

## NASA Survey on Ball Lightning Characteristics

The following survey of ball lightning observers is taken from NASA Technical Note NASA TN-D-3188, authored by Warren D Rayle from the Lewis Research Center and published in January 1966. The full report was kindly provided to NIDS by Stanton Friedman. It can be ordered from the NASA Center for Aerospace Information, (301) 621-0390, fax (301) 621-0134.

The following is a summary from the report:

*Surveys of NASA Lewis Research Center personnel were conducted to obtain information about ball lightning occurrences. A comparison of the frequency of observation of ball lightning with that of ordinary lightning impact points reveals that is not a particularly rare phenomenon. Contrary to widely accepted ideas, the occurrence of ball lightning may be nearly as frequent as that of ordinary cloud-to-ground strokes.*

*Detailed descriptions of 112 ball lightning events were obtained. Corresponding techniques applied to the set of descriptions failed to pick out any strong connection between factors such as brightness, size, duration, or color. This result, along with the reported constancy of appearance of the balls, makes it appear unlikely that they represent the slow dissipation of stored energy.*

*Ball lightning diameter estimates follow a normal log distribution. Such a distribution also represents the quantity of charge in lightning strokes and has been associated with the field intensity of sferics (electromagnetic disturbances) from thunderstorms. The similarity of these distributions, while certainly not conclusive, suggests that such quantities may be related.*

*Two different categories of events are tentatively identified among those reported. In one the ball appears after a lightning stroke to ground and remains and ends near the ground. In the other the ball is first seen in midair and remains aloft, vanishing without noticeable disturbance.*

The report is of interest because of the substantial number of reports on balls of light (red, orange, blue and white) that NIDS has noted in some of its databases. It is also of interest because of the methodologies for processing and analysis of results. The 112 detailed descriptions are analyzed in the body of the report. These 112 represent the data compiled from positive responses to a second questionnaire, following an initial questionnaire that was sent to 4400 NASA employees in April 1963. NIDS is interested in soliciting any more recent similar studies on ball lightning characteristics from the public.

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1. How many times have you seen ball lightning?

- 77 1
- 17 2
- 11 3
- 1 4
- 0 5-6
- 3 more
- 3 Not Answered

**WHEN was this event observed?**

2. During the years

1945-1954

3. In the month of

- 0 January
- 0 February
- 0 March
- 3 April
- 7 May
- 28 June
- 35 July
- 18 August
- 4 September
- 2 October
- 1 November
- 0 December
- 12 Not Answered

4. The time of day was

4:00 am-6:30 pm

5. Your age at the time of observation?

- 12 ≈0-10 years
- 23 ≈11-14 years
- 23 ≈15-17 years
- 17 ≈18-24 years
- 5 ≈25-28 years
- 15 ≈29-36 years
- 8 ≈37-46 years
- 5 ≈47-59 years
- 0 ≈60+ years

**WHERE did this occur:**

6. State or foreign country (No Data Available)
7. City or if rural, # of miles from city (No Data Available)
8. The terrain in this area is best described as
  - 67 flat
  - 22 rolling
  - 16 hilly
  - 5 mountainous
  - 2 Not Answered
9. In the area nearest the ball lightning, the earth surface could best be described as
  - 8 water-covered
  - 6 barren
  - 23 meadow or brush
  - 16 wooded
  - 56 building covered
  - 3 Not Answered
10. Was your location
  - 54 within a building
  - 14 a vehicle
  - 43 out-of-doors
  - 1 Not Answered
11. With respect to ground level, were you
  - 2 below ground
  - 93 near ground level
  - 11 second floor
  - 6 higher
12. How many others that you know of saw this ball lightning?
  - 36 none
  - 32 1
  - 31 2-4
  - 8 more
  - 5 Not Answered
13. Did you observe it (check as many as apply)
  - 13 through eyeglasses
  - 29 through window glass
  - 11 through a screen
  - 71 directly

**CONDITIONS PRIOR TO OCCURRENCE**

14. The ball appeared during which part of a storm?

- 28 early
- 16 late
- 47 middle
- 6 no storm connected
- 15 Not Answered

15. If no storm at the time, how much of the sky was cloud-covered?

(replies not tabulated, too few cases)

16. Was the storm, if any, more violent than the average?

- 42 more violent
- 48 average
- 2 less violent
- 5 no storm
- 15 Not Answered

17. The rainfall just before the observation was

- 11 none
- 16 slight
- 24 medium
- 38 heavy
- 23 Not Answered

18. At the time, the wind velocity was about

- 10 0-10 mph
- 19 10-20 mph
- 13 20-30 mph
- 13 30-40 mph
- 7 40-50 mph
- 1 50-60 mph
- 1 60+ mph
- 48 Not Answered

19. The direction from which the wind was blowing was

- 2 NE
- 1 E
- 0 ES
- 2 S
- 11 SW
- 19 W
- 3 WN
- 1 N
- 73 Not Answered

20. Preceding your observation, was there any unusual amount of dust or smoke in the air?

- 8 dust
- 3 smoke
- 62 none
- 39 Not Answered

### FIRST APPEARANCE OF BALL LIGHTNING

21. Did you see the ball originate

- 48 yes
- 60 no
- 4 Not Answered

22. Did the appearance of the ball seem to follow a lightning stroke?

- 62 to ground
- 7 between clouds
- 26 no stroke
- 17 Not Answered

23. IF the ball followed a stroke to the ground, was the point of impact

- 1 water
- 19 tree
- 8 earth
- 19 structure
- 18 power or telephone wires
- 47 Not Answered

24. When first seen, was the ball

- 6 among clouds
- 55 in midair
- 16 contacting metal
- 12 contacting non-metal
- 14 contacting ground
- 9 Not Answered

