



**34th IEA / FPCC meeting at Paris
March 22, 2005**

Annual and End of Term Reports of IEA Large Tokamak Implementing Agreement

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Contents

- 1. Objectives, scope and strategy of LT IA**
- 2. Participants**
- 3. Work program**
- 4. Coordination with other bodies**
- 5. Information dissemination**
 - 5.1 Publicity with LT Homepage**
 - 5.2 Publications**
- 6. Activities**
 - 6.1 Ex-Co**
 - 6.2 Tasks**
 - 6.3 Workshops**
 - 6.4 Personal assignment**
- 7. Achievements, benefits and Issues**
- 8. Overall significance of LT IA and Summary**



Introduction

**IEA Large Tokamak IA : initiated on Feb.19, 1986
(JET, JT-60, TFTR)**

1997 : TFTR shut down
-> DOE large tokamak fusion science program

Dec. 31,1999 : JET Joint Undertaking completed

Jan.1, 2000 : EFDA-JET started

**Jan. 8, 2003 : Report of working group on Fusion Research
JT-60 becomes one of 3 national centralized
joint research devices**

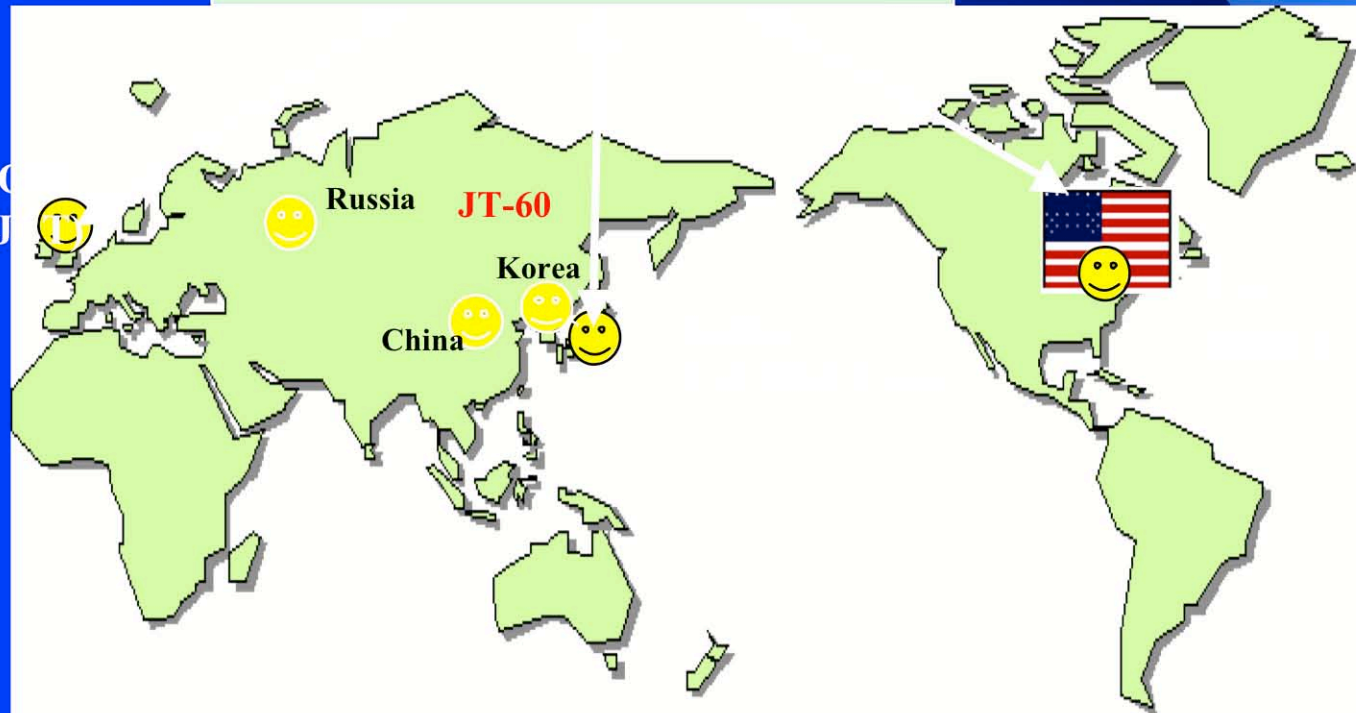
This term : Jan.15,2001-Jan.14, 2006

1. Objectives, scope and strategy of LT IA

During the ITER construction phase, the confirmation and extension of ITER operating scenarios and their implementation in the ITER program becomes key research elements of existing tokamaks such as JET and JT-60.

