 feet Mean Sea Level, 7,000 feet above the earth. Seen  $2 \frac{1}{2}$  hours after scheduled balloon release time. Wind at levels from 10,000 to 15,000 was WNW while flare was reported as travelling at very high speed in a WNW direction. Very accurate observation made by two F.B.I. agents. Definitely not a weather balloon.

No. 225: No date given. Object sighted within 15 minutes of release time of pilot balloon soundings at Albuquerque at low altitude, 500 feet. Exploded in red spray at 200 feet. This exact phenomena occurred on three different occasions at the same time which would seem to eliminate possibility of burning weather balloon.

No. 226: Sighted one hour after release at Albuquerque; same green flare appearance as in previous five or six cases, and moving into the wind from East to West. No balloon.

No. 227: Read report of incident; definitely not a weather balloon. Serves also as guide to interpreting incidents 223, 224, 225, and 226.

No. 228: Case under investigation, no information.

No. 229: Case dropped.

No. 230: Exactly as described in 223, etc. Definitely no weather balloon.

No. 231: Another glowing green flare just as described above.

No. 232: Investigation dropped.

No. 233: Definitely no balloon; made turns, definite fuselage, accelerated from 200 M.P.H. to 400 M.P.H.

APPENDIX D

Dr. G. S. Valley

Some Considerations Affecting the Interpretation of Reports  
of Unidentified Flying Objects

SOME CONSIDERATIONS AFFECTING THE INTERPRETATION OF REPORTS OF UNIDENTIFIED  
FLYING OBJECTS.

By  
G. E. Valley, Member Scientific Advisory Board,  
Office of the Chief of Staff, United States Air Force.

The writer has studied summary abstracts and comments pertaining to unidentified flying objects, which were forwarded by Air Force Intelligence. These remarks are divided into three main parts: The first part is a short summary of the reports; the second part consists of a general survey of various possibilities of accounting for the reports; the third part contains certain recommendations for future action.

PART 1 SHORT SUMMARY OF OBSERVATIONS.

The reports can be grouped as follows:

Group 1. The most numerous reports indicate the daytime observation of metallic disk-like objects, roughly in diameter ten times their thickness. There is some suggestion that the cross section is asymmetrical and rather like a turtle shell. Reports agree that these objects are capable of high acceleration and velocity; they often are sighted in groups, sometimes in formation. Sometimes they flutter.

Group 2. The second group consists of reports of lights observed at night. These are also capable of high speed and acceleration. They are less commonly seen in groups. They usually appear to be sharply defined luminous objects.

Group 3. The third group consists of reports of various kinds of rockets, in general appearing somewhat like V-2 rockets.

Group 4. The fourth group contains reports of various devices which, in the writer's opinion, are sounding balloons of unusual shape such as are made by the General Mills Company to Navy Contract.

Group 5. The fifth group includes reports of objects in which little credence can be placed.

General Remarks.

In general it is noted that few if any reports indicate that the observed objects make any noise or radio interference. Nor are there any indications of any material effects or physical damage attributable to the observed objects.

SUMMARY, PART 1.

This report will consider mainly the reports of groups 1 and 2.

PART 2. ON POSSIBLE EXPLANATIONS OF THE REPORTS.

Section A. What can be deduced concerning the nature of an unknown aerial object from a single sighting.

Here there are two problems: first, how much can be deduced concerning the nature of the objects from geometrical calculations alone; second, how much more can be deduced if, in addition, it is assumed that the objects obey the laws of nature as we know them.

Concerning the first problem it can be stated that only ratios of lengths, and rates of change of such ratios can be accurately determined. Thus the range and size of such objects cannot be determined; and it is noticeable that reports of size of the observed objects are widely at variance. However, angles, such as the angle subtended by the object, can be observed. Likewise there is fair agreement among several observers that the diameter of the objects of Group 1 is about ten times their thickness. Although velocity cannot be determined, angular velocity can be, and in particular the flutter frequency could, in principle, be determined.

