

Analysis of Digital Photographs of Commercial
Airplane and Small UAP on November 8, 2009¹

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Abstract

This paper describes the analysis of high resolution color, digital photographs of a two-engine commercial jet airplane and relatively small, white UAP nearby. Seven high resolution frames were taken at between 17:16:37 hrs and 17:16:50 hrs. MST and another nineteen of allegedly the same luminous object beginning at 17:46:35 hrs. and ending at 17:48:13 hrs. A third set of six images was taken between 17:51:42 hrs and 17:53:35 hrs of three military jets that arrived minutes later and flew overhead in the same direction as the commercial jet airplane. The photographer's location was near Cottonwood, Arizona. The first two photos each clearly show the UAP and airplane. The following five photos show only the UAP located near the jet's contrail. Most of the remaining nineteen photos (taken thirty minutes later) show a single, intensely white object seen against a homogeneous, darkening sky. There is no consistent shape to the very intense UAP. The jet's contrail remained straight suggesting that the pilot didn't see or try to avoid the UAP. The calculated lateral velocity of the UAP was about eleven mph, consistent with that of a balloon of some kind, except that it flew against the wind. The UAP could have been illuminated by the setting sun and disappeared when it burst. The UAP did not clearly impact flight safety and cannot be identified at this time.

¹ The author thanks the Mutual UFO Network and Mr. Dominic Mancini for his cooperation with this study.

Introduction

Mr. XX (referred to as first witness) submitted four (4) color, digital photographs to the Mutual UFO Network (MUFON) through its web-based Case Management System (CMS)² on November 9, 2009. Subsequently he submitted to the author a DVD copy of thirty-one photographs he had taken. He took all of them between 17:16:37 and 17:53:35 on November 8, 2009³ from his home near Cottonwood, Arizona⁴ soon after his girlfriend had called his attention to a commercial airplane passing overhead toward the NW with two prominent contrails behind it and a bright spot of white light. Thirty five seconds after he had taken what he thought was to be his final photograph at 17:48:13 hrs. the witness saw three military jets airplanes approach at high speed from the SE in formation and flying on the same heading as the larger jet had. He took five more photographs of them.

The Commercial Airplane

The first analysis consisted in enlarging the image of the jet airplane. Figure 1 shows it to be a B-737-300 (or later model) with the newer high-bypass engines. The width of its fuselage is 12.3 feet and the wingspan is 94.7 feet.

Figure 1

Enlarged Photograph of Jet Airplane

(IMG 0295) T = 17:16:37 1/500th sec. f8 250 mm



² MUFON Case Management number 20388

³ All dates and times obtained from the camera's RAW data file.

⁴ 34 deg 43.8 min N; 112 deg 2.1 min. W.; Yavapai County; Elevation: 3550 feet (approx.)

Inspection of a current high-altitude flight chart (H-4) near Cottonwood, Arizona did not show any jet airways oriented NW - SE (i.e., between Flagstaff and Prescott). The airplane could have flown to and from waypoints or perhaps was cleared to fly off an airway direct to a destination airport or to another waypoint.⁵

Camera and Lens

A new Canon Rebel, Model XSi, DSLR, camera was used (12 MB). It was operated with its auto-focus and auto-zoom set to "on" and its exposure program set to "normal." The glass zoom lens possessed a 55 to 250 mm range (maximum aperture: 4 - 5.6) and was set at full zoom (maximum magnification) for all photographs. The first witness said that he purchased this new digital camera with its large memory (and resolution capability) because he had seen and video recorded very unusual sky phenomena in Cottonwood on October 1st, and the 31st, 2009. The extreme sharpness of all photos in Series I attest to the auto-image stabilization system being on. The elongated images seen in some of the Series II photographs may be due to extreme camera motion that exceeded the capability of the image stabilization system's compensation.

