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On October 9, 1997 at ~18:47:15 UT (during the local noon hour) a large fireball appeared near the Chihuahua, Mexico - Texas, USA border moving northwards to detonate east of El Paso, TX. Most residents of El Paso and Ciudad Juarez heard the blast and many watched the resulting dust clouds. The fireball was bright enough to cast discernable shadows (for some) on this cloudless, clear day; the terminal flash was bright enough to be recorded by downward-pointed security video cameras and to be noted by persons inside curtained rooms. The fireball's terminal flare reached –21.5 magnitude (-23 to -24 for observers near the explosion) putting it in the superbolide category (>10^6 times brighter than the -5 magnitude meteor/fireball classification boundary). Witnesses working outdoors under the burst location described the landscape turning red around them. A nearby security camera system recorded the secondary shadow cast by the event.

The location of the terminal explosion is well determined by eyewitness reports, videos and photographs of the resulting dust cloud, and timed seismic arrivals of the blast wave. This location is 31.80 N, 106.06 W at ~28.5 km altitude. To date, eight witnesses have furnished 19 photographs of the dust cloud, and six witnesses have provided video recordings (Figure 1), of which one records the sound of the explosions. The most distant photographer was ~110 km away, but the fireball was visible and audible for several hundred km. These photographs and videos were taken between 2 and ~20 minutes after the event; the dust cloud was perceptible for ~40 minutes. The dust cloud is recorded as a chain of puffs reflecting episodic disintegration of the projectile from ~35 to 28.5 km altitude culminating in a terminal burst that yielded a near circular cloud ~1.0 km in diameter. The burst cloud contains flattened polygonal structure expressed internally as a five-pointed star. Eyewitnesses describe streamers continuing past the terminal explosion, but only one series of photographs records minor dust past the burst point suggesting that most of the projectile was pulverized. Wind shearing of the chain of puffs along the trajectory destroyed its linearity within ~5 minutes. The location and direction of shearing are consistent with upper wind data recorded nearby earlier that day, confirming the derived altitude for the terminal burst. A prominent change in wind velocity and direction was located at 30 km altitude leading to the initial perceptible distortion occurring just above the terminal burst ring (Figure 1).

The explosion was also recorded by infrared satellite systems (e.g., 1), visible light satellite systems (e.g., 2), a dozen seismographs, and three infrasound detectors, which will allow intercalibration of these systems to atmospheric explosions. The satellite detection fixed the time of the fireball

and provides some information as to its character. The nearest seismic array is maintained by the University of Texas at El Paso which recorded extended records at 4 of 5 active stations. The provisional calibration of energy released to induced ground motion (3.3×10^{10} Jnm^{-1} for 58 km distance) derived for the St-Robert fireball (2, 3) is supported by preliminary data. Seismic solutions from the El Paso region indicate average velocities of ~305 ms^{-1} (after allowing for an initial ~1 km radius supersonic shock) for the loudest audible arrivals which are recorded as a large-amplitude burst. Although a single relatively compact ground-shaking "boom" dominated the sound heard, the audible energy lasted ~20 seconds (for observers within ~ 40 km), and the subaudible signal ~35 seconds. At Los Alamos National Labs two infrasound arrays maintained as part of the Comprehensive Test Ban monitoring system recorded the event. The signal lasted ~4 min at this ~450 km distance with a 0.2 - 0.8 Hz frequency range and maximum amplitude of 21 microbars.
The visible-light satellite detection peaked at 1.0×10^{11} watts/steradian with a total radiated energy of 1.9×10^{11} J. A total energy release equivalent to ~0.5 kilotons is indicated.

The fireball moved roughly south to north (~185° azimuth), with an elevation angle of ~65°. Radiants within this range require entry velocities of ~25 kms^{-1} for objects from the 3:1 resonance of the asteroid belt (~2.5 AU) indicating that 5 to 10 tonnes of projectile was pulverized in the terminal burst; the dust of the extended clouds indicates an initial mass of ~15 tonnes. Although a relatively strong rocky object is indicated by the deep atmospheric penetration, the large entry velocity resulted in disintegration of most of the projectile thereby suppressing macrometeorite delivery. Any meteorites fell in terrain that is relatively favourable for meteorite recovery, as most of the prospective fall area is hard-surfaced desert. The release of large quantities of dust into an environment of known winds represented a favourable opportunity for airborne dust recovery (4).

This fall occurred 11 hours prior to the node crossing for the fifth anniversary of the Peekskill H6 chondrite fall on October 9, 1992, but the trajectory is well enough known to exclude a Peekskill radiant.

Acknowledgements: We are grateful to all the witnesses of the fireball who volunteered their observations, and especially to those who offered photographs and videos of the dust clouds. Additional thanks to all landowners and leasors who permitted searches and all search participants.

References: (1) Tagliaferri et al., 1994, in *Hazards due to Comets and Asteroids, T. Gehrels, ed.*, 199-200; (2) Brown et al., 1996, X 10^{11} J MAPS, 31:502-517; (3) Hildebrand et al., 1997, JRASC, 91:261-275; (4) Zolensky et al., 1997, LPSC XXVIII:1631-1632.

Figure 1. Enhanced negative image recorded by an 8 mm video camera ~2 minutes after passage of the El Paso fireball. Recorder (L. Hernandez) was ~40 km from the clouds (~29 km from sub-ground point). Chain of dust visible here represents ~8 km of trajectory which is foreshortened at this angle (fireball was past and moving away from observer). Note prominent roughly circular cloud with concentric structure marking terminal burst.