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April 15, 1944

This document contains 57 pages

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REPORT OF THE ORDNANCE DIVISION

Status as of April 15, 1944

W D - Nuclear Components, Ballistics

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REPORT OF THE ORDNANCE DIVISION

Capt. W. S. Parsons, U.S.N., Division Leader

Status as of April 15, 1944

I. GUN ASSEMBLY

Steps reported in the March 15 summary to expedite gun assembly, design and manufacture have borne fruit in the visit of Mr. C. B. Green, Head Gun Designer of the BuOrd, Navy Department. Mr. Green's visit of 21-22-23 March was most productive in that the factors controlling design of our guns were brought out clearly in the discussions. It appeared undesirable to pierce the side walls of the powder chamber for radial primers; therefore, Mr. Green is making a layout in which the primers are inserted in the mushroom. This appears feasible to Green, and a 5" mushroom embodying this feature is expected to arrive by 15 May.

49

Tests conduoted with navy powder, bazooka powder, and W. M. slotted tube powder in the 5" type B gun (adapter shrunk on) indicate that, at least with the latter powder, maximum pressures of 75,000 psi are possible with the powder initially at normal temperatures. The next step is to fire the W. M. powder at greatly reduced temperatures to detect signs of erratic action due to break-up of grains. Following this test, the type A 5" gun

will be mounted, and the W. M. powder used in a test of this gun, in which the adapter does not add strength to the gun. It is expected that these tests will be underway by 1 May.

Projectile Target

The construction of a 20 mm range adjacent to Building B is proceeding. This range should be sufficiently completed by 1 May to permit non-toxic tests. In this range it is planned to test initiator, projectile, and target designs using or simulating actual materials and geometry, feasible fabrication and expected velocities of assembly. Designs which show promise at 20 mm scale will be tested further at 3" and 5" scale.

For the above tests, information on density and physical properties of 49 is essential. Pending quantitative information, Metallurgy has agreed to furnish an alloy of gold and uranium to approximate the hardness of copper. This should have a density of about 19.

Recently McMillan has proposed a change in geometry of projectile and target, essentially increasing rate of change of volume during pre-critical and critical stages of seating. This proposal is being examined by the Theoretical Division, to determine optimum geometry. This may allow decrease of probability of pre-detonation for a given velocity of assembly.

Tamper

Absorption of neutrons generated in the center of a sphere of tungsten has now been measured, and it is found to be in line with previous

estimates based on two isotopes; in other words, qualitatively very good. This, combined with a short mean free path in WC, make WC the outstanding tamper material for gun assembly.

Source

Progress has been made in mechanical design since the March 15 summary, but further testing of active (toxic) materials, and thorough testing of mechanical features of source designs awaits completion of 20 mm range.

25

Three of the original Bureau design of 6.5" guns to accelerate a 200 pound projectile to 1,000 f.s., with a maximum pressure of 40,000 psi, have been ordered manufactured. Meanwhile, the design has been changed to include radial expansion of the tube, since this is felt to increase the reliability of the gun.

II. H.E. ASSEMBLY

Research work in the H.E. assembly program has proceeded to the point at which the anticipated difficulties of attaining symmetry have now been encountered. The use of multiple detonation points does not in itself solve this problem. The use of an air gap between the explosive layer and the tamper has given results which indicate that in this manner the effect of inter-action between detonation waves may be greatly reduced. It is by no means certain that perfect symmetry of the collapse of the inner surface is required in order to attain high density. However, it is felt that early

jet formation is a phenomenon whose cause and effect must be intensively investigated.

Arrival and installation of the IBM machines has accelerated theoretical work essential in the study of the implosion process. The three additional X-ray machines ordered from Westinghouse are now under high priority manufacture, and the date of completion has been moved from 15 June to 1 June, with the prediction that one of the three machines may be completed and delivered before 1 June.

III. INSTRUMENTATION

Instrumentation of the bomb ballistic and flight tests at Site M was adequate and successful. This includes photographic recording of the flight of the bomb, osoillographic and photographic determination of the time of fall to within .01 second; and, in combination with a 584 radar, determination of ground track and ground speed of the airplane.

X-Ray

As reported in the March 15 summary, the instrumentation group is developing improved timing control for the present X-ray photographic work. These controls will also apply to other X-ray work. In cooperation with experimental physics, the counter method for extending X-ray observations to larger scales is under active development. The source problem for gun assembly is also being worked on as an instrumentation problem.

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γ-Ray

Use of an intense source of 2 Mev γ-rays to determine maximum density of a 1/2 scale tuballoy core when imploded in a steel or dural tamper, has now reached the stage of scheduling materials and preliminary tests.

Optics

Photographic recording of events at Site M was successful. Camera recording of events in the gun assembly is now standardized. Experimental work continues in high speed recording of implosion phenomena.

IV. FUSING

Brode is now preparing an overall design and specifications for safety and fusing control for the gadget. Effort will be made to combine what is possible with what is essential, and then to criticize this design here and in Washington.

(a) Barometric Fusing

An order for 200 barometric switches has been placed with Gibbs Company. Delivery is expected early in May. These units will be flight tested first in standard 2000 pound bombs at Site M.

(b) F.M. Radio Altimeters

An OSRD contract has been let and work has begun at the Norden Company to develop and manufacture the first of the modified AYD type F.M. radio altimeter, for use as a proximity fuse. No major difficulties have been encountered to date, and it is expected that field tests of the first

unit will be begun in May.

(c) Pulse Type Radio Altimeters

The first of the modified pulse type radio altimeters has arrived in Albuquerque. This is one of the G.E. experimental models manufactured as an Air Corps tail warning device. It is found that G.E. production of this device has been delayed two months, due to changes requested by the Air Corps. Therefore, the Signal Corps does not expect G.E. to be in production on this item before July. Parsons and Brode contemplate negotiations through the Signal Corps to obtain a substantial part of the pilot production at G.E. during May and June. On the basis of performance in development tests, this tail warning device seems a best bet as a radar proximity fuse for the gadget.

(d) Batteries

Storage batteries already developed, in which the electrolite is gelatinized to prevent sloshing, and which operate to minus 50° C, are being obtained for test here.

(e) Entirely Mechanical Control Units

Still in the "consideration" stage.

(f) Standard Navy Fuses

Have been received for possible use to detonate the H.E. gadget on impact with the ground.

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V. DELIVERY

The B-29 plane is still under modification at Wright Field. Conferences have been held at Dayton on 1 and 12 April, in regard to reliability of design of suspension and release mechanism. It will be recalled that the four drops of the thin man in the initial Site M tests showed the first design of suspension and release mechanism to be completely unreliable. The second conference focused on design of mock-ups for cold and vibration tests of these mechanisms, to be conducted on the ground. In the first conference it was determined that several defects existed in the original suspension and release mechanism which could have caused failure. A modification which would return to the original design of the glider release is now being incorporated. This provides positive mechanical centering of the bomb lug in the glider release. In addition to the above, the rear glider release is being slotted to allow thermal contraction without binding.

Bomb Flight

Three new designs of tail for the fat man have been evolved and are under manufacture for tests at Site M. These include a square box tail approximately tangent to the 59" cylinder which was the original tail, and with the same overall length (120" of the bomb, but with the sides of the box reduced from 30" to 25". The rear opening of the tail cone has been increased to about 20". Fourteen of these tails are now under manufacture. Two alternate designs of tail - one similar to the box tail described above, but with the box moved 8" to the rear, and the second a fin type box tail

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similar to orthodox Army and Navy tail designs - have been designed and orders have been placed for three of each of these.

A 23/59 scale model of the fat man has now been designed, in order to permit reduced scale tests of the original unstable, cylindrical tail in comparison with the three designs outlined above. This model of fat man is for "insurance", to permit some progress in the matter of tail design for the fat man, even if the B-29 is not available for full scale tests as soon as is now expected (before 15 May).

