IMPACT CRATERING EXPERIMENTS FOR EJECTA KINEMATICS ANALYSIS, Michael G. Austin, AEAE, Dept. of Planetary Sciences, 1187 Granada St., Vallejo, CA 94590

A series of experiments of impact cratering was performed at the NASA Ames Vertical Gun Range May 9 through May 20, 1983, see Table 1. These experiments are a continuation of experiments and analysis begun under NASW-3168 but also represent new combinations of experimental technique and more accurate dynamic measurements. The purpose of these experiments is to improve experimental measurements of dynamic cratering motions and to provide a data base for future analysis of ejecta kinematics and for comparison with computer simulations for crater mechanics theory development.

An ejecta plume dissector was used for all experiments, including the quarter-space experiments. The dissector consists of two aluminum sheets with a vertical slit of variable width. Positioned approximately edge-on to the camera the dissector allows dynamic measurements to be made of a portion of the ejecta plume so that individual particles can be followed. Together with more accurate timing of the film speed at various points during the plume growth (the film speed varies somewhat during the course of the filming even after it's "up to speed") provided by Ames photography personnel, the use of the dissector allows ejecta velocity measurements of different portions of ejecta to within a few percent. The technique in general is similar to (1), but an attempt is made to obtain more accurate velocity measurements. Also different target materials and other experimental conditions and measurements were employed.

To study the variation of the measured ejecta kinematics, various important impact parameters were varied. Impact velocity was varied from 1.0 to 4.84 km/sec. Projectile types were ¼" Al, 1/8" Al, and ¼" pyrex. Target materials were clay, coarse sand, moist sand, compacted moist sand, and sand with a subsurface highly competent layer. Target geometry included quarter-space as well as half-space. The plume dissector position was varied. Lighting was varied for optimum results. Horizontal pins across the plume dissector slits were varied in position or eliminated in some shots to find the optimum design. In addition to the film, final craters were also measured and analyzed.

The variation of ejecta kinematics with impact conditions and target type is of fundamental concern. Several important issues of experimental technique can also be addressed with this data. The effect of quarter space on ejecta and crater dynamics is of particular concern. The present data when completely reduced and correlated with previous data should aid improved understanding of cratering dynamics and will provide a relevant data base for judging the ejecta velocity distributions calculated in computer simulations of laboratory-scale cratering. Also continued development of experimental dynamic measurements at the NASA AVGR will increase the data return from that unique and important facility for cratering studies.

IMPACT EXPERIMENTS FOR EJECTA ANALYSIS

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TABLE 1. NASA AVGR impact cratering experiments.

SHOT	PROJ.	VELOCITY (km/s)	TARGET	CRATER DIA. (cm)	RAD.
830501	1/4" AL	4.37	coarse sand	29.2	4.7
830502	same	3.85	same	29.5	6.5
830503	same	4.69	fine sand	31.1	7.2
830504	same	4.55	same	31.5	6.4
830505	1/8" Al	4.84	same	17.7	3.6
830506	same	no meas.	same	13.8	2.6
830507	same	2.24	same	13.5	2.5
830508	1/4 " Al	2.03	same	23.6	5.4
830509	1/4" Al	2.10	same	23.8	4.9
830510	same	2.00	f.sand/comp.lyr2"d	23.8	4.7
830511	same	1.88	f.sand/comp.lyr1"d	23.6	2.7
830512	same	1.00	fine sand	18.6	3.8
830513	same	1.87	wet fine sand	25.4	5.2
830514	same	1.89	loose,moist f.s.	18.1	4.8
830515	same	1.89	compacted,moist f.s	19.7	2.6
830516	same	1.94	coarse sand	22.5	4.6
830517	same	1.04	same	20.2	4.0
830518	same	2.10	clay	6.2	3.9
830519	same	2.08	basalt	not meas,	
830520	same	1.92	water	N/A	
830521	same	2.06	coarse sand,¼space	23.2	4.4
830522	same	1.84	clay,quarter space	7.8	4.2
830523	1/4"Pyrex	2.03	coarse sand	21.2	4.8
830524	1/4" Al	2.00	clay, quarterspace	7.5	4.0

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References-1)V.R. Oberbeck and R.H. Morrison(1976) Proc. Lunar Sci. Conf. 7th,p.2983-3005,Pergamon.