Revised
August, 1962

U. S. ATOMIC ENERGY COMMISSION

PLOWSHARE PROGRAM
FACT SHEET

PROJECT CHARIOT

The following information has been prepared by the Atomic Energy Commission to respond to inquiries received on Project Chariot and to place in context the survey and planning work undertaken by the Commission.

I. BACKGROUND

The Commission formally established a program, called "Plowshare", in June, 1957 to investigate and develop peaceful uses for nuclear explosives. The responsibility for technical direction of the program is assigned to the University of California, Lawrence Radiation Laboratory, Livermore, California.

Of the many possible peaceful uses for nuclear explosives, the one which is most clearly promising is excavation. This application has tremendous potential since it can make possible many large excavation projects which are not feasible nor economically justifiable with conventional methods. Such projects have been called "geographical engineering" and include excavation for harbors and canals. All available data, from experience with crater producing nuclear detonations and with chemical explosives, indicate that the use of nuclear explosives for excavation will save time and money. These data also indicate that when nuclear explosives are buried and detonated at a depth which will produce the most usable crater most of the radioactivity is trapped underground.

One study, which compares the cost of nuclear excavation with conventional methods, employs engineering data obtained from Panama Canal Company reports on the construction of a sea-level, trans-Isthmian canal. The study shows such a canal could be excavated with nuclear explosives for about one-third the cost and in about one-half the time required for conventional methods; and the resulting canal would be wider, deeper, less vulnerable to destruction, and otherwise better than would be the case if conventional methods were used. In the same connection, the Board of Consultants for Isthmian Canal Studies (H.R. No. 1960, 86th Cong., 2nd Session) said that "a sea-level canal cannot be justified economically in the near future unless it can be built more cheaply than under plans so far proposed. As of now, the only hope for an economically justificable sea-level canal appears to be by excavation through as yet unproven nuclear means." The Board recommended that "the experimental development of excavation by nuclear explosions sould be vigorously pushed by the appropriate government agency."

II. PROJECT AND SITE SELECTION

In order to develop the detailed safety and engineering technology needed before nuclear excavation could be widely applicable, the Commission authorized the Lawrence Radiation Laboratory, in November, 1957, to undertake project and site selection studies for an excavation application.

The criteria used in these studies were:

1. Location in the United States.

2. Location that assures protection of people and wildlife.

3. Conditions satisfying geologic and engineering requirements for essential experimental data.

4. Possible long-term utilitarian value.

Preliminary studies were made between November, 1957 and May, 1958. The services of many groups, including the Corps of Engineers; U.S. Geological Survey; Laboratory of Radiation Biology, University of Washington; and the E. J. Longyear Company, were utilized in conducting these studies. Many projects were considered but the excavation of a harbor in the Cape Thompson area on the northwest coast of Alaska most nearly satisfied all selection criteria.*

The proposed project, termed Chariot, was discussed with Alaskan officials, including the then Governor Michael Stepovich, and the then Congressional Delegate E. L. Bartlett. Also in order to conduct studies to determine the feasibility of the project, the Commission, by a letter dated June 5, 1958 to the Secretary of the Interior, asked that the land in a defined area be withdrawn from the public domain for use in Project Chariot. The Commission issued a public announcement on the studies for the proposed project on June 9, 1958. On July 10, 1958, the Department of the Interior informed the AEC that the Bureau of Land Management had prepared an order for the withdrawal of the land. On September 5, 1958, the Bureau of Land Management published notice of the proposed land withdrawal in the Federal Register. This notice defined the area, but incorrectly added "containing approximately 40 square miles." This error was corrected by an amendment published in the Federal Register on April 30, 1959, stating that the area is about 1600 square miles.

---

*The site lies 32 miles from the village of Point Hope and 40 miles from Kivalina, with 1960 Bureau of Census populations of approximately 324 and 142, respectively. The only other village within a 100-mile radius is Noatak with a population of about 275.

In the Summer and Fall of 1959, after discussions and correspondence with Senator Bartlett of Alaska and the Department of the Interior, it was decided that the application for land withdrawal would remain pending until more definitive plans for the project were completed. In the meantime the Department of the Interior issued, on June 1, 1959, a land use permit so that the AEC could conduct necessary studies and investigations on the site.

III. TECHNICAL PLANS

The first plan proposed for Chariot was to detonate simultaneously two 1-megaton* and two 200-kiloton* devices in order to form a harbor suitable in size for commercial utilization. This harbor would have given access to mineral deposits which were reported to be in the area. In the Summer of 1958, preliminary geologic and engineering surveys were made of the area. These surveys raised substantial doubt whether the mineral deposits in the area, even with the proposed harbor, would be suitable for commercial exploitation. Otherwise, the surveys showed that technically the site was apparently well-suited for an experimental project.

In the Spring of 1959, it was decided to continue investigation of the site on the basis that the project would be a useful excavation experiment even though it probably would not be commercially useful. At that time the experiment was revised to utilize the simultaneous detonation of two 200-kiloton devices and three 20-kiloton devices which would produce a smaller entrance channel and turning basin. This plan would have still provided adequate engineering data but would have reduced costs and simplified steps which were to be developed in the safety program.

During 1959, 1960, and 1961, several series of cratering experiments were conducted with chemical explosives at the Nevada Test Site. These experiments have indicated that two potentially important phenomena are associated with the simultaneous detonation of a row of charges. These phenomena are an enhancement of crater size and a virtual lack of debris thrown out at the ends of the crater.

