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Analysis and Discussion of the May 18,1992 UFO Sighting in Gulf Breeze, Florida

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Abstract — A professional TV crew traveled to Gulf Breeze, Florida on two occasions in the spring of 1992 at a time when sightings were occurring on a weekly basis. On each occasion anomalous lights were observed and videotaped passing through the Gulf Breeze skies. This paper reports briefly on the first sighting and concentrates on the analysis of the second sighting when the TV crew used a special "high power" camera. During the second sighting the lights were observed from two locations allowing for triangulation and a subsequent estimate of the spacing between them (about 10 ft). They were moving in an early rectilinear path at a speed exceeding 20 mph before they faded out. **A** discussion of the hoax hypothesis involving pyrotechnic devices and incandescent light sources is presented. It is shown that the sightings, if not of "real" UFOs, constitute a hoax of considerable ingenuity, expense and persistence. This sighting was just one of about 170 which have occurred in the Gulf Breeze area during 1990-1992.

Introduction

Starting in November, 1990, residents of Gulf Breeze, Florida began seeing unusual lights in the sky, sometimes hovering but often moving with, across or against the wind. Although they were usually red when first seen, sometimes they would initially appear white and then turn red. Very often they would turn from red to white and flash rapidly before disappearing. Sometimes after the white flash they would return to red before disappearing, as happened during the May 18, 1992 sighting. (During one sighting the light changed from red to white to red to white and back to red before disappearing.) Sometimes they would drop glowing material or lights. These lights have been given the generic name "Red/White Lights" or RWLs. In a number of sightings revolving pairs of lights and even rings of light (ROLs) have been seen and videotaped while moving through the sky. On Sept. 6, 1991 a ROL was observed (and videotaped) as it slowly flipped over and blocked background stars while moving slowly through the sky. In another case (Nov. 5, 1991) a complex array of lights consisting of an elliptical bottom, a nearly horizontal arc of five lights above that and a single light above the arc, was photographed. In a couple of sightings the RWLs have turned into ROLs or vice versa. Many of these previous sightings have been reported in detail elsewhere (1; 2; 3; 4; 5; 6). (This author witnessed the appearance, slight movement through the sky and subsequent disappearance, after 70 seconds, of a ring of eight white lights on Sept. 16, 1991, in the company of about 30 other people.) (4)

There had been well over 100 sightings when, on the night of March 14, 1992, several groups of witnesses at various locations in Gulf Breeze saw at least six RWLs one night, with three at one time in sufficiently close proximity to give the impression of being geometrically arrayed. During this sighting witnesses flashed lights at the RWLs and in at least one case there was a rather convincing response in the form of a similar set of flashes by one of the RWLs. (7) (This was documented on videotape.) Ten days later Jim Moore, a reporter from KHOU TV (Houston, TX), and a film crew arrived in Gulf Breeze to do a story on the Gulf Breeze sightings. Jim joined the Gulf Breeze Research Team (GBRT) and other observers at Shoreline Park. One RWL appeared and then a second light immediately adjacent appeared. These lights were seen revolving around one another, without swinging back and forth, for about 2.5 minutes. The revolution rate was 75 sec/cycle (0.013 Hz), as determined by the camera used by the TV crew and confirmed by Bruce Morrison's videotape made at the same time (Morrison is a MUFON investigator who has video documentation of over 150 sightings). The pair of lights disappeared and about 30 seconds later a second (or the same) RWL appeared, a single light this time. A million candlepower spotlight was flashed on and off at the light. It turned white and its own pulsation rate suddenly changed from slow to fast, seemingly in response to the flashing of the spotlight, before it, too, disappeared. The spacing between the pair of revolving lights, as recorded on Bruce Morrison's videotape, was about 5 mm on a 14” TV monitor used for the video analyses discussed in this paper. The actual spacing between the lights could have been calculated had there been a triangulation that night. Unfortunately there was no triangulation (all the witnesses were at one observation site) so it was not possible to calculate the distance to the lights.

However, a "repeat performance" on April **3,** was triangulated with reasonable accuracy. Bruce Morrison again videotaped the sighting and again the maximum spacing between the images was about 5 mm. The two lights were revolving, without swinging back and forth, at a rate of about 90 sec/cycle (0.011 Hz) and were estimated by triangulation to have been 3 to 4 miles (about 16,000 to 21,000 ft) from the camera. As explained in Appendix A, the image spacing corresponded to an actual separation of 10 to 12 ft. Hence if these two lights were attached to a single, revolving object it had a substantial size.

Having "seen the light" on March 24, Jim Moore's interest was heightened considerably and his TV station arranged to have him return to Gulf Breeze during the week of May 18 when the "Intruders" TV mini-series (about a psychiatrist who discovered some of his patients were abductees) was shown nationally on CBS. This time he had a special "high power" black and white (B&W) video camera as well as the standard color camera. His film crew set up on the pier at Shoreline Park on the night of May 18 and waited along with some members of the GBRT. The remainder of this paper is a discussion of the

May 18 sighting. Numerous technical analyses have been done which support the conclusions stated in the main text. For the convenience of non-technical readers the analyses are not presented in the text but are in a series of Appendices at the end of the paper.

