Useful Research Methods for Aircrew and Air Traffic Controller UAP Sightings[1]

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Abstract

Various methods are available to collect and analyze sighting reports of unidentified aerial phenomena (UAP) made by ground witnesses. They include but not limited to interviews, image and audio recordings, and subjective drawings usually made from memory. There are also UAP sightings made by aircrew and air traffic controllers around the world where additional relevant technical methods and scientific information are available from a powerful array of virtual, nearly real-time ground- and space-based detection equipment. The following subjects will be presented from the author's National Aviation Reporting Center on Anomalous Phenomena (NARCAP) related research on this subject: initial and follow-on interview techniques that do not bias the witness; methods of 3-D cockpit documentation; event reconstructions using flight simulators, artist, and computer-based virtual reality reconstructions, and even hypnosis; and integration of ground-based multi-spectral sensor data with near real-time space-based internet data. Photographs, tables, figures and illustrative UAP pilot sighting cases will be presented.

This paper describes a variety of methods of air-crew and air traffic controller interrogation and data collection-management-analysis techniques that can help improve overall reliability of the data as well as uncover otherwise "invisible," "unexpected" Black Swan-like (Taleb, 2007) events that lie outside the expectations even of highly experienced investigators (e.g., the where and when of these occurrences still cannot be predicted) yet can have an extremely significant impact by producing great uncertainty and even inappropriate, unsafe physical and cognitive flight-related behaviors in the flight crew and others. Like Black-Swan events UAP encounters are a-typical

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and can have a non-linear influence. Such logic makes what we don't know about them more relevant than what we do know. To the extent that close proximity, UAP encounters with airplanes qualify as true Black Swan events and if flight safety and a deeper understanding of UAP are our objectives then clearly we need far more effective research methods than we have been using to date; e.g. statistical approaches that are not based on large sample Gaussian distributions. We should be developing new and far more creative analytical approaches for the future.

Introduction

Unidentified aerial phenomena (UAP) continue to be reported by pilots and air traffic controllers around the world. (Bravo and Castillo, 2010; Clark, 1996; Ferguson 2013; Guzman and Salazar, 2001; Haines; 2000: Haines & Weinstein, 2001; Randles, 1998; Sillard, 2007; Smith, 1997; von Ludwiger,1999; Weinstein, 2007) Governments and private individuals have also continued to try to discover their core identity as numerous books and journal articles will verify. (COMETA, 1999; Project Hessdalen, 2014) Nevertheless, little more is known today about the true nature of UAP than was known in the 1950s when they came under scrutiny by many governments because of their marked increase in appearances particularly around nuclear facilities of all kinds (Hastings, 2007; 2008), secret military flights and operations, (Saunders, 1968), intercontinental ballistic missile launch sites (Crane, 1988; Hastings, 2007; NICAP, 2009) and earth's power-generating plants. UAP also appear without warning near airplanes in flight which is the primary subject of this paper.

Aircrew of commercial and military airplanes are relatively good witnesses of UAP. They are well educated, highly trained and experienced through their many hours of flight to recognize most otherwise prosaic visual phenomena in the air. They also have various equipment available that may detect and alert them to the presence of one or more UAP and even record some of its characteristics. In some instances they can also pursue the phenomenon; doing so may achieve several important objectives: (a) determine whether the UAP is capable of reactive behavior (e.g., by avoiding confrontation with the airplane) and (b) placing the UAP visually against the earth's background whereby useful calculations may be made of its maximum slant range and size. Finally, if pilots radio ground authorities additional support resources (ground radar contact; air force scrambles; diversion of other airborne airplanes) may be provided to confirm the UAP's existence and performance. The author has studied such reports for over thirty years and has amassed a large collection of detailed aerial encounters at relatively close range.

On the ground air traffic controllers (ATC) also detect unidentified traffic by primary (so-called "skin paint" returns) and secondary (aircraft transponder) returns. (Shough, 2002) Although most of these contacts are later identified there remain a small and challenging residue that call for serious study. In order to glean the most useful information about these UAP radar returns the investigator should become very familiar with how air traffic controllers carry out their daily tasks, their unique human factors and work-load demands and how they communicate with one another within their own radar center and within their nation's larger network of airspace monitoring facilities. (Hopkin,1995) Much of this information is unclassified and open to public scrutiny. Investigators should also understand radar technology and its limitations; indeed, some UAP appear to demonstrate stealth-like characteristics.

If investigators are unwilling to become knowledgeable about these subjects it is less likely that pilots and air traffic controllers will be willing to cooperate with them. Investigators should also understand that controllers are extremely busy while on duty; they are not permitted to take outside phone calls and are discouraged from giving out information on UAP events. With increased concerns over terrorism these days most control towers are now "sterile," i.e., off limits without special entry permission. All of this makes for challenges to the serious investigator who wants to investigate a radar sighting. I have been fortunate over the years to have made friends with controllers who have contacted me (later) with useful information, off the record.

The Black Swan Event Metaphor.

In his insightful work "The Black Swan: The Impact of the Highly Improbable" Taleb (2007) has presented us with a useful metaphor for UAP, particularly as they affect advanced avionic systems and, therefore, flight safety. By definition, a Black-Swan event: (a) is rare and lies outside our regular expectations since little or nothing can convincingly point to its possibility, (b) produces an extreme impact, and (c) leads to after-the-fact explanations that try to make the event more "predictable" and understandable – as also occurs today in some airplane accident investigations.

Our future research methodology must focus more upon invisible and unexpected Black-Swan-like events that lie outside the expectations of highly experienced UAP investigators and aviation officials than upon what appears to be the obvious. We must keep an open mind to the possibility that some UAP may be "designed" to appear one way while in reality are quite different while at the same time allowing the pilot witness to describe and interpret what he saw any way he wants to. The concept of deliberate stealth comes to mind here. Also, some aerial close encounters can have an extremely significant and serious impact by causing uncertainty about what the UAP may do next – e.g., while it is flying near the airplane – as well as inappropriate and unsafe cognitive and physical flight-related behaviors by the flight crew. I have documented scores of them elsewhere. (Haines, 2000) But how can we focus on invisible, unpredictable, uncertain, non-linear things? That is one of our great challenges we face as investigators.

Things that are not yet known cannot be included in any formal decision model but can only be given estimated probabilities that originate in man's logical reasoning and imagination. The decision support tools and surrounding culture of both governmental and commercial aviation policy makers are based on overly linear assumptions and calculations. Perhaps the same thing may be said for some of us UAP investigators as well. Yet, as Taleb has made clear, "The world is getting less and less predictable and we rely more and more on technologies that have errors and interactions that are harder to estimate let alone predict." (Ibid., pg. 174) Perhaps the same is true about the ubiquitous phenomena that we call UAP. It is probably true that no two UAP sightings are the same. Yet, man loves the consistent, the "real," the tangible, and visually confirmed events of life and he tends to overestimate what he knows, or thinks he knows, about them while underestimating less certain things. So what? We can become desensitized to the effects of these events. We tend to underestimate what is less visible, less obvious. Therein lies part of the threat both to achieving a penetrating understanding of UAP as well as to flight safety.