**IEA Large Tokamak Agreement
(EURATOM, JAERI, DOE, 1986-)**

EURATOM
(EFDA-JET)



Strategy :

Phase I : 1986 - 1995

Cooperation to achieve mission of Large Tokamaks

Phase II: 1996–2005

Cooperation to provide database for ITER construction and concept development of AT

Phase III: 2006~

Cooperation to extend ITER operation scenarios and further development of AT

The strategy is to enhance close coordination with other programs, including experiments, theory, and advanced computing, integration to achieve high beta and high performance plasmas in steady-state conditions, and to extrapolate them to burning plasmas in ITER.

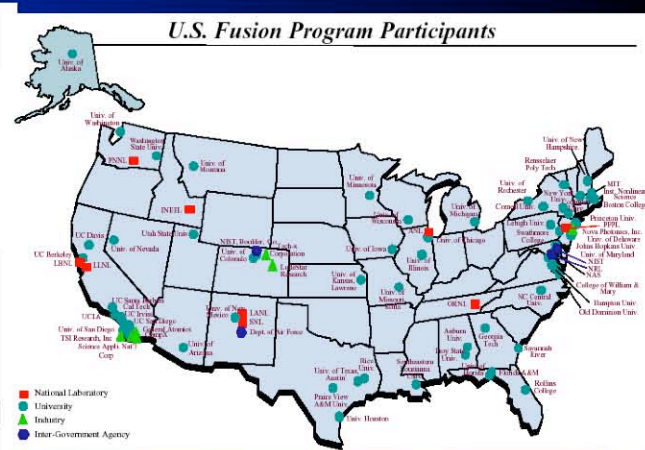
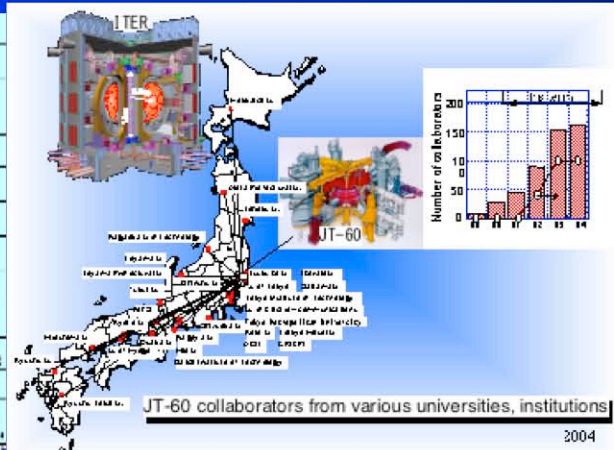
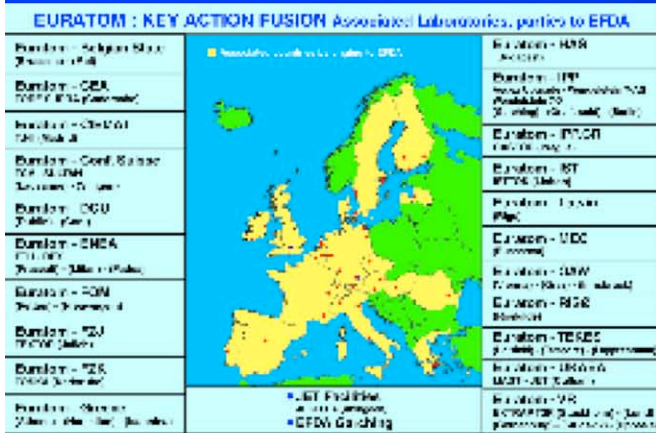
2. Participants



