

ePHM Workshop Questionnaire Results

This questionnaire was completed by attendees at the CALCE/UMD Electronics Prognostics and Health Management Workshop held on August 24th 2004.

11 responses were received. Answers have been interpreted as yes/no responses. The numbers refer to the number of yes answers given. No response has been taken as a no.

Industries represented Avionics 6 Military 3 Other 2	# Yes Answers
Do your products need to meet safety or availability requirements?	7
What is your typical product operational life need?	10 > years
Do you believe that-	
Semiconductors have a finite (<10yr) life?	7
Semiconductor lifetime will decrease in the future?	9
Semiconductor failure rate (constant failure rate) will increase in the future?	8
Electronics failure is a significant contributor to loss of availability?	9
ePHM could be implemented?	10
If so, which of these approaches are promising?	
Life models?	10
Canaries/fuses?	8
Precursor monitors?	10
Any of these benefits could flow from ePHM?	
Reduced unscheduled removals?	11
Reduced warranty cost?	6
Quicker diagnostics in the shop?	10
Improved availability?	10
Better asset management?	10
Centralization of maintenance shops?	5
Reduced redundancy?	7
There is an economic return with ePHM?	
System cost will increase?	9
Support cost will decrease?	9
You will need to use 130nm DRAM half-pitch or less feature size semiconductors in the future?	3
These die failure mechanisms will unacceptably reduce life at the 130nm node and below?	
Electromigration?	2
Hot carrier degradation?	2
Charge trapping/negative bias temperature instability?	1
Gate oxide breakdown?	2
Die/substrate CTE mismatch?	0
ESD damage?	2
SEE/SEU?	1
Other?	
These board/package failure mechanisms will unacceptably reduce life?	
Area array package solder-ball/PCB CTE mismatch?	8
Moisture ingress/corrosion?	9
Delamination?	7
Wire bond fracture/lift-off	7

Interpretation of results

Respondents were overwhelmingly from the avionics/military-electronics industries (9/11). Most have a product life requirement in excess of 10 years.

Most thought that semiconductor reliability will be a future problem, either in terms of limited life (7/11), or decreased reliability (8/11) and that electronics is a significant contributor to loss of availability (9/11).

By far the majority thought that ePHM could be implemented in some form (10/11). Of the three methods presented, canaries were thought slightly less promising (8/11).

There was apparently some skepticism that ePHM could reduce warranty cost (6/11), allow greater centralization of maintenance operations (5/11) or allow for reduced redundancy in system design (7/11). The majority expect that ePHM will increase system cost (9/11) and decrease support cost (9/11) but the net cost/benefit question was largely unanswered.

Only a few positively expect to be using 130nm or less parts in the future (3/11, this question was largely unanswered). The impact of the various failure mechanisms that were listed was also largely unanswered (<2/11). Most listed part/board attach failure mechanisms as life limiting factors (>7/11).

In summary, the view was that ePHM is an implementable technology but the cost/benefit is not clear cut. There was little consensus on the impact of 130nm and less semiconductor technology on system life and reliability.