The central and useful idea of uncertainty is that we can have a clear idea of the consequences of an event (or a UAP encounter) even if we don't know how likely it is to occur or when or where. Therefore, we should focus on the consequences which we can know rather than on the probability of occurrence which we can't. What else can we do?

UAP investigators should focus on establishing a broad "net" in which to "catch" all of the *objective* (Project Hessdalen, 2014; Teodorani, 2009) and *subjective* characteristics of a UAP. Both types of characteristics are important. Our objective net must operate 24/7 and also be broadly sensitive to a wide range of electromagnetic (E-M) frequencies, seemingly random temporal patterns – similar to the algorithms used in the Search for Extraterrestrial Intelligence (SETI) program - and even possibly intelligent messages and responses to human behavior. (Haines, 1999) Some of the subjective characteristics of UAP are discussed below.

Of course the various features of the net that UAP investigators use will determine what is caught. One of the present day problems faced by UAP investigators it is that they do not work hard enough to clarify witness descriptions that contain conflicting and ambiguous terms such as "a light," "an object," "a vehicle," "a craft." Many reports are filled with multiple conflicting terms for the same phenomenon. We need a comprehensive taxonomy of UAP to categorize and parse the various classes of these phenomena. (Haines, Section 5.2, 2010)

Several elements or strands of this net are discussed next. They include: Interviewing the witness, interviewing the airplane, sighting reconstruction and data selection, integration and analysis.

I. Interviewing the Witness

Earning Credibility and Trust.

It is probably more important to earn the trust and confidence of professional aviators and ATC personnel to obtain their full cooperation than it is of people in most other areas of society because they must be convinced that the investigator is highly knowledgeable about their own profession as well as about UAP in general. They also must be assured that they will be treated with respect, believed, and not made fun of. Gaining this credibility and trust is not easy, it takes patience, hard work, focus, and a willingness to suspend judgment about what is heard from the witness. Most pilots who report UAP want to tell the truth and assist others in collecting the facts and should be treated without negativity or derision.

When to Interview?

The question of when is it best to interview the pilot or controller after the event comes down to two things: the ability to gain access to the witnesses in the first place and minimizing various witness and investigator biases. Since the 9/11 terrorist attacks in the USA it has become almost impossible to initiate contact with aircrew witnesses. It is fortunate that this situation is quite different in France. Nevertheless, a strong argument can be made for "the sooner the better" in both these cases because witness memory is most acute then; if the pilot makes a radio transmission to ground authorities during the incident or shortly thereafter a permanent record of the details also may be made. In other words some memory-linked biases can be minimized.

Another bias that should be taken into account whenever possible is that of the pilot's prior beliefs about UAP in general. These often hidden biases may overlay what the witness already thinks he knows about UAP and thereby contaminate his subsequent perceptions. The papers by Bouvet (2014) and Abrassart (2014) at this meeting should be consulted in this regard. This is particularly true if they face peer pressure to cover up their experience. Although the investigator cannot know in advance what biases the witness has he can attempt to find out later and discount their effect on the sighting report.

Ridicule from others produces yet another source of reporting bias. If the witness thinks that he will be ridiculed for making a sighting report he will be either less likely to make it in the first place or perhaps will cast the details in more acceptable terms (e.g., "the airplane I saw did remarkable aerobatic maneuvers" rather than "the object, thing, or phenomenon" I saw did truly extraordinarily impossible maneuvers.") Derisive social treatment by others can impose additional stress on the witness than did the original experience. A helpful procedure is one used by the National Aviation Reporting Center on Anomalous Phenomena in the U.S.A. It is to assure the witness that he is not going to be quoted or identified in any way by name and that his information is collected only for scientific use. What he says is taken seriously.

What about the stress that can accompany a close aerial UAP encounter? Depending on such factors as the separation distance to the UAP, its flight dynamics in relation to the airplane, duration of the encounter, and perceived threat, overt and covert stress responses can be great. After the encounter posttraumatic stress disorder (PTSD) is known to be associated with altered processing of emotional material with a strong attentional emphasis or bias toward trauma-related information and can interfere with cognitive processing. A wide range of cognitive impairments have been related to PTSD with predominant attention and verbal memory deficits. (Londre et al, 2012)

In addition, the longer the witness takes to begin writing out his report memory distortion biases may contribute additional errors of omission or commission to that report. One possible explanation for this effect is that when experiences pass from short-term memory into long-term (permanent) memory they undergo a reformatting or filtering (more likely a new “header” bit) with which they are stored and retrieved more efficiently. Whether or not this is true the witness’s report should be completed within hours or less of the sighting whenever possible.

UAP investigators possess various kinds of biases as well. Minimizing them is an important consideration that has not been fully appreciated to date. Investigator biases include: incomplete and faulty understanding of how to obtain accurate data from both the equipment that is used and from the witness, leading the witness to think and say things that did not really occur, fears of appearing qualified when one isn’t, compensatory behaviors for ignorance of UAP facts, and others.

How to Interview.

NARCAP has developed detailed 100% confidential pilot and ATC reporting forms (www.narcap.org) that ask all of the relevant questions: The Anomalous Phenomenon: (13 questions); Aircraft Flight Details (*Spatial*: 6 questions); (*Temporal*: 4 questions); (*Aircraft*: 11 questions) (*Weather*: 2 questions) (*Miscellaneous*: 6 questions); Eye Witness Details (10 questions). This computer-friendly form should be used across national boundaries to help standardize computerized data collection and analysis. Sadly, the pilot incident and near-miss reporting forms issued by the FAA and other agencies today do not provide any encouragement to report UAP sightings, in fact some of them discourage pilots from doing so.

It is better to have the witness complete the form in the presence of the investigator in order to answer any questions about it, otherwise it can be sent to the witness via the internet or by regular post. NARCAP safeguards the identity of the reporting witness by using the same procedures as are used by the Federal Aviation Administration’s Aviation Safety Reporting System (ASRS).

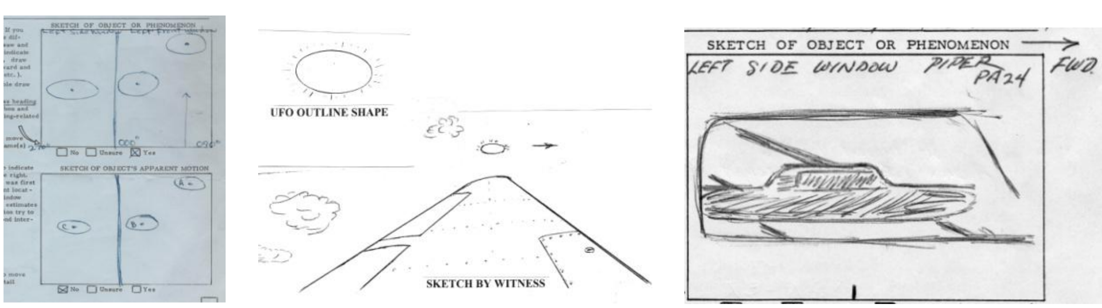
Where to Interview.