The May 18,1992 Sighting

While the KHOU TV crew was waiting at Shoreline Park, other members of the Gulf Breeze Research Team, including chemist Ray Pollock, were at the Bay Bridge site somewhat over a mile north (see map). The "Bay Bridge Watchers" were the first to see the light appear at 10:28 p.m. The red light/object was first seen at 75° azimuth and somewhat less than 26" elevation (the exact value was not recorded). According to Pollock's measurements, over the next 4 minutes it moved southwestward to 97° azimuth and 26" elevation where it disappeared (see map). Soon after the light appeared a witness using binoculars saw some whitish, filmy material fall from the red light. Later it seemed to turn white and divide and then return to red so that there were two lights side-by-side. Subsequently one light disappeared and finally the second light disappeared. Several photos taken by Mr. Pollock, using a 35 mm camera with a 500 mm telephoto lens and ISO 1600 film, near the end of the sighting produced pictures showing two, side-by-side tiny, very slightly smeared red images. The spacing varied from picture to picture, but the maximum spacing was 0.4 mm. This spacing corresponds to an actual spacing as projected onto the line of sight from the camera to the objects (i.e., perpendicular to the line of sight) 0.8 ft for each 1,000 ft of distance (see Appendix B). This information is used later in the calculation of the spacing between the lights.

Meanwhile, the KHOU TV crew, waiting at Shoreline Park, did not immediately see the RWL. However, about 45 seconds after Pollack saw it, they saw it and began filming with the special B&W camera (8). They continued filming with this camera until the end of the sighting, about 3 min., 16 sec. later. About 1 314 minutes after starting the B&W video, or about 2.5 minutes after Pollack first saw it, one member of the TV crew started filming with a high quality color TV camera with a telephoto zoom lens. Thus, during the last 1.5 minutes of the 4 minute sighting both cameras were running simultaneously. (Although the cameras weren't electronically synchronized, voices were picked up simultaneously by both cameras and this made it possible to synchronize them.) The color camera showed that during the last 1.5 minutes the lights were red.

The TV crew did not keep track of the azimuth and elevation during the sighting. However, for 15 seconds at the beginning of the color camera video segment (2.5 minutes into the sighting) and before he zoomed in for a close-up view, the cameraman showed a wide field of view picture which recorded nearby street lights at Shoreline Park. The azimuths of the street lights were subsequently measured from the location of the video camera. Using these azimuths and the video imagery I have determined that the azimuth of the RWL was about 51° and the elevation was about 15". This 15 second segment showed the object traveling to the left 16.5 mr and upward 12.2 mr (9). Unfortunately no one at Shoreline Park measured the ending azimuth immediately after the sighting. However, on the day afterward MUFON investigator Arthur Hufford interviewed several of the Shoreline Park witnesses and they agreed that the lights moved from right to the left from their point of view and that the final azimuth was about 42°. This information is used below to help estimate the travel path of the lights.

The Video Imagery

The B&W videotape of the sighting begins with a single, large, bright, unfocused, nearly round image with some dim, filmy material falling downward, confirming the testimony of a Bay Bridge observer that it dropped some glowing material. (The video also showed very faint glowing material falling downward a couple of more times during the sighting, but, unlike a typical flare or pyrotechnic device, material was not falling continuously.) During the next 30 seconds, as the crew focused the camera, the image shrunk to one or two and occasionally as many as three bright "blobs" of light (roundish, overexposed images) that merged together at their edges (they don't completely overlap; if they did the image would appear as one "blob"). The fact that the image consisted of multiple "blobs" rather than a single featureless "blob" indicates that there were at least three sources of light so close together that the camera could not completely resolve, i.e., separate, them. The video did not record any smoke or vapor at any time during the sighting.

About one minute into the B&W video a second bright light appeared at the left of the original one. At this time the lights turned white, according to Jim Moore, and then a few seconds later returned to red. (The color change did not show up on the B&W camera, of course.) There was no rapid leftward motion of the image of the second light, as there would have been had it separated or "fissioned" from the first and then moved to the left. The second light just appeared in one frame as if it were turned on by a switch. It immediately dropped some faint, glowing material and then faded in and out several times over the next second, brightened and then the image began a steady clockwise revolution about the image of the first light. In the first 5 112 seconds after its appearance the image of the second light moved to the right and merged with the top part of the image of the first light. Then it dimmed and moved farther to the right and down in a rapid continuous circular motion until, after another 5 112 sec, it was at the right side of the first light. It continued the revolution, but more slowly, so that about 17 seconds later it was below and to the right at about the 5 o'clock position relative to the first light. By this time it was also very dim. Then, over the next minute it revolved counterclockwise (upward) slowly so that at about 2.5 minutes into the B&W video (3 114 minutes into the sighting) it was level with the first light. At this point the spacing was 22 mm on the 14" TV screen. (This is also the time when the color camera showed two red lights side by side. The images were spaced 3.5 mm apart, indicating that the focal length of the B&W camera was about 6.3 times greater than that of the color camera.) It continued to move upward slightly to a location at about the 2:30 o'clock position. Several seconds later the original light, now on the left, ejected a single dim light that fell straight downward. As explained in Appendix F, I have estimated that the ejection velocity was about 2.85 m/sec. (This is discussed in more detail below.) Over the next 7 seconds the original light dimmed and brightened randomly and then faded out. About 20 seconds after that the second light (formerly on the right of the original light) ejected a dim light straight down, with an ejection velocity of about 4 m/sec and then it began to dim and brighten randomly. Finally it, too, faded and disappeared, about **3** minutes and 16 seconds after the video began.

The objects which were ejected downward were too dim to be recorded by the color video camera. That camera did, however, show the left hand (original) light fading and going out and then the right hand one fading and going out.

Analysis of the Video and Photographic Data

Reconstruction of the Track and Speed of the Lights by Triangulation

There is not enough direct evidence to allow a complete determination of the track (path of travel) through the sky. However by combining some educated guesswork with the measured azimuth values it is possible to construct a straight track that is reasonably consistent with the available data. This track has been used to (a) estimate the overall average speed, (b) to estimate speeds at several points along the track and (c) to estimate the distance to the lights near the end of the sighting in order to calculate the actual spacing between them.

