

RESEARCH ARTICLE

Unidentified Aerial Phenomena: The VASP-169 Flight Brazilian Episode Revisited

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Abstract—The February 8, 1982, sighting of an unidentified aerial phenomenon by crew and passengers in the VASP-169 flight over Brazil had significant media repercussions at the time and is still referred to today by several UFO publications. In this paper we reinvestigate the occurrence in depth and suggest that the “object” was indeed the planet Venus, possibly distorted by an atmospheric mirage effect. An almost simultaneously occurring but lesser-known secondary case is also commented upon.

Keywords: UFOs—VASP 169 Brazilian case—planet Venus—mirages

Introduction

Thirty-one years ago, in the early hours of Monday, February 8, 1982, passengers of Brazilian flight VASP-169 from Fortaleza city to São Paulo were awoken by crew and informed that the aircraft was being accompanied by an unidentified object. The phenomenon was first observed near Bom Jesus da Lapa City, state of Bahia, in the northeast region of Brazil, and pursued the plane for 1 h, 25 min until its stop in Rio de Janeiro (see Figure 1).

The case had great repercussions in the media during the subsequent days and weeks, with declarations from several political, military, and scientific authorities. It was suggested that the plane’s crew had mistaken the planet Venus for a UFO, but this conclusion generated much controversy. In this work, we carefully review the available evidence about that occurrence and conclude that Venus provides a valid explanation, although an atmospheric mirage effect must have also been invoked. We also comment upon and reject the alleged connection between the VASP-169 “object” and a ring-shaped luminous cloud seen over southern Brazil just two days before. The main source material for the present investigation is the official pilot report sent to the VASP aerial company (Britto 1982), as well as several important Brazilian newspapers and magazines from that epoch.

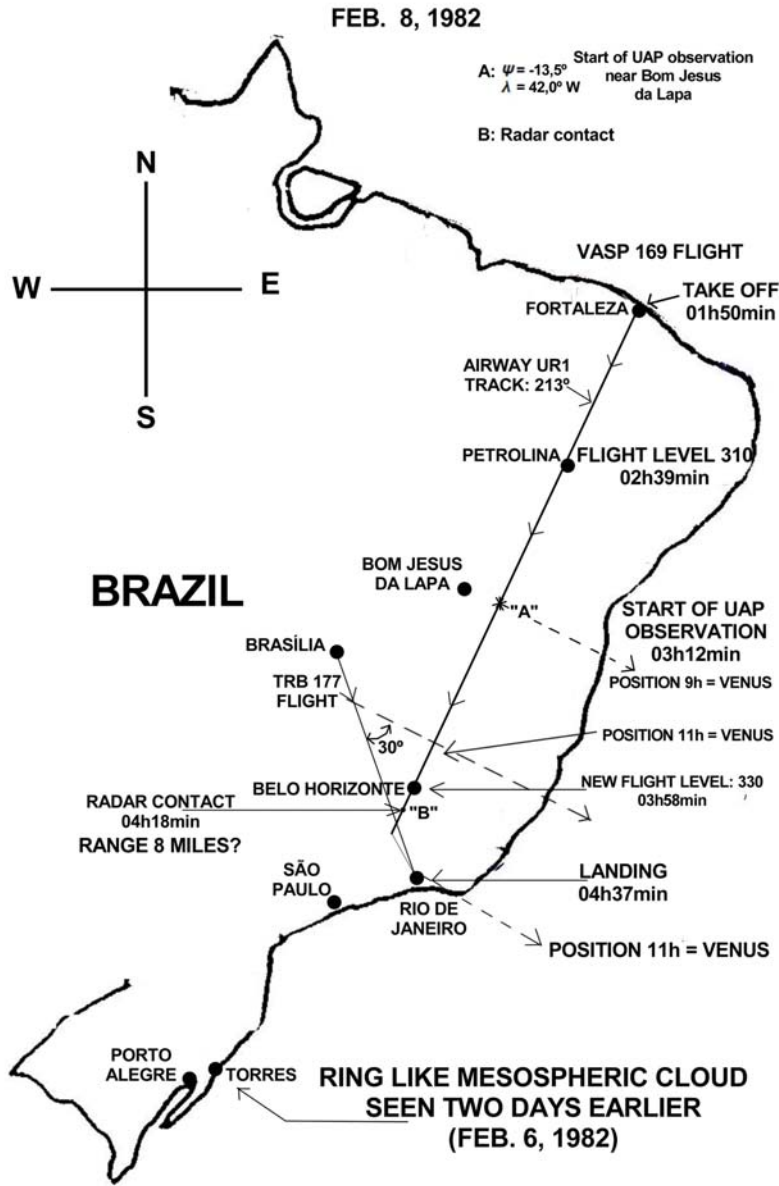


Figure 1. A timeline of flight VASP-169, with the relevant facts reported and discussed in this paper.

A Historical Review

There is some uncertainty about the exact position of the plane when the unidentified aerial phenomenon (hereafter, “UAP”) was first observed by Mr. Gérson Maciel de Britto, commander of the 727-200 Boeing PP-SNG owned by the now-extinct Brazilian aerial company VASP. He reported “a strong light” to the left of the airplane, at the approximate position of Bom Jesus da Lapa City ($\varphi = 13.2^\circ \text{ S}$; $\lambda = 43.4^\circ \text{ W}$), over Bahia state, at 3 h, 12 min local time (GMT-3 h). Surprised, Commander Britto radioed a message to CINDACTA, the aerial traffic control center in Brasília, in order to check if there were other planes in that position. The answer was negative. The strange light then began to change color very rapidly. The reported colors were red, blue, and white. Minutes later, another pilot from an Aerolíneas Argentinas plane behind the VASP 169 but in the same route communicated that he was also seeing the unidentified light. A third report came at 3 h, 40 min from Mr. Milton Missaglia, commander, and Mr. Mário Pravato, co-pilot, who were aboard a 727-100 Boeing (Transbrasil flight number TRB-177, en route from Manaus to Rio de Janeiro). From Missaglia and Pravato’s points of view, the UAP was located at position 11 h. Their plane then flew from Brasília to Rio de Janeiro.

