Summary of Technical Plans for the Remainder of PROMETHEUS Study

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Study DOE Review Meeting,
Washington, D.C., August 28, 1991

Summary of Remaining Tasks

- **Complete Conceptual Designs**
  - Finalize Laser-Driven Reactor Design
  - Shift effort to developing HI Reactor Design

- **Cost and Economic Analysis for L and HI Designs**

- **Identify, characterize Issues**
  - Key issues for all major areas
  - (Top level) critical issues

- **Identify R & D**
  - To resolve key issues
  - Facilities and time

- **Comparative Analysis of L and HI Designs**
  - Comparison of technical issues
  - Detailed comparison based on evaluation methodology

- **Write and Issue Final Report**

Remaining Conceptual Design Tasks

PROMETHEUS - L

- Review and Refine engineering design for all subsystems
- Perform a final iteration to ensure self-consistency for the "point" design
- Finalize configuration and remote maintenance, and BOP Design
- Complete ongoing analysis tasks

PROMETHEUS - H

- Complete system studies tradeoffs
- Complete tradeoffs and make final selection for major subsystems
  - HI Driver characteristics and architecture
  - Cavity (wall protection, blanket)
  - Configuration and remote maintenance
- Develop balance of plant design
- Final iteration on design parameters self consistency
- Complete analysis tasks

Technical Issues and R & D

Objective

Identify and characterize Key Technical Issues for Inertial Fusion Reactors (Heavy Ion- and Laser-Driven) and identify R & D to resolve them

Approach

1. **Identify Issues**

   - Key Issues
     (Large number of discipline-specific issues)
   - Critical Issues
     (limited number of top level issues)

2. **Characterize Issues** [Quantitative Summary Table and Issue Description builds on FINESSE Methodology]

   - Potential Impact
   - Design Specifity
   - Level of Concern
   - Operating Environment
   - Relevance to MFE

3. **Identify R & D**

   - Facilities (new, existing, or common to MFE)
   - Cost
   - Time

IFE Issues Summary Table (Format Illustration)
(This summary table will be several pages)

Issue/Technical Area	Reactor Concept	Potential Impact	Design Specifity	Level of Concern	Operating Environment		Relevance to MFE
					Neutron	Parameters	
A. Target							
a. Target Physics							
1. (Title for issue number A.a.1)							
2. (Title for issue number A.a.2)							
3. etc.							
b. Target Fabrication							
1. (issue number A.b.1)							
2. etc.							
B. Driver							
a. Laser Driver							
1. (issue number B.a.1)	**L**						
2. etc.	**L**						
b. Heavy Ion Driver							
1. (issue number B.b.1)	**HI**						
2. etc.	**HI**						
etc.							

Notes to team members
Note: Format for the entries are explained in Table Z, the text and the attached table.
Note: Letters A, B, C, etc. for Majer System/Area is the same as Table IV.1.

Definition of Potential Impact Table Entries

Feasibility Issues:	**DW**	May Close the Design Window
	US	May Result in Unacceptable Safety Risk
	UL	May Result in Unacceptable Reliability, Availability or Lifetime
Attractiveness Issues:	**RP**	Reduced System Performance
	RL	Reduced Component Lifetime
	IC	Increased System Cost
	RS	Less Desirable Safety or Environmental Implications

Examples of Critical Issues

- **Reactor Chamber Evacuation and Rep Rate**

  Including limitations on Repetition Rate, Vaporization and Recondensation, required and achievable chamber pressure, debris and tritium handling/processing/recycling, Driver Energy/Rep. Rate /Gain Trade

- **Wall Protection Scheme**

- **Optics Requirements, Performance and Lifetime**

- **Driver Performance, Efficiency, Cost and Reliability for various architectures**

- **Illumination Requirements for various types of Targets**

  indirect, direct
  constant focus, zoom focus, etc.
  illumination uniformity, power balance, target positioning, etc.

