

MUFON Case #	57046	BGE Results	18.0
Field Investigator	Dana Simpson West	ID#	
Date Reported	June 8, 2014	Date of Event	June 8, 2014
Time of Event	19:40 CDT	Duration	1 minute or less
Event Location	I-270 & Telegraph	Coordinates	38.2731N/90.1910W
City, State	Oakville, MO 63129	County	St. Louis
Witness		Witness	
Current Address			
City, State		County	
Contact Number		Email Address	
Case Type Case Category	MA2 2	Case Disposition	Unknown UAV

COORDINATES ACCURACY

Object's location is approximate. The witnesses were traveling south on I-270, exiting at the Telegraph exit (Exit 2) on the way to their home. The object was NNE of their position and the exact distance was unknown.

NATURAL/MAN-MADE PHENOMENON:

Neither the ISS nor any major satellites were visible at the date and time of the sighting. Since it was not dark at the time, planets and other astronomical phenomenon have been eliminated.

WEATHER CONDITIONS AT TME OF SIGHTING

Weather conditions varied depending on the airport data used. The Cahokia, IL site is closest to the sighting. Although that site reports clear skies, the photos indicate that there were scattered clouds in the area. In addition to the photos taken during the sighting (#915-#927) of the sky conditions, photo #930 shows the sunset taken approximately 32 minutes after the sighting at the witnesses' home.

Temperature = 73°

Humidity = 71%

Pressure = 29.94

Wind = NNE @ 3.5 mph

Visibility = 10 mi and Clear

Sunset: 8:23 pm CDT

Civil Twilight = 8:55 pm CDT

Astronomical Twilight = 10:19 pm CDT

Data from the three different airport locations are as follows:

	Lambert St. Louis International Airport	Spirit of St. Louis Airport	Downtown St. Louis/ Cahokia Airport
City, State	St. Louis, Mo	Chesterfield, MO	Cahokia, IL
Distance from Oakville, MO	29 miles to the North and West	20 miles to the North and West	14 miles to the East and North
Wind	NNW @ 4.6 mph	Calm	NNE @3.5 mph
Ceiling	OVC150	OVC180	Clear
Sunset	8:24 pm CDT	8:25 pm CDT	8:23 pm CDT
Civil Twilight	8:56 pm CDT	8:57 pm CDT	8:55 pm CDT
Astronomical Twilight	10:21 pm CDT	10:22 pm CDT	10:19 pm CDT

GENERAL DESCRIPTION OF THE EVENT:

The witness (Age 46) was driving South and East on I-270 and exiting at Telegraph (Exit 2) toward home with her son, (Witness 2—Age 14) in the passenger seat. Her son (Age 10) was in the back seat, when a bright white reflecting light caught their attention. They describe the sun reflecting off of a metallic object near the Jefferson Barracks Bridge, which is 2 miles east of their location, directly in front of them. This bridge spans the Mississippi River between MO and IL. Her son took one photograph (#915) of the original sighting and several additional photographs (#916-#927) of the object as it moved NNW as they were exiting. Once they exited, they turned around and came back to the location to see if they could see the object, but it was gone. Photograph #930 is of the sunset at their home approximately 32 minutes after the original sighting.

INVESTIGATOR NARRATIVE

Witness Interview:

I arranged a phone interview with the witness on June 27. She indicated she was driving on I-270S/I-255E traveling on the Missouri side of the Mississippi river with the Jefferson Barracks Bridge directly in front of them. Her son (Witness 2) was in the front seat on the passenger side and her other son was in the back seat. She and her son noticed a grey metallic object brightly reflecting the sunlight. She indicated it was the brightness and glare of it that attracted their attention. It was larger (about the size of a penny at arm's length) and moving faster than an airplane. It got larger and blacker as they got closer. It appeared to be over the Jefferson Barracks Bridge which is approximately 2 miles east of where they exited at Telegraph Rd. (exit 2). Her son took out his iPod Touch and took a series photographs (#915-#927), which are attached in the CMS. The object(s) moved quickly traveling to the northwest and then south toward them. They lost sight of the object when they exited the highway. They turned around when they had the opportunity, to see if they could see the object again, but it was gone. The witness indicated she was not sure if there was one object moving very fast, or multiple objects. However, later when they examined the photos they thought they saw a second object in photo #915 and streaks behind the objects. This was not visible during the sighting. The

witness indicated there was no missing time and no health effects from the sighting. She gave me the information and birthdates of her children. She indicated that since she was driving she didn't have as good a look at the object(s) as her son. I asked her if I could interview her son. She indicated she would have him email what he saw since he wasn't home at the time.

Witness 2 (Son) Email

"Thank you for talking to my mom this morning. For the first few seconds we saw the object it was very bright and shiny. It appeared to be metallic in color. It started out in the east almost directly above the Jefferson Barracks Bridge. Within a second either the metallic object was out of view range and another closer object came into view or this object moved in a northwest direction, a little closer to us. It then seemed to move to slowly move south toward Oakville. Then right before we got onto Telegraph, it disappeared out of sight. We're not sure whether it actually disappeared or if it moved really fast out of our view range. In the first photo it also appears as if there is a second object too, although it was not visible to us. In the last few photos there also appears to be a second object too, although that was also not actually seen by us. In a few of the last photos there are also 2 very faint lines or streaks in the sky, each behind and a little below the 2 objects. These streaks in the sky were not visible to us during the sighting."

Additional Investigation

Once the case was selected as a possible candidate for one of the best cases of 2014, I emailed the Witness 2 (son) and asked him to check with his parents to see if I could interview him by phone to clarify some additional points regarding the sighting. We also asked Witness 2 (son) for the original photos on his device so the necessary photo analysis information was available. He submitted the originals to me which were forwarded on January 31, 2015 to Robert Powell (UT) for analysis. He indicated the photos were taken from the dashboard of their car with an Apple iPod Touch, ME643LL/A. The car was going approximately 45-50 mph as they were exiting the highway.

Witness 2 (Son) Interview

I interviewed Witness 2 (son) by phone on February 8, 2015. His mother called me. She and I talked briefly about the sighting. When I asked, she indicated that the second object and the streaks behind the objects that she initially talked about in her report were based on a later analysis of the photos. She didn't actually witness more than one object at a time and no streaks were visible at the time of the sighting. She indicated that the light was a very bright white glaring light reflecting off of a metallic object. She then gave the phone to her son, giving permission to interview the minor. I asked if she wanted to give me her email so that I could copy her on any emails we sent to him. She indicated that he was very forthcoming with the communication and would just check in with him.

Witness 2 (Son's) description of the sighting was very much in line with what he had emailed me on June 27, 2014. See "Witness 2 (Son) Email". He indicated they were traveling home going I-270S/I-255E toward the Jefferson Barracks Bridge. They noticed a very bright white light reflecting off of a metallic object—just like the sunlight reflects off of a car hood at times. The light was very bright and he indicated that there were no colors, just white and he was definite in his opinion that it was a reflecting light from the sun and not a light source—and only white, no colors.