It is hoped that by the end of May, 1944, sufficient engineering information will have been distilled from the results of experimental and theoretical work relating to the design of the 49 gun model, to decide whether it is feasible to design a 49 gun gadget which can be carried in the forward bomb bay of the B-29. If the answer is affirmative, then our B-29 can be modified back to its original two bomb bay construction, and installation of radar navigation and bombing equipment can be made on this basis. It is already practically certain that the 25 gun gadget can be carried in the forward bomb bay of a B-29.

VI. ENGINEERING DESIGN

Mr. Frederic Flader, ex-Chief Engineer of Curtiss-Wright, is now in the final stages of negotiating to join this project. The question of part time or full time employment is not yet settled. At the present, Mr. Flader is working on a mock-up for cold testing of the suspension-release mechanism, this to be done at Curtiss-Wright.

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Difficulties have been experienced with the organizational set-up by which engineering design work and model procurement, including expediting, are done in the Detroit area. It appears desirable to centralize administrative control of these operations under the OSRD contractor, the University of Michigan. Conferences will be held in Detroit and Ann Arbor to this end on 22 April. An OSRD contract is under negotiation with the Gulf Research Laboratory in Pittsburgh, for procurement of laboratory apparatus, special cameras, etc. For this contract Brode is authorized representative of OSRD.

VII. OVERALL SUMMARY

The summary given on 15 March is repeated as follows: "The Division and its associated activities are moving - it is hoped in the right direction - but no specific problem which controls the success of the overall development is sufficiently well in hand for any sense of comfort. Enough delays have occurred up to now to justify acute worry and drastic action, in order to avoid being a bottleneck when the time and the material arrive."

In addition to the above, there is quoted the final conclusion of one of our aircraft commanders, summarizing the battle of 24 August 1942: "The enemy is faster; we must be faster."

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SUMMARY OF H. E. IMPLOSION PROJECT

George B. Kistiakowsky

Neddermeyer's report covers the activities of the E-5 Group devoted to research on the implosion mechanism. The following facts merit particular attention.

Intensive work on the improvement of the quality of pentolite castings has been underway because of the observations that the quality of such castings has a very profound effect on experimental results. It has led, however, to a somewhat unexpected conclusion that castings carefully freed of air entrapments and therefore having densities of the order of 1.7 g/cc frequently fail to be properly initiated by boosters which are perfectly adequate for ordinary castings of 1.6 g/cc and slightly higher densities. It is as yet not completely certain that the effect is not caused by partial segregation of the constituents. If not, it constitutes a very important observation, affecting the future course of the work of the project. It may be noted in passing that while similar behavior has been reported in the literature for blasting gelatines and some data on Amatols may be similarly interpreted, nothing quite like it has been observed with sensitive cast explosives.

The optical work on the implosion of cylinders has progressed satisfactorily and good data are now available on the velocity of implosion

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of 1 1/2" and 3" steel cylinders. These data show that towards the end of the implosion process the inside surface of the cylinder is markedly accelerated. This, needless to say, is essential for the attainment of the high pressures in the interior predicted theoretically. So far, however, the symmetry of the collapse leaves much to be desired and work towards its improvement is actively pursued.

The work on terminal observations has also been mainly concerned with improvement of the symmetry of collapse of spheres, particular attention being paid to local violent effects observed directly under initiation points and where denotation waves meet. Good indications have been obtained that a thin layer of air between explosive and metal does much to eliminate these effects.

The X-ray team has devoted most of its time to improvements in the functioning of the equipment and not many data on the implosion of small spheres have been obtained.

The staff of the E-5 Group has now grown to over 50 men and not many further additions are contemplated. Its activities would have been more fruitful were it not that the facilities at the firing sites are still in the process of construction and experimental work had to be done under severe handicaps.

The S-Site H.E. plant was turned over to us by the contractor around the middle of the month but has not as yet been put in operation because of many minor changes and corrections which had to be done. However good progress in the installation of equipment has been achieved and it is

expected that the plant gets into operation during April.

Bainbridge's report on E-9 Group outlines the program of future activities and summarizes briefly the present status of the theoretical and preliminary experimental work on the containing sphere for proof firing of the gadget. While the conclusions are still very tentative, it appears rather probable that a steel sphere of about 150 tons weight will be adequate to contain the explosion of two tons of H.E., that a sphere of this size can be cast and transported by rail.

This group is now in the active formative phase and it is hoped that its activities will greatly expand during April.

GROUP E - 1, PROVING GROUND - Lt. Comdr. A.F. Birch

1. Two rounds were fired from the 6"/47 gun, as a test of the 6" recoil mechanism. After this, about two weeks were spent waiting for the 5" experimental barrels, and for the copper jacketed pressure gauges. The first round from the 5" type B gun was fired on March 17.

2. Firing with 5" Type B Gun

Sixteen rounds (143-158 inclusive) have been fired up to March 31. Ten of these were with 20.9 pound charges of SPDN 3750 powder and 60 pound common projectiles, fired with the object of testing instruments, chiefly the piezo electric pressure gauge, the gun and the mushroom. Pressures and velocities varied considerably and rather inconsistently for these rounds. The copper pressures for individual guages varied between 18 and 25 tons, velocities between 2730 and 2620; the predicted pressure and velocity were around 20 T. and 2560 respectively. This powder evidently behaves in an erratic manner; it was used for this preliminary work merely because it was the only powder immediately available in sufficient quantity.

Three shots were fired with the "Slotted Bullseye Special" powder. On two of these, piezo records were obtained, indicating peak pressures were higher than expected, - about 60,000 pounds/inch^2. Further firings will be made with this powder when instrumentation is more reliable. Four piezo records were made with the SPDN powder. These were all unsatisfactory in some respect, - either intensity of trace, intensity of timing marks, continuity

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of trace etc. Adjustments to improve readability and reliability of these records are continuing. No leaks of pressure in or around the guage, nor around the projectile were observed.

3. Instrumentation

Trouble was experienced with the Potter chronograph during these firings. Ten readings that could be considered reasonable were obtained in the sixteen rounds. Of these, several may be of low precision. If this type of instrument is to be used, there should be at least three units in action on each shot. Otherwise, other instruments must be used. Another casualty was one of the General Radio Recorders whose take up motor developed a defective armature.

Some rearrangement of control and recording equipment is being undertaken, with use of the drum camera in mind. This instrument should be usable within the next week or two. The muzzle feed for bore-accelerations measurements was installed on March 31, and tuning up is proceeding.

4. New Construction

Building 15 is now very nearly finished, and the 3" gun will be installed there in a few days.

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GROUP E - 2, INSTRUMENTATION - L. G. Parratt

I. E-2 Organization

K. T. Bainbridge	Group Leader until March 20
L. G. Parratt	Supervisor of Implosion Instrumentation Appointed Group Leader March 21
Lt. Comdr. A. F. Birch	Supervisor of Gun Instrumentation Transferred from Group March 21
Mrs. Runyan	Secretary

Photographic and Optics Section

J. E. Mack - SM - Section Leader
B. Brixner - SM
R. H. White - SM
Felix Geiger - SM (Joined March 31)
Mrs. Janet Kreiner - Secretary
Ralph L. Conrad - Technician
Mrs. E. King (3/4 time) - Technician
Cpl. G. W. Thompson - S.E.D.
Pfc. H. C. Barr - S.E.D.
Pfc. Edwin York - S.E.D. (Joined March 25)
Pfc. John Wahlen - S.E.D. (Joined April 5)
Mrs. B. Chamberlain - Draftsman - on loan from E-6

Electronics Section

John Wieneke - SM - Section Leader
H. G. Voorhies - SM
Arthur Schelberg - SM
Robert Huffhines - Technician Leader
Mrs. Caldes - Secretary
Gilbert Mathis - Technician
Calvin Linton - Technician
Gertrude Carroll - Technician
Pvt. Geno Newlin - S.E.D.
Pfc. Robert Schluter - S.E.D.
Pfc. Price - S.E.D. (Joined March 10)

Electronics Section (cont.)