25. The direction from you to the ball as first seen was

- 8 NE
- 12 E
- 4 ES
- 14 S
- 3 SW
- 22 W
- 3 WN
- 21 N
- 25 Not Answered

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26. When you first saw it, its distance from you was

- 55 under 50 feet
- 31 50-500 feet
- 15 500 feet-1/2 mile
- 9 over 1/2 mile
- 2 Not Answered

27. As it first appeared, its diameter was about

- 1 ≈0-1 inch
- 8 ≈1-3 inches
- 7 ≈3-5 inches
- 9 ≈5-7 inches
- 12 ≈7-10 inches
- 13 ≈10-15 inches
- 23 ≈15-25 inches
- 15 ≈25-35 inches
- 10 ≈35+ inches
- 14 Not Answered

28. Its shape was

- 98 round
- 9 elliptical
- 3 ring-shaped
- 2 other

29. Check the best description of the ball's brightness

- 12 As bright as an ordinary lightning stroke.
- 23 Bright enough to illuminate nearby objects.
- 66 Bright enough to be clearly visible in daylight.
- 9 Bright enough to be barely visible in daylight.
- 2 Not answered

30. The ball appeared brightest

- 12 Near the outer surface
- 10 Near the center
- 68 Uniformly all over
- 22 Not Answered

31. The color of the ball was (check location on spectrum)

- 7 red
- 46 orange
- 37 yellow
- 10 green
- 16 blue
- 4 indigo
- 5 violet
- 27 white
- 3 Not Answered

## DURING THE BALL'S EXISTENCE

32. How long did the ball last?

- 8 ≈0-1 second
- 14 ≈1-5 seconds
- 24 ≈5-7 seconds
- 9 ≈7-10 seconds
- 11 ≈10-15 seconds
- 12 ≈15-25 seconds
- 10 ≈25-35 seconds
- 7 ≈35+ seconds
- 17 Not Answered

33. While you were watching, did the ball's size become

- 5 larger
- 9 smaller
- 89 remain about the same
- 9 Not Answered

34. Did its brightness

- 2 increase
- 12 decrease
- 91 remain about the same
- 7 Not Answered

35. Did its appearance change noticeably? If yes, describe on last page.

- 7 yes
- 89 no
- 16 Not Answered

36. Did you notice any sound from the ball?

- 25 yes
- 83 no
- 4 Not Answered

37. Did you notice any odor from the ball?

- 23 yes
- 75 no
- 14 Not Answered

38. Did you notice any sensation of heat?

- 4 yes
- 100 no
- 8 Not Answered

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39. The motion of the ball was mostly

- 20 vertical
- 58 horizontal
- 20 mixed
- 10 no motion
- 4 Not Answered

40. Its closest approach to you was

- 1 contact
- 2 0-1 feet
- 32 1-10 feet
- 38 10-100 feet
- 38 over 100 feet
- 1 Not Answered

41. Its closest approach to any solid object was

- 51 contact
- 13 0-1 feet
- 19 1-10 feet
- 8 10-100 feet
- 11 over 100 feet
- 10 Not Answered

42. Its maximum velocity appeared to be

- 30 ≈0-10 mph
- 20 ≈10-20 mph
- 3 ≈20-30 mph
- 3 ≈30-40 mph
- 3 ≈40-60 mph
- 12 ≈60+ mph
- 41 Not Answered

43. Its minimum velocity appeared to be

- 35 ≈0-5 mph
- 8 ≈5-10 mph
- 13 ≈10-15 mph
- 3 ≈15-20 mph
- 2 ≈20-30 mph
- 4 ≈30+ mph
- 47 Not Answered

44. Did the ball's movement seem to be guided by

- 3 cloud layers
- 16 ground surface
- 12 power or telephone wires
- 6 other metal structure
- 34 no guide

17 other  
24 Not Answered

45. Did you have any impression of spinning or rotational movement within the ball?

35 yes  
61 no  
16 Not Answered

46. During its lifetime, did the ball appear to pass through small apertures, screens, or solid objects?

24 yes  
77 no  
11 Not Answered

47. If it made contact with any solid object, did it seem to be

25 Surface contact with a metal object.  
33 Surface contact with a non-metallic object.  
1 Deeply penetrating contact with metal.  
8 Deeply penetrating contact with non-metal  
45 Not Answered

#### **DISAPPEARANCE OF BALL**

48. Was your last sight of the ball

71 as it disappeared or ended  
31 as it passed from your view  
10 Not Answered

49. Did the ball end

54 quietly  
24 explosively  
26 didn't see  
8 Not Answered

50. Did you notice any particular change in size, shape, brightness, color or velocity immediately before the ball ended?

11 yes  
82 no  
19 Not Answered

51. Where was the ball when it disappeared?

34 midair  
23 on the ground  
15 contacting metal  
26 contacting non-metal  
14 Not Answered

52. How far from you was it when it disappeared?

- 20 under 10 feet
- 31 10-50 feet
- 20 50-200 feet
- 30 over 200 feet
- 11 Not Answered

53. Its velocity at termination was about

- 14 zero
- 17 0-3 mph
- 17 3-10 mph
- 6 10-50 mph
- 5 over 50 mph
- 53 Not Answered

### **AFTERMATH**

54. Did the ball lightning have any aftereffects on (check as many as apply)

- 9 metal structures
- 10 buildings
- 5 earth surface
- 5 people or animals
- 11 vegetation
- 55 none
- 25 Not Answered

55. Was any unusual behavior noted concerning equipment such as radio, TV, hi-fi, car motors, etc. at about this time?

- 8 yes
- 60 no
- 44 Not Answered

56. Was any photographic film found unexpectedly darkened after this event?

- 0 yes
- 78 no
- 34 Not Answered