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The El Bosque Video Case:[+]
A Preliminary Study of Anomalous Objects in Active Airspace*

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Abstract

This paper presents the results of an analysis of many video segments taken on November 5, 2010 at the El Bosque Air Force Base in the S.W. suburbs of Santiago, Chile. Nothing out of the ordinary was seen in the sky by the many military personnel and civilian spectators who were present at this Air Force ceremony. Nevertheless, an angularly small, low-contrast, oval- shaped object was recorded by two digital video cameras as ten airplane formations flew by over a five minute-long period. Twenty one separate unidentified aerial phenomena (UAP) trajectories on consecutive frames were discovered that involved more than 150 video frames. Flight trajectories and UAP shapes were quantified. NARCAP's interest in this case lay mainly in aviation safety, i.e., could any of the unidentified aerial phenomena (UAP) discovered here have represented a risk to aviation operations for any number of reasons? Some of the present data suggest that they could have. Related to this was the parallel question of what the phenomenon might be. It was concluded: First, that the same UAP was very probably recorded by two digital cameras at the same time on one occasion which made it possible to estimate its nearest distance and thus, a likely range of UAP sizes. The relatively short exposure durations, high angular velocities and high speed changes in direction and small angular size of the UAP recorded during seven of the ten formation fly-overs help explain why no one saw them at the time; these characteristics would appear to qualify these UAP as anomalous; they cannot be explained in prosaic terms. Second, if any of these small UAP possessed finite mass they could have caused physical damage to the airplanes upon impact due to their high velocity. This conclusion also rests on the fact that if these objects (phenomena) could move as fast as they did and change direction as fast as they did they could have flown into the path of an airplane. Third, of those videos segments in which a UAP was recorded almost five and one-half (5.5) percent of all video frames taken of approaching airplanes captured a UAP as well as over

seven and one-half (7.5) percent of the video frames taken while the airplanes were departing. Fourth, a variety of UAP trajectories were discovered: linear, curvilinear, and zig-zag. Many appeared to pass in front of the approaching airplanes and/or behind them soon after they had passed. In one instance the UAP appeared to fly parallel (and in the same direction) with the formation of the airplanes. Nevertheless, in no case did a UAP appear to come near to any airplane. Fifth, a much higher number of video frames contained UAP during fly-bys of high performance jets and helicopters than for aerobatic airplanes, twin-turbo props, corporate jets, or heavy jets. These UAP remain unidentified at this time.

* The first public disclosure of this incident took place on March 13, 2012 by Air Force Gen.(ret.) Ricardo Bermudez at the 21st 2012 International UFO Congress, Fountain Hills, Arizona. Other details are provided in a Huffington Post article published two days later by Kean and Blumenthal (2012). (see Appendix 3)

Introduction

An impressive airshow took place between 11:00 am and noon on November 5, 2010 and was part of a military change of Air Force Command (*Cambio de Mando*) at the El Bosque Air Force Base in the S.W. suburbs of Santiago. Part of the ceremony consisted of fly-overs by ten formations of Chilean military airplanes; all seventy five airplanes flew over the runway in straight and level flight within a five minute period. It is fortunate that a continuous video record was made of these aeronautical activities from which Table 1 was developed (File: MOV01011.MPG; also see Appendix 1) because very interesting and unexpected phenomena appeared in many frames of the video tapes that were taken. This report documents the characteristics of these strange phenomena. Elapsed time refers to the time (min:sec) that each formation reached the cameras' location and is accurate to about two seconds.

Table 1
Details of Chilean Air Force Aircraft Fly-overs
on November 5, 2010

No.	Elapsed Time	A/C Type	No.	Comments
1	0:07	Halcones	6	Single engine, prop
2	1:08	T-35 Pillan	15	Single engine, prop
3	1:22	2 engine prop.	7	High-wing, turboprop
4	2:00	Helicopter	10	various models
5	2:26	Halcones	9	3 parallel staggered lines
6	2:53	Corp. Jets	3	V formation
7	3:30	Heavy Jets	4	Airbus, KC-135, Radar, B737
8	4:07	F-5E	6	Wide V formation
9	4:33	F-16	7	3 rows
10	4:57	F-16	8	2/4/1/1

Overview of the Air Base

Figure 1 is a photograph taken above the El Bosque Air Base and surrounding areas. North is up. This Air Force facility has a single runway 5,985 feet long with parallel taxiway. The runway is oriented at 30 degrees – 210 degrees. The *Empresa Nacional de Aeronautica* (ENAER) Pillan aircraft factory is located adjacent and shares runway operations with an Air Force training squadron. The air field's coordinates are 33.566 S, 70.682W. ENAER maintains, reconditions, and

modernizes aircraft. < www.enaer.com/ingles/negocios/m_avion_mil.php > The three videographers (hereafter referred to by the color of the shirts they each wore were all located near the lower end of the red line seen at the bottom-center of the Figure 1.

Figure 1

Aerial View of the El Bosque Air Field and Surrounding Areas

Information Related to the Video Camera Sites

This section documents the three primary video camera locations in greater detail both in relation to each other and to other airfield geospatial features.

Primary Camera Locations: Figure 2 and 3 are photos taken on March 21, 2012 during a reenactment of this incident coordinated by CEFAA where each videographer stood were he had on November 5, 2010 to obtain the video images that are studied here. Figure 2 helps to emphasize their distance from one another and their lateral offsets. Figure 4 is a drawing of the approximate camera locations based upon the above supplied information and photographs.

It was learned after this reenactment from an eye witness who was watching the behavior of the three men with the cameras that, for some unknown reason, "…they all tended to separate from each other…as soon as the flyby started, they (the videographers) unconsciously started to drift AWAY from each other. I was watching them ALL the time….The man…(white shirt)… walked a few steps forward toward the incoming planes… the chap at the other end of the line (of three) stepped back towards the shade of the little tree behind him. Actually, he ended up the show standing there." (Personal correspondence from CEFAA, March 24, 2012). In a more recent

correspondence on this same subject it was learned that, during the reenactment, the same eye witness saw a "…reflex movement from ALL three videomen. As the airplanes approached, they either went forward, backed up or went sideway (sic) a couple of steps, which is more than 3 feet difference." (received from CEFAA, May 16, 2012)

The rectangular building where the three videographers were standing is located at the SW corner of the El Bosque Air Base (taken on 4/2/09; Google-Earth imagery). The longest side of this building was 49.2 (15 m) long.

Figure 2

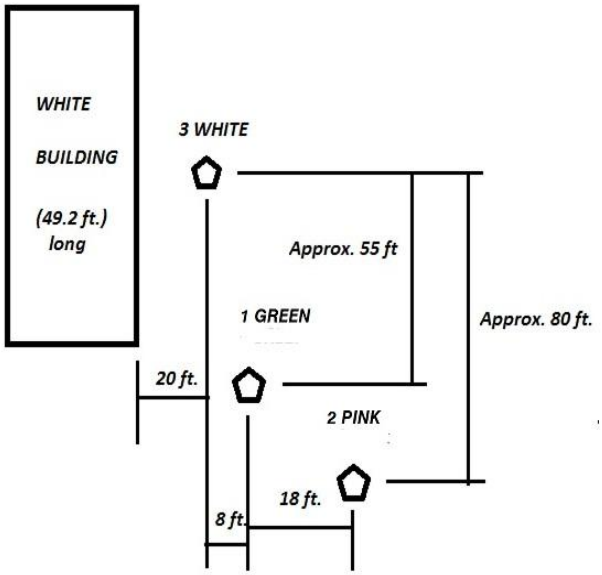
Photograph of Relative Location of Three Primary Cameramen
Courtesy of CEFAA

Figure 3

Orthogonal View to Figure 2 of Location of Three Primary Cameramen
Courtesy of CEFAA

Figure 4

Plan View of Approximate Camera Locations



The video data received from CEFAA with selected technical facts for each data file are listed in Appendix 1. All video possessed 640 x 480 resolution either in .MPG or .AVI format with a sound track. The video cameras are also referred to by the color of the shirt each videographer wore at the time, i.e., pink (**Camera 1**), green (**Camera 2**), and white (**Camera 3**). As shown in Figure 4 which is a not-to-scale plan view of the camera locations, **Camera 1** was located at least thirty two feet from **Camera 2** whose location was along a line approximately forty degrees arc from a line parallel with the front of the white building seen in Figure 4. The front of this building was approximately parallel with the runway. **Camera 2** was located about fifty-five feet from **Camera 3** (White) as measured by CEFAA personnel on March 21, 2012. **Camera 1** and **3** lay almost on a line parallel with the long side of the building and about twenty feet away (toward the runway). Significantly, it was later discovered that all of these videographers moved around during the fly-overs by some unknown amounts making these measurements only approximate. Although **Camera 3** and its video are referred to throughout this report a very recent communication from CEFAA (May 30, 2012) indicated that the data from it was unavailable for study for an unspecified reason.

The weather on this day was sunny and warm. The wind was calm. Local sunrise was at 6:35 am and sunset at 8:18 pm.

Selected Camera Specifications

The video cameras that imaged these small, dark, compact anomalous airborne objects are described in Table 2.

Table 2

Comparison of Cameras Used

Parameter	Samsung Location 3 White Shirt	Sony Location 2 Pink Shirt	Canon Location 1 Green Shirt
Model Designation	Digimax A402, 420, V4	Cybershot DSC-W210	Powershot – A85
Lens (zoom)			
Focal length (mm)	38 (w) to 114 (tele)	30(w) to 118(tele)	35(w) to 105 (tele)
f stop	5.8 – 17.4	2.8 – 5.8	2.8 – 4.8
zoom	3x opt.	4x opt.	3x opt.
	4x dig.	6x dig.	3.6x dig.
	12x total	25x total	10.8x total
Shutter			
Speed (sec.) fastest	1/2000	1/1600	1/1000
CCD (sensor)*			
Total pixels	4.0 MP	12 MP	4.0 MP
dimensions	5.27 x 3.96 mm	1/2.3	1/2.5”
surface area (mm^2)	20.8	27.8	20
pixel size (mm/pixel)	2.323×10^{-3}		
Video			
frames/sec.	25, 29 VGA	29 (max)	10
format	AVI		

* Reference: < en.wikipedia.org/wiki/image_sensor_format >

Airplane Fly-Over Information

Selected information on several groups of airplanes involved in the fly-overs has been given in Table 1. In addition the following details are cited:

Chilean Air Force Aerobatic Display Team “Halcone” Airplanes: Two separate fly-overs were made by these acrobatic (Extra 300L) aircraft (Formation 1 and 5). Each formation flew at about

2,350 feet altitude in level flight above the runway at 140 knots. A smoke trail was left by the first chevron formation of six airplanes.

T-35 Pillan Airplanes: Formation 2 consisted of a tightly and evenly spaced triangular formation of fifteen single engine, low wing monoplanes. Their speed is not known but they cruise at 266 km/hr.

F-5E "Tiger Jets: This formation (number 8) of six Northrup built twin-engine jet airplanes flew in a very wide V formation over the runway at about 2,500 feet altitude and at high speed.

F-16 "Falcon Jets: The last two formations (number 9 and 10) of F-16 jet interceptor aircraft followed the same flight path as the preceding airplanes and past overhead at a high rate of speed about four and one-half minutes and five minutes, after the first fly-over, respectively. Careful planning and precision flying was exhibited in all ten aerial fly-overs.

