

"Sandia Corporation Monthly Reports" 1958-1963

1957

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From the first report in this series, December, ~~1958~~, the Sandia status of their activity on each specific nuclear device is detailed, including both those in development and those in production. There are also sections addressed to carrier systems, test operations such as Hard Tack, other types of tests run by Sandia at Eglin, Salton Sea, White Sands, and other locations; and various other special projects and studies including in this month work on new balloons. As of this time Sandia is active in a program to develop an aerodynamic balloon capability with the first flight tests scheduled at the NTS in May and June of 1958.

April, 1958:

Under the Hard Tack operation is noted the Pinon shot which is to be the UN observer test scheduled as the last event in Hard Tack. It will be fired on a barge at EPG  Also noted in this month is the Sandia participation in the Harbor operation in Alaska for Plowshare. "Sandia will assist in topographic studies of the coast around Cape Thompson to choose the most feasible locations. Field surveys will be made this summer and the exact location decided upon late in the summer. Actual work is expected to begin in 1959. AEC has approved the FY '59 preliminary work."

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May, 1958:

Under specific device activities, first mention of Sandia's participation in the Nike Zeus warhead which is still in Phase II but on which Sandia will begin work when Phase III is authorized. This is expected to happen very soon. Under the heading of Plowshare, Sandia is analyzing and investigating the possibilities of using nuclear explosives for underground oil storage tanks. Based on Rainier data, the volume of a cavity from a nuclear detonation is estimated to be 410,000 times

the yield in cubic feet.

June, 1958:

For the first time operation Millrace is mentioned as being a series in Nevada on which liaison with Livermore is going on. No mention is made of LASL. It is said to be a series with five tests and several other one point safety shots and Sandia plans to participate with a number of projects, and in particular ground motion and other ground measurements on the largest tunnel shot, Evans.

July, 1958:

The first mention of the Jericho experiment, now scheduled for the fall of 1959 in NTS with a twenty kt underground detonation is made. X-ray measurements in a tube to simulate a high altitude environment are to be performed.

August, 1958:

The Phase III authorization for Nike Zeus was received this month.

Sandia refers for the first time to the fall operation now called Operation Hard Tack Phase II which is presently to include eleven nuclear tests and seven safety tests. At present seven are to be balloon shots, three in tunnels and one on a tower.

This report discusses Project Gnome for the first time with Sandia planning to participate in arming as well as strong motion studies. No mention is made of any plan to date. There is a brief appendix covering Teak and Orange with summaries of the results of Sandia technical measurements. Note that the radio chemical samplers were not successful on either shot. Furthermore, many of the measurements made by Sandia instrumentation were either unsuccessful or had questionable results, with an estimated 50% success rate. In spite of this, Sandia wrote, "There seems little doubt that bursts like Teak and Orange isolate

their radioactive debris from the population of the earth as effeciently as do underground shots. This fact, of course, makes the possibility of high altitude testing grounds even more attractive from a political viewpoint."

September, 1958:

For the first time since the beginning of the year, a new device has entered Phase III and Sandia development work. This is the XW-50, the Nike Zeus warhead.

The report on Hard Tack Phase II indicates that present plans are for nine one point tests underground (three in tunnels), three balloon shots, two tower shots, and six tunnel shots.

October, 1958:

Another specific warhead is added to the Sandia development activity, the XW-51, on which informal notification of Phase III has been received. This is to have applications in the Davy Crockett and Falcon missile systems.

The summary of Hard Tack Phase II indicates a total of 37 tests divided as follows: Tunnel, 7; wells (vertical holds), six; balloons, eleven; towers, eleven; surface, two.

November, 1958:

For the first time under Flowshare, Sandia activity on studying feasibility and methods of digging a ship canal with nuclear explosions is discussed.

December, 1958:

Under specific devices, the XW-52 (Sergeant application) and the TX-53 are both added to the list of Phase III programs, noted as being preliminary in this phase.

