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HE FRICTION SENSITIVITY
OBLIQUE IMPACT SENSITIVITY OF EXPLOSIVES
(THE SKID TEST)

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DEVELOPMENT DIVISION

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This is a study of the frictional sensitivity of explosives and the mechanism of frictional initiation. It is also the use and study of a sensitivity test for large bare explosive samples in oblique impact.

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HE FRICTION SENSITIVITY OBLIQUE IMPACT SENSITIVITY OF EXPLOSIVES (THE SKID TEST)

ABSTRACT

The oblique impact test series on LX-10-0 Lot 710-2 was completed.

Two instrumented oblique impact tests were done using RX-04-DW dropped at 45°, 5' onto a smooth steel surface.

One additional oblique impact using RX-04-EB at 45°, 3.5' was done.

An instrumented vertical drop and oblique impact series was begun on RX-04-EC (96/4 HMX/Viton).

DISCUSSION

The oblique impact test series on LX-10-0 Lot 710-2 was completed. This lot is of special interest with respect to dynamic physical properties as the binder was 3-M's Fluorel rather than Du Pont's VITON.

Vertical drop tests done last period showed this lot to be significantly less stiff than the more usual composition. Normal and rotational acceleration histories are given in Figs. 1-6. Results of the present series of drops—three at 14°, 0.88-feet, no reactions—are given in Table I; also given are results of the previous oblique impact tests at 45°, 3.5' and the vertical drop tests for comparison.

Two instrumented oblique impact tests were done using RX-04-DW (HMX/Viton 95/5) at 45°, 5' onto a smooth steel surface. These tests are to serve as reference points for several oblique impact tests done onto a thin layer (~ 7 mils) of silicone rubber (Dow Corning 93-119 Silastic) spread on a smooth steel surface. There has been some question as to the properties of this rubber when subjected to a high shear rate. It is thought that a high shear rate on a thin layer may produce irregular, small, hard granules which would serve as centers for frictional initiation. The accelerometer records from these two tests showed significant differences. The rotational acceleration on one test was approximately twice that of the other (acceleration histories given in Figs. 7-10). There was one reaction level 6 observed. Several more oblique impact tests will be done onto smooth steel to resolve the rotational acceleration anomaly.

An additional RX-04-EB (HMX/Viton 95.5/4.5) oblique impact test was done at 45°, 3.5". Acceleration histories are given in Figs. 11 and 12. The FASTAX coefficient of restitution and final rotational velocity were 0.30 and 29.27 rads/sec respectively.

An instrumented vertical drop and oblique impact test series was started on RX-04-EC (HMX/Viton 96/4). Five vertical drops were completed. Test parameters are listed in Table II. Acceleration histories are given in Figs. 13-16. Oblique impact tests have not yet been done.

COMMENTS; CONCLUSIONS

Vertical drop tests on LX-10-0 Lot 710-2 (95/5 HMX/Fluorol) showed it to be significantly less stiff than the usual (HMX/Viton) LX-10-0 composition.

Several more oblique impact tests using RX-04-DW onto smooth steel will be done.

An instrumented vertical drop and oblique impact test series was started on RX-04-EC. Vertical drops have been completed, oblique impact tests have not.

Table I. Test Results for LX-10-0, Lot 710-2

(Vertical Drop Tests)

<u>Billet wt (lbs)</u>	<u>Drop Hgt (in)</u>	<u>Contact Spot Diameter (in)</u>	<u>Coefficient of Restitution</u>	
			<u>Accelerometer</u>	<u>FASTAX</u>
23.46	1.5	0.73	0.482	Indeterminant
23.44	3.0	0.83	0.489	0.48
23.51	12.0	1.14	0.449	0.46
23.48	24.0	1.31	0.449	0.46
23.49	36.0	1.39	0.429	0.45

45°, 3.5'

<u>Billet wt (lbs)</u>	<u>Coefficient of Restitution (FASTAX)</u>	<u>Final Rotational Velocity (FASTAX) (rads/sec)</u>
23.41	0.35	30.44
23.45	0.33	27.81
23.46	0.30	28.29

14°, 0.88'

23.46	Indeterminant	~ 6.0
23.51	Indeterminant	~ 6.0
23.47	Indeterminant	~ 6.0

Table II. Vertical Drop Test Results

(RX-04-EC)

<u>Billet wt (lbs)</u>	<u>Drop Hgt (in)</u>	<u>Contact Spot Diameter (in)</u>	<u>Coefficient of Restitution</u>	
			<u>FASTAX</u>	<u>Accelerometer</u>
23.49	1.2	0.64	0.50	0.506
23.48	2.65	0.73	0.51	0.475
23.46	11.6	1.02	0.52	0.540
23.40	24.0	1.19	0.48	0.476
23.58	36.0	1.31		Scope Record Lost Piece Cracked