Azimuths were measured from the Bay Bridge site only at the beginning and end of the sighting (75" and 97" respectively) and, from the Shoreline Park site, at 2.5 minutes into the sighting (51") and at the end of the sighting (42°; see map). The 75, 97 and 51 degree azimuths are probably accurate to a degree or better. The 42" azimuth is based on the witness' recollections and could be off by several degrees. However, for the purpose of estimating a track I assume that these azimuth values are accurate. (The overall conclusion is not very sensitive to slight variations in these azimuth values.) The 97 and 42 degree azimuths established the end of the track. The initial azimuth from the Shoreline Park location was not measured so it must be estimated from the video itself. Fortunately this is possible to do since, superimposed on the up, down and sideways jitter of the image caused by camera vibration, there is a continual slow, leftward motion (in agreement with the witness' recollection that the light moved generally southwestward). (Note: Although the images jittered about, there was no regular oscillation, as would be expected if the lights were hanging suspended below some supporting object.) The leftward image motion as a function of time has been used to measure the azimuth angle change rate (AACR). The change in the AACR with time during the video has been used to estimate the initial azimuth by the "trial and error" method described in Appendix C. It was difficult to accurately measure the AACR because each time the image moved somewhat to the left, the cameraman turned the camera to (approximately) recenter the image on the screen. The cameraman never let the image drift for more than 3 seconds and usually for less than two seconds, except at the beginning of the color video when the camera was stationary for 15 seconds. Nevertheless, by measuring the angle change rate for short durations (1-2 seconds) near the beginning, middle and end of the B&W video I have found that the AACR increased from about 2.5 to about 6.5 degrees per minute. (10) The beginning of the color video showed that when the lights were along the 51" azimuth the AACR was about 3.8°/min.

Appendix C shows how some simple assumptions about the motion of the lights (straight path, constant speed) make it possible to estimate the track of the lights as projected onto the earth's surface. As a check of the track obtained in this way I measured (on the map) the change in angle that corresponds to motion along the track during one minute of time centered where the 51" azimuth crosses the track. I found about 3.3°/min which is reasonably close to the rate measured directly from the color video, about 3.8°/ min, assuming that the track is at least approximately accurate. As a further check I found that the 51" azimuth crossed the track approximately at the 2.4 minute point (between the numbers 2 and 3 on the map), and this compares favorably with the estimate that the color video camera recorded the lights as being along the 51° azimuth at about 2.5 minutes into the sighting. Similarly, the B&W video, at a time estimated to be 95 seconds into the sighting, showed an AACR of about 3.2°/min, whereas a direct measurement on the map of the AACR during one minute of time centered on the 90 minute location (between points 1 and 2) gave about 2.5°/min.

I do not claim that this is the exact projected track of the lights. The fact that the AACRs at the 51" azimuth and at the 1.5 minute location do not agree exactly with the AACRs measured directly on the video shows that there is some inconsistency, suggesting a possibly curved path and/or changes in speed. However, the path is useful for distance and speed estimation purposes. The azimuth of the path is 245° and its length was about 2.7 miles.

The altitude of the lights could also be estimated. According to Ray Pollock, at the end of the sighting the elevation was about 26°. The map showed that at the end of the sighting the horizontal distance from the Bay Bridge site to the lights was about 1.32 miles. An angular elevation of 26" then gave an actual height of about (1.32 mi x tan 26 = 0.64 mi =) 3,400 ft and a radial (slant) distance from the observers of (1.32/cos26 =) 1.47 mi = 7,750 ft. The angular elevation along the 51" azimuth from Shoreline Park was determined from the color video image to be about 15°. Using the track on the map, the distance was about 2.67 miles, so the elevation at that point on the track was about (2.67 x tan 15 =) 0.715 mi = 3780 ft, about 380 ft higher than at the end of the track. Hence the lights were traveling very slightly downward and, since the distance from the end of the track to the intersection of the 51" azimuth is about 1.09 mi = 5770 ft, the angle downward was about equal to {arc-tan([3780-3400]/5770) =) 3.80. If this downward slope were constant from the beginning of the track then the lights began at an altitude of about {[3,400 + (380/5770)(2.7 x 5,280)] =) 4,340 ft and dropped about 940 ft while traveling 2.67 miles horizontally. If the lights actually followed this track they traveled about 2.7 miles in 4 minutes which is equivalent to an average speed of about 40 mph in the southwestward direction (against the prevailing gentle wind).

This average speed can be compared with the speed estimated directly from the color video during the first 15 seconds assuming that the track on the map is at least approximately correct. During that 15 seconds the azimuth changed by about 0.95" and the elevation angle changed by about 0.7". By trigonometric or graphical analysis one can show that, if the lights were actually traveling along the path shown on the map, then these azimuth and elevation angle changes mean that the lights were at an altitude of about 3,780 ft and were traveling on a slant path downward at about 5.5° and at a speed of about 47 mph. A similar analysis using B&W video data taken about 1.5 minutes into the sighting, using the track on the map showed that the lights were about 4,340 ft high and traveling downward at an angle of 5.4" and at a speed of 56 mph. An analysis to be presented below suggests that at the end of the path the lights were traveling at about 20 mph. Hence it may be that the lights were actually decelerating (in which case the path shown on the map would not be correct).

The Spacing of the Lights

At about 3 1/4 minutes into the sighting both cameras were showing two lights side by side at apparently the same altitude and of apparently the same intensity. The color camera image spacing was 3.5 mm +/- 0.1 mm. Video imagery of the moon has provided the angular spacing calibration for the color camera, 0.2 mrlmm (see Appendix D). By multiplying the measured image spacing by the angular spacing calibration value one finds that the angular spacing of the light images was (3.5 mm x 0.2 mrlmm) = 0.70 mr.

