GA–C23333

DIRECT ENERGY CONVERSION FISSION REACTOR

for the period December 1, 2000 through February 28, 2001

by

L.C. BROWN

Prepared under
Nuclear Energy Research Initiative (NERI)
Program. DE-FG03-99SF21893
for the U.S. Department of Energy

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Direct Energy Conversion Fission Reactor

Nuclear Energy Research Initiative (NERI)
Program DE-FG03-99SF21893
Technical Progress Report
December 2000 through February 2001

Highlights

- Analysis of the side forces on the cathode of the fission electric cell indicates that large side forces may occur. Introduction of side perturbations at adjacent cells may allow the net forces to cancel out.

Introduction

Direct energy conversion is the only potential means for producing electrical energy from a fission reactor without the Carnot efficiency limitations. This project was undertaken by Sandia National Laboratories, Los Alamos National Laboratories, The University of Florida, Texas A&M University and General Atomics to explore the possibilities of direct energy conversion. Other means of producing electrical energy from a fission reactor, without any moving parts, are also within the statement of proposed work. This report documents the efforts of General Atomics. Sandia National Laboratories, the lead laboratory, provides overall project reporting and documentation.

Current Quarter Accomplishments

Project Coordination

A project coordination meeting was held January 30th in Albuquerque. GA was formally assigned the tasks of defining fuel fabrication techniques for the magnetically insulated fission electric cell (MIFEC) and the fission fragment magnetic collimator reactor (FFMCR). GA was also assigned the task of modeling fission product removal from the vapor core reactor (VCR) with MHD concept.

Magnetically Insulated Fission Electric Cell

A potentially fatal flaw with the concept was discovered by L. Brown of GA. Any radial deviation in the cathode position from the exact center of the anode causes a net radial force due to the resultant asymmetry in the electric field. This radial force is countered by axial tension in the cathode support rod. Preliminary calculations indicated that, for small offsets, the required tension is independent of the amount of offset. Considering only one cell in the middle a of 3 m string of cells, the preliminary results indicated that the tension in the cathode support rod is too high to be accommodated by a support rod of reasonable dimensions. The problem is being addressed by Sandia with GA's assistance. Preliminary indications are that tension may be moderated by imposing a known radial perturbation in the field at each cell and arranging the direction of the offsets such that the direction of the radial force in any give cell is opposed by the radial force in the cells above and below the cell.

Planned Next Quarter Activities

We will begin analysis of the fuel recycle loop of the gas core reactor concept.

Schedules and Budgets

GA is on schedule with its assigned tasks. Status of all tasks of the combined project schedule is indicated in Table 1 and Fig. 1. Expenditures to date and projected expenditures for the rest of Phase 2 are given in Fig. 2. Sandia has requested an extension of the GA contract so as to match the revised contracts of the other participants.

Table 1. Summary of NERI Tasks – Phases 1-3

Identification Number	Milestone/ Task Description	Planned Completion Date	Actual Completion Date	Comments
1A(i).	Preliminary critical review of previous work	Jan 2000	Jan 2000	Work complete
1A(ii).	Review foreign literature	Nov 2000	Nov 2000	Work terminated due to classification issues
1B.	Identify opportunities for improvement	Mar 2000	Mar 2000	Work complete
1C.	Develop new/alternate concepts	May 2000	May 2000	Work complete
1D.	Characterize/compare alternate concepts	Jun 2000	July 2000	Work complete
1E.	Screen to 3 promising concepts	Jul 2000	Sept 2000	Work complete
1F.	Final (annual) Report for Task 1	Nov 2000	Nov 2000	Work in complete
2A.	Identify and develop 3 concepts	Apr 2001		Work in progress
2B.	Identify critical technology issues	May 2001		Work in progress
2B'.	Define key experiments	Jun 2001		Work not begun
2C.	Compare and assess conceptual designs	Jun 2001		Work not begun
2D.	Prioritize concepts	Aug 2001		Work not begun
2E.	Final (annual) Report for Task 2	Oct 2001		Work not begun
3A.	Preliminary design of most promising concept	Mar 2002		Phase 3
3B.	Analyze technical performance	Jul 2002		Phase 3
3C.	Analyze economic performance	Jul 2002		Phase 3
3D.	Identify manufacturability issues	Jun 2002		Phase 3
3E.	Perform selected experiments	Sep 2002		Phase 3
3F.	Complete Phase 3 and project	Oct 2002		Phase 3
3F'.	Final Report for Phase 3 and project	Oct 2001		Phase 3