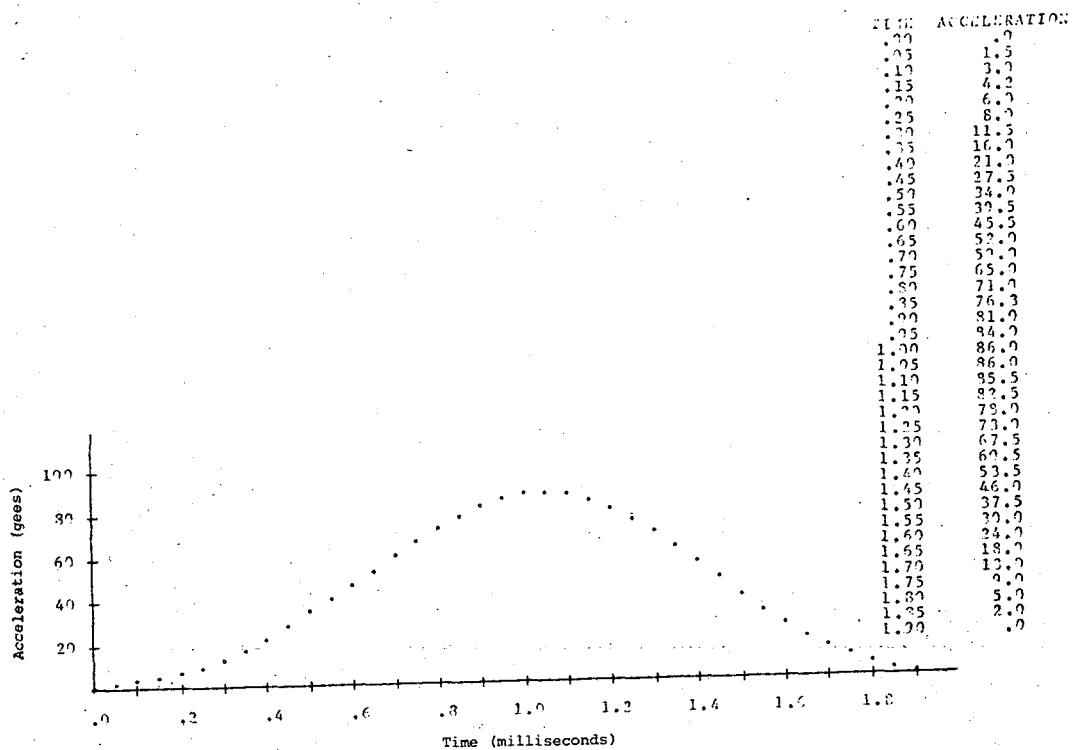


Fig. 1. LX-10 Lot 710-2
 0.88", 14°
 wt = 23.47 lbs
 Final Rotational Velocity
 Fastax = 6.0 Rads/sec
 Normal Acceleration

