Valentich Disappearance: New Evidence and a New Conclusion

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Abstract—This paper presents new evidence regarding the now-famous disappearance of Frederick Valentich, who was flying a Cessna airplane on the evening of October 21, 1978, somewhere near Cape Otway SW of Melbourne. The testimony of three witnesses is given, each of whom claim they saw an airplane descending downward at a steep angle with a much larger object with green lights flying just above it. A plot of the most probable flight path is also included. Based on this new evidence, taken in conjunction with the pilot's own in-flight reporting of sighting events, we have to conclude that there appears to be sufficient evidence to suggest that Valentich's airplane probably crashed into the sea SE of Cape Marengo between 3 and 12 miles offshore. The nature of the large object with green lights that accompanied the airplane during its steep descent remains to be identified.

Keywords: pilot disappearance — accident analysis — UFO — crash investigation

Introduction

The in-flight disappearance of Frederick Valentich over Bass Strait, Australia, on October 21, 1978, has become one of the most well-publicized mysteries of aviation since Amelia Earhart disappeared on July 3, 1937. Accounts of this tragic event may be found elsewhere (*International UFO Reporter,* 1978; Bass Strait mystery, 1979; Haines, 1987; Norman, 1979; Pinkney and Ryzman, 1980; Valentich, 1980). Despite the coordinated efforts of private pilots and the Australian government's search-and-rescue airplanes immediately following the event, no trace of Cessna DSJ (its registration letters: "Delta Sierra Juliet") of any kind was ever found.

What has made this event such a perennial and popular mystery was the existence of an air-to-ground radio (voice) transmission between young Valentich and a flight service specialist, Steve Robey, who was working at Melbourne International's "Tullamarine" airport at the time of the disappearance. Other pilots overheard this transmission and, because of intense and immediate pressure on the civil aviation authorities, the Department of Transport

(DoT) released a printed transcript of the conversation long before the official accident report was issued. The authors also have listened carefully to this tape recording; the eyewitness description and other sounds therein should be of interest to those who are truly interested in UFO phenomena (Haines, 1981). A detailed account of the entire event is found elsewhere (Haines, 1987). There is nothing in this 13-minute audio tape that contradicts the new evidence presented below. Other than a short article published in Australia (Norman, 1991), there has been no new evidence that relates directly to this reported aerial encounter and subsequent aircraft disappearance

Aircraft pacing and other forms of reported interference with airplanes by unusual and nonaerodynamically shaped objects is not exceptional. One of the authors (R.H.) has compiled the following list of such events for the general period 1948–1989: 55 cases involving airplane pacing, 15 cases in which the aerial object completely circled the airplane one or more times, 12 cases in which the object suddenly disappeared from the pilot(s) sight, 22 cases involving a head-on approach to the airplane and near-miss by objects that did not appear to be airplanes, and scores of incidents in which on-board electromagnetic hardware was affected only when the UFO was nearby (Haines, 1992; Sturrock *et al.*, 1998).

Selected Background Information

Pilot Frederick Valentich, 20, made arrangements with Southern Air Service, located at the Moorabbin airfield SSW of Melbourne city center, to rent a Cessna 182L model, single-engine, propeller-driven airplane for his night flight. He submitted his flight plan to the briefing officer at the airfield at 5:20 p.m. and finally took off alone at 6:19 p.m. for what was to be a "full-reporting" flight. This means that he was supposed to check in by radio with flight service personnel at certain defined checkpoints for safety reasons. His destination was King Island, about halfway between the Australian mainland and the tip of Tasmania (see lower left inset in Figure 1). Flying at 120 miles per hour (neglecting wind effects), the journey from Cape Otway to the nearest point of land on King Island would be about 48 miles (24 minutes of flight) flying at 4,500 feet altitude. The sun would set at 6:48 p.m.; but it was almost 7:00 p.m. when Valentich finally reached his designated (radio) reporting point near Cape Otway. This conclusion is based on a complete flight path reconstruction, including prevailing wind conditions. His radio call at 9:00:29 stated, "Melbourne, Delta Sierra Juliet. (Now at) Cape Otway, descending for King Island." He was right on time. (Note the 2-hour time difference between local and GMT used in the official transcript. We will use GMT for the remainder of this paper).

According to his flight plan, Valentich planned to climb to at least 4,500 feet altitude for his water crossing (for safety and visibility reasons). We assume that he made this ascent well before reaching Apollo Bay. Several eyewitness-

es observed his blue and white Cessna from the resort town of Apollo Bay as it flew SW over the water at an unspecified distance.