When flight VASP-169 passed over Belo Horizonte city ($\varphi = 19.7^\circ \text{ S}$; $\lambda = 43.6^\circ \text{ W}$), CINDACTA operators reported a radar blip situated about 8 miles from the VASP 169 plane at position 9 h as seen from the pilot’s cockpit. At that moment, the UAP was supposedly nearer, and Mr. Britto described it as “a flying saucer outline embedded in a flurry of lights activity.” He added the object “was not a star. It looked like a fixed thing, a fixed outline with a luminous focus, although it showed vertical motions up and down from its point of origin” (Britto 1982). The supposed approaching and departing motions were made exclusively in the horizontal plane, that is, within the pilot’s line of sight. Immediately, Commander Britto “tried to communicate with [the] saucer’s crew, hoping to receive some kind of message.” He also activated the external lights of his airplane, trying to send light signals. There was no answer.

Several passengers also saw the supposed object, but their descriptions, in most cases, are vague and imprecise. S. Del Rosso said that “the object shone as a mercury vapor street lamp.” M. S. Marrocos affirmed that she “saw a very intense and variable light dot.” More dramatic (and atypical) seems to be A. L. Ximenes’s report: “What I saw was like a second moon.” R. A. Lima notes that “the UFO shape was oval, its center more luminous, with clearer edges,” and S. H. Vieira reported “an intense light approaching and departing.” F. S. de Araújo described the UAP as “a circle with fluorescent lights, no doubt a UFO . . .” (Ricardo 2003).

When preparing to land in Rio de Janeiro, the “object” was still visible. According to Commander Britto, “the plane had passed through several cloud layers and the object appeared and disappeared.” Maneuvering the airplane to land on runway number 14 of Galeão International Airport, Britto was informed that “a strange light was being observed starting two days before, and that a Brazilian Air Force (FAB) squadron was in alert state” (Anonymous 1982a). On February 10, that assertion was denied by the FAB.

A good general review about the flight VASP-169 case may be found in Gross (2005). A very extensive review (written in Portuguese) may be found in Martins (2011).

Some newspapers (e.g., Anonymous 1982b) reported other persons on the ground had observed “a strange object in the sky emitting multicolored lights” shortly before sunrise on February 9. One such report came from Virginia Drummond, a psychologist living in the nearby area.

When interviewed later, Transbrasil commander Milton Missaglia declared: “The only thing I could see right on the announced position reported by Britto was the planet Venus. That night it was unexpectedly luminous.” Even after he had received an alert from CINDACTA, Missaglia could only confirm seeing Venus.

Another (Almost Forgotten) Episode

Just two days before the flight VASP-169 incident, another intriguing atmospheric phenomenon was photographed by Mr. Guaracy Andrade in the small coastal city of Torres ($\varphi = 29.3^\circ \text{ S}$; $\lambda = 49.7^\circ \text{ W}$), southern Brazil. A professional photographer, Andrade captured the image of a beige ring-shaped luminous cloud moving slowly across the dawn sky. Local newspapers such as *Folha da Tarde* and *Zero Hora* divulged his photos on Wednesday, February 10 (Anonymous 1982b, 1982c). Excited, Mr. Andrade declared that he believed those photos revealed the same unidentified object seen by Commander Gérson Britto. One week later (Anonymous 1982d), both publicly confirmed that opinion based on a superficial comparison between those two phenomena. According to them, “at Torres, the UFO had a bluish color in its center and beige in the periphery. During flight VASP-169, it was seen with an intense blue-white core and red-orange borders.” And there was more: “Commander Britto asserted his UFO kept a quasi-static position, just like the Torres UFO. Concerning the shape, the striking differences could perhaps be explained by different view angles: Britto would have seen it edge-on, while Andrade, face-on.”

The Venus Hypothesis

Several astronomers suggested that the flight VASP-169 UFO was indeed the planet Venus. Among them were Almeida and Hodara (1982), who concluded based on a simulation made with a Zeiss Spacemaster planetarium projector that the UAP was “planet Venus possibly magnified by some type of rare anomalous atmospheric condition.” However, some days later, the renowned scientific journalist Fernando G. Sampaio (Sampaio 1982a) pointed out that at that time, Venus was rising at about 4 a.m. Even taking into account the fact that the airplane flew at an altitude of about 10,000 m, causing a 3° horizon depression, Venus couldn’t have been seen at 3 h, 12 min. At most, 3° would have produced a 12-minute anticipation in the Venus rising time, that is, roughly 25% of the 48-minute discrepancy.

Another important question was: Could experienced Commander Britto (then with more than 26,000 flight hours) realistically confuse Venus with a UFO? Many think this would be impossible. However, as the present investigation will show, even an experienced airplane commander can be wrong.