Methodology

Organizing the Video Data

The large amount of video data that was analyzed here required a systematic approach that kept each video frame clearly and individually labeled by formation, official (CEFAA) file name, camera location, frame number, and elapsed time. A sequential frame number was assigned (within each fly over formation) and all frames containing an anomalous (UAP) object were marked for later analysis. Because camera 2 was found to be zoomed in on the formations of airplanes flying over the amount of zoom was determined. In order to validly compare scene details between cameras it was also necessary (when possible) to correct for camera pitch, yaw, and roll that occurred from frame to frame because all cameras were hand-held. No resampling of any image was performed. In plotting the trajectory of these UAP two different symbols were used: a small "x" indicated a UAP image that was darker than the sky and/or cloud background; a small "o" indicated the presence of an image that was lighter than the sky background.

In highly visible and controversial cases such as this (cf. Kean and Blumenthal, 2012) in which apparently anomalous phenomena are found embedded in otherwise normal digital video media one must follow a rigorous methodology that keeps each group of data clearly separate from each other and does not contaminate or destroy any relevant data or compromise the data in any other way(s). Data can be compromised, for instance, by studying a wrong image(s) while believing it is the correct image or it can occur during the data analysis stage where inappropriate data are used that lead to erroneous interpretations , e.g., use of "lossy" compressed video when uncompressed video may be available. Another is relying only on video data that others have invisibly modified in some way.

Data Analyses

This section presents analyses of these video data in the following three sections: I. Overall Summary, II. UAP Trajectories, and III. Enlarged UAP Images, Pixel Intensities, and Pixel Intensity Stretch Results.

I. Overall Summary

Several interesting findings emerged from an overall tally of these data (Table 3). While more than one video version of some of these formation fly-overs was received from CEFAA only one was selected for study (CEFAA number cited in parentheses).

Table 3
General Summary of Findings

Total number of:	
Video tapes received for study ……..	15
Different airplane formations ……	10
Different airplane types during all fly-overs …….	13
Video frames on analyzed tapes ……..	1,995
Video frames (on all available tapes) ……	3,489[+]
Separate UAP trajectories ……	21
UAP imaged during airplane approaches (No. frames) …….	79
UAP imaged during airplane departures (No. frames) …….	79
Pixels making up frame (horizontal, vertical) ……	640, 480
Percentage of:	
Frames with UAP image(s) by each formation (airplane type):	
1. (Halcone single engine prop.) ……	5.9
2. (T-35 Pillan single engine prop.) …….	2.3
3. (Twin-turbo prop) ……	0
4. (Helicopters) ……	11.2
5. (Halcone single engine prop.) ……	0
6. (Corporate jets) ……	0
7. (Heavy jets) ……	1.0
8. (F-5E Tiger jets) ……..	14.3
9. (F-16 jets) ……	30.9
10. (F-16 jets) ……	10.5
Typical UAP shape: …….	horizontal oval
Most frequent UAP trajectory ……..	linear

[+] Several video tapes received were duplicates of others already received.

Referring to Table 3 and 4 it may be significant that: (1) UAP were recorded during the very first fly-over formation. Does this suggest that the UAP's presence was deliberately planned with foreknowledge of this ceremony, that the UAP were somehow "attracted" to this airshow, or perhaps that the UAP might have been somewhere else and traveled to the El Bosque Air Base very quickly? If the UAP was a natural phenomenon why would it appear more often in the vicinity of certain airplane models than others? It would require far more information and video data taken under both similar and different social situations (than is available here) to answer these questions. (2) No UAP images were recorded during the fly-overs of turbo-prop airplanes, the second Halcone formation, or the Corporate jets for some unknown reason, and (3) A similar number of UAP frames were found regardless of whether the airplanes were approaching or departing the cameras' locations.

Table 4

Number and Percentage of all Frames Containing UAP Images
Within each Airplane Formation and their Location Relative to Cameras

			Approaching		Departing	
Formation	Airplane	No. Frames	No. UAP Fr.	Percentage	No. UAP Fr.	Percentage
1.	Halcones	299	8	2.6	10	3.3
2.	T-35 (prop.)	299	7	2.3	0	0
3.	Twin-turbos	290	0	0	0	0
4.	Helicopters	299	8	2.6	26	8.7
5.	Halcones	0	0	0	0	0
6.	Corporate Jets	0	0	0	0	0
7.	Heavy Jets	299	3	1	0	0
8.	F-5E Jets	139	2	1.4	18	12.9
9.	F-16 Jets	181	42	23.2	14	7.7
10.	F-16 Jets	189	9	4.7	11	5.8
	Totals = 1,995		79	37.8	79	38.7
				Mean=5.4		Mean=7.7

II. UAP Trajectories

The twenty one trajectories flown by UAP are plotted in this section. The number of consecutive video frames containing a UAP ranged from 2 to 42 (mean = 8) over all the available videos. Of course the more frames involved the farther the formation of airplanes would have flown during that period of time. Therefore a video frame was selected (for each formation) on which to plot the UAP trajectory that represented the approximate mid-point of the airplanes' travel. In this way a general representation of the angular proximity of the UAP to the airplanes could be presented. It must be remembered that the absolute distance to any UAP could not be determined in any case.

Formation 1

The Halcone Data Set

The following data are limited to the first formation fly-over of six Halcone, single engine propeller airplanes at about 11:00 am. Figure 5 shows their appearance when nearing the cameras (but with no UAP present).

Figure 5
Formation of Six Halcone Airplanes
(**Camera 2**)

Camera 1. During the fly-over of these six airplanes four separate groups of consecutive frames were discovered on the same video **Camera 1** (MVI_0136) that contained a UAP; two occurred during the approach phase and two during the departure of the Halcone airplanes. Each of these video camera data sets is discussed separately using the video file's original, official (CEFAA) designation and frame numbers given within parentheses.

It is fortunate that **Camera 1** (Green) recorded this fly-over at 10 fps and its lens zoomed fully back. The angular width of this video segment (MVI_0136.AVI) is about three times wider as that of **Camera 2** (Pink) (discussed below) and thus includes much more sky area. In each set *the UAP appeared to pass across the path of the approaching or departing airplanes*. However, there can be no definite proof of this since (a) the distance to the UAP is not known with precision, (b) the UAP appears from beyond the edge of the fifth frame and (c) it isn't known what its starting location was.

The first set of three UAP (frames 5 through 7) from camera 1 shows it traveling from right to left as shown in Figure 6. The UAP traveled (apparently) upward and to the left at a relatively high angular rate; it would have been in sight for only 0.2 second. Of course it also could have been travelling horizontally or perhaps even slightly downward. The UAP appears to be traveling at a velocity that took it beyond the camera's field of view in the following frame, however there is no way to be sure. The formation of six approaching Halcone airplanes can be seen in the distance near the horizon just above the trees. An estimated nine more seconds will pass before the airplanes reach the approximate location where this UAP has just travelled.

Figure 6
UAP Flight Path - Six Approaching Halcones
(**Camera 1**)

Note: All following figures are found at the end of this report

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The appearance of the UAP at frame 7 can be seen above the number. Its shape and other characteristics are considered in section III.

The second appearance of a UAP occurred about 3.6 seconds later when a single, small, dark oval (1:5) appeared in five consecutive frames (42 – 46) and moved linearly back across the air field (to the right), i.e., in an almost opposite direction, as is shown in Figure 7 (MVI_0136.AVI). The appearance of the UAP can be seen above the number 43. It is enlarged and discussed in more detail in section III. The Halcone airplanes are still about nine seconds from arriving at the location of the camera. Could this UAP be the same as that recorded thirty six frames earlier, i.e., Fig. 6

Figure 7
UAP Trajectory During Second Appearance
(6 Approaching Halcones Airplanes)
(**Camera 1**)

The third appearance of a UAP was found on seven consecutive frames (MVI_0136.AVI:174-180) with the six Halcone airplanes now past the end of the runway. The linear trajectory of this UAP is plotted in Figure 8 moving from right to left, seemingly back across the runway again. This UAP appears as a medium gray oval (1:3) that is seen above the number 175. Frames 174 to 179 are enlarged in section III. The UAP becomes increasingly dim as it departs. It does not appear in frame 181.

Figure 8
UAP Trajectory During Third Appearance
(6 Departing Halcones Airplanes)
(**Camera 1**)

The fourth and final appearance of a UAP on this tape (MVI_0136.AVI) is shown on Figure 9 where frames 220 – 222 show that it follows a linear flight path from left to right, again seeming to reverse its direction (from its previous appearance?). The appearance of this faint white, almost circular area (of the UAP) is seen above frame number 220. The Halcone airplanes are now even farther away than before. Although the distance to the UAP is not known it is perhaps significant that the UAP begins its movement to the left in Figure 8 and its movement to the right in Figure 9 from approximately the same location in the sky (disregarding distance, if this can be accepted) and separated in time by 4.6 seconds.

Figure 9
UAP Trajectory During Fourth Appearance
(6 Departing Halcones Airplanes)
(**Camera 1**)

Camera 2. Now we turn to video segments taken by **Camera 2** (Pink Shirt) where the same (or a very similar appearing) UAP was recorded two separate times during the departure of the airplanes. The first was found at (Halcones-2Copy:44 - 53) as the airplanes were approaching the camera area. This Sony camera operated at 25 fps and a video resolution of 640 x 480 pixels. Also, as can be seen in Figure 10 of the UAP's trajectory on seven consecutive frames, the camera was zoomed in by a factor of approximately 3.4x compared with **Camera 1**. The two mountain peaks in the distance were used as spatial referents imaged in both cameras to compute this approximate magnification factor.

Figure 10 shows the slightly curved trajectory of the UAP relative to the approximate location of the six approaching airplanes. Since neither distance (nor altitude) of the UAP is known it is not possible to state with certainty the likelihood that they were a direct threat to flight safety. Indeed, here it appears that the UAP were some distance away from them. This entire UAP flight trajectory was over in 0.24 second. This small, dark UAP was oval-shaped and always horizontally oriented. Its approximate length to height ratio varied only a little around 1:1.5. Using the location of the airplanes related to the distant mountain peaks for comparison no evidence of a UAP could be found from **Camera 1** video imagery at the same time or area of the sky.

Figure 10
UAP Trajectory During Approach of
6 Halcones Airplanes
(**Camera 2**)

The second and more significant UAP to be detected by **Camera 2** took place on frames 316 to 328 (Halcones-2Copy); the UAP's trajectory is plotted in Figure 11. It was fortunate that there was a single tall tree visible on every frame which permitted plotting the changes in position of the airplanes and the UAP. The camera did not roll or pitch significantly during these frames. Here the airplanes are departing from the camera area; the entire flight of this UAP motion was over in about 0.32 second. Note that its trajectory may be described as two linear segments that change direction slightly at frame 324. If this flight path was normal to the camera's optical axis then the UAP would have turned to its right and/or upward by an unknown amount. The UAP appears here as a small, dark oval with a length to width ration of about 1:2 that is tipped forward-end downward by about fifteen degrees arc relative to its path of flight as it moves to the left. Perhaps the UAP appears to simply pass out of the video frame in 328 rather than suddenly disappear in 327. Five of these frames are studied in section III.

It is tempting to speculate that the UAP continued to travel along the second trajectory shown in Figure 11 even though it simply passed beyond the edge of frame 328. In Figure 8, on the other hand, the UAP is simply gone in frame 181.