T/5 Keszenic - S.E.D. (Joined March 10)
T/5 Myron Daly - S.E.D. (Joined April 5)
Pfc. Donald Miller - S.E.D. (Joined April 5)
Cpl. Benjamin Bederson - S.E.D. - on loan from E-9 (Joined March 21)
Pfc. Josef Hofmann - S.E.D. - on loan from E-9 (Joined March 21)
Pfc. R. C. Lowry - S.E.D. - on loan from E-9 (Joined March 21)
Pfc. Keith Henderson - S.E.D. - on loan from E-9 (Joined March 21)
Pfc. Frank Fortino - S.E.D. - on loan from E-9 (Joined April 5)
T/5 Walter Treibel - S.E.D. - on loan from E-4 (Joined April 3)

Bore Acceleration and Piezo Gauges: Gun

J. Allen Crocker - SM in charge
Wray Garn - SM

Electro-Magnetic Method: Implosion

J. L. Fowler - SM in charge - on loan from Physics Division
Pvy. Mike Clancy - S.E.D. - on loan from E-5

X-Ray Pulse Photographic: Implosion

T. R. Cuykendall - SM in charge
E. Titterton - SM - on loan from British contingent
David Anderson - SM
Pfc. Kilburg - S.E.D.
Pfc. Lepman - S.E.D.
Pfc. Fishbein - S.E.D.
Sgt. Ritner - S.E.D. - on loan from E-5
Sgt. Burditt - S.E.D. - on loan from E-5
T/5 N. Greenspan - S.E.D. - on loan from E-5
L. T. Finlayson - SM - loan from E-5 (Joined March 20)
Donald Hudson - T - on loan from E-5 (Joined March 1)
Pfc. R. P. Matthews - S.E.D. - on loan from E-4 (Joined April 5)

X-Ray Pulse Counter: Implosion

B. Rossi, Consultant - on loan from Physics Division - In charge
Matthew Sands - on loan from Physics Division - (Joined March 5)

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X-Ray Pulse Counter; Implosion (cont.)

Pfc. Chester McCaughey - on loan from E-5 (March 10)
T/5 Everhart - S.E.D. - (Joined March 10)
Pfc. Whitmore - S.E.D. - (Joined April 6)
Donald Mayers - on loan from E-5- (Joined March 31)

II. Condensed reports from Section Leaders and Staff Members in charge.

PHOTOGRAPHIC AND OPTICS SECTION, J. E. Mack

Site M Activities

Mack, Brixner and White have assisted at Site M. The time of Brixner and White since their return has been spent largely in editing the film taken so far.

The use of the turret truck as a power driven pan-tilt head for the Mitchell chronograph records of the drop was outstandingly successful.

Designed and in the shop is a telephoto lens system which will allow the present 34 cm f:10 camera on the 584 dish to be conveniently replaced by a camera of three to five times the focal length and f number. This will be useful in case the 584 is utilized in an attempt to follow the drop.

Of the fourteen routine photographic records taken in each drop, E-2 personnel takes only one, the one with the turret truck camera. However, the films of seven records are collected by E-2 personnel and sent to Hollywood for processing, and the remaining records are processed at the Base

photographic laboratory jointly by an E-2 representative and specially assigned Army assistants. The records are then given to E-7.

Skyscreen

One skyscreen has been finished in the shop and its optics checked. The second one is now in the shop.

By means of a train consisting of a 5 cm f:2 lens, a finely machined adjustable slit, a condensing lens and a photoelectric cell, the instrument will read the luminous flux through a rectangle which is accurately controllable in length from 0 to 24° (but whose light-gathering power is somewhat unreliable above 20°) and in width from 0 to 1.7°. The object-focusing range is from 1 meter to infinity.

Drum Camera

This instrument records simultaneously six oscilloscope tracings in the same transverse line on a 4 x 60 inch film which travels at about 70 ft per second. It is suitable for recording events for about 0.07 seconds with a resolving power of 10^{-5} seconds. The instrument is expected to come from the shop for its optical test March 31, and barring unforseen circumstances, can be tested the same day. Immediately upon a satisfactory test, a shop order for a second camera will be placed.

Rotating Mirror Camera

Previously this camera has been running with a 1 1/4" rotor at an image velocity of about 950 meters per second and a resolving time of about one microsecond. This week there was installed a 3/4" rotor; one of whose first two pictures yielded a resolving power of 0.25 microseconds at an image

speed of 1620 meters per second. Some further improvement in image speed and resolving power is expected.

A new rotating mirror camera for May delivery for the implosion program has been requested. This instrument is to be electrically driven and manufactured by the Gulf Laboratory shops from a design to be submitted by E-2. The design should be agreed upon in an early conference with E-5.

Service

There has been a considerable increase in the demand for copy work; for example, copying of mineral specimens, especially for the chemistry division. Agfacolor film has been ordered for some of this work. With special grainless plates, several reticules have been made.

Conrad has been occupied almost completely this month in fine optical instrument work and has been occupied with the upkeep of cameras. The number of armored cameras in use on the southwest mesa (which require servicing almost every day) has increased from one to two, and will soon be three.

This month a new set of darkroom rules has been inaugurated. We have undertaken to process the same day all of the material submitted before 5:30 P.M. Since several men come in from the field at about 5:30 this puts a considerable fraction of the daily processing load into the evening hours. Thompson and York are now running morning-afternoon and afternoon-evening shifts

ELECTRONICS SECTION, J. E. Wieneke

Strain Gauge Amplifier

Two high current amplifiers to drive the G.E. PM10-B2 oscillograph have been installed at Anchor. A pre-amplifier for this high current amplifier has also been completed. Seven additional amplifiers are in process. No strain gauge records have been taken or yet requested on the five-inch gun now in use.

Design and construction of an amplifier for a strain gauge on the blind target assembly with the 20 mm gun has been undertaken for E-4.

Piezo Gauge

Satisfactory piezo gauge records have been taken since March 30. The gauge is connected directly to a DuMont 208 oscilloscope using only the amplifier in the scope. Timing is furnished by a 1000 cycle tuning fork and amplifier driving a flashing neon bulb which is in the field of the G.R. oscillograph recorder used to photograph the scope. A base line of the film from which the deflection is measured is supplied by an incandescent bulb. A relay circuit for automatically calibrating the scope gain is being built up. A cathode follower for matching the gauge to the line impedance is also in progress.

Sky Screens

Price and Keszenic are working on the assembly of the sky screens.

Photocells for Projectile Velocity

These units were rebuilt and are being installed at Anchor.

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20 mm Projectile Velocity

Amplifiers and suitable recording of the 20 mm projectile velocity, both before and after penetration through a metal plate placed about 15" from the gun muzzle, have been undertaken.

BORE ACCELERATION AND PIEZO GAUGES, J. A. Crocker

Microwave

Plumbing for the 5" microwave oscillator has been received from the shop and installed on a rack and panel.

Necessary repair and rebuilding of the wavemeter has been accomplished.

A probe to simulate the movement of the 5" projectile in the gun has been built.

The 5" oscillator has been tuned to the desired frequency and a standing wave pattern has been propagated in the 5" pipe in the laboratory using a dipole antenna as a muzzle feed.

Blast shields and shock mountings for the 5" unit are now finished and have proven adequate under actual firing conditions.

The muzzle guide feed was received March 31 and has been installed on the gun.