The UAP had been seen simultaneously from three different airplanes that were dozens or even hundreds of miles apart, with no important paratactic deviations reported. This fact clearly indicates that the phenomenon was at a great distance from the observers. In combination with the good meteorological conditions prevalent at that time, an astronomical object well beyond the terrestrial atmosphere seems to be a valid explanation. As seen from the airplane, the sky was clear, suggesting the local predominance of a tropical anticyclone (high atmospheric pressure cell—see Figure 2). Looking through the airplane cabin’s windows, a careful and skilled observer would see the constellation Crux directly ahead and, to the left, the bright stars Alpha and Beta Centauri. To the starboard, 37° above the horizon (considering a 3° horizon depression caused by the plane’s altitude), was the full moon, placed at the constellation Leo, at 303° azimuth. High, near zenith, the planets Mars, Jupiter, and Saturn were visible, relatively near to each other because of the already long-forgotten “great planetary alignment” which would occur the following month. Looking at larboard, the highest star one could see was reddish Alpha Scorpii (Antares), shining at about a visual magnitude 0.9. From the VASP-169 airplane position at 3 h, 12 min local time, Antares’s horizontal coordinates were 113° azimuth and 36° high (horizon depression included). The azimuthal discrepancy between Antares’s position and the UAP’s position would be only 9.8 degrees.

Concerning the five bright naked-eye planets, only Mercury and Venus

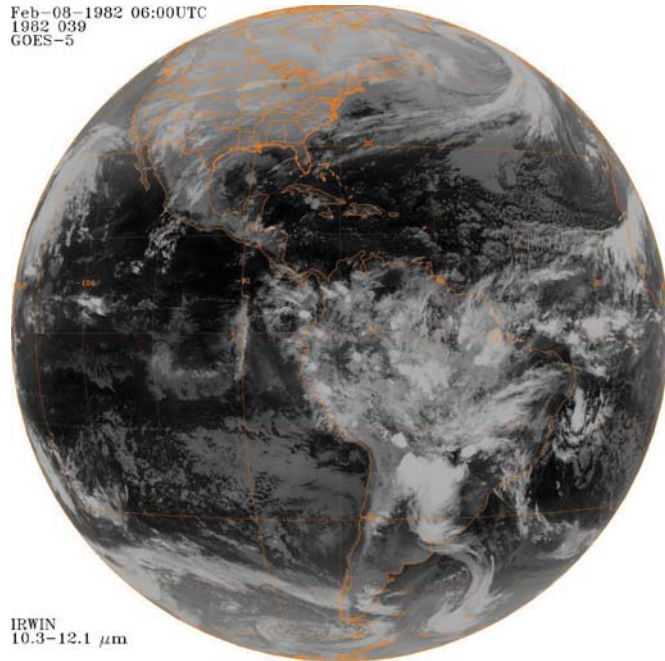


Figure 2. South America infrared satellite image (GOES 5) obtained at GMT-06 h February 8, 1982 (from NOAA files).

were not above the plane's horizon. The first was in retrograde motion at Capricornus, rising at about 4:45 a.m. and shining at a magnitude of +1, lost in the twilight, and therefore definitely not visible from the airplane. The second planet, Venus, is an attractive possibility.

However, Commander Britto declared to the press that "he had seen Venus rising before seeing the UFO." This claim contains, at the same time, a clue and a contradiction. First, a clue because, if the reported UAP was not Venus, then Britto should have reported that he was seeing Venus in addition to the UFO near the position of the first. This never happened. Therefore, if Venus was already above the horizon, the only plausible possibility is that the Venus image merged with the UFO image (in such a case, it would be simpler and more logical to assume the UFO was, in fact, Venus). Second, we have a contradiction because Venus could not actually have been visible from the airplane's position and altitude at the reported time. Table 1 shows the results concerning Venus's visibility obtained from the author using several sky simulation computer programs calculated for Bom Jesus da Lapa City's position. From that table we definitively conclude that Venus

TABLE 1
Mornina Visibility of Planet Venus on February 8, 1982.
in Northeast and Southeast Brazil

Aircraft	Venus Rising Time	Azimuth	Position ⁺	Elevation*
VASP-169 (<i>j</i> = -13.2° S; <i>l</i> = 43.4° W)	04h 02min ^a (50)	105°	9h	—
	04h 02min ^b (50)	105°	9h	-12.3° (-9.3°)
	04h 03min ^c (51)	—	—	-11.5° (-8.5°)
	04h 02min ^d (50)	104.5°	9h	—
	04h 01min ^e (51)	104.5°	9h	-12.2° (-9.2°)
Mean	04h 02.0min (50.4)			-12.00° ± 0.25°
TRB-177 (<i>j</i> = -20.0° S; <i>l</i> = 44.0° W)	03h 57min ^a (45)	105.0°	11h	-3.5° (-0.5°)
	03h 58min ^b (46)	105.0°	11h	-4.2° (-1.2°)
	03h 58min ^c (46)	—	—	-4.2° (-1.2°)
	03h 57min ^d (45)	104.5°	11h	—
	03h 56min ^e (44)	105.2°	11h	-4.3° (-1.3°)
Mean	03h 57.2min (45.2)			-4.05° ± 0.19°

^a Data calculated with Cartes du Ciel software (© 2002 Patrick Chevalley)

^b Data calculated with Cyber Sky software (© 2002 Stephen Schimpf)

^c Data calculated with Sky Lex software (© 1997 Data Becker GmbH)

^d Data calculated with Sky Map software (© 1994 C. A. Marriott)

^e Data calculated with TASCOSky Watch software (© 2000 TASCOSky Corp.)

* For the VASP-169 aircraft, this column lists the apparent elevation in degrees at 03 h, 12 min, local time (06 h, 12 min GMT) on February 8, 1982. For the TRB-177 aircraft, the reference instant is 03 h, 40 min, local time (06 h, 40 min GMT). In parenthesis, we have elevations corrected for a 3° horizontal depression corresponding to a 10,000 m altitude.

