

The Campeche, Mexico 'Infrared UFO' Video

Mysterious objects filmed by the Mexican military in March 2004 created a flurry of excitement and strange claims. A new analysis from a respected expert suggests that the images have a prosaic explanation—despite premature dismissals by skeptics and believers alike.

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A now-classic UFO video was taken on the afternoon of March 5, 2004, in southern Mexico, over the states of Chiapas and Campeche. A Merlin C26/A aircraft of SEDNA, the Mexican Secretariat of Defense, was on routine patrol looking for drug smuggling or other illegal activity. It was using the Star SAFIRE II infrared sensing device manufactured by FLIR Systems of Portland, Oregon. From an elevation of 3,500 meters (approximately 11,500 feet), the infrared sensor system recorded a sequence of unidentified objects, at one point numbering as many as eleven.

These UFOs (like most UFOs photographed) appeared only as bright points of light, showing no detail or structure. But they were different from the run-of-the mill UFO sightings

because the objects could not be seen visually but did appear only in the infrared images. Infrared systems such as the Star SAFIRE II detect electro-magnetic radiation in the 3 to 5 micron bandpass, with a resolution of 640 by 480 pixels. Images are formed by the differences in the scene's apparent infrared radiant intensity caused by temperature differences and emissivity differences, and to a lesser extent reflected energy. Thus, objects hotter than their background appear to be self-luminous. The images can be recorded digitally or on conventional video recording equipment (with lower resolution) as was the case here. Infrared systems are useful for daytime operations, especially in humid climates where visibility tends to be poor, because infrared radiation penetrates the atmosphere better than visible light. These objects were recorded as brilliant objects in the infrared, suggesting that they were emitting enormous amounts of heat. However, due to the nature of the video recording and lack of knowledge of the sensitivity parameters, actual temperatures are impossible to ascertain from the available data.

To get a better understanding of the operation of the infrared recording system, and the situation in which it was being employed, I contacted John Lester Miller, author of more than forty scientific papers and four textbooks on infrared and electro-optical technology. He is also an active member of Oregonians for Rationality.¹ He explained:

The UFOlogists' concerns about not being able to acquire the objects visually is meaningless. These systems are specifically designed to detect objects that cannot be seen by the human eye. Frankly, it would be a waste of taxpayers' money to equip a plane with a system that could not detect objects invisible to the eye. If the eye could see everything that the IR sensor can, then it would be far cheaper and more effective to put a few privates in the aircraft with binoculars. But this isn't the case. By exploiting infrared electromagnetic radiation caused by thermal and emissivity differences in a scene, a different landscape is revealed. For example, infrared imagers can easily detect humans and animals at a distance of several miles at night where the eye or CCD sees nothing but darkness. Moreover, being longer in wavelength, typically infrared radiation transmits better through the atmosphere than visible and is exactly why it is now being deployed on commercial aircraft for enhanced vision for pilots.

These images were viewed though one of the worst atmospheric conditions possible. Hot, humid, and partly cloudy at a land and sea interface, during the thermal instability of sunset or sunrise. This represents one of the most difficult atmospheric conditions for accurate imaging. These conditions seriously impair the quality of the images in the visible and even

reduce the quality in the infrared. In these stressing atmospheric conditions, it is no surprise that there was nothing visible to the eye and the images are blurred and altered in the infrared. The smaller images below the main images could be reflections from water or ground (common in the infrared) or even mirages. All of these phenomena are typically observed in such conditions. The bending of the light in the atmosphere going through multiple dynamic layers of varying indexes of refractions also call into question the angular indications.

Any representation of a three-dimensional scene on a two-dimensional surface (be it a painting, photograph, television, or infrared scene on a display) lacks absolute range information. It is impossible to infer the range from the image of an object based on brightness or size, unless the brightness and size are well known, the atmospheric conditions are well known, and the sensor settings are known. There are simply too many unknowns to solve the equations. Painters and photographers have long exploited the human predisposition to read range into a two-dimensional scene for both optical illusions and stunning artistic effects. Infrared sensors frequently employ a laser rangefinder option for this very reason, which was not present on the sensor that acquired these images. The only way to accurately determine range is by radar.