Figure 11
UAP Trajectory During Departure of
6 Halcones Airplanes
(**Camera 2**)

Is the Same UAP Recorded by Two Cameras? The following evidence is given to evaluate the assertion that the same UAP was recorded both by **Camera 1** (Fig. 8) and **Camera 2** (Fig. 11) during the departure of the six Halcone airplanes taking part in the first formation fly-over. If this can be proven then its nearest distance (and thus calculated size) can be determined.

On the supporting side.

In both of these video segments:

1. The apparent depression angle of the UAP's trajectory relative to the horizon is the same (approx. -10 deg.).
2. The UAP is traveling in the same (right-to-left) direction.
3. The apparent location of the UAP's trajectory relative to the formation of airplanes is very similar as is discussed below.
4. The angular velocity of the UAP is approximately constant in both videos. Small errors in plotting UAP positions make this more difficult to prove conclusively, however. Thus, a UAP that required about 0.40 second to cross the frame of **Camera 1** took about one second to cross the frame of **Camera 2** due to its slower frame rate and wider field of view.
5. The UAP itself is always seen against a sky background.
6. The UAP's shape is similar, i.e., generally an horizontally oriented oval with length

to width ratio that varies approximately as indicated in Table 5. Also see the discussion related to these enlargements in section III.

7. The darkness (varying from light to dark gray) is similar.

Regarding point three above two separate analyses were carried out. The first employed visible ground references with which to measure the relative changes in position of the airplanes and the UAP for the seven consecutive UAP frames of Figure 8 and the nine UAP frames of Figure 11. A relatively close correspondence was found between the two sets of images that support points 1 through 5 above. In the second approach all of the frames showing the UAP were plotted on one graph for the seven UAP frames of Figure 8 and on another for the nine UAP frames of Figure 11. The same X – Y axes (*abscissa* - seconds of elapsed time; *ordinate* - lateral distance between the leading airplane and the UAP) were used for each graph in order to be able to overlap and slide them (in time) over one another to see if any segments of the two curves corresponded. Both lens magnification and frame rate differences between the two cameras were taken into account. It was discovered that a good correspondence was found, within error of measurement, between the following frames of Figure 8 (178 and 180) and those of Figure 11 (316 and 321). This correspond-dence was found only when the two graphs were overlaid when the UAP had just reached the apparent position of the lead airplane. Table 5 presents these corresponding frames in columns A and D. Note that frame 179 in column A falls between frame 317 and 318 in column D (due to differences in frame rate).

Enlargements of frames 174 through 179 in Figure 8 and frames 316 through 321 in Figure 11 are presented in section III for visual comparison. All were enlarged by the same amount. While the original unmodified (raw) video images of the UAP seen in these two sets of images do not look particularly useful or impressive because of their very low contrast and lack of color differences their pixel intensity stretched versions disclose some useful details. The data of Table 5 deserves further explanation in this regard.

Table 5

Approximate Length to Width Ratios and Range of
Pixel Intensity Stretched UAP Images from
Figures 8 and 11 Frames.*

Fig. 8 HY Frame No. **Camera 1** (10 fps)	L/W Ratio	Intensity Stretch Factor	Fig. 11 SY Frame No. **Camera 2** (25 fps)	L/W Ratio	Intensity Stretch Factor
A	B	C	D	E	F
174	1:2	4.11			
175	1:2	4.11			
176	1:1.6	4.11			
177	1: 1.3	3.75			
178	1:1.1	3.75	**316**	1:1.5	5.80
			317	1:1.4	8.22
179	1:1.1	3.98			
			318	1:1.8	8.22
			320	1:1.7	7.08
180	not enlarged		**321**	1:1.9	7.08

* Frames 322 through 327 of column D are not included because little of interest could be learned from their enlargements.

First, the vertical spacing of the frame numbers in columns A and D of this table attempts to represent the difference in frame rate of each camera. **Camera 2** took 2.5 frames to every one frame taken by **Camera 1**. Frame 316 in column D is inserted adjacent to frame 178 in column A because both of these frames in particular showed the UAP to be at almost the same relative

position above and slightly to the right of the airplane formation. Other frame combinations would not fit this alignment criteria as well. Second, the pixel intensity stretch data given in columns C and F were calculated as follows. The total pixel intensity input range (R) was calculated by subtracting the lower stretched (STR) value (seen lower left corner on each intensity stretched figure in section III) from the higher value. R represents the approximate number of the 255 possible intensity levels that represented the UAP's image. R was then divided into 255 to produce what is called the intensity stretch factor given in columns C and F. The larger R becomes the fewer intensity *input* levels that are "stretched out" to fill the 255 available *output* intensity levels. This factor might be thought of as a multiplication factor of input levels that result in a more discriminating (output) image. Note that in Table 5 **Camera 1** had lower stretch factors than did **Camera 2** indicating that the UAP images from **Camera 1** could be characterized by a larger range of RGB pixel intensity levels than those from **Camera 2**.

<u>On the negative side</u>.

The UAPs' shape might have corresponded more closely than they did between (seemingly) corresponding frames taken by these two cameras. Referring to Column B in Table 5 we see (in the L/W ratios from **Camera 1**) that the shape of the UAP changes from an elongated oval to nearly a sphere over time while no such regular shape change is found in column E from **Camera 2**. Indeed, these UAP shapes appear to change very rapidly over these five consecutive frames (each about 0.04 second apart) but do not trend toward a sphere! Perhaps the cause of this is that the sequence of UAP frames from **Camera 2** were not located closely enough with their counterparts from **Camera 1**.

But what about the size of the UAP images recorded by these two cameras? Every attempt was made to enlarge these original video images by the same amount (x50 magnification) and then carry out the pixel luminance stretching operations on the resulting images hopefully to better display their shape and relative sizes. It was discovered that the larger the pixel intensity input range (R) used, everything else held constant, the larger the image becomes; this occurs because adding more pixel intensity levels acts to expand the output image. However, R was held as constant as possible to aid in comparing the length and width of each UAP image. Table 6 present these image size data. The values in columns D and H refer to how much larger the UAP image dimensions were in **Camera 2** than in **Camera 1**.

Table 6

UAP Image Size Data from Camera 1 and Camera 2

Fig. 8 Frame No. **Camera 1**	UAP width (mm)	UAP height (mm)	Width Magnif. (F/B)	Fig. 11 Frame No **Camera 2**	UAP width (mm)	UAP height (mm)	Height Magnif. (C/G)
A	B	C	D	E	F	G	H
174	46	24					
175	39	19					
176	29	18					
177	31	24					
178	27	24	x2.1	316	57	37	x1.5
				317	44	31	x1.8
179	18	17	x2.4				
				318	54	30	
				320	53	32	
180	not enlarged			321	48	26	

So What? If the above assertion is accepted that these two cameras did record the same UAP, the implications are great for the interpretation of many of the other UAP characteristics considered here. If **Camera 2** (Pink) was located at least 32 feet nearer to the UAP than **Camera 1**[+] (Green), then: (1) this particular UAP would have had to be located at a distance greater than 32 feet in order to have been detected by both cameras at the same time, and (2) the UAP should appear different in size, i.e., larger in the nearer **Camera 2** after its magnification is taken into account and smaller in the farther **Camera 1**. These subjects are discussed next.

The angular size of an object decreases with increasing distance from the camera as a tangent function and not linearly. Therefore, if we place an object that is one inch in size ten feet in front of **Camera 2** that is facing the direction of departing airplanes it will be about forty two feet away from **Camera 1** using the camera positions shown in Figure 4. This small object will subtend an angle of 28’ 38” at **Camera 2** but only 6’ 49” at **Camera 1**. This is an angular difference of over 4.2 times. But if the same object is moved forty feet away from **Camera 2** it will subtend an angle of 7’ 20” and will be seventy two feet away from **Camera 1.** It will subtend an angle of 3’ 58”, an

+ According to a recent e-mail from CEFAA (May 29, 2012) this video is not in their files and (therefore) could not be studied.

angular difference of 3.3 times. The farther that the same object is located from both cameras the difference between its subtended visual angles will become progressively smaller.

What this means for the present case is that: (1) if UAP image sizes vary by a large amount between one camera and the other (all other factors held constant) then the UAP must be relatively nearer to them both or alternately, (2) if the UAP was sufficiently far away from the two cameras the difference in their subtended angles in both cameras would be smaller and probably not likely be discriminable. As noted above the UAP images from **Camera 2** were somewhat larger than those from **Camera 1** which would tend to favor a nearer distance for the UAP. Yet such a conclusion is not that simple because of differences arising from two sources: (1) differences existing between the two cameras such as CCD pixel sensitivity to different wavelengths, shutter speed used, and lens f-stop setting and, (2) the effect of pixel intensity stretching (cf. Table 5) discussed above.

Table 7 presents the major differences between the cameras relative to the video data shown in Figure 11 and 8.

Table 7

Major Camera Differences Related to Figures 11 and 8

Fig. 11	Fig. 8
Camera 1	**Camera 2**
Green Shirt	Pink Shirt*
6 departing Halcone A/C	6 departing Halcone A/C
25 fps	10 fps
UAP seen on 9 video frames	UAP seen on 7 video frames
0.32 sec. total duration	0.6 sec. total duration
zoomed approx. (x3) = narrower FOV	not zoomed (x1) = wider FOV
reference location	camera location approx. 32 ft. nearer to the UAP than **Cam #1**
every 3rd frame is null+	every frame active

* See this man in the lower left corner of MVI_0136.AVI, on frame 174.

+ This camera continuously took two video frames followed by a third frame that was a copy of the preceding frame.

To summarize, it appears to be more probable than not that the same UAP was recorded both by **Camera 1** and **2** as shown in Figures 11 and 8, respectively. The small, gray oval-shaped UAP seen in both videos is very likely at a distance from both cameras that is well beyond their hyperfocal distances (estimated between 5.7 and 7.3 feet (see Appendix 2) and is, therefore, not likely a flying

insect. A flying insect of some kind was recorded on video MOV01011.MPG about one minute after the start of the fly-overs as the second formation was approaching. One of these two frames is discussed in Figures 80 and 81 in the Discussion section.

One of the additional video files received from CEFAA involving formation 1 was labeled "2Pasada_WMV". The trajectory of both the six Halcone airplanes and the UAP appeared to be identical to that found on tape (MVI_0136.AVI) that is shown as Figure 7. It contained fifty three frames (10-62), each with one or two UAP, lasting over a 2.17 second period. It was taken by **Camera 1** and showed the first formation of Halcone airplanes approaching in the distance about one-half mile away. It probably represents a more precise computer rendering of this particular event. This video is interesting because repeatedly it shows a UAP appearing at two locations within the same frame at the same time. Referring to Figure 7 a single, dark, UAP first appeared in frame 10 at position 42 shown here. By frame 23 it begins to lighten in intensity and by frame 37 another, similar appearing UAP appears at position 43. This occurs while the UAP seen at position 42 fades away completely. This same sequence of appearing-fading out repeats itself in position 44 and 45 as well making the UAP seem to skip suddenly forward when this video is played at normal speed. The video (2Pasada_WMV) definitely shows two UAP together on the same frame but never more than two. Further research is needed to determine if the camera's inter-frame interval (when no image can be recorded) might account for the UAP's large spatial displacement across the screen.

Formation 2

Fifteen T-35 Pillan Airplanes in a Tightly Spaced Triangular Formation

One minute after the first formation had flown by the second formation arrived over the field. It is shown in Figure 12 just before reaching the cameras' location. Their passage was recorded by **Camera 1**. Interestingly, a small, white oval shaped area with diffuse edges appeared after sixty seconds seemingly out of a cloud (or was simply masked by it). It dimmed in brightness in its final frame (67) but most likely simply passed beyond the frame's edge (68). The UAP moved to the left in seven consecutive frames as shown in Figure 13. The appearance of the UAP is visible above number 64. Also, its flight path is not linear but slightly undulating and is visible for only 0.6 second.