I have found it very useful to conduct the witness interview in the cockpit of the airplane that was flown at the time (or its simulated equivalent) for reasons discussed below. (cf., Cockpit

Documentation). Research has shown that being in the actual cockpit (or a high fidelity flight simulator) will help enhance memory. Pilots also feel more comfortable in familiar surroundings and will often recall more details than if they were in a room somewhere else. These "associative memories" may perhaps come from the mind being set back in time to the original sighting event and then progressing forward, flight-detail by flight-detail, which will also involve the UAP. I also like to begin the replay well before the UAP appeared to help establish the context, much like the procedure used during a hypnotic regression. The effect is something similar to establishing inertia to the contents of memory. Thus, mental inertia drives the associations forward in time while linking new contextual memories to them along the way.

Drawing What was Seen.

I always request that the witness draw one or more sketches of what was seen. For reasons discussed elsewhere (Haines, 1979) these sketches seldom contribute very much to our overall knowledge but they do document the basic outline shape, primary luminous and color details of the phenomenon, as well as the important fact that something actually was present. Artistic ability is not essential. Even if the witness is an accomplished artist, however, the stress of the sighting can distort what is drawn. To illustrate this Figure 1(a) presents line drawings made by Capt. Phil Schultz on July 10, 1981 only six days after his close encounter over Lake Michigan that is described in detail elsewhere. (Haines, 1982a, 1982b). At this early point in his disclosure he only drew very basic details. As is quite common, later questioning discovered many other valuable details, probably because he felt some stress from his sighting and also because he did not realize how important such details could be to the investigator. Figure 1(b) is the drawing made by a private pilot of the round, self-luminous ball of light that accompanied his airplane for more than five minutes on August 3, 1976 over Northern Germany and which produced interesting magnetic and flight-control effects on his airplane. (Haines, 1999) Figure 1(c) is an initial sketch made for me by Carlos de los Santos of one of the three identical solid objects that maintained a very close and continuous station near his airplane for many minutes on May 3, 1975 southwest of Mexico City Airport. In these three drawings it is clear that the pilots intended only to portray the general outline shape of the unexpected phenomenon, probably because they did not know what might be of interest to the investigator; perhaps they were waiting to be asked.



(a) 7-4-81 USA (b) 8-3-76 Germany (c) 5-3-75 Mexico

Fig. 1 Initial Witness Sketches of UAP's Apparent

UAP Shape and Position in Cockpit Window(s)

In order to move beyond these initial sketches made by pilots, whenever possible, I employ the services of a professional artist who works closely with the witness to render one or more accurate images of what was seen. Figure 2 illustrates how essential it is to not accept the pilot's initial sketches as being particularly accurate but to attempt to recreate an almost photographic quality image of the UAP if possible.

From This (9-27-96 LAX) to This (9-27-96 LAX)

Fig. 2 Artist's Final Rendering of the UAP

Professional artists can also recreate the cockpit environment and appearance of the UAP relative to the cockpit window(s). One example is shown in Figure 3 from the 9-27-96 sighting near LAX airport. (Haines, 2012) Using modern computer-aided design software it is also possible to create dynamic, virtual reality video reconstructions of the sighting. When this is done by each flight crew member independently valuable insights can be obtained about the similarities and differences in what was perceived.

Fig. 3 Artist Rendering of Jumbo Jet Cockpit and UAP (9-27-96 LAX)

In summary, a carefully drawn and verified rendering really is almost worth a thousand words. It often raises many other new questions that demand answers. Other interesting artistic renderings of UAP reported by pilots are found in the Technical Report section of NARCAP's website (www.narcap.org)

Psychological Issues in Interviewing

Those who don't fly for a living or for pleasure cannot fully understand why so many pilots will not make a UAP sighting report. Many of the reasons are discussed elsewhere. (Roe, 2004) Some of the sources of this non-reporting bias have been discussed above in the witness Interview section as well. Here I discuss a different aspect of this challenge, viz., various psychological factors.

By definition Black Swan events in life are unexpected and often beyond belief quite like UAP. This makes them harder to accept as reality at all and, therefore, more prone to be dismissed as a temporary psychological dysfunction or optical illusion rather than a measureable physical phenomenon, an event that many people believe could never happen again. In short, by their very nature, over time, Black Swan events act to condition one's entire culture to ignore or downplay certain things making it more difficult to obtain sighting information from witnesses. Indeed, if one's expectancy model does not permit the possibility that UAP are "real" then they may become perceptually invisible. I have carried out laboratory research that supports this assertion. (Haines,1989) This raises further interesting challenges to the investigator who must separate fact from fancy, objective from subjective reality.

Assuming that UAP are physical, energetic phenomena and not hallucinations or other subjective constructs then so-called physical science offers numerous methods and equipment with which to study them. (e.g., Teodorani, 2009) Even if UAP turn out to be entirely psychological in origin then the so-called social sciences offer other perhaps less objective means to investigate them. In either case UAP are well documented (Clark, 1996: COMETA, 1999; Haines, 1994; Hall, 2001) and deserve the serious attention of both physical and social scientists.

II. "Interviewing" the Airplane

Eye witnesses onboard the airplane are not the only ones who should be "interviewed," i.e., carefully examined. This is because it is possible that some residual or remnant of a UAP encounter with an airplane may remain after the witness's visual contact with the phenomenon has ended; it is important to carry out a variety of airplane surface and systems' checks whenever possible. Even in the early cold war days of the U.S. Air Force's Project Blue Book ionizing radiation measurements were made on military airplanes surfaces that had chased UAP. (Ruppelt, 1956) Yet aviation systems have matured greatly since then and currently include highly sensitive digital-electronic sensors and effectors, data processors, and digital flight control systems, each of which may have been affected (temporarily or permanently) by radiated energy from the UAP. In short, most modern military and commercial airplanes represent flying "laboratories" perhaps capable of detecting otherwise very subtle radiation. We should be asking whether any of these airplane systems are ever re-tested and re-calibrated immediately after a UAP encounter? Are current flight crews asked about the operation of these systems after a reported close encounter beyond the obvious general question: "did you notice anything unusual displayed on your instrument panel during your sighting?" Given the extremely low level of seriousness that the phenomenon is afforded these days it is not likely that aviation officials will spend the funds, energy, or time to do so. This gross level of "airplane interrogation" is not nearly enough. We may be overlooking valuable data related to the phenomenon.

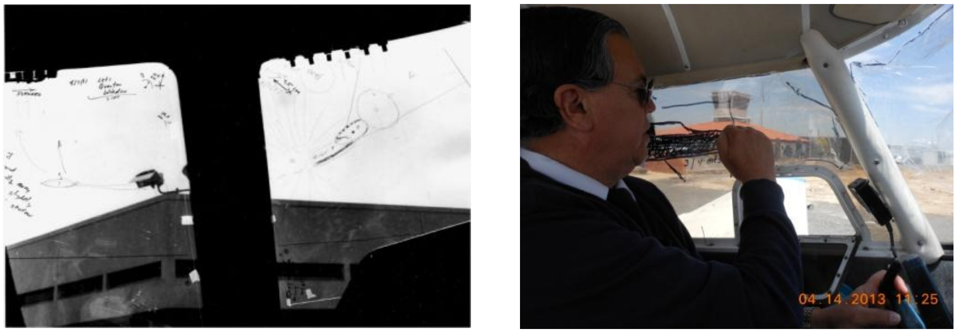
In my own study of such electro-magnetic effect cases I have discovered that most of these effects are transient with the airplane's system(s) returning to normal before landing. In these cases there is nothing physically wrong to report to the airplane maintenance staff. It is understandable why these pilots are less likely to report the incident.