Several local pilots have pointed out that it is normal procedure to "cut the corner" at the cape when flying to King Island (*i.e.,* not to fly all the way to Point Franklin, Crayfish Bay, or the lighthouse itself before turning left for King Island; Figure 1). Valentich had flown this same route in the past, and presumably, he cut the corner on this flight as well. Doing so would shorten his trip by about 6 miles, saving both time and fuel. Indeed, Norman (1991) interviewed fishermen who had camped along the Parker River (south of Point Lewis; Figure 1) that night. They apparently saw the Cessna make this turn
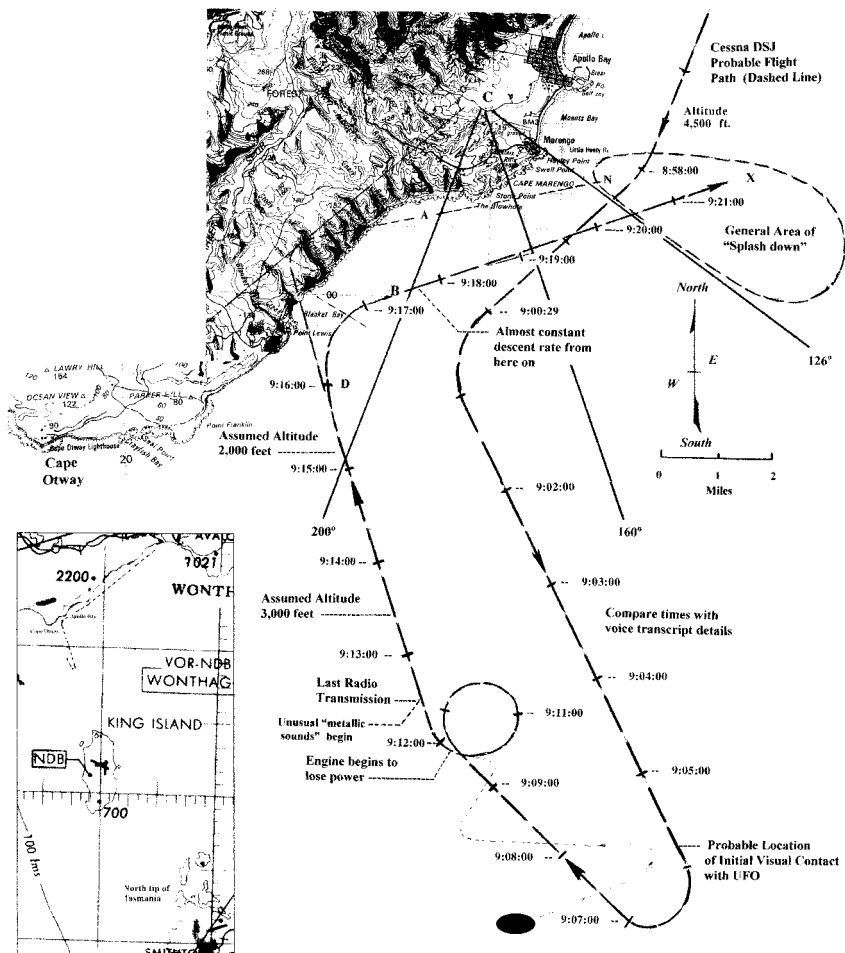

Fig. 1. Enlarged scale chart of region from Apollo Bay to Cape Otway.

about 3 to 4 miles ENE of the Cape Otway lighthouse. The eastern sky was now dark, although the western sky still possessed some orange glow from sunset. The scattered ground lights visible off Valentich's right side likely helped him maintain his general flight path direction up to this point.

After changing his heading to the left, he probably continued on out over Bass Straight toward the nondirectional beacon (NDB; inset, Figure 1) on King Island (a magnetic heading of 154.5°). Flying at 4,500 feet altitude and between 110 and 120 miles per hour (there was a tail wind of about ten knots out of the NW), he reported by radio to Steve Robey, who was handling this particular air sector that evening, that he saw "a large aircraft below 5,000" (feet altitude). The time was exactly 9:06:14 according to the official transcript of this interchange.

Table 1 presents the DoT voice transcript as it may possibly relate to the new evidence presented here. The key for Table 1 defines the speech timing and inflection symbols that were added based on a detailed analysis of the original voice tape by R.H.