EFDA-JET

JT-60

Large tokamak fusion science



20 association

s [EURATOM-Belgian State (Belgian), EURATOM-CEA (France), EURATOM-CIEMAT (Spain), EURATOM-Conf. Suisse (Switzerland), EURATOM-DCU (Ireland), EURATOM-ENEA (Italy), EURATOM-FOM (Netherlands), EURATOM-FZJ (Belgian), EURATOM-FZK (Germany), EURATOM-Greece (Greece), EURATOM-VR (Sweden), EURATOM-UKAEA (United Kingdom), EURATOM-TEKES (Finland), EURATOM-RISO(Denmark), EURATOM-OAW (Austria), EURATOM-MEC (Hungary), EURATOM-Latvia(Latvia), EURATOM-IST (Portugal), EURATOM-IPP.CR (Czech), EURATOM-IPP (Germany), EURATOM-HAS (Hungary)]

JAERI, collaborating university and NIFS researchers

**JT-60 staffs ~160 peoples
Collaborators ~160peoples**

. The US large tokamak fusion science consists of participation in JET and JT-60 research activities, contributions from US national devices such as DIII-D, C-Mod, and NSTX, and theory and modeling activities. PPPL, GA, MIT, ORNL, LLNL, Columbia University, Lehigh University, University of Wisconsin

3. Work program

[1] Exchange of information;

(i) Experimental program plans for the Large Tokamak Facilities;

(ii) Experimental planning

(iii) Experimental, theoretical and technical studies

(iv) Management and operation of facilities

[2] Personal assignment;

Assignment of scientists, engineers and other technical experts to work at the facilities of the other Contracting Parties

[3] workshop:

Organization of selected workshops

4. Coordination with other bodies

- 1. Joint experiments for ITER are recommended by different Topical Physics Groups of the ITPA.**
- 2. Coordination with ITPA was initiated by the IEA Large Tokamak Executive Committee at its annual meeting in June 2002.**

**1st planning meeting was held at MIT in November 2002,
2nd meeting at Naka in November 2003,
3rd meeting near Oxford in December 2004.**

- 3. Coordination with other bodies,**
 - tokamak related IEA IA's (Poloidal Divertor and TEXTOR),**
 - technology related IAs (Environment & Safety),**
 - International Tokamak Physics Activity (ITPA)**
 - Bi-lateral agreement : tokamak programs in Russia and China**

Implementation of the ITPA coordinated research recommendations (W52(LT IA), W54, W58 (LT,PD,Textor IA))

Program leaders or representatives of JT-60U, JET, DIII-D, ASDEX-U, C-MOD, NSTX, FTU, MAST, JFT-2M, TRIAM-1M, TEXTOR, TCV, Tore Supra, Russian Tokamaks (T-10,T-11M,Globus-M,Tuman-3M,FT-2), and Chinese Tokamaks (HL2A, HT-7) joined to this workshop to discuss results and implementation of ITPA joint experiments to their research programs.



W54 WS photo,2003



W58 WS photo, 2004





Third Joint Workshop of Large Tokamak (W58), Poloidal Divertor and TEXTOR IA's "Implementation of the ITPA Coordinated Research Recommendations" 8-10 December 2004, Eynsham Hall, Near Oxford, UK

Wednesday 8 December 2004

16:00	Workshop begins	Harcourt Room	(Ch: J Pamela)
	1. Opening Remarks		Jerome Pamela
	2. Report from Last Workshop		Mitsuru Kikuchi
	3. Status of Documentation		Ron Stambaugh
20:00	Dinner		Oak/Red Restaurant

Thursday 9 December 2004

07:30	Breakfast		Harcourt Suite
09:00	Workshop Resumes	Harcourt Room	(Ch: J Pamela)
	ITPA/IEA Multi-Machine Experiments		Ron Stambaugh
	1. Status of Implementation of Joint Experiments		
	2. ITPA Views on Implemented Joint Experiments		
	Discussion		
10:45	ITPA Proposals on Implementation of Joint Experiments		Ron Stambaugh
	1. ITB and Transport		(Ch: M Kikuchi)
	2. Confinement Database and Modeling		
	3. Steady State Operations and EP		
	4. Divertor and SOL		
	5. Edge Physics and Pedestal		
	6. MHD		
	Overall discussion		