- **Target Performance and Requirements**

  acceleration limits, thermal environment gain vs. illumination uniformity, output spectra

- **Viability of SiC Structures**

  manufacturing, survivability of high radiation, heat and fatigue environment

Evaluation Methodology and Comparative Evaluation Analysis

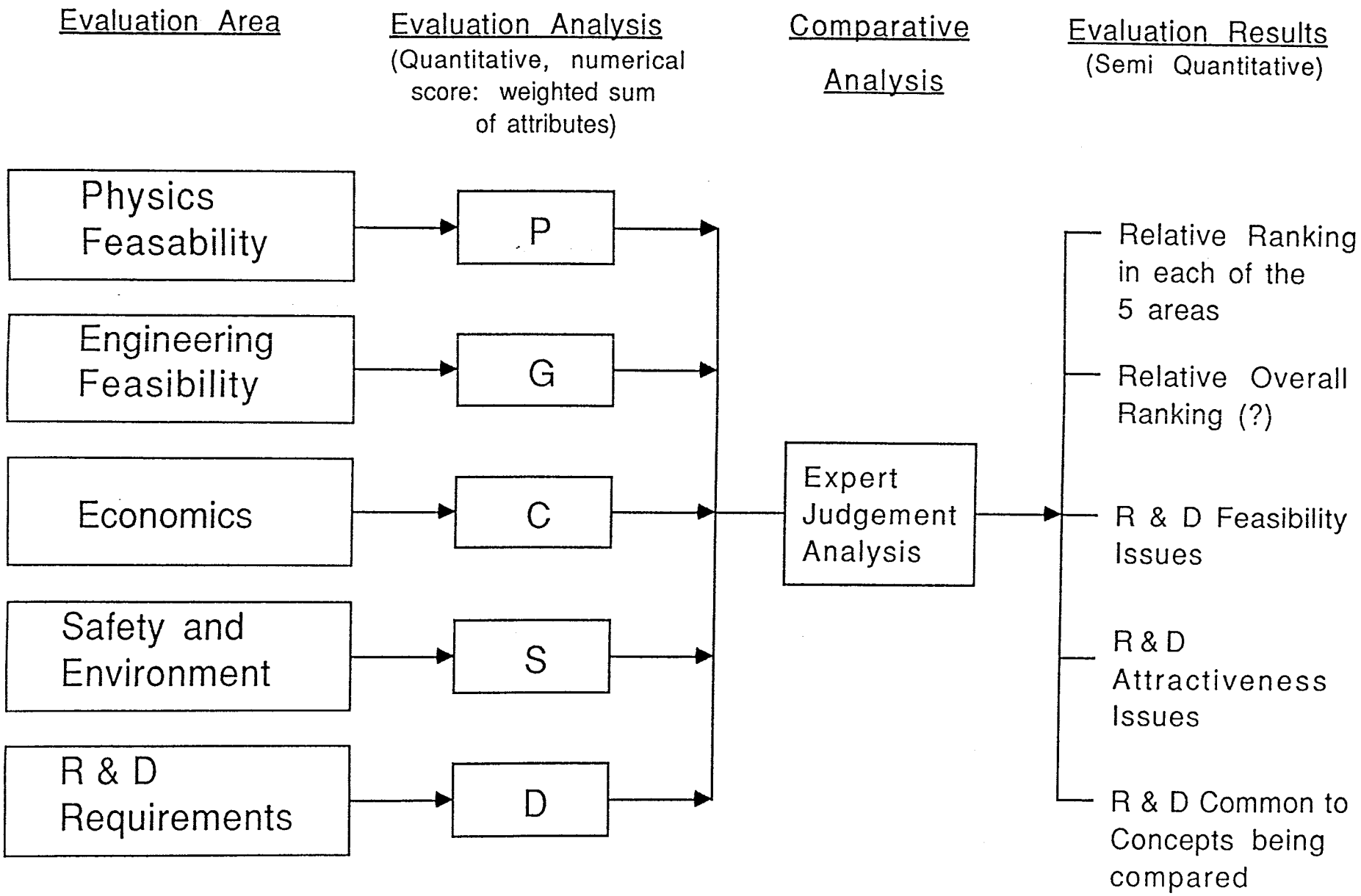
- An Evaluation Methodology is being developed for utilization in
  - Comparison of different IFE Reactor Options (Laser- and Heavy-Ion Driven)
  - Comparison of MFE and IFE Reactor Concepts