In the years following this event, one of the authors (P.N.) succeeded in locating and interviewing a number of people traveling or living in the region along Great Ocean Road, which runs north and south through Apollo Bay. Reports were obtained from 20 eyewitnesses in this region, describing an erratically moving green light in the sky at that same time of evening as Valentich's flight. In addition, P.N. learned of three primary eyewitnesses who shed valuable new light on this event. Their testimony is recounted here. They saw both the lights of a small aircraft and a very large green light traveling directly above it. The primary witness, Mr. Ken Hansen (pseudonym), who was 47 years old at the time, told his wife of what he and his two nieces had just seen on their way home, but she laughed at his story. The following morning at work he told his fellow employees, who believed what he said about seeing the airplane, but not about the large green object flying above it, the details of which are given below. Of course, at this early date, he could not have known anything about Valentich's description of a green light flying near him. Hansen decided to drop the subject to avoid further ridicule. Years later, he happened to discuss his sighting with a local policeman, who later mentioned the story to Guido Valentich, father of the missing pilot. Guido Valentich then told author P.N., who interviewed Hansen and his two nieces. Both girls gave the same basic details as their uncle.

Site Visit to Apollo Bay

During a visit to the area between Cape Otway and the resort town of Apollo Bay on March 17, 1998, both authors had an opportunity to meet Mr. Ken Hansen (pseudonym), who was then age 67. Hansen lives in the resort town of Apollo Bay. As he had told author P.N. in 1991, he said that he had seen, with his two nieces, an odd aerial event the same night that Valentich had disappeared. We asked if he would take us to his original observation site so that we

TABLE 1

Official Voice Transcript Between Flight Service (FS) and the Cessna Aircraft (DSJ)

Time (GMT)	From	To	Text
9:06:14	DSJ	FS	Melbourne, this is Delta Sierra Juliet. Is there any known traffic below five thousand?'
9:06:23	FS	DSJ	Delta Sierra Juliet—No known traffic.
9:06:26	DSJ	FS	Delta Sierra Juliet. I am—seems (to) be a large aircraft below 5,000.
9:06:46	FS	DSJ	D Delta Sierra Juliet—What type of aircraft is it?
9:06:50	DSJ	FS	Delta Sierra Juliet—I cannot affirm. It is four bright … it seems to me like landing lights.
9:07:04	FS	DSJ	Delta Sierra Juliet. [This statement affirms to the pilot that the person on the ground heard his transmission.]
9:07:32	DSJ	FS	Melbourne, this (is) Delta Sierra Juliet. The aircraft has just passed over me at least a thousand feet above.
9:07:43	FS	DSJ	Delta Sierra Juliet—Roger—and it, it is a large aircraft—confirm?
9:07:47	DSJ	FS	Er, unknown due to the speed it's travelling… is there any airforce aircraft in the vicinity?~
9:07:57	FS	DSJ	Delta Sierra Juliet. No known aircraft in the vicinity.
9:08:18	DSJ	FS	Melbourne… it's approaching now from due east~ towards me.~
9:08:28	FS	DSJ	Delta Sierra Juliet.
9:08:42	DSJ	FS	//Open microphone for two seconds//
9:08:49	DSJ	FS	Delta Sierra Juliet. It seems to me that he's playing some sort of game.'—He's flying over me two—three times at a time at speeds I could not identify.'
9:09:02	FS	DSJ	Delta Sierra Juliet—Roger. What is your actual level?
9:09:06	DSJ	FS	My level is four and a half thousand, four five zero zero.~
9:09:11	FS	DSJ	Delta Sierra Juliet… And confirm—you cannot identify the aircraft.
9:09:14	DSJ	FS	Affirmative.'
9:09:18	FS	DSJ	Delta Sierra Juliet—Roger… standby.
9:09:28	DSJ	FS	Melbourne—Delta Sierra Juliet. It's not an aircraft'… it is //open microphone for two seconds// [This duration measured as three seconds. No information appears to have been removed from the tape.]
9:09:46	FS	DSJ	Delta Sierra Juliet—Melbourne. Can you describe the…er—aircraft?