At some points two unidentified objects were reported to have turned up on radar. However the position and number of the radar objects did not even come close to matching that of the infrared ones, so whatever the radar targets were, they were not the same as those recorded on video. This is generally the case when visual sightings of UFOs (or in this instance, infrared sightings) are "confirmed" by radar. Unfortunately, no radar data from the aircraft was recorded, so we must rely on the crews' recollection of what it showed. The military radar operator in the city of

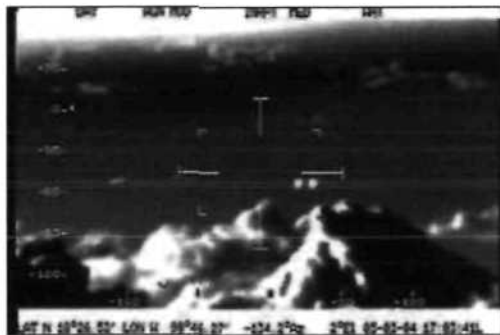


Figure 1. Infrared view showing two reported "UFOs": Oil well platforms with intensely hot flares, seen with medium zoom setting.

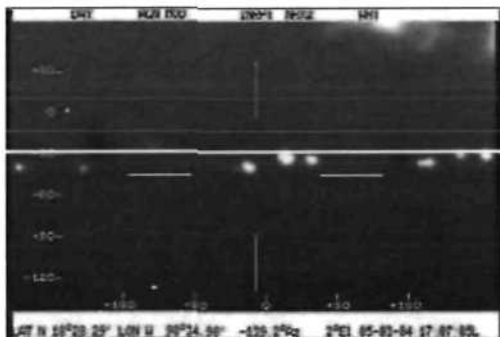


Figure 2. The same reported "IR UFOs" at maximum zoom: individual flares from each oil well are now visible.



Figure 3. The flight path of the Merlin C-26/A aircraft. The look-back angle of -134 degrees points toward the offshore oil platforms in the Bay of Campeche. The supposed "radar UFOs" were in the opposite direction, ahead of the aircraft. Some of them were probably trucks on the Yucatan Highway.

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Carmen was contacted, and it was not showing any unknown objects.² UFO researcher Brad Sparks, plotting the direction and distance of the aircraft's radar returns on a map, found that some of them appear to match the position of the Yucatan Highway 186. He suggests that the measured velocity of the radar objects (fifty-two knots, or sixty miles per hour) is quite consistent with the velocity of trucks, and so concludes that some, although not all, of the moving objects spotted on radar are due to trucks on the highway.³ There are many kinds of objects, both flying and on the ground, that can turn up as targets on aircraft radars and infrared sensors.

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The tapes were released to Jaime Maussan, a well-known Mexican broadcaster and UFOlogist who has made a career out of the sensationalist promotion of supposedly "unexplained mysteries." Maussan's pronouncements range from the sensational to the absurd. For example, in 2000 he told a UFO conference about "glowing extraterrestrials" being widely seen in Mexico, and claimed to have sighted one of them himself. He also showed a photo of a supposed alien "life form" reportedly encountered by Apollo 11 astronauts on the Moon, labeled "El Hombre de la Luna."⁴ If one wanted an objective evaluation of the objects in the video, Maussan would be last person to turn to. Indeed, a May 17, 2004, editorial in the influential Mexican newspaper *La Cronica de Hoy* by Raul Trejo Delarbre suggested exactly that.

On May 11, Maussan held a press conference promoting the videos as a sensational mystery. Maussan's story ran widely in the news media worldwide, including the Associated Press, CNN, Reuters, MSNBC, *USA Today*, and Fox News. He soon had the videos on his TV show, as well as on a Web site.⁵ The Web site is filled with a mixture of information and misinformation concerning the objects. It claims that the "halos" seen surrounding the objects is evidence of a powerful magnetic field. It goes on to wax knowingly about the objects' "frequency" and "vortex," as well as their supposed violation of "entropy," all of which is complete pseudoscientific balderdash.