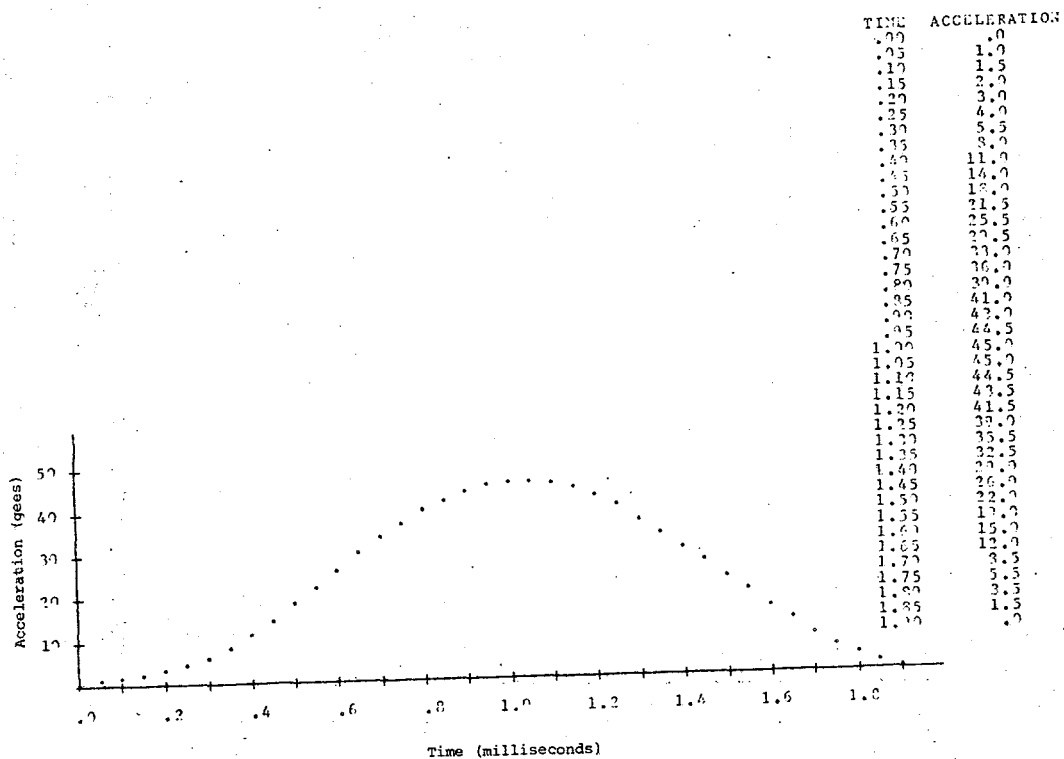


Fig. 2. LX-10 Lot 710-2
 0.88", 14°
 wt = 23.47 lbs
 Rotational Acceleration

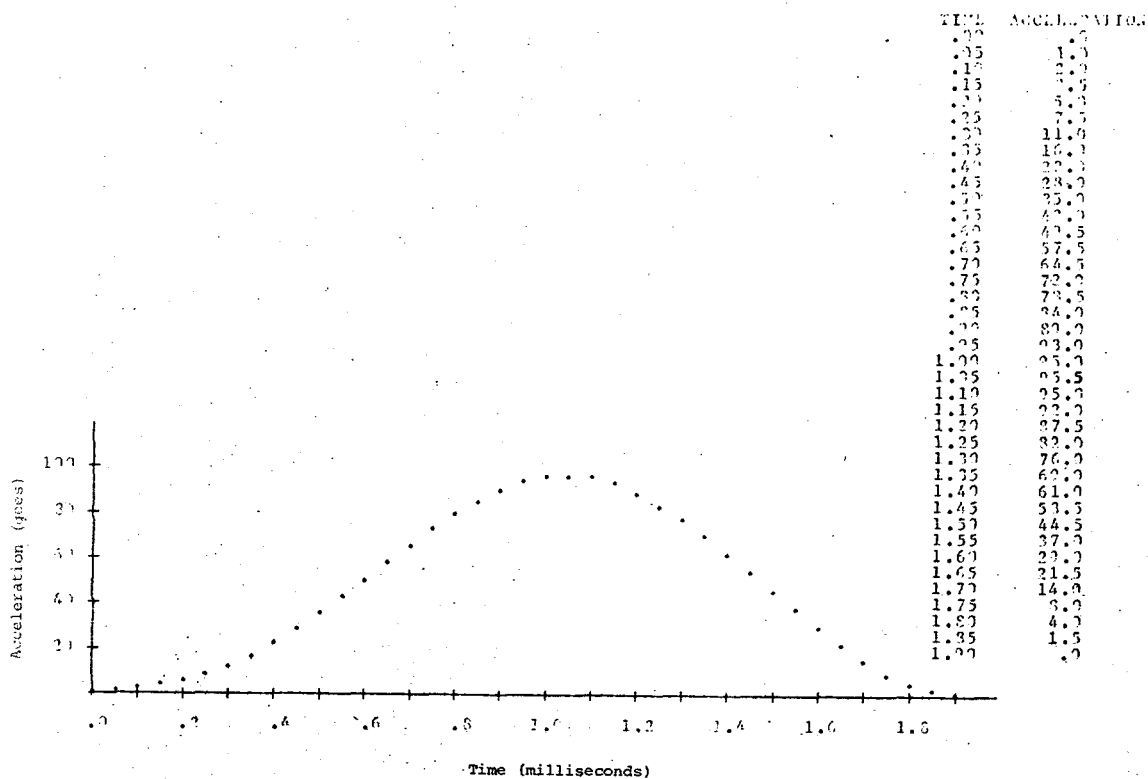


Fig. 3. LX-10 Lot 710-2
0.88', 14°
wt = 23.51 lbs
Final Rotational Velocity
Fastax = 6.0 Rads/sec
Normal Acceleration