⁺ Positions seen from the pilot's cockpit, assuming a magnetic northeast-southwest route, for flight VASP-169.

() Numbers in parentheses refer to the minute of Venus rising minus 12 min, corresponding to the maximum anticipation possible caused by a 3° horizon depression.

was still below the horizon line at the beginning of UAP observation. So, must the Venus hypothesis be dismissed?

Perhaps not. The clues list is revealing. The UAP was low in the sky, permitting its observation through the left side windows of the passenger cabin. Its color was described as “white like a mercury vapor street lamp,” which is exactly Venus’s color. The “object” disappeared behind occasional clouds, suggesting a distant light source, possibly a celestial object. The astronomical azimuth for the Venus rising point at Bom Jesus da Lapa City’s position was 105° , only 2 degrees off the reported UFO position (103°). In Rio de Janeiro, observations made two days beforehand suggest a recurrent apparition, which is also compatible with Venus observations. In 1982, the morning Venus apparition began on January 21 with its inferior solar conjunction. The planet then rapidly invaded the pre-dawn sky. For an observer placed in Rio de Janeiro, between January 30 and February 9, Venus rising times ranged from 04 h, 36 min to 03 h, 45 min—51 min in just 10 days, or 5 min earlier each day. This means Venus’s rising time on February 8 would have been 03 h, 50 min. Venus’s maximum brightness (visual magnitude -4.6) would be reached on February 24, so the planet was already very bright on February 8 (magnitude -4.13).

Many reports of anomalous Venus risings or settings can be found in literature. See, for example, Gray (1962), Rose (1914), Hollis (1915), Borthwick (1966), and Sinclair (1958). Even the reported motions described by Britto (1982) have been mentioned when Jupiter (Tennant 1888) or the Moon (Reade 1888) were near the horizon. Such phenomena can be explained in terms of abnormal refractions.

When flight VASP-169 landed in Rio de Janeiro at 04 h, 37 min local time, Commander Britto said he still could see the “object.” The plane was then aligned with runway axis 14 of Galeão International Airport. The UFO position was estimated by Britto as 11 h. Today, Galeão runway 14 points to 146° (magnetic azimuth). In this case, the 11 h position corresponds to a magnetic direction of $146^\circ - 30^\circ = 116^\circ$. Correcting the 116° value for the magnetic declination of that epoch (-19.3°), we find an astronomical azimuth of 96.7° . At the instant of landing, Venus’s astronomical azimuth on Galeão airport was 101.2° . Therefore, the difference between Venus’s azimuth and the supposed UFO’s azimuth would be only 4.5° . Such a discrepancy would be a bit larger if one remembers that in 1982, the magnetic azimuth of the Galeão runway 14 was about 2° lesser than 146° . Even so, a 6.5° discrepancy (see Figure 3) is equivalent to 0.2 h in the UFO estimated position, a very small error if we consider that the crew would have been very busy landing the aircraft. We therefore have strong evidence in favor of the Venus explanation for the reported UFO. Table 2 summarizes

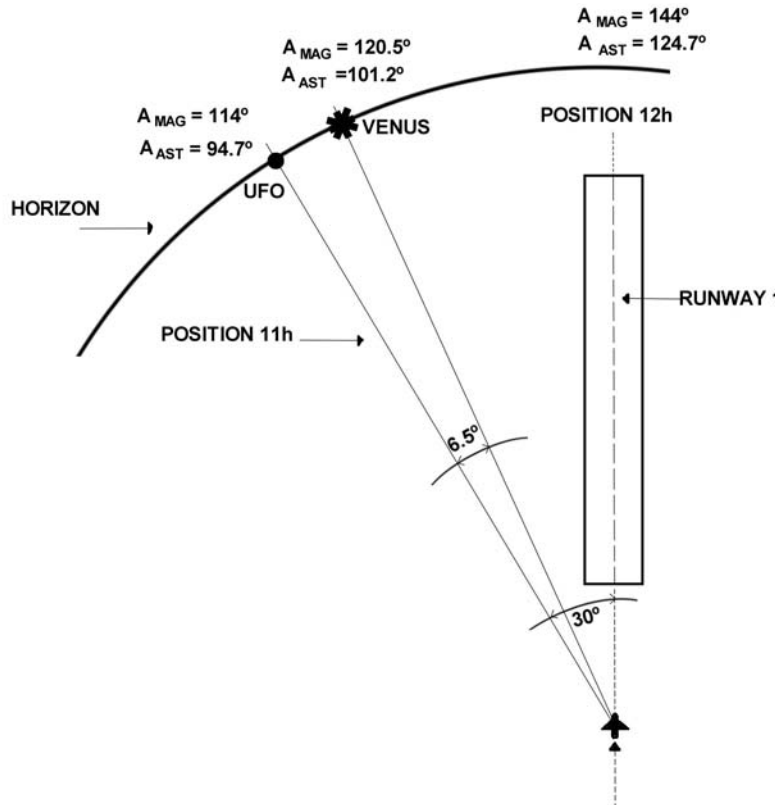


Figure 3. Comparison between UFO's and Venus' azimuthal positions at the landing time of flight VASP-169 at Rio de Janeiro (Galeão International Airport) on February 8, 1982, 04 h, 37min (local time, GMT-03 h). Magnetic azimuths refer to the year 1982.

the circumstances of Venus's visibility at Galeão airport at the exact time flight VASP-169 was landing. It is still worth mentioning that, even during landing procedures, Commander Britto did not recognize Venus as a planet, considering it to be a UFO flying over Guanabara Bay, just a few miles away (the planet was then 47 million km from Earth).