Unfortunately, many would-be skeptics made hasty pronouncements about the objects, thereby giving all UFO skeptics a bad name. The Urania Astronomical Society of the state of Morelos told the newspaper *El Universal* on May 13 that the UFOs filmed might be a group of weather balloons. Dr. Julio Herrera of Mexico's National Autonomous University told the Associated Press that the UFOs were electrical flashes in the atmosphere, a theory that makes very little sense. A few days later, he was attributing them to "ball lightning." Rafael

Navarro of that same university told a press conference on May 14 that the UFOs were luminous sparks of plasma energy. Mexican astronomer Jose de la Herrin stated that the stationary objects could be meteor fragments. UFOlogists were soon gleefully mocking these absurd explanations, making it look as if skeptics were ignorant fools who couldn't recognize alien spacecraft when they saw one. There is nothing wrong with saying, "I don't yet have enough information to know what the objects are, but I am confident that when more facts come in, we'll find a prosaic explanation."

By May 20 some skeptical analysts had identified the probable source of the objects: burning oil well flares from offshore oil platforms in the Bay of Campeche. This region is the center of Mexico's petroleum industry, containing more than 200 wells on nine platforms, many of them close to the city of Carmen. (One of the voices on the video can be heard saying that the objects are "at Carmen.") At that point it was thought that there had been some temporary burn-off of excess natural gas within the well—but it turns out that the oil well flares burn more or less continuously in this region. The area also has large steam generating plants that pump incredible amounts of hot steam deep into the ground to increase the pressure and ease the flow of oil.

One anonymous "concerned outdoorsman" who works on offshore oil platforms wrote on the environmentalist Web site www.myoutdoorjournal.com:

Each day while I work, I see flares burning at such a rate that it is almost unbelievable to the human eye. I'm told that all gas sources are being burnt off through the flares just to keep the crude oil flowing from each well. Each production platform consists of at least twelve penetrations drilled into the sea floor reaching to different depths. Each platform has a flare some have two, in which are roaring twenty-four hours a day, three hundred and sixty-five days a year. . . . At night when looking across the bay of Campeche, it looks like a spotted forest fire out of control in the distant far yonder, in any direction you choose to look. The black smoke rolls and it never stops!

On May 26, Capt. Alejandro Franz of the private Mexican UFO research organization Alcione, who is far more skeptical than Maussan and his colleagues, independently came to the same conclusion. A former pilot who has flown extensively in that region, Franz wrote on the widely-read UFO Updates online forum: "Cantarell Field or Cantarell Complex is the largest oil field in Mexico, located 80 kilometers offshore in the Bay of Campeche. . . . The objects (lights) are in a fixed position with a dark background (the sea) while the camera on board is following the lights that are showing in the screen as a very brilliant source of light . . . the lights are coming from steady oil platform flames (passive fire) located in the Gulf of Mexico between 50 and 90 Km from Ciudad del Carmen City where the objects, at least one light as the FLIR or RADAR operator tells is exactly over Ciudad del Carmen"⁶

On the Alcione Web site, Franz provides a great deal of

information and many photos concerning the Cantarel offshore oil wells and their continuous flares. No reasonable person could see his photos comparing the flaming offshore platforms with the infrared UFOs from the video and reject the probability that the two are the same.

Franz is mistaken in suggesting that the aircraft was headed north at the time that the videos were taken. The aircraft was headed eastward, at an azimuth of approximately 80 degrees. This is confirmed by an event occurring near the end of the half-hour video, twenty-six minutes in. The crew members are briefly surprised by the image on the Star SAFIRE II of a large, round object. They zoom in, and realize that it's the moon coming up. "The moon, it's the moon," they laugh. The moon rose at approximately 17:20 from their location, at a geo-azimuth of 75 degrees. Because the azimuth of the Star SAFIRE II relative to its aircraft mount is reading approximately -5 degrees (just left of straight ahead), that confirms that the aircraft was on a heading of about 80 degrees. It may or may not be significant that the Sun was at this time at an azimuth of 260 degrees, directly behind the aircraft.

The Star SAFIRE II records the altitude and azimuth of the object it is imaging at all times relative to its aircraft mount. The altitude of the UFOs is within a degree or two of the horizon with respect to the aircraft. The crew said that the objects were at the same elevation, i.e., on the horizon. The pitch of an aircraft in "level flight" depends on a number of factors, including its airspeed, trim, bank angle, the configuration of its flaps, gear, spoilers, etc. If the aircraft had a one to three degree pitch upward from its centerline (typical of normal flight), this needs to be figured into the altitude reading from the infrared sensor. It would mean that a "zero elevation" reading indicates that the sensor is pointed below the horizon, when looking backward.

