Lasers and the 'Phoenix Lights'

By David Rapp

It has been over a year since the March 13, 1997 sightings by Arizona residents of a mysterious V-shaped formation of lights that traveled across their state. The origin of these luminous objects, nicknamed the "Phoenix Lights," has undergone endless debate, largely to no conclusion. As a field investigator of UFOs and a person interested in the technical aspects of such events, I naturally followed some of the forthcoming explanations. The subject of this writing is not intended to necessarily lend support to what these lights were, but rather what they were not. I would now like to share with you the results of a personal investigation I conducted regarding one of the so-called causes of the "Phoenix Lights."

Like many UFO researchers, I frequently listen to Art Bell, who hosts the syndicated radio talk show programs "Coast to Coast" and "Dreamland." On Sept. 18, 1997, Art's guest was Ed Dames, who addressed the topic of the "Phoenix Lights." Dames comes from a military background where he served the Army as an intelligence officer, analyzing Soviet weapons projects. Later, at his request, Dames was assigned to the remote viewing unit at Fort Meade as a remote viewing monitor and analyst, training under Ingo Swann. He retired a major and went on to form his own remote viewing company, Psi-Tech.

A hoax using lasers?

During the interview, Dames stated that he and others at Psi-Tech had determined through remote viewing that these lights were the result of a hoax, created artificially through the use of lasers. I was outraged at his incorrect and misleading explanations, especially since Dames claims that his company provides near 100% accuracy in its work. Anyone making such claims, if proven wrong once, could be wrong again–a significant point considering he has provided many of these "100% correct answers" regarding past, present, and future UFO events.

I set out to make my voice heard by sending emails and faxes to both Ed Dames and Art Bell. There was no response from either person. While the circulation of this article may not have an audience the size of "Coast to Coast" listeners, at least some of Ed Dames' followers will be enlightened.

Lets begin by reviewing some of the key observations of the light formations that were seen to fly over Arizona that night in March 1997. It is generally recognized there were two distinct sets of events. The first sightings occurred between 8:15 p.m. and 8:45 p.m.; the second after 10:00 p.m. A V-shaped formation was sighted over Paulden at about 8:15 p.m. It was then sighted over Phoenix at about 8:30 p.m.. The formation continued to move SE to Tucson where it turned and headed NW. It was last sighted over Kingman at 8:45 p.m.. Hundreds of people observed these lights; however, only a single person video taped this event. The formation was seen as 5 to 6 amber lights that appeared to change orientation, although some Phoenix residents observed a direct fly-over, claiming to see structure between the lights.

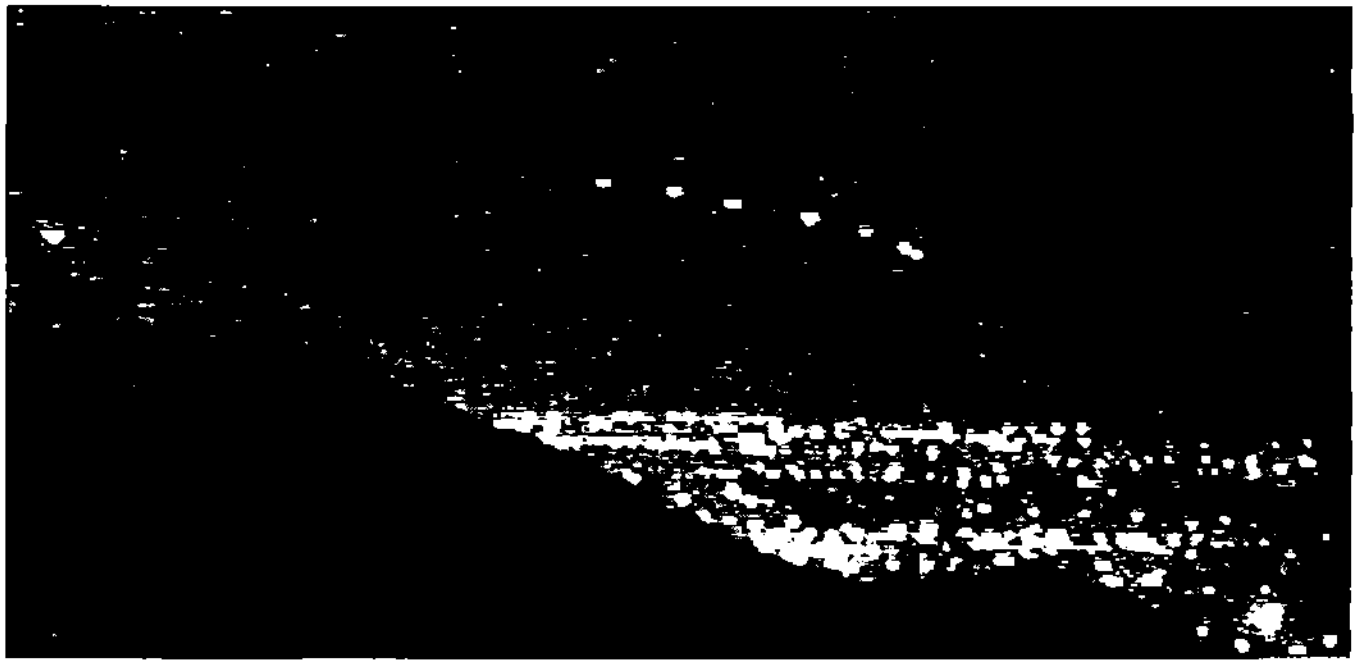
Some estimated it at 10,000-15,000 feet traveling at 300-400 knots, gliding silently. Others reported it as very low; so low they thought it was going to crash. The second set of sightings occurred at 10 p.m. in a direction SW of Phoenix. As many as 9 amber lights, estimated at over a mile in length, were seen as a slowly descending arc. These lights appeared in a sequence, and were seen to disappear in much the same manner. There were several individuals who video taped this event. No one reported a fly-over.