A Mirage Effect?

At this point in the discussion, it seems well-established that Commander Britto's UFO could indeed be planet Venus. But two problems remain. First, under normal circumstances, Venus could not have been visible from flight VASP-169's position at 03 h, 12 min local time. Second, something must

TABLE 2
Venus Visibility at Galeão International Airport,
Rio De Janeiro*, Feb. 8, 1982, 04 h,37 min[†]

Software	Azimuth ^a	Elevation	Position ^b
Cartes du Ciel	102.5°	9.5°	11h
Cyber Sky	101.2°	9.9°	11h
Sky Map	99.7°	10.0°	11h
TASCO Sky Watch	99.7°	10.0°	11h
Mean	101.15° ± 0.57°		

* $j = 22^{\circ} 48'36''S$; $l = 43^{\circ} 15'02''W$; $h = 0$ m.

[†] GMT – 3 h

^a Astronomical azimuth. Add 19.3° to obtain 1982 magnetic azimuths.

^b Assuming a 12 h direction defined by the Galeão airport runway 14 axis (1982 magnetic azimuth @ 144°).

have occurred so that Venus became unrecognizable. Both facts could be explained by the occurrence of an atmospheric mirage effect.

If the crews of flights VASP-169 and TRB-177 believed they saw Venus when, in reality, it was still -1° to -9° below the horizon (see Table 3), some type of abnormal effect must be invoked.

Of particular interest to our study are two types of mirages, known as Fata Morgana and Novaya Zemlya. Both of them have been known for centuries. Fata Morganas produce curious effects, such as the projection on the air of images from ships and even entire cities situated near or slightly beyond the observer's horizon (see, e.g., Charton 1870). The Novaya Zemlya effect was first observed in 1597 by Dutch polar explorer Willem Barents (c. 1550–1597) when he was in the Russian Arctic region northeast of Finland (Sampson 1993). Such a mirage can anticipate the rising of a celestial body by conducting its light rays along a curve way sandwiched between two air layers with different temperatures during a thermal inversion (see Figure 4). Such thermal inversions are more frequent before dawn, because they rarely survive diurnal atmospheric heating. In fact, nighttime mirage conditions may persist for long stretches. Hence, it seems possible that a similar effect accompanied Venus rising that morning and, at the same time, distorted its image. A typical mirage may cause a variable but intense concentration of light rays. Scintillations and apparent brightness variations would simulate the approximation motions reported by Commander Gérson Britto. Based

TABLE 3
Venus Height During Flight Vasp-169 on Feb. 8, 1982

City	Time (GMT-3h)	Height	Notes
Fortaleza (j = 3.7° S; l = 38.5° W; h = 0 m)	01 h 50 min	-43.9°	Takeoff
Petrolina (j = 9.4° S; l = 40.5° W)	02 h 39 min	-29.3°*	
Bom Jesus da Lapa (j = 13.2° S; l = 43.4° W)	03 h 12 min	-9.0°*	Start of observation
Belo Horizonte (j = 19.7° S; l = 43.6° W)	03 h 58 min ⁺	-10.7°*	
South Belo Horizonte	04 h 18 min		Radar blip
Rio de Janeiro (j = 22.6° S; l = 43.3° W; h = 0 m)	04 h 37 min	+10.0°	Landing

* Taking into account a 3° horizon depression as seen from the VASP-169 airplane flying at an 31,000 ft altitude.

⁺ Exact time not informed by the pilot. After Belo Horizonte city, the plane climbed to level 330 (33,000 ft high).

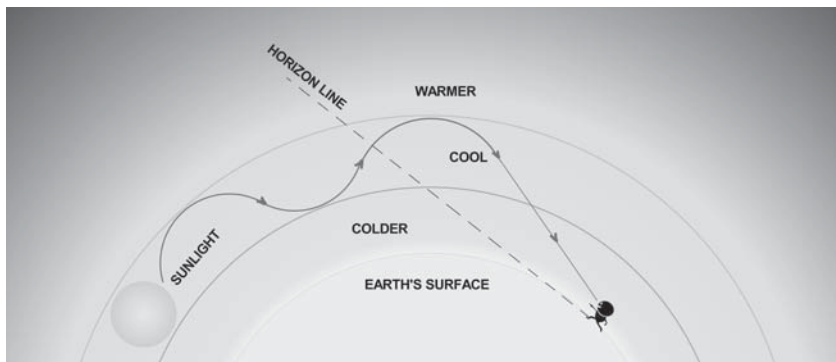


Figure 4. Basic mechanism involved in the Novaya Zemlya mirage. Illustration adapted from Sampson (1993).

on the official report of the incident (Britto 1982), the only observed motions of the UAP were the apparent approaches and departures along the direction perpendicular to that of the airplane route. No lateral translations