Preliminary work on matching the microwave oscillator to the 5" gun has been started.

Piezo Gauge

Some broken parts in the calibrating mechanisms have been replaced.

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The gauge has been recalibrated.

Modifications in the manner in which the signal is brought out of the mushrooms have been made with the view of reducing "chatter" in the record. Muzzle contact fingers and their related circuits have been installed. Much time has been consumed in debugging circuits and obtaining initial piezo records.

Drum Camera

This is still in the shop. The drum has been driven at slight over-speeds and appears to be satisfactory. There remains some work to be done in the shop and installation and alignment of the optical system by the Optics Section.

Blast and Vibration Pick-Ups

There are on hand crystal pick-ups and electromagnetic pick-ups with which it is intended to measure or compare air-borne and earth-borne shocks in connection with group E-5.

Some thought has been given to means of calibrating these as a first step in interpreting records. An amplifier to enable the electromagnetic pick-up to drive a recording meter has been built by the Electronics Section but this needs modification.

Initiator

Firing (two rounds) was made to determine the time between impact of a projectile in a blind target and the final balling up. First attempts were disappointing. The main trouble seems to be in the manner in which the strain wire was bonded to the target. Further work along this line has been

held up because of lack of targets.

A voltage amplifier is being constructed to mount on the rack and panel with the fast sweep scope to make this a complete and more flexible unit for this type of work.

ELECTRO-MAGNETIC METHOD OF STUDYING IMPLOSION, J. L. Fowler

This program has run up against a number of experimental difficulties. The fast amplifier built in the Electronics Section has been abandoned. Records taken with the original amplifier of Nuckoll's design gave pictures which sometimes showed a high frequency oscillation (a continuous blur on the film).

When a new fast amplifier built by Elmore in the Physics Division was used, the high frequency pattern still occurred sometimes when the implosion charge was cast around concrete as well as around a copper cylinder. Shielding the cap leads and the scope tripping leads with iron pipes and using only series grounds seem to improve the situation but did not cure it. Furthermore, during this period, there were a number of shots wasted because the scope trace would fade out.

Mr. Witham of the Physics Division found and repaired a number of things wrong with the wiring of the scope. Now the traces seem to be satisfactory. However, there is still the high frequency pattern occasionally, even when only a cap and primacord are shot, although there is no trouble when the scope is tripped with a switch. Since a possible explanation of this difficulty might be in the electrical connection between the

charge and the apparatus through the scope tripping leads, a phototube and amplifier is being constructed to trip the scope by means of the light flash from the primacord.

It is planned to work more intensively on this method during the coming month for early evaluation of its possibility.

X-RAY PULSE PHOTOGRAPHIC, T. R. Cuykendall

Accuracy of Triggering the Surge Generator

An accuracy of ± 1 microsecond in predicting the interval between the initiating signal and the x-ray flash has been attained in the laboratory with one x-ray surge generator. Modifications are as follows:

a) The trigger gap system has been redesigned to place the two gaps adjacent to one another, thus eliminating a long conductor between.

b) A second pole trigger gap has been added to the lower bank of condensers to insure simultaneous firing of the upper and lower banks.

c) The power unit has been revised to supply +25, 0, -25 k.v. in place of 0-50 k.v. to reduce corona and to simplify design of trigger gaps.

d) A new trigger transformer and thyratron (M.I.T. radar design) has been installed in place of the equipment supplied by Westinghouse.

Preliminary observations made with the fast sweep unit (1 microsecond per inch) indicates a "triggering accuracy" of better than 1/2 microsecond in the discharge of the first condenser of either the upper or the lower bank. 150 k.v. capacity dividers ordered in February have just arrived

which will permit the measurement of the timing accuracy to be extended to include the building up of the voltage on the tube. Preparations are being made to employ a G.M. counter to detect the x-ray burst and thus terminate the CR sweep, resulting in a truly overall time measurement.

The existence at the site of but one transformer and thyratron is extremely serious and Voorhies and Titterton are on travel to M.I.T. to expedite procurement of additional units and to ascertain general design characteristics of the M.I.T. trigger circuit.

The complete system (timer and surge generator) are being operated many times a day in order to discover inherent faults or difficulties not now apparent.

For expediency the general design has been prepared and equipment is being assembled to modify, as in paragraph 1, the #2 surge generator now at Anchor Range.

The Time Measurement Equipment

A second transient-timing unit has been completed embodying improvements learned from operation of the first unit. Satisfactory photographs of sweeps faster than 4 microseconds per inch have not yet been obtained, but the record is clearly visible to the dark adapted eye. It may be necessary to revise the CR panel of these units to employ tubes of higher anode voltage (now 4 k.v.) to allow satisfactory photographs.

An informal manual of instructions describing the functions of this "timer", its operation, and simple trouble-shooting is in preparation.

Several ASTP men are being trained as future operators for E-5 and E-4.

Characteristics of the X-Ray Pulse

Apparatus has been constructed to record simultaneously as follows:

a) Three pinhole photographs of the target, each photo representing a different quality of radiation by means of differential filters.

b) Step-wedge photographs to determine the effective wavelength after transmission through various thicknesses of aluminum and iron.

c) Photographs of models of various states of implosion in order to determine the optimum geometry of scattering shields, protective plates, etc., for greatest accuracy in measurement of the inner radius of the imploded sphere.

X-RAY PULSE, COUNTER METHOD, L. G. Parratt

Under the supervision of B. Rossi, Physics Division, and of Mat Sands, Physics Division, the basic design of auxiliary circuits for the trigger counters, or pulse-chambers, is nearing completion. To decrease the chances of spurious operation, it has been found satisfactory to apply a steady voltage to the counter just below that at which it will operate and to boost the voltage to the operating range (500 volts additional) for the duration of the implosion - 100 microseconds is used in the laboratory tests. These circuits have now been constructed in "regular" relay rack style.

Air at atmospheric pressure appears to be a satisfactory gas for

the trigger counter. (The counter is not a true counter in that the discharge is not self-extinguishing, and thus is good for only one "count".) Fortunately, the pulse obtained when the counter "breaks down" is so great that no amplification is needed. A small, cold cathode thyratron is triggered directly.

Dimensions of the counter used for the preliminary studies is 1/8" I.D. cylinder, 1" long, with 0.005 central wire.

The efficiency of the counter is determined partly by wall material and wall thickness; studies to find the optimum conditions have just been started.

A 100 k.v. x-ray set-up for 1 microsecond pulses of x-rays has been assembled for laboratory test of the counters.

GROUP E-3, FUSE DEVELOPMENT, R. B. Brode

A. The Electrical Group

The electrical group of E-3 has concerned itself during the month primarily with the tests at Site M. The results of these tests indicate that the radio method of obtaining time of flight gives satisfactory values in agreement with high speed camera data to within one hundredth of a second. In preparation for the installation of barometric switches, considerable work had been done on the barometric informer. The laboratory model has been put into a small scale production in Michigan and some twenty units have been made in our shops. Five of these have been tested at Site M with satisfactory results. The test equipment for the reception of these units has been improved by modifying a Hallicrafter Receiver to make it into a panoramic receiver of a fairly uniform response. The results of tests at Site M on the Michigan proximity unit were unsatisfactory and it has been decided to abandon the use of these instruments. The informer used in the tail to furnish information with regard to operation of units has been modified to a more satisfactory form and will be used in future tests of other types of units.

B. The Mechanical Division

The mechanical division of Group E-3 has completed the design of an airtight barometric switch suitable for production and has investigated its operation at low temperatures and under a violent vibration. In all

these it proves to be satisfactory. Work has continued on clocks for arming devices. Study has been made of direct firing barometric mechanical units. These seemed to operate consistently to within 200 feet.