Figure 12
Formation of Fifteen Approaching T-35 Airplanes
(**Camera 1**)

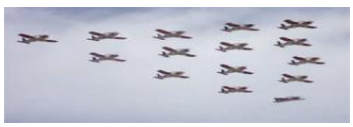

Figure 13
UAP Trajectory During Approach of Fifteen T-5 Airplanes
(**Camera 1**)

The fifteen propeller driven airplanes are still at a relatively large distance away, just visible below the tree tops at the left side of this view. They will require another twelve to fourteen seconds to reach the camera location when this UAP appeared.

Formation 3
Seven Turboprop Airplanes in a Tight V Formation

The fifteen Halcones airplanes had just passed by the camera locations when the next formation of twin-engine turboprop airplanes passed by twelve seconds later as shown in Figure 14. These high-wing airplanes have their wheels down. The video recording of them lasted only about four seconds and showed no UAP.

Figure 14
Formation of Seven Twin-Engine Approaching Airplanes
(**Camera 1**)

Formation 4
Ten Assorted Helicopters

The fourth group of airplanes to fly over included several different models of helicopters as shown in Figure 15. The video recording of them (MVI_0138.AVI) lasted twenty nine seconds and included three separate groups of UAP images. The first lasted six frames, the second two frames, and the third twenty six frames. We will consider each group separately.

Figure 15
Formation of Ten Assorted Approaching Helicopters
(**Camera 1**)

Considering the first group of six consecutive UAP frames (131 to 136), the UAP travels along an almost linear trajectory to the left at an almost constant angular velocity (Figure 16). Captured at 10 fps, the UAP is in sight for 0.5 second and appears to be well under the height of the approaching airplanes. In every frame the UAP appears as a light gray oval with a length to width ratio of about 1:3 that remains horizontally oriented in every frame.

Figure 16
First UAP Trajectory During Approach of 10 Helicopters
(**Camera 1**)

Considering the second appearance of a UAP in this same video, a small, medium gray, horizontally oriented oval with a length to width ratio of about 1:3.5 appears suddenly in frame 154 (it probably enters the field of view rather than spontaneously materializes) and appears to move slightly downward and left to frame 155 (cf., Figure 17). It appeared 1.8 seconds after the UAP imaged in Figure 16 WW disappeared. It remained horizontally oriented and is not found on frame 156. The approximate position of the helicopters can be seen above this trajectory.

Figure 17
Second UAP Trajectory During Approach of 10 Helicopters
(**Camera 1)**

The third and final appearance of another UAP is also found in this video (MVI_0138.AVI) while the helicopters are departing. Figure 18 shows frames 220 to 245 where a small white area apparently seems to fall vertically downward at a fairly constant angular velocity. This trajectory has been corrected to account for the camera's pan to the right and small CW roll. It lasted 25 frames or 2.5 seconds in all. Frame 220 occurs only about 6.5 seconds after the end of the UAP's second appearance.

It may be noted that this UAP maintains the same size, outline shape, and apparent brightness during most of these frames, only becoming lighter and less clear in the final six or seven frames. A large flock of dark-colored birds can be seen in the lower portion of these frames; they are readily identifiable as birds.

Figure 18
Third UAP Trajectory During Departure of 10 Helicopters
(**Camera 1**)

Formation 5
Nine Halcone Airplanes

The fifth group of airplanes to fly over were nine Halcone acrobatic airplanes shown in Figure 19. They arrived at the camera location at about two minutes twenty six seconds into the fly-overs. While there were no UAP detected there were many dark birds visible flying relatively near the ground. Their constantly changing appearance and movements made them easy to identify.

Figure 19
Formation of Nine Halcone Airplanes
(**Camera 2**)

Formation 6
Three Smaller Corporate Twin-Jet Airplanes

The sixth group of airplanes to fly over were three smaller (corporate size) jet airplanes shown in Figure 20. They arrived at the camera location at about two minutes twenty six seconds into the fly-overs. No UAP were detected during this video segment but there were many dark birds visible flying relatively near the ground in the distance.

Figure 20
V Formation of Three Small Twin-Jets and a Large Bird
(**Camera 2**)

Formation 7
Four Heavy Jet Airplanes

The seventh group of airplanes to fly over were four heavy jet airplanes shown in Figure 21. They arrived at the camera location at about three minutes thirty seconds after the start of the fly-

overs.

Figure 21
Formation of Four Heavy Jets
(**Camera 1**)

A small, medium gray, oval-shaped UAP was detected during this video segment on only three consecutive frames (MVI_0140.AVI: 2 – 4) (Figure 22). It travels horizontally to the right over a relatively small angle and then disappears in frame 5. It is of interest to note that the UAP fades out in luminance progressively in the last two frames. As suggested in this figure the four large jets won't reach this approximate location for about another fifteen seconds ; this is only an approximation since the actual location of the UAP is not known. Again, there were many birds visible circling near the ground in these frames.

Figure 22
UAP Trajectory During Approach of 4 Heavy Jets
(**Camera 1**)

Formation 8
Six F-5E Jet Airplanes

The eighth group of airplanes to fly over were six F-5E Tiger jet airplanes shown in Figure 23 flying in a tight formation. They arrived at the camera location about four minutes after the start of the fly-overs. An angularly small UAP appeared at least five separate times (and sky locations) during this video segment (MVI_0142.AVI). Each appearance is discussed separately below and summarized in Table 8. It should be noted that all UAP appeared as horizontally oriented ovals regardless of their contrast and location in the video frame.

Figure 23
UAP Flight Path – Six Approaching F-5E Jets
(**Camera 1**)

Table 8

Overview of Five UAP Appearances
During F-5E Jet Fly-over

	UAP Appearance Number				
	1	2	3	4	5
Figure No.	24HQ	25KK	27OP	28DD	29SL
No. frames with UAP	2	5	1	5	4
First frame no.	16	64	80	83	126
Last frame no.	17	68	---	87	129
UAP in sight (sec.)	0.1	0.4	0.1?	0.4	0.3
Location of jets	approach	depart.	depart.	depart.	depart.
General shape	oval	oval	oval	oval	oval
Orientation	horiz.	horiz.	horiz.	horiz.	horiz.
Length/width ratio (approx.)	1:3	1:3	1:4	1:3	1:2
Contrast	med. gray	white	white	white	med. gray
Edge definition	sharp	semi sharp	semi shrp.	semi.	semi shrp.
Initial Location in FOV	lower rt.	upper rt.	upper left.	upper cntr.	lower rt.
Final Location in FOV	lower cntr.	upper lft.	--------	upper cntr.	mid. cntr.

The first appearance of the medium gray oval-shaped UAP occurs on frames 16 and 17 (Figure 24). It is travelling almost horizontally to the left and does not appear in frame 18.

Figure 24
UAP Trajectory During Approach of 6 F-5 Jets
(First Appearance)
(**Camera 1**)

In the second appearance of a white, oval-shaped UAP the jets are now departing; the UAP's trajectory is plotted as frames 64 - 68 (Figure 25) approximately 4.7 seconds after it had disappeared in the first appearance. It travels to the left, apparently upward ; it does not appear in frame 69. Note that its angular velocity is relatively constant. Its appearance may be seen above the number at frame location 67 and in section III.

A second and angularly large and rather unexpected UAP also appears near the bottom center only on frame 67. The lower part of Figure 25 is enlarged in Figure 26 to show this second UAP.

Figure 25
UAP Trajectory During Departure of 6 F-5 Jets
(Second Appearance)
(**Camera 1**)

Figure 26
Enlarged Portion of Frame 67 Showing Departing Jets
and Second UAP near Bottom of Frame
(**Camera 1**)

In a third appearance only one frame (MVI_0142.AVI: 80) contains a white, long oval (1:4) image in the upper left-hand corner (Figure 27). Nothing is visible in the frames on either side of it. The jets are almost out of sight in the distance.

Figure 27
UAP Trajectory During Departure of 6 F-5 Jets
(Third Appearance)
(**Camera 1**)

The fourth appearance of a UAP in this video sequence is found on frames 83 to 87. As with the previous two appearances the UAP is diffuse white with an oval form (approx. 1:2 ratio). However, this appearance is unique to every other appearance of a gray or white UAP on any of the present video tapes in that its trajectory is not linear or curvilinear but in the shape of a Z from the camera's perspective (Figure 28). The appearance of the UAP can be seen near frame 87.

Figure 28
UAP Trajectory During Departure of 6 F-5 Jets
(Fourth Appearance)
(**Camera 1**)

Frames 126 to 129 (MVI_0142.AVI) contain the fifth and final UAP images discovered in this video sequence. The F-5E jets are almost out of sight (just above the tree in the foreground of Figure 29). The UP appears as a medium to dark gray, horizontally oriented oval (1:2 ratio) travelling along an almost linear flight path to the left at a relatively constant angular velocity.

Figure 29
UAP Trajectory During Departure of 6 F-5 Jets
(Fifth Appearance)
(**Camera 1**)

Mention must also be made of a very dark horizontal sharp-edged rectangle (approximately 6:1 ratio) that appeared only on frame 142 at the top center of the frame. It is very likely an artifact of the camera's digital circuitry.

Formation 9
Seven F-16 Jet Airplanes

The ninth group of airplanes to fly over were seven F-16 jet airplanes shown in Figure 30 traveling in a tandem V formation. They arrived at the camera location about four and one-half minutes after the start of the fly-overs.

Figure 30

UAP Flight Path – Seven Approaching F-16 Jets
(**Camera 1**)

An angularly small UAP appeared in four separate sequences during this fly-over; each is discussed separately below. It should be noted that almost all of these UAP images were circles or horizontally oriented ovals with length to height ratios ranging from 1:1.5 to 1:3 regardless of their contrast and location in the video frame.

The first appearance of a light gray oval-shaped UAP is clearly obvious in fourteen of the twenty-one frames (MVI_0143.AVI:18 to 40) however, seven other frames are unclear as to whether or not

a UAP is present. This may be because the UAP is very faint in most of these seven frames. The trajectory of this UAP is presented in Figure 31 (not every frame is numbered). Because the distance to the UAP is not known it is not possible to comment on whether it is flying parallel with the ground or is descending. However, it does appear as if this UAP is traveling in the general direction of the approaching jets. It is estimated that the jets will arrive in the vicinity of this UAP trajectory in about three to five seconds after it had disappeared (i.e., at frame 40).

Figure 31
UAP Trajectory During Approach of 7 F-16 Jets
(First Appearance)
(**Camera 1**)

The second appearance of apparently the same or a similar light gray oval UAP in this video sequence occurs in twenty seven frames (56 to 85) with two frames in which the UAP is not visible for some unknown reason (65, 77). The total duration of this appearance is 2.8 seconds, the trajectory of which is presented in Figure 32 and presents to us an interesting surprise.

