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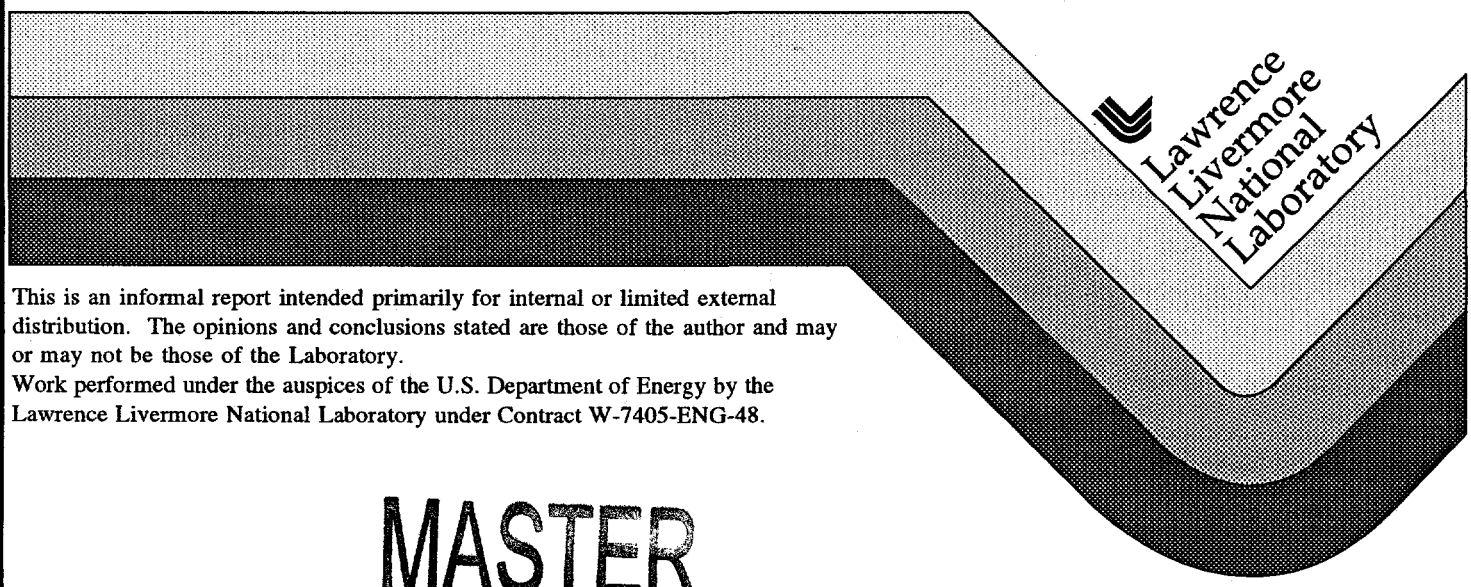
Sensitivity Testing of Liquid High Explosives

L. O'Connell

January 31, 1961



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ENGINEERING NOTE

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SUBJECT

SENSITIVITY TESTING OF LIQUID HIGH EXPLOSIVES

NAME L. O'Connell

DATE January 31, 1961

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Purpose - The purpose of this test program is to determine the sensisitivity of various liquid high explosives when subjected to high accelerations such as those obtained in gun firings.

Scope - The complete program will include the testing of several liquid explosives, the exact number as yet undetermined. This document describes the testing of one liquid, NTN. Additional documents will be issued to describe the testing of other liquids at a later date.

Test Description

1. General - The test will be performed in an M1A1 - 155mm howitzer and will include the firing of 16-M107 projectiles - as modified by UCLRL 10 filled with NTN and 6 filled with an inert material. The latter will be used, as needed, for final adjustments of the howitzer, diagnostics, etc., prior to the firing of live rounds. Picatinny Arsenal will furnish sufficient propellant charge to provide an overtest of the projectile. Desired nominal overtest 15,500 g's. Maximum overtest not to exceed 16,500 g's. The ambient temperature at firing time is to be between 20°F and 110°F. Drawing of the modified projectiles will be published in the near future.

a. Equipment to be Furnished by UCLRL

1. 10 Mod. M107 projectiles filled with NTN.
2. 6 Mod. M107 projectiles filled with a non toxic inert liquid.
3. All materials and equipment required for the filling and assembly of the projectiles at the proving ground.
4. Safety equipment and breathing apparatus for five UCLRL personnel.