To investigate these phenomena more fully, the plan for the Chariot experiment was modified further to provide for the simultaneous detonation of one 200-kiloton device and a row of four 20-kiloton devices.

---

*Kiloton and megaton are terms that measure the explosive energy of a nuclear device by comparison to the explosive energy that could be obtained from one thousand tons and one million tons, respectively, of TNT; or 10^{12} calories and 10^{15} calories, respectively.

The 200-kiloton device would be detonated about 800 feet underground producing a basin some 400 feet deep and 1800 feet in diameter. The row of 20-kiloton devices would be detonated 400 feet underground producing a channel approximately 200 feet deep, 900 feet wide, and 1900 feet long. The total area of the craters would be less than 0.2 square mile. Since the detonations would occur underground, the effects commonly associated with nuclear detonations, such as the fireball, would either not be present or would be substantially reduced. It is extimated that about 3% of the radioactivity produced would escape to the surface or the atmosphere.

The present objectives of the project are to provide:

1. Information on the formation of craters in relation to the yield and depth of burial of the explosives, and the simultaneous detonation of a row of devices;

2. Additional information on the distribution of underground and surface radioactivity which would be produced in the explosion;

3. An evaluation of the effects of the radioactivity, air blast, and seismic shock on the environment.

IV. SAFETY CONSIDERATIONS

As indicated in its June 9, 1958 announcement on Project Chariot, one of the primary concerns of the AEC has been to assure that the project could be conducted safely. Therefore, in February, 1959, a "Committee on Environmental Studies for Project Chariot" was appointed. The Committee members were appointed because of their recognized competence in scientific disciplines covering the various aspects of Arctic life that might be affected by the project or because of previous experience with the effects of nuclear explosions. Only the chairman, Dr. John N. Wolfe, is on the AEC staff. A program which eventually comprised more than thirty studies recommended by the Committee was initiated in May, 1959 and covered such fields as meteorology, ecology, biology, oceanography, geology, etc. These studies have provided a base of bioenvironmental knowledge of the area on which to assess any possible hazards and the effects of the experiment if it were conducted. Such a comprehensive bioenvironmental program has never been undertaken before and its intrinsic scientific value is considerable.

The first statement of the Environmental Studies Committee was issued in January, 1960. Although the work of the Committee was still in a preliminary stage, this report was specifically requested by the Commission to provide a basis upon which decisions could be made as to the future scope and content of the project. The statement was based on the Committee's knowledge of the region and the results of earlier investigations by others. A First Summary by the Environmental Studies Committee was prepared in December, 1960 and, after editing and printing,

distributed in May, 1961.* The report explicitly pointed out that in some areas the data were incomplete and that further studies and investigations were in process. Also certain problem areas were identified which would have to be taken into account in developing any final plans for the project. Although certain studies concerning radioactivity in northwestern Alaska will continue, those directly related to Project Chariot will end by September, 1962 and a second summary report is now being prepared based on additional information collected; it will be made available through the same channels as the first report. These investigations have not revealed any way in which Project Chariot would endanger the local inhabitants or the plant and animal species from which they derive their livelihood.

Additional independent review of Project Chariot is provided by the Plowshare Advisory Committee (PAC). The PAC, a group of twelve outstanding men with broad experience and backgrounds in a wide range of fields, with an AEC chairman, was established in 1959 by the Commission in order to obtain independent and objective advice and evaluation regarding the entire Plowshare Program. Based on the environmental studies reports and on comparisons of radioactivity at the Nevada Test Site, the PAC has advised that it appears that Project Chariot can be conducted safely. They have endorsed the project and the need for the data which would be obtained from it. At the Commission's request the PAC has established a Subcommittee on Project Chariot to review the environmental studies reports and to assess the significance of the bioenvironmental effects predicted. Dr. Paul B. Sears, formerly Chairman of the Conservation Program of Yale University, has been designated Chairman of this Subcommittee by the Commission.

V. PRESENT STATUS

Following resumption of Soviet atmospheric nuclear tests in 1961, fallout monitoring stations were established at the Project Chariot site and at several villages to detect changes in the radiological environment in the project area. The data collected are available publicly in the U. S. Public Health Service's monthly bulletin "Radiological Health Data."

---

* This report, TID - 12439, "Bioenvironmental Features of the Ogotoruk Creek Area, Cape Thompson, Alaska, A First Summary by the Committee on Environmental Studies for Project Chariot," December, 1960, is available from the Office of Technical Services, Department of Commerce, Washington 25, D.C. for $1.00.

Through a public announcement issued on August 24, 1962 the AEC states, that after reviewing the plans for Project Chariot, it had decided to defer, for the present, any decision to recommend to the President on whether to conduct the experiment. Some of the data originally planned to be obtained from Chariot are now available or may be developed from other experiments. As new data are developed they will be evaluated with respect to their possible influence on the role the Chariot experiment could play in the over-all Plowshare Program. The camp site is being placed in a caretaker status and will be available for use in the interim for other possible scientific investigation purposes.

With respect to technical plans for Project Chariot. it should be recognized that although they have been modified twice they may be revised again if international, economic, technical, or safety considerations indicate that a change is warranted.

The Commission has not recommended that the President authorize any nuclear detonations for the proposed Project Chariot.

Division of Peaceful Nuclear Explosives
U. S. Atomic Energy Commission
Washington 25, D.C.