The U.S. National Transportation Safety Board carries out detailed post-crash analyses within eight key areas that could have contributed to an accident (operations, structures, powerplant, systems, air traffic control, weather, human performance, and survival factors). (NTSB, 2002) Whenever possible serious investigation of UAP sightings should be equally as thorough.

Cockpit Documentation

Obtaining an accurate understanding of the cockpit in which the witnesses sat during the encounter is of paramount importance. This is because of both structural and procedural factors that could have influenced what was seen and heard. Was the witness fully and properly seated? Were there any visual obstructions present (viz. window frame struts, head-up display) that would have either blocked vision or introduced spurious reflections? What effects would different window geometries have had on the refraction of light from exterior light sources or reflection of internal light sources? Did other witnesses in the cockpit view the UAP from their own positions and yet see virtually the same visual characteristics? By correctly documenting both the airplane's cockpit and each witness's location in it as during sighting reconstruction much of value can be obtained.

The first step I use is to tape clear plastic sheets over all relevant cockpit windows, have the pilot assume the seated body position he was in during the sighting, and then hand him a black grease pencil to draw the apparent size, shape, and location of the UAP when it first appeared. This is followed by other sketches of the UAP at later, equal time intervals that are appropriate to the sighting. Figure 4(a) presents such a drawing for a daytime encounter in an L-1011 jumbo jet on July 4, 1981 over Lake Michigan and described in detail elsewhere (Haines, 1982). Figure 4(b) shows another pilot drawing what he saw out his left-side window on May 3, 1975 south of Mexico City International Airport. With his head and eyes located in the same position relative to the window(s) he reconstructed the outline shape, position, and size of what he saw, in this case a solid apparently metallic, symmetrical object hovering only centimeters above the top of his wing.



(a) 7-4-81 USA (b) 5-3-75 Mexico

Fig. 4 Witness's drawings of Apparent Size, Shape and Position of UAP

The second step consists in taking photographs to document the witness's head and body positions, particularly if he moved during the incident as is illustrated in Figures 5 and 6. In Fig. 5(a) the captain is shown in his relaxed seating posture just before the UAP came into sight. Fig. 6(a) shows that he lurched forward and placed both hands on the glare shield when he saw the approaching object on a collision course. His eye-to-windshield distance and angles are affected by this instinctive, self-protective body movement.

(a) 7-4-81 USA (b) 5-3-75 Mexico

Fig. 5 Witness's Body Posture Just Prior to UAP Appearance

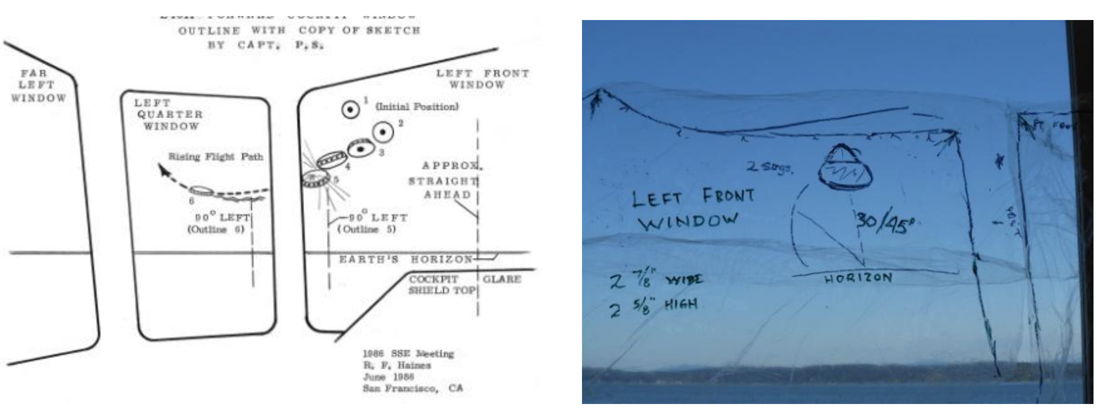
(a) 7-4-81 USA (b) 5-3-75 Mexico

Fig. 6 Witness's Body Posture Just After Sighting the UAP

The third step includes making careful linear measurements of the following details relative to straight and level flight:

1) The distance from the eyes to the windshield(s) penetration point of the pilot's line of sight while looking at the UAP during different moments during the encounter.
2) X-Y location on the windshield(s) of each above penetration point ("x" seconds apart).
3) X-Y-Z Reference Eye Position for the airplane in question.
4) Differences between 2 and 3 over time.

The autopilot was engaged during the sighting that took place on July 4, 1981 in clear smooth air at FL 370 (approx. 37,000 ft.). Therefore neither the heading, pitch, roll, yaw nor altitude of the jumbo jet changed during the sighting. Knowing this fact made it possible to graph the apparent flight path of the UAP relative to the jumbo jet's cockpit windows (and the captain's reference eye point) [Figure 7(a)] and in a plan-view. (Fig. 8)



(a) 7-4-81 USA (b) 5-3-75 Mexico

Fig. 6 Apparent Positions of UAP Relative to the Cockpit Window Outline

Figure 8. Reconstructed UAP Flight Path of 7-4-81 Sighting (dashed line at left) Relative to the L-1011 Flight Path (vertical line at right)

Referring to Figures 7(a) and 8 it is apparent that this symmetrical, metallic, silver-hued object approached the airplane, performed a relatively small radius turn, and departed almost in the opposite direction from which it had come. Even if there were angular size estimation errors (as will occur during times of stress and confusion) the presence of the stable and familiar cockpit window outlines help to reduce them.

It is also possible to estimate the change in subtended apparent visual width of the UAP for each plotted point on the windshield (Fig. 9) with the assumption that the object possessed a constant size. These estimates made from memory are probably accurate to within an order of magnitude or better.

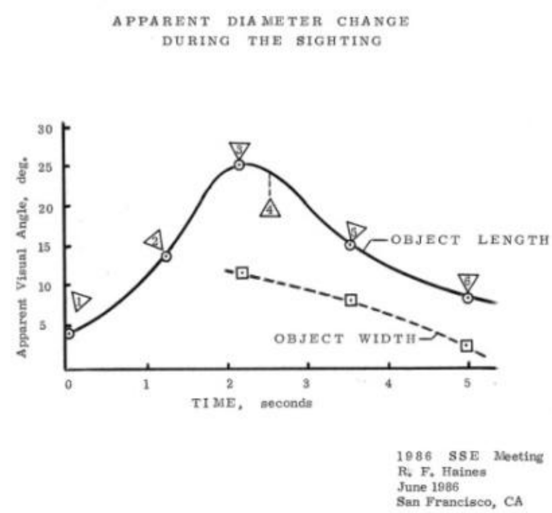


Fig. 9. Apparent Angular Length and Width of UAP of 7-4-81 at Each Plotted Location on the Jet's Windshield

Of course nighttime sightings raise many other research questions. Did the UAP appear to blink off and on because it passed behind some airplane window frame or cockpit obstruction? Did the witness move his head to see if the phenomenon reappeared? Did the hue and/or luminance of the UAP change as a function of its apparent location within the window's outline? Did the airplane's windows possess any special optical coatings? Was the UAP so bright as to produce visual after-images or pain? These and other related questions must be answered to fully understand the cause of visual perception changes of the UAP.