The Photographs

On November 21, 2009 the first witness supplied the author with a DVD containing the raw digital images (about 18 MB each) as well as a JPEG compressed image (about 5 MB each) of each of thirty-one photographs. All images possessed 4,271 pixels x 2,848 pixels. The first seven (Series I) were of the airplane and its contrail, and the single, intense, white UAP. The next nineteen (Series II) showed the alleged UAP as a single, white spot.⁶ The final five (Series III) show either a completely dark field or an extremely interesting but bizarre and unexplained set of two luminous phenomena that are probably caused by the formation of military jet airplanes in some way that will not be considered here. Series III began 3 minutes 29 seconds after the last exposure in Series II and shows only two white spots and a reddish smeared image.

⁵ The author thanks commercial pilot Paul Kinzelman, NARCAP Research Associate for this information.

⁶ The last image was completely dark and probably convinced the witness to stop taking photographs.

Figures 2 and 3 are the first two digital color photos of Series I submitted to MUFON.⁷ "T" represents local time for each photograph. Shutter speed and the aperture setting (f) is also given. He said he had already taken 180 photographs with this new camera before these UAP photographs in order to learn how to use its many functions.

Figure 2

Photograph 1 of Commercial Airplane and UAP
 In Front of Airplane on its Left Side
 (IMG 0295) T = 17:16:37 1/500th sec. f8 250mm



⁷ MUFON's file number is given for each photograph so that interested readers can view them at: www.MUFON.com within the CMS section. Search for November 8, 2009 where the four images are located.

Figure 3
 Photograph 2 of Commercial Airplane and UAP
 Behind Airplane on its Left Side
 (IMG 0296) T = 17:16:39 1/400th sec. f8 250 mm



The remaining five photos of the UAP and jet contrail in Series I are not included here; the lateral distance (mm) between the UAP and the center of the contrail were:⁸ (frame 3: +11(right of centerline); frame 4: +5.8; frame 5: -1.5 (left of centerline); frame 6: -8; frame 7: -13; T = 17:16:40). The total elapsed time for these seven images was thirteen seconds or 1.9 seconds per image. These measured UAP offset distances are used later.

Weather

The nearest weather station was at Prescott, Love Field just over twenty five miles west of Cottonwood. Sunday had very pleasant weather with light (9-13 mph) ground-level winds out

of the S to SW for much of the day. Air temperature at the time of the sighting (1716 hrs MST) was 67 deg F,⁹ Dew Point 25, Relative Humidity 20%, visibility was clear, and the atmospheric pressure was 29.82 in. The first witness said¹⁰ that the weather was "pretty clear and calm." Local sunset was at 1726 hrs.

Image Data Analysis

The second analysis performed consisted of enlarging only the UAP area on all of the twenty-one photographs. Several are reproduced here (Figures 4 through 13) at the same enlargement factor to illustrate the wide range of shapes that were recorded.

Figure 4

Enlarged UAP from Figure 1 (Series I)
 IMG 0295 T = 17:16:37 1/500th sec. 250 mm



Figure 5

Enlarged UAP from Figure 2 (Series I)
 IMG 0296 T = 17:16:39 1/400th sec. f8 250 mm



⁸ All mm values are dimensionless, being taken from a computer screen with each image enlarged by the same amount.

⁹ The witness said, "...it was a bit chilly, in the 60s." (Personal correspondence, November 21, 2009)

Figure 6

Enlarged UAP of IMG 0299 (Series I)

T = 17:16:46 1/500th sec. f8 250 mm



Figure 7

Enlarged UAP of IMG 0301 (Series II)

T = 17:16:50 1/500th sec. f8 250 mm



Figure 8

Enlarged UAP of IMG 0359 (Series I)

T = 17:46:38 1/8th sec. f5.6 250 mm



Figure 9

Enlarged UAP of IMG 0360 (Series II)

T = 17:46:39 1/8th sec. f5.6 250 mm



¹⁰ Personal correspondence (November 21, 2009)

Figure 10

Enlarged UAP of IMG 0367 (Series II)