The approximate location of the lights 3 114 minutes into the sighting, assuming that the lights traveled along the track shown on the map, was found just to the left of the 3 minute mark (see the triangle on the track). This position was about 0.5 mi = 2,700 ft before the end of the track. The location was about 2.14 mi = 11,300 ft, measured horizontally, from Shoreline Park and 1.79 mi = 9,450 ft, measured horizontally, from the Bay Bridge site. The elevation at this location was slightly higher than at the end of the path: 3,400 ft + 2,700 tan 4.2 = 3,600 ft. Therefore, the slant ranges to the lights (the actual distances from each of the cameras to the lights) were 2.245 mi = 11,860 ft from Shoreline Park and 1.91 mi = 10,110 ft from the Bay Bridge. Multiplying the slant distance from the Bay Bridge by the angular spacing of the images, 0.8 mr (see Appendix B), the spacing of the lights, as projected onto the line of sight, was about (10,110 ft x 0.8 mr)/1,000 = 8.1 ft. At the same time the KHOU TV camera indicated a projected spacing of (11,860 x 0.70 mr/1,000) = 8.3 ft. These numbers are surprisingly close considering the considerable differences in equipment used and the difficulties in estimating the actual path of the lights. Furthermore, one must take into account the fact that the two groups of people were viewing the lights from directions that were about 41° apart in azimuth so they were having different perspective views. Appendix E shows that the spacing was actually about 8.8 ft. Of course the calculated length depends upon the assumptions described above and upon the accuracy of the measured azimuths. Other assumptions would lead to slightly different paths for the lights and different locations 47 seconds before the end of the sighting. However, these other locations probably would not be far from the location specified here (the triangle on the map), so the calculated spacing would not be greatly different. Considering the possible variations it seems quite certain that the spacing was between 7 and 11 feet. This spacing is comparable to that calculated for the spacing of the two lights seen on April 3, 10 - 12 ft (see Appendix A).

Since the angle A (see Appendix E) was about 18.5° the imaginary line between the lights was nearly perpendicular to the line of sight to the KHOU TV crew. Of more interest is the observation that the bisector of the lights lay almost exactly parallel to the path of travel, i.e., the imaginary line connecting the lights was almost exactly perpendicular to the path as shown in the map.

Distance and Speed Calculated by Another Method

Approximately two seconds after the two lights were side by side at the same apparent altitude, i.e., about 45 seconds before the end of the sighting, the original light ejected, straight downward, a dimmer light which dropped out of the view of the camera. Subsequently it faded out. About 31 seconds after the ejection by the first light (about 14 seconds before the end of the sighting), the second ejected a small light straight downward which dropped below the field of view of the camera. (These falling lights faded out before reaching the ground.) Then it, too, faded out. By plotting the positions of the falling lights as a function of time and fitting them to the gravitational fall equation, $y - y_0 = V_0 t + (1/2)gt^2$, it was possible to determine the initial velocities. The surprising thing is that it was also possible to estimate the distances to the lights! The method, probably of interest only to mathematicians and physicists, is described in Appendix F. The distances, calculated in this way, provide no information on the direction to the lights because no ground reference lights appeared in the video field of view. Therefore I have drawn arcs on the map which cross the estimated track. The arc most distant from the Shoreline Park site, which corresponds to the distance 2 seconds after the lights were side-by-side, does not intersect the track at the triangle on the map. Therefore, this method indicates that the distance at the time when the lights were side-by-side was closer to the camera than the triangle would indicate, providing fur-

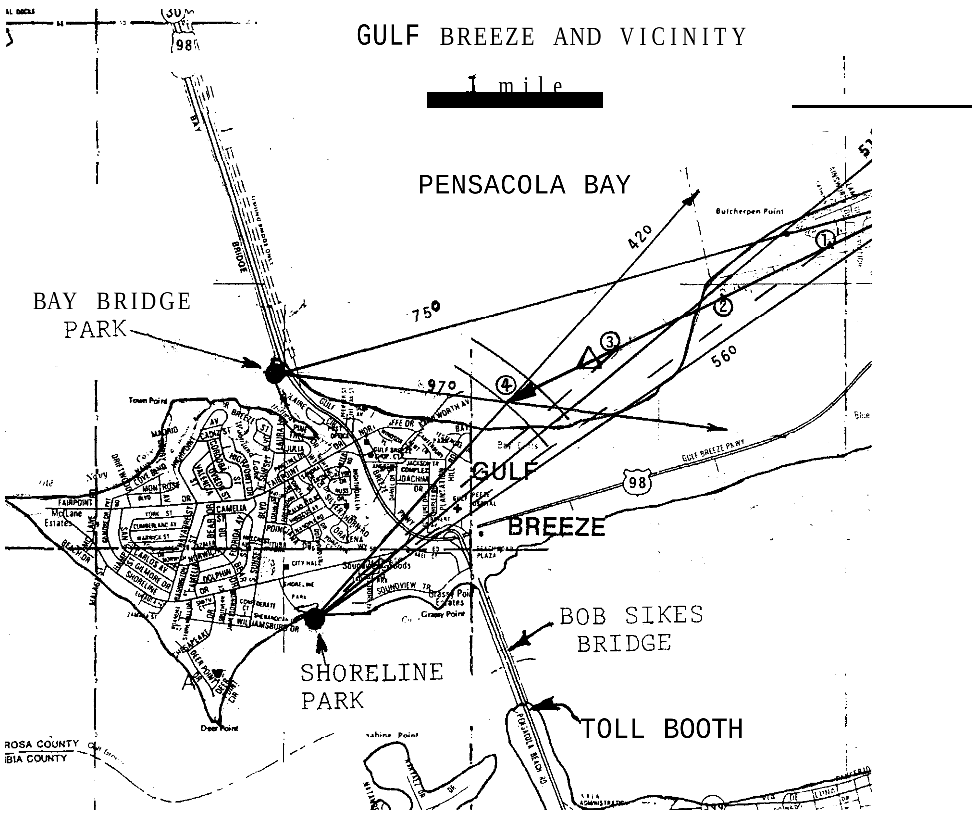

Fig. 1.