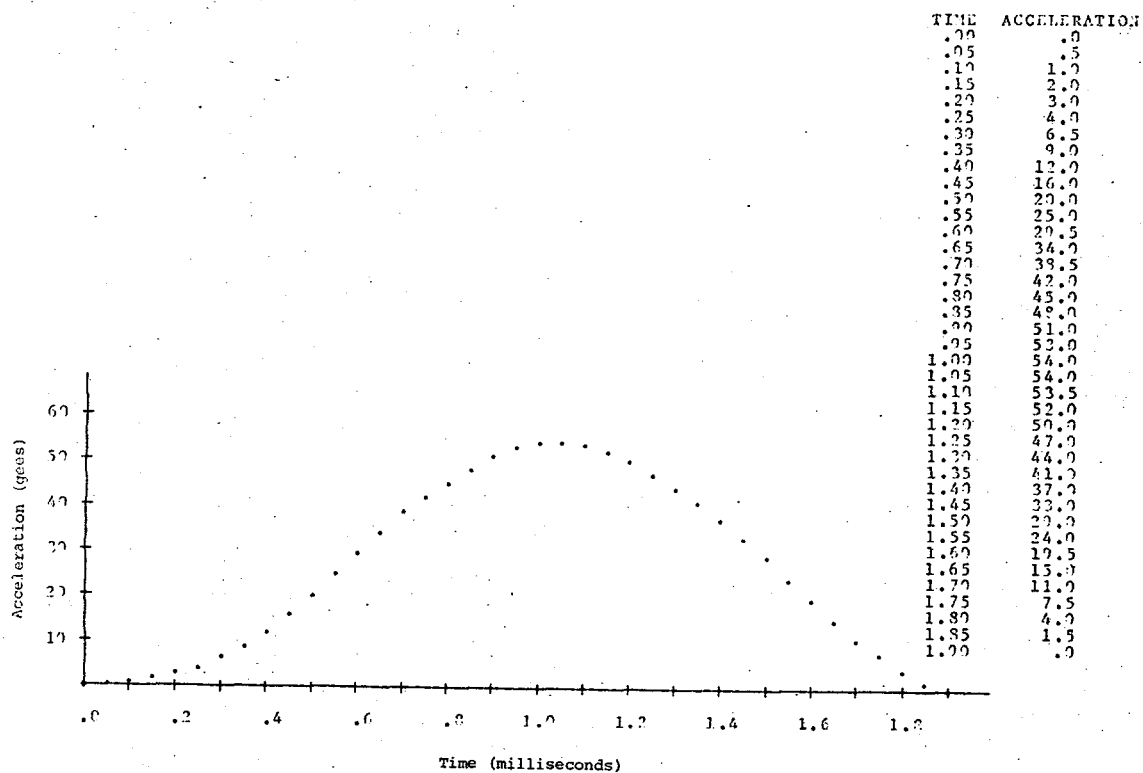


Fig. 4. LX-10 Lot 710-2
0.88', 14°
wt = 23.51 lbs
Rotational Acceleration

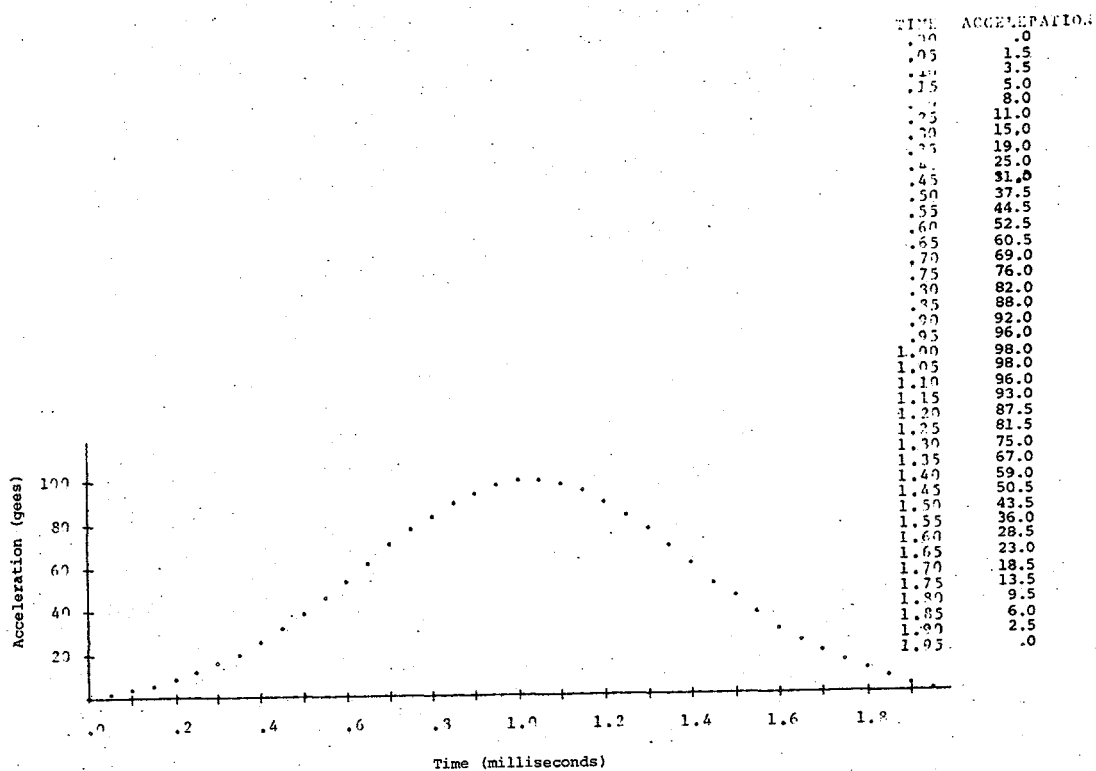


Fig. 5. LX-10 Lot 710-2
 0.88', 14°
 wt = 23.46 lbs
 Final Rotational Velocity
 Fastax = 6.0 Rads/sec
 Normal Acceleration