Investigators should also be armed with manufacturer's photographs and engineering drawings of the cockpit from which accurate scale measurements may be made.

Witness Drawings.

I always request sketches of what was seen from *all* witnesses. Several have been included above. For example, figure 1(a) was made for me by the senior captain on July 8, 1981 using a special pilot UAP report form (www.NARCAP.org). It is important to have them include an arrow facing upward (opposite to the gravity vector) and the cockpit window(s) outline to establish orientation and angular scale. As already mentioned these drawings may misrepresent what was actually seen but they do act to refresh memory concerning basic details about the UAP and are therefore of value.

III. Sighting Reconstruction

Purpose/Objectives.

Having the witnesses "replay" their in-flight experience in a flight simulator is important both to confirm their original account and also prompt their memories to give up additional new facts. I have achieved this second objective on many occasions. It is probably due to what I call "embedded memory effects." i.e., the boundary between past and present is blurred in the simulator causing some memory contents to emerge more readily. In other words, one's natural memory boundary limitations are made more "porous" probably because the immediate sensory environment is very similar to the original environment.

Having the flight crew located in a simulator of the same model as when the sighting occurred can help prompt additional details of possible importance to be revealed such as current airspeed, altitude, warnings, outside visual (and meteorological) environment, turbulence effects, radio transmission frequencies, navigation-related information, where the UAP first appeared during the pilot's normal and ongoing eye scan sequence, conversation with authorities on the ground, etc. The expense in carrying out such sighting reconstructions in a simulator will usually more than pay-back in valuable information that otherwise would be lost.

Finally, the use of a video camera (with sound recording) within the cockpit during a sighting reconstruction can yield useful insights about such things as the interactions among the cockpit crew during the (reconstructed) sighting, documenting the all witness's body postures and demeanors, etc.

Event Reconstruction using Hypnotic Regression.

If pilots and ATC personnel are agreeable and if a competent hypnotherapist is available who knows a great deal about airplanes, flying, and UAP it is possible to learn even more about the original incident. This additional somewhat novel interrogation approach also gives the investigator another opportunity to uncover both supporting and conflicting information. The author has used regressive hypnosis with a number of pilots over the years not only with good but rather surprising success. In the case of Capt. Schultz [Haines, 1982(a); 1982(b)] for example, he told me that he had heard a "pure tone" lasting several seconds just as the disc-shaped UAP was at its nearest point to his airplane. Using a post-hypnotic suggestion I instructed him to remember the tone so he could play it for me later on a piano. He did. It turned out to be key 81 (F-7th) having a frequency of 5793.83 Hz. By itself, such unsubstantiated data is of questionable utility. However, when related to other witness reports that involve auditory tones it could assume a more important role. Only while under hypnosis he also remembered that the UAP seemed to pop into sight almost full size as if it had somehow broken through some sky-blue veil while also producing spider-like, thin lines radiating outward from its edges in many different and irregular directions. I also hired a professional artist [Fig. 2 (center)] to work with Capt. Schultz in order to recreate a color image of these verbalized details. This was done with the witness constantly correcting the art work until it was fully acceptable.

In another case that took place on 12-24-89 south of the Russian city of Cheyabinsk by a then Soviet Air Force pilot, Vladimir Kuzmin. He was practicing aerobatics at the time in an L-39 advanced jet trainer. I hypnotized and regressed him (in Russian) and learned several more interesting details that he had left out of this conscious recall report. Further details are presented elsewhere (Haines, 1991)

Even though hypnotically retrieved memory is not acceptable in U.S. courts of law today for various reasons I believe it is still a valid procedure for collecting additional cognitive information from aircrew witnesses when they fully approve of being hypnotized, trust the hypnotist who is clinically proficient, and can achieve a sufficiently deep trance state. My *Three Stage Hypnosis Technique* is offered as one means of reducing hypnotist biases to a minimum. (Haines, 1994)

Simulator Fidelity

Airplane simulators are now available that present a wide range of realism and user costs. Figure 10 shows several flight training simulators that are currently in use. At one end of the spectrum of flight training simulators are U. S. government certified devices that accurately reproduce not only the full external visual environment but the auditory and acceleration environments as well. The Federal Aviation Administration has approved specific design and operating guidelines for such “high-end” simulators that allow pilots to transition directly from the simulator into the real cockpit in commercial operation. (FAA, 1992)

At the other end of the spectrum are desktop computer flight simulators. They are useful for establishing many pre- and post-sighting details and are now available simulating many different and highly realistic private, corporate, military, and commercial airplane models. Some of them possess remarkably high fidelity in their speed of control feedback, coordination of instrument readings, accuracy of air-to-ground radio communications, navigation information, and numerous other features. They are relatively inexpensive to own as well. Figure 11 illustrates the high level of external scene (day and nighttime) realism that can be achieved today.

High Fidelity-Motion Base Commercial Flight Training Simulator

Representative General Aviation-Fixed Base Flight Training Simulators

Fig. 10 Flight Training Simulators

Fig. 11 Examples of High Fidelity Simulated External “Virtual” Visual Scenes

One of the challenges involved in a realistic reenactment of a UAP sighting event is developing the same level of cognitive workload and distractions as occurred during the original sighting incident. Pilots may not have perceived all available visual or auditory details of the

UAP because they had to carry out their many flying duties at the same time. The sudden and unexpected introduction of a UAP into this ongoing and complex set of behaviors can be expected to disrupt them; this disruption will conflict with the witness's memory of details that would otherwise be present. Interrogation procedures should try to recreate as much of the original cockpit environment workload as possible so as to put the witness's memory in the same work "setting."

Yet another benefit of using a modern flight simulator to reenact the aerial sighting is that each cockpit witness can be tested separately (so as to not bias or influence one another). Their individual details may be compared later. Modern computer-based systems can readily store all flight-related settings for purposes of replay, analyses, and print-out.

Number of Replays

If a flight simulator is available how many times should the pilot be asked to replay the incident? From my experience I have found little utility in repeating the encounter more than two times unless the witness appears to be on the verge of a memory "breakthrough" of some kind. The first time should be alone, without a second witnessing crewmember present (if there was one). The second replay should be with the second crewmember present whether or not the second crewmember saw the UAP. Simulator operating cost will be a primary concern here, of course. Some can cost upwards of thousands of dollars an hour. What kinds of additional sighting information can be expected from a second or third replay? In theory at least multiple replays might continue to unlock new flight-related details that each witness had overlooked or even left out on purpose.

IV. Data Selection, Integration and Analysis

Data Selection

Every pilot and ATC sighting encounter contains a large amount of information that may (or may not) be related to the presence of the UAP. Because we still do not know what UAP are we are wise to collect and analyze more information than we may think we need and not reject data too soon simply because it does not seem to be relevant. To do otherwise is to impose our own personal biases on our investigations. In this regard, the extraterrestrial hypothesis for the origin of some UAP is not popular today within scientific circles. This intellectual bias can cause pilot reports to be ignored or downplayed particularly if they include UAP "behavior" that appears to be "intelligent" in some way. (Haines, 1999a) The logic surrounding Black Swan events makes what we don't know about UAP more relevant than what we do know.