As is shown by the progression of small "x" representing the UAP's path it appears as if this UAP is pacing the jets in their same direction for at least a 2.4 second long period. Because the camera pitched upward beginning at frame 80 ground details were lost which made it impossible to accurately track the position of both UAP and jets in the sky after this frame. Also note the appearance and location of the airplane formation in Figure 32; this is their location on frame 64 of the UAP's trajectory. The cameraman kept the airplanes approximately centered in the camera's field of view throughout most of this fly-over. Thus, in Figure 31 we see a UAP approaching the jets in fourteen consecutive frames (lasting 1.4 sec.) and then (perhaps) turning around and pacing them in Figure 32 for another twenty eight frames (lasting 2.8 seconds). The jet airplane's flight path appears to be paralleled by the trajectory of this UAP, at least as viewed from the location of this camera.

Given that previous UAP have appeared to travel on linear or almost linear flight paths (except for one cases shown in Figure 28 (above during Formation 9), could a flying insect hover for so long in the same location or fly so straight a path as is shown here?

Figure 32
UAP Trajectory During Approach of 7 F-16 Jets
(Second Appearance)
(**Camera 1**)

The same (or similar) appearing angularly small, faint, oval-shaped (1:2) UAP appeared a third time during this fly-by of jets although after they had passed by the camera location

(MVI_0143.AVI). Frames 92 to 99 captured it over a 0.7 second-long period; it did not appear to change its shape or darkness to any marked degree. Its trajectory is plotted in Figure 33; its appearance can be seen to the left of position 97. The UAP is seen to be either rising, traveling toward the camera, or some combination of them both. In all of these nine frames the UAP is faint but definitely darker than the sky background. Once again it appears to be travelling along a generally straight line path.

Figure 33
UAP Trajectory During Departure of 7 F-16 Jets
(Third Appearance)
(**Camera 1**)

The fourth and final appearance of a UAP in this video (MVI_0143) is found on frames 102 to 107). As shown in Figure 34, the UAP first appears near the center of the frame and seems to rise upward and/or move in the general direction of the camera. It is detected for only 0.3 second and appears as a angularly small, diffuse white area that is generally oval (1:3). Its appearance is visible near position 105 and follows a gradual curve. The departing jet interceptors are also seen in this figure as well.

Figure 34
UAP Trajectory During Departure of 7 F-16 Jets
(Fourth Appearance)
(**Camera 1**)

Formation 10
Eight F-16 Jet Airplanes

The final airplane fly-over occurred almost exactly five minutes after the first and consisted of a beautifully tight formation of eight F-18 jet airplanes. They are seen nearing the camera location in Figure 35.

Figure 35
Formation of Eight F-16 Jet Airplanes
(**Camera 1**)

During this video sequence an angularly small, dark, horizontally oriented oval-shaped UAP appears in three separate segments. Each is discussed separately below. In addition, this video (MVI_0144.AVI) includes several frames of a large bird with outstretched wings that is easily identified.

Frames 55 to 63 present the first appearance of a UAP as the jet airplanes are clearly seen approaching at high speed. These nine frames of the UAP's trajectory require a total of only 0.8 second and are plotted in Figure 36. The location of the approaching airplanes does not change significantly over this short period of time which provides an idea of their apparent proximity to the UAP as shown here.

Figure 36
UAP Trajectory During Approach of 8 F-16 Jets
(First Appearance)
Camera 1)

Referring to Figure 36 and the numbered UAP locations it is suggested that the UAP began its flight from the opposite side of the valley (toward the hills seen in the distance) and that the UAP was in level flight from positions 55 to 61 before it descended nearly to the ground (62 to 63). As is discussed below, this trajectory does not appear to be random or unrelated to the presence of the approaching airplanes. Could the UAP have been monitoring the air quality *before* the jets arrived. The appearance of the UAP is seen just above the number at frame 59 and in section III.

The second appearance of a UAP begins some 10.2 seconds later on Frame 165 after the jets have passed the camera location. These two UAP locations are plotted on Figure 37. This UAP appears round and dark; it does not appear in Frame 164 and probably has left the camera's field of view in frame 167. It is seen at frame position 166 to the left of the number. Could the UAP have been monitoring a change in air quality *after* the airplanes passed? The man seen in the lower left corner could be cameraman 2 (Pink Shirt).

Figure 37
UAP Trajectory During Departure of 8 F-16 Jets
(Second Appearance)
(**Camera 1**)

The third and last appearance of a UAP on this video segment occurs on Frames 180 to 189. The jet airplanes have travelled out of sight behind the tree in the foreground of Figure 38 on which is plotted the UAP's trajectory. These nine consecutive frames of the UAP's trajectory require a total of 0.8 second. Note that no UAP was visible on frame 187 for some reason. While the actual location of this trajectory cannot be known in three dimensional space it is intriguing to speculate that this UAP may have actually crossed the airplane's earlier flight path between frame 186 and 188 and that all of the points plotted may actually lie in a horizontal plane. The UAP is seen at

frame location 188 above the frame number.

Figure 38
UAP Trajectory During Departure of 8 F-16 Jets
(Third Appearance)
(**Camera 1**)

Additional UAP Evidence During Reenactment Flights on March 21, 2012

A reenactment of the earlier event was conducted on March 21, 2012 at the El Bosque Air Base (coordinated by CEFAA) to help document various facts surrounding the earlier event. Groups of airplanes flew over the runway in formation. One of these groups was a formation of five F-16s shown in Figure 39 (MVI_0124.AVI).

Figure 39
UAP Trajectory During Approach of 5 F-16 Jets
(**Camera ?**)

When the 195 frames of this video sequence were examined a single, angularly small UAP appeared at frame 104 and remained in sight until approximately frame 192 (duration of 8.8 sec.). It first appeared when the jets had passed by the camera location, reaching an angle of about 45 degrees beyond their closest point. Situated in the clear sky to the right of the jets was a small, horizontally oriented, oval (1:1.5) of bright light. It appeared to emit its own light several times or reflect sunlight and, *it did not appear to move* at all for about nine frames. Frame 105 is shown in Figure 40. Finally, by frame 120, the UAP had changed into a medium gray, compact amorphous area that seemed to change shape slightly from frame to frame. By about frame 130 the UAP began to rise vertically; the videographer followed it upward (keeping it centered on the display screen) until there was only sky background. At this point it was impossible to measure any characteristics of its motion. Figure 41 shows frame 122 when the UAP had changed to its dark phase.

Figure 40
Hovering Bright UAP During Departure of 5 F-16 Jets
(**Camera ?**)

Figure 41
Rising Dark UAP During Departure of 5 F-16 Jets
(**Camera ?**)

As the UAP continues to ascend it becomes increasingly smaller, dimmer, and changes in shape slightly suggesting that it may be a bird of some kind flapping its wings. Nevertheless, these shape changes from frame to frame do not appear similar to other frames showing birds. Several of these enlarged frames are included in the next section.

III. Enlarged UAP Images, Pixel Intensities, and Pixel Intensity Stretch Results

This section presents several UAP image details of interest: (1) Enlargements. Enlargements were made of UAP images present in the video(s) referenced in parentheses. It was not feasible to present all 158 UAP images so only selected images of interest were included. Each UAP area was closely cropped (to eliminate most of the surrounding scene), copied, and pasted into a new file. This new file was then enlarged (typically by a factor of x50) (for inspection and various measurements). The area shown in Figure 42, for example, represents a cropped area only 50 pixels wide by 34 pixels high (1,700 pixels). It was not possible to exactly crop the same size areas in every case. (2) Pixel Intensity. Red/green/blue (RGB) pixel intensities were measured on several images at the locations noted on the figure. Since each color-sensitive pixel could possess values between zero intensity (0) to maximum intensity (255 levels) these intensity numbers are only relative. Likewise, the colors of the UAP and surrounding sky presented here are arbitrary and *do not* necessarily represent actual colors or imply anything in particular such as heat, energy emissions, vapor trails, etc. No color or contrast changes were made to any of the following enlargements. (3) Pixel Intensity Stretching. Otherwise unmodified video images of the enlarged UAPs were subjected to quantification of the distribution of pixel intensities recorded from each of the three color-sensitive sensing elements of the camera's charge-coupled device (CCD): red sensitive, green sensitive, and blue sensitive. In a general sense this may be thought of as stripping away those RGB pixel intensities that lie outside of the major distribution of intensities that represent the UAP's image (e.g., background sky). This was done by eye on the software's X-Y intensity distribution graph and was somewhat arbitrary, however, an attempt was made to end up with approximately the same total number of pixel intensity input steps across video frames within the same series. If, for instance, the original image, i.e., its input distribution, possessed a distribution of RGB pixel intensities which ranged from 0 to 255 levels for each color, after luminance stretching was performed the number of pixel intensities was reduced and might range, for example from 80 to 156 (76 total) rather than the full number of steps. The lower 80 intensity levels (from 0 to 80) were stripped away as were the upper 98 (157 to 255). They didn't contribute significantly to the appearance of the UAP's image. Thus, the 76 (input) intensity levels that

remained were mapped onto the entire 254 output levels thereby spreading out the distribution of pixel intensities by a factor of about 3.3 times. Such intensity stretching can help bring out otherwise hidden details in the space-intensity domains. The (STR) input and output levels are noted in the lower corner of each figure.

Formation 1

Two video frames containing a UAP were enlarged from Figure 6. The first is of Frame 6 that is presented in Figure 42. (MVI_0136.AVI:6-7)

Figure 42
Enlarged UAP Image from Frame 6 of Figure 6
with Pixel Intensity Measurement Locations (see text).
(**Camera 1**)

The UAP appears as a gray oval (approx. ratio of 1:2) with diffuse edges. Pixel intensities for locations indicated are given in Table 9. UL = Upper left corner, UR = Upper right corner, LL = Lower left corner, and LR = lower right corner. Corner measurements show the expected increase in sky luminance with altitude at this time of day. The other sky intensity measurements do not suggest the presence of any clearly obvious infrared (heat) or ultra-cold source(s).

Table 9

Pixel Intensities for Frame 6 of Figure 6
from Formation 1

Location	R	G	B
UL	133	139	157
UR	126	138	155
LR	84	110	144
LL	83	111	142
1	105	127	153
2	99	119	144
3	98	117	143
4	88	108	137
5	84	110	145
6	85	109	144

a	108	123	147
b	99	121	143
c	121	135	155
d	98	120	150
e	84	112	142
f	85	111	143

Figure 43 shows the image of this same frame 6 that has been intensity-stretched. Note the symmetrical form of the UAP, its attitude (relative to gravity), and the lighter halo that surrounds it. Its length to width ratio is 1:2. Again, the immediate sky background does not appear to be modified by the UAP in any obvious way.

Figure 43
Intensity Stretched UAP Image from Frame 6 of Figure 6
(**Camera 1**)

The second UAP frame from Figure 6 was number 7 whose enlarged image is presented in Figure 44. This particular image has received much attention since it was publicly released. Pixel intensities at each numbered location are given in Table 10. It may be noted that compared with frame 6 the UAP has a length to width ratio of over 1:4 and the lighter area is predominately on top. The darkest part of the UAP has a pixel intensity of zero (location 4) while the brightest part of the area above the UAP, a value of over 150.

Figure 44
Enlarged UAP Image from Frame 7 of Figure 6
Showing Pixel Intensity Measurement Locations.
(**Camera 1**)

Table 10

Pixel Intensities for Frame 7 of Figure 6
(Formation 1)

Location	R	G	B
A	56	87	125
B	50	87	125
C	55	87	127
D	58	88	129

1	55	85	127
2	45	73	111
3	150	158	173
4	0	8	32
5	73	97	134
6	60	90	134

Another series of measurements were made on frame 7 but covering a larger area of the sky surrounding the UAP image. This was done to see if there were any measureable changes in RGB pixel intensities, perhaps due to the presence of the UAP. No noticeable distortion of sky "luminance" was found anywhere. The sky was almost homogeneously bright (blue).