January, 1959:

The TX-53 has entered Phase III and is to be a weapon with a full fuzing option (FUFO).

February, 1959:

The XW-54 is added to the specific devices in Phase III and it is stated, "This program, formerly the XW-51, [REDACTED]

Also, the

XW-52 and 53 are both shown as being in Phase II rather than preliminary.

Sandia engineers, draftsmen, and administrative personnel moved into new facilities for Sandia at Livermore this month.

Note that in April of 1959, Sandia changed their reporting system so that the monthly report was greatly abbreviated to include only specific device details and specific testing summaries and the bulk of the former monthly reports was now to be included in a quarterly report, the first of which covered April through June of 1959.

April - June, 1959:

The addition to the specific device activities is the XW-55 for Subroc applications which has been authorized for Phase III.

One of the appendices is entitled, "Using Nuclear Explosives in the Construction of Geothermal Power Plants." The proposal at this time was to use nuclear explosives detonated far underground in geothermal steam regions to greatly increase the size of a cavity and provide extensive boundary surfaces.

Another appendix is entitled, "High Altitude Measuring and Sampling" and notes the recent high altitude events and the probability that future testing will include such events. Sandia, therefore, is developing a rocket and sampling system

with a 400 kilometer altitude capability as well as a sampling system that could be used at higher altitudes. The former involves a three stage rocket being developed by Sandia while the latter would be a package that could be carried on very high altitude tests by the warhead carrier and deployed. The latter concept looks much like what I imagine the Daisy sampler was involving leaves overlapping in a circular fashion.

July - September, 1959:

Among the appendices of this report is, "The Stockpile Sampling Program," which is ~~not~~<sup>now</sup> ongoing and began at the end of 1957.

There has been absolutely no mention of a test moratorium or of any test readiness activities or thinking. Business seems to have gone on the same as before the moratorium with the exception of any specific nuclear tests. Some of the main subject headings are: Weapon Feasibility Studies; Air Force bombers; Air Force Fighters; Navy Aircraft; Test Operations, including all sorts of bomb shape drops, missile and rocket tests, systems compatibility tests, sled tests, etc; various other special studies and projects, frequently on weapon components and carrier components; technical reports published; military liaison and training, including many technical training sessions for military organizations; and a section with usually two to four special appendices. These appendices generally are an overview of one or another specific program going on at Sandia and don't indicate the program either began or ended in the period of time of the report.

October-December, 1959:

Under specific devices, the XW-56 (Minuteman application) and the TX-57 were both added to Phase III authorization in this time period.

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January - March, 1960:

For the first time, the Vela Hotel project was mentioned as one in which Sandia

has cooperated with LASL for the past year.

Sandia has also recently made a feasibility study for the DOD on the operation of unattended seismic stations. Done in consultation with BTL, "The study included consideration of such things as the basic design of the individual stations, what type of communication system would best serve to connect the various unmanned sites (spaced perhaps 170 kilometers apart) to the control posts, what probable overall reliability could be expected from the system, and how many stations would be required to provide adequate data, taking into consideration the normal ground noise which would be encountered." Among other things, the study determined that stations constructed according to these specifications could be left unattended for four months, "the cost of establishing the unmanned communication network necessary for 850 unmanned stations would be comparable to the cost of establishing the communication facilities for the original Vienna network of 21 control posts."

Under the heading of HE projects, Sandia is in various stages of stagecoach, toboggan, buckboard, and scooter. Furthermore, Sandia has done some fairly extensive experiments in Nevada in the desert alluvium to investigate the "optimum depth of burst for various energy charges which would produce the most efficient cratering effects from nuclear explosives." Further, they are attempting to address the ratio between the efficiency of HE and nuclear explosions at various depths of burial.