14:00 Break-out Session for Programme Leaders

1. To discuss Proposed List of Joint Experiments

2. To discuss other ITPA Experiments, if any

3. To enter their responses regarding implementation, identifying those which are, might be or are not included in their plans

4. To present Programme Schedules for 2005 (Organiser: O Gruber)

JET, ASDEX Upgrade, FTU, MAST, TCV, TEXTOR, Tore Supra, DIII-D, CMOD & NSTX, JT-60, JFT-2M & TRIAM-1M, Russian Tokamaks, Chinese Tokamaks

15:45 Break-out Session for Programme Leaders (continued)

18:00 Presentation of Status of Draft Responses Ron Stambaugh Chair: E Oktay

18:30 Workshop Adjourns

19:30 Dinner Oak/Red Restaurant

Friday 10 December 2004

07:30 Breakfast Oak/Red Restaurant

09:00 Finalise Implementation of Joint Experiments Chair: Uli Samm

1.Status of Implementation of New Joint Experiments Ron Stambaugh

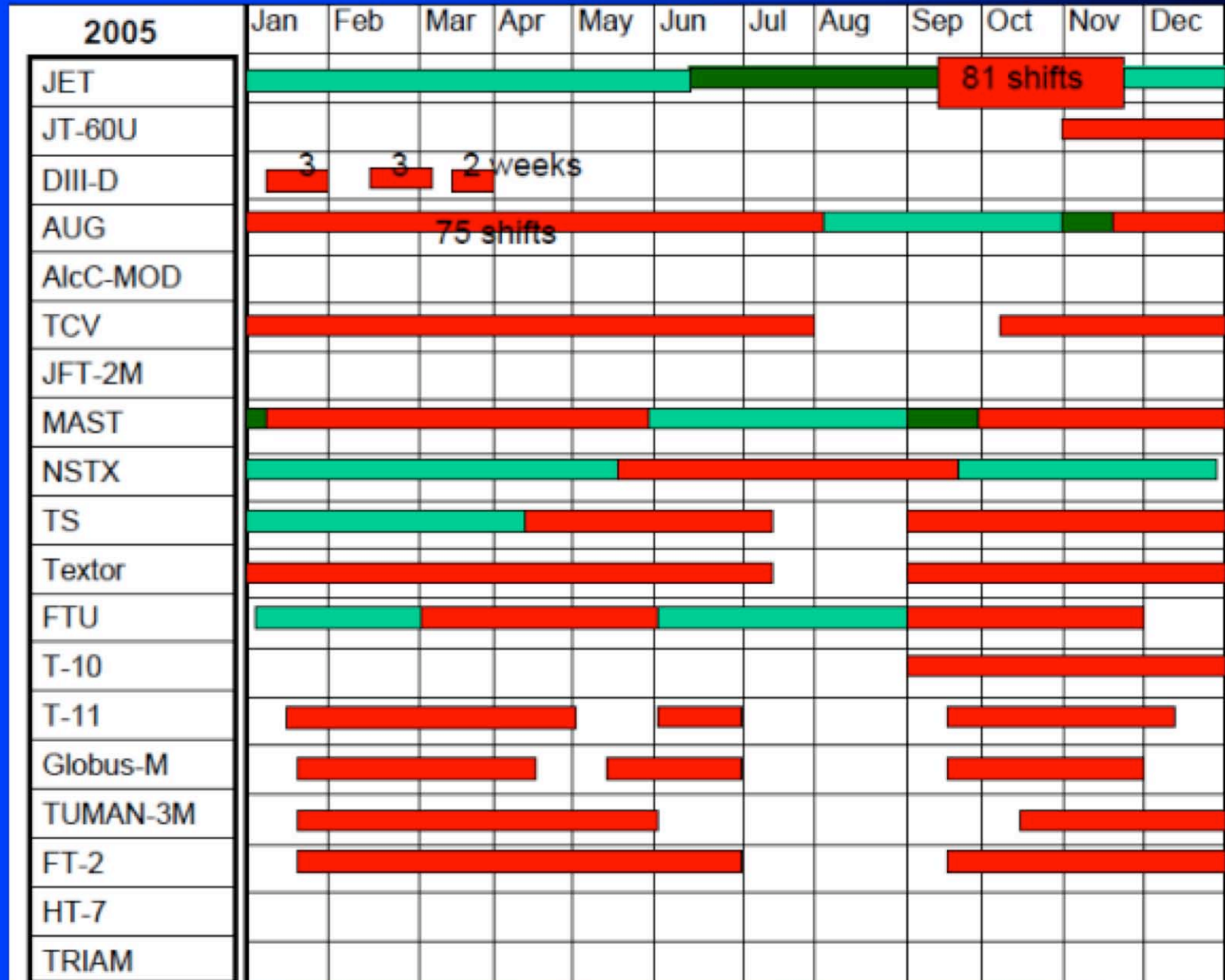
10:45 Finalise Implementation of Joint Experiments (continued) Chair: U Samm