Technical but necessary

This background information will be helpful in understanding some of the comments that follow. I have transcribed portions of the Ed Dames' interview, which are pertinent. Following his statements are my responses, much of which are very technical, but necessary for a complete and correct understanding of what lasers can and cannot do. Ed Dames begins by telling Art that this event was created using lasers, and describes the specifics of how it was accomplished. In general, he discusses how two or more ultraviolet lasers from different locations could have their beams

About the author

Rapp's interest in lasers began at an early age, less than a decade after their invention in 1960. As a teenager, he constructed a gas laser for a science fair project. He later received a B.S. in Physics and has pursued an engineering career for the past 21 years. Much of this time was spent in the aerospace industry. Seven years were devoted exclusively to working R&D contracts with the military, analyzing and testing the effects of lasers on sensors. Specifically, he worked in an area known as "laser hardening." It was his job to analyze the path of a laser from its source to the target, calculating atmospheric losses and determining the irradiance on a sensor. The sensor could be located in a space platform, missile, or night vision device. Having knowledge of the optical system and internal components of the sensor, he would determine its vulnerability to the laser exposure. Using available laser hardening (protection) technologies, these sensors were modified and re-tested. Rapp gathered data in the laboratory or field, performed theoretical analyses, and prepared presentations and final reports on the results.



Raw video by Mike Krzyston from the top of Mt. Ridge.

intersect to create visible interference patterns in the sky. Dames' explanation requires the use of ultraviolet lasers; otherwise, the beams projecting from the ground would be visible and expose an obvious hoax.

Ed Dames:

"At the point where the two lasers intersect there would be interference, constructive and destructive interference. There would be standing wave patterns. This is all Physics 101."

My Response:

Well, not in the physics class where I was taught. Lasers have two distinct properties not exhibited by white light sources. They are monochromatic and coherent. Monochromatic means that it is light of a single wavelength or color. Coherence means that all the light emanating from the source is in phase (i.e. crest to crest and valley to valley). Another laser off the assembly line would have these same properties except there is nothing that ensures both lasers are in phase with respect to each other. This is the basis of interference; light from the same source is split and made to interfere with itself where the two beams have traveled over different optical paths. This path length difference accounts for a slight variation in phase, causing a stable standing wave interference pattern. This phenomenon cannot happen unless both intersecting beams are initially in phase.

There is a property exhibited by monochromatic light sources called temporal coherence. This is the interval over which the lightwave resembles a sinusoid, The average time interval during which the lightwave oscillates in a predictable way is the coherence time. Observed from a fixed point in space, the passing lightwave appears fairly sinusoidal for some number of oscillations between abrupt changes in phase. The coherence time of interfering beams from two different lasers can be appreciable (milliseconds) and can be detected electronically, but not by the human eye. Thus it is unlikely that two or more lasers can be made to produce any type of standing wave interference pattern as described. All intersecting laser beams must be split from one source to produce multiple interference patterns. This is impractical to implement, as I will describe later.