TABLE 1
Continued

9:09:52	DSJ	FS	Delta Sierra Juliet… as it's flying past it's a long shape' *//open microphone for three seconds//* (cannot) identify more than that. It has such speed *//open microphone for three seconds//*. It is before me right now Melbourne.'
9:10:07	FS	DSJ	Delta Sierra Juliet—Roger. And how large would the —er—object be?
9:10:20	DSJ	FS	Delta Sierra Juliet—Melbourne. It seems like it's (stationary). [Author R.H. has determined that this word should be "chasing me" based on special filtering]. What I'm doing right now is orbiting, and the thing is just orbiting on top of me also' … It's got a green light,' and sort of metallic (like)~. It's all shiny (on) the outside.~
9:10:43	FS	DSJ	Delta Sierra Juliet.
9:10:48	DSJ	FS	Delta Sierra Juliet *// open microphone for 5 seconds //* [measured as 3 seconds] It's just vanished.'
9:10:57	FS	DSJ	Delta Sierra Juliet.
9:11:03	DSJ	FS	Melbourne would you know what kind of aircraft I've got?' It is (a type) military aircraft?'
9:11:08	FS	DSJ	Delta Sierra Juliet. Confirm the… er—aircraft just vanished.
9:11:14	DSJ	FS	Say again.
9:11:17	FS	DSJ	Delta Sierra Juliet. Is the aircraft still with you?'
9:11:23	DSJ	FS	Delta Sierra Juliet… It's ah… Nor *//open microphone for two seconds//* (now) approaching from the southwest.
9:11:37	FS	DSJ	Delta Sierra Juliet
9:11:52	DSJ	FS	Delta Sierra Juliet - The engine is, is rough idling. —I've got it set at twenty three—twenty four… and the thing is—coughing.
9:12:04	FS	DSJ	Delta Sierra Juliet—Roger. What are your intentions?
9:12:09	DSJ	FS	My intentions are—ah… to go to King Island—Ah, Melbourne, that strange aircraft is hovering on top of me again *//open microphone for two seconds//* it is hovering and it's not an aircraft.
9:12:22	FS	DSJ	Delta Sierra Juliet.
9:12:28	DSJ	FS	Delta Sierra Juliet—Melbourne *//open microphone for 17 seconds//* [A very strange pulsed noise is also audible during this transmission.]
9:12:49	FS	DSJ	Delta Sierra Juliet, Melbourne.
			End of official DoT transcript

Note: — = a normal pause in communications (based on the first author's flying experience); … = a longer than normal pause (*i.e.,* several seconds); ' = an upward ending voice inflection (such as an interrogative question); ~ = a downward voice inflection. Parentheses ( ) enclose words that are open to interpretation because they are not clearly audible. Brackets [ ] enclose the authors' comments.

might reconstruct each step of his sighting. He gladly agreed to do so, during which time he gave us the following information.

Sighting details obtained from Mr. Hansen. Mr. Hansen and his two nieces had been shooting rabbits on the late afternoon of October 21, 1978, in the hills about 2 km west of Apollo Bay in the direction of Marriners Falls. He said that it was dusk, but he could not recall the exact time. They were in his four-wheel-drive vehicle driving east on Barham Valley Road toward his home on the southern outskirts of the town. Figure 2 shows an enlarged scale drawing of the road on which they were travelling when they sighted the lights in the sky.

Hansen was driving (in the left front seat), and one niece, Tracy, was sitting in the right front seat. His other niece was in the back right seat. Tracy first sighted colored lights in the sky on their right side. The automobile was travelling about 30 miles per hour at the time in the left lane. Suddenly, she said, "What is that light in the sky?" Point A of Figure 2 shows their location at this time.

As the automobile continued, Hansen craned his neck to look out the right side window in the direction that she was pointing. He caught sight of some lights and said to her, "Those are only the lights of an airplane." "No," she replied, "I mean that other large green light above it!" He drove on and then turned to look again some 10 to 15 seconds later. At that point, he also was able to make out two separate sets of lights in the clear but darkening sky. They were now near point B in Figure 2. They continued down the road, although Mr. Hansen was now slowing down because of the left turn ahead and because he wanted to better see the strange set of aerial lights. Mr. and Mrs. Hansen live near a small airstrip located just south of Apollo Bay, and he is knowledgeable about aircraft and the appearance of their lights at night. He noted clearly the familiar lights of a small airplane (white navigation light; red wing-tip light) that were visible. He told us that these colored lights on the aircraft
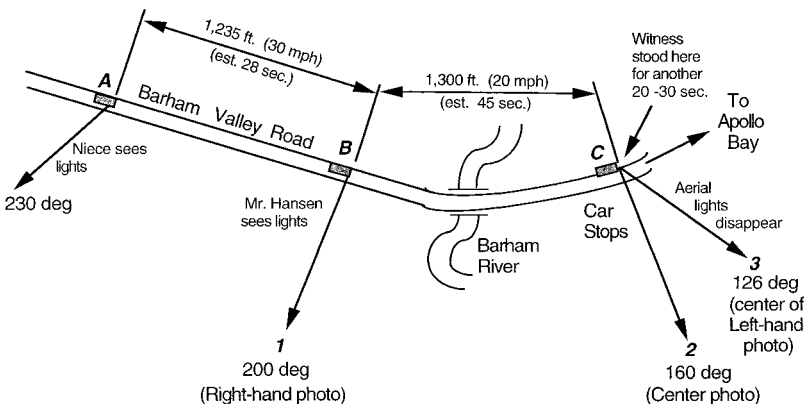

Fig. 2. Sighting area of Mr. Hansen and his nieces, SW of Apollo Bay, Australia (north is up).

were separated by about the same angle that is subtended by a marble (0.65 inches) held at arm's length (approximately 22 inches from the eye) or about a 1.7° arc. Both aerial objects had passed through a 30° arc toward the east during this initial sighting interval, which lasted about 28 seconds.