At that point he took a photo with his Apple iPod Touch (Image 1: #915). The object went “out of view range.” Then he caught sight of the object again, still reflecting the sunlight--which he photographed in photos (#916-#927). He indicated the object was metallic, silver or grey, oval-shaped, and about the size of a penny at arm's length. There was no sound. He assumed this was the same object, but if it had moved a long distance (approximately 2 miles) in a very short amount of time. It had moved north-northwest and was much closer to them. He estimated it at about 30-45 degrees. He photographed it as it moved from the northwest to the southeast toward Oakville until he lost sight of it as they exited.

Once they exited, they turned around as soon as they could and went back to see if they could catch sight of the object again, but it was gone. When they got back home, the son took a picture of the sunset at their home (#930), which occurs approximately 32 minutes after the sighting. He said that he had deleted #928 and #929) but couldn't remember what they were. Photo #930 was sent to us on February 3, 2015 when we requested the first photo he took after the event.

Witness 2 (son) was strong in his view that there was only one object that they saw. At first he and his mom thought there might be two objects when they examined the first photo (Image 1: #915). In this photo, if the UFO is the center of the clock, there is another black speck on the photo at about the 2:00 position (about 1.5 inches away—when measured on the picture—not actual distance). This is what they thought might have been a second one—but they didn't actually see it visibly during the event.

He also indicated the that streaks they referred to in the report were streaks they saw in the photo, behind what they thought were two objects in the photo—the streaks were not something they witnessed visibly. Again, they never actually saw two objects at the same time. They only saw one object—first far away—then very quickly at a closer range.

I asked him if the object was moving quickly before they took the photos, while, or after. His reply was “all three.” “It was moving quickly the entire time.” He indicated it really moved quickly at the beginning of the sighting, especially if what they saw in Photo 1 was the same UFO that they saw in the photos that came after. He indicated that the object in Photo 2 through the last photo was moving about the speed of an airplane (if it was that low and close). He indicated there were no other aircraft in the area at the time that they noticed. I asked is the object was fuzzy or sharply outlines and he indicated he didn't notice. He indicated that they did not experience any effects physically or to any electronics or the car and they did not experience any missing time. Witness 2 (son) has always had an interest in Astronomy and is taking an Astronomy class next year.

CORRELATING CASES

Case # 56322: A similar report in Oakville by a police officer (former military). The witness reported one object on May 11, 2014 at approximately 19:30 CDT. The object was oval shaped with a dull surface. The object was the apparent size of an aspirin with the actual size unknown. The surface was described as grey/lead with no exterior lights, emission, or sound. There were airplanes also in the

area. The object was sighted at 45 degrees at treetop level and was over 1 mile from the witness. The object moved in a straight-line path from east to northeast.

LOCATION

The sighting occurred approximately 2 miles west of the Jefferson Barracks Bridge and the Mississippi River on I270S/I255E at the Telegraph Exit (Exit 2) in Oakville, MO 63129. Oakville is a southern suburb of St. Louis County. It is a combination of residential and business with a population of approximately 36,143. Other significant places in the area include:

Location	Rivers	Airports	Scott Air Force Base	Boeing Defense Space & Security	Whiteman Air Force Base
Oakville, MO 63129	Mississippi River is 2 miles to the east Meramec River is 3 miles to the southwest	Lambert St. Louis International Airport is 29 miles north and west Spirit of St. Louis Airport in Chesterfield is 25 miles to the north and slightly west Downtown St. Louis/Cahokia Airport is 14 miles to the east and north in IL	30 miles to the northeast in IL	30 miles to the northwest in Hazelwood, MO The Boeing Company is the second largest defense contractor in the world and is responsible for defense and aerospace products and services.	200 miles to the west and north on the western side of the state of MO The Northrop B-2 Stealth Bombers are located here

PHOTO ANALYSIS

Robert Powell, MUFON Director of Research

Robert Powell, MUFON Director of Research conducted an analysis of the photographs taken by the Witness 2 (Son), during the event. His Photo Analysis Report and the correlating photographs in Appendix A are attached to this report and is also attached in File 2 on the CMS. Since the automobile was in motion when the photos were taken, it is to our advantage, because it helps rule out some things the object more than likely was not. The calculation of the angular size of the object indicated "This equates to an object that takes up about the same amount of sky as the full moon."

The report ruled out the possibility of the object being an insect; "Therefore the object could not have been an insect or any other one inch sized object because it would have needed to be so close to the automobile that multiple photos of it could not have been taken. A small object would have shown up in only one photo before shifting over 90 degrees due to the car's movement. This is also easy to

understand from a common sense perspective in that one certainly would not expect an insect at a distance of eight feet from an automobile traveling at 50 mph to remain visible for more than a split second."

The possibility of the object being a small bird or bat is also not likely: "A small bird or bat fits the size but would need to be flying parallel to the car in order to minimize the impact of the vector driven by the car's 50 mph speed. This would require a bird or bat traveling parallel to the car and at a minimum of 30 mph. At a distance of 48 feet a bird or bat should be recognizable. The object is also moving at an angle in relation to the car to suggest that it would be moving faster than the car during the two seconds that it was photographed, so now it would require a bird capable of 60 mph or more in level flight, that is traveling parallel to the car, and that is not recognizable as a bird or bat. The only animal of that size capable of maintaining that speed is the Mexican free-tailed bat with level speeds of 40 mph and capable of diving at 80 mph." "What makes it difficult to believe this is a bat is the movement from frames 920 to 921. Although there is a 2.28° angular movement between those two frames; the move is in the vertical direction. This would imply that the bat took a vertical drop while still maintaining its speed."

The report also shed doubt on a large bird: "There are similar problems as just mentioned with an object 18 inches in size that is traveling at a distance of 143 feet from the car. This size is similar to that of a large bird. Since the object's angular size is fairly constant then an object at that distance range would need to maintain a roughly constant distance from the car as it flew. The only large birds native to Missouri and capable of reaching such speeds only in a dive, the peregrine falcon and the golden eagle, visit this area during the winter and this occurred in late spring."

The report indicated: "Based on the discussions in the last few paragraph the feasible distances that allow an explanation for the object in the photographs are:

1. A Mexican free-tailed bat at 40-55 feet distance and diving at 60-70 mph.
2. Some type of new drone around one to two feet in size, oval shaped, at 100 to 200 feet distance and capable of speeds of 80 to 110 mph.
3. A larger oval shaped drone at about five feet in size, at a distance of 400-500 feet and capable of moving at speeds of 150 to 200 mph.
4. A small aircraft (20-30 feet) at a distance of 1900-2800 feet and traveling at 400 to 600 mph."

Tonio Cousyn, IPACO France

On February 26, 2015, Robert Powell contacted Antoine Cousyn an analyst for IPACO in Quimperlé, France for photo authentication and analysis. The IPACO dedicated software, derived from an established image intelligence operational tool, has been developed for five years in cooperation with Airbus/DS and CNES/GEIPAN to:

1. Assess the **authenticity** of the document (evidence of a fake)

2. Identify a **spurious effect** (no phenomenon outside the camera)
3. Perform measurements in order to **identify a known phenomenon**
4. Perform measurements in order to **characterize an unidentified phenomenon**

Attached in Appendix B is the documentation of conversations between Robert Powell, MUFON Direction of Research and Tonio Cousyn, member of IPACO software team which includes the photo analysis data and conclusions:

1. Cousyn agreed with the basic parts of the Powell report and believes the object's distance was somewhere between 70 to 2300 feet.
2. Cousyn's data indicated that the blur seen from the object was due to its movement and not the movement of the car or the camera-phone.
3. Cousyn's data indicated that the object is traveling erratically and in a curved path:

"The fact that this movement cannot be seen in some other pictures is possibly caused by what could be called an erratic movement, i.e. moving for example in a straight line on a **transverse plane** between photos #918 and #919 and in another axis more oriented towards the camera (the object then moving a little more away) in photos #922, #923 and #924. This strongly suggest a sort of sinusoidal or **curved trajectory**."

