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AIRCRAFT NUCLEAR PROPULSION PROJECT

QUARTERLY PROGRESS REPORT

FOR PERIOD ENDING DECEMBER 10, 1955

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ORNL-2012, Part I, II, III
C-84 – Reactors-Special Features of Aircraft Reactors

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AIRCRAFT NUCLEAR PROPULSION PROJECT

QUARTERLY PROGRESS REPORT

For Period Ending December 10, 1955

W. H. Jordan, Director
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A. W. Savolainen, Editor

DATE ISSUED

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FOREWORD

This quarterly progress report of the Aircraft Nuclear Propulsion Project at ORNL records the technical progress of the research on circulating-fuel reactors and other ANP research at the Laboratory under its Contract W-7405-eng-26. The report is divided into three major parts: I. Reactor Theory, Component Development, and Construction, II. Materials Research, and III. Shielding Research.

The ANP Project is comprised of about 530 technical and scientific personnel engaged in many phases of research directed toward the achievement of nuclear propulsion of aircraft. A considerable portion of this research is performed in support of the work of other organizations participating in the national ANP effort. However, the bulk of the ANP research at ORNL is directed toward the development of a circulating-fuel type of reactor.

The design, construction, and operation of the Aircraft Reactor Test (ART), with the cooperation of the Pratt & Whitney Aircraft Division, are the specific objectives of the project. The ART is to be a power plant system that will include a 60-Mw circulating-fuel reflector-moderated reactor and adequate means for heat disposal. Operation of the system will be for the purpose of determining the feasibility, and the problems associated with the design, construction, and operation, of a high-power, circulating-fuel, reflector-moderated aircraft reactor system.

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CONTENTS

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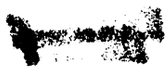
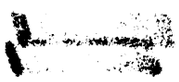
PART III. SHIELDING RESEARCH





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ANP PROJECT QUARTERLY PROGRESS REPORT

SUMMARY

PART I. REACTOR THEORY, COMPONENT DEVELOPMENT, AND CONSTRUCTION

1. Reflector-Moderated Reactor

Construction work is now under way on the Aircraft Reactor Test facility. Package 1 construction, which consists in alterations to the existing building, an addition to the building, and installation of the reactor cell, was 10% complete at the end of the quarter. A major design change was made in order to provide more space for NaK system piping and equipment, as well as for a special heat-dump facility for the removal of heat from the fuel fill-and-drain tank. Drawings and specifications for a modified version of package 2 work were completed. This work now consists in the installation of the diesel generators and facility, the electrical control center, and the spectrometer room electrical and air-conditioning equipment. The piping work for nitrogen, air, cooling water, helium, lubricating oil, and hydraulic oil drive systems was removed from the package 2 work unit and was designated as package A. Design work continued on package 3, which covers the experimental instruments, controls, process lines, and process equipment to be installed by ORNL forces.

System flowsheets and instrumentation lists were prepared in an initial attempt to define the entire ART. The flowsheets show the various components of the system; the annunciator pickup and presentation locations; the operating conditions of temperature, pressure, and flow rates; the control stations for electrically operated components; the normal valve positions and uniform valve identification; and line sizes.

The fuel-to-NaK heat exchanger design was modified to overcome interferences at the headers and to provide additional space in the region of the headers for the beryllium support struts. Dimensional and operating data for the heat exchangers were revised accordingly.

The problem of cooling the fuel fill-and-drain tank was studied. Dual NaK systems are to be utilized for both cooling and heating the tank. Each system is to be capable of operating individually and of removing the total maximum heat load of 1.75 Mw from the fuel in the tank.

The basic mechanical design work on the ART lead-and-water shield and supports was completed, and the procedure for assembly and installation was studied. A comparative evaluation of rubber and aluminum containers for the borated shield water showed aluminum to be preferable on all counts, including weight.

Additional core flow studies were made on both the full-scale aluminum and plastic core models. Photographs were made of the flow patterns obtained with various core inlet configurations. Intensive studies of the various flow patterns are under way.

An equipment layout was prepared for the Engineering Test Unit (ETU), and work was started on design of the facilities required for operation of the unit. Design problems have delayed the issuance of firm drawings of the reactor components, and it is estimated that operation of the ETU will be about three months behind the originally scheduled date of September 1, 1956.

Instrumentation lists were prepared for each ART system, and instrument sensor locations were designated. Five permanent instrument information centers will be used, in addition to three temporary ones, and some instruments will be located and read on the equipment. Layouts of control and instrument panels and boards are being prepared, and elementary wiring diagrams have been completed. The layout of the control rod and drive mechanism is being prepared.

The problems of procurement of special reactor materials and components are being investigated. Equipment for machining the large beryllium reflector blocks is being prepared by The Brush Beryllium Co. A newly developed Hydrospin process shows promise of being satisfactory for the fabrication of the required six sets of thin Inconel shells, which vary from 18 to 54 in. in diameter. The processing of the 100,000 lb of special CX-900 Inconel required for tubing is under way. Welders qualified under the special ORNL procedures are being trained for several

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