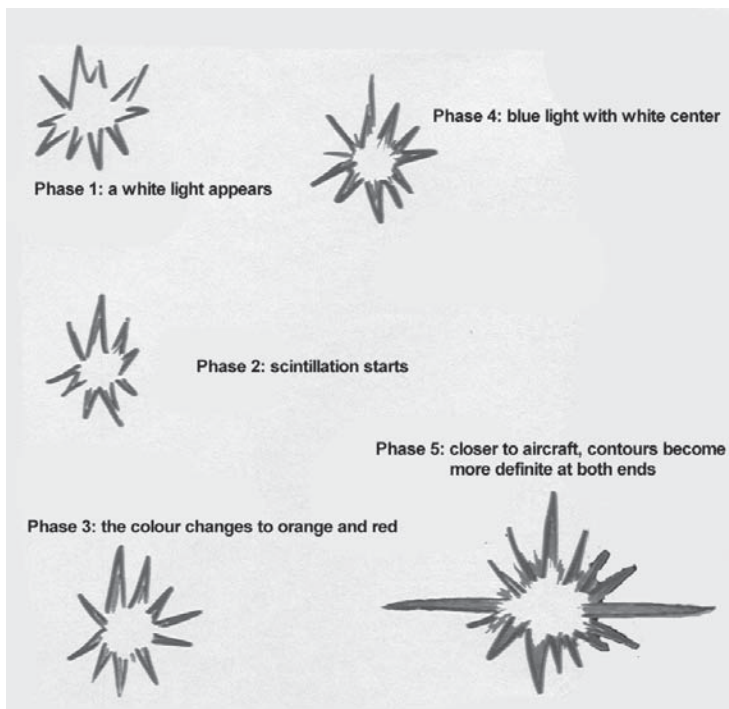


Figure 5. Drawings of the UAP seen by Commander Gerson Britto on Feb. 8, 1982, at dawn, showing brightness and color changes. Illustration adapted from Anonymous (1982e).

are cited, only vertical oscillations. Random dispersion of different light wavelengths can also occur, explaining the diverse colors observed. In Figure 5, we reproduce Britto's drawings as published in the Brazilian press. They are fully compatible with an image of Venus distorted by an atmospheric mirage.

A critical point here is that usually a Fata Morgana mirage produces images situated just above the horizon. However, in the Novaya Zemlya effect, real objects are effectively several degrees below the horizon. Even so, the mirage may be seen several degrees above the horizon line. It is important to mention that the Novaya Zemlya effect may occur in any place, not only in Polar Regions, if temperature variations are great enough to produce a high refraction. According to Heidorn (1999), in the case of Novaya Zemlya mirages, apparent elevations (that is, displacements) of 5 degrees or more are possible. Light rays must travel within an inversion layer

for hundreds of kilometers. The layer must have just the right temperature gradient so that the light continuously bends with the curvature of the Earth over that long distance (400 km for a 5-degree rise in elevation.)

Technically, when an image appears much higher in the sky than the actual object's position, the condition is termed *looming*. Indeed, the most common form of superior mirage is looming. Most looming mirages occur over large bodies of water that are much colder than the air above. The greater and deeper the inversion, the higher the object appears in the sky. In extreme cases involving strong looming, the image may appear relatively high in the sky, although still near the horizon line.

It seems logical to say that Commander Britto started to see the UAP light when this became visible close to the astronomical horizon line. He reported that the light was visible approximately in the center of his left side window, showing occasional vertical oscillations with a 15-cm amplitude (as measured on the glass surface). This could be translated to about a 10- to 15-degree oscillation in the sky plane (assuming the pilot's distance to the window was 0.5 m.)

These possible mirage effects would most likely not have prevailed along the entire flight trajectory. It is more reasonable to assume that they occurred during a limited time interval, attracting the crew's attention, more specifically, between the cities of Bom Jesus da Lapa (the start of the observations) and, perhaps, around Belo Horizonte (when the radar blip was detected). Also, if one must choose between a Fata Morgana and a Novaya Zemlya effect, the latter seems more adequate to explain the starting of UAP flight VASP-169 observations.

It is worth briefly mentioning that in addition to Venus, there were other possible explanations for the VASP-169 episode. An interesting possibility was an atmospheric optics phenomenon involving the full moon and icy crystals in cirrus clouds. According to this hypothesis, the UAP could presumably be a "lunar anthelion," that is, a lunar reflection on the same almucantar as that of the Moon, diametrically opposed to it in azimuth. This reflection would be situated around astronomical azimuth 123° . The 9 h UAP reported position would correspond to a 103° astronomical azimuth. The azimuthal discrepancy would then be 20° (see Figure 6). However, there are problems with this interpretation. Normally a lunar anthelion would be rare, faint, and colorless. It is theoretically possible that a very bright lunar anthelion could produce one or two symmetrically placed moon dogs. The expected azimuths for these would then be 101° and 145° , assuming the most common 22° separation from the central lunar anthelion. Moon dogs may be colored. But moon dogs are also very faint, so they, too, are an unlikely alternative explanation to the VASP-169 flight UAP.