All that can be concluded about the range and size of the objects, from geometrical considerations alone, is: 1) from the fact that estimated

sizes vary so widely, the objects were actually either of different sizes, or more likely, that they were far enough from the observers so that binocular vision produced no stereoscopic effect; this only means that they were farther off than about thirty feet; 2) since objects were seen to disappear behind trees, buildings, clouds etc, they are large enough to be visible at the ranges of these reasonable objects.

Now it is obviously of prime importance to estimate the size and mass of the observed objects. This may be possible to some extent if it is permissible to assume that they obey the laws of physics. Since the objects have not been observed to produce any physical effects, other than the one case in which a cloud was evaporated along the trajectory, it is not certain that the laws of mechanics, for instance, would be sufficient.

But suppose that mechanical laws alone are sufficient. Then the following example is sufficient proof that at least a length could, in principle, be determined: suppose a simple pendulum were observed suspended in the sky; then after observing its frequency of oscillation, we could deduce from the laws of mechanics its precise length.

This suggests that something could be deduced from the observed fluttering motion of some of the objects of Group 1. Assume that we know the angular frequency and angular amplitude of this fluttering motion (they can be measured in principle from a motion picture). Then for purposes of calculation assume the object to be thirty feet in diameter, to be as rigid as a normal aircraft wing of 30 foot span, to be constructed of material of the optimum weight-strength ratio and to be a structure of most efficient design. It is now possible to calculate how heavy the object must be merely to remain rigid under the observed angular motion. Let the calculation be made for a plurality of assumed sizes 1, 2, 4, 8, 16, 32, 64 ----- up to say

200 feet, and let calculated mass be plotted versus assured size. The non-linear character of the curve should indicate an approximate upper limit to the size of the object.

If in addition, it is assumed that the flutter is due to aerodynamic forces, it is possible that more precise information could be obtained.

The required angular data can probably be extracted from witnesses most reliably by the use of a demonstration model which can be made to oscillate or flutter in a known way.

#### SUMMARY, PART 2, SECTION A.

Geometrical calculations alone cannot yield the size of objects observed from a single station; such observation, together with the assumption that the objects are essentially aircraft, can be used to set reasonable limits of size.

#### PART II, SECTION 5. THE POSSIBILITY OF SUPPORTING AND PROPELLING A SOLID OBJECT BY UNUSUAL MEANS.

Since some observers have obviously colored their reports with talk of rays, jets, beams, space-ships, and the like, it is well to examine what possibilities exist along these lines. This is also important in view of the conclusions of Part II, Section A. of this report.

##### METHOD 1. Propulsion and support by means of "rays" or "beams".

By "rays" or "beams" are meant either purely electromagnetic radiation or else radiation which is largely corpuscular like cathode-rays or cosmic-rays or cyclotron-beams.

Now it is obvious that any device propelled or supported by such means is fundamentally a reaction device. It is fundamental in the theory of such devices that a given amount of energy is most efficiently spent if the momentum thrown back or down is large. This means that a large mass should

be given a small acceleration - a theorem well understood by helicopter designers.

The beams or rays mentioned do the contrary - a small mass is given a very high velocity - consequently enormous powers - greater than the total world's power capacity - would be needed to support even the smallest object by such means.

METHOD II. Direct use of Earth's Magnetic Field.

One observer (incident 68) noticed a violent motion of a hand-held compass. If we assume from this that the objects produced a magnetic field, comparable with the Earth's field, namely 0.1 gauss, and that the observer found that the object subtended an angle  $\theta$  at his position, then the ampere-turns of the required electromagnet is given by

$$ni = \frac{30 R}{\theta^2} \quad \text{where } R \text{ is the range of the object.}$$

For instance, if  $R$  is one kilometer and the object is 10 meters in diameter, then  $ni = 1$  billion ampere-turns.

Now if the object were actually only 10 meters away and were correspondingly smaller, namely 10 cm in diameter, it would still require 10 million ampere-turns.

These figures are a little in excess of what can be conveniently done on the ground. They make it seem unlikely that the effect was actually observed.

