A-84-019
46-17

~~CONFIDENTIAL~~

INTER-OFFICE MEMORANDUM

UNCLASSIFIED

DATE 9 September 1944

TO: Dr. Kistiakowsky

FROM: Captain Ackerman

SUBJECT: Lack of Symmetry on Cylindrical Charges.

VERIFIED UNCLASSIFIED
LMR NOV - 1990

This supplements our discussion of yesterday regarding possible reasons for the lack of repetetive symmetry observed in test firing of cylinders made with Comp. B. I concur with you in believing that the lack of symmetry observed with cast explosives is a function of the properties of these explosives and that some of the unreproducibility may result from the boundry conditions introduced by the shape and internal characteristics of the cast explosives.

PUBLICLY RELEASABLE
LANL Classification Group
P. Lang 6-5-98

In accordance with your suggestion, a test to determine the possibility of reducing the TNT crystal sizes on the interior of the mass by "creaming" Composition B by addition of liquid TNT and crystalline TNT during the pouring operation. These tests will be made by Lt. Hopper at any time when you can be present. Also radial slabs for "squirrel cage" tests will be made by two methods: one producing fast cooling and the other slow cooling.

After thinking of the subject further since our discussion, I wonder if one or more of the following special tests would not be justified:

a. Test a cylinder of cast Baronal for comparison with a similar cylinder of Composition B.

b. Test of cylinders of tamped Pentolite and tamped Composition B of microscopic size.

c. Test a cylinder of tamped TNT or Tetryl using 16, 24 or 32 detonation points to see if the granular explosive reduces the interactions so noticeable in tests with solid cast explosive.

d. Test a cylinder of cast Composition B with a circular air gag, 1/4" to 1/2" thick, completely around the cylinder under the detonators. This air space should be only 2 or 3 inches long along the axis of the cylinder and not open to the ends as in case of levitated cylinders. Purpose would be to determine possible effect of gas compression around cylinder in improving symmetry.

e. Test a sphere of tamped TNT or Tetryl to determine whether jet action is reduced.

f. Test cylinders of Composition B in which the boosters are placed in holes drilled in the casting to a constant distance from the internal cylinders. I believe this item was discussed with you yesterday by Lt. Hopper.

VERIFIED UNCLASSIFIED
P. Lang 5-7 65-98

Consideration of the conditions occurring during the implosion show several factors that could lead to the random results secured in the cylinder tests when compared with the sphere tests. These are:

a. In the case of the sphere, the three dimensional symmetry is such that the detonation wave produces compression in all parts of the internal sphere through the initial time of the implosion at least. The magnitude of the compressional stress

CLASSIFICATION CANCELLED
PER DOC REVIEW JAN. 1973

~~CONFIDENTIAL~~

UNCLASSIFIED

Form 25

2277 U 3 7 2

INTER-OFFICE MEMORANDUM

UNCLASSIFIED

DATE

TO:

FROM:

SUBJECT:

may vary from part to part of the sphere but direction does not change until late in the cycle. In the case of the cylinder, however, the area directly under the detonators is primarily in compression, but this area and the areas adjacent are subject to combined stresses with the magnitude of the longitudinal tensile stresses apparently very high. Slight differences in properties of the material, symmetry of detonation, etc., could be magnified by these conditions. There is some possibility that the condition of large combined stress in the zone of implosion could be reduced by simultaneously detonating two additional belts of detonators located outside of the central row. These detonators would be fired a microsecond or so later than the central row. The two additional belts of detonators would contain the same number of detonators as the central row and would be located short distances from the central detonators toward each end of the cylinder. The intention in using the added rows would be to minimize tensile stresses in the zone of test.

b. Although the mass ratios may be quite similar for the spheres and cylinders, there appears to be considerable difference in the thickness of the explosive layer around the metal inserts. In the case of the 1-1/2" spheres, the thickness of explosive is approximately equal to the radius of the spheres. In the case of cylinders with the 3" pipe, the thickness of the explosive is almost equal to the diameter of the pipe. The net result is that the ratio of the shortest length of path of the detonation wave from a detonator to a point mid-way between detonators compared with the distance from the detonator to the surface of the internal cylinder is less than in the case of a sphere. This might permit sufficient time delay in the implosion of the cylinders to increase the effect of interaction of the waves to produce random jets. In the case of the spheres, this might not be true except in cases where a large number of detonation points are used.

I have read the July and February reports by Koski and the recent report by Griesen as you suggested. For the cylinders at least the effect of jets produced by blast wave interaction as well as by the square shape of the pipe when part way down appears probable. Photos showing jets penetrating the pipe invariably show jet blasts on the outside of the cylinder of explosive as well.

J. O. Ackerman

J. O. ACKERMAN
Captain, C. E.

JOA:mw

2277 0393

UNCLASSIFIED

CONFIDENTIAL

CLASSIFICATION CANCELLED
PER DOC REVIEW JAN. 1973

Form 25