C. External Manufacture of Radar Altimeter

External manufacture of Radar altimeter as a type of proximity fuse has been initiated at the Norden Laboratories Corporation in New York and use of the R.C.A. AN/APS/13 device has been investigated for use in the same capacity. Arrangements have been made for the manufacture of the barometric switch by the Gibbs Corporation. The University of Michigan group is preparing informer units for output boxes which are to take the output of either the Radar or the barometric units and convert this into the firing pulse for either gun or detonator.

GROUP E-4, PROJECTILE, STRIPPER, TARGET, SOURCE, C. L. Critchfield

1. Designs tested

Active experimental design has been restricted during March to initiators. The first round involving radioactive material was fired on March 18. The results indicate that materials brought together under impact are more efficient as neutron source than when brought together by hand. This result is fundamental to, and encouraging for, the general program. Details of these tests will be presented by Ayers.

The initiator design testing work is going too slowly to be satisfactory. The reason for this is delay in obtaining shop work, in the first place, and the poor quality of the work when obtained. The minimum delay on the items ordered by Ayers has been fifteen days past the promised date. There are now on hand ten targets, of which, however, only two can be used for firing. The remaining eight had to be returned to the shop for rework. The poor quality of the machine work is sometimes not discovered until the gold and platinum members are inserted and this increases the delay.

2. Prospective Program

a) Materials and Equipment

Fabricated tungsten carbide for 20 mm targets should be available April 8th. On this date the design for the inner chamber for the 20 mm range and the setup for making neutron counts should be finished. It is

expected that the range itself will be ready for non-radioactive shots by April 15th. It is hoped that the purification system, etc. will be installed for active shots by May 15th. The inner chamber will probably be made in an outside shop.

b) Initiators

The designs produced by Ayers and Robinson will be tested at 20 mm scale for mechanical performance and, if satisfactory, for neutron performance. It should be possible with reasonable service from the shop to finish tests on the designs that have been detailed so far. These preliminary tests are of an idealized nature and Ayers will prepare for inserting initiating mechanisms in the larger scale targets. This preparation should be finished by May 1st, provided that by that time a usable formula for duplicating actual targets in steel is obtained by Wood.

Cornog will be responsible for determining the strengths of neutron sources before and after firing and for developing criteria for comparing results on source strengths obtained at 3" and 20 mm scale. Due to shortage of laboratory space for E-4 the electronic equipment will be installed in Cornog's office. With this equipment we expect to make all our own neutron counts in determining source strength and in comparing with standard sources. The problem that must eventually be solved of firing radioactive materials in the larger scale gun will be considered. One possibility of delaying the contamination of Anchor Ranch is to fire larger tubes in free recoil at the east end of the Gomez Ranch where the 20 mm polonium shot of March 18th was fired.

Measurements on the time required for deformation in steel and in heavy metal impacts will be carried on by Crocker. This time is of primary importance in determining the source strength necessary.

c) Target and Projectile

The purpose of the 20 mm work is design and experimentation on projectile shapes and target composition, structure, method of anchor, etc. In one series of experiments the heavy metals, tungsten carbide, tuballoy and fake 49 will be used in construction. In a parallel series steels of various heat treats will be used in an effort to duplicate the flow and fracture. A program of the latter type will also be carried out at 3" scale to establish the scale relations and to provide a larger size target in which initiator tests can be made. Mr. Stroke will be actively interested in this work which will be done under Wood at 20 mm scale. Designs for the 3" scale will be prepared by Serduke and Stroke, as the heat treat expert, will be unofficially responsible for coordination of the tests.

It is expected that the 20 mm preliminary results will indicate certain simplified fundamental tests, some of which may be initiated in April. All work of metallurgical import will have the close cooperation of Cyril Smith. A possible program that is still in a nebulous stage is to study pressure volume relations under impact. The advantages of attempting such a study are that the strengths of materials may be expected to be somewhat greater, and especially that the short time may allow compressing liquid hydrogen which cannot be contained during a static test. This sub-

ject has been discussed briefly with Cmdr. Birch.

In addition to Serduke's activities on the 3" target and projectile design, he will continue designs of sealing bands. He will also design a mechanism for securing the projectile in the gun.

3. The following personnel has been added to E-4 during March:

Pfc. R.O. Webster, to work with Serduke

Pfc. Nooker, to work with Cornog

Pfc. Emil Karas

Messrs. Breslow, Perlman and Blecker, to work with David Wood who also joined the Group this month.

GROUP E-5, IMPLOSION EXPERIMENTATION, S. Neddermeyer

In the past three weeks a great deal of time has been spent in improving experimental techniques and in attempting to overcome experimental difficulties, some of which were inevitable, and others of which were unexpected.

A. Detonation Failures

One of the most important developments is the finding that pentolite, even when cast in rather large charges of thickness about 2", is exceedingly difficult to detonate reliably, when the castings are made with great care to eliminate all air bubbles and obtain maximum density. This is contrary to all previous experience at other places where no difficulty has been experienced in detonating cylindrical charges of pentolite only about 1 1/2" in diameter. It was found that when the explosive is melted down without prolonged heating and cast at as low a temperature as can be used satisfactorily and puddled to prevent local cavitation, that fairly reproducible densities can be obtained in the neighborhood of 1.6 to 1.62. These charges gave internally consistent results with points on a plot of collapse ratio against time lying on a smooth curve; a mass ratio 4 gave a collapse time of about 20 microseconds. When, with the same size charges, great care was taken to heat the melted explosive for a prolonged period to eliminate air bubbles before pouring, densities in the neighborhood of 1.70 to 1.71 were obtained, but some of the charges failed to

detonate, and the indicated collapse times were longer even when they did detonate. The photographs gave rather clear evidence of initiation failures at one or more of the detonation points. (These particular cylinders were cast for the first test of symmetry using 8 detonation points.) Work is now under way to make castings of more reproducible density in the neighborhood of 1.6, either by careful control of the casting technique or else by introducing a controlled amount of foreign material, such as activated carbon. (Since this was written, a casting containing charcoal caused a near accident. One of the men was careless in removing a small piece of explosive from one of the cylinders that had just been cast, and the particle went up in smoke. If the main charge had gone, it would have killed several men. No more activated charcoal will be used.) Work is started to test local variations in density as a function of the casting procedure. This should also be done on the variation of composition, and has been proposed as a project that could be carried out at the Bruceton Laboratories. It is possible that the failures occurred because of an excess concentration of TNT in the neighborhood of the boosters.

Some data are now available to test the scaling between 3" diameter, 1/4" wall wall cylinders, and 1 1/2" diameter, 1/8" wall, both with mass ratio 4. The best available data for castings of the lower density, which do not present initiation difficulties, are shown in the graph of Fig. 1. The three upper curves represent collapses of 1 1/2" OD cylinders obtained by the rotating-prism camera method, in which one photograph gives the whole history of the collapse along one diameter. The lower points (x)

[redacted]

are flash observations on the 3" cylinders, each point representing a different stage of the collapse of a different cylinder. For comparison of the two scales, the times for the latter points have been divided by two. Thus the observed collapse time is about 20 microseconds for the 3" cylinders, and about 10 microseconds for the 1 1/2". Most of the irregularities in the last parts of the prism-camera curves probably result from dissymmetry in the final stages of collapse.