Now the Earth's magnetic field would react on such a magnet to produce not only a torque but also a force. This force depends not directly on the Earth's field intensity but on its irregularity or gradient. This force is obviously minute since the change in field over a distance of 10 meters (assumed diameter of the object) is scarcely measurable - moreover the gradient is not predictable but changes due to local ore deposits.



Thus even if the effect were large enough to use it would still be unreliable and unpredictable.

METHOD III. Support of an Electrically Charged Object by Causing It to Move Transverse to the Earth's Magnetic Field.

A positively charged body moving from West to East, or a negatively charged body moving from East to West will experience an upward force due to the Earth's magnetic field.

A sphere 10 meters diameter moving at a speed of one kilometer/second would experience an upward force of one pound at the equator if charged to a potential of  $5 \times 10^{12}$  volts. This is obviously ridiculous.

SECTION D. THE ANTI GRAVITY SHIELD.

It has been proposed, by various writers, perhaps first by H. G. Wells, that it might be possible to construct a means of shielding a massive body from the influence of gravity. Such an object would then float. Recently there appeared in the press a notice that a prominent economist has offered to support research on such an enterprise.

Obviously, conservation of energy demands that considerable energy be given the supported object in order to place it on the shield. However this amount of energy is in no way prohibitive, and furthermore it can be gotten back when the object lands.

Aside from the fact that we have no suggestions as to how such a device is to be made, the various theories of general relativity all agree in assuming that gravitational force and force due to acceleration are indistinguishable, and from this assumption the theories predict certain effects which are in fact observed. The assumption therefore is probably correct, and a corollary of it is essentially that only by means of an acceleration can gravity be counteracted. This we can successfully do

for instance by making an artificial satellite - but this presumably is not what has been observed.

SUMMARY, PART II, SECTION B.

Several unorthodox means of supporting or propelling a solid object have been considered - all are impracticable. This finding lends credence to the tentative proposed assumption of Part II, that the objects are supported and propelled by some normal means, or else that they are not solids. No discussion of the type of Part II, Section A can, in principle, of course, be complete.

PART II, SECTION C. POSSIBLE CAUSES FOR THE REPORTS.

CLASSIFICATION I. NATURAL TERRESTRIAL PHENOMENA.

- 1) The observations may be due to some effect such as ball lightning. The writer has no suggestions on this essentially meteorological subject.
- 2) The objects may be some kind of animal.

Even in the celebrated case of incident 172 where the light was chased by a P-51 for half an hour and which was reported by the pilot to be intelligently directed, we can make this remark. For consider that an intelligence capable of making so remarkable device would not be likely to play around in so idle a manner as described by the pilot.

In this connection it would be well to examine if some of the lights observed at night were not fire-flies.

- 3) The observed objects may be hallucinatory or psychological in origin.

It is of prime importance to study this possibility because we can learn from it something of the character of the population; its response under attack; and also something about the reliability of visual observation.

One would like to assume that the positions held by many of the re-

ported observers guarantee their observations. Unfortunately there were many reports of curious phenomena by pilots during the war - the incident of the fire-ball fighters comes to mind. Further, mariners have been reporting sea-serpents for hundreds of years yet no one has yet produced a photograph.

It would be interesting to tabulate the responses to see how reliable were the reports on the Japanese balloons during the war. There we had a phenomenon proven to be real.

It is interesting that the reports swiftly reach a maximum frequency during the end of June 1947 and then slowly taper off. We can assume that this is actually an indication of how many objects were actually about, or, quite differently, we can take this frequency curve as indicating something about mass psychology.

This point can be tested. Suppose the population is momentarily excited; how does the frequency of reports vary with time? A study of crank letters received after the recent publicity given to the satellite program should give the required frequency distribution.

It is probably necessary but certainly not sufficient that the unidentified object curve and the crank-letter curve should be similar in order for the flying disks to be classed as hallucinations.

A large scale experiment was made at the time of Orson Welles's "Martian" broadcast. Some records of this must persist in newspaper files.