ther evidence that the track on the map is not exactly correct. The greater arc crossed the track at a horizontal distance of about 1.72 mi from Shoreline Park. At this time the slant range was about 1.92 miles (see Appendix F). Multiplying this by the angle between the lights, 0.7 mr, yields a spacing of (1.92 x 5280 x 0.7)/1000 = 7.1 ft as projected onto the line of sight. Taking into account the perspective effect (Appendix E) the spacing was about 7.5 ft. Thirty-one seconds later, when the second light dropped a smaller light, the slant distance was smaller, about 1.75 mi.

The slant distances given above, 1.92 mi and 1.75 mi, the end segment of the track on the map (which provided an estimate of the direction the objects were moving) and the time between the events, 31 sec, can be combined to give the speed. Projecting the slant distances onto the ground yields 1.79 mi for the larger arc and 1.63 mi for the smaller. Hence the lights were moving closer to the camera at the rate of about 0.16 miles per 31 sec or (0.16 x 3,600131 =) 18.5 mph, as projected onto the 42° azimuth from Shoreline Park (see map). If they traveled along the track on the map then the actual distance traveled was greater than 0.16 mi, since they were not traveling straight toward the camera.

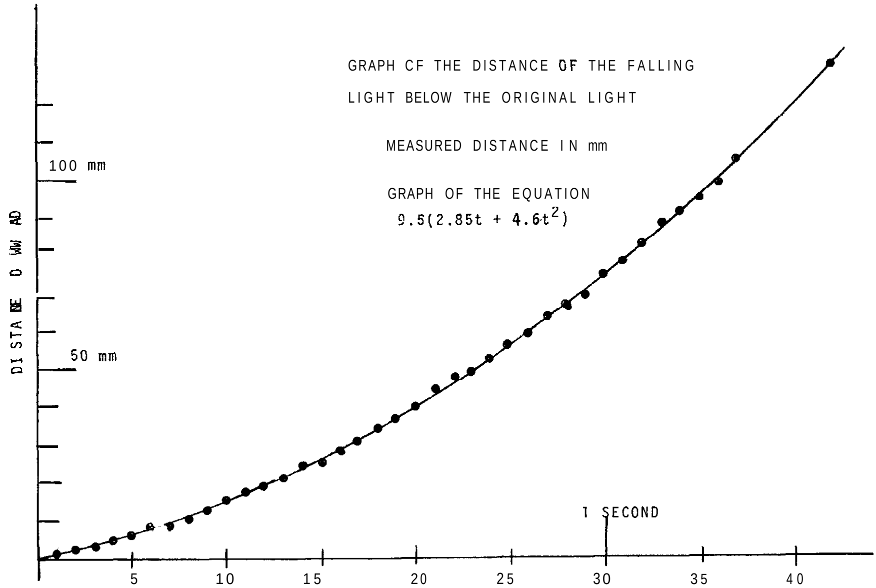

Fig. 2.

The track on the map runs at an angle of about 22" to the line of sight at point (4), so the distance would be 0.16/cos 22 = 0.17 mi in 31 sec, corresponding to about 20 mph. This calculated value is about one half of the average speed of about 40 mph calculated from the track length and the 4 minute sighting duration as described above, and it is less than half of the speeds calculated at earlier times by the methods described above (47 mph between points 2 and 3 and 56 mph between points 1 and 2 on the map). The final low speed indicates that the lights were slowing down as they approached the end of the track. If this were so, then the constant speed assumption used above to calculate the path in the map would be wrong and some other path would be needed. (I have not tried other paths because of the inherent uncertainties in the data and because, if one allows for curvature and variable speed, the number of possible tracks becomes very large.)

Further Characteristics of the Lights

The initial image in the B&W video appeared to be several light sources very close together which were revolving around one another. Then a second light appeared to the left of the first. Assuming that the path shown on the map is approximately correct, when the second light appeared, 11 seconds into the sighting, the lights were about 3.1 miles away and spaced by about (17.5 mm on the TV screen; 3.1 mi x 5280 ft/mi x 17.5 mm x .0317 mr/mm =) 9 ft (projected onto the line of sight). The second light subsequently made a partial orbit of about 200° around the first in a clockwise direction to a location at about the 5 o'clock position. At this time, about 138 seconds into the sighting, it was about 2.8 miles away (using the path on the map) and was spaced from the original light by about 9 mm on the TV screen; 2.8 x 5280 x .0317 mr/mm = 4.2 ft as projected *onto the line of sight.* It then reversed its revolution, finally ending up at the right side of the first and at the same apparent altitude, as discussed above. A few seconds later the first one ejected something downward and then faded, and subsequently the second light did the same. During the sighting the video showed that the lights dropped glowing matter or objects at the very beginning of the video, when the second light suddenly appeared, and at the very end. On a couple of other occasions very faint glowing material seemed to be emitted downward. However, the emission of material was occasional, not continuous throughout the 3 114 minute video.