[Notes:
- the MFE/IFE comparison is deleted from the scope of the present study
- MFE/IFE comparison has not been intended to rank them (can not)
  The idea is to understand what are the unique, different and common issues and features]

- The methodology evolves attempts in previous studies (BCSS, FINESSE, etc.) to a more mature and broader framework

- Key Areas of Comparison:
  - Physics Feasibility
  - Engineering Feasibility
  - Economics
  - Safety and Environment
  - R&D Requirements

Evaluation Methodology Approach



PROMETHEUS Brief Report Outline (Chapters)

Executive Summary (~ 5 pages)

I. Introduction (~ 5 pages)

II. Study Overview (50 to 70 pages)

III. Study Objectives, Requirements, Guidelines and Assumptions (~ 20 pages)

IV. Key Technical Issues and R & D Requirements (~ 50 pages)

V. Conceptual Designs Selection and Description (> 400 pages)
(Detailed, broken down by subsystem, for each subsystem laser and heavy ion designs are described, rationale for selection is given)

VI. Comparison of IFE Designs (~ 40 pages)

A. Appendices A → ? as needed

PROMETHEUS Detailed Report Outline

Executive Summary (~ 5 pages) [Waganer, Abdou]

I. Introduction (~ 5 pages) [Waganer, Abdou]

II. Study Overview (~ 50 to 70 pages) [Waganer, Abdou, and subsystem leaders]

1. Introduction (Waganer)
2. Key Requirements and Assumptions (Abdou)
3. PROMETHEUS-L Laser Design Overview [Driemeyer, Lee, Tillack, Ghoniem, Linford, Drake, Matsugu, Ostrow]
4. PROMETHEUS-H Heavy Ion Design Overview [Lee, Driemeyer, Tillack, Ghoniem, Linford, Drake, Millard, Matsugu, Ostrow]
5. Key Technical Issues and R & D Requirements (Abdou and subsystem leaders)
6. Comparison of IFE Designs (Abdou, Waganer and subsystem leaders)
7. Conclusions (Waganer, others)

III. Study Objectives, Requirements, Guidelines and Assumptions (~ 8 pages) (Abdou, Waganer)

IV. Key Technical Issues and R & D Requirements (~ 50 pages) (Abdou, Waganer and subsystem leaders)

V. Conceptual Designs Selection and Description (Waganer) (As long as needed, probably ~ 400 pages)

1. Introduction (Waganer)
2. Parametric system Studies (Driemeyer)
   - 2.1 LASER
   - 2.2 Heavy Ion
3. Configuration and Maintenance Approach (Lee, Millard)
   - 3.1 LASER
   - 3.2 Heavy Ion
4. Target (Physics, Fabrication, Factory, delivery) (Drake)
   - 4.1 LASER