B. Tests of Factors Affecting Symmetry

The most important factor affecting symmetry of collapse is unquestionably the interaction of detonation waves. One might expect to be able to reduce this effect greatly by introducing an air space between the charge and the metal, and at the same time not appreciably reduce the total momentum transfer. A series of tests of the interaction effects have been carried out using flat steel slabs, 4" x 8", and flat pentolite charges 1/2" thick, detonated at two points. As the momentum transfer is too great in this case to be conveniently measured by the time of flight of the steel slabs, a separate series of tests were run for this using, instead of the steel slabs, steel cylinders 4" in diameter and 6" long, fired with circular slabs of cast pentolite 1/2" thick and 6" in diameter placed underneath. The momentum transfer was measured by the time of flight as a function of the space between explosive and steel cylinder, and the strength of interaction was inferred by the extent of the region of Neumann banding in the steel slabs. It was found that the momentum transfer decreased only 15 per cent at a gap of 1/2" (= thickness explosive) and

that with a gap of 1/4" the depth of the Neumann bands was only slightly different along the line of interaction from what it was elsewhere. Tests are being continued on the effect of a gap, using terminal observations on spheres and flash photography of cylinders.

The above technique is also to be tried on the 1 1/2" scale X-ray experiments to find out whether it is possible in this way to eliminate the jets, which, with two detonation points diametrically opposite, always occur at the detonation points. The jetting at the detonation points (two) can be understood in terms of a more violent collapse around the equator. When two oblique detonation points are used, there is evidence that a jet (or sheet) forms also on the far side in a plane through the detonation points and the center.

C. X-Ray Apparatus

Improvement of the surge generator, by the Instrumentation Group, so that it can be triggered reliably and accurately, and the development of an accurate electronic timer for measuring the time of the X-ray pulse with respect to the time that a detonation wave reaches a specified point in the explosives train has been highly successful and is likely to be in actual use within two weeks.

Tests by the Anchor Group for scattered radiation, the installation of shields and improvement of geometry have increased considerably the likelihood of obtaining reliable data on liners.

REMARKS ON OPERATIONS AT THE SOUTH MESA

This location has been used for the entire program on flash photography of cylinders, as well as for the work on the magnetic method, which has not so far been successful. Up to about March 1, the largest charges fired regularly were 12-15 lbs., and since then have been regularly 22 lbs., used with both 1/4" and 1/2" steel cylinders 3" in diameter. The 15 lb. shots produced a considerable amount of air blast at the Technical Area, but apparently no serious damage or interference with sensitive equipment. There were, however, brought to my attention about March 15, four instances in which actual damage was done to technical equipment, one of which was rather serious; the presumption is that the time correlation was good enough so that there was little question about the immediate cause.

Fire and fragment hazard are, moreover, considerably greater than with the smaller charges. During the last dry period (which was when the first experiments with high mass ratios were done) from one to three fires per day were started at distances up to nearly 1/2 mile. There was also a report by a guard that fragments were whistling into Los Alamos Canyon. Mr. Koski made a search and found one of the 3" cylinder ends a few feet from the main road at the bottom of the canyon.

For these reasons, and to permit larger scale firing starting very soon, the program on flash photography will be transferred to the "3-mile mesa" east of Anchor Ranch (Site R).

WORK FOR IMMEDIATE FUTURE

A. Explosives

1. Tests of casting techniques for pentolite in relation to sensitivity, homogeneity, and uniformity.
2. Will start using composition B (RDX, TNT) for the larger charges (about 20 lbs. or more) when S-site gets into operation around 4/15
3. Regular sampling of charges to check uniformity.

B. Cylinders

1. Liner tests. A number of 3" steel cylinders with .030" Pb liners are ready to cast.
2. Symmetry, effect of number of detonation points and air space. (Both above delayed by initiation difficulties.)
3. Use of rotating-prism camera to get time against mass ratio.
4. Tests of intermittent light source.
5. Pb cylinders, 3" OD, 1/4" wall, are available for early tests.

C. X-Ray Work on Small Spheres

1. New timing unit to be ready for installation in about two weeks.
2. Effect of mode of initiation on jet formation.
3. Effect of air gap on symmetry and jet formation.
4. Tests with Pb liners in steel and copper spheres.
5. Preliminary tests of Al shells for gas tamper gadget.
6. Mg and Al shells with liners.

D. Terminal Observations

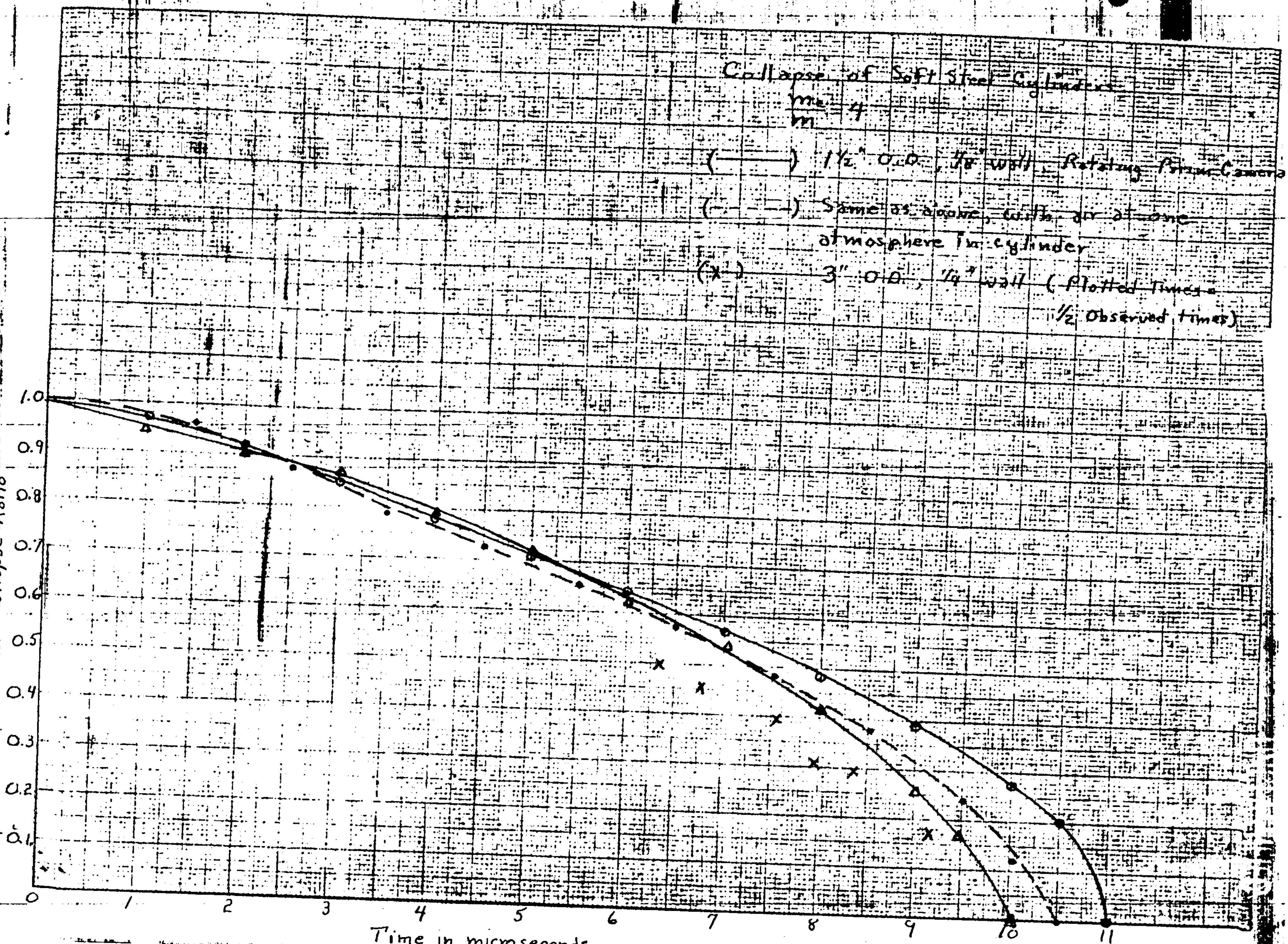
1. Use of small solid brass and steel spheres at center as indicators.