Discussion

So, what were these lights? It would be "nice" to get a definitive answer. Unfortunately, all one can provide are arguments for or against hypothetical explanations. The conventional simple explanation is that the sightings have all been hoaxes in which the lights were road flares supported by balloons drifting through the sky. However, this explanation does not have "smooth sailing." In favor of the "red flare" explanation is the red color, the tendency for the brilliance to decrease in a fluctuating manner near the end of the sighting and the fact that glowing material fell downward occasionally. Against the flare explanation is the fact that the emission of burning matter was not continuous, but only occurred several times (video of flares showed that they continually drop glowing material while emitting sparks and smoke). Also against the road flare explanation is the fact that no evidence of smoke was recorded by the video, nor was any seen by the witnesses. The lack of smoke might be explainable by assuming that instead of a simple road flare a special pyrotechnic composition was used. However, this assumption of a special pyrotechnic composition increases the difficulty of the assumed hoax.

Although no spectrum was recorded during this sighting, in a previous case (Feb. 7, 1992) the spectrum of an RWL was recorded using a diffraction grating in a camera. Using the same camera and film a few hours later the spectrum of a road flare was recorded. Analysis of the film shows that there are two important differences between the RWL spectrum and that of the flare: (a) the blue to green ratio for the RWL is much greater than the same ratio for the flare, and (b) the red portion of the RWL spectrum does not show line spectra, whereas the flare spectrum does have several lines (spectral "lines" are particular frequencies where there are relatively large amounts of radiation). The semi-quantitative accuracy of the flare spectrum obtained on Feb. 7 was confirmed by comparison with published spectra of military red flare pyrotechnic mixtures (which rely on the element strontium to produce the red color). The lack of lines in the Feb. 7 RWL spectrum suggests that it was not any type of pyrotechnic device, since these devices create plasmas which generate increased radiation at frequencies that are characteristic of the elements which are burned in the pyrotechnic. Of course, this does not prove that the May 18 sighting was not a pyrotechnic device, although the similarity between the sightings suggests that the results of the Feb. 7 experiment should be considered in evaluating the pyrotechnic explanation for the May 18 sighting.

Certainly this was not just a pair of pyrotechnic devices such as marine flares shot from a gun, nor was it a pair of parachute flares because (a) the duration was too long, (b) such flares fall downward in an obvious way and (c) such flares do not change from red to white and back to red. The next best guess would be a pair of special pyrotechnic devices suspended at some distance apart under a balloon. However, balloons move at the mercy of prevailing breezes and they rise as the weight of the pyrotechnic is reduced by burning, unless a special controlled device is included which can allow the balloon to leak slowly as the pyrotechnic burns. But the RWL, according to the evidence presented previously, actually traveled at a "good clip" into the prevailing wind and dropped downward as it traveled. Also, an object suspended below a balloon, whether on a long or short tether, will swing back and forth in an essentially random way. However, no swinging was noted. Thus motion into the wind and the lack of oscillatory motion of the lights rules out the "simple" balloon hypothesis.

Although no noise was heard (nor has any been reported in any sighting), one might suggest a motorized model plane or blimp. Such a device could move into the wind at some sizeable speed. Ignoring for the moment the expense of such a device, let us pursue this hypothesis a bit farther. Since the light images do not exhibit any swinging motion, one may assume that the structure supporting the flares was substantial and had some form of aerodynamic stabilization. Since there were two lights it would require at least two flares, the second one designed to come on after the first (or perhaps it didn't ignite in time). They were separated by at least 7 ft, yet they maintained coherent motion indicating that they were linked together mechanically as they traveled into the wind. One might imagine a 7 ft long suspension member supporting two flares and supported at its center by the hypothetical motorized blimp. This does not explain, however, how the flares could revolve around one another as did the lights in the video.

Even a motorized blimp or model plane (with a quiet motor) would require some directing mechanism to keep it from flying in circles. A blimp would not go into a crash dive, of course, but model planes tend to do that if they are not controlled. A small military type drone aircraft might do the trick. But either radio control or an "autopilot" would be necessary to direct the vehicle over the "target area." Also, unless one can afford to lose such devices, radio control would be necessary to get the vehicle to return to its owner after the flares had burned out. (Balloons are cheaper of course, and do not need to be retrieved, but balloons can't move against the wind. Incidentally, no balloon/flare debris has been reported in the Gulf Breeze area.)

Needless to say, this "conventional explanation" is not very appealing, especially considering that this was only one of a number of sightings of pairs of lights traveling through the sky (consider March 14 and April 3, referred to at the beginning of the paper). In May alone there were 16 sightings, with 11 in a row. During the year and a half of sightings there were about 170 RWLs seen. Where does one get all these "motorized blimps?"

Aside from the difficulty in creating the objects that fly through the sky carrying one or more pyrotechnic devices, there is also the risk factor. What if something went wrong? Considering that many of these sightings are many minutes long, the amount of pyrotechnic material must be substantial (the amount of pyrotechnic material would be measured in pounds). Such a device landing on a house or in a field of dry grass, etc., could cause substantial fire damage. Alternately, an object of substantial size at a several thousand foot altitude is a hazard to aircraft. If these are flares as has been claimed, then certain government agencies such as the Coast Guard, the FAA and perhaps even the local police are guilty of nonfeasance of duty by not pursuing and arresting the person(s) responsible for the flares. At the very least the person(s) responsible for flying pyrotechnic devices could be guilty of "reckless endangerment" as well as breaking the law against sending up flares when there is no emergency.

