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E. Jan Vardaman

# Future R&D for the Electronics Industry: Who's in Charge?

## Can the lost art of R&D be regained?

**W**ith recovery on the way, the electronics industry is experiencing the need for new materials, process developments and reliability analysis. Where will the research and development come from? Who will pay for it?

### The Old Days

In the old days, companies such as AT&T and IBM were the source of a tremendous amount of research and development (R&D) in the electronics industry. Not only were new packages and assembly technologies developed, but the companies also focused on new material developments—working closely with material suppliers. A great deal of time and effort went into the development of process technology and reliability analysis.

With downsizing and divestiture, R&D in today's companies is a lost art. Most companies have reduced R&D spending, shed manufacturing and cut employees. R&D on materials, process and even labs for failure analysis and testing are a distant memory. At some point, the oil companies conducted R&D on new epoxy-based materials, but these companies have long since left the electronics business to focus on huge profits in oil and gas.

### Squeezing Profits and Limiting R&D

With the tremendous outsourcing both in integrated circuit (IC) package assembly and board-level assembly, most companies no longer have the personnel to conduct many R&D projects in-house. Compounding the problem are the low profit margins at assembly houses that do not allow large R&D budgets. With continued cost pressure driving margins thinner, little hope is in sight.

### The Role of the University

Historically, universities were the source of much basic science. The National Science Foundation continues to support centers of excellence in semiconductor packaging and assembly. With scarce resources during the recent downturn, many companies have turned to universities for more than just basic R&D.

Research activities at the University of California Berkeley, Stanford University and the University of California Los Angeles (UCLA) are famous. Cornell is well-known for its materials research and research in underfill materials. Rensselaer Polytechnic Institute (RPI) has a strong electronics packaging program. The Georgia Institute of Technology (Georgia Tech) has a worldwide reputation for its electronics packaging research—including system-in-package, underfill materials, substrates and other areas.

The State University of New York (SUNY) Binghamton is known for its work in electronics packaging. The University of Maryland's reliability and failure analysis is highly regarded. The University of Texas at Austin has a strong reputation in materials research. The University of Arizona is famous for modeling and simulation

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work. North Carolina State University—with its location in Research Triangle, NC—has electronics-related activities. Arizona State University has electronics industry research programs based on its close proximity to Intel and Motorola.

Auburn University is highly regarded for its reliability work in automotive electronics and has expanded its activities into wireless communications. With Auburn's new professors, the university will now be recognized as the premier very large scale integration (VLSI) test center in the U.S.

Each of these universities has developed corporate partnerships with industry, and the industry is increasingly depending on the cooperative research and development at these academic institutions. Will this be sufficient to meet the future needs of the electronics industry?

One cause for concern is the decline in the number of foreign students that are now coming to U.S. universities. Why should anyone be concerned about this? Students outside the U.S. make up an increasing portion of the engineering population at most universities. Since the events of September 11, 2001, it has become increasingly difficult for foreign students to obtain visas to study in the U.S. Without students to

do the research, how will university and industry goals and objectives be accomplished? Clearly, U.S. government policy needs to address these issues.

### Industry Developments Today and Tomorrow

Future electronics packaging developments will depend on the coordinated efforts of strong industry leaders in bringing equipment, materials and assembly suppliers together to work on problems. A good example of a positive development is LSI Logic's development of assembly and packaging solutions for silicon with low-k dielectric material. Activities at LSI Logic included coordinating the work of the silicon foundry, low-k dielectric material suppliers, assembly houses, wire bond equipment makers, molding compound material suppliers and flip chip underfill material suppliers. Similar activities will be required for the future if the industry is to achieve growth and prosperity.

The future competitiveness of the electronics industry depends on strong activities in R&D. Leaders and members of the government, industry and academic community must all pay attention to and take a role in the R&D activities that are required. ■