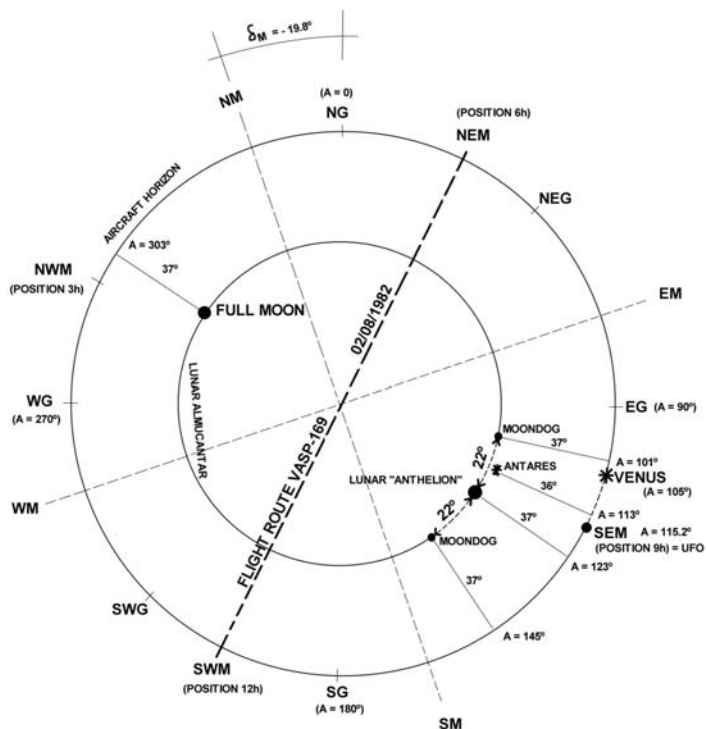


Fig. 6. Zenithal flat projection of the sky at the position of VASP-169 flight at 03 h, 12 min (GMT-3h) on Feb. 8, 1982, near Bom Jesus da Lapa city, taking into account a 3° horizon depression and a magnetic declination of -19.8° . A highly improbable lunar “antheleon” and two 22° moon dogs are plotted, along with Venus rising point and the reported UAP position (9 h). The coincidence between Venus’s position and the UAP position is excellent.

The Radar Contact

The alleged radar detection is one of the most controversial questions involving the UFO flight VASP-169 case. In fact, at 4 h, 18 min (GMT-3 h), CINDACTA communicated to the pilot that they had a blip at position 9 h about 8 miles from the plane. In general, ufologists consider this strong evidence of the presence of a real UFO flying near the airplane.

However, some days later, an official bulletin stated that the signal “was not meaningful, having appeared also near other airplanes that night.” Furthermore, the list of evidence supporting the Venus hypothesis is long and reasonably well-justified, so it is believed that the mentioned radar detection could simply be a radar dot angel, that is, a spurious echo, which sometimes originates from thermal inversions (Corliss 1984). According

Figure 7. The Torres ring-like mesospheric cloud seen two days before the flight VASP-169 case in southern Brazil. Photo © Mr. Guaracy Andrade, reproduced with permission.



to Glover et al. (1966), radar dot angels may be ascribed to insects, birds, or atmospheric refractivity perturbations. See also Goodman (1954), Rumi (1957), and Atlas (1965). These false targets can persist for as long as 35 minutes, and they frequently have a significant velocity relative to the mean wind velocity. Experiments suggest there is in fact a type of radar dot angel caused by atmospheric perturbations in the refractive index (associated with temperature inversions) in atmospheric layers no more than a few meters thick, in which turbulent eddies the size of a few centimeters occur. Therefore, the flight VASP-169 radar blip may in fact point to an atmospheric mirage effect. The alternative possibility of a radar ghost (radar echoes of distant targets that appear close) seems less attractive in this case.

The Torres Ring-Shaped Cloud

As mentioned earlier, a lesser-known relationship between the flight VASP-169 UAP and an uncommon cloud photographed in southern Brazil two days before was published in the Brazilian press. But now it seems evident that such a relationship cannot be sustained. Most likely, the Torres cloud (see Figure 7) was a rare type of nacreous or even noctilucent cloud, illuminated by the first solar rays in the upper atmosphere (Sampaio 1982b). The photographer estimated the angular elevation of the cloud in relation to the horizon line to be about 30° to 45° (Andrade 2013).

Nacreous clouds or, more generically Polar Stratospheric Clouds (PSCs), can be observed during the civil twilight period (Sun center between -1° and -6° below the horizon), at altitudes of 15,000–25,000 m. If the Torres cloud was in the stratosphere, its distance from the observer would be about 20–50 km.

On February 6, 1982, at the position of Torres city, the Sun rose at 05 h, 54 min (local time). Civil twilight began at 05 h, 27 min, nautical twilight at 04 h, 57 min, and astronomical twilight at 04 h, 26 min. At 04 h, 30 min, when the cloud was photographed, solar depression was at -17.7° .

This seems to indicate that our cloud was probably a noctilucent cloud (NLC) or Polar Mesospheric Cloud (PMC). These clouds are visible in a deep twilight condition and composed of tiny crystals of water ice up to 100 nm in diameter. Their heights vary from 76 to 85 km. From a sample of PMCs observed between 1981 and 1985, Thomas and Olivero (1986) found

an average value of 85.0 ± 1.5 km for northern PMCs. Southern PMCs have slightly shorter average heights of about 83.0 km. Such clouds form under very restrictive conditions and are visible only when illuminated by sunlight from below the horizon. If the Torres cloud was in the mesosphere, its distance from the observer would be about 117 km to 166 km (assuming a height of 83 km.) As mentioned earlier, because the Sun was still very depressed, a mesospheric cloud seems more plausible than a stratospheric cloud. This would have been a typical type IV PMC (whirls cloud), which, on rare occasions, shows a complete ring structure with a dark center (subtype IVc), according to Gadsden and Parviainen (1995).

Sporadically, mesospheric and nacreous clouds may be seen from latitudes far from either pole. A similar observation was made from the nearby city of Porto Alegre, also in southern Brazil, on the summer night of December 19, 1971, approximately 21 h local time (Sampaio 1982b). This cloud was very similar in form to that of the cloud seen in 1982. Solar depression was also at about -17° , the cloud was about 0.5 degree in diameter, and described a circular ring with a dark transparent center (subtype IVc), surrounded by a more diffuse nebulosity. In the southern hemisphere, such clouds may be observed between November and February (Gadsden and Parviainen 1995).

Therefore, we can conclude that there was no relation between the Torres UAP and the VASP-169 UAP.

