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IITRI-578-T68-1

Title: (taken from final report - SC-CR-68-3705, C1034) Acquisition of Data for the Design of an Underwater Location Aid Device (U)

January 17, 1968

[redacted]

Sandia Corporation
P.O. Box 5800
Albuquerque, New Mexico 87115

[redacted]

For: Technical Information Division, 3413

Attention: John G. Boyes, 2523

Subject: Report No. IITRI-C6124-5 (Monthly Report)
December 7, 1967 through January 6, 1968
Contract No. ASB82-9677
IITRI Project C6124

Gentlemen:

The objective of this program is outlined in IITRI Proposal No. 67-778C, dated May 5, 1967. During this report period and pursuant to discussions between Mr. Paul Cooper of Sandia Corporation and IITRI personnel, a decision was made to terminate the underwater acoustics study and concentrate the remaining effort on the development and evaluation of the B-AgF_2-MS (molecular-sieve) igniter. However, further consideration of a timed-release mechanism will continue.

Detailed discussion and results of the underwater acoustic experiments is awaiting the completion of pertinent drawings and will be postponed until the next report.

Evaluation of parameters that influence the underwater ignitability characteristics of B-AgF_2-MS are continuing, although on a more definitive basis. The major parameters are (1) proportions of the components, (2) particle size of the components, (3) size of the igniter, (4) packing density of the igniter, (5) degree of dryness of the components and effect of moisture

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contamination, and (6) compatibility and stability of the igniter. Effects of environmental conditions, such as temperature and pressure, are also being studied. The pressure effect, to 9,000 psi, will be determined upon completion of the required test apparatus, described in earlier reports. Additionally, the prototype igniter that is being developed on this program will also be evaluated as pertains to autoignition temperature, stability range, and ignition sensitivity.

The procedure for igniter evaluation is as follows. Test units were prepared from 1/2-in. diameter stainless steel rod by cutting in lengths of 9/16 in. and drilling out a 1/2-in. hole into one face of the unit. This cylindrical volume is filled and pressed with the igniter being tested and secured to a rod above a beaker of water. When released, the rod to which the unit is attached slides under the surface of the water and, in so doing, closes an electrical circuit that triggers the sweep circuit of an oscilloscope. Ignition and burning are monitored by a phototransistor light detector (located outside the beaker) with readout on the oscilloscope. With the use of an attached Polaroid Land Camera, a permanent record of time delay to ignition and burning time is available.

Data from this parametric evaluation of the igniter is accumulating but is not ready for presentation nor interpretation. However, the following results can be stated at this time.

As pertains to size of igniter, tests have been conducted with 5/16, 1/4, 3/16, and 1/8 in. diameter cylinders, about 1/2 in. long. Reliable ignition was achieved in all cases without exception and furthermore, the diameter generally did not influence the time delay to ignition nor the burning rate. The time delays (dependent on B:AgF_2 ratio, MS additive, and other factors) in general range between several hundred milliseconds to nearly a second. Burning rates are in the neighborhood of 1/2 in/sec.

Some tests were conducted by loading BPN into 5/16-in. diameter size test units and topping with 1/16 to 1/8 in. of the B-AgF_2-MS igniter. Results were highly favorable, indicating that this small layer of the igniter is sufficient to ignite BPN, which can certainly provide the thermal energy required to ignite a primary explosive. Similar tests with smaller diameter igniters are scheduled.

Homogeneous mixtures of BPN and B-AgF_2-MS were also tested and are under evaluation. These systems are affected by both B:AgF_2 ratio and MS additive but do show promise of yielding faster burning rates and probably hotter reaction.

Evaluation of B:AgF_2 ratio and MS proportion is more complicated. For instance, with 5% MS additive, time delays to ignition were as follows: (1) 8:1 (B:AgF_2) ratio, 360 msec; (2) 6:1 ratio, 550 msec; and 4:1 ratio, 650 msec. With no MS additive and 8:1 ratio, the time delay to ignition was 1500 msec, and perhaps half the sample was already consumed by hydrolysis and dispersion from the igniter site. At 20% MS additive and 4:1 ratio, the time delay to ignition was 200 msec and burning rate was about 1 in./sec. At 10% MS additive and 2:1 ratio, the time delay to ignition was 2500 msec and burning was partial only since little sample remained after 2.5 sec. These results illustrate the effect of several key parameters on the ignition characteristics but must await complete evaluation before interpretation is appropriate. Other parameters, such as particle size and degree of dryness of all components, also influenced the stated results and must be determined.

It should be noted that with the use of MS additive underwater ingnitability is positive and the problem of too-much water is solved. Time delays to ignition in these underwater tests approach the optimum short time delays determined in an earlier program IITRI conducted for Sandia Corporation (IITRI Project C6110, Contract No. ASB58-2728, Final Report) where drops of water were added to B-AgF_2 systems.

An excellent dry-box facility has been prepared and a major portion of future tests will be conducted with all components prepared in a near-absolute dry environment. This is essential so as to determine the negligible moisture contamination levels of the components and effects of exposure to humidity. It is quite possible that the advantages gained in this manner are negligible and that preparation of B-AgF_2-MS igniters in readily available dryrooms using commercially available boron, AgF_2, and MS powders is fully satisfactory. The MS additive probably maintains dryness of both the boron and AgF_2 to keep them fully effective up to some level of the MS's own capacity for water absorption.

Future work will consist of continuing evaluation of the B-AgF_2-MS igniter, determination of pressure effect on the igniter, and consideration to a timed-release mechanism as discussed recently with Mr. Paul Cooper of Sandia Corporation.

Respectfully submitted,

Approved by:

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