Not wanting to stop on the small bridge crossing Barham River, he drove on at about 20 miles per hour and finally decelerated to zero at point C of Figure 2. The car's measured transit time from point B to point C was no more than 45 seconds. Although it is not uncommon to see the lights of small airplanes in the vicinity, the presence of the large green light was so unusual that Hansen decided to pull over, stop, and get out of his automobile. He said that when he did so, he clearly saw a second, large, greenish, circular light "like it was riding on top of the airplane." Its angular diameter was equivalent to that of a tennis ball held at arm's length (approximately a 6.8° arc), for an angular ratio for the two objects of about one to four. Its color was similar to the navigation lights on an airplane. He also said that it kept a constant distance above and slightly behind the airplane's lights at all times. He stood watching for another 15 to 20 seconds until both lights disappeared from sight. Thus, the entire sighting from point A to point C-3 lasted about 93 seconds.

Figure 3 is a photo-collage taken by author R.H. at the three locations along Barham Valley Road referred to in Figure 2. Mr. Hansen said that it was so dark, he was barely able to make out the tops of the trees and hill against the southeast sky. Both the airplane and accompanying light (which appeared to fly in parallel with the Cessna) seemed to descend at an apparent 30 to 40° angle (above the horizontal) along a straight line approximately as shown by the dashed line in Figure 3. Both lights eventually disappeared behind the hilltop at a magnetic bearing of about 126° from Hansen's location (left section of Figure 3). No sounds were heard coming from the direction of the lights at any

Fig. 3. Three contiguous photographs of sighting area (from 126 to 200° magnetic bearing).

time during this sighting. The witnesses never saw the airplane strike the ground or the sea.

Estimating Airplane Position

Although there are too many unknowns to calculate a definitive flight path, we felt that some attempt should be made to estimate the position of the Cessna if it had continued downward on a relatively linear path, as described by the three witnesses. One difficulty in this regard arises from the possibility that the airplane and the accompanying light may not have been flying in a plane of travel normal to the line of sight but obliquely toward or away from the witness's location to some degree. If this was the case, then even a level flight path could appear to descend toward the distant horizon when viewed from the ground. This well-known optical illusion would make it appear as if the airplane was descending when it was not.

Of course, there is no way to test this possibility in regard to Valentich's flight. If the plane of travel was not normal to the witness's line of sight and the airplane was descending, then the location of the "splash point" could extend over a wide range of angles and distances or may not have occurred at all. All that is known for certain is that the airplane and accompanying green light traveled somewhere within the arc defined by the two lines C-200 and C-126 in Figure 1. Other difficulties have to do with the accuracy of the perception of temporal duration itself and memory accuracy long after an event. As Hawkinds and Meyer (1965) found, most people tend to underestimate duration when they personally attend to a task and overestimate duration if they were not personally involved in a task. Although individual differences make it difficult to apply these findings to this case specifically, it is likely that Mr. Hansen underestimated the total duration of his sighting to some degree.

In spite of the above difficulties, we attempted, in each of the following sections, to estimate what might have taken place using both the eyewitnesses' testimony and Valentich's in-flight DoT narrative. Our objective was to try to establish the most likely "splash down" point of the airplane in Bass Strait, assuming that the airplane continued to descend along a linear path after it disappeared from the view of the three witnesses.

Probable flight path using the witness's observing time estimates. If the small airplane Mr. Hansen and the girls saw was traveling at 100 miles per hour and was seen for a total of 93 seconds (between points A and C-3 in Figure 2), it would have traveled a distance of 2.58 miles. Indeed the splash point would be only 1.2 miles off the shoreline. This linear distance is plotted on Figure 1 as line A–N near Cape Marengo. If the Cessna had been flying more slowly, say 80 miles per hour, it would have traveled a total distance of only 2.1 miles, placing it even nearer to the shoreline. Although there were many tourists in town at the time and the spring weather was relatively warm, clear, and calm, only the three witnesses reported seeing anything at that time of the

evening. For these reasons, the above position estimates appear to be too close to the shore.