The next UAP image that was studied was that of frame 43 on Figure 7. It was an enlargement by approximately x15 and is presented in Figure 45. The edge of this UAP is so diffuse that its length to width ratio can only be roughly estimated at 1:4. Otherwise the image is devoid of obvious useful information.

Figure 45
Enlarged UAP Image from Frame 43 of Figure 7
(**Camera 1**)

This same image was subjected to pixel intensity stretching (Figure 46). It produced a darker image representing the UAP with an elongated shape as shown. Its approximate ratio was 1:3. A lighter region appeared both above and below the right-hand end of the UAP.

Figure 46
Intensity Stretched UAP Image from Frame 43 of Figure 7 JL
(**Camera 1**)

The third set of six consecutive UAP images studied from formation 1 fly-overs was of frame 174 to 179 of Figure 8 when the Halcone airplanes had flown past the cameras (MVI_0136.AVI). The cropped area around the UAP's original image was enlarged by a factor of x50 in each of the following enlargements. This series is of special interest for comparison with a separate series of UAP images presented in Figure 11 recorded using a different camera. Figure 47 is an enlargement of frame 174 (the first appearance of the UAP in the frame).

Figure 47
Enlarged UAP Image from Frame 174 of Figure 8
(**Camera 1**)

The UAP's shape is seen better in Figure 48 which is a pixel intensity stretched version of the above image.

Figure 48
Pixel Intensity Stretched UAP Image
from Frame 174 of Figure 8
(**Camera 1**)

The second frame in this series is 175 (Figure 49). As in the previous figure the UAP is of very low contrast and indistinct in outline so that it is not possible to comment further.

Figure 49
Enlarged UAP Image from Frame 175 of Figure 8
(**Camera 1**)

This same image was also used to measure RGB pixel intensities at the locations shown in Figure 50. These values are given in Table 11. As can be seen, sky background luminance is relatively constant.

Figure 50
Enlarged UAP Image from Frame 175 of Figure
with Pixel Intensity Measurement Locations.
(**Camera 1**)

Table 11

Pixel Intensities for Frame 175 of Figure 8
for Measurement Locations Shown in Figure 50
(**Camera 1**)

Location	R	G	B
A	131	149	182
B	134	150	182
C	131	144	179
D	133	149	181

1	138	152	182
2	143	157	187
3	139	152	181
4	114	126	155
5	138	149	178
6	136	154	181
7	136	153	181
a	134	150	181
b	134	151	178
c	136	150	178
d	141	154	182
e	140	154	182
f	134	152	179

Figure 51 presents the results of pixel intensity stretching of frame 175 of Figure 8. Note that a lighter halo of almost constant thickness appears to surround the entire UAP; the UAP's ratio is about 1:2 in this image.

Figure 51
Pixel Intensity Stretched UAP Image
from Frame 175 of Figure 8
(**Camera 1**)

Frame 176 of Figure 8 was enlarged and is presented in Figure 52. It is of very low contrast.

Figure 52
Enlarged UAP Image from Frame 176 of Figure 8
(**Camera 1**)

When frame 176 was pixel intensity stretched it resulted in Figure 53. Its shape is relatively sharply defined and has a ratio of about 1:1.6.

Figure 53
Pixel Intensity Stretched UAP Image
from Frame 176 of Figure 8
(**Camera 1**)

The enlarged frame 177 is from Figure 8 and is presented in Figure 54 where the UAP's image is very faint.

Figure 54
Enlarged UAP Image from Frame 177 of Figure 8
(**Camera 1**)

When frame 177 was pixel intensity stretched it resulted in Figure 55. Its shape is relatively round with a ratio of about 1:1.

Figure 55
Pixel Intensity Stretched UAP Image
From Frame 177 of Figure 8
(**Camera 1**)

The fifth frame in this series of six from Figure 8 is frame 178 (Figure 56) which is of such low contrast it is almost invisible.

Figure 56
Enlarged UAP Image from Frame 178 of Figure 8
(**Camera 1**)

Figure 57 presents frame 178, pixel intensity stretched. Its shape is relatively round with a ratio of about 1:1.

Figure 57
Pixel Intensity Stretched UAP Image
From Frame 178 of Figure 8
(**Camera 1**)

The last frame (No. 179) in this series from Figure 8 is presented in Figure 58. As before, it is almost invisible.

Figure 58
Enlarged UAP Image from Frame 179 of Figure 8
(**Camera 1**)

When subjected to pixel intensity stretching, frame 179 appears as in Figure 59; it possesses a ratio of about 1:1.9.

Figure 59
Pixel Intensity Stretched UAP Image
from Frame 179 of Figure 8
(**Camera 1**)

The next frame studied from the formation 1 fly-over was number 47 from Figure 10. It is presented in Figure 60. The UAP's shape is so faint and diffuse that even its outline shape cannot be accurately determined.

Figure 60
Enlarged UAP Image from Frame 47 of Figure 10
(**Camera 2**)

When pixel intensity stretching was carried out on this same image a generally round shaped UAP emerged as is seen in Figure 61.

Figure 61
Pixel Intensity Stretched UAP Image
from Frame 147 of Figure 10
(**Camera 2**)

The last set of UAP images studied from formation 1 came from Figure 11; the Halcone airplanes are leaving the area trailing their smoke paths. Of the nine frames containing a UAP image five were able to be extracted from the video; they are presented here in order.

Frame 316 (Halcones-2Copy) is presented in Figure 62 and shows a very faint gray amorphous area. A rough estimate of its ratio is 1:1.5.

Figure 62
Enlarged UAP Image from Frame 316 of Figure 11
(**Camera 2**)

When this same frame was pixel intensity stretched it resulted in Figure 63. Its oval shape has a ratio of about 1:1.5.

Figure 63
Pixel Intensity Stretched UAP Image
from Frame 316 of Figure 11
(**Camera 2**)

Figure 64 presents the next frame (317). Again, it is so faint and indistinct as to provide little useful information.

Figure 64
Enlarged UAP Image from Frame 317 of Figure 11
(**Camera 2**)

When frame 317 was pixel intensity stretched it resulted in Figure 65. Again, its shape is compact with a ratio of about 1:1.4. Also note that the slight indentation that appears in upper portion of frame 316 seems to become larger here in frame 317.

Figure 65
Pixel Intensity Stretched UAP Image
from Frame 317 of Figure 11
(**Camera 2**)

The next UAP frame studied was 318 (Figure 66). Like the preceding figures it is very faint.

Figure 66
Enlarged UAP Image from Frame 318 of Figure 11
(**Camera 2**)

When frame 318 was pixel intensity stretched it resulted in Figure 67. Its shape progressed very quickly (within approximately 0.04 second) to that of a kidney with a ratio of about 1:1.8.

Figure 67
Pixel Intensity Stretched UAP Image
from Frame 318 of Figure 11
(**Camera 2**)

Figure 68 presents the next frame (320). As before, it is so faint and indistinct as to provide little useful information

Figure 68
Enlarged UAP Image from Frame 320 of Figure 11
(**Camera 2**)

When frame 320 was pixel intensity stretched it resulted in Figure 69. Again, its shape changed quickly having a ratio of about 1:1.7.

Figure 69
Pixel Intensity Stretched UAP Image
from Frame 320 of Figure 11
(**Camera 2**)

The fifth and last UAP frame studied from Figure 11 was 321 (Figure 70). Like all the preceding figures it is very faint and indistinct, most likely due to light scatter in the atmosphere.

Figure 70
Enlarged UAP Image from Frame 321 of Figure 11
(**Camera 2**)

When frame 321 was pixel intensity stretched it resulted in Figure 71. Its shape had changed again to a more symmetrical shape with an approximate ratio of 1:1.9.

Figure 71
Pixel Intensity Stretched UAP Image
from Frame 321 of Figure
(**Camera 2**)

Formation 8

The next group of four consecutive video frames examined appeared during formation 8 with the fly-over by six F-5E Tiger jets. Each of the three separate groups of UAP trajectories have been presented in the preceding section. These four frames (MVI_0142.AVI:122 – 125) are enlarged by a factor of x50 and are presented here.

Figure 72 is an image of the UAP shown in frame 122 of Figure 29. It is a very faint gray area with diffuse edges.

Figure 72
Enlarged UAP Image from Frame 122 of Figure 29
(**Camera 1**)

When frame 122 was pixel intensity stretched it resulted in Figure 73. Again, its shape is basically round with a ratio of about 1:1.4.

Figure 73
Pixel Intensity Stretched UAP Image
from Frame 122 of Figure 29
(**Camera 1**)

The next UAP frame studied was 123 (Figure 74). Like the preceding figures it is very faint.

Figure 74
Enlarged UAP Image from Frame 123 of Figure 29
(**Camera 1**)

When frame 123 was pixel intensity stretched it resulted in Figure 75. Its shape had progressed to an almost round shape with an approximate ratio of 1:1.2.

Figure 75
Pixel Intensity Stretched UAP Image
from Frame 123 of Figure 29
(**Camera 1**)

Figure 76 is an enlarged image of the UAP shown in frame 124 of Figure 29. Once again it is a very faint gray area with diffuse edges.

Figure 76
Enlarged UAP Image from Frame 124 of Figure 29
(**Camera 1**)

When frame 124 was pixel intensity stretched it resulted in Figure 77. Its shape is not symmetrical and has a ratio of about 1:1.5. Note the thin halo (lighter pixels) surrounding the UAP.

Figure 77
Pixel Intensity Stretched UAP Image
from Frame 124 of Figure 29
(**Camera 1**)

The final UAP frame studied was 125 shown of figure 29. It is presented in Figure 78. Like the preceding figures it is also very faint.

Figure 78
Enlarged UAP Image from Frame 125 of Figure 29
(**Camera 1**)

When this frame was pixel intensity stretched it resulted in Figure 79. Its shape had changed into nearly a circle with an approximate ratio of 1:1.

Figure 79
Pixel Intensity Stretched UAP Image
from Frame 125 of Figure 29
(**Camera 1**)

Discussion

The video analyses carried out in this study consisted of plotting the trajectories of as many different UAP as could be found on the official video tapes received from CEFAA as well as enlarging and enhancing the immediate UAP image area for selected frames. One of the unexpected findings of this analysis was that there were a relatively large number of "incursions" by a single, angularly small unidentified phenomenon or object into the general area of flight of many military airplanes. These incursions often appeared to cross over in front of the airplanes at high speed before the planes had arrived and again, (in an opposite direction?) after they had passed. If this assessment is accurate then a case can be made for a possible impact on flight safety. In addition, many of these UAP trajectories appeared to be linear for some reason or smoothly curvilinear. A few were of an irregular geometry. Even though none of the pilots saw anything during flight this does not reduce the potential threat level. As is discussed later, the very high angular (physical?) velocity of these UAP combined with finite mass could result in damage to the airplane on impact. There was no known radar detection of these phenomena and no other means of determining their distance (other than several video frames of UAP obtained by two separated cameras as discussed above). Therefore, neither the distance to these UAP nor their physical size could be determined in most of the video frames.

