HE Friction Sensitivity
Oblique Impact Sensitivity of Explosives
(The Skid Test)

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DEVELOPMENT DIVISION

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SANL 900-001

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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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Section A
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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)

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

45°, 3.5'

<table>
<thead>
<tr>
<th>Billet wt (lbs)</th>
<th>Coefficient of Restitution (FASTAX)</th>
<th>Final Rotational Velocity (FASTAX) (rads/sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>23.41</td>
<td>0.35</td>
<td>30.44</td>
</tr>
<tr>
<td>23.45</td>
<td>0.33</td>
<td>27.81</td>
</tr>
<tr>
<td>23.46</td>
<td>0.30</td>
<td>28.29</td>
</tr>
</tbody>
</table>

14°, 0.88'

<table>
<thead>
<tr>
<th>Billet wt (lbs)</th>
<th>Coefficient of Restitution</th>
<th>Final Rotational Velocity (FASTAX) (rads/sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>23.46</td>
<td>Indeterminant</td>
<td>~ 6.0</td>
</tr>
<tr>
<td>23.51</td>
<td>Indeterminant</td>
<td>~ 6.0</td>
</tr>
<tr>
<td>23.47</td>
<td>Indeterminant</td>
<td>~ 6.0</td>
</tr>
</tbody>
</table>
Table II. Vertical Drop Test Results

(RX-04-EC)

<table>
<thead>
<tr>
<th>Billet wt (lbs)</th>
<th>Drop Hgt (in)</th>
<th>Contact Spot Diameter (in)</th>
<th>Coefficient of Restitution FASTAX</th>
<th>Coefficient of Restitution Accelerometer</th>
</tr>
</thead>
<tbody>
<tr>
<td>23.49</td>
<td>1.2</td>
<td>0.64</td>
<td>0.50</td>
<td>0.506</td>
</tr>
<tr>
<td>23.48</td>
<td>2.65</td>
<td>0.73</td>
<td>0.51</td>
<td>0.475</td>
</tr>
<tr>
<td>23.46</td>
<td>11.6</td>
<td>1.02</td>
<td>0.52</td>
<td>0.540</td>
</tr>
<tr>
<td>23.40</td>
<td>24.0</td>
<td>1.19</td>
<td>0.48</td>
<td>0.476</td>
</tr>
<tr>
<td>23.58</td>
<td>36.0</td>
<td>1.31</td>
<td></td>
<td>Scope Record Lost</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Piece Cracked</td>
</tr>
</tbody>
</table>
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
0.89°, 14°
wt = 23.47 lbs
Rotational Acceleration
Fig. 5. LX-10 Lot 710-2
0.88', 14°
wt = 23.46 lbs
Final Rotational Velocity
Pastax = 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
3°, 45° Onto Smooth Steel
wt = 23.46 lb
#6 Reaction at 0.67 usec
Normal Acceleration

Fig. 8. RX-04-DW
3°, 45° Onto Smooth Steel
wt = 23.46 lb
#6 Reaction at 0.67 usec
Rotational Acceleration
Fig. 9. RX-04-DW 5', 45° Onto Smooth Steel

wt = 23.36 lb
Cor Fasax = 0.37
Final Rotational Velocity
Fasax = 20.73
Normal Acceleration

Fig. 10. RX-04-DW 5', 45° Onto Smooth Steel

wt = 23.36 lb
Cor Fasax = 0.37
Final Rotational Velocity
Fasax = 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  
t = 23.49 lbs  
Cor Fastax = About 0.50  
Spot Dia = 0.64 in

**Fig. 14.** RX-04-EC
Vertical Drop
hgt = 2.65 in  
t = 23.45 lbs  
Cor Fastax = 0.51  
Spot Dia = 0.73 in
Fig. 15. RX-04-EC
Vertical Drop
hgt = 11.6 in
wt = 23.66 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