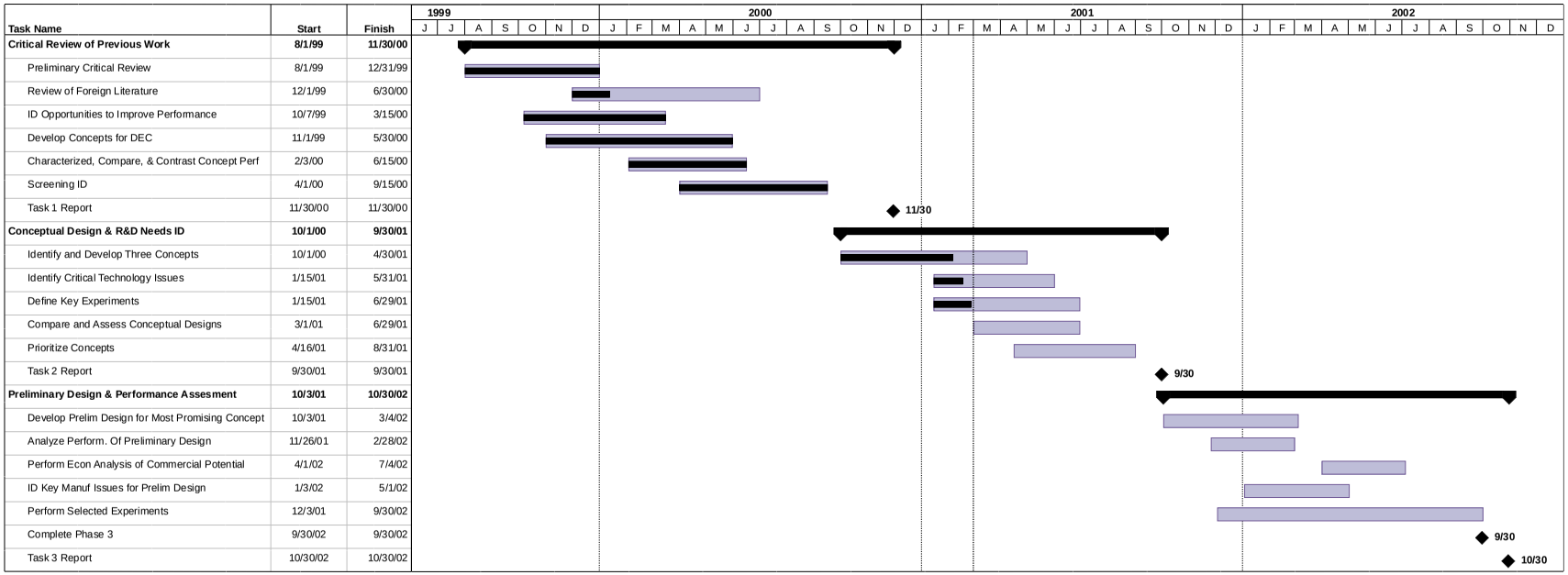

Fig. 1. Project Schedule.

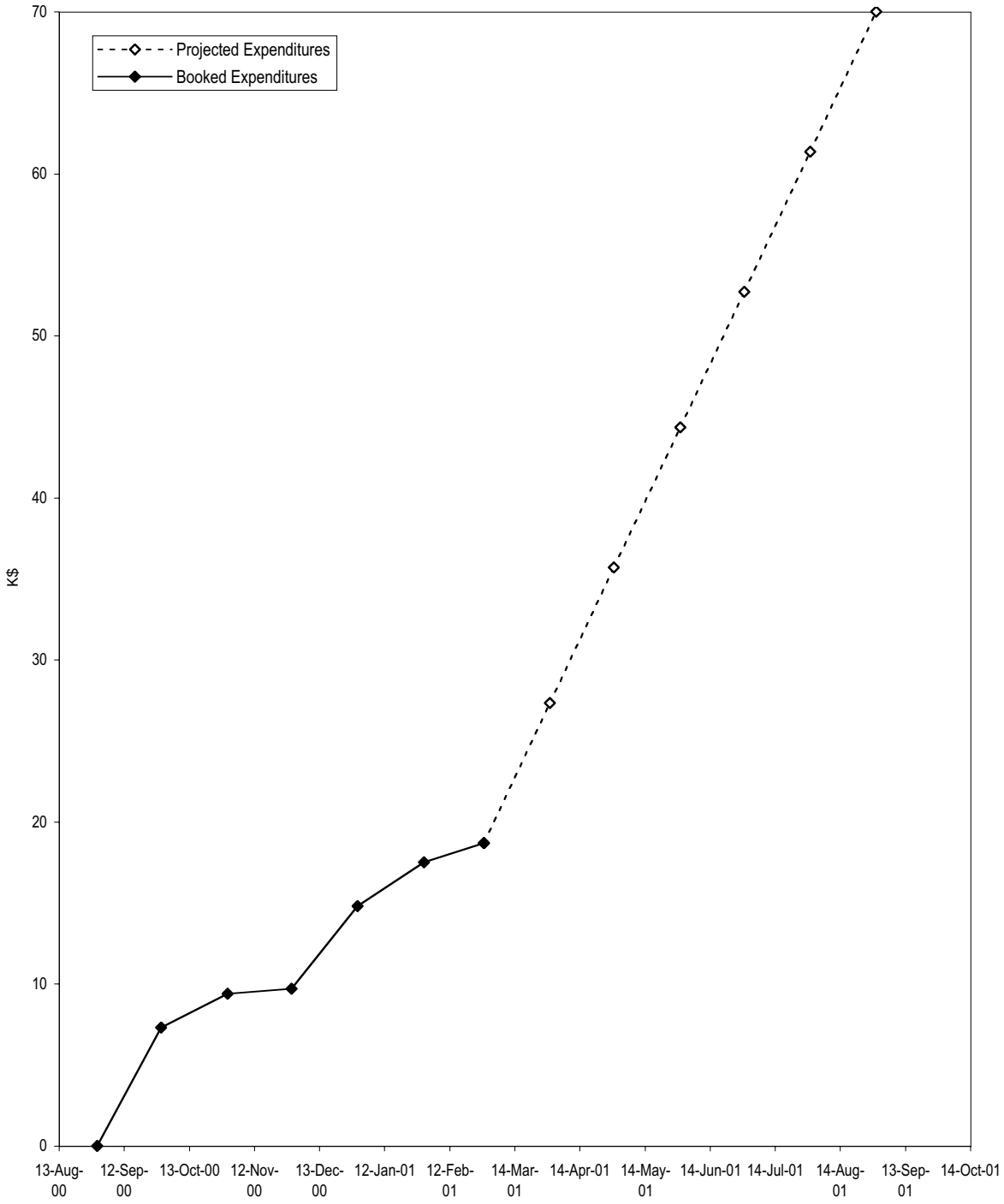

Fig. 2. Spending Profile