An alternative source of the lights, namely incandescent light bulbs with color filters, has also been proposed. However, this hypothesis is subject to many of the criticisms leveled against the pyrotechnic hypothesis and also some new ones: the lack of stability under a balloon; the need for a motorized support to move rapidly through the atmosphere against the wind; the weight of batteries needed to power the bright lights for many minutes; the requirement for a means to change from white to red momentarily (e.g., a white bulb next to the red bulb, operated by some control circuit); the inherent danger in allowing a device of substantial size to float over a populated area and through an aircraft landing area.

Conclusion

Although some high quality cameras were used to videotape and photograph the RWL that was seen on May 18, the observations were not carried out with the precision of a scientific experiment. Hence it has not been possible to accurately determine the track of the RWL, nor has it been possible to determine the exact nature of the RWL. However, the analysis and discussion presented above does allow one to conclude that lighted objects of substantial size were observed traveling over populated areas of Gulf Breeze on May 18 and, by extrapolation to other similar sightings, on many occasions during 1991 and 1992. Simple hoax methods have been proposed to explain the sightings, including flares and incandescent lights carried by balloons. Numerous arguments against the simple hoax hypothesis have been presented. It has been shown that if these lights were hoax devices then they constitute an "ingenious" and expensive hoax (possibly involving more than one person). Considering that sightings of this nature began in November 1990, the long duration and number of the sightings would indicate a hoaxer (or hoaxers) with a persistence that is unprecedented in the history of UFOlogy. It would also indicate a rather reckless disregard of the safety of the community.

On the other hand, if these sightings were not hoaxes, then they represent some new, as yet unrecognized phenomenon related to the long-standing UFO mystery.

(Note added in proof: At the time that this report was written sightings were continuing in Gulf Breeze. However, as of November 1992, there have been no RWL sightings since July 13, 1992. The MUFON observers have continued their nightwatches, however, so the ending of the sightings is not a result of lack of observation. A few UFO-type events of a different nature have occurred since July 13. These will be reported elsewhere).

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6. Numerous articles on the RWLs and ROLs appeared in the Gulf Breeze Sentinel from December, 1990 through October, 1991. Since November, 1991, articles have appeared in The Islander, a weekly newspaper in Pensacola, FL. A history of the first year of sightings is presented in "One Year and Still Counting: Sightings of Unusual Lights in the Gulf Breeze Skies," by B. Maccabee. This 32 page paper is available from the author for $10.00.
7. Hufford, A, MUFON Sighting Report for Florida Case 92-98, July, 1992 (private correspondence); this sighting involved 57 known witnesses at 7 locations around Gulf Breeze and included photographs and video.
8. They used a Sony SSC-M370 CCD camera attached to a small telescope consisting of a Tamron 200-500 mm, f/5.6 zoom lens with a 1.6 X teleconvertor for an effective optical focal length of about 900 mm at about f/10. When the image is displayed on a 14" TV monitor for analysis the image is magnified by a factor of about 35 which means that the effective focal length is about 31,500 mm = 31.5 m!
9. The measured spacing of the street lights is 10 degrees. The image spacing is 78 mm on the 14" monitor corresponding to an angle calibration of 2.22 mr/mm. The light moved 7.5 mm to the left and 5.5 mm upwards during 15 seconds.
10. These angle change rates were estimated by graphing the horizontal position of the image as a function of frame number for a second or so at several times during the video.

Appendix A: The April 3 Sighting

Bruce Morrison's videotape from April 3 shows a maximum spacing of the light images of about 5 mm on the 14 inch monitor that was used for this analysis. This spacing corresponds to some particular angle between the lights. If one knew the angle one could multiply the angle in milliradians (mr) by the distance and divide the product by 1,000 to obtain a good estimate of the spacing as projected onto the line of sight, i.e., as seen in perspective (the distance perpendicular to the line of sight). (Note: if an angle is given in degrees, multiply it by 17.4 to convert it to mr. This estimation method becomes increasingly unreliable as the angle grows beyond about 300 mr.) The angular spacing between images on the monitor was determined by using the calibration factor for Bruce Morrison's video camera. The calibration factor was found, using a light source of known angular size (the moon, 9.2 mr), to be about 0.12 mr/mm. Multiplying the maximum spacing of the images (5 mm) by the calibration factor, 0.12 mrlmm gives the angular spacing as 0.6 mr. Multiplying this by the estimated distance, 16,000 - 21,000 ft, yields a spacing of about 10 - 12 ft.

Appendix B: Ray Pollock's Photo

Dividing the spacing between the images, 0.4 mm, by the camera focal length, 500 mm, gives the angle between the images, 0.8 mr. Multiplying this number by the distance to the object in feet and dividing by 1,000 gives the spacing between the lights in feet as projected onto the line of sight, i.e., a distance between the lights as measured perpendicular to the light of sight to the camera. (If C is the angle between the line of sight and a line, S, joining the lights, then the projected spacing is $S_p = S \cos C$, where cos is the cosine function; C is 90" when S is perpendicular to the line of sight.) Thus, if the lights were 1,000 ft away the projected spacing would be 0.8 ft; if it were 2,000 away the projected spacing would be 1.6 ft, etc. The projected spacing is always equal to or less than the actual spacing so the actual spacing could have been greater than 0.8 ft ($S = S_p/\cos C$ and the value of cosC is 1 or less).