One of the appendices address the "radiation effects program," studying since 1956 the effects of nuclear radiation on weapon materials and components. Some of the specific objectives are to assure functioning of weapons when exposed to other nuclear bursts; to evaluate the possible deterioration of functions if a weapon is carried by a nuclear-powered vehicle; and addressing the radiation effects problems encountered by reactor materials and instrumentation and by weapon carrier electronics.

April - June, 1960:

One of the appendices is entitled, "Nuclear Construction of a Sea Level Canal," which discusses briefly the report made a year ago (February, 1959) which showed, "that significant savings could be realized if nuclear explosives were used in the construction of a new sea level canal instead of a more conventional excavation method" and the follow-up studies and activities by Sandia, Livermore, and others on this proposal since then.

July - September, 1960:

Added to the specific weapon list, is the XW-58 which is now in Phase III. Authorized in August, this is to be a warhead for the Polaris Mark II re-entry body. Here is the first mention of a specific Vela Uniform test, project Lollipop. Referring to the Berkner panel recommendations in 1959, one of the priority recommendations was to be a  nuclear detonation in granite which became Lollipop, "and is scheduled to be fired by the AEC at the NTS in mid-November, 1960. In addition to basic seismic research, there will also be participation by an inspection team which will study the problems involved in training inspectors to recognize the site of an underground nuclear event." Briefly described is the 36 inch diameter hole already dug for the device and another shaft 800 feet deep with tunnels going out from it to "accommodate a structures response program and free field measuring equipment." There is also plans for another very deep hole near the shaft for other instrumentation.

The preliminary results of the Toboggan project are described.

One of the appendices is entitled, "The Advanced System for Weapons Test Program." The description is of the ASWT systems described elsewhere.

October - December, 1960:

At DMA's request in the area of specific weapons, the XW-56 program was cancelled

in November in favor of two more-advanced Minute Man warheads. One is the LRL XW-56-XI [redacted] and the other is [redacted] known as the XW-59. Both are now in Phase III.

This Quarterly Report for the first time indicates, at least in terms of numbers of tests, a decrease in the test operations on various bombs, missiles and rockets, and other systems. It is not a terribly large decrease.

Project Buckboard is reported on. It was designed, "to provide basic information concerning formation of craters by chemical explosives in hard rock" and is part of the Plowshare program. Several tentative conclusions were reached and are reported upon here.

Sandia has also been doing some investigation with experimentation on air blast predictions and measurements, in part due to the need to understand this for these explosions for Plowshare projects.

Another activity where Sandia has been working with the military for the past several years is in the area of determining how susceptible certain weapon components are to EM radiation.

January - March, 1961:

Under the specific weapons developments, the Vela Uniform program shows the Whirlaway Mark VII device and it says, "Radiation testing has been completed at Sandia which verifies that with proper thermal protection a Whirlaway [redacted] device may be safely placed in an underground cavity fifteen days after the detonation of [redacted] five kt [redacted] in the same cavity. Electrical and mechanical dry runs have been successfully completed at Sandia on a [redacted] Whirlaway device in preparation for a compatibility test to be conducted at NTS in April." Also mentioned in the weapons section is Sandia's participation in an Afcswc/sri vulnerability test program "to determine the effects of x-rays on warheads/re-entry vehicle assemblies. The effects are simulated by a high explosive detona-

tion." The experimentation has been completed and the write-up is in progress. Project Toboggan is reported on in this period.

April - June, 1961:

Under the Vela Uniform Whirlaway program, a brief description of the compatibility in field and environmental tests completed on 4 through 14, April at the NTS is presented. "It was established that the Whirlaway  device could be assembled in the assembly building, transported to the tunnel portal, mounted on on a mine car, moved to the zero point in the tunnel, and positioned within plus or minus one inch of the zero point. Compatibility of the black box with the polyethylene experiment, the zero rack, LRL prompt-sampling pipe, and the two LASL prompt-sampling pipes was also established. A concrete pad will be required at the zero point to provide a stable platform for the device and the lead paraffin shielding."