4. Cousyn believes the Photo #915 is a different object and possibly an insect.

CONCLUSION

Based on the witness testimony and the photo analysis data by Powell and Cousyn, it appears that the object was a craft, based on the witness's noting the shiny metallic appearance that reflected the sun. The object appears to be a disk shaped craft traveling erratically and in a curved type path. Since one would expect a drone to fly in more of a straight path if at high speed then this does not fit the normal expectation of a drone due to its speed and curved path. Therefore, it is being classified as an Unknown UAV.

CMS Photo & File Correlation

The photo correlation is:

CMS by Witness	Witness Photograph
File 1	#915
File 2	#916
File 3	#917
File 4	#918
File 5	#919
File 6	#919
File 7	#920
File 8	#922
File 9	#924
File 10	#926

CMS by Investigator	Witness Photograph
File 1	Field Investigator Report
File 2	Photo Analysis—Robert Powell
File 3	Documentation of IPACO Analysis
File 4	#916
File 5	#918
File 6	#921
File 7	#923
File 8	#925
File 9	#927
File 10	#930

Photo Analysis of Photographs

June 8, 2014

St. Louis, Missouri

By Robert Powell

ANALYSIS OF PHOTOGRAPH EXIF DATA

The camera used in these photos was an Apple iPod Touch 5G. This was reported by the witness and by looking at the EXIF data embedded in each of the photographs. A software program that looks at the compression signatures of photographs to verify that a photograph has not been manipulated in any way was used to examine all of the photos. This was done using JPEG Snooper version 1.7.3, which received a 5 of 5 star rating on CNET magazine. There was no indication of any manipulation of the photographs. Additionally, a photograph prior to and after the photos in question was obtained to verify the camera's compression signatures were not changed. Lastly, the witness was asked to keep the original photos in his camera.

The embedded EXIF data on the photographs verified the date of the incident as claimed by the three witnesses as June 8, 2014 at 7:47pm. The ISO setting of the camera was 50, the F-stop or relative aperture was 2.4, and the exposure was 1/120" for all photographs. The image width and height was 960 x 1280. All thirteen photos were taken within three seconds of each other. The exact time that each photo was taken to the nearest .001 second is shown in the following table. A copy of each image is attached in the appendix.

Photograph Number	Time of Photograph	Time change from previous photo
915	19:47:14.074 hours	N/A
916	19:47:15.273 hours	1.199 seconds
917	19:47:15.462 hours	.189 seconds
918	19:47:15.618 hours	.156 seconds
919	19:47:15.781 hours	.163 seconds
920	19:47:15.948 hours	.167 seconds
921	19:47:16.096 hours	.148 seconds
922	19:47:16.250 hours	.154 seconds
923	19:47:16.419 hours	.169 seconds
924	19:47:16.587 hours	.168 seconds
925	19:47:16.718 hours	.131 seconds
926	19:47:16.896 hours	.178 seconds
927	19:47:17.034 hours	.138 seconds

TABLE 1

CALCULATION OF PIXEL ANGULAR SIZE IN CAMERA

A study of objects of known distance and size were used to imperially calculate the angular size of each pixel in the 960 x 1280 array used by this camera. This information can then be used to calculate the angular size of any object in the photograph. Photos of these landmarks made by Google are in the appendix in Images A and B.

The first calculation was made using a nearby road sign. The "Exit 2" road sign is in photograph #915. The vertical size of the number "2" in the sign is 375mm or 1.25 feet per the Missouri Sign Manual document. Using Google Earth the distance between the witness in the auto and the sign was estimated at 57 feet +/- 5 feet. Solving for the formula, tangent of angle = opposite side (size of the "2" on the sign)/ adjacent side (distance to the sign), this equates to a vertical angular size in degrees for the number "2" in the sign of $1.30^{\circ} \pm .13^{\circ}$. There are 34 pixels in the vertical direction of the number "2". The angular pixel size for this cell phone camera is therefore $(1.26^{\circ} \pm .13^{\circ}) / 34 = .037^{\circ} \pm .003^{\circ}$ per pixel.

A second calculation was made using the distance and the height of the underpass in photograph #916. The height of the overpass was calculated using Google Earth and came out to be 18 feet +/- .5 feet and the distance to the underpass as 1099 feet +/- 10 feet. There are 24 pixels in the vertical direction of the underpass. Using the same formula as before resulted in an angular pixel size for this camera as $.039^{\circ} \pm .001^{\circ}$

A third calculation was made using the distance and width of the Jefferson Barracks Bridge in photograph #915. This bridge was 8466 +/- 40 feet from the witness based on Google Earth and each side is 70 feet across based on Google Earth. There are 13 pixels in the horizontal direction of each side of the bridge. Using the same formula as before resulted in an angular pixel size of $.037^{\circ} \pm .002^{\circ}$

The calculations of angular size of three different objects in two different photos and at three significantly different distances all resulted in very similar results. Based on these results an average value of $.038^{\circ} \pm .002$ per pixel will be used.

CALCULATION OF ANGULAR SIZE OF OBJECT

The pixel size of the object was measured using photograph numbers #916 - #927, except for #925 which was too blurry to measure. The object's shape was oblong with a length to width ratio of roughly 5:3. The number of pixels making up the object increased during the two seconds of photographs from a size of 14 x 8.5 pixels to 16.9 x 9.9 pixels. The angular size can be calculated by multiplying these values by $.038^\circ$ per pixel, giving an angular size of $.53^\circ \times .32^\circ$ in the first photo to an angular size of $.64^\circ \times .38^\circ$ in the last photo. This equates to an object that takes up about the same amount of sky as the full moon. The pixelated object is shown at its smallest and largest size in Figure 1 and Figure 2 respectively.



FIGURE 1: Photo #916; 14 x 8.5 pixels pixels

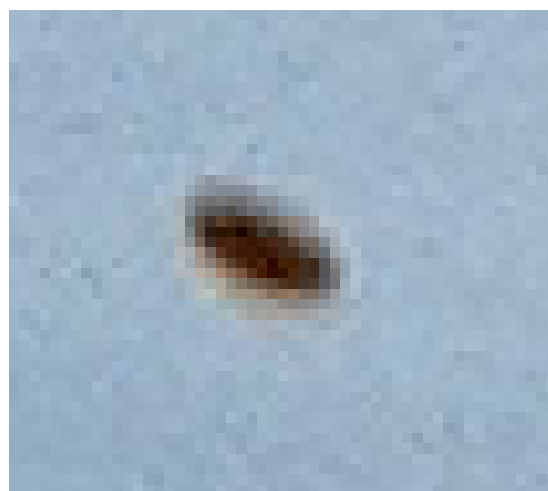


FIGURE 2: Photo #927; 16.9 x 9.9

POSSIBLE SIZE, DISTANCE, AND SPEED ESTIMATES

We know the angular size of the object but not its distance or its true size. We can, however, create a table that shows a relation of distance and size based on the known angular size. This is done using the trigonometric relation $\tan A = a/b$ where 'A' is angular size of an object, 'a' is the physical size of an object, and 'b' is the distance to an object. An average angular size of $.60^\circ$ was used in creating Table 2 and includes the error in the angular size determination.

