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Report of Aerial Shell Burst Height Measurements

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Aerial shell burst height data is perhaps one of the more interesting and important pieces of information that an artistically minded display designer needs. Unfortunately, this information has generally not been available and has essentially never been reported in the technical fireworks literature. One of the authors recently published an article suggesting a simple design for an instrument to collect burst height data.[1] Another author fabricated an instrument based on that design, and now offers similar instruments (Pyro-Meter II) for sale to the industry.[2] This article reports on the first use of the instrument to collect burst height data for commercial aerial shells.

The Pyro-Meter II is capable of automatically measuring the times between shell firing and shell burst. However, this was not done for most of these test firings.

Air density has an effect on the height to which shells will be propelled. These data were collected at approximately 1000 feet above sea level.

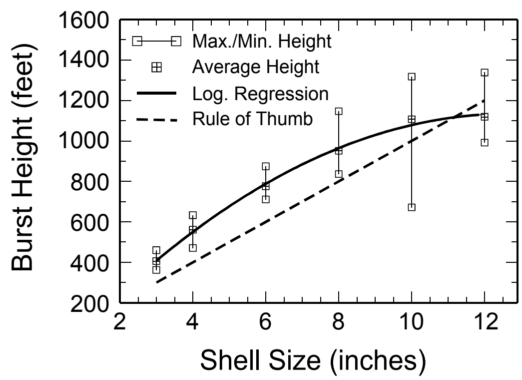

Figure 1. Spherical aerial shell burst height data.

Author Schwertley recently attended a test shoot of commercial aerial shells conducted by Jack Harvey of Harvey Productions, Inc. The purpose of his attending was to measure burst heights of the spherical shells as they were being test fired. Prior to these measurements, the instrument was calibrated using small test salutes fired at known distances. Table 1 summa-

Table 1. Spherical Aerial Shell Burst Height Measurement Results.[a,b]

Shell Size (inches)	Number of Trials	Highest Burst Height (feet)	Lowest Burst Height (feet)	Average Burst Height (feet)	Logarithmic Regression Height (feet)
3	3	460	362	406 (50)	400
4	5	633	471	561 (66)	560
5	0	—	—	—	680
6	9	874	711	776 (52)	785
8	9	1146	836	949 (88)	950
10	8	1371	671	1092 (193)	1070
12	6	1338	992	1164 (134)	1175

(a) The Pyro-Meter II is capable of automatically measuring the times between shell firing and shell burst. However, this was not done for most of these test firings.

(b) Air density has an effect on the height to which shells will be propelled. These data were collected at approximately 1000 feet above sea level.

rizes the results of the measurements. Also included in Table 1 are standard deviations using the n–1 method (listed parenthetically after average burst heights) and the burst heights determined from a logarithmic regression fit to the average burst heights.

Figure 1 is a graphic presentation of highest, lowest and average burst heights. The solid line is the logarithmic regression fit to the average burst heights. Also included is a dashed line corresponding to the traditional rule-of-thumb that burst heights are 100 feet per shell inch. For shells less than 12 inches, the rule-of-thumb under-estimates true burst heights by about 150 feet.

The authors gratefully wish to acknowledge Jack Harvey for granting permission to publish these data. The authors hope that other persons in the industry will volunteer to allow the collection and publication of similar data during their testing of aerial shells.

References

K.L. Kosanke, "Determination of Aerial Shell Burst Altitudes," *PGI Bulletin*, No. 64, 1989.

For a specification brochure on the **Pyro-Meter II**, contact L. Alan Schwertley, RR 1 Box 5, Modale, IA 51556, (712) 645–2077.