If these UAP are some kind of unknown or poorly understood natural phenomenon then many questions are raised: Why were there more UAP associated with the fly-overs of certain types of airplanes than others? And, if they are some kind of electrostatic phenomenon (DIAS; 2000; Spalding, 2010) what guides their trajectory and propels them? Previous discussions of ball lightning have suggested that they are often associated with thunder storms (Fryberger, 1994; Singer, 1971) and have been reported by pilots even flying at high altitudes (Haines, 2010; Singer, 1971). However, there were no thunderstorms present on November 5, 2010 in the Santiago area. Elsewhere, the author has presented three arguments against spherical UAP being the same phenomenon as ball lightning: viz., size, motion behavior, and duration. (Haines, paper 4.3, 2010). We may also ask what are their energistic characteristics? What mechanism(s) guided their movements? Why did they maintain a generally small and compact area (volume?) over all of the video frames taken of them? What caused their changes in shape within very short periods of time? NARCAP Research Associate R. E. Spalding has put forth a theory that some luminous spheres that

appear near airplanes flying at high altitudes "…are most probably an atmospheric electrical phenomenon." (Spalding, 2010) And, if these UAP were nothing more than flying insects of some kind as has been suggested on several internet blogs then how could they fly so fast across so many degrees of arc and maintain such a consistency of shape and orientation?

If some or all of these UAP were intelligently guided objects could it be that they were monitoring changes in the air quality (or other such physical properties) due to the passage of the airplanes? Of course this assertion raises many other non-trivial questions that must remain unanswered at this time. This assertion forms the basis for a working hypothesis that should be tested on additional similar data, particularly in light of previously documented occurrences of the same kind (Haines, 2010). Let us return to our primary concern.

Aviation Safety Impact. According to an article by Kean and Blementhal (2012), CEFAA enlisted the aid of "…eight highly skeptical scientists who analyzed the footage." One of them was Professor Luis Barrera, an astronomer at the Metropolitan University of Sciences in Chile. He wrote, "The object performed a risky flight maneuver in front of the Halcones from W-E-W, at low altitude and high speed… it had intentional movements. It moved east with 25 degrees inclination, which is the same angle of spacecraft when entering the atmosphere." With this early assessment in mind it behooves us to take a closer look at this important issue.

In order to properly assess the possibility of a mid-air collision we must assume two things: (1) These UAP possess finite mass, and (2) The UAP could have collided with an airplane because of their high (angular) velocities and maneuverability. These considerations have also been raised elsewhere (Haines, et al., 2010).

In simple terms force (F) is proportional to the mass (M) of a body and to the acceleration (A) of the body which is produced by the force. The usual formula found in texts is F = MA. Since force is a vector quantity both a direction and magnitude are required for its complete specification. If the UAP recorded in these video segments actually travel as fast as they appear to and they obey the normal laws of physics then they very likely possess negligible mass. Indeed, no sonic booms were heard during this airshow.

If these UAP were on the order of ten grams or less and had struck an airplane it is unlikely that any significant damage would have been done to the airplane. If, on the other hand, most or all of the UAP recorded on these CEFAA video tapes were large birds the consequences of physical impact with an airplane could have been serious depending on a host of physical factors (Cleary, et al., 2005; Richardson, 1994). As stated previously, the birds imaged on these video segments could be readily identified because of their constantly changing shapes, low angular velocities, and their presences in flocks. The present UAP images possess none of these characteristics.

The "Bug" Hypothesis. Perhaps because a number of assertions have been made on internet BLOGS that the UAP recorded during the El Bosque ceremony is something rare and perhaps even extraterrestrial others have countered that all of these flying objects are little more than bugs of some kind. (e.g., Devoid, 2012) This is as good a working hypothesis as anything else as long as its ultimate proof or disproof does not distract us from pursuing the more important matter of flight safety.

What kinds of tests can be made to reasonably support the assertion that *all* of the single, small, typically dark objects seen in these many video sequences are merely flying insects of some kind? It is suggested that *angular velocity* (which is proportional to absolute velocity), *angular object size* (which is proportional to absolute size), and *amount of blur or lack of blur* of a hypothesized insect form the primary supports for or against the "bug" assertion. The first two subjects depend on knowing the distance between the UAP and the camera(s). Unfortunately the only evidence that was discovered concerning distance to one of the UAP comes from **Camera 1** and **2**, located about 32 feet apart as has been discussed above and presented in Frames 174 to 179 of Figure 8 and Frames 316 to 321 of Figure 11.

Angular Velocity. The angular width of the frame taken by **Camera 1** from which Figure 7 (MVI_0136.AVI) was taken was found to be approximately 56 degrees arc. Considering the small, dark, oval (1:1.5) that flew linearly across this field of view in 0.4 second its angular rate of travel was 140 deg/sec. Its velocity can only be calculated for arbitrarily selected distances. Thus, if the UAP moved normal to the camera's optical axis the velocities shown in Table 12 would result for the distances shown. If a bumblebee's average velocity of flight is between 12 and 15 mph then the UAP shown here could have been such an insect flying within eight feet from the camera. However, it has been shown that the UAP recorded by both cameras (Figures 8 and 11) was at least 42 feet from **Camera 1** and probably much farther. This would effectively eliminate all flying insects.

Table 12

Calculated UAP Velocities Related to Figure 7

Distance to UAP (ft.)	Velocity (mph)
8	14.5
20	36.1
50	90.7
100	181
200	362

400	725
1,000	1,812

Angular UAP Size. The length of each UAP (A) shown in Figure 7 was measured and related to the width of the video frame on the screen (B). This ratio (A/B) was then converted to the UAP's visual angle (using a screen width of 56 degrees). Table 13 presents these results. The UAP is definitely becoming smaller over time.

Table 13

Calculations of Angular Size of UAP for Figure 7

Frame No.	UAP Length (mm)	Frame Width (mm)	A/B	Calculated UAP arc length (deg.)	UAP Length (in.) (see text)
	A	B	C	D	E
42	3.6	330	0.01091	0.611	6.4
43	2.9	330	0.00879	0.492	5.2
44	2.0	330	0.00606	0.339	3.6
45	1.5	330	0.00455	0.254	2.7
46	1.2	330	0.00364	0.204	2.1

Column E in Table 13 presents calculated UAP length for a distance of fifty feet from the camera. If this is a flying insect it is large indeed.

Shape of Flying Insects. This subject is definitely more in the province of the entomologists of Chile who should be searching for the largest and fastest flying insects in the vicinity of metropolitan Santiago. Kean (2012) contacted Prof. Ratcliffe of the University of Nebraska's Department of Entomology about this general subject. When sent still frames from one of the videos he wrote back to her, "(I have) No idea what it is but it does not seem to be an insect… altho very fast flying insects captured on slow shutter speeds do look like amorphous blurs or blobs." When he showed the images to "several…colleagues" "No one had any idea of what could have caused that." The interested reader should consult (Bugguide, 2011) for an impressive photo array of various shaped insects, some of which can fly. Suffice it to say that flying insects possess a wide range of shapes whose length to width ratios span all those discovered in these videos.

Image Blur. Sophisticated image recording hardware and image analysis software are required to discriminate between an insect flying past a nearby camera and a larger object farther away, both presenting the same visual angle and angular rate at the camera. (Louange and Cousyn, 2012) It has been presumed (without supporting proof) that the rapid motion of the wings of a flying insect could be seen on a video and also that features (color and shape) of its body might also support an insect hypothesis. However, it is not as simple to find evidence of this as might be thought because of such (optical) factors as the limited resolution of the camera in both space and time. If the wings are short relative to the body of the bug (e.g., a bumblebee) they may not exceed the spatial resolution of the camera and remain invisible or, if they are large enough, their contrast still may not be great enough to be sensed by the camera's image sensor. If the frequency of wing motion is the same as that of the video frame rate it can be "stopped" altogether and appear to not be moving at all. Of course other out-of-synchrony frequency combinations can produce unusual apparent wing-motion effects.

Example of a Blurred Flying Insect. A large flying insect (presumed to be a bumble bee) was captured on two consecutive video frames during the second formation fly-by about one minute after the start of the video (MOV01011.MPG) taken by **Camera 2**. This insect appeared almost cut in half at the extreme left edge of the frame at its first appearance and is not discussed further here. Its second appearance on the following frame is shown on the left-center of Figure 80 which has been pixel intensity stretched to enhance what are considered to be wings above and below its dark body.

Figure 80
Pixel Intensity Stretched UAP Image
of Approaching T-35 Pillan Airplanes and Probable Flying Insect
(**Camera 2**)

The region including one airplane and the insect has been enlarged and stretched and is shown in Figure 81.

Figure 81
Pixel Intensity Stretched UAP Image
of One T-35 Pillan Airplane and Probable Flying Insect

This camera operated at 25 fps. Its electronic shutter speed during this video is not known, however. It is most probable that its fastest shutter speed of 1/1600 second was not used because, otherwise, even high speed fluttering wings would likely have been "stopped" in their motion. But more importantly, this alleged insect is not in focus. It is suggested that this is because it was nearer to the camera than the camera's hyperfocal distance, estimated to be between 5.7 to 7.3 feet. The wings of the airplane located at a much greater distance are in sharper focus than is the alleged insect seen here. It must be pointed out that *virtually all of the UAP images reviewed in this report were in sharper focus than was this alleged insect* suggesting that they were all at a distance greater

than the hyperfocal distances of these cameras!

In Figures 82 and 83 are presented two in-focus, enlarged, side views of bumblebees. It may (or may not) be relevant to the present discussion to point out that the measured length to width ratios of these two bees is about 1:1.9 and 1:2.3, respectively, which is a lower ratio than is found among the majority of UAP images on these video segments. Of course another kind(s) of flying insect might have been recorded here than a bumblebee.

Figure 82
First Enlarged Side View of a Bumblebee

Figure 83

Second Enlarged Side View of a Bumblebee

Conclusions

The contents of these videos are complex and have become controversial. They have raised many interesting questions and conjecture by people who had only the early YouTube video segment(s) to study. Yet valid and useful conclusions must be based on a careful study of all available evidence. The present preliminary report has attempted to present such evidence. Were any of these UAP a possible threat to the safety to the passing airplanes? Without knowing for sure whether these UAP possessed finite mass it is not possible to say. However, it is safer to decide that they were a possible threat than that they were not. Further research should be carried out on this subject because such phenomena are appearing near airplanes in other nations as well. (Haines, 2007; 2010)

Could all of the UAP recorded here have been flying insects? On balance, the answer is very likely no because of the linearity of their flight, their apparently high angular velocity, their apparent trajectories relative to the different airplane formations, their almost consistent oval shape and nearly horizontal orientation, and their lack of any color other than gray and white. Nevertheless, this hypothesis must be left unanswered at this time.

Another possibility is that these UAP were little more than artifacts created by electronic circuitry within the cameras. This might be a reasonable explanation had it not been for a second camera that captured a UAP traveling across the same part of the sky at the same time. The likelihood of two cameras producing the same artifactual characteristics is extremely improbable.

