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May 1, 1956

Brigadier General Alfred D. Starbird
Director of Military Application
U. S. Atomic Energy Commission
1901 Constitution Avenue, N. W.
Washington 25, D. C.

SUBJECT: OUTLINE OF UCRL-LIVERMORE ROVER PROGRAM

Dear General Starbird:

This report describes the method of the attack UCRL proposes to make in developing a nuclear rocket engine. The program is broken down into several phases which follow each other in time, and into several problem areas which are to be attacked concurrently as indicated.

I. PHASE I

Phase I will occupy, roughly, most of the next two years, and may be characterized as the "Core Feasibility Phase". For this phase we have separated the development program into three separate problem areas, namely, Hot Critical Experiments, Erosion and Corrosion Problems, and Engine Auxiliary Problems.

1. Hot Critical Experiments

We propose to design and build a series of reactors, called the Tory series, consisting of a cylindrical graphite core impregnated with uranium having a C to U ratio in the range of 500 to 1000:1, a diameter of about 24 inches, a length of about 60 inches. It will have end reflectors of graphite and be surrounded by an annular D_2O reflector. It will be controlled by vanes in the D_2O, it will be cooled by passing nitrogen gas through axial holes having diameters within the range of 1/8 to 1/4 inch, and occupying in all some 30%-40% of the volume. It is hoped to operate at temperatures in the low 2000's of degrees Kelvin, and to build the power up from perhaps 0-30 mw at the start to perhaps 300 mw at the end of a year of operation. We presently plan to begin low power operation in mid-1957.

In designing and building this reactor, we will be attacking the following problems:

a. Preparation of impregnated graphite, including problems of uniformity, concentration, and stabilization of U, and uniformity of the graphite itself.

b. Experimental and theoretical analysis of the neutronics problem, including power distribution, reactivity control, and reactivity variation with temperature. (A cold critical experiment is now in progress using a new assembly known as Puppy.)