Estimating the distance between the eyewitnesses and the airplane based on the airplane's subtended visual angle (from memory). We then attempted to estimate how far Hansen actually was from the airplane using his memory estimate of the angular size of its lights. The linear distance between the red wing-tip light and the white tail light on a Cessna 182L airplane, viewed from the side, is about 12 feet, and this was said to be equivalent to the angle subtended by a marble held at arm's length. Therefore, the calculated distance to the airplane would be only 404 feet. This distance is clearly in error for several reasons: (a) a large scale topographic chart of the area shows that the distance to the hills seen in the left part of Figure 3, behind which the airplane allegedly was seen to disappear, is about 3,000 feet away; and (b) engine sounds from a small airplane would have been heard at such close range, regardless of wind velocity and direction, yet no sound was heard. It is more likely that his use of a "marble" as a reference object is too large. Valentich's engine was running at this time and is heard on the voice tape.

Assuming this angular estimate is 50% too large, we are left with a subtended angle of a 51 min arc between the two airplane lights and a calculated separation distance from point C (Figure 2) to the airplane of just over 800 feet, which is still too small a value for the same reasons discussed above. Indeed, if the airplane had disappeared just behind the indicated hill and had not leveled out, it would have impacted the ground and not the ocean. Its wreckage would have been found immediately. Thus, Mr. Hansen's recollection of the angular size of the airplane's lights is too large by perhaps several orders of magnitude. What might the maximum distance be between the witness and the airplane? Another estimate can be made by knowing the distance acuity for unaided vision by someone who does not wear prescriptive lenses. This is reasonable because Mr. Hansen did not need to wear corrective eyeglasses at the time.

Estimated distance between the eyewitnesses and the airplane based on normal visual acuity. The human visual system can correctly discriminate two point lights at night as being separate at very small angles (less than 0.3 min arc or less; Haines, 1980). If we use this lower visual acuity threshold for the above calculations (*i.e.,* the angular separation between the two colored lights on the airplane that can be correctly perceived as separate), we find a practical maximum separation distance between the witness at point C (Figure 1 and 2) and the airplane of 137,457 feet (26 miles). This maximum distance estimate is far too large, considering the relatively short amount of time the lights were in view and the impossibly high velocity the Cessna would have had to fly to cover this total visual angle.

Estimating airplane altitude and range at disappearance. The Cessna disappeared behind low hills to the SE of the witnesses, which were about 180 feet above sea level. Site measurements indicated that these hills ranged from 5–10° arc above the local horizontal. If the Cessna were 26 miles away, it would have been at an altitude of either 12,027 feet or 24,233 feet altitude, re-

spectively. There is little reason to accept either value as correct for several reasons. First, other witnesses saw the small plane pass overhead earlier toward the south at an altitude of no more than 5,000 feet. Second, Valentich himself indicated that his altitude at 9:09:06 p.m. was 4,500 feet (less than 4 minutes before his final disappearance); indeed, this airplane could not have climbed fast enough to reach such altitudes in the available amount of time. Finally, the eyewitnesses' total viewing duration of about 93 seconds was much too short to account for an airplane flying at this large a distance and altitude. In short, the theoretical, maximum distance to the airplane of 26 miles is, again, far too large.

Estimating distance to airplane by its assumed altitude. If the Cessna was at an altitude of 4,500 feet when it disappeared below the line of hills south of Apollo Bay (along line C-3 in Figure 2) and these hills were about 180 feet high (determined from topography chart), then the horizontal distance to the airplane would have had to be about 14 miles. This point would lie along an extension of line C-126° (Figure 1). Interestingly, Mr. Hansen's estimate of the distance to the airplane was from 10 to 12 miles. We can assume that a lower initial aircraft altitude reduces this distance. Because the eyewitnesses saw the airplane descending at a fairly rapid rate, let us assume it was at an altitude of only 1,000 feet when it disappeared behind these same hills; this yields a horizontal range of only about 2.5 miles from the witnesses (point N on Figure 1). Point N is only about 1 mile farther from the shoreline than the extension of point C3 (discussed above).