Conclusion

In this paper, it has been clearly shown that the UAP positions reported by Commander Britto at his first and last observations coincide notably well with planet Venus's positions. Therefore, the evidence supporting the Venus hypothesis is strong.

The flight VASP-169 episode serves as an excellent example to illustrate what usually happens in UAP sightings. Even well-trained persons like air pilots can commit mistakes, and the popular "Venus explanation" is not always invalid. The incident also shows that one episode may generate a cascade of secondary cases and easily lead to false correlations between those cases. There is, additionally, what we define as "the media lens effect," which introduces significant distortions that strongly influence public opinion. A typical example is the Brazilian network TV Globo airing a simulation of the flight VASP-169 incident that shows a gigantic luminous ellipse, like some kind of "mother ship," approaching the aircraft and almost filling the windows of the pilot's cockpit, something which never occurred (see, e.g., Figure 5.)

Surprisingly, the Brazilian magazine *UFO* (Gevaerd 2007) has recently

revisited the flight VASP-169 incident, classifying it as “one of the most important cases in the Brazilian UFO casuistic.” The Venus hypothesis was ridiculed, and it was added that Commander Britto asserted, many years later, that he did succeed in his telepathic contact with the supposed UFO’s crew. Based on our detailed study, such assertions cannot be supported and reveal a completely unscientific approach to that occurrence.

To someone rigorously using the scientific method, the flight VASP-169 episode cannot be attributed to anything other than a Venus observation affected by a possible atmospheric mirage effect, misinterpreted by an air pilot with an obvious tendency to believe in alien origins for unexplained occurrences.

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References

- Almeida, L. D., & Hodara, R. H. (1982). Fenômeno Induz Piloto a Ver um Disco Voador. *Correio do Povo*, 26.
- Andrade, G. (2013). Private interview.
- Anonymous (1982a). OVNI Segue Boeing da VASP da Bahia até o Rio. *Jornal do Brasil*, Part 1, 9.
- Anonymous (1982b). Pilotos da Transbrasil estão Confirmando Relato. *Zero Hora*, 29.
- Anonymous (1982c). Disco Voador Fotografado na Praia da Guarita, em Torres. *Folha da Tarde*, 20.
- Anonymous (1982d). Piloto e Fotógrafo são Unânicos: OVNI Existe. *Folha da Tarde*, cover, p. 8.
- Anonymous (1982e). O Fascínio do Cosmos. *VEJA*, 702, 50.
- Atlas, D. (1965). Angels in Focus. *Journal of Research NBS*, 69D, 871.
- Borthwick, C. A. (1966). Venus Abnormal Refraction. *Marine Observer*, 36, 183.
- Britto, G. M. (1982). Flight Report 169/0802-1982, VASP.
- Brum, N. C. (1982). CINDACTA Official Press Communication.
- Charton, M. E. (1870). *Los Meteoros*. Paris: Libreria Hachette.
- Corliss, W. R. (1984). *Rare Halos, Mirages, Anomalous Rainbows and Related Electromagnetic Phenomena*. Glen Arm, MD: The Sourcebook Project.
- Gadsden, M., & Parviainen, P. (1995). *Observing Noctilucent Clouds* (first edition). Turku, Finland: International Association of Geomagnetism & Aeronomy.
- Gevaerd, A. J. (2007). O Que Foi o Caso VASP Vôo 169. *UFO*, 23(130), 6.
- Glover, K. M., Hardy, K. R., Konrad, T. G., Michaels, A. S., & Sullivan, W. N. (1966). Radar observations of insects in free flight. *Science*, 154, 967–972.
- Goodman, F. (1954). Unidentified radar echoes. *Marine Observer*, 24, 81.
- Gray, J. H. (1962). Scintillation. *Marine Observer*, 32, 122.
- Gross, P. (2005). UFO—Aircraft Encounters: Flight 169 Incident, Brazil, February 8, 1982. <http://>

- www.ufologie.patrickgross.org/htm/pp-sng1982.htm
- Hollis, H. P. (1915). The Green Flash. *English Mechanic*, 101, 380.
- Heidorn, K. C. (1999). The Superior Mirage: Seeing Beyond. In: *The Weather Doctor*, <http://www.islandnet.com>
- Martins, R. (2011). Vasp 169. *Ufologia Objetiva*. <http://www.ufologiaobjetiva.com.br/vasp-169/>
- Reade, T. M. (1888). Curious apparent motion of the Moon seen in Australia. *Nature*, 38, 102.
- Ricardo, S. (2003). Boeing 727 Data Center. <http://727datacenter.net/hist/especiais/especial13/especial13.htm>
- Rose, E. G. (1914). A planetary phenomenon. *Knowledge*, 11, 50.
- Rumi, G. C. (1957). VHF radar echoes associated with atmospheric phenomena. *Journal of Geophysical Research*, 62(4), 547—564.
- Sampaio, F. G. (1982a). Discos Voadores, Objetos Aéreos e Muito Misticismo. *Correio do Povo*, 49.
- Sampaio, F. G. (1982b). Fenômeno visto em torres era uma nuvem muito rara. *Correio do Povo*, 32.
- Sampson, R. (1993). Novaya Zemlya: A solar mirage. *Sky and Telescope*, 85(2), 96.
- Sinclair, I. M. (1958). Setting of the Planet Venus. *Marine Observer*, 28, 194.
- Tennant, J. F. (1888). Jumping stars. *Observatory*, 11, 433.
- Thomas, G. E., & Olivero, J. J. (1986). The height of polar mesospheric clouds. *Geophysical Research Letters*, 13(13), 1403.