During the main part of the UFO encounter, the object's azimuth is reading around -134 degrees, approximately the 7:00 position behind the aircraft. When plotted on a map showing the aircraft's position and heading, this points in the direction of the largest oil well platform complex in the Gulf of Campeche. From the video, the objects can be seen to be over water, but one cannot judge the altitude of the objects above the water, or their relative motion with respect to the water. When two brilliant UFOs are seen behind fluffy clouds (figure 1), the infrared camera is set to the medium zoom field of view, giving a field of 3.4 by 2.6 degrees. We are seeing the two main oil well platforms. Soon afterwards, the operator selects the narrowest field of view using the E-zoom feature. The field of view is only .04 by .03 degrees, which makes the objects appear about nine times larger. We see the result in figure 2, when individual flares are resolved on each oil platform, revealing nine or more "UFOs." If you compare this frame to the photo found on the Alcione Web site showing a daytime view of flares on the oil platforms, you will see that they match up quite well.

The objects appear to be moving *with respect to the clouds that pass in front of them*, giving the objects the illusion of motion. However, the motion of the aircraft with respect to the clouds, as well as the motion of the clouds themselves, causes the highly magnified lights to appear to shift position with respect to the clouds. Since the azimuth of the objects does not change significantly during the time they are being filmed, it is evident that the apparent motion of the objects with respect to the clouds is caused primarily by the motion of the aircraft with respect to clouds, and not by motion of the objects themselves. This situation is analogous to zooming in using a telephoto lens

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on a video camera, and pointing to a far away mountain. Then, while keeping the camera pointed to the mountain, walk along a treed path. The trees will have apparent angular motion (or optical flow) due to the camera's movement, while the mountain stays approximately still. When overworked, stressed, disoriented, and confined to looking at a three-dimensional scene on a two-dimensional display, it is easy for the crew to become confused regarding what is moving. All of the UFOs recorded by the Star SAFIRE II are on the left side of the aircraft, toward the Gulf of Mexico, with the great majority of them around -134 degrees.

Discussing the image quality that we see in the UFO video, Miller explained:

Unlike CCDs [charge-coupled devices, commonly-used photo detector systems], all infrared focal planes suffer from sensitivity drifts from pixel to pixel, and periodically require all scene pixels to be normalized. This is generally done by the user commanding it, then a "paddle," coated with a uniform black coating, is inserted into the field of view. Without this being done, images will possess "Fixed Pattern Noise" and these images all do. The vertical lines and dark splotches are classic infrared fixed pattern noise and limit operator effectiveness. They are not indicative of typical images from this system. Moreover, though these are infrared images, they suffer from the same poor quality that most "UFO" photographs suffer from—blurry, out of focus with incorrect exposures.

In the 1990s a wonderful new technique to grind and shape infrared optics went into production. This is diffractive optics via diamond turning. A fixed fresnel-lens-like circular pattern is cut onto the lens surface (typically the back of the lens). This results in color-corrected optical systems with far fewer lens elements, thus saving significant cost and weight and size. The drawback is that this "ring" pattern scatters a small amount of light. The amount of this scatter is minimal and can be seen only with a bright overexposed image. This scatter from the diffractive optic pattern accounts for the halo effects of these overexposed images.

Unfortunately, the infrared sensor's recoded output is in a standard commercial video format (e.g., NTSC or PAL). These were the accepted video standards when the equipment was designed. The infrared focal planes have dynamic ranges of thirteen or fourteen bits, but the image-forming electronics compresses this wide range in a nonlinear fashion to make cosmetically appealing images on a six or eight bit capable display, a low-dynamic range for video recording. In other words, a lot of information gets lost. Unfortunately, just like your camcorder, the compression is adaptive based on scene statistics and details, and the settings are not recorded. This, along with other factors such as atmospheric, eliminates such airborne infrared system from recording any precise data, unlike common handheld thermographic and scientific cameras. From a videotape, one cannot glean any radiometric data, as it is all processed in an unknown manner with nonlinear and adaptive algorithms to make a clearly displayed image on conventional television. Also every copy degrades the tape, and every format (DVC, SVHS, VHS, etc.) imposes its own proprietary scaling and changes on the data, making reliable scientific measurement impossible.