Viewing duration, airplane velocity, and distance traveled. The following time and distance estimates are based on the eyewitness testimonies and lie between viewing lines B-1 and C-3 of Figure 2. Assuming that the airplane and the strange light were (a) flying in a plane normal to the line of sight, (b) flying at 100 miles per hour (8,800 ft/min.), and (c) viewed for 65 seconds, they would have traveled a distance of 9,504 feet or 1.8 miles. Next, assuming that the airplane was at an altitude of only 2,000 feet when first seen by Mr. Hansen (from point B, Figure 2) and descended at a constant 30° angle, it would have descended the 4,000-feet glide path distance to the ground in only 27.3 seconds. The airplane was viewed for a significantly longer period than this— more than two times longer—before it disappeared. One or more of the following factors may explain this anomaly: The assumed descent angle is too steep; the velocity of the airplane was less than 100 miles per hour; its altitude, distance, or both is in error; the airplane was not flying in a plane that is normal to the line of sight; or the airplane leveled out after it disappeared behind the foreground hills. For example, if we repeat this calculation using a smaller descent angle of 20°, a speed of 80 mph, and an initial altitude of 2,000 feet, the airplane would travel the 5,847-foot-long flight path to the ground in about 50 seconds, which is more nearly equivalent to what was described by the eyewitnesses. In summary, the authors are more inclined to accept the nearer distance estimates (*i.e.,* 3 miles to sea) than the farther distance estimates (26 miles) of

the airplane's final disappearance point into the sea because they are more in line with the eyewitnesses' temporal estimates than with the angular estimates.

The minimum-controlled-flight (stall) speed for this model Cessna is 48 knots with no flaps, zero bank angle, and center of gravity in its most forward position. Traveling at this velocity for the total viewing duration of 93 seconds at a descent angle of 30° along line B-X (Figure 1) yields a distance traveled of only 1.43 miles (to the point of aircraft disappearance behind the distant hills). This distance is clearly too small (Figure 1). The descent angle that yields a flight path length that is most compatible with all of the above facts (2,000 feet initial altitude) is between 5 and 10°. A descent angle of 10° yields a distance of 11,517 feet to the surface of the sea. Traveling at 48 knots, the Cessna would require 142 seconds to travel this distance. A descent angle of 5° yields a distance of 22,946 feet and a flight time of 4 minutes, 43 seconds, to sea impact.

Yet another estimate of airplane flight path can be derived from knowledge of its engine-off glide path ratio, which is between 7:1 and 8:1, yielding a descent angle of 8° and 7.4° below the horizontal, respectively. Here, the airplane would glide (at 7:1) the 2.73 miles to the earth's surface from a starting altitude of 2,000 feet in 2.4 minutes, assuming a speed of 60 knots. The corresponding glide distance (at 8:1) is 2.94 miles in 2.6 minutes; both duration values are reasonable. Nonetheless, engine sounds can be heard in the background of the audio tape throughout this period, which suggests a higher forward velocity than 60 knots.

The Valentich audio tape transcript. At 9:09:52, Valentich stated that the unknown aerial object near his airplane appeared to be "a long shape." At 9:10:20, he said, "… its got a green light and sort of metallic like, it's all shiny on the outside." Then, almost two minutes later, at 9:12:09, he said, "My intentions are—ah… to go to King Island—ah, Melbourne. That strange aircraft is hovering on top of me again *//open microphone for two seconds//* it is hovering—and it's not an aircraft." These were the last words ever heard from the young pilot according to the audio tape. Note that these descriptions by Valentich correspond in color and general size with the testimony of the primary eyewitness on the ground near Apollo Bay. Significantly, the signal strength and audio quality of Valentich's radio transmission did not change at any time during the entire tape, indicating that his altitude was above at least 3,000 feet. Line of sight transmission is blocked to Melbourne below this approximate altitude at this distance.

Estimating UFO size. It is reasonable to assume, on the basis of psychophysical research data, that Mr. Hansen's angular estimates were basically accurate in comparing the size of the two aerial objects because they were seen side by side at the same time. Psychophysical research supports this view. Thus, the UFO's apparent angular diameter was about 4 times larger than the distance between the airplane's two external lights. Using this ratio and the known dimension separating the two airplane lights (12 feet), we find that the

UFO would be about 48 feet across, assuming it was at the same distance as the airplane.

A hypothetical aircraft flight path. The dashed line in Figure 1 presents one possible flight path for Cessna DSJ, which is consistent with the voice transcript. (Unfortunately, the transcript does not contain any references to particular spatial locations after 9:00:29, and even this location is not known exactly.) Tick marks are approximately 1 minute apart (assuming an airspeed of 110 miles per hour) and taking the wind differential into account. The main objective of this flight path reconstruction is (a) to bring the aircraft's position into correspondence with where Mr. Hansen and the girls said they saw it located and (b) to identify a general "splash down" area in Bass Strait from which search operations should commence. This flight path reconstruction is based on the possibility that at about 9:06:30, Valentich either became disoriented and frightened and banked back toward the mainland for reasons of safety, or the presence of the unidentified aerial object somehow affected his compass so that he thought he was continuing on to his original destination. A number of other magnetic compass interference cases in aircraft have been reported (Haines, 1992; Sturrock *et al.*, 1998).