Ed Dames:

"This interference would produce reflections and a glow from the dust that is scattered in the atmosphere. And that glow would appear to move straight ahead very fast. All they were, were glowing fuzzy interference patterns.... There are a couple of technologies called Laser Doppler Anemometry or Laser Doppler (inaudible). And what these technologies do is to use lasers, a split beam laser, of the same color, to focus on a point in a gas or a liquid. And that point glows. And the feedback from that glowing point can be utilized as a tool to measure the speed and the size of the particles that are flowing across that point.... Now apply that same type of technology to the atmosphere, the same way that the LIDAR Light Direction and Ranging are used in weather. Most of your listeners might be familiar. Sometimes you can see a big

green or red light over the city. And that's a weather station taking remote sensing ... reading of the moisture content and other things in the atmosphere for your particular city. Now if that big laser beam that shines across the city were ultraviolet instead of visible, you would not see it. But if another laser beam, an ultraviolet beam, intersected it, at that point of intersection there would be an elongated or roundish fuzzy glow. A glow in the visible light range."

My Response:

Ed Dames appears to be confusing two distinct phenomenons: interference and backscatter (which he refers to as glow). Interference, as a result of two beams initially in phase and re-converging, produces a series of alternating light and dark lines or rings depending on the aperture shape. This pattern displays intensity variations at the same wavelength. As the two beams come together over different optical paths, their phases shift slightly with respect to each other. Thus, there is constructive and destructive interference as he indicated; however, there is no substantial change or shift in the frequency (color). If an ultraviolet (UV) laser were split into two beams and re-converged to create an interference pattern, that pattern would exist at the same UV wavelength as the source and would remain invisible to the human eye.

Dames also mentions reflections and a glow from dust scattered in the atmosphere. This is exactly what happens when a visible laser shines into the atmosphere containing aerosols (e.g. water droplets, ice, dust, organic material). Backscatter of that same visible light bouncing off these aerosols produces a diffuse glow. Depending on the wavelength and the size of the scattering agent (aerosol or molecule) two kinds of backscatter may be produced (Rayleigh or Mie). There is no loss of energy, only directional redistribution of the same wavelength scattered back to the source.

LIDARs are suggested as an example to prove his point. The reason you see a green or red glow over the city is because that is the original color of the laser source. You are simply observing visible backscattered light. LIDARs may operate using any number of wavelengths: infrared, visible, or ultraviolet depending on the molecular absorption band of interest. There are three general types of LIDARs: range finders, DIAL, and Doppler LIDARs.

The first type is used to measure the distance to a solid target. The second, Differential Absorption LIDAR, is used to measure chemical concentrations in the atmosphere. A DIAL LIDAR uses two different wavelengths, each selected so that one wavelength is absorbed by the molecule of interest while the other is not. The difference in intensity of the two return signals can be used to deduce the concentration of the molecule being investigated. The Doppler LIDAR is used to measure the velocity of a target (solid or atmospheric). When the light hits a target moving towards or away from the LIDAR, the wavelength of the light is shifted to a slightly longer or shorter wavelength. This is known as a Doppler shift, hence the name. I am not aware of any interference that occurs using LIDARs, although multiple laser beams are involved in their operation.

Back in the 1980's as part of the Strategic Defense Initiative (SDI), the U.S. developed artificial guide stars as a method of improving the optical resolution of earthbased telescopes. This method, since declassified, used a special dual beam high-powered laser to produce a visible wavelength output of 589 nanometers. This wavelength was chosen since it is the atomic resonance line of sodium. The laser, when trained on the mesosphere 90 km high, created a glow due to resonance fluorescence.

I see few options available for producing visible spots in the sky using UV lasers. Perhaps a very powerful laser focused to a small spot in the atmosphere could be used to produce a visible glow caused by fluorescence or air breakdown. I cannot quote a specific laser power without performing careful calculations. However, this method would be very difficult to perform and would require expensive, sophisticated equipment.

Even if this were the mechanism used, it would be unlikely that a group of persons would be able to slave a series of lasers focused at the same altitude, to produce moving visible spots and project them over long distances. Besides, if lasers were the cause of the lights over Phoenix, what produced the lights seen over Paulden, Tucson, and Kingman?

Ed Dames:

"It can all be done from one place within 50 to 100 feet along a straight line, lined up within 50 to 100 feet. It could actually be done with three lasers but it was probably done with five. Our results show five lasers. You could use one in the center and split the beam and you could nicely, you could project out to several miles a really nice delta-wing consisting of five dots UFO. But if you try to make that UFO move across the horizon then you'd run into some problems technically. But five lasers would do the trick.