Appendix C: The Path of the Lights

The basic assumptions are (1) that the lights moved at a steady rate, and (2) that they moved along a straight path. Any other assumptions will make the motion of the object more complicated (e.g., curving, accelerating, decelerating). Next, I assumed that during the first minute (including the 45 seconds before the B&W video started) the Azimuth Angle Change Rate, as seen from Shoreline Park, was 2° per minute (counterclockwise) and that during the last minute the AACR was 6.5°/min. Next, I carried out the following operations using trial travel paths: (1) I drew a trial azimuth line from the Shoreline Park site until it crossed the 75" azimuth at the right side of the map (this is the trial starting point of the track of the lights); (2) following the assumption that the lights traveled in a straight line, I drew a straight line from the trial starting point to the intersection of the 42" and 97" azimuths (the end point of the path as projected onto the surface of the earth); (3) following the assumption of constant speed, I divided the path into four equal segments corresponding to the four minutes of the sighting; (4) I drew lines from the Shoreline Park site to the 1 minute and 3 minute marks on the path (see the circled numbers and dashed lines on the map); (5) I compared the change in angle between the (dashed) line to the 1 minute mark and the trial azimuth (e.g., 56") with the required change in angle during the first minute (2 degrees); (6) I compared the angle between the (dashed) line to the 3 minute mark and the 42° azimuth with the required change in azimuth during the last minute (6.5"); (7) if I found that the angle changes measured in steps (5) and (6) did not match the required angle changes I rejected the trial azimuth and drew another trial azimuth line. I repeated the above procedure until I found an azimuth that obeyed the conditions just listed. This azimuth, 56°, is shown as the starting point of the track of the RWL. (This trial and error procedure was much more sensitive to the change in azimuth during the last minute. That is, trial azimuths were rejected generally because they did not meet the 6.5°/minute drift rate during the last minute.)

Appendix D: The Projected Spacing Between the Lights

The spacing of the images on a 14 inch monitor was 22 mm for the B&W and 3.5 mm for the color video. Hence the effective focal length of the B&W camera was about 6.3 times greater than that of the color camera. The effective focal length of the color camera was determined from the image size of the moon (about 9.2 mr). The diameter of the moon image is 46 mm which gives a calibration of about 0.20 mr/mm for the color camera and, since the spacing of the two lights was about 6.3 times greater on the B&W video, 0.216.3 = 0.0317 mrlmm for the B&W camera. The effective focal length in meters is the inverse of the focal plane calibration in mr/mm (which is equivalent to radians/meter). Hence the effective focal length of the color camera was about 5.0 meters and that of the B&W camera was about 31.5 m. (Note that this includes the "blowup factor" created by displaying the image on a 14" TV monitor which is much larger than the size of the focal plane of the TV camera.)

Appendix E: The Actual Spacing Between the Lights

By assuming that the spacing, S, between the lights was greater than 8.3 ft and that the bisector of the lights (a line perpendicular to the imaginary line connecting the lights) lies between the two viewing directions, one can solve two equations which make the calculated apparent spacings completely self consistent: A + B = 41" and (S1/S2) = cosA/cosB = 8.318.1 = 1.025, where A is the angle between the bisector and the line of sight to the KHOU crew, B is the angle from the bisector to the GBRT, and S, the actual spacing, is given by S = S_1/cosA. (I have ignored the slight effect of the difference in angular elevations from the two sites.) The two equations are solved to a sufficient accuracy for A = 18.5° and B = 22.5". Hence the actual spacing was about S = 8.3/cos18.5 = 8.8 ft.

Appendix F: Ejection Velocity and Distance Estimated from the Gravitational Free-Fall Equation

After observing the video of the falling lights several times I realized that, if they fell under the acceleration of gravity, then it should be possible to determine how far away they were by fitting a graph of the position as a function of time to the gravitational fall equation. After I worked through some theoretical calculations I found out how to adapt the gravitational fall equation to the video imagery. One must first realize that positions of the image of the falling light (on the TV screen) are related to positions of the actual falling light at some distance from the camera by the equation $Y^S - Y^S_0 = K(y-y_0)$ where $K = (F/S)(\cos E)$ and $y - y_0 = V_0t + (1/2)gt^2$ (distances, y, are positive downward). The values of $Y^S - Y^S_0$ are the image distances downward from the upper (ejecting) light to the falling light at various times. F is the effective focal length of the camera (including the blowup factor of the TV monitor), S is the slant range from the camera to the falling light, E is the angle of elevation of the viewing direction, V_0 is the ejection velocity and g is the acceleration of gravity (9.8 m/s^2 or 32.2 ft/s^2). The factor cosE projects the fall distance at anytime, assumed to be straight down (air drag is ignored) onto the sighting line direction. F was determined to be 31.5 m = 31,500 mm (see preceding discussion) and E is the estimated angular elevation at the end of the sighting, about 21° from the Shoreline Park site. The only unknown quantities are S (in m) and V, in m/sec. Figure 2 is a graph, for the first case of the ejected lights, of the distance between the lower (ejected) light and upper (ejecting) light, i.e., of $(Y^S - Y^S_0)$. The dots are measured distances on the TV screen in mm and the solid line was generated by the equation $(Y^S - Y^S_0) = K(V_0t + 4.9t^2) = (9.5$ mm/m$)(2.85$ m/sec x $t + 4.9t^2)$. (For mathematicians: there were two unknown constants in this quadratic equation, K and V_0. They were varied independently to achieve a good fit to the data.) The initial velocity was 2.85 m/sec. The value of K could vary by as much as 0.1 mm/m (i.e., K = 9.5 +/- 0.1) corresponding to about 1% accuracy in the fit to the data. Since K = 31,500 cos 21/S we can solve for S and find S = (31,500 cos 21)/(9.5) = 3095 m = 1.92 miles. The horizontal component of this slant distance is ScosE = 1.79 mi, which is the length of the greater arc drawn on the map. A similar graph was made of measured distance points for the second light that fell downward and it, too, was well fitted by the above equation but with different values of V, and K. In this case V, = 4.2 m/sec and K = 10.4 mm/m, which corresponds to S = 2820 m = 1.75 mi and a horizontal distance of 1.63 mi (the shorter arc on the map).