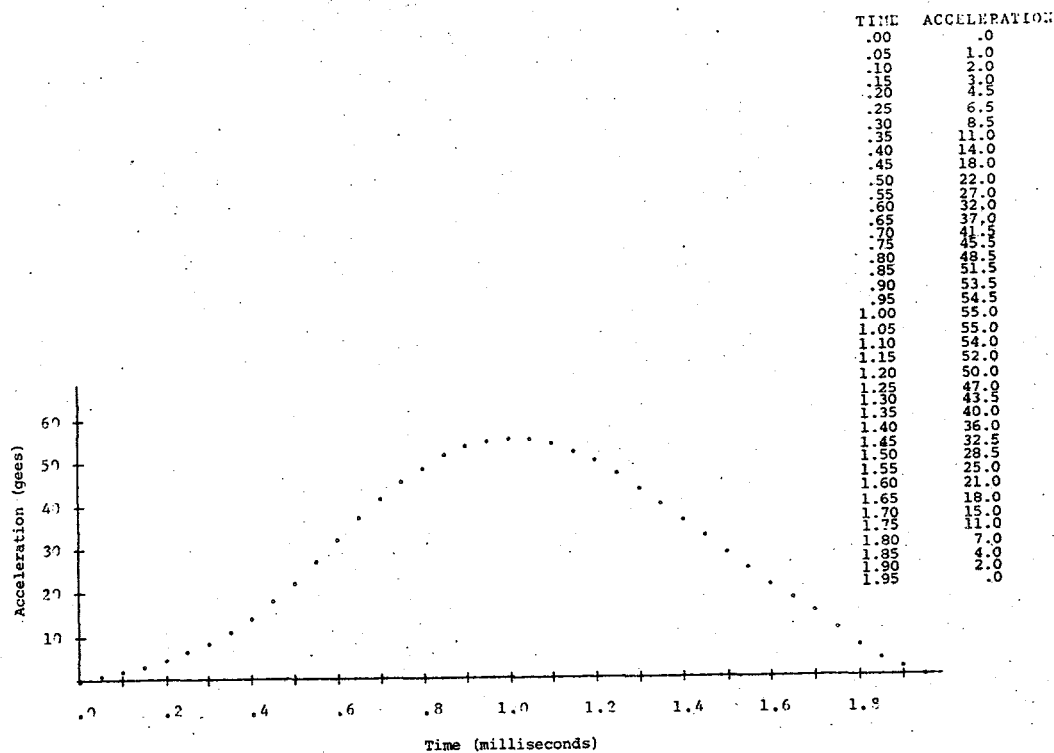


Fig. 6. LX-10 Lot 710-2
 0.88', 14°
 wt = 23.46 lbs
 Rotational Acceleration

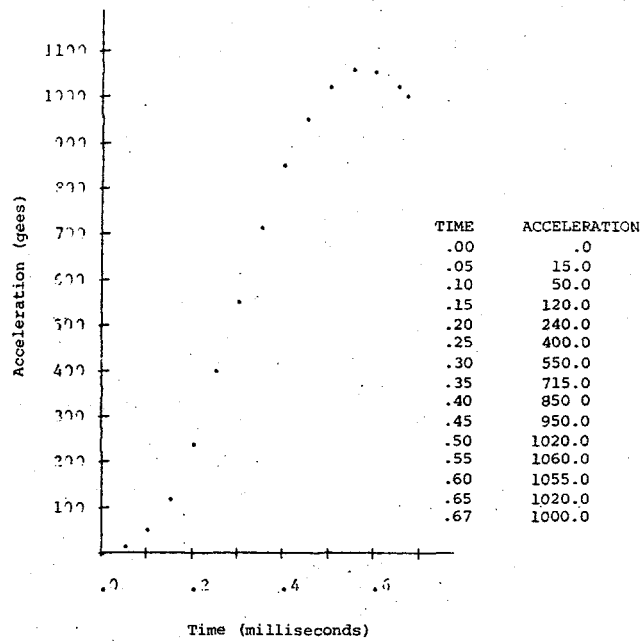


Fig. 7. RX-04-DW
5', 45° Onto Smooth Steel
wt = 23.46 lb
#6 Reaction at 0.67 μ sec
Normal Acceleration

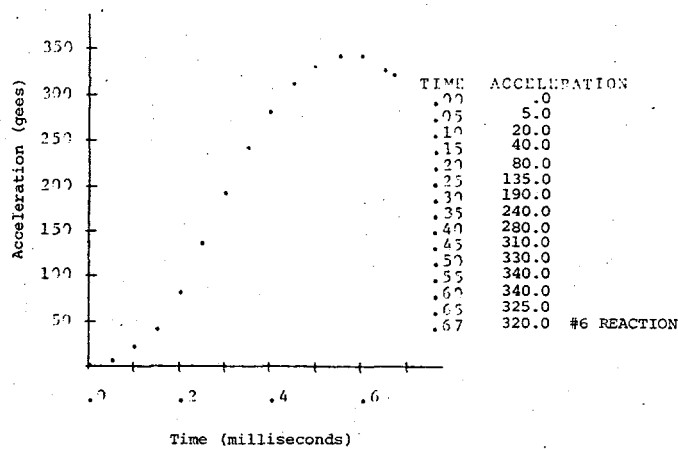


Fig. 8. RX-04-DW
5', 45° Onto Smooth Steel
wt = 23.46 lb
#6 Reaction at 0.67 μ sec
Rotational Acceleration

