

ITER Test Program  
Status and Issues

Mohamed A. Abdou

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# ITER Test Program

Status: Not Good

Issues: Serious issues that require resolution at the highest level of ITER JCT and Home Team Management as well as the management of the fusion program in the parties.

1) What priority does ITER JCT management place on having an effective Test Program on ITER?

- Is the machine being designed to accommodate the needs of the Test Program?
- Who in JCT has the authority and manpower to look after the Test Program needs?
- How is JCT effort (if any) on the Test Program coordinated with the home team?

2) Given that ITER will not give credit to Test Program R&D:

- How will each party do this R&D?
- How will the parties coordinate this R&D?  
(No mechanism exists at present)

# ITER Test Program

## Events During The Past Year

- SWG1: Test Program is integral part of ITER.
- JCT structure does not have the Test Program anywhere on the management chart.
  - It is understood that it is under Blanket & Vacuum Vessel Division (Shatalov).
- US Home Team Leader, C. Baker, wrote a letter to the ITER Director in May '93 suggesting a workshop on the Test Program among JCT and the 4 home teams. The letter had specific suggestions for topics of discussion.
- US Home Team took the initiative of appointing a Task Area Leader for the Test Program.
- TAC Report in September '93 indicated the importance of accommodating the Test Program needs in ITER design.
- October '93:  
Unofficial indication that the Blanket & Vacuum Vessel Meeting in Garching in November will include the Test Program.
  - Concern that without ITER JCT Management support, discussions in Garching will not have any effect.

## Suggested Actions

### 1) ITER Test Program Working Group

The parties should officially request that a Working Group on the Test Program be formed.

#### Membership

- 2 or 3 members of JCT.
- 4 members from the parties (one from each party).
- Supplement by experts from JCT and Home Teams as needed.

#### Responsibility

Should be defined carefully.

[General: Coordinate Test Program with JCT. What tests are needed? What are the requirements on the ITER design? Can these requirements be accommodated? Can changes in tests or machine designs be made to reach an acceptable compromise?]

#### Meetings

- Once every 3 or 4 months.

#### Reporting

- Summary reports from the Working Groups should be available to JCT, Home Teams and user community.
- Progress and issues from the Working Group should be part of the TAC and MAC reviews.

## Suggested Actions (Continued)

### 2) Test Program R&D Formal Agreement

An official agreement should be developed among the parties on the Test Program R&D.

The agreement should include:

- What R&D to be done
- Who will do what
- Areas of collaboration
- Formation of a Standing Committee or a Working Group that coordinates and monitors progress

## Serious Observations

- The past few months deliberations on ITER Blanket Design and Material Choices illustrate a fact well known among the experts.
  - We (the world program) have not developed the materials and first wall/blanket technology necessary to achieve high performance plasmas.
  - Candidates for low activation materials and inherently safe blanket designs are very limited and they all have technical problems.
- Time has come to deal with this problem.
  - Test Program on Fusion Devices and the R&D necessary for such a Test Program must receive high priority.

# US ITER Test Program

FY94 Funding: fraction of \$60 K

(In FY93 we received ITER credit for \$90K)

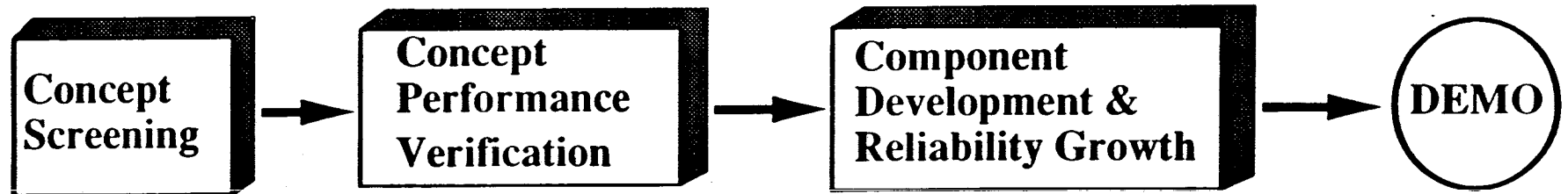
## Organizations

Now:	UCLA
Needed in the future:	ANL, ORNL, SNLL, others, Industry

## Technical Effort

- Very useful but very limited
- Examples --
  - Failure rates, component engineering development and reliability growth requirements on: a) number of test modules, b) time (fluence).
  - Tests for components other than blankets (divertor; rf in-vessel components).

