



# Discussion of Tasks

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# Mid-term ARIES Pathway Project Goals

- Define top-level Requirements (qualitative and quantitative) of the next step facility (fusion power technology demonstration and certification facility).
- System Code: Understand trade-offs to provide a range of embodiments for fusion power plants (and thus Demos)
  - Trade-offs (visualization)
  - Develop costing model/object functions for the next-step facility.
  - Operate in optimizer mode.
- Interim report
  - Top-level requirements
  - Systems code trade-off studies (of power plants)
  - What is new in our approach!



# Working Groups

- **Identifying the technical issues that has to be addressed**
  - **Report of Working groups (Use Mark's format).**
  - **Use TRLs to identify gaps**
  - Outlines due Dec. 23 (in sufficient depth so that we can ensure all issues are covered among working groups). Outline should also include issues/systems for appraisal by TRL.
  - Draft reports Jan. 30, final reports Feb. 15.
  
- **Do we need an integrated burning plasma working group?**
- **Can we produce a figure similar to shown regularly by EU people? (This can be used to define top-level requirements for the next-step facility)**
- **How can we fold in “certification” issues?**

## Report Draft Outline 1

### Preface (Tillack)



### I. Introduction (Tillack)

### II. Program Goals (Steiner)

(what level of knowledge and performance is needed to proceed to Demo? What are the key metrics for power management?)

### III. Current state of knowledge

- a. Plasma power distribution (Turnbull)
- b. High heat flux handling (Raffray)
- c. Materials compatibility (Tillack)
- d. Systems integration (Malang)
- e. Development and fabrication (Waganer)

### IV. R&D Needs (*gaps in knowledge*)

- a. Plasma power distribution (Turnbull)
- b. High heat flux handling (Raffray)
- c. Materials compatibility (Tillack)
- d. Systems integration (Malang)
- e. Development and fabrication (Waganer)

### V. Development Paths (TBD)

(how can we close these gaps, i.e. with

## Report Draft Outline 2

### Preface (Tillack)

### I. Introduction (Tillack)

### II. Issues, metrics and milestones

- a, b, c, d, e

### III. Current state of knowledge

- a, b, c, d, e

### IV. R&D Needs (*gaps in knowledge*)

- a, b, c, d, e

### V. Evaluations (TBD)

(application of the methodology to evaluate various R&D proposals)

- a. Plasma power distribution (Turnbull)
- b. High heat flux handling (Raffray)
- c. Materials compatibility (Tillack)
- d. Systems integration (Malang)
- e. Development and fabrication (Waganer)

# Example: EU Issue list

	Issue	Approved devices	ITER	IFMIF	DEMO Phase 1	DEMO Phase 2	Power Plant
Plasma performance	Disruption avoidance	2	3		R	R	R
	Steady-state operation	2	3		r	r	r
	Divertor performance	1	3		R	R	R
	Burning plasma (Q>10)		3		R	R	R
	Start up	1	3		R	R	R
	Power plant plasma performance	1	3		r	R	R
Enabling technologies	Superconducting machine	2	3		R	R	R
	Heating, current drive and fuelling	1	2		3	R	R
	Power plant diagnostics & control	1	2		r	R	R
	Tritium inventory control & processing	1	3		R	R	R
	Remote handling	1	2		R	R	R
Materials, Component performance & lifetime	Materials characterisation			3	R	R	R
	Plasma-facing surface	1	2		3	4	R
	FW/blanket/divertor materials		1	1	3	4	R
	FW/blanket/divertor components		1	1	2	3	R
	T self sufficiency		1		3	R	R
Final Goal	Licensing for power plant	1	2	1	3	4	R
	Electricity generation at high availability				1	3	R

Output:	1	Will help to resolve the issue
	2	May resolve the issue
	3	Should resolve the issue
	4	Must resolve the issue

Input:	r	Solution is desirable
	R	Solution is a requirement

UKAEA September 2007 (revised/improved version of original table in UKAEA FUS 521, 2005).



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- System Code: Understand trade-offs to provide a range of embodiments for fusion power plants (and thus Demos)
  - **Trade-offs (visualization)**
    - Magnet model
    - Need to expand physics data base
    - Visualization and/or data mining (We need to think this through).
    - Benchmark, ARIES-I', ARIES-RS, and ARIES-AT
    - When can we have results?
  - Develop costing model/object functions for the next-step facility.
  - Operate in optimizer mode.



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  - What is new in our approach!