T = 17:47:06 1/15th sec. f4 65 mm



Figure 11

Enlarged UAP of IMG 0369 (Series II)

T = 17:47:15 1/13th sec. f5 100 mm



Figure 12

Enlarged UAP of IMG 0373 (Series II)

T = 17:47:33 1/10th sec. f5.6 171 mm



Figure 13

Enlarged UAP of IMG 0374 (Series II)

T = 17:47:38 1/10th sec. f5.6 194 mm



UAP Location Relative to the Airplane and Flight Path Deviations

If the cockpit crew had seen the UAP and considered it to be a danger for some reason they might have changed their flight path. When the author asked the first witness if he thought the airplane had altered its flight path in any way he said that he could not be sure.

The linearity of the contrail over all seven photos of Series I is important because it indicates that the jet's heading did not change significantly. This suggests either that the pilot did not see the UAP or, if he did, he did not consider it worth changing his heading. Again, it is not possible to determine which is correct without speaking with the flight crew.

The first seven photographs of Series I represents an elapsed time of about eleven seconds. Flying at a cruise speed of 485 mph the airplane would have traveled a distance of 1.48 miles in this short period of time.

Witness Interviews

The author phoned the first witness on November 14, 2009 (from 1737 to 1750 hrs) to obtain more facts about this sighting.¹¹ He was cooperative, friendly, knowledgeable, and willing help out in any way he could. He said he was a private pilot and that he had submitted jpeg (compressed) copies of four (4) photographs to Mr. Dominic Mancini of MUFON for possible analysis.

A second phone interview occurred on November 21, 2009 (1023 to 1055 hrs) with the first witness in order to clarify several other points. It was discovered that: (1) The zoom lens was set on automatic control and all other functions were under manual control, (2) He took the first two photographs (Nos. 0295 and 0296) "as fast as I could push the button (on the camera)." There was almost no pause between each shot. This would account for the two-seconds elapsed

¹¹ The witness had been contacted several times previously by Mr. Dominic Mancini, MUFON Assistant State Director for Arizona who was assigned to investigate this case. He provided the author with additional facts.

time. (3) When the airplane left the camera's field of view (after IMG 0296) the witness said the zoom lens changed its setting and caused it to go into a brief hunt mode which onto took two seconds to complete. (4) Once the UAP's location was reacquired he continued to take continuous photos at about 1 frame every two seconds for a total of another nine seconds. (5) Thirty minutes later at 17:46:35 hrs he began taking the second set (called Series II) of photographs only of the small, white UAP, (6) He said the UAP seemed to be moving slowly in the direction of Sedona.¹² The UAP disappeared either by fading out or leaving the area very fast, he couldn't be certain which is correct. (7) He said that he stopped taking photographs either because the object had gone or he had run out of memory in his camera. He couldn't remember which.

Based upon the internally registered clock times within the camera the following facts were also established: (1) The photograph taken at 17:48:13 showed no lights at all and probably represent his last attempt to capture the UAP in Series II. (2) Three minutes and twenty nine seconds later at 17:51:42 hrs he began taking a third and final set (Series III) of five photographs. He said that they were of a flight of three military jet airplanes that had unexpectedly arrived overhead. They flew toward the NW in the same flight path as had the commercial airplane. These images are not considered here.

The above estimated time intervals are useful in calculating the apparent velocity of the UAP. The first two photos (Figure 2 and 3) show the B-737 and provide a wingtip to wingtip linear dimension equivalent to a known distance of 94.75 feet. Table 1 provides measured and calculated values for the velocity of the UAP assuming that there was negligible horizontal movement of the contrail, i.e., it is assumed to be fixed in the sky for purposes of a first order approximation of UAP velocity and comparison with local winds (and thus possible balloon flight). Of course, local winds could have caused the contrail to drift toward the NE making a fixed point of light in the sky appear to move in the opposite direction. This possibility cannot be discounted.

¹² Sedona is located NE of Cottonwood which is in the opposite direction from the direction of travel of the UAP assuming that the witness's statement is correct that the airplane was flying toward the NW. It is not known why there is this discrepancy.