We are also wise to develop new "experimental" strategies for data selection that may not have been used before, [cf. Ailleris' (2014) comments at this workshop.] In the following discussion two general classes of data are considered: on-board data and data derived outside of the airplane. The first has already been discussed to some extent.

Regarding the selection of candidate correlative data that originates outside the airplane during a UAP encounter the investigator should avail himself of the huge amount of nearly real-time data that is available today on the internet. These data include geophysical and astrophysical sensor data, meteorological (weather) data, orbital imagery data, commercial flight schedule data and a host of others. The appendix presents selected internet URLs that NARCAP staff find useful in their research. Each of the 23 primary subject areas listed contains numerous websites that provide different aspects or dimensions of the data of interest. The poster presentation at this workshop by Wattecamps (2014) should also be consulted.

The biggest challenge here is knowing what corollary data to look at. Perhaps a statistically-based factor analytic approach is best where our "net" is deliberately planned to be very broad and precise at first and perhaps include almost every known aerophysics parameter. Man's space exploration and military efforts have developed a huge array of "surveillance" technologies that provide us with these valuable corollary data. These technologies are made up of multiple satellites, millimeter and electromagnetic waves, infra-red, regular and ground penetrating radar, x-rays, radio waves and a myriad of other sensors. In fact, these elements are now being combined into multi-sensor, multi-modal arrays. If UAP investigators had deeper access to such data we would be farther ahead in our understanding of UAP.

Data Integration

There is little doubt that unidentified aerial phenomena are complex. But today's scientific disciplines confront complexity all the time. Their complexity is not as much the issue as we humans are. As data collectors and analysts we cannot separate our own contribution to the UAP data that is collected. This is particularly true for so-called automated monitoring systems. Humans select every detail of these systems: e.g., the wavelengths that are recorded, the fields of view and directions of their aiming, data recording durations and data download frequency, data recording formats employed, and other details. I believe, however, that when the data is integrated properly and the seemingly anomalous features *are included* - despite their apparent challenge to current scientific laws - we will really move forward in our understanding of what UAP are.

Skillful integration of all available data is an art form as much as it is an exercise in the application of scientific protocols. It would seem to call for an almost intuitive grasp of invisible, hypothesized relationships along with an application of scientific methodology where a testable hypothesis is first generated and then systematically tested. In the case of pilot sightings we are fortunate to have available a very large "control group" of other airplanes against which the airplane and flight crew that saw a UAP should be compared in many ways.

If external data on the atmosphere surrounding the airplane during an encounter (e.g., winds, temperature, pressure, electrostatic potential, gaseous constitution, etc.) is integrated with internal data coming from the airplanes' avionic and control systems' performance (e.g., instrument functioning, flight path and flight control performance, onboard electrical power consumption, computer functioning, transient changes in magnetic compasses and gyro-compasses, electrical short-circuits) will yet unrecognized patterns be discovered? What if data are obtained from a randomly selected, very large "control group" of other airplanes flying under similar conditions? Would the UAP airplane be found to have experienced one of the parameters differently from the control group? What about the use of automated sensor data in performing such studies?

The subject of automated, preprogrammed sensing of the sea, land, and atmosphere from the air has been studied within the military, governmental, and private hobby establishments since before WW-2. The papers and posters presented in the present CAIPAN workshop's section on "Observation Systematique du Ciel" will also provide much useful information in this regard.

Today unmanned aerial vehicles (UAV) of all shapes, sizes, performances and payloads continue to expand the budgets as well as populate the skies of many nations. Automated data from UAV may be useful in our studies of pilot sightings. At the same time telling UAV apart from UAP will become an increasingly difficult task. (Haines & Reed, 2013) It is unfortunate that private UAP investigators do not have access to certain correlative data that might be related to a UAP aerial encounter. We must rely on unclassified data or else work within the classified "system."

Figure 12 is an example of an infra-red sensor system that recorded a UAP recently. Here we see one frame from an airborne Forward Looking Infrared (FLIR) system video taken on April 26, 2014 at 7:24 am in NW Puerto Rico. This full video recording shows a (angularly) small, round object. The video shows that it flew within controlled airspace above a regional airport for many minutes. It then flew out over the Atlantic Ocean, dove underwater, and then split into two parts before disappearing. Automated sensor data such as this could contribute significantly to our understanding of the energistic and dynamic characteristics of UAP.

Fig. 12 Airborne FLIR Video Frame of a Small Heat-Emitting UAP Flying Inside Controlled Airport Airspace

Conclusions and Recommendations

The fact that pilots and air traffic controllers continue to see and report highly unusual energistic phenomena in the atmosphere is both significant and challenging. And because pilots are good witnesses, are flying semi-instrumented “laboratories,” can maneuver in the sky, and can radio for assistance and even confirmation of what they see their testimony is particularly important to those of us who take UAP seriously and want to discover the core identity of UAP. As this paper has pointed out there are many useful procedures available for collecting, recording, and analyzing pilot and ATC personnel data. Also, as has been mentioned, these myriad data call for application of scientific procedures involving hypothesis testing, control groups, creative data selection and integration and leaving our personal biases behind.

By following an integrated program of research involving all elements of government and society, as is done in France and Chile today, and establishing international working collaboration at both the private and governmental levels we are more likely to capture the Black Swans that we call unidentified aerial phenomena. We are making slow progress in our endeavors, a fact that should provide us with encouragement to continue.

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Appendix
Selected Research URLs

No.	Primary Level Subject	Secondary Level Subject	URL	(footnote)
1	**Aero-Physics**			
		Atmospheric Extinction-all wavelengths	http://www.google.com/#q=terrestrial+atmospheric+extinction+coefficients	
		Solar Coronal Mass Ejection (CME)	www.geomag.usgs.gov	
		Real Time Solar Quiet Graphs	www.geomag.usgs.gov	
		Proton flux – low & mid altitudes	www.swpc.noaa.gov/rt_plots/pro_3d.html	
		USA – Lightning strikes – last 60 min.	www.eldoradocountyweather.com	(19)
		USA – lightning strikes	www.weatherusa.net/lightningnet	
		Worldwide – lightning strikes	http://www.science.nasa.gov	
		Lightning – monitoring - last 20 min	thunderstorm.vaisala.com/lightning explorer	
		USA- Lightning strike monitoring(fee)	www.weatherops.com	
		USA – Atmosphere- UV index	www.noaawatch.gov/themes/UVphp	
		USA – Atmosphere – UV index	www2.epa.gov/sunwise/UV-index	
		Stratospheric – UV index	www.cpc.ncep.noaa.gov/currentUVindex	
		Blue Jets & Sprites	http://www.angelfire.com/ga2/stepstoinsanity/sprite.html	
		Blue Jets & Sprites	http://nova.www-star.stanford.edu/~vlf/bibliography/sprites.bib	
2	**Astronomical**			
		Worldwide – sunrise/set,	aa.usno.navy.mil/data/docs/RS_OneYear.php	
		Worldwide -sunrise/set, other	www.esri.noaa.gov/gmd/grad/solcalc/sunrise.html	
		Worldwide – sunrise/set, lunar	www.timeanddate.com	
		USA, Canada,England, Australia	www.sunrisesunset.com	
		Worldwide – Timezones, converter	wwp.greenwichmeantime.com	(20)