Equipment to be Furnished by Picatinny Arsenal

1. One M1A1 155mm howitzer.
2. 16 overtest propellant charges with characteristics as described above.
3. Instrumentation to obtain data as indicated below.
4. Adequate safety equipment for proving ground personnel as outlined in Appendix A.
5. Materials and equipment which may be required in the disposal of expended projectiles.

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[redacted]

2. Target Date of Test - 1-3 March 1961

3. Place - U. S. Army Test Activity, Yuma Test Station, Yuma, Arizona

4. Length of Test - The test should be completed in three (3) days. This allows two (2) days for firing and one (1) day for area cleanup. However, if difficulties arise then the time will be extended.

5. Test Responsibilities - UCLRL will have the responsibility of :

   a. Modifying the M-107 projectiles.

   b. Mixing NTN.

   c. Loading the projectiles with the explosive.

   Picatinny Arsenal, in conjunction with its designated representative, will have the responsibility of conducting the test firing, providing the proper diagnostics and destroying the fired shells, in accordance with the requirements stated in this document. Any deviation from the requirements herein stated require prior UCLRL approval.

6. Description of Modified Projectile - The M-107 projectile will be modified so that it will weigh 75 lbs ± 2 lbs. when filled with NTN. The rotating band will be modified so that it is ineffective and the shell will have a rubber obturator (Ordance Corps. Drawing No. AA-44-162) attached to the rear of the round to provide a gas seal. The intent is to have the projectile leave the muzzle in a non-spinning condition.

7. Description of Explosive - See Appendix A.

8. Safety - UCLRL will have the responsibility for safety during mixing of the NTN and the filling of the projectiles. At this time the responsibility for safety will transfer to Picatinny Arsenal or its designated representative.

9. Destruction of Fired Projectiles - Projectiles will be destroyed as outlined in Appendix A. One UCLRL representative, to be designated, will be consulted on this phase of the operation.

10. Security - This test is to be conducted on a "Confidential Restricted Data" level. Hence, each fired shell must be located and destroyed.

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11. Diagnostics - Picatinny Arsenal will arrange for diagnostics to determine the following:

    a. Maximum acceleration of projectile.

    b. Muzzle velocity of projectile.

    c. Angular velocity of projectile.

    d. Distinguish between high and low order explosion in case of failure.

    e. Temperature of projectile at firing.

    The shells will be painted by UCLRL-white with suitable black pattern for determining spin rate.

12. Number of UCLRL Personnel - Five (5)

13. Planning Meeting - Picatinny Arsenal should arrange for a meeting of interested parties with UCLRL representatives at Yuma Test Activity during the week of Feb. 13 - 17, 1961 to discuss final arrangements for tests.

14. Test Results - Picatinny Arsenal will furnish UCLRL a report of the diagnostics results of each shell fired.

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January 30, 1961

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APPENDIX A

Description of NTN

NTN is a mixture of Nitromethane (NM), Tetranitromethane (TNM), and 1-Nitropropane (NP) in 52, 33.3, and 14.7 weight per cent respectively. The three separate components can be considered as toxic, flammable solvents. NTN is very toxic because of the high toxicity of TNM (approximately 1 ppm).

NTN is considered relatively safe to shock or impact. However, it should be regarded as any other explosive, with utmost caution. The handling of NTN requires protective clothing, rubber gloves and respirators. A Scott Air Pak or other self contained breathing apparatus is recommended. However, an MSA all service respirator with Type S cannister may be used in fringe areas surrounding the material.

The three components of NTN may be stored in the same area, but in separate containers. Ideal storage would be a well ventilated area with a temperature range of 20°-80°F (prefer 62°F). TNM may freeze (Fp = 55°F) in storage. However, it may be thawed quickly and safely by immersion in warm water.

NTN or its components are not chemically compatible with all materials. UCRL Report No. 5861 lists several compatible and non-compatible common materials. A copy will be forwarded at a later date.

We do not have a detector for TNM fumes. However, every effort will be made to have such a device soon. At a later date we will forward references and reports covering the toxicity of TNM, and a report covering the hazards of the two other nitroparaffins.

NTN may be destroyed or disposed of in the following ways:

1. Burning in an open vessel or area.
2. Destruction by detonation.
3. Chemically decomposed by alcoholic alkali and then burning.
4. Natural evaporation in a well ventilated area.

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