The UFO believers who participate in the online UFO Updates forum, which includes many "leaders" of the UFO movement, laughed off the valid explanation of oil well fires as flippantly as they did the absurd ones. UFO author Ray Stanford scoffed at "oil rig flares tracked on radar at near the aircraft's altitude," of which neither statement was true: the radar targets were in a different direction entirely, and distant objects near the horizon may well be on the ground. Roswell champion David Rudiak scoffed at "invisible, flying oil wells," while Alfred Lehmborg suggested that skeptics might as well propose "soar-

ing lighthouses and gassy pelicans." Others raised the specter of elves, angels, flaming seagulls, etc. Jaime Maussan argued that the flaming oil wells would not have been visible, because they were 125 to 200 km or more distant. He neglected to calculate that from an altitude of 3,500 meters, the horizon is nominally 211 km distant, and that atmospheric refraction typically extends this distance somewhat, depending on meteorological conditions, as also does the height above the water of the flames themselves.⁷

By their reaction, the "leaders" of UFOlogy have shown themselves incapable of distinguishing logical from illogical thought, and science from pseudoscience. The lesson of the Mexican Infrared UFO video illustrates once again the inability of the UFO movement to perform critical thinking.

Notes

1. Miller is the author of the textbook *Principles of Infrared Technology: A Practical Guide to the State of the Art* (Kluwer Academic Publishers, 1994) and *Photonics Rules of Thumb* (McGraw-Hill, 2004), as well as two ancillary versions of *Photonics Rules of Thumb* (McGraw-Hill 1994 and 2003).
2. Information provided by Jaime Maussan. See www.virtuallystrange.net/ufo/updates/2004/may/m26-003.shtml.
3. See www.virtuallystrange.net/ufo/updates/2004/jun/m01-002.shtml.
4. At the Bay Area UFO Expo, San Jose, California, September, 2000. See "Reptoids and Martians Invade Silicon Valley" by Robert Sheaffer, SKEPTICAL INQUIRER, January 2001.
5. See Maussan's Web site about the videos at www.ovnistv.tv/noti_mayo/n_11_mayo_reporte.htm.
6. See Franz's original posting at www.virtuallystrange.net/ufo/updates/2004/may/m27011.shtml. Alcione's Web site is at www.alcione.org.
7. See www.istp.gsfc.nasa.gov/stargaze/Shorizon.htm for an explanation of how to calculate the distance to the horizon as a function of elevation. □

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survival of the fittest (and the much more important fact that s/he is going to have the most offspring) by means of natural selection, they have independent ways to assess which members of a population of organisms actually are the "fittest." For example, biologists employ optimization analyses to predict which combinations of morphological, behavioral, or physiological traits are more likely to be advantageous (i.e., to increase "fitness") in the range of environments actually encountered by a given living form. They then sample natural populations of organisms, determine in which environments they actually live, measure those traits they hypothesize are more likely to make a difference, and obtain statistical predic-

tions on where natural selection should push the population next. Finally, biologists wait until the next generation of organisms comes out and measure their characteristics again.

If the theory were correct (and given some other verifiable conditions, such as the presence of adequate genetic variation for the traits in question), the population's mean for the characters under selection should have shifted in the predicted direction. This is an eminently falsifiable hypothesis, in the same sense in which predictions made by astronomers or physicists are falsifiable, and very much unlike the explanations of human behavior put forth by psychoanalysts, which are notoriously so flexible that they can fit (*a posteriori*) virtually any observed pattern.

The tautological circle thus broken, evolutionary biology can be fully admitted among the sciences even by the

Popperian criterion of falsification. Much more than a useful metaphysical research program, the modern theory of evolution is as scientific as Newtonian mechanics, though by all means not as precise as, say, quantum mechanics. The distressing part of this story is how many creationists, and occasionally even professional philosophers, keep bringing up Popper's alleged refutation of evolution as if it were the last word on the subject. They often imply that evolutionary biologists are either dupes or, worse, consciously misleading the public into thinking that they are doing good science at the expense of that same public's generosity. For this, however, we cannot blame Popper, who demonstrated in his retraction a much higher intellectual standard than the people who attempt to exploit one of his mistakes in order to serve their parochial ideological agendas. □