If the object's length is:	Then the object's distance is:
one inch (large insect)	8 +/- .4 feet
6 inches (small bird or bat)	48 +/- 2.5 feet
18 inches (large bird, balloon, or small drone)	143 +/- 7 feet
5 feet (medium size drone, large balloon)	477 +/- 24 feet
20 feet (large drone, helo, small plane, milt jet)	1910 +/- 96 feet
100 feet (small to medium size jet)	9549 +/- 477 feet (1.7 to 1.9 miles)
250 feet (large jet or blimp)	23,873 +/- 1241 feet (4.5 +/- .24 miles)

TABLE 2

Table 2 shows the possible objects that fit those size and distance relationships. Additional information can be determined by taking into account the movement of the automobile. The photographs were taken by the passenger as the driver began taking the exit ramp from the freeway. The speed of the vehicle when taking the exit is important as a certain amount of movement in the photographs can be due to the movement of the vehicle rather than that of the object. Both occupants of the car were observing the object as the exit occurred. The automobile was exiting off freeway 270 at exit 2 to Telegraph Road. The speed limit on the highway is 60 mph and the speed limit for the exit is 40 mph. The driver estimated that she was exiting at between 40-55 mph. There is a tendency for most drivers to exit at above the exit speed limit but in this instance there might also be a tendency for the driver to slow down some since she was also observing an object while driving. For the purposes of calculating movement in the photographs of other objects induced by the vehicular movement, an exit speed of 50 mph +/- 10 mph will be used. Most of the photographs are about two tenths of a

second part, which would equate to a distance traveled by the automobile of 14.66 feet +/- 2.9. We can round this to 15 +/- 3 feet travel distance per .2 second period of time for our purposes. (The yellow line in Figure 3 represents the movement of the automobile during the three seconds when the 12 photos were taken.)

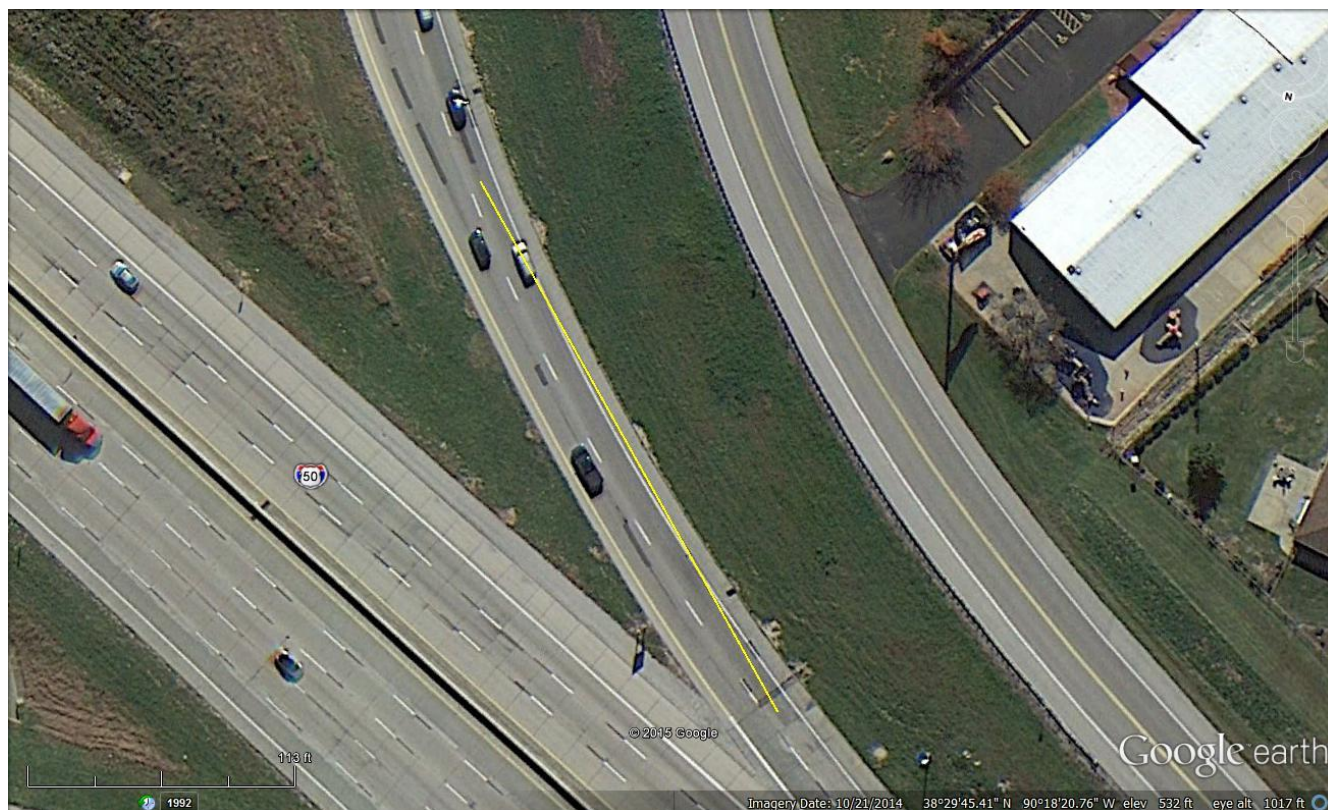


FIGURE 3

The value of the movement of the auto is that it allows the calculation of how much movement would be seen in an object, based on its distance, due to only the movement of the auto. A very distant object will not shift its location in the sky relative to the auto while an object close by will show extreme movement through the sky due to the automobile's movement. This movement can be approximated using the Law of Cosines and the angle of movement of the car as compared to the object in the sky. The object was to the east northeast of the automobile based on landmarks in the photo, and the car was exiting the freeway to the southeast. Using Google Earth to measure the angle of separation, the car was moving away from the object at a 68 degree angle, which is represented as angle 'C' in Figure 4. Adjacent side 'b' represents the 15 feet that the automobile moved in .2 seconds; and 'a' represents a given distance to the object. Once those values are substituted then the length of side 'c' can be calculated using the Law of Cosines where $c^2 = a^2 + b^2 - 2ab \cos(C)$ and with the value of 'c' then angle 'B' can be calculated using the formula: $\text{angle } B = \arccos((a^2 + c^2 - b^2) / 2ac)$. Angle 'B', the amount of angular movement, provides the apparent movement in the sky of the object based on the movement of the automobile.

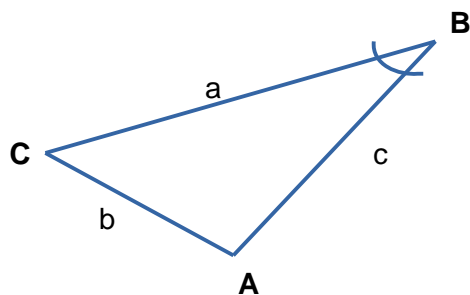


FIGURE 4

Table 3 shows the expected angular displacement of an object in the sky based on a given distance from the automobile and the automobile moving 15 feet +/- 3 feet in two tenths of a second. The error shown in the table is due to variability of the car's actual speed. The same distances used in Table 2 were used here.

