James F. Morrissey

NOTES

ROCKET GRENADE EXPERIMENT

1. A. INTRODUCTION

The rocket grenade experiment is a technique whereby measurements of the speed of sound are used to determine the temperature and winds of the atmosphere at altitudes between 30 and 95 km. This general technique (sound ray tracing) was used by Whipple (1) who used the idea to explain the zones of audibility of explosions and was the first to employ the higher temperatures of the stratosphere.

The rocket grenade experiment was first tried by personnel of the U.S. Army Signal Laboratories (Stroud (2)). The initial experiments were designed around the WAC Corporal method but were later redesigned for the AEROBEE rocket. For the past several years this experiment has been carrie out by personnel of the Goddard Space Flight Center (Nordberg and Smith (3) in the U.S. The experiment has also been performed by people in other countries, Groves, et al (4) in Great Britian, Maeda, et al (5) in Japan.

This experiment has been one of the most important in the U.S. in providing data above 30 km. It has provided data from a wide range of latitudes at all times of the year. For example in 1966 there were 39 successf firings from the following sites (5a).

Place	Latitude	No. Firings
Point Barrows, Alaska	(71°N)	9
Fort Churchill, Canada	(59°N)	10
Wallops Island, U.S.	(38°N)	11
Natal, Brazil	(6°S)	9

Its importance between 50 and 95 km is especially clear where it provid the bulk of the information available for studying the atmosphere and for developing atmospheric models.

This information is made available in yearly reports. Figure 1 is a sample of the data taken from (5)[a] for Churchill on 4 May 1966.

B. GENERAL DESCRIPTION

In this experiment 19 rocket grenades are carried aloft by an AEROBEE rocket (Figure 2). These grenades are ejected one by one at alt tudes between 30 and 95 km while the vehicle is ascending (approximatel 45 seconds from first to last grenade). The time of this explosion is determined from photo detectors on the side of the rocket which telemet this information to the ground. This information is then used in conju tion with the radar track to determine the X, Y, Z coordinates of the b Energy from this is then propagated through the atmosphere to the groun where a system of microphones is used to detect its time of arrival and direction cosines.