As far as any words addressing any Vela Uniform, Plowshare, or weapons test activities or preparations, there are none in this report. That is with the exception of the Whirlaway tests.

July - September, 1961:

The section on test operations seems to indicate that the number of specific tests with bombs, missiles and rockets, and miscellaneous systems has picked up again in quantity, at least. For instance, there were 49 Mark 57 bombs tested in various ways (vibration, fusing and firing, ballistic, parachute development, etc.). Note that there is absolutely no mention of any test resumption or test preparations either in this report or in the previous Quarterly Reports.

October - December, 1961:

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To the specific weapon list, the XW-60 (Typhon) has been added to the devices

authorized for Phase III. Typhon is the name of a Navy missile system. Under the heading "full scale test projects," the Blue Straw, Saguaro, and Nugget operations are reported on. Under Blue Straw this is listed as a special project set up to prepare for a series of atmospheric tests. "In preparation for a series of tests initially scheduled to run from November, 1961 through February, 1962, universal test vehicles were designed to using the Mark 39 Mod I type III and the Mark 15 Mod II type III units. The tests are now scheduled to start on April, 1962. A discussion of the activities states "a previously requested system, designed to trail a TM package up to 3,000 feet behind any of the full scale test vehicles, has now been cancelled in favor of a TM package to be positioned 3,000 - 6,000 feet away from and 100 feet below the burst center. To meet the new requirements, the Mark 28 - IN type II shape was chosen as a telemetry vehicle to be dropped with the Mark 15/39 shape. The present plan is to carry the Mark 28 shape in the aft bomb bay and the Mark 15/39 shapes in the forward bomb bay of the B-52 and to release the Mark 28 shape two to three seconds before the Mark 15/39. The Mark 28 will follow in a trajectory to place it 4,000 plus or minus 1,000 feet from the trajectory of the Mark 15/39 at burst time. Three Mark 39 shapes with complete fusing and firing systems were dropped during the quarter to check out the proposed electrical systems for the special test units. The first test was completely successful. On the second, there was a malfunction in the self-destruct system. This was attributed to a tack switch which had been operated at some time before self-destruct charge. On the third test, although F and F functions operated satisfactorily, the self-destruct system failed to function because the self-destruct arming circuits had been omitted."

Under Saguaro, the specific details of the Starfish and Bluegill tests as presently outlined, complete with the four components which Sandia is developing to provide a safe flight are discussed. As of this date, the dry run launch was scheduled

at PMR (Vandenberg, I think) not later than 1, April, 1962 with the first full scale test for May at Johnston.

Listed under Sandia's participation in Nugget is a "major technical program" which has fielded "a series of free-field particle motion measurements and some electra-magnetic radiation studies made under DASA sponsorship as part of Vela Uniform project. These measurements are made to afford a better understanding of the phenomena associated with the coupling of the energy of underground nuclear detonations into the seismic transmission media."

January - March, 1962:

Sandia is well on the way to completing the systems for carrying the laboratory devices and providing the F and F on the Dominic operation. Note that the companion instrumentation vehicles for the LASL Mark 15/39 ballistic cases are themselves Mark 28 IN shapes.

Under the Fishbowl summary, Sandia notes that "the Mark 49 warhead will be reversed in the Mark II RV to enhance the predictability of x-ray emission."

One of the appendices is a fairly lengthy description of the objectives and results of Gnome.

April - June, 1962:

The Dominic and Fishbowl programs are reported on where it is noted that the DME data was difficult to analyze due to the poor placement of the antenna on the drop aircraft. After changing displacement, typical accuracies of plus or minus 150 to 300 feet were obtained.

As for the Fishbowl launches, the Starfish launch included a one pod, 2 RV configuration which it was believed contributed to the failure.

Note under the heading of Nougat that the April 14th Platt shot is said to be the third in a series of vulnerability experiments conducted in the Sioux

program.