Assumed distance to the object	Object's angular movement due to car moving 15 ft. in two tenths of a second
8 +/- .4 feet	> 90°
48 +/- 2.5 feet	18.2° +/- 4.1°
143 +/- 7 feet	5.8° +/- 1.2°
477 +/- 24 feet	1.7° +/- .4°
1910 +/- 96 feet	.4° +/- .1°
9549 +/- 477 feet (1.7 to 1.9 miles)	.08° +/- .02°
23,873 +/- 1241 feet (4.5 +/- .24 miles)	.03° to .04°

TABLE 3

The information in Table 3 along with the apparent movement seen in two seconds worth of photos allows one to bracket potential distances for the object. The first row of Table 3 indicates that an object eight feet in distance will have shifted more than 90° in two tenths of a second due to movement of the automobile. Table 2 shows that an object at that distance would have been one inch in size in order to match the angular size in the photo of .6°. Therefore the object could not have been an insect or any other one inch sized object because it would have needed to be so close to the automobile that multiple photos of it could not have been taken. A small object would have shown up

in only one photo before shifting over 90 degrees due to the car's movement. This is also easy to understand from a common sense perspective in that one certainly would not expect an insect at a distance of eight feet from an automobile traveling at 50 mph to remain visible for more than a split second.

An object 48 feet away and six inches in size is also problematic. A small bird or bat fits the size but would need to be flying parallel to the car in order to minimize the impact of the vector driven by the car's 50 mph speed. At a distance of 48 feet a bird or bat should be recognizable. The object is also moving at an angle in relation to the car so that it would be moving faster than the car during the two seconds that it was photographed. This situation can be visualized in Photo C of the appendix. An image of the line of sight of the object as the car is traveling is displayed. Using this ruler to estimate 48 feet, the distance of a 6" bird or bat would have placed it in the green meridian, and the bird/bat would have had to have crossed 202 feet of space in the same time (1.76 seconds per Table 1) that the car covered 163 feet, which means it would have been moving 20% faster than the car. Since there is no indication of a wing or appendage in the photos, the bird/bat would have had to maintain that speed without flapping of wings for 1.76 seconds. The only animal of that size capable of maintaining that speed is the Mexican free-tailed bat with level speeds of 40 mph and capable of diving at 80 mph.

There are similar problems as just mentioned with an object 18 inches in size that is traveling at a distance of 143 feet from the car. This size is similar to that of a large bird. Since the object's angular size is fairly constant then an object at that distance range would need to maintain a roughly constant distance from the car as it flew. This can also be visualized using Photo C in the appendix. An object at 143 feet would need to traverse 285 feet in the same time that the auto traveled 163 feet, which means it would have had to be moving at about 90 mph. The only large birds native to Missouri and capable of reaching such speeds only in a dive, the peregrine falcon and the golden eagle, visit this area during the winter and this occurred in late spring. There are small drones in that size range but none are known to be shaped as an oval object and capable of traveling at 90 mph.

Objects twenty feet in size or larger, as shown in Table 2, would be at 1910 feet or farther to match the angular size of the object in the photos and in those cases the impact of their movement by the automobile would be minimal as shown in Table 3. Movement of these objects in photo to photo would be caused by the speed of the object itself. For example, an object at 1910 feet that was twenty feet in size would take up .6 degrees of the sky just as what was seen in the photo. Its speed at that distance would be between 500-550 mph. As the distance from the camera location increases the speeds go up. Due to these higher speeds, objects above about thirty feet in size are eliminated.

Based on the discussions in the last few paragraph the feasible distances that allow an explanation for the object in the photographs are:

1. A Mexican free-tailed bat at 40-55 feet distance and diving at 70-80 mph.
2. Some type of new drone around one to two feet in size, oval shaped, at 100 to 200 feet distance and capable of speeds of 80 to 110 mph.

3. A larger oval shaped drone at about five feet in size, at a distance of 400-500 feet and capable of moving at speeds of 150 to 200 mph.
4. A small aircraft (20-30 feet) at a distance of 1900-2800 feet and traveling at 400 to 600 mph.

The above discussions were based on an assumption of uniform speed across the 1.76 seconds of photographs. However, measurements of angular movement from photo to photo varies. This variation can be used to further delineate the possible identity of the object.

The angular movement from photos #916 to #917 and from #917 to #918 are almost identical. An examination of the angular displacement of the object from photo #916 to #917 (this angular displacement was calculated by using the bridge and tree clump as reference points and using .038 degrees/pixel to calculate the angular displacement) shows that it moved 3.34 degrees (Up to 12% of that movement or .4 degrees could be due to the car's movement if the distance was 1910 feet. Since the direction of the object is in the same general direction as the car, the car's movement will reduce the actual movement) in 0.189 seconds. The angular displacement from photo to photo was calculated using this same procedure. Table 4 displays the various speeds in miles per hour (mph) required to cause this amount of angular displacement at various distances. Only distances at 1910 feet and farther are shown because an object closer in will be impacted significantly by the movement of the car. Error due to small angular shifts caused by the car's movement are obtained from Table 3; corrected for actual time movement compared to the two tenths of a second time in Table 3; and are shown in the speed variation for only the 1910' column because the errors due to the car's movement is too insignificant in the other columns.

The speeds shown in Table 4 for objects in the column reflective of distances of 9549 feet and 23,873 feet are so large that they effectively eliminate any object at that distance. An object at 1910 feet (which would be 20 feet in size based on Table 2) is somewhat difficult to explain due to the high variation in the speeds shown. These high speed variations are driven by the large angular displacement variation seen in a lot of the photos but especially seen in photo #919. However, the speed calculations assume the object is moving in a straight line parallel to the camera. If the object also had movement towards/away from the camera then that would cause additional speed variations.

The most likely remaining possibilities are an object at distance of between 48 to 477 feet. Let's begin with the possibility of a Mexican free-tail bat. Because the bat would have had to fly parallel to the car to minimize the car's movement, the best case scenario will be assumed, which would minimize the movement of the car. This bat is 3.5 to 4.5 inches in size. The table originally assumed a six inch object displacing .6 degrees of sky, which equates to a distance of 48 feet. This bat would need to be 28 to 36 feet in distance to displace .6 degrees of sky and its wings would need to be folded in a dive to reach the necessary speeds to not be left behind by the car during those two seconds. This could be done if the bat was traveling at a speed 15% greater than the car (The car traveled an estimated 162 feet, frame 916 to 927, in 1.76 seconds per Table 1. At a distance of 32 feet the bat would have traveled 186 feet.). This puts the bat traveling at 72 mph, which is possible if the bat was in a dive. What makes it difficult to believe is the movement of the object from frames 920 to 921. Although there is a 2.28° angular movement between those two frames; the move is in the vertical direction.

This would imply that the bat took a vertical drop while still maintaining its speed while in a dive; very difficult to believe.