We assume the following:

1. The Cessna's altitude began to descend at about 9:10:30, shortly after Valentich began to fly in circles ("orbit"). His engine began to malfunction at 9:11:52 (engine trouble is audible on the audio tape).
2. The airplane continued to descend at approximately 500 feet per minute so that the airplane was at 2,000 feet altitude upon reaching point B (Figure 1).
3. Radio transmission ceased after 9:12:45 because of progressive line-of-sight signal loss caused by the earth's curvature. Of course, there is no way to determine the accuracy of this hypothetical flight path.

A small dark oval (UFO) object with a dashed trail is also drawn in at various locations on Figure 1 in accordance with Valentich's description. It is obvious that his aircraft was the focus of attention of this strange object.

Summary

Based on what is already known about his flight plan and what can be learned from the new eyewitness evidence, we have come to the following conclusion regarding the fate of Frederick Valentich. We conclude, on the basis of the evidence presented above, that Frederick likely crashed into Bass Straight. The ground witness testimony places the airplane's approximate flight path somewhere within the arc defined by the lines C-200° and C-126° in Figure 1, ESE of Cape Marengo. The most likely range of distances from the witnesses is from 3 to 12 miles as is discussed above. Consider the following line of evidence.

First, no wreckage of Valentich's airplane has been found. If he had crashed

on land, search-and-rescue personnel would have found crash debris in the 20 years following the disappearance. Locating a crash at sea is a far more difficult task. Second, Valentich's airplane was seen flying in a southerly direction east of Apollo Bay around 9:00 p.m. (based on certain reasonable assumptions). Third, Valentich was clearly disoriented by 9:10 p.m. at the latest and probably earlier. Many pilots will not admit this to the authorities for fear of pending medical investigations that might be required, which would put their flying career in jeopardy. Fourth, the Cessna could have flown a distance of 27.5 miles at 110 miles per hour during these 15 minutes. Of course, the main question is, in which direction was Valentich flying? Fifth, Valentich was flying in circles by 9:10:20 (and possibly earlier) and admitted to being confused about the relative magnetic bearings to the UFO by 9:11:23. Clearly, he did not know where he was at that point. It is possible that he could have flown back toward the mainland at some time after 9:06, either deliberately or by mistake. Perhaps he was somehow captivated by the strange object he saw flying near his airplane. Sixth, at 9:12:09, Valentich reported that the strange aircraft was "…hovering on top of (him) again … and (was) not an aircraft." Is this what Mr. Hansen and his nieces witnessed from the ground minutes later? If so, then the Cessna was descending within the area shown in Figure 1 and may have impacted the water somewhere within the dashed area shown in Figure 1. Underwater search activities should begin in this region of Bass Strait.

According to an Australian Marine Research report (Ocean Currents, 1997), Bass Strait is a shallow continental shelf with an average depth of from 50 to 70 m. Tide and wind action results in the mixing of the Bass Strait and the Tasman Sea, causing the saltier, colder (1–3°C) surface waters to sink (downwelling) and fall, much like a waterfall down the continental shelf slope, "beginning midway between Flinders Island and the Victorian coast and extending north almost to Jervis Bay" (Ocean Currents, p. 5). The Bass Straight Cascade pours toward the east.

Tides in Bass Strait "originate from the tidal wave traveling southward down the east coast of Australian. As the wave passes the eastern entrance of Bass Strait, some of its water is deflected into it, slowing down to 80 km per hour in the shallower water. The rest of the wave continues at high speed around Tasmania in a clockwise direction to reach the western entrance to Bass Strait some 3 hours later. The wave front entering from the west meets the wave front entering from the east, causing large tides along a north-south line in the middle of Bass Strait."

Because of the velocity and force of these currents, it is likely that underwater debris may be carried a long distance. The relatively low mass aluminum structure of Valentich's Cessna airplane would not sink quickly, nor would it dig into the bottom surface very far as would an anchor or the hull of a heavy ship. It might be possible to locate a particular area where such debris would accumulate over time. Computer simulations should be run to develop estimates of the debris field on the sea bottom, given tides and currents in the vicinity of the probable impact point of Valentich's plane on the sea surface.

We may never know exactly what happened to Frederick Valentich. Nevertheless, an attempt should be made to locate the airplane. An underwater search should be mounted, despite the 20 years that have elapsed since the event took place.

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