3 Geo-Physics

Worldwide Earthquake/fault-line locations	**http://www.earthquake.usgs.gov/earthquakes/search (8)**
Recent seismic activity	**http://earthquakes.usgs.gov/recenteqsww/Quakes/quakes_all.html**
Europe – Seismic activity	**http://www.emsc-csem.org/index.php?page=current&sub=list**
Earth Resources Observ. & Science	**http://eros.usgs.gov/**
Earth-Sea surface temperature	**neo.sci.gsfc.nasa.gov/view.php?datasetid=MYD28M (22)**
Earth surface magnetic field	**http://www.intermagnet.org/data_donnee/download-eng.php (6)**
Earth surface electric fields	**http://www.w3.org/TR/html40/loose.dtd (10)**
Earth surface electric fields	**www.en.wikipedia.org/wiki/Earth%27s_magnetic_field**
USA – Real time seismic monitoring	**www.geomag.usgs.gov (9)**
USA – Infrasound monitoring	**http://www.ees.lanl.gov/pdfs/secur1.pdf (17)**
Worldwide – geonames, coordinates	**http://geonames.nga.mil/ggmaviewer/**

4 Oceanographic

USA – NOAA	**http://www.ndbc.noaa.gov/**
Sea State	**www.oceanweather.com/data**
USA-Pacific 3-hr, sea state analysis	**www.opc.ncep.noaa.gov/shtml/PacRegSSA.shtml**
British Isles/West France Sea State	**www.seastates.net**
Worldwide – Surface temperature	**www.eldoradocountyweather.com (19)**
Worldwide – Sea Surface Temp.	**www.ncdc.noaa.gov > Climate Monitoring > State of the Climate**
Worldwide – Sea Surface Conditions	**www.oceanweather.com/data**

5 Weather – At airplane Location

USA – national	**www.nws.noaa.gov/rss**
USA – national	**www.weather.gov**
USA – national	**www.noaa.gov/wx.html**
USA – regional	**www.weather.yahoo.com**
USA – regional	**www.accuweather.com**
USA – Rawinsonde launch sites	**www.ua.nws.noaa.gov/nws_upper.htm**

		Worldwide	**www.eldoradocountyweather.com**
		Worldwide – Climate analysis	**www.ncdc.noaa.gov > Climate Monitoring > State of the Climate**
		Europe – satellite radar imagery	**www.eldoradocountyweather.com (19)**
		Canada – Satellite radar imagery	**www.eldoradocountyweather.com (19)**
		Historical (2)	**http://www.wunderground.com/**
		Worldwide current and forcast	**http://weather.cnn.com (7)**
		Worldwide – Current	**www.landings.com**
		Worldwide – Current – interactive	**www.weatherspark.com (15)**
		Extreme forcast	**www.extremescience.com/weather.htm**
		Extreme forcast	**www.wunderground.com/climate/extreme.asp**
		USA – national	**www.noaa.gov/extreme2011/index.html**
		USA – heavy rain, thermodynamics	**www.eldoradocountyweather.com (19)**
		Wind shear data	**www.eldoradocountyweather.com**
6	**Radar Antenna Sites**		
		USA - ARTCC Sites (NAS) (3)	**https://nfdc.faa.gov/xwiki/bin/view/NFDC/ARTCC+Radar+Sites**
		UK – 30 nations	**http://www.nats.aero/services/information/wind-farms/ self-assessment-maps/ (23)**
7	**Radar Data Decoding USA**		**http://www.ncdc.noaa.gov/oa/radar/radardata.html**
8	**NEXRAD Data Archive USA**		**http://www.ncdc.noaa.gov/oa/radar/radardata.html**
9	**Airport(s)**		
		Worldwide Identifiers, Lat., Long.	**www.landings.com**
		Airport identifiers (e.g., KBOS)	**www.airnav.com/airports**
		USA-Airport Diagrams (searchable)	**www.faa.gov/airports/runway/Safety/airport-diagrams**
		Worldwide – Airport Data	**www.al-nasir.com/www/PVA/Library/World_Airport_Data/ basic-spec.shtml**
		Worldwide – Airport Codes	**www.world-airport-codes.com (18)**
		USA – Airport City Codes	**www.airportcitycodes.com**

10 Orbital Imagery

USA – Landsat Imagery	**http://landsat.gsfc.nasa.gov/?p=7042**
Earth Observatory	**http://earthobservatory.nasa.gov/NaturalHazards/ view.php?id=80687**
Earth Explorer	**http://earthexplorer.usgs.gov**
Earth	**www.google.earth (11)**
NASA-USGS, Spectroradiometer MODIS	**http://Ita.cr.usgs.gov/MODIS**
USA – NOAA Imagery	**http://www.nhc.noaa.gov/satellite.php**
USA – NOAA Satellite Imagery	**http://www.class.ngdc.noaa.gov/saa/products/welcome%3bj sessionid=F9BA0=0B29BC7FD055ABCAE5F8929D (1)**
USA – California Coastline	**http:/www1.californiacoastline.org/**
USA – California Coastline microwave	**https://fortress.wa.gov/ecy/coastalatlas/tools/ShorePhotos.aspx**
USA – National Park Service	**http://www.nps.gov/pub_aff/imagebase.html**
USA – Fed. Gov't. Public Domain Images	**http://stellarone.com/public/US_federal_government_ public_domain_images.htm**

11 Rocket launch data

Worldwide -	**http://www.planet4589.org/mailman/listinfo/jsr (16)**
Worldwide-	**http://planet4589.org/space/log/launch.html**
Worldwide – Rocket launch sites	**http://planet4589.org/space/log/launch.html**

12 Incident Databases

USA–FAA Accident/Incident Data Syst	**http://www.asias.faa.gov**
USA – NTSB – Near Miss Reports	**www.ntsb.gov/aviationquery/index.aspx**
USA – NASA – ASRS	**www.asrs.arc.nasa.gov**
USA – NATCA	**www.safetyl.natca.net**

13 Near (Airplane) Miss Events

USA – ASRS	**http://www.asrs.arc.nasa.gov/docs/rpsts/nmac.pdf**
USAQ – Pilot Reported	**http://www.rita.dot.gov/bts/sites/rita.dot.gov.bts /files/publications/**
USA – midair events, narrative search	**http://www.ntsb.gov/aviationquery/index.aspx**