#### CLASSIFICATION II. MAN-MADE TERRESTRIAL PHENOMENA.

1) The objects may be Russian aircraft. If this were so, then the considerations of Sections A and B indicate that we would have plenty to worry about. It is the author's opinion that only an accidental discovery

of a degree of novelty never before achieved could suffice to explain such devices. It is doubtful whether a potential energy would arouse our curiosity in so idle a fashion.

#### CLASSIFICATION III. EXTRA TERRESTRIAL OBJECTS.

- 1) Meteors: It is noteworthy that the British physicist Lovell writing in "Physics Today" mentions the radar discovery of a new daytime meteorite stream which reached its maximum during June 1947. The reported objects lose little of their interest however if they are of meteoritic origin.
- 2) Animals. Although the objects as described are more like animals than anything else, there are few reliable reports on extra-terrestrial animals.
- 3) Space Ships. The following considerations pertain:
  - a) If there is an extra terrestrial civilization which can make such objects as are reported then it is most probable that its development is far in advance of ours. This argument can be supported on probability arguments alone without recourse to astronomical hypotheses.
  - b) Such a civilization might observe that on Earth we now have atomic bombs and are fast developing rockets. In view of the past history of mankind they should be alarmed. We should therefore expect at this time above all to behold such visitations.

Since the acts of mankind most easily observed from a distance are A-bomb explosions we should expect some relation to obtain between the time of A-bomb explosions, the time at which the space ships are seen, and the time required for such ships to arrive from and return to home-base.

#### PART III. RECOMMENDATIONS.

- 1) The file should be continued.
- 2) A meteorologist should compute the approximate energy required to

evaporate as much cloud as shown in the incident 26 photographs. Together with an aerodynamicist he should examine whether a meteorite of unusual shape could move as observed.

3) The calculations suggested in Part II, Section A, should be estimated by an aerodynamicist with such changes as his more-detailed knowledge may suggest.

4) The mass-psychology studies outlined in Part II, Section C, Classification I 3 should be carried out by a competent staff of statisticians and mass-psychologists.

5) Interviewing agents should carry objects or moving pictures for comparison with reporter's memories. These devices should be properly designed by a psychologist experienced in problems pertaining to aircraft and design of aircraft control equipment so that he shall have some grasp of what it is that is to be found out. If the Air Force has reason to be seriously interested in these reports it should take immediate steps to interrogate the reporters more precisely.

6) A person skilled in the optics of the eye and of the atmosphere should investigate the particular point that several reports agree in describing the objects as being about ten times as wide as they are thick; the point being to see if there is a plurality of actual shapes which appear so under conditions approaching limiting resolution or detectable contrast.

APPENDIX E-1

Rard Corporation

Letter, dated 29 March 1947

The RAND Corporation

1500 Fourth St - Santa Monica - California

29 March 1949

L-2563

Lieutenant Colonel A. J. Kenstreet  
Technical Intelligence Division  
Air Materiel Command  
Wright-Patterson Field  
Dayton, Ohio

Dear Colonel Kenstreet:

In reply to your inquiry of March 21th, we had not planned to issue a formal report on Project Grudge until or unless our study leads to some unusual or unexpected finding which would throw new light on Grudge.

We are now working through the data in search of significant consistencies or other indirect bits of evidence. It is expected that we shall have explored all our various avenues of attack in about two months. To date we have found nothing which would seriously controvert simple rational explanations of the various phenomena in terms of balloons, conventional aircraft, planets, meteors, bits of paper, optical illusions, practical jokers, psychopathological reporters, and the like.

We should like to take this opportunity to raise a few questions: (1) The file on incident 50 contains a photograph which apparently belongs with incident 40. Is this surmise correct? (2) The file on incident 162 was omitted from the data. Why? (3) We have heard from a reliable source of an incident in which fishermen observed flying objects which dropped hot material which they collected and subsequently gave to official investigators. The investigators' plane crashed but there was a survivor. We do not seem to have a file on this incident - certainly not a complete file. May we have one?