1.Status of Implementation of New Joint Experiments Ron Stambaugh

11:30 Concluding Discussion Mitsuru Kikuchi

12:15 Concluding Remarks and Close of Meeting Jerome Pamela

Device Schedules shown at W58 workshop



5. Information dissemination

5.1 LT Homepage(start from 4 Nov 2003)



IEA Implementing Agreement on Co-operation on the Large Tokamak Facilities - Microsoft Internet Explorer

<http://www-jt60.naka.jaeri.go.jp/lt/>

IEA Implementing Agreement on Co-operation on the Large Tokamak Facilities

IAEA EURATOM JAERI CNDPGE

News
Objective and Scope
History
Annual Reports
Executive Committee Members
Task
IFPA coordinated Experiments
Others
Links
Internal use only

IEA Implementing Agreement on Co-operation on the Large Tokamak Facilities

Agreement

JET JT-60



Excellent Science
Attractive Energy

Office of Fusion Energy Sciences

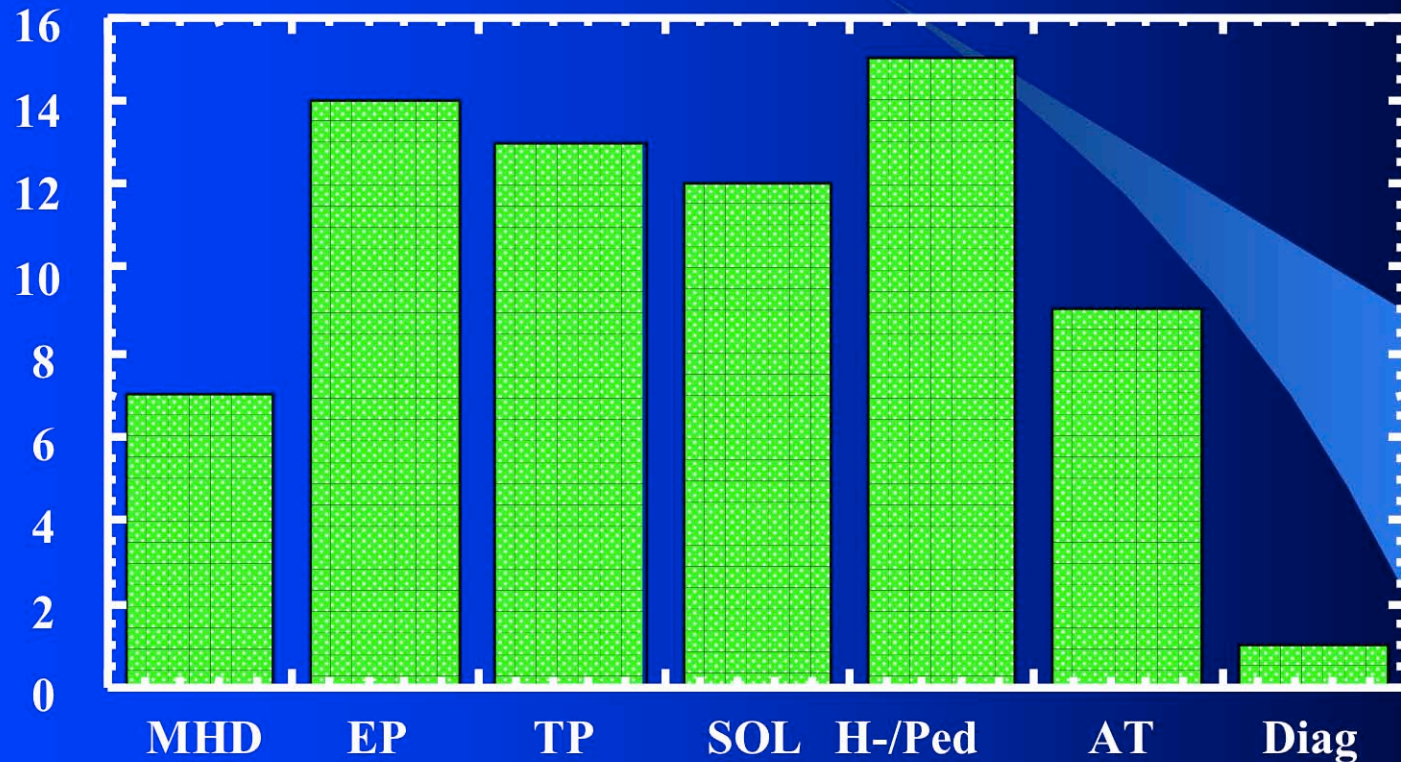


LLNL GA ORNL PPPL MIT

5.2 Publications



Published collaboration papers
from IEA LT implementing agreement



EP: Energetic particles, TP: Transport physics
SOL: Scrape-off layer, H-/Ped: H-mode and pedestal
AT: Advanced Tokamak, Diag.: Diagnostics



6. Activities

6.1 Ex-Co

16th Ex-Co ; held at JAERI, May31 to June 1, 2001