Series I Results

The lateral distance between the airplane's (straight) flight path and the UAP in IMG 0295 through IMG 0301 was measured. Table 1 gives these values. As is discussed below, the UAP traveled a total of 376 feet horizontally over this 11 second period of photos.¹³ If the UAP was a balloon free-floating in the air and was at the same altitude as the contrail both would have moved approximately together by the same distance over the period of these photographs. Clearly they didn't which suggests either that the UAP was at a different altitude than the contrail but was floating passively in air travelling in a different direction and/or velocity, was at the same altitude as the contrail and powered and moving against the wind, or was at a different altitude than the contrail and powered. It isn't possible to determine which of these is the right one.

Table 1

UAP Lateral Velocity Calculations

Frame (IMG) No.	UAP location rel. to A/C Flt path C/L (+ = Rt.; - = Left) (mm) on screen	Calculated Lateral Dist. (feet)	Elapsed time (seconds)	Calculated Lateral velocity (mph)
0295	+24	244	1	
0296	+17	172.8	2	
	Aircraft out of frame here			
0297	+11	111.8	4	
0298	5.8	59.0	6	
0299	-1.5	15.25	19	

¹³ Assuming that the contrail did not move in the air.

0300	-8.0	81.3	21
0301	-13.0	132.2	23
<hr/>			
	Totals =	376.2	23
			11.1

Series II Results

The collection of fourteen photographs of Series II must also be considered. They were taken almost exactly thirty minutes after those of Series I ended; beginning at 17:46:35 hrs and almost continuously. If the UAP had traveled at a constant velocity of 11.1 mph in a constant direction after the Series I photographs had ended it would have traveled a distance of 5.57 miles and become smaller in size (and angle) at the beginning of the Series II photographs. The witness said that the UAP did seem to move continuously across the sky.

The total elapsed time of the eighteen images in Series II was 63 seconds¹⁴ or 3.5 seconds per image on the average. Inspection of these images shows a wide variety of shapes, Figures 8, 10, 12, and 13 are generally symmetrical. The images in Series II raise interesting questions as to how they could have been produced within the brief shutter-open durations indicated. Given the similar shutter durations shown in Figure 11 and 12, for instance, how could the camera's image stabilization system have produced such different shapes only one second apart? The same could be asked about Figures 8 and 9. It is possible that the UAP was actually changing shape this fast. On the other hand, camera motion that exceeded the capability of the camera's image stabilization system might also possible explain these diverse shapes.

UAP size may only be compared between those photographs taken with the same zoom setting. Thus, IMG 0367 (Figure 10) through IMG 0374 (Figure 13) were taken with the zoom pulled back significantly from 250 mm which would cause the UAP to shrink in size.

Image 0367 (Figure 10) is interesting because the interior of the UAP possesses a slight reddish color; all of the other photographs were intense white which suggests an overexposure

condition. Figure 14 presents the original image enlarged. In Figure 15 the three input

Figure 14
Image 0367 - Enlarged



Figure 15
Image 0367 - Exposure Stretched



Figure 16
Image 0367 - Contrast/Brightness Change



¹⁴ The witness estimated total elapsed time of about sixty seconds (Personal correspondence, November 21, 2009).

levels (0, 1, 255) were reduced to 136, 1, and 237 (exposure) bits while the output was not changed (1, 255). This procedure helps to make luminance differences within the UAP more apparent. Figure 16 shows the results of increasing contrast and decreasing brightness; there appears to be two round, red balls inside the overall shape of this UAP. The fact that no internal colors could be seen on any other photograph (other than an intense homogeneous white) suggests that the luminous output of the UAP was so great that it exceeded the camera's CCD maximum sensitivity and only IMG 0367 showed the UAP at a lower radiated output level.

Was the Object a Weather (or other) Balloon?