4.2 Heavy Ion

5. Driver (including transmission and focusing) (Linford)

5.1 LASER (Linford)

5.2 Heavy Ion (Maschke)

6. Vacuum System (Calkins)

6.1 LASER

6.2 Heavy Ion

7. Tritium Processing System (Matsugu)

7.1 LASER

7.2 Heavy Ion

8. Cavity Design [Wall Protection, Blanket and shield] (Tillack, Ghoniem)

8.1 Introduction

8.2 Wall Protection [Tillack, Ghoniem, Ying]

8.2.1 Laser

8.2.2 Heavy Ion

8.3 Blanket [Raffray, Youssef, Ying, Abdou]

8.3.1 LASER

8.3.2 Heavy Ion

8.4 Primary Shield [Youssef, Abdou, Lee]

8.4.1 LASER

8.4.2 Heavy Ion

9. Heat Transport and Secondary Energy Conversion (Ostrow)

9.1 LASER

9.2 HI

10. Balance of Plant (Ostrow)

10.1 LASER

10.2 HI

11. Remote Maintenance (Millard, Lee)

12. Material Data Base and Other Considerations (Ghoniem, Sharafat)

    12.1 LASER

    12.2 HI

13. Safety and Environmental Analysis (Ostrow et al)

    13.1 LASER

    13.2 HI

14. Economic Analysis (Waganer, Driemeyer)

    14.1 LASER

    14.2 HI

VI. Comparison of IFE Designs (~ 40 pages) (Abdou, Waganer and Subsystem Leaders)

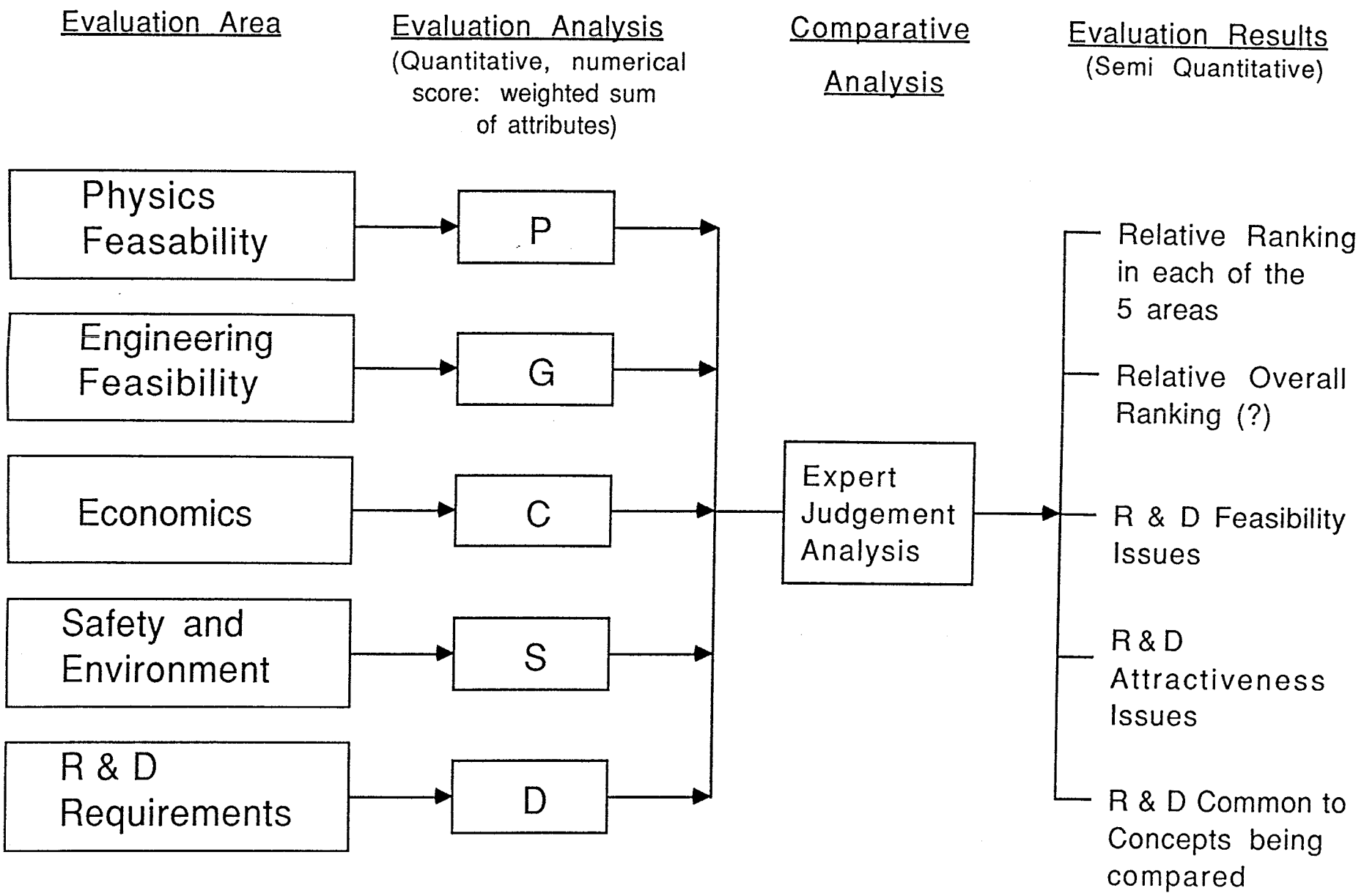
1. Introduction

2. Evaluation Methodology

3. Comparative Evaluation Results

A. Appendices as needed (Appendix A thru Appendix ?)

Evaluation Methodology Approach



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