One of the appendices is entitled "Scheduling for Operation Dominic: The Critical Path Approach." Noting that this was such a crash program, Sandia at Livermore (SCLL) adopted the critical path method (CPM) "to control the shipment of all SCLL equipment for Dominic, as well as the procurement, assembly, and testing that preceded the actual drops." Examples of how these charts are prepared based on the various items that must be accomplished either in series or in parallel and the various lengths of time is presented in a brief report on this method in this appendix.

Another appendix is entitled "Project Stagecoach" and reports on this project which "resulted from a re-examination of the data accumulated from all previous cratering experiments at NTS. In these tests, HE cratering charges had been fired below the surface in desert alluvium, and the data on the effects of these subsurface explosions indicated a departure in scaling from the generally accepted cube root of yield. Since there was not enough data from the earlier programs Stagecoach was initiated and the tests took place in March of 1960 with the results now available confirming that the cube root scaling is not valid for all burst depths in desert alluvium. The principal results in numerical and narrative form are presented here.

July - September, 1962:

This report includes some words on the extension of Dominic and the activities in the interim period. The decision was made to use the Mark 36, Mod I ballistic case on all of the newly scheduled air drop events. The two C-130 aircraft were modified at Kirtland for the All-Airborne diagnostic coverage of the air drop events coming up. The instrumentation was considerably augmented in early September and now "both C-130's and the B-52 drop aircraft contain release and arm-baro signal receiving equipment to start their cameras, and equipment to

receive the fire signal from the unit. Both C-130's have a DME system, and one has an FM/FM receiving and recording station. In addition, considerable control and communications equipment was installed."

Under the Fishbowl progress, the addition of boosters and pads to the program is described with a special note given to the Checkmate event. Under this, Sandia is developing the Strypi booster for use with the recruits and Mark 50 warhead. The system development was begun in mid-August, authorized by the AEC on 24 August, and completed in about six weeks. One ballistic round was fired on 21 September and an F and F unit was tested on 30 September, both successfully. As for the above-ground tests at the NTS, Sandia's participation in making measurements both in the EM and Vulnerability areas on Small Boy are noted; as well as Sandia's responsibility for overall coordination of all AEC-sponsored projects on the Little Fellers and Johnny Boy. Sandia was responsible on these last three shots for procuring, modifying, and placing, arming, and firing all three of them.

As a result of problems encountered in Dominic, a number of projects are under way to improve the performance of the HRT for weapons diagnostics.

The appendices contain some brief summaries of Sandia's overall participation in Dominic and Nougat, and a report on the Dominic test vehicles.

Note that now, as has been going on for some time, the progress reports, at least have been devoted in ever increasing measure to Sandia's research activities and other technical areas such as materials and processes. The trend seems to be away from the reporting on the routine production, component testing, training, etc. activities toward the more technical work. This is not to say that there is a clear indication that the scope of effort by Sandia has moved from one type of activity into another.

October -December, 1962:

This report briefly describes the Dominic extension tests and Sandia's participation and goes into a little more detail on Sandia's plans for improving the air drop capability (including diagnostic aircraft) for the future as well as improvements in the area of high altitude tests, entailing improvements of the Strypi and other rocket systems and various instrumentation packages and components.

One of the appendices of this book is entitled "Project Buckboard," with a brief overview of the results and evaluations of this Sandia contribution to the Plowshare program.

January - March, 1963:

This report briefly sums up the next projects to be undertaken in the area of testing which include: Ferris Wheel, Roller Coaster, Shoal, Marshmallow, Project 437, and others with more or less relevance to nuclear testing and some already well underway or almost complete. Several of the technical measurement programs that Sandia had on Dominic are reported on at some length. In the appendix section, one of the reports is on the "Aero Dynamic Balloon System" which has been designed by Sandia to support the test devices up to 5,000 feet and in winds up to 30 knots and it is proposed for use in areas such as Christmas Island.