- EU reported that JET had started its operation under the frame work of EFDA successfully.

17th Ex-Co : held at PPPL, June 6,7, 2002

- The committee recognized that this IA could promote the implementation of the research topics identified by the ITPA.

18th Ex-Co : held at JET, June 4,5, 2003

- According to FPCC recommendation, the Committee decided to streamline and enhance the coordination of activities within the IEA LT IA as well as across IEA IAs and ITPA. The committee also decided to create IEA LT Web site (<http://www-jt60.naka.jaeri.go.jp/lt/>)

19th Ex-Co : held at JAERI, June 14,15, 2004

- The Committee recognized the importance of this IA again, and started the extension procedure for the Implementing Agreement.

20th Ex-Co : planned at PPPL, May,2005

We received an announcement dated Dec. 3,2002 that our Ex-Co member (Director of UKAEA) Dr.Derek Robinson has passed away. Here, we would like to express our deep appreciation again for his great contribution to world Fusion Program and also to our IEA Large Tokamak Implementing Agreement.

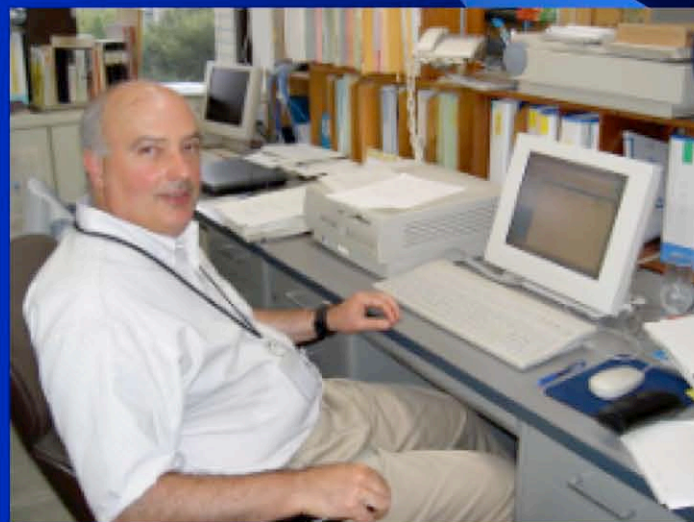
6.2 Tasks

International collaborative experiments coordinated through IEA IAs have made significant progress and expanded multi-machine data sets .

