GA–C23333

DIRECT ENERGY CONVERSION FISSION REACTOR

for the period
September 1, 1999 through November 31, 1999

by
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Direct Energy Conversion Fission Reactor

Nuclear Energy Research Initiative (NERI)
Program DE-FG03-99SF21893
Technical Progress Report
September through November 1999

Highlights

- A kick-off meeting/brainstorming session was held in November at Sandia.
- A prompt critical pulsed reactor was proposed at the brainstorming session and deemed worthy of further consideration by the participants.

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

GA sent a representative, Lloyd Brown, to the kick-off meeting held November 18–19. Dr. Brown participated in the discussions and brainstorming.

Based on the TurboStar concept for direct energy conversion of inertial fusion energy, Dr. Brown proposed a prompt critical pulsed fission reactor. A schematic diagram of this concept is presented in Figure 1. The reactor has an electrically conductive liquid fuel, probably aqueous, contained in a volume. A prompt critical reaction causes the liquid to be expelled from the volume due to gas generation throughout the volume. The expelled liquid passes through a MHD channel producing electrical energy, after which the fuel drains back to the reactor volume. A means is provided to modulate the reactivity such that there is sufficient time for the fuel to fully return to the reactor before it pulses again.

Action item assignments to GA are: (1) Estimate minimum material thickness for the spherical fuel shell of a DEC cell and (2) Investigate the feasibility of the prompt critical pulse reactor (PCPR) proposed during the brainstorming session.

Scheduled Progress

All tasks are proceeding on schedule. The one task scheduled for completion in this time frame, preparation of the screening criteria, was completed on time.

Planned Next Quarter Activities

Minimum material thicknesses will be estimated for the fuel shell of a DEC cell. Other fuel concepts will be evaluated as the need becomes evident.

A preliminary feasibility evaluation will be made for the PCPR concept.

Schedules and Budgets

All tasks are on schedule as indicated in Table 1 and Figure 2. Expenditures to date and projected expenditures for the rest of Phase 1 are given in Figure 3. As of the end of November we are almost $9K under the straight-line spending profile.