		USA – Aviation Safety Magazine	**www.aviationsafetymagazine.com/links**
		USA -	**www.37000feet.com**
		USA – NTSB	**http://www.ntsb.gov/aviationquery/index.aspx**
14	**Accident Databases**		
		USA – FAA	**http://www.asias.faa.gov/data_research/accident_incident/**
		USA – NTSB	**http://www.ntsb.gov/investigations/reports_aviation.html**
		USA – NTSB accidents/serious incid.	**http://www.ntsb.gov/aviationquery/index.aspx**
		USA – NTSB Last ten days accidents	**http://www.ntsb.gov/data/aviation_stats.html**
		USA – Flight Safety Foundation	**http://aviation-safety.net/database/**
		USA – Skybrary	**http://www.skybrary.aero/index.php/Accident_Incident_ Data_System**
		USA - Air Transport Safety	**http://www/rita.dot.gov/bts/sites/rita.dot.gov.bts/files/ publications/National_Transportation_statistics/ index.html#chapter_2**
		USA – ERAU (University)	**http://archives.pr.erau.edu/resources/accidentinfo.html**
15	**Accident – Incident Investigation**		
		ICAO – Annex 13	**www.cockpitseeker.com/wp-content/uploads/atpl/ 010/course/ICAO%20**
		ICAO – Investigations	**www.servito.net/go/international-civil-aviation-aircraft-accident-**
		NASA – ASRS	**www.37000feet.com**
16	**Operational –Flight Related**		
		Flight tracking/schedules (4)	**http://www.flightradar24.com/**
		Flight tracking/schedules (14)	**www.flightstats.com**
		Worldwide – Flight planning	**www.landings.com**
		USA - NOTAMS	**https://notams.aim.faa.gov**
		USA – NOTAMS	**www.landings.com**
		USA – FAA -NOTAMS	**https://www.pilotweb.nas.faa/PilotWeb/**
		UK – NATS	**www.landings.com**
		USA – Temporary Flight Restrictions	**http://www.tfr.gov/tfr2/list.html**

17 FAA Forms

Flight Plan (USA) – FAA 7233-1	**www.faa.gov/airports**
Flight Plan (Intern't) – FAA 7233-4	**www.faa.gov/airports**
Data Release Request – FAA 1200-5	**www.faa.gov/airports**
ASRS reporting forms	**www.asrs.arc.nasa.gov**

18 Aircraft

Worldwide – All models ever built	**http://www.aviastar.org/index2**
ICAO- Make-Model Designations	**www.icao.int/safety/ism/Accident%20Incident%20 Reporting%20Guidance (21)**
Design specifications – civil only	**www.airliners.net/aircraft**
Design specifications	**www.planeandpilotmag.com/aircraft/specifications.html**
Design software (5 airfoils) – free	**www.aircraftdesigns.com/designing-aircraft.html**

19 ATC Operations -

USA – FAA	**https://www.faa.gov**

20 Navigation Charts & Aids

USA – NAS	**www.faa.gov/air_traffic/flight_info/aeronav**
USA	**www.aeroplanner.com**
USA – Wide Selection	**www.skysupplyusa.com**
USA & territories	**www.airnav.com**
USA – Wide Selection	**www.aviationcharts.com**
Worldwide	**www.avcharts.com**
Worldwide (by subscription)	**www.jeppesen.com**
Worldwide – FAA	**www.faacharts.faa.gov**
Worldwide	**www.skyvector.com (5)**
Worldwide	**www.landings.com**

21 Accident – Topical

Investigation data	**www.ntsb.gov/investigations/index.html**

Investigation data **www.faa.gov/accident&incidentdata**

Investigation data **www.flightsafetyfdoundation.com/aviationsafetynetwork**

Laser – Pilot Vision **http://en.wikipedia.org/wiki/Lasers_and_aviation_safety**

22 Flight Simulation

Full size cockpit/hardware **www.therealcockpit.com (12)**

Plans to build full size home cockpit **www."Series One Plans"**

Computer-based software-training/fun **www.kwikpit.com**

Computer-based software-training/fun **www.fspilot.com (13)**

23 Electronics (Avionics)

EWSIGINT (Electronic Warfare) **http://www.ewsigint.net/**

Worldwide – HF radio propagation **www.bidstrup.com/7ri-hf-radio-propagation.html**

Assoc. of Old Crows (>50subcategories) **https://www.crows.org**

Assoc. of Old Crows (projects) **https://www.crows/org/advocacy-publications/publications.html**

Notes:

1 **All data is free but must be requested. Links are then provided to the requested data.**
2 **Weather data prior to 1980s must be purchased from National Climatic Data Center (NCDC) http://www.ncdc.noaa.gov/**
3 **Includes all NAS radar systems capable of transmitting MOSAIC data. Since Dec. 2012 systems without slave capabilities only record audio (no video).**
4 **Uses ADS-B transponder signals. Only about sixty percent of commercial A/C now have ADS-B transponders.**
5 **Skyvector.com navigation charts are free.**
6 **International Real-Time Magnetic Observatory Network. Collects/analyzes 1 min. digital data for USGS observatories after 1985. For World Data Center data back to 1985 see: http://www.wdc.bgs.ac.uk/catalog/master.html**
7 **To use weather.cnn.com insert city name and/or postal code.**
8 **USGS seismic data base allows archival searches using multiple search options, graphics are clear.**
9 **This seismic monitoring site provides many research-oriented, free, sub-sites in Data & Products section: realtime H index, HEZF (for 15 stations mostly in USA K index, Dst display, and others.**
10 **International Geomagnetic Reference Field (IGRF11) is updated every 5 years (latest 2011); presents earth's main mag. Field and secular variations.**
11 **Google-Earth (Version 7.1.2.2041) allows flexible user-controls for 3-D eye-point movement, zoom, overlays, notations, 360 deg. Street-level photos, etc.**
12 **The Real Cockpit – product name is TRC Simulators, B.V. (Netherlands); products include full size two-man cockpits with realistic and fully functional panels, etc.**

13 **fspilotshop sells computer s/w to "fly" 1,434 different airplane models, 794 utilities, 997 terrain/scenery add-ons, 106 hardware items, etc.**

14 **Flightstats website contains a wealth of real time flight information: schedules, delays, current location. etc.**

15 **Weatherspark.com provides useful near real-time data: Temp., dew pt., wind, pressure, humidity (Radar-USA only). Maps with color-topogr; zoom-slewable.**

16 **Planet – rocket launch data - JSR Space Report: 2 updates/month; unmanned and manned launches (from: Harvard-Smithsonian Center for Astrophysics)**

17 **Infrasound monitoring is conducted by Los Alamos National Lab. (since 1981) with six sensor arrays in western USA and one on Ascension Island; Data feeds are to U.S.A.F. Technical Applications Center (AFTAC) and the Prototype International Data Center (PIDC) in Alexandria, VA. Sensors can detect nuclear explosions, Space Shuttle launches and re-entry and smaller missile launches, bolide atmospheric entry, earthquakes, volcanic eruptions, gas-fire explosions, etc.**

18 **World Airport Codes presents runway length data, abbreviations, codes, etc. for over 9,000 airports**

19 **www.eldoradoweather.com Provides a wealth of near real-time and forecast meteorological data including printable maps, rapid replay barographic charts,etc.**

20 **wwp.greenwichmeantime.com Contains a wealth of practical information about GMT, local conversion to, current time at any location, etc.**

21 **ICAO Airplane Make/Model Report 157 Pp. (ECCAIRS 4.2.8) Provides unique number for all world aircraft.**

22 **Moderate Resolution Imaging Spectroradiometer (MODIS). Image date: 30 March to 30 April 2014, 8 day average. Measures 1 mm sea depth.**

23 **Charts related to turbine (windfarms) plans. Shows UK Primary radar, SSR radar, AGA communications & Nav-Aid Coverage for NATS sites. Airport radar not incl.**

This list is subject to change at any time

The End

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