# Testing in Fusion Devices For Fusion Nuclear Development Can Be Classified Into a Number of Stages



Required  
Fluence  
MW.Y/m<sup>2</sup>

0.3

> 1.0

> 4 - 6

Size of  
Test  
Article

Submodules

Modules

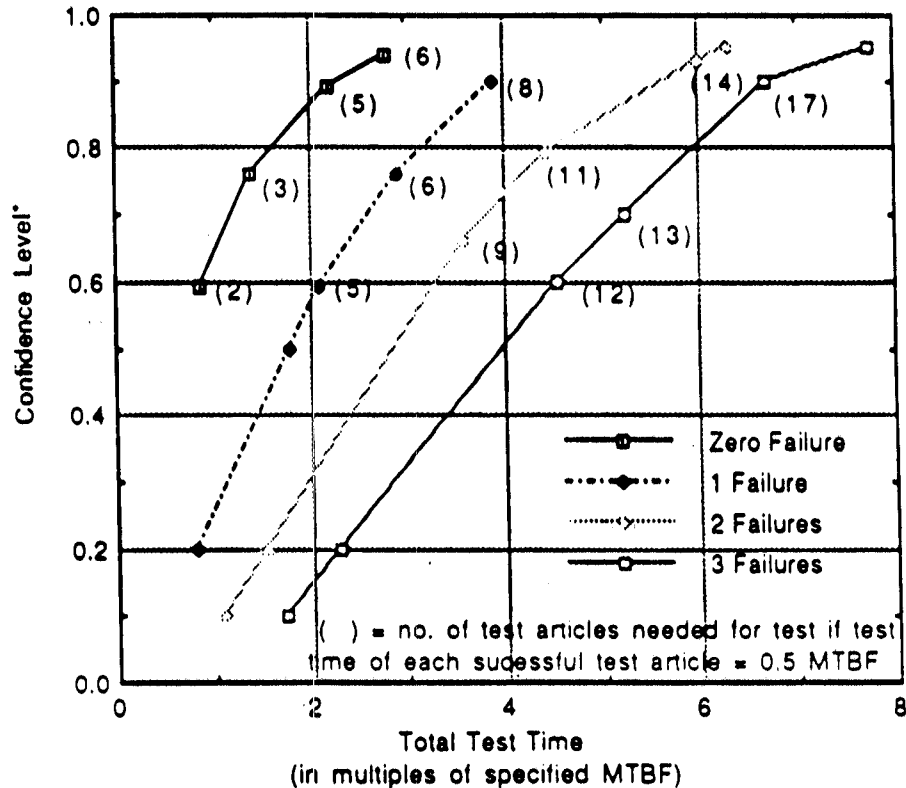
Modules/Sectors

- Reliability Growth Testing is Most Demanding
  - Requires testing of components in real operating environment (n,  $\gamma$ , B, T, V)
  - Requires an aggressive design/test/fix iterative program
  - Requires many test modules and high fluence



# Test Time and Number of Test Articles vs Confidence Level

- For MTBF tests, the minimum test time per component = 0.5 MTBF (assuming that the component useful operating time is equal to the MTBF)
- This requirement implies that 6 test components are needed for achieving a 90% confidence level, if the number of failure is zero.
- With 1 failure during the test, the number of test articles would be 8 for achieving a 90% confidence and 7 for 80% confidence.



\* Confidence level 0.8 means that the confidence of the lower limit on the MTBF being equal to the specified MTBF is 80%.