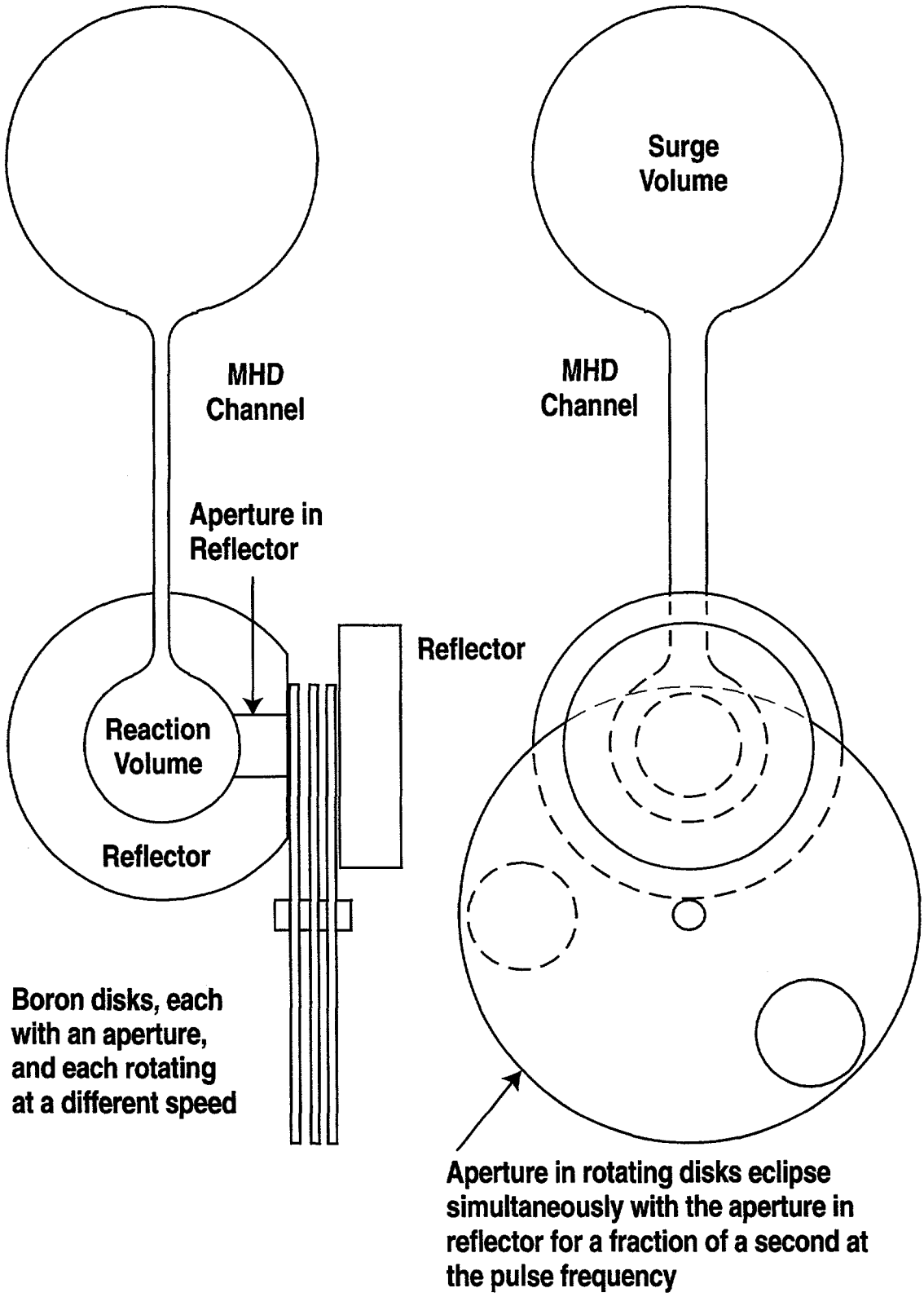
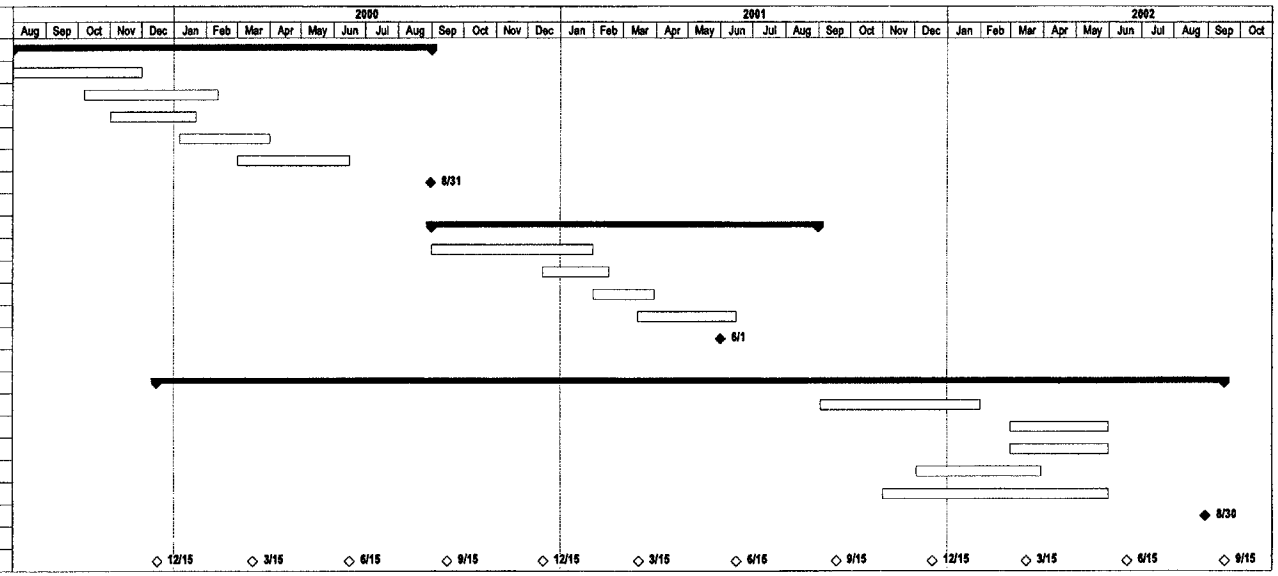


Figure 1. Prompt critical pulsed reactor.

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

Identification Number	Milestone/ Task Description	Planned Completion Date	Actual Completion Date	Comments
1A.	Preliminary critical review of previous work	Jan 2000		Work in progress and on schedule
1B.	Identify opportunities for improvement	Mar 2000		Work in progress and on schedule
1C.	Develop new/alternate concepts	May 2000		Started
1D.	Compare new/alternate concepts	Jun 2000		Work not begun
1E.	Screen to 3 promising concepts	Jul 2000		Work not begun
1F.	Final (annual) Report for Task 1	Aug 2000		Work not begun
2A.	Identify and develop 3 concepts	Feb 2001		Phase 2
2B.	Identify critical technology issues	Mar 2001		Phase 2
2C.	Compare and assess conceptual designs	May 2001		Phase 2
2D.	Identify most promising concept	Jul 2001		Phase 2
2E.	Final (annual) Report for Task 2	Aug 2001		Phase 2
3A.	Preliminary design of most promising concept	Feb 2002		Phase 3
3B.	Analyze technical performance	Jun 2002		Phase 3
3C.	Analyze economic performance	Jun 2002		Phase 3
3D.	Identify manufacturability issues	Apr 2002		Phase 3
3E.	Perform selected experiments	Jun 2002		Phase 3
3F.	Final (annual) Report for Task 3	Aug 2002		Phase 3