2. Air gap tests with spheres.

3. Continuation of work with weak explosives.

E. Tests with Special Materials

Shells of commercially available ceramic materials, to simulate a BeO tamper, are on order, to be tested with metal liners. Mg and Al spheres and cylinders are also on order. Metallurgical Group to supply standard cylinders of various tamper materials for test.



APPROVED FOR PUBLIC RELEASE

GROUP E-6, ENGINEERING AND SHOP, Paul Esterline

Engineering on Thin Man development continues mainly on full scale 5" blind target assembly and the design layout of the 6 1/2" full assembly.

Engineering requirements for 20 mm target and range equipment is somewhat increased.

Final design and fabrication of Fat Man is continuing, along with some work on alterations of Fat Man dummies.

The greatest percentage of engineering work continues to be on special range and test equipment for the various Ordnance Groups.

The shortage of machinists in the C shop remains the most serious problem.

GROUP E-7, DELIVERY, N. Ramsey

1. During the last half of February and the first half of March, tests were carried out at "M" Site with our B-29. These tests were to determine flight characteristics of our different models of bombs, ballistic data on the bombs, the suitability of the modified aircraft for use with these bombs and data on the operation of different fuses. The initial period of testing was much delayed by very bad weather, by additional work required on the aircraft, but considerable information was obtained during the final period. A total of seventeen runs was made. Eleven of these were with 500 lb. bombs for testing our observational equipment and for special fuse tests. Most of the 500 lb. runs were with a B-24 borrowed from the air base prior to the availability of the B-29. Four "Thin Men" (gun model) and two "Fat Men" (implosion model) were released from the B-29. The tests were abruptly terminated by the last "Thin Man" prematurely releasing itself and thereby smashing the bomb bay door.

2. The tests with the "Thin Men" definitely showed the release mechanism to be unsatisfactory. Three of the "Thin Men" hung up for 10 to 20 seconds after they were supposed to have been released and the fourth released itself prematurely and smashed the bomb bay doors. The first three "Thin Men" were released from 19,300 ft above terrain and showed stable flight as far as could be visually determined. Unfortunately, due to the hang ups, good photographic observations were not possible hence it is difficult to esti-

[redacted]

mate the extent of the stability. The visual observations probably mean that any wobble which occurred in flight must have been less than a 4° departure from the line of flight. The fourth premature release was from 26,000 ft. The bomb in breaking through the bomb bay door was finally launched tail first but in the first few thousand feet straightened into good stable flight and remained stable as far as it could be visually followed by the bombardier.

3. Both "Fat Men" were satisfactorily released with neither hang ups or prematures. Both, however, showed flight which was not sufficiently stable. Both "Fat Men" precessed about the line of flight with the axis of the bomb departing from the line of flight by 19.3° and 20.3° in the two cases. The precessional frequency was about 1.4 per second.

4. The data taken during the tests have not as yet been completely analyzed. However, a preliminary analysis of the times of fall yields values of ballistic coefficients, when corrected to targets at sea level, of C = 7.6 for the "Thin Man" and 1.45 for the "Fat Man".

5. The B-29 is now being modified at Dayton to improve the release mechanism and to make the other changes which the initial flight tests proved to be necessary. These changes include the provision of means for centering the lugs in the release, improved sway bracing, provision for greater thermal and other expansion, and various engine and aircraft modifications which do not directly concern our units.

[redacted]

6. Three different fin designs for the "Fat Man" are being built in the attempt to attain stability. The first consists of a replacement of the circular fin by a square box, one of 59" side and with the shroud 25 1/2" instead of 30" long; the second is like the first except that the whole fin is moved back an additional 8"; and the third is like the first except that the shroud, instead of going to the outer edges of the fins will be part way inside.

7. Other matters of concern to Group E-7 at the present time include the following:

a) Planning of functional mock ups of the airplane for use both in testing the operations of the release mechanism under extreme conditions and for tests with different model bombs.

b) Investigation of the theater assignment of B-29's to determin whether the preparation of only that airplane will suffice for all places our gadget may be wanted when it is ready.

c) Investigation of the need for and of the possibility of heating the bomb bay.

d) Further analysis of Muroc data.

e) Participation in discussions pertaining to the effects of different methods of using the bomb.

f) Planning for armoring the bomb and aircraft.

g) Preliminary planning as to the most suitable form of radar and other auxiliary equipment to be used on the final mission etc.

[redacted]

GROUP E-8, INTERNAL BALLISTICS, J. O. Hirschfelder

The work of E-8 was largely concerned with the preliminary firings of the 5" H.P. gun. So far the emphasis in these firings has been on obtaining satisfactory instrumentation. The piezo electric pressure gauge is now working satisfactorily, but the chronograph is still unreliable. The bore acceleration apparatus has not been installed. We have fired both navy (5"/51) powder and Bullseye slotted tube up to pressures of 25 tons.

The navy powder gives large fluctuations in the maximum pressure for a given loading. For example, nine rounds of 20.9 pounds of the 5"/51 powder fired with a 60 pound projectile led to pressures varying between 18.8 and 25.3 copper tons. We will reject the possibility of using navy type powder if similar dispersion is found when the charges are carefully stacked and an air core is provided for improvement of the ignition.

The preliminary tests with slotted tube Bullseye seem very promising. Its extremely high flame temperature (4000° K) and correspondingly large force should enable us to obtain the required muzzle velocity with a low maximum pressure and a normal density of loading. We have placed an order for an additional 2000 pounds of this powder to be manufactured.

Our specially prepared lot of Canadian W.M. slotted tube has just arrived and we believe that it will prove to be well suited for our requirements. It is reputed to burn very smoothly and to be extremely stable.

Mr. Magee and Miss Kowsky are reading the piezo gauge records on the microfilm reader with the help of a reticule prepared by Julian Mack.

The Ft. Belvoir comparator should arrive next week and make it easier to measure the films. The first records did not have a base line and because of the vertical motion of the film we could not measure the maximum pressure accurately. This led to apparent discrepancies between the piezo and the copper pressures which have since been eliminated. The addition of a muzzle finger, will make it easier to interpret the records. Considerable difficulty has been encountered with mechanical chatter of the gauge. When this is eliminated we will be able to distinguish pressure waves in the gun.

The stacking machine is still being made in the shop and therefore it was necessary for Magee to stack some charges of navy powder using only improvised equipment. We hope that it will not be necessary to stack many charges since only the navy type of powder requires such manipulation.

Loading charts have been prepared for all of the powders which we anticipate firing in the 5" H.P. gun.

GROUP E-9, H. E. DEVELOPMENT, Kenneth Bainbridge

PROGRAM AND PLANS

I. Group E-9 was started March 20 as a unit of the implosion program under G. Kistiakowsky.

The particular duties and responsibilities of this group as considered by Kistiakowsky are:

A. Prosecution of the studies and tests relevant to the assembly of tamper and active material, detonation train, charges, case, mounting supports.

B. Preparation for tests of the final gadget or smaller editions of it with provision for

1) Recovery of active material in the case of no reaction of any magnitude.

2) Securing all possible blast, shock, or n-flux, photographic data of interest for the Project in the event of successful operation.

B involves selection of a site for which many suggestions have been made

Channel Isles - California, possibly San Nicholas

Spur from Williams to Grand Canyon

Windover Field

Northwest part of New Mexico

Sand bars off Texas Coast

Culpepper or Wenmann Islands

Sites within the borders of the United States are attractive on the basis of convenience but are decidedly unattractive on the basis of possible biological effects which will finally determine the area to be cleared.

The time and expense of clearing, isolating and securing an area in the Southwest have been greatly underestimated in the writer's opinion. If further examination supports this opinion then the Gulf of Mexico has much to recommend it.