Frame to Frame	Time Delta	Angular Shift	Distance@ 1910' .4° error	Speed mph@ 1910'	Distance@ 9549' .08° error	Speed mph@ 9549'	Distance@ 23873'	Speed mph@ 23873'
916-917	.189"	3.34°	111'	354-400	557'	2010	1392'	5022
917-918	.156"	3.31°	110'	436-481	552'	2435	1380'	6032
918-919	.163"	6.27°	209'	829-874	1046'	4375	2615'	10939
919-920	.167"	4.18°	139'	523-568	697'	2846	1742'	7113
920-921*	.148"	2.28°	76'	305-350	380'	1751	950'	4377
921-922	.154"	1.67°	56'	202-248	278'	1231	696'	3081
922-923	.169"	1.52°	51'	160-206	253'	1021	633'	2554
923-924	.168"	2.36°	79'	275-321	393'	1595	983'	3989
924-927	.447"	10.45°	349'	486-532	1747'	2664	4366'	6658

* Angular shift is vertical

TABLE 4

The last distance range that has been fully discussed is the range represented by an object five feet in size and 477 feet in distance. This distance is in an area where it is still affected by the car's movement (Table 3 indicates a 1.7° movement in .2 seconds due to the car.) but it is not so close as to be driven out of the viewing photos if the object doesn't travel parallel to the car. It is too close to be able to eliminate movements due to the automobile, which makes it more difficult to analyze. The distances chosen in these tables are arbitrary but they can be used to extrapolate information for other objects of similar size. All that can be said is that objects in the distance range of 400 to 800 feet would be respectively four to eight feet in size and in a speed range of 185-370 mph. This eliminates most objects other than some type of small drone.

PHOTOGRAPH #915

Although photograph 915 was helpful as a reference point in the calculation of angular degrees/pixel, it is also of interest in terms of an object in that photo. The witnesses indicate that the object in this frame is the same object that they saw in photos 916 – 927. Photo 915 was taken 1.2 seconds prior to photo 916 while the remaining photos were all taken in very rapid succession and less than .2 seconds apart. The witnesses stated that either the object in photo 915 is a different object or it rapidly accelerated. The movement was so quick that the witnesses are not certain which occurred. The object that has been discussed through most of this analysis is the one shown in Figure 6. The size and the proportion of the length/width is similar but not exact. Whether these are the same object is difficult to ascertain due to either the distance or size of the object in Figure 5. Because of that, it is not worth trying to analyze the object in photo #915 in detail. But if it is the same object as in the other photos then it would have moved at extreme speed. Image C in the appendix shows a red arrow as the line of sight to the object in photo 915. This line of sight is completely out of order with the other photos so it would have taken a sudden movement and change of direction to be the same object as are in the other photos.