Sincerely yours,

/s/ A. M. Wood  
A. M. Wood

AM:rb

APPENDIX 2

Wend Corporation (J. E. Lipp)

Space Ship Considerations



13 December 1949

300  
AI-1009

Brigadier General Putt  
United States Air Force  
Director of Research and Development  
Office, Deputy Chief of Staff, Materiel  
Washington 25, D. C.

Dear General Putt:

Please refer to your letter of 18 November 1948 relative to the "flying object" problem and to Mr. Collbohm's reply dated 24 November 1948. In paragraph (b) of the reply, Mr. Collbohm promised (among other things) to send a discussion of the "special design and performance characteristics that are believed to distinguish space ships."

This present letter gives, in very general terms, a description of the likelihood of a visit from other worlds as an engineering problem and some points regarding the use of space vehicles as compared with descriptions of the flying objects. Mr. Collbohm will deliver copies to Colonel McCoy at Wright-Patterson Air Base during the RAND briefing there within the next few days.

A good beginning is to discuss some possible places of origin of "visiting space ships." Astronomers are largely in agreement that only one member of the Solar system (besides Earth) can support higher forms of life. It is the planet Mars. Even Mars appears quite desolate and inhospitable so that a race would be more occupied with survival than we are on Earth. Reference 1 gives adequate descriptions of conditions on the various planets and satellites. A quotation from Ref. 1 (p. 229) can well be included here.

"Whether intelligent beings exist to appreciate these splendors of the Martian landscape is pure speculation. If we have correctly reconstructed the history of Mars, there is little reason to believe that the life processes may not have followed a course similar to terrestrial evolution. With this assumption, three general possibilities emerge. Intelligent beings may have protected themselves against the excessively slow loss of atmosphere, oxygen and water, by constructing homes and cities\* with the physical conditions scientifically con-

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\*Not too large or they might be visible. Perhaps underground, where the atmospheric pressure would be greater and where the temperature extremes would be reduced.

trolled. As a second possibility, evolution may have developed a being who can withstand the rigors of the Martian climate. Or the race may have perished.

"These possibilities have been sufficiently expanded in the pseudo-scientific literature to make further amplification superfluous. However, there may exist some interesting restrictions to the anatomy and physiology of a Martian. Rarity of the atmosphere, for example, may require a completely altered respiratory system for warm-blooded creatures. If the atmospheric pressure is much below the vapor pressure of water at the body temperature of the individual, the process of breathing with our type of lungs becomes impossible. On Mars the critical pressure for a body temperature of 98.3°F. occurs when a column of the atmosphere contains one sixth the mass of a similar column on the Earth. For a body temperature of 77°F. the critical mass ratio is reduced to about one twelfth, and at 60°F. to about one twenty-fourth. These critical values are of the same order as the values estimated for the Martian atmosphere. Accordingly the anatomy and physiology of a Martian may be radically different from ours - but this is all conjecture.

"We do not know the origin of life, even on the Earth. We are unable to observe any signs of intelligent life on Mars. The reader may form his own opinion. If he believes that the life force is universal and that intelligent beings may have once developed on Mars, he has only to imagine that they persisted for countless generations in a rare atmosphere which is nearly devoid of oxygen and water, and on a planet where the nights are much colder than our arctic winters. The existence of intelligent life on Mars is not impossible but it is completely unproven."

It is not too unreasonable to go a step further and consider Venus as a possible home for intelligent life. The atmosphere, to be sure, apparently consists mostly of carbon dioxide with deep clouds of formaldehyde droplets, and there seems to be little or no water. Yet living organisms might develop in chemical environments that are strange to us: the vegetable kingdom, for example, operates on a fundamentally different energy cycle from man. Bodies might be constructed and operated with different chemicals and other physical principles than any of the creatures we know. One thing is evident: fishes, insects, and mammals all manufacture within their own bodies complex chemical compounds that do not exist as minerals. To this extent, life is self-sufficient and might well adapt itself to any environment within certain limits of temperature (and size of creature).

Venus has two handicaps relative to Mars. Her mass, and gravity, are nearly as large as for the Earth (Mars is smaller) and her