B(1) is being investigated for two methods, the containing spheres, and the sand pile.

Bethe, Henderson, Bainbridge and later Weisskopf met March 30 for a discussion of the containing sphere. Suggestions were made at that time for addition of water to reduce the temperature and the possibility of reducing the effective Seeger-Von Neumann factor by addition of a liner to the inner wall. A definitive answer was requested on the question of decrease of internal pressure versus decrease of wall strength after firing although at first glance this looks satisfactory.

Dynamic pressures, quantity of steel melted and safety factor all looked sour and sad at this meeting.

(More refined calculations improved the situation as described by Weisskopf in an April 5 meeting attended by Henderson and Bainbridge. A recantation by the advocate of high blast pressures at D/2 distance has lowered the dynamic pressure to about 0.6 of the previous value which brings the dynamic and "static" pressures to about 18,000 p.s.i.)

The chemical engineering plans for the recovery of active material are being prosecuted by Kennedy.

Lt. Schaffer has been actively working on studies of 6" spheres and will be in charge of all work on explosives and charge assembly.

Immediate strain and pressure measurements on small spheres are planned by Lt. W. Schaffer and P.B. Moon assisted by members of E-2 and some E-9 technicians. Pressure and strain measurements applicable to the large sphere are planned in detail for 6", 12" and 24" spheres. Essentially the tests include proof-firing before instrumentation to detect gross weakness or poor castings, followed by full instrumentation, piezo-gauge and strain measurements for two successive rounds. Then the piezo-gauge will be removed after two satisfactory records and firing will continue to destruction with strain gauges only. In some cases the spheres will be cut for metallographic study if good pressure and strain history is known.

II. Test Site Instrumentation

Tentative plans for the instrumentation include:

Blast measurements at many selected ground sites.

Blast measurements from high elevations by informer meters dropped by planes.

n - measurements from the ground and planes.

Photography of meteorological behaviors of the ball of fire.

Photography of ground effects.

Shook measurements and seismographic records if ground effects data are needed to aid in evaluating ground damage under this condition

which I believe is desirable in case of failure of high elevation detonation devices.

The ball of fire is amenable to radar following and this may be desirable to avoid in part poor meteorological conditions subsequent to firing which might prevent good photographic records at high altitude.

III. Testing Gadget Assembly

Two men have been assigned to Ramsey from E-9 to help with the mechanical tests which affect the gadget design proper. A site has been picked at S.

Tests visualized now include;

a) Loading and hoisting tests

b) Support tests

c) Vibration tests, support, and gadget. E-3 may wish to participate in these tests.

d) Deformation of H.E. gadget heading towards final design.

e) Tests b, c, and d repeated at low temperature

f) Drop tests with and without H.E. (H.E. tests will probably be carried out in Pajarito.

g) Vibration tests of primacord train. Rock wool packing may be useful here for support and also for insulation in the double shell.

The A.A.F. Quonset type huts use for roofing 4" mats of rock wool between canvas. This might be convenient stuff to use for insulation in the cold tests.

IV. Appendices to Report

A. TENTATIVE ORGANIZATION OF THE H. E. DEVELOPMENT GROUP

[redacted]

GROUP 1	GROUP 2	STAFF MEMBER - SEC'Y.	ASTP - CIVILIAN TECHNICIANS
H. E. Dev.		K. T. Bainbridge Mrs. B. Runyan, Sec'y.	
Engineering Design, procurement mounting, servicing, testing sphere.		R. Henderson Mrs. B. Runyan, Sec'y. (Carrier) Theory	2 Electronic, Elec. Eng. 5 Mech. Eng. 1 Drafting
	Inner Assembly Tamper and active material.		2 Mech. Eng. 2 General
Explosives Charge assembly studies, charge assembly in the field. Scale tests on spheres.		Lt. Worth)	2 Chem. Eng. 4 General
	Detonation Train Testing and study of detonation train.		1 Chem. Eng. 3 General
Physics Strain, blast, shock, radioactivity.		(Lampson) (1 from Wilson) (Anderson?)	3 Electronic or Elec. Eng.
Chem. Engineering Preliminary concentration and recovery of contents.		(1 from Kennedy) (3 from Kennedy)	8 (Chosen by Kennedy)
	A/C Mock-up Mounting, testing, dropping, rigging.		2 Mech. Eng. Aid from Eng. Expl, Phys. groups and E-7

[redacted]

[redacted]

GROUP 1	GROUP 2	STAFF MEMBER - SEC'Y.	ASTP - CIVILIAN TECHNICIANS
Test site		Proj. Y representative and staff from E-5, E-7, E-9, etc. At first Army representative and consultants from E-5, E-9.	
		13 SM, 1 Sec'y. 4 Chem. 18	27, 8 Chemistry 35

Group (1) groups are considered to have continuing functions and form the main framework of E-9.

Group (2) groups are considered to have more limited scope and are more flexible in nature and may be created from Group (1) groups later to be absorbed by them.

[redacted]

B. E-9 PERSONNEL AS OF APRIL 1, 1944

K. T. Bainbridge, Group Leader (SM)
Mrs. B. Runyan, Secretary

Engineering Section - R. Henderson, Head (SM)
M. Kreiner, Drafting engineer
ASTP - Pfc. R. W. Friedman
Pfc. John M. Weil

Men we are attempting to obtain for Henderson.
(Carrier)
(Carlson)

H. E. Section - Lt. Schaffer, Head (SM)
R. S. North (coming April 5) (SM)

ASTP - Frederick H. Hauser
William R. Stewart
Alvin D. Van Vessem
John F. McNamara
Leo H. Jercinovic
Vladimer M. Vuletic

Physics Section - (Curtis Lampson, Head)
P. B. Moon (SM)

Being recruited - (One man from E. B. Wilson's Lab.)
(Crittenden)
(Thurston of General Radio)

ASTP -
Electronic techs. Benjamin Bederson
Keith W. Henderson
Josef A. Hofmann
R. C. Lowry

Mock-up - This section will probably be under N. F. Ramsey's group, but 2 of the following men from E-9 will be put in the pool.

ASTP - Charles R. Barnoord
Raymond L. Brin
Philip H. Dailey

[redacted]

TOTAL -- 5 Staff Members
15 ASTP
1 Draftsman
1 Secretary
22

8 to 12 additional ASTP men coming.
7 addition SM coming

Total - 15 - 19

Grand Total - 37 - 41

[redacted]

C. SPACE AND CONSTRUCTION REQUIREMENTS OF E-9

1. Chemical Engineering group will need a separate laboratory on the site. Design responsibility has to be taken by leader of that group.

2. A/C Mock-up at S-site.

   a) Additional barriers.

   b) Short road extension.

   c) Construction of a frame, representing the fuselage, which can be rolled on two short tracks to clear (1) hole in ground, or (2) hole with ramp leading out from it.

   d) I favor a hole about 9' x 9' x 5' deep and using a wrecking crane or A frame for lowering gadget into the hole prior to fuselage being rolled into position.

3. Temporary location of a hutment at the far detonation point is desirable for the crew working on 6", 12" and 24" sphere tests. This can be removed prior to the cylinder experiments. An armor plate three sided shield should be erected.

4. The Physics section, Lampson, will need a small laboratory in Building A, first floor. These rooms will need additional outlets and power wiring, benches, etc., not provided at present.

5. Full scale experiments in Pajarito or the canyon north of that, will require some construction and leveling of ground.

6. The test site will require construction of instrument observation posts and miniature pill-boxes up to some miles away, channel dredging, erection of tent or hutment temporary shelters, and moving a considerable amount of earth or sand.

7. An estimated total of seven rooms in Building A of which two are for laboratories will be necessary. This works out to 3 men per office.