WBS	Task Name	Start	Finish
1	**Critical Review of Previous Work**	8/1/99	8/31/00
1A	Preliminary Critical Review	8/1/99	11/30/99
1B	ID Opportunities to Improve Performance	10/7/99	2/11/00
1C	Develop Concepts for DEC	11/1/99	1/21/00
1D	Characterized, Compare, & Contrast Concept Perf	1/6/00	3/31/00
1E	Screening ID	3/1/00	6/15/00
1F	Task 1 Report	8/31/00	8/31/00
2	**Conceptual Design & R&D Needs ID**	9/1/00	8/31/01
2A	ID Three Concepts from Task 1	9/1/00	1/31/01
2B	ID Critical Tech Issues and R&D Needs	12/15/00	2/15/01
2C	Characterize, Compare & Contrast Rx Concept Designs	2/1/01	3/30/01
2D	ID Most Promising Concept for Further Development	3/15/01	6/15/01
2E	Task 2 Report	6/1/01	8/31/01
3	**Preliminary Design & Performance Assesment**	12/15/99	9/16/02
3A	Develop Prelim Design for Most Promising Concept	9/3/01	1/31/02
3B	Analyze Perform. Of Preliminary Design	3/1/02	5/31/02
3C	Perform Econ Analysis of Commercial Potential	3/1/02	5/31/02
3D	ID Key Manuf Issues for Prelim Design	12/3/01	3/29/02
3E	Perform Selected Experiments	11/1/01	5/31/02
3F	Task 3 Report	8/30/02	8/30/02
	Quarterly Report	12/15/99	9/16/02



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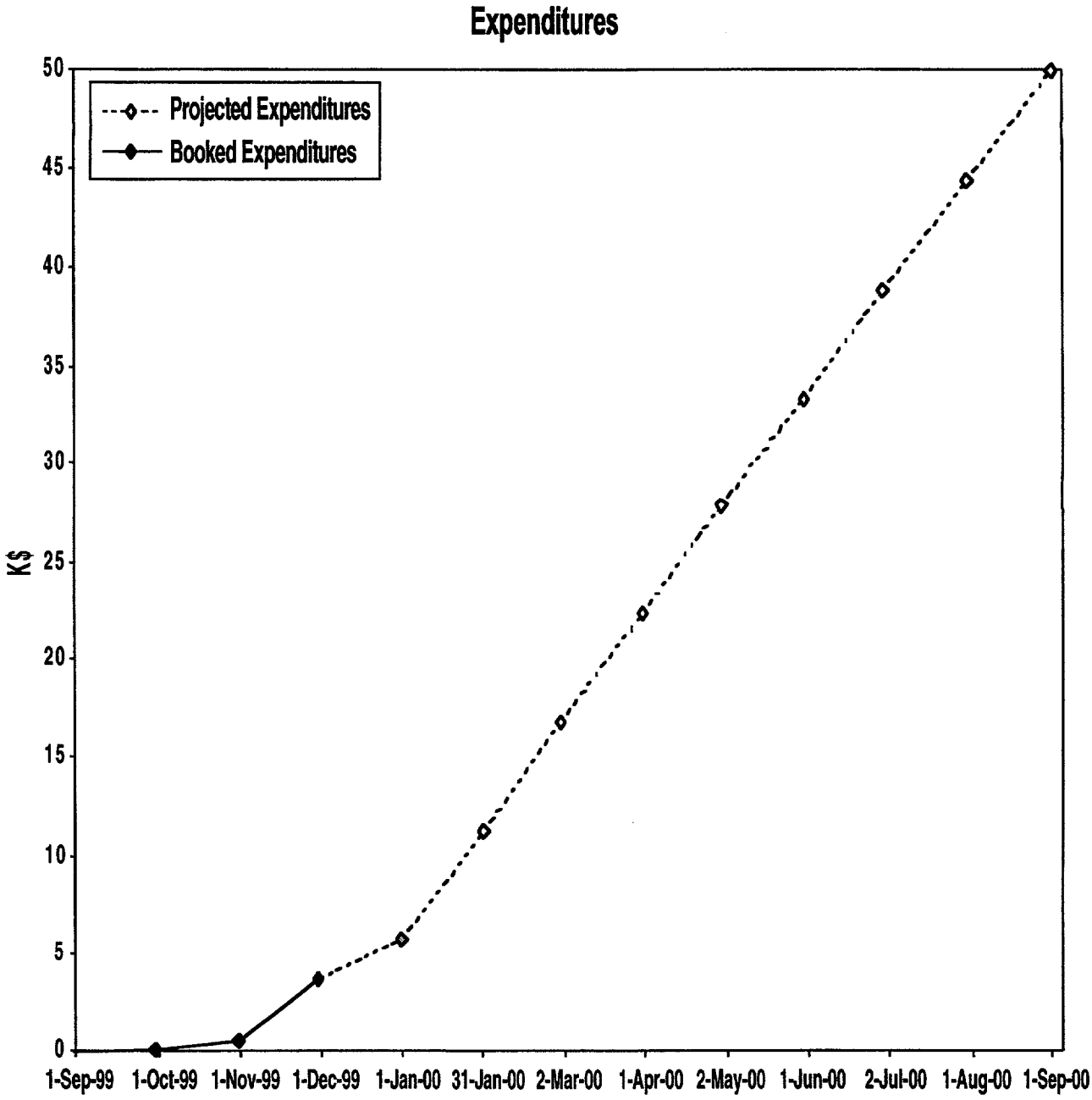

Figure 3. Spending Profile