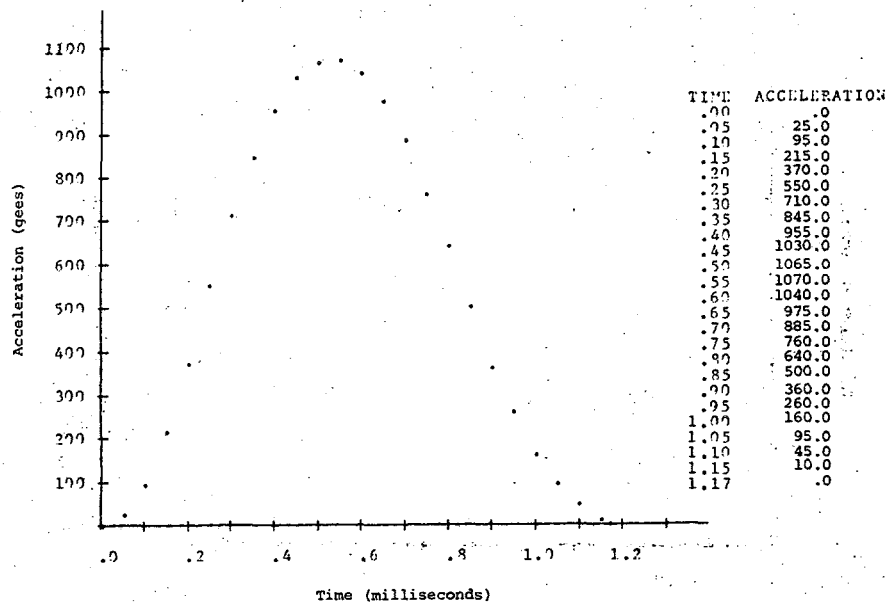


Fig. 9. RX-04-DW
 5', 45° Onto Smooth Steel
 wt = 23.36
 Cor Fastax = 0.37
 Final Rotational Velocity
 Fastax = 20.73
 Normal Acceleration

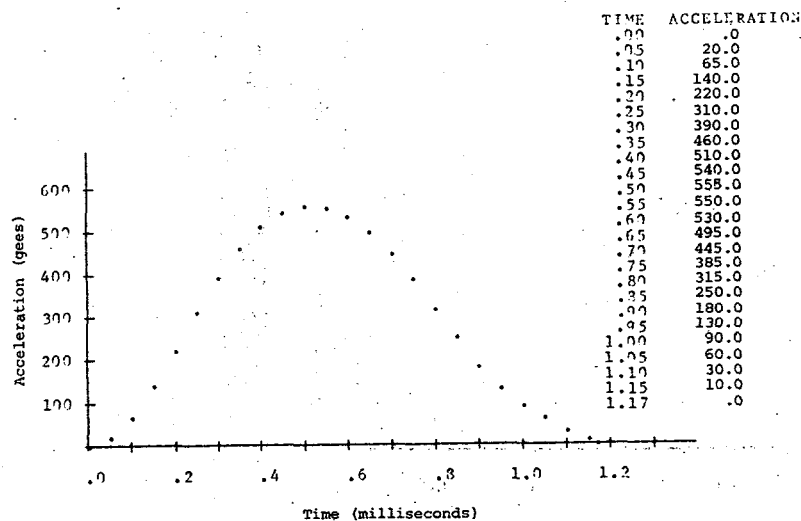


Fig. 10. RX-04-DW
 5', 45° Onto Smooth Steel
 wt = 23.36 lb
 Cor Fastax = 0.37
 Final Rotational Velocity
 Fastax = 20.73
 Rotational Acceleration