This is just like a fireworks company. This is the same kind of business as fireworks. In fact laser light shows are sometimes combined with fireworks displays. What we have is an on-demand phenomenon that's produced by the laser light show commonly called lumia. Now lumia is not really popular because all it is is just a glowing fuzzy display that moves across the

spectator's field of view. It's not really pretty particularly if its just sitting there or standing there in the air as a standing wave form....It's not really difficult to do....We wire-diagramed this at work with some really good experts and way less than 2 watts of power per laser will do it for you as some of your engineers out there know."

My Response:

Responding to the second half of his statement first–I was not familiar with lumia, so I contacted a company which is in the business of producing indoor and outdoor laser light shows. They described lumia as "a swirling cloud-like effect usually projected on a surface." Also, they said the effect is created by the result of interference of light waves produced by "shining a laser through various irregularly-shaped objects." Their use of the word "surface" implies an indoor display; however, it does not preclude the use of smoke (after a fireworks display) as a screen for projecting lumia. I suspect that because of the distance involved and the irregularity of the smoke, it is less effective.

Again, this phenomenon is produced using visible lasers. The glow produced is nothing more than backscatter of that same wavelength off of the aerosol particles. The addition of the interference "effect" just adds a little pizzazz to an otherwise not-so-interesting display. Interference has nothing to do with the cause of the glow itself. The company did not answer my question regarding the use of UV lasers to produce visible lumia.

Complex setup required

For the sake of argument, assume that crossing UV laser beams produces a visible glow in the atmosphere. I cannot imagine the complexity that would be required to produce a reasonably symmetrical V-shaped pattern whereby the shape is maintained over the distances observed by Phoenix residents. Obviously, several lasers would have to be involved, operating from separate locations, to be able to produce the 5 to 9 observed glowing spots.

This means that multiple motorized platforms carrying lasers were somehow synchronized perfectly for the duration of the event. You don't just throw a switch and produce the effect on the first try without lots of experiments and adjustments. Near perfect synchronicity in angular displacement of the beams would be required to produce a moving V-shaped pattern. Another problem is that if multiple beams are crossed to produce multiple visible spots, then these beams would most likely intersect at other altitudes causing more spots outside the horizontal plane of the formation. Except for the 10 p.m. sighting which appeared arc-shaped, Arizona residents observed a reasonably "planar" movement of lights.

Last fall, the Discovery Channel aired an hour-long investigative report on the "Phoenix Lights" incident. It showed fairly convincing evidence that the 10 p.m. event occurred SW of Phoenix, beyond the Estrella Mountain range. An independent analysis conducted by Cognitech, Inc., an image processing firm, analyzed the video of the second event taken by Mike Krzyston. They superimposed his nighttime video with a daylight video from the same location and determined that each light disappeared exactly when it came in contact with the edge of the mountain range. This seemed to confirm why the lights were mysteriously extinguishing in sequence. It also coincided in time and direction with Operation Snowbird, a night maneuver conducted by the Maryland Air National Guard. That night they claimed to have dropped a series of illumination flares at the North TAC Range, located 30 miles SW of Phoenix.

"Phoenix lights" not explained

Their analysis certainly does not explain the "Phoenix Lights" as illumination flares, as many would have you believe. In fact, it does not necessarily even preclude that the lights seen during the 10 p.m. event were separate objects. There are still too many unknowns. Speculation suggests that the second event was indeed a military operation used to confuse the public regarding a real (unknown) sighting of a formation of lights earlier in the evening.

Real or not, the second event appears to have occurred beyond the Estrella Mountains. Also during this event, no one reported any lights directly overhead, contrary to the 8:30 p.m. sightings. This would have to place the lasers and operating crew described by Ed Dames at this location and time. If lasers were used to produce the "Phoenix Lights" and were set up beyond the mountain range at 10 p.m., it would have been impossible to project them at the altitudes seen by residents in the 8:30 p.m. sighting. They had two setups you say? Well, they would need much more equipment than that to have produced the lights seen earlier between Paulden, Tucson, and Kingman.

Extremely difficult

The issues I have stated above describe the difficulties in creating the "Phoenix Lights" using lasers. Ed Dames presented an eloquent explanation, making it appear as a simple prank perpetuated by a laser light show company. He claims it is easy to do. I say it is extremely difficult, if not impossible, under these circumstances.

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