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Appendix 1

Video Files Made Available for Analysis
(All frames: 640 x 480 pixels)

No.	File Name	Duration (min:sec.)	FPS	Camera	Details and Comments
1.	Halcones1.AVI	0:30	10	1	6 ea. Halcones fly-over, smoke
2.	Halcones2.MPG	5:21	25	2	6 ea. Halcones, enlarged
3.	MOV01011.MPG	5:15	25	2	(See Table 1)
4.	MVI_0124.AVI	0:30	10	1	5 ea. F-5E fly-over
5.	MVI_0125.AVI	0.06	10	1	spectators near white building
6.	MVI_0136.AVI	0:30	10	1	6 Halcones, smoke trail
7.	MVI_0137.AVI	0:30	10	1	15 ea. T-35 Pillan, V formation
8.	MVI_0138.AVI	0:30	10	1	10 ea. Helicopters fly-over
9.	MVI_0139.AVI	0:13	10	1	3 ea. F-5 fly-over
10.	MVI_0140.AVI	0:30	10	1	4 ea. Large aircraft
11.	MVI_0141.AVI	0:08	10	1	spectators near building
12.	MVI_0142.AVI	0:14	10	1	6 ea. F-16 fly-over
13.	MVI_0143.AVI	0:18	10	1	7 ea. F-16 fly-over
14.	MVI_0144.AVI	0:19	10	1	8 ea. F-16 fly-over

Appendix 2

Optical Hyperfocal Distance

Hyperfocal distance (H) refers to the distance of an object from the camera at which the camera must be focused in order that the distant end of the depth-of-field range will just extend to infinity. H can be approximated by:

$$H = AF/c' = F^2/c' \times (\text{f-number}) \quad (1)$$

Where: A = lens' (aperture) diameter (mm), F = lens' focal length (mm), and c' = diameter of a "circle of confusion" on the film or sensor surface which is so small as to be indistinguishable from a point. The interested reader should consult other references as well on this important subject. (Ogle, 1961)

Although the precise camera focal lengths and f-stop settings are not known for **Camera 1** and **2** they can be estimated. Values for H range from about 5.7 to 7.3 feet.

Appendix 3

Article in the Huffington Post, April 13, 2012
"Update on Chilean UFO Videos: Getting the Bugs Out"
by L. Kean and R. Blumenthal

Is this the case UFO skeptics have been dreading?

Sightings of mysterious flying craft with capabilities unknown on Earth have confounded mankind throughout recorded history. Most have been convincingly explained away as unfamiliar aircraft, natural phenomena or illusions. But then there are the others, witnessed in our time by pilots and air traffic controllers, military leaders, scientists, law enforcement officers and other trained observers, sometimes with physical evidence, including corroboration on film and video.

"We don't know what they are," says Nick Pope, a former head of the official UFO office in Britain's Ministry of Defense. "But they do exist."

As agreed by authorities around the world, these truly unexplainable unidentified flying objects appear solid, metallic and luminous, able to operate with speeds and maneuvers that defy the laws of physics. And, most chilling of all, they often behave as if under intelligent control.

One such case has just come to light in Chile, and was presented by government officials for the first time at a press conference on March 13.

It was a glorious, sunny morning on Nov. 5, 2010, when crowds gathered to celebrate the changing of the Air Force Command at El Bosque Air Base in Santiago. From different locations, spectators aimed video cameras and cell phones at groups of acrobatic and fighter jets performing an air show overhead. Nobody saw anything amiss.

But afterward, an engineer from the adjacent Pillán aircraft factory noticed something bizarre while viewing his footage in slow motion. He turned it over to the government's well known Committee for the Study of Anomalous Aerial Phenomena, or CEFAA, for analysis.

The stunning conclusion: The Chilean jets were being stalked by a UFO.

In the clips below, the UFO is difficult to see because it's moving so fast. The clip is repeated with the UFO highlighted as it makes passes around three separate groups of airplanes: (Clip in article)

CEFAA was established in 1997, within the Department of Civil Aeronautics, the equivalent of our FAA. Its creation was sparked when aeronautic specialists and others reported multiple sightings of anomalous lights near Aeropuerto Chacalluta -- an airport in Northern Chile -- which were then reported in the press.

Gen. Ricardo Bermúdez, formerly chief commander of the air force's 3rd Air Brigade (southern area) and an air attaché in London, was one of CEFAA's founders, and he currently directs the agency with a full-time staff of three.

"Our mission is to study cases of unidentified aerial phenomena for which there is adequate data, to determine any possible risk to air operations," says Bermúdez. "Since this is a worldwide phenomenon, it should be subjected to rigorous scientific analysis so we can come to viable conclusions."

CEFAA officials collected seven videos of the El Bosque UFO taken from different vantage points. Bermúdez commissioned scientists from many disciplines, aeronautical experts, and air force and army photogrammetric technicians to subject the videos to intense scrutiny. They all came to the same conclusions.

Each video included three different, mainly horizontal loops flown by the UFO within seconds of each other. The object made elliptical passes either near or around each of three sets of performing jets. It flew past the Halcones, F5s and F16s at speeds so fast it was not noticed by the pilots or anyone on the ground below.

Images show it as a dome-shaped, flat-bottomed object with no visible means of propulsion. The rounded top reflects the sun and appears metallic; the bottom is darker and flat, emitting some form of energy which is visible in photo analysis. Infrared studies show the entire object is radiating heat, just like the jets.

This extraordinary machine was flying at velocities too high to be man-made. Scientists have estimated the speed, depending on the size of the object, to be at least 4000 - 6000 mph. Humans inside this object could not survive. And, somehow, it made no sonic boom, a noise similar to thunder which occurs whenever something exceeds the speed of sound (750 mph at sea level).

The shock waves generated from an object at such high velocities would normally be enormous. But no known aircraft or drone could possibly fly this fast at such low altitudes anyway. Our fastest air-breathing jet, the SR-71, has a maximum speed of just over 2,000 mph, but that's at high altitudes.

And, this strange object is clearly operating under intelligent control. It zooms toward each set of jets at about their height, circles around and zooms back out again. Pilots who were shown the trajectory of the object in the three flybys were amazed that this maneuver is characteristic of reconnaissance aircraft coming in for a quick look at others in the sky.

Astronomer Luis Barrera from the Metropolitan University of Sciences in Chile, who has an asteroid named after him, was one of eight highly skeptical scientists who analyzed the footage. He was able to rule out a meteoroid, pieces of meteors or comets, space junk, a bird or an airplane.

"The object performed a risky flight maneuver in front of the Halcones from W-E-W, at low altitude and high speed," Barrera concluded. "It had intentional movements. It moved east with 25 degrees inclination, which is the same angle of spacecraft when entering the atmosphere."

Alberto Vergara, an expert in digital imaging, reported that "when we examine the whole scene frame by frame, we have been able to realize that it has, apparently, moved at a speed far superior to any flying object of known manufacture."

Has Chile found proof of something possibly extraterrestrial?

"At this time, this incident cannot be scientifically explained," Bermúdez wrote in a recent email. "As agreed by those who have studied the videos, we can affirm that there is an unidentified aerial object present. We do not know what it is or where it came from."

The El Bosque Air Base in Santiago, Chile, where the UFO event occurred on Nov. 5, 2010. There was an air show due to the changing of the Air Force Command, which happens every four years. The UFO was captured on seven cameras from different vantage points.

Chile is among a growing number of countries around the world that officially take UFOs seriously. Others include Brazil, Peru, Equador, Uruguay, Argentina, Belgium, France and Britain. The United States is not on the list.

In 1986, Brazil's entire defense system was put on alert while F5 and F103 jets were scrambled to intercept multiple UFOs. The acting commander of the Brazilian Air Defense stated in an official report that radar readings from both the Air Defense System and intercepting jets were recorded simultaneously while the pilots observed the objects through the cockpit window. The document says that the phenomena made sudden accelerations and decelerations, had an ability to hover, and moved at supersonic speeds.

In 1989-90, Belgium was repeatedly visited by UFOs. The Belgian air force actively responded by putting radar stations on alert and scrambling F16s. A dedicated group of scientists made voluminous records of the sightings -- some from police officers and military personnel -- and conducted over 650 investigations.

"Hundreds of people saw a majestic triangular craft with a span of approximately 120 feet and powerful beaming spot lights, moving very slowly without making any significant noise but, in several cases, accelerating to very high speeds," says retired Maj.-Gen. Wilfried De Brouwer, chief of the operations division in the Air Staff at the time, referring to the first night of the Belgian wave.

America's closest ally, Britain, had a "UFO Desk" within the Ministry of Defense from the 1950s until 2009, when the program was closed due to the overwhelming number of Freedom of Information requests clogging the system. But the MoD acknowledges that any "legitimate threats" -- cases involving military pilots, air defense installations or objects tracked on radar -- will still be properly investigated.

The French government agency studying unidentified aerial phenomena is part of the French National Space Agency, known as CNES, the equivalent of our NASA. This office has been operating for 35 years with a focus on pure scientific research. It has amassed many compelling case studies, some involving landed UFOs affecting the immediate environment.

Former CNES Director-General, Yves Sillard, who later became assistant secretary-general for Scientific and Environmental Affairs at NATO, founded this agency, GEIPAN, in 1977. "The objective reality of unidentified aerial phenomena is no longer in doubt," he wrote in a recent essay. "The climate of suspicion and disinformation, not to mention derision, which still too often surrounds the collection of reports, illustrates a surprising form of intellectual blindness."

In contrast, the U.S. government wants nothing to do with UFOs. The Air Force once had an official, public investigative office, called Project Blue Book, in operation from the early 1950s until 1970 when the Air Force declared that UFOs were not national security threats and no longer warranted attention.

Blue Book had been overwhelmed with reports, and was incapable of explaining the phenomenon. In 1953, a classified CIA report encouraged all branches of government to use the media to "debunk" and demystify UFOs as a means of dealing with something beyond their control. Some respected professional scientific organizations urged continuing scientific investigation, despite the close of Blue Book, but ridicule and a lack of resources have made that all but impossible.

One example from many: Even though hundreds of citizens witnessed massive delta-shaped objects traveling silently over Arizona on March 13, 1997, the government ignored inquiries from state officials and never offered the public any explanation. This dismissal occurred despite a letter to the Air Force from Sen. John McCain requesting an investigation, and a class action lawsuit, filed by witnesses, seeking information from the Department of Defense.

Former Arizona governor Fife Symington acknowledged in 2007 that he, too, had witnessed this "craft of unknown origin" while in office, which he did not disclose at the time for fear of ridicule.

Incomprehensibly, pilots are ordered not to report sightings. The FAA Aeronautical Information Manual states that "persons wanting to report UFO/unexplained phenomena activity" should contact a civilian collection center, or, if the encounter is life-threatening, "report the activity to the local law enforcement department."

By way of contrast, the Civil Aviation Authority (CAA) in Europe requires that such incidents be reported. And in Chile, CEFAA reporting forms are readily available at every commercial and military airport in the country.

Why this longstanding U.S. government posture of willful ignorance and dismissal of UFOs? Maj.-Gen. Denis Letty of the high-level French UFO study group, called COMETA, pondered an

answer: "I don't think a powerful country like America finds it acceptable to acknowledge that something strange can fly over and the country can't clear the skies of it. Another problem can be panic, created by people imagining that their military can't protect them."

Official investigators from around the world hope that scientific curiosity, and concerns about air safety, will eventually overcome the U.S. government stalemate. They recognize that UFOs provide a challenge to our current scientific paradigm, since the "extraterrestrial hypothesis" must be considered along with others. For this reason, a taboo against the topic remains fixed.

"Scientists should take the subject seriously. It is their moral duty to investigate something that somehow could affect -- one way or another -- the lives of many people around the world," Bermúdez says.

Theoretical physicist Michio Kaku, author of "Physics of the Impossible" and popularizer of science, believes that the small percentage of UFO cases with "evidence from multiple sources and multiple modes" cannot be dismissed.

"Scientists must stop giggling, and maybe we'll be able to learn more in the future," he says. "If another civilization is 1,000 years, a million years, ahead of us, then new laws of physics open up. And a million years, on the scale of the universe, is nothing."

The End