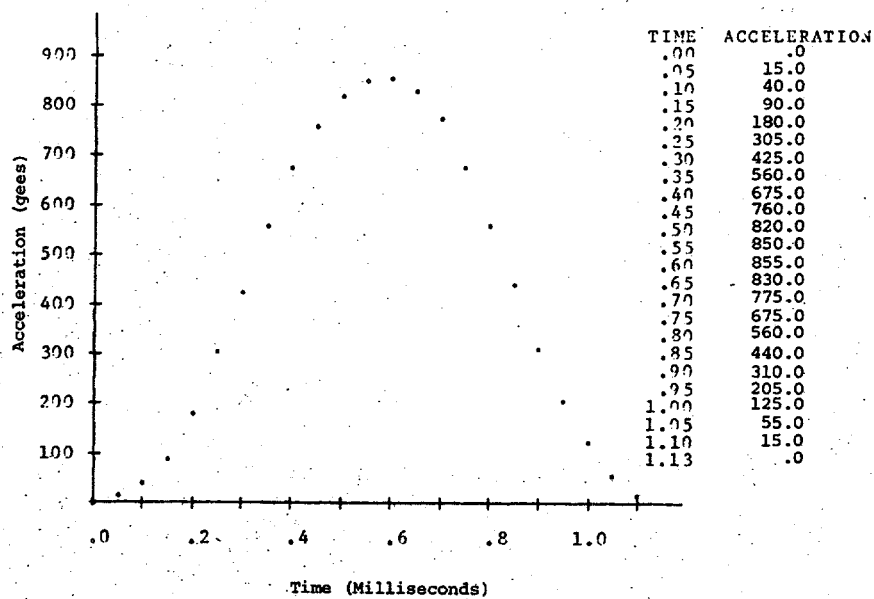


Fig. 11. RX-04-EB
 45°, 3.5'
 wt = 23.50
 Final Rotational Velocity
 Fastax = 29.27 Rads/sec
 Cor Fastax = 0.30
 Normal Acceleration

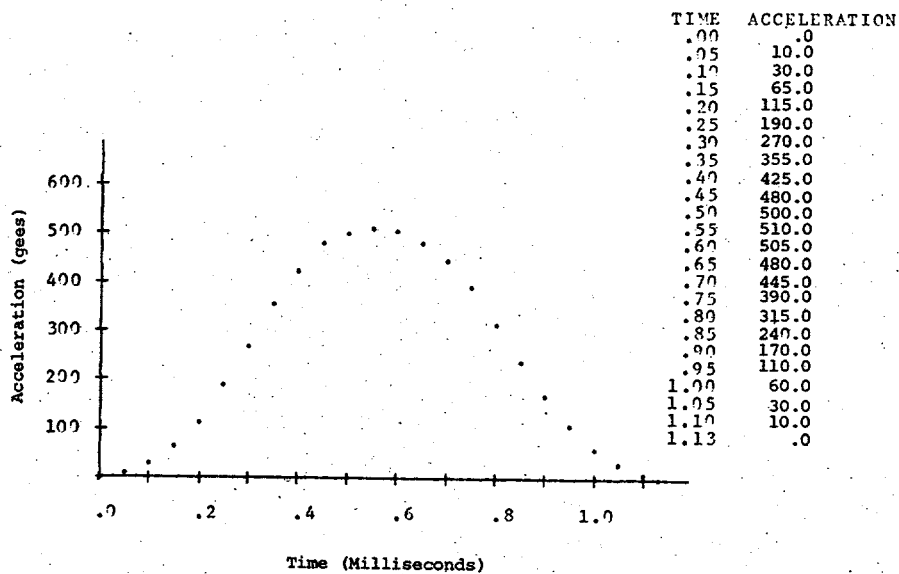


Fig. 12. RX-04-EB
 45°, 3.5'
 wt = 23.50
 Final Rotational Velocity
 Fastax = 29.27 Rads/sec
 Cor Fastax = 0.30
 Rotational Acceleration

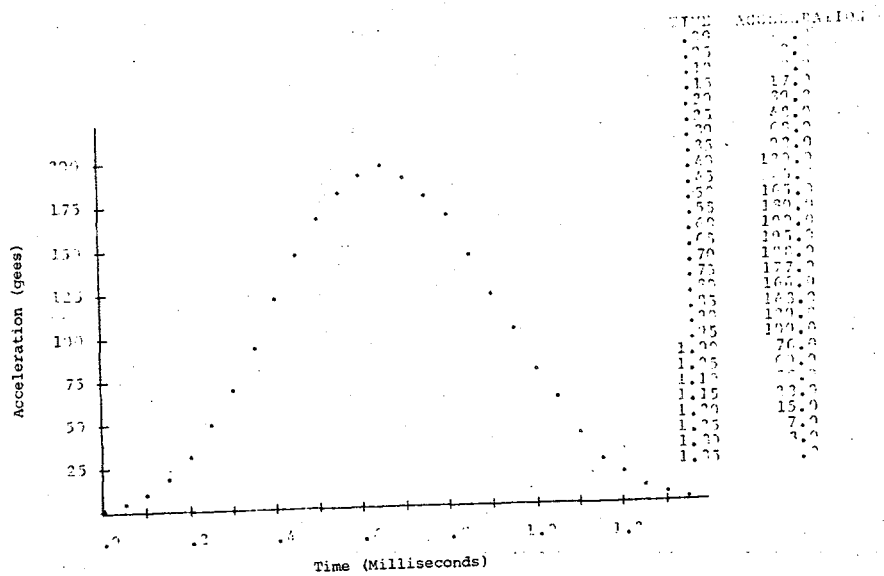


Fig. 13. RX-04-EC
Vertical Drop
hgt = 1.2 in
wt = 23.49 lbs
Cor Fastax = About 0.50
Spot Dia = 0.64 in