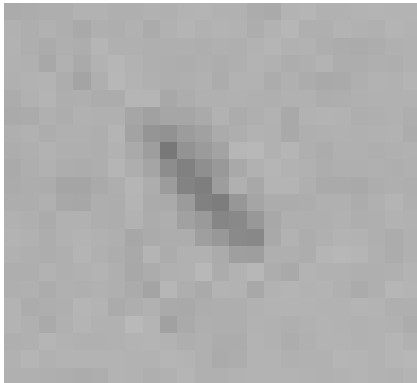


FIGURE 5; Object in Photo #915



FIGURE 6; Object in Photo #916

APPENDIX A

**Appendix to
Photo Analysis of Photographs**

June 8, 2014

St. Louis, Missouri

By Robert Powell

A

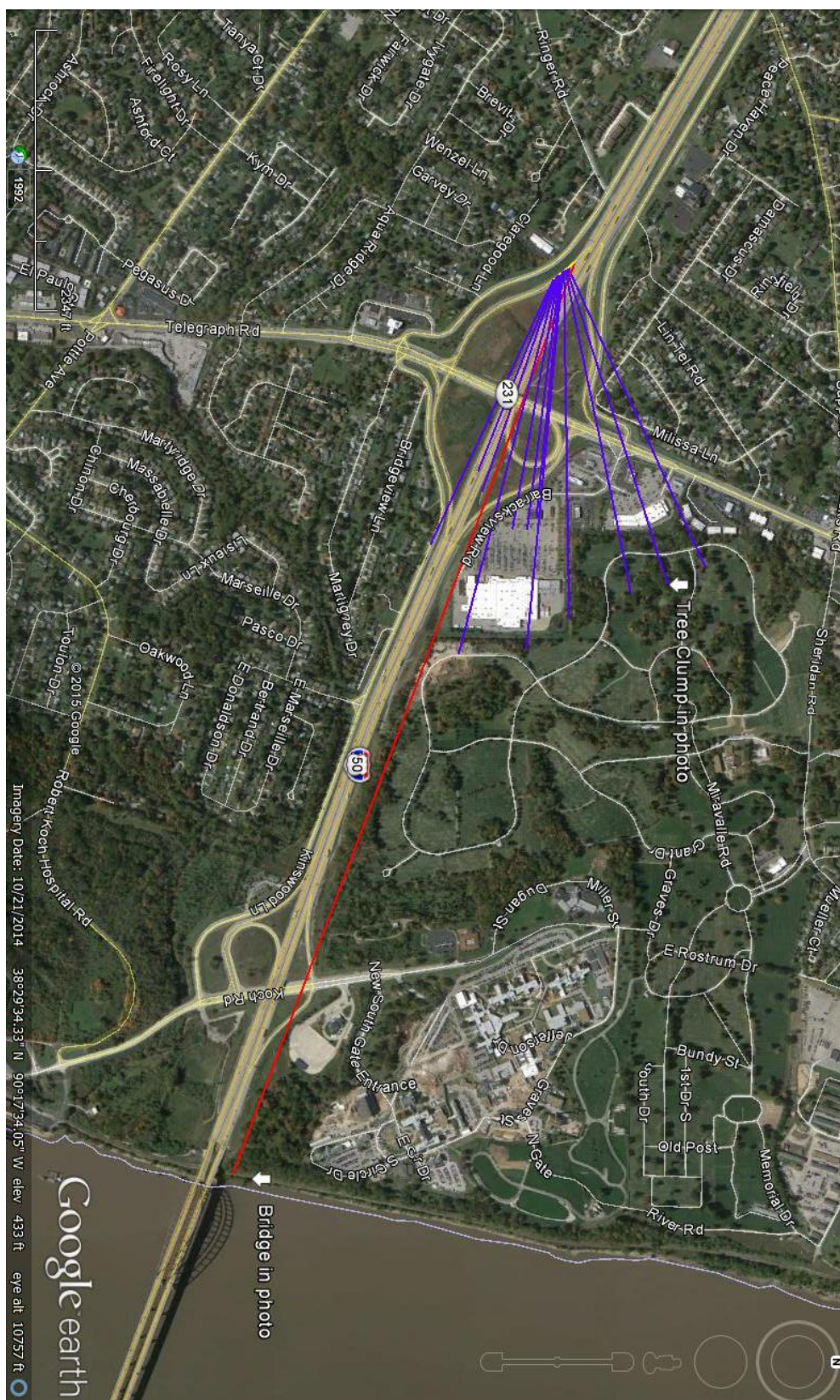


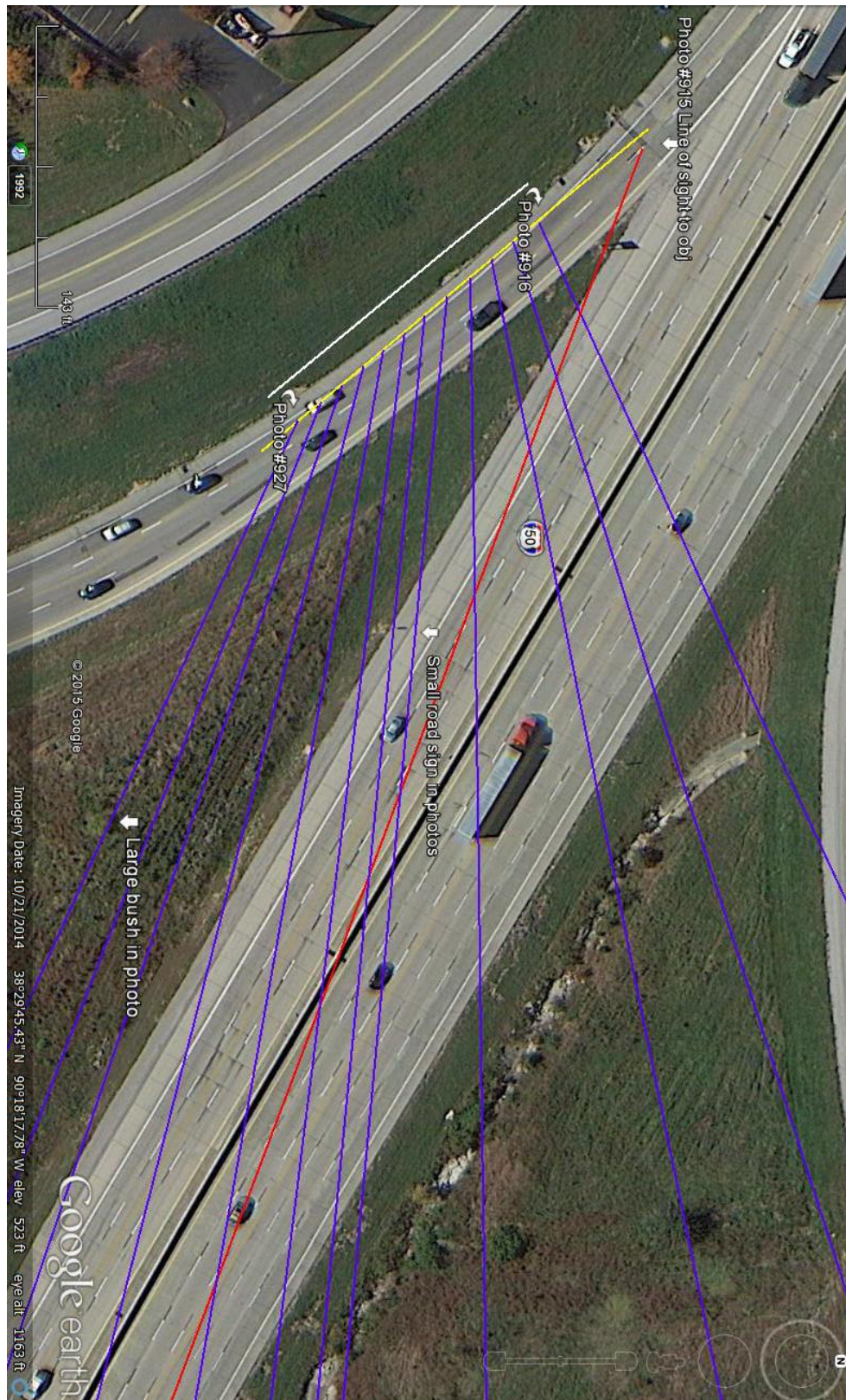
Image of distant landmarks; bridge and tree clump

B



Images of nearby landmarks

C



Line of Sight for Photos #915(red) and #916 - #927 (blue)



Photo 915



Photo 916



Photo 917



Photo 918



Photo 919



Photo 920



Photo 921



Photo 922



Photo 923



Photo 924



Photo 925



Photo 926



Photo 927

APPENDIX B

DOCUMENTATION OF CONVERSATIONS BETWEEN ROBERT POWELL, MUFON DIRECTOR OF RESEARCH, AND TONIO COUSYN, MEMBER OF IPACO SOFTWARE TEAM

Most recent listed first and original communications listed last.

On 3/25/2015 12:53 PM, tonio cousyn wrote:

Hi Robert,
You're welcome.

Yes, you're right and that's the conclusion my analysis leads me to as well.

In photo #915, the object looks like a "blurfo", a close insect quickly passing in front of the camera. Definitely not the same object, not the same radiometry, color, etc... If you need some IPACO screen capture on it, with radiometry measurements, just let me know.

Of course, you can include my report with yours and with that of the field investigator.

Tonio

Date: Wed, 25 Mar 2015 10:21:06 -0500

From: Robert Powell

To: Tonio Cousyn

Subject: Re: Interesting set of photos and an initial photo analysis

Hi Tonio,

Thank you very much for your analysis. It was valuable to see the analysis in terms of isolation of the blur of the car vs the object. That was helpful.

If I understood correctly, the IPACO software indicates that the distance of the object is somewhere beyond the road side (about 70 feet distance) and the clump of trees (about 2300 feet distance). This is similar to my estimate of distance, which was between 48 feet to 477 feet. This puts the object's size at one foot to five feet depending on distance and traveling at 50 mph to 200 mph depending on distance. If its distance approaches the clump of trees then the size would be about 20 feet and a speed of around 400 mph. Both witnesses indicate that they saw the sun reflect off the object. The only explanation that I can think of is some type of new military drone that is disk shaped.

If photo #915 is the same object then it becomes more difficult to explain due to the change in distance and line of sight that occurs during the 1.199 seconds between photos 915 and 916. Do you think those are the same object or is it not possible to determine?

Would you mind if I include your report with my report and the report from the field investigator that interviewed the witnesses?

Thanks,
Robert

Subject: RE: Interesting set of photos and an initial photo analysis

Date: Sat, 21 Mar 2015 16:02:15 +0100

From: tonio cousyn

To: Robert Powell

Hi Robert,

Sorry for the delay, but I finally found the time to take a closer look at your case.

Of course, there are lot of motion blur in all the photos, however and fortunately, some of them show interesting characteristics:

- File IMG_924:

The object appears to be very sharp with a radiometric slope as low as almost 2 pixels in the smaller axis (See attached file #1) and 3 pixels in the bigger axis (attached file #2). There's neither any motion blur detected and eventually caused by the cameraman movement of the car movement nor any depth of field blur. It's visible in comparison with the radiometric slope of the windscreen wiper visible on the lower part of the picture (attached file #3) that shows a 4.6 pixel slope (for a potential cameraman movement). The smaller difference is likely due to a small out-of-focus effect thought.

Radiometric measurements show that the object is rather dark but no distance determination can be drawn from the lower gray pixel examination and comparison (attached file #4). All that can be said is that the atmospheric diffusion effect is barely visible in the more distant landscape (1 compared to 2).

What could be the most interesting things to compare in this picture is the motion blur effect caused by the car movement both on the UFO and on the closer landscape. General axis of the blur is oriented towards 2 o'clock in the very close objects (closest parts of the road) and the farthestmost we look at, the more this axis naturally tend to turn up to 3 o'clock.