Here we will consider arguments for and against the assertion that the UAP was a passive (non-powered) balloon of some kind. Regarding the subject of the visibility of a balloon from the ground, if an observer possesses uncorrected (or corrected) 20:20 distance acuity, is accommodated for infinity (beyond about twenty feet), is looking directly at the balloon through clear air and it possesses even a moderately high contrast¹⁵ the balloon will be visible at 30,000 feet altitude. However, if the observer has to visually locate the same balloon in the sky first it might not be detected above an altitude of about 10,000 feet. This is one reason why these balloons are tracked by radar today and not with a (visual) theodolite. The fact that the sun was near setting and the sky above the UAP becoming somewhat darker the contrast of the UAP would have increased to make it more conspicuous to the naked eye.

Arguing against a balloon hypothesis is the fact that the wind was out of the SW (at this time and location) at about nine or ten mph while the UAP appeared to move in the opposite direction at a calculated velocity of 11.1 mph. (Table 1) Also, the odd appearance of this UAP shown in Figures 8 through 13 and others not included here would also seem to preclude a weather balloon explanation.

In Arizona, the National Weather Service launches (generally white) latex balloons from

¹⁵ It becomes problematic if a white or gray latex weather balloon would possess sufficient visual contrast under these particular viewing conditions.

Flagstaff, Phoenix, and Tucson, Arizona twice a day twelve hours apart at 0400 hrs and 1600 hrs local time (MST) (Figure 17). Assuming they are about six feet diameter at ground level,

Figure 17
 NOAA Weather Balloon Soon after Launch
 (Courtesy of NOAA)



upon rising to 2,000 feet the average balloon would have a diameter of about 6.2 feet.¹⁶ Using the Combined Gas Law Equation¹⁷ one can calculate the expansion dimensions of balloons under different conditions. Table 2 presents calculated balloon diameters and plane angles for the altitudes shown and (only for convenience) assuming constant temperature and pressure and a six foot diameter balloon:

Table 2
 Calculated Balloon Diameters and Visual
 Angles for Selected Altitudes
 (Assumes 6 ft. diameter at launch)

Altitude (ft.)	Diameter (ft.)	Plane Visual Angle (deg. min. sec.)
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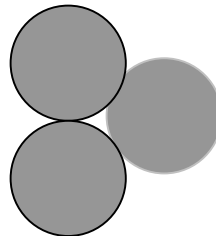
¹⁶ An approximate ascent rate is 1,000 feet per minute.

¹⁷ <w www.1728.com/combined.htm> (Temperature must be in degrees Kelvin).

2,000	6.22	0	10	42
5,000	6.58	0	4	31
10,000	7.17	0	2	28
15,000	7.75	0	1	46
20,000	8.33	0	1	26
25,000	8.91	0	1	14
30,000	9.50	0	1	5

Even if three balloons were tethered together at their necks they could not assume the shape shown in Figure 8 (IMG 0359), but would appear something like that of Figure 18 in which all three spheres are distinctly outlined.

Figure 18
 Approximate Appearance of Three Balloons
 Tethered Tightly Together at their Stems



Arguing in favor of a weather balloon explanation is the approximate size and sudden disappearance of the UAP. An attempt was made to determine the size of the UAP using the known width of the B-737 fuselage (12.3 feet) and its length (Figures 2 and 3) along with the width of the UAP in the same figures. If the UAP was at the same distance from the camera as the airplane it would have been about 5 feet wide which is reasonably close to the size of a weather balloon at even at a relatively low altitude (e.g., under 5,000 feet AGL); its diameter would be about 6.6 feet. In addition, the disappearance of the UAP could have resulted from a balloon suddenly bursting at some altitude.

Conclusions

Based on all of the photographic evidence this UAP has not been positively identified. It is problematic (for a number of reasons) whether it could have been a balloon of some kind. Nevertheless, its presence did not cause the commercial airplane to deviate from its flight path and thus did not appear to constitute a safety issue. The appearance of three military jet airplanes in formation soon after the UAP had disappeared is not considered here.