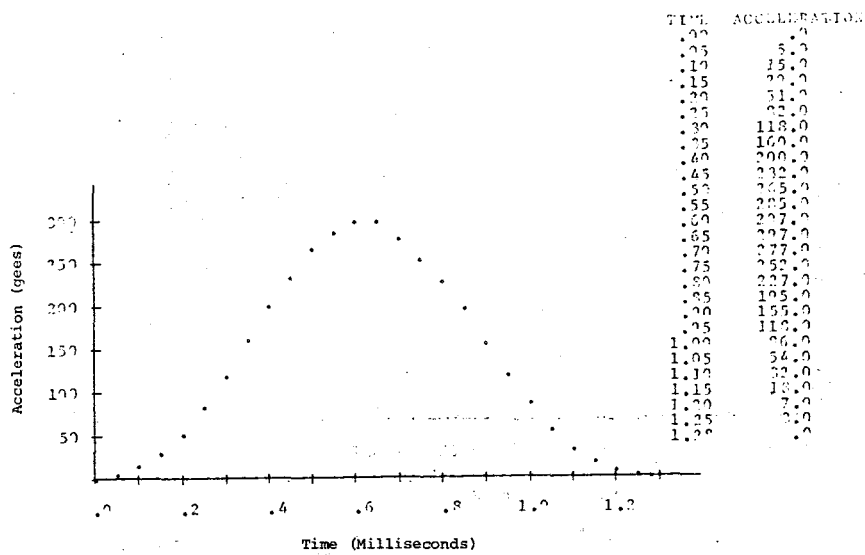


Fig. 14. RX-04-EC
Vertical Drop
hgt = 2.65 in
wt = 23.48 lbs
Cor Fastax = 0.51
Spot Dia = 0.73 in

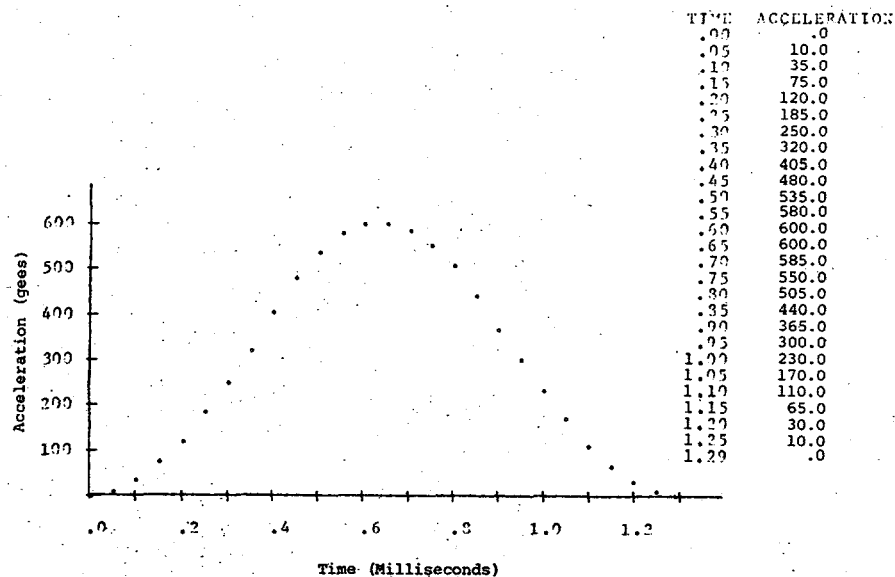


Fig. 15. RX-04-EC
 Vertical Drop
 hgt = 11.6 in
 wt = 23.46 lbs
 Cor Fastax = 0.52
 Spot Dia = 1.02 in

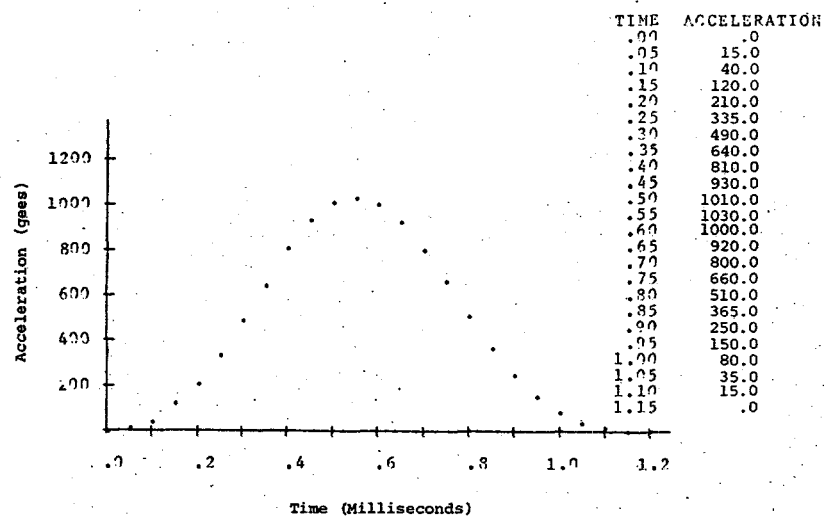


Fig. 16. RX-04-EC
 Vertical Drop
 hgt = 24.0 in
 wt = 23.40 lbs
 Cor Fastax = 0.49
 Spot Dia = 1.19 in