However, while this blur is clearly visible on the road, it is barely visible on the small grassy promontory and cannot be detected/quantified by IPACO anyway, as there are not enough contrasted areas located in a transverse axis of the blur in this landscape part. The same problem occurs as well with the more distant landscape reference points in all the images.

So, my best guess at this point is that the UFO is NOT affected by any motion blur eventually caused by the car movement, and this is confirmed by the analysis of some others pictures (see below).

What could also be a (little!) clue for the object's distance is the comparison of its radiometric slope in IMG_924 to that of other objects, even in other photos. UFO in IMG_924 appears as neat as possible with a 2-3 pixel radiometric slope. The road sign on picture IMG_915 (not affected by any cameraman blur) have a 3.8 pixels radiometric value for its motion blur oriented in the axis of the car's movement (attached file #5). As the car seems to keep all along its same relative position to the side of the road, we can assume that the distance that separates the car from this side is constant.

However, as you show it in appendix C, the line of sight for image #915 is not the same as the others and the camera angle from the car movement is smaller, thus the distance that separate the side of the road than the car greater; but this will not change the range of possibilities.

If the UFO were located at the same distance as that of the road sign, it would inevitably showed the same blur and radiometric slope (and this is not the case in image #924), and the more close it is, the more this blur is present.

We can deduce from this that the UFO is located likely a little further away, and at least further than a point where the motion blur effect is not detectable anymore. On image #915, it will be likely a little further than the road sign and up to the distant trees located on the lower leftmost part of the image (tree clump).

File IMG_918 and IMG_919:

Interestingly, if you look closely at the axis of the blur visible on the UFO in photo #918 and #919 (+/-5 o'clock), it's clear that this blur is not oriented at all the same way as the blur caused by the car movement (2-3 o'clock), if the UFO is close (and the same goes as well if it is more far away as the camera exposure time settings barely (or completely not) allow this blur to be visible in the farthestmost objects - the "EXIT" road sign in IMG_915 for example show a 3.8 pixel radiometric slope whereas the distant trees show a 1.7 pixel radiometric slope [attached file #5]). So, again, this blur is NOT caused by the car movement, but rather by the object itself, either by parts of it (like wings in the case of an insect, but unlikely as they can't be seen in image #924) either by its own movement during the exposure time.

The fact that this movement cannot be seen in some other pictures is possibly caused by what could be called an erratic movement, i.e. moving for example in a straight line on a **transverse plane** between photos #918 and #919 (attached file #6) and in another axis more oriented towards the camera (the object then moving a little more away) in photos #922, #923 and #924. This strongly suggest a sort of sinusoidal or curved trajectory (see below).

Radiometric slope difference between big and small axis of the UFO in photo #918 can be seen in attached files #7 and #8 (8.3 for the big axis and 2.8 for the small).

A registration with IPACO of images from IMG_916 to IMG_927 using close reference points shows this sinusoidal movement (attached files #9 and #10). The distance that separates the object's position between IMG_918 and IMG_919 is longer than everywhere, while there's no significant difference in the time that separate these shoots than in the others. This confirms that the object was moving in a transverse plane between these two images, with likely an angle close to 90° to the camera plane, and with a blur axis lined up between the two images.

This allows as well to measure the angular length of the blur (0.37° in IPACO) for eventually further speed estimations.

Conclusion:

The best I can tell is that:

- 1- The UFO is likely at a distance between a point located a little further away than the side of the road and the clump of trees,
- 2- His sharpness is not affected by the car movement,
- 3- The motion blur visible on the UFO is caused by its own movement and is more visible when it move along a transverse plane.
- 4- It has a sinusoidal trajectory,
- 5- Best accurate speeds/distances/sizes computation could take into account these results and can be done especially with pictures 918 and 919.

I'm afraid that all of this will not help you that much in your analysis, but the blur analysis is not that easy here, especially with photos taken with this android camera where basically everything is inside the DOF...

Let me know if you need any other measurements, especially about radiometry.

Tonio

Date: Fri, 27 Feb 2015 20:27:50 -0600
From: Robert Powell
To: Tonoï Cousin, Francois Lousange
Subject: Re: Interesting set of photos and an initial photo analysis

Hi Tonio,

Attached are original copies that will allow you to obtain the EXIF data.

If you need any further information let me know.

By the way, I have found a free software that is quite useful and perhaps you might be able to use some of its features. It was developed by a U.S. government organization. Here is a link to the site:
<http://imagej.nih.gov/ij/>

Robert

On 2/27/2015 12:32 PM, tonio cousyn wrote:

Hello Robert,

Nice analysis that I fully agree with.

There are three more things/ideas that immediately come up in my mind that could possibly better define the possible distance the object was standing at:

1- **The radiometric tools** as the object, while mainly brown, appear to have some dark parts. However, while the darkest gray pixel value is around 10/15, this only discard the possibility for the object to be very far away as the other lower gray pixel values for the other parts of the scene (at the exception of the most far away) have the same range of value (mainly comprised between 0 and 20).

2- By chance, there is one photo where the object is as sharp as possible (#924) and does not show any motion blur. **The sharpness estimation (FTM)** could be helpful as well for the determination of the possible distance. However, in photo #924 and at first glance, I'm not sure that it will be conclusive and informative as we have around the same gray/pixel slope for both the object and the distant tree line...

Conclusion of the two above is that these methods are not more helpful than what you have already done for the distance determination.

3- A reconstruction of the total path of the object using **distant** landscape reference points in the "**3 points registration**" tool of IPACO will "freeze" the car movement and then only show the "real" distance vs size vs speed of the object. In fact, the registration will act as if the photos were taken from a motionless car. This can be done on the 8 possibly 9 first photos though.

If the registration is well done, then it will become easier to do some speed estimation, using the time laps that separates each photo, without taking account the speed of the car.

I can try to do this if you want, but I would need then the original full format photos.

As to try to determine the distance using the amount of blur in the object and some landscape points, I'm not sure if that can be done as we don't know if the object's blur is caused by its own movement or by the car movement and, if both, in which proportion.

All the best,

Tonio



MUFON FIELD INVESTIGATOR'S REPORT



Date: Thu, 26 Feb 2015 19:23:45 -0600
From: Robert Powell
To: Francois Louange, Tonio Cousyn
Subject: Interesting set of photos and an initial photo analysis

Bonjour Francois and Tonio,

I have recently analyzed an interesting set of photos; thirteen photos of an unknown object taken across a three second period of time with most photos within about two tenths of a second of each other. My evaluation of the photos is attached in the file labeled "June 2014 Missouri photos" and the investigator's preliminary report is also attached and is labeled "57046_report..." I do not have a theory that adequately explains the object in the photos. What is nice about this set of photos is that they were taken from a moving car so there is the added issue of the car's movement and its impact on the movement of the object in the photos; a photo of a nearby object would be severely affected by the movement of the vehicle while an object farther away would not be. Perhaps the level of blur in the object as compared to that of nearby and far-away objects can help determine the object's distance.

If you believe this set of photos is worth analyzing and if you have the time then let me know and I will email you original copies of the photos. I look forward to hearing back from you.

Best wishes,

Robert