(1) Transport Physics, (2) Confinement Database and Modelling, (3) MHD, Disruption and Control, (4) Edge and Pedestal Physics, (5) SOL and Divertor Physics, (6) Energetic Particles, Steady State Operation , (7) Tritium and Remote-Handling Technologies, (8) Others



Drs G. Saibene, A. Loarte, J. Lonnroth during their joint experiments at JT-60 Task (4)



Dr. L. Grisham during his stay in JT-60 Task (8) for N-NBI

6.3 Workshops



No.	Title	Date	location	No. of participants
W47	Experimental Planning	7-8, February, 2001	JAERI-Naka, Japan	35
W44	Plasma Shaping	25 - 26 June 2001	Culham Science Centre, UK	16
W49	Real Time Control of ITB Discharges Approaching Steady-state	4 - 6 February 2002	JAERI-Naka, Japan	36
W50	Electron Transport	3-6 April 2002	U.S.A	
W48	ELMS	24 -26 June 2002	Culham Science Centre, UK	31
W51	In-Vessel Tritium Inventory	19 - 21 March 2003	Culham Science Centre, UK	51
W52	Implementation of the ITPA Coordinated Research Recommendations	18 - 19 Nov.2002	MIT, USA	13
W53	Experience in the Management of Wastes From Fusion Facilities	25 - 26 March 2003	Culham Science Centre, UK	29
W54	Implementation of the ITPA Coordinated Research Recommendations	23 Nov. 2003	JAERI-Naka, Japan	33
W55	Physics Needs for High Beta Steady State Tokamak	24 Nov. 2003,	JAERI-Naka, Japan	30
W56	Physics of Current Hole	3 -4 February 2004	JAERI-Naka, Japan	46
W58	Implementation of the ITPA Coordinated Research Recommendations	8-9 Dec. 2004	Eynsham Hall, Near Oxford, UK	24
W59	Shape and Aspect ratio Optimization for High β steady-state tokamak	Feb. 2005	General Atomics, USA	43
W61	Heating and Control for long pulse operation in large tokamaks	Aug. 30, 2004	Venice, Italy	8
Number of Completed WS : 14				Total participants:395
No.	Planned workshops	W60 Burning Plasma Physics and Simulation	June. 2005	EPS location

W56 Workshop on Current Hole

Workshop Number: W56
Subject: Physics of current hole
Date: 3rd -4th February 2004
Place: JAERI-Naka
Name (s) of attendees: N Hawkes EFDA-JET(EU)
R Jayakumar GA (US)
T Ozeki JT-60U (JA)
46 participants



6.4 Personal assignment



	2001	2002	2003	~Sep.2004	2005	Total
Workshops	2	4	4	2		12
Personnel Assignments (Total)	63	35	32	25	-	155
(1) Participation: more than 4 weeks	6	1	0	0	-	7
JET --> U.S.						0
JET --> JT-60						0
JT-60 --> U.S.						0
JT-60 --> JET						0
U.S. --> JT-60	1					0
U.S. --> JET	5	1				7
(2) Participation less than 4 weeks	57	34	32	25	-	148
JET --> U.S.	5	0	9	6		20
JET --> JT-60	1	2	1	6		10
JT-60 --> U.S.	3	3	2	0		8
JT-60 --> JET	5	8	6	3		22
U.S. --> JT-60	13	9	3	4		29
U.S. --> JET	30	12	11	6		59

7.1 Contribution to Policy Making through LT IA

- This implementing agreement is one of most active fusion IAs under IEA.
- The productivity of large tokamaks such as JT-60 and JET has been greatly enhanced through this cooperation
- and the fusion energy science programme of US has contributed to and benefited from this collaboration.
- This cooperation has contributed to the success of large tokamaks in demonstrating equivalent break even conditions and significant DT fusion power production enriched through this cooperation
- and thus contributed to advance the implementation of the international large scale fusion program, ITER.
- Thus this IA is significantly contributing to the international political decision of implementing ITER program in the near future.

Overall Significance of LT IA and Summary

- World fusion research is preparing to enter a new phase in the development of fusion devices: the construction of ITER, planned to last for 10 years.
- Before the start of ITER operation, large tokamaks will continue to be a key driving force to advance tokamak physics and the tokamak concept with strong cooperation of other IAs.
- During this term, confirmation and extension of ITER operation scenarios and also further development of AT will be pursued through this cooperation. Thus the overall significance of this IA continues to be quite high.