PREAMP CONSORTIUM (JOINT VENTURE)

New Models to Speed the Development of Electronics Components

*P*rinted circuit boards are ubiquitous. Most people know that boards are in computers, and that each computer actually contains several boards. They are also found in televisions, VCRs and the hand-held controls for these devices, as well as in printers, airplanes, thermostats, automobiles, appliances, calculators, garage-door openers, industrial controls, communications satellites, and numerous other devices.

> **COMPOSITE PERFORMANCE SCORE**
> *(Based on a four star rating.)*
> ★

Data Sharing Speeds Component Development

In this ATP project, the PreAmp consortium developed common parts identifiers (a standard product model for components) and fabrication procedures (a generic manufacturing process model for making components) that can be shared among producers and users of printed circuit boards and other electronics components all along the production chain. These models will enable true concurrent (simultaneous) engineering of component design and manufacturing processes, an arrangement that will reduce the cost of developing components, improve their quality and decrease their time-to-market. These improvements, in turn, will lead to similar improvements in finished electronics products that incorporate printed circuit boards and other components developed via this new technology.

These models will enable true concurrent (simultaneous) engineering of component design and manufacturing processes . . .

PreAmp is a joint venture of the South Carolina Research Authority (SCRA) and four large companies that use printed circuit boards in their finished products. Funding from ATP enabled the consortium to conduct research that it otherwise would have been unable to do.

It also facilitated the formation of alliances among the research partners, helping them to demonstrate technology-enhanced concurrent engineering concepts to industry.

The research involved four major tasks: the design of software architecture for electronically sharing component specifics; the development of software prototypes; the implementation, analysis, evaluation, and demonstration of a component database and access mechanism; and the refinement of the manufacturing capability database, its software architecture, and manufacturing process planning.

Easier to Share Information

The PreAmp product model for electronics components was successfully developed. It is a complete standards-based, data-sharing framework for automating the design and manufacture of electronic components such as printed circuit boards. It is an extension to the electronics industry of STEP (Standard for Exchange of Product Model Data), an international standard that defines a standard product model for automation systems in order to facilitate the capture and use of all information relevant to product design and manufacture. This extension will speed the development of electronics components (and, ultimately, finished electronics products) by greatly easing the sharing of information among the engineers who design electronics components and those who design the processes for manufacturing these components.

In addition, the PreAmp generic model of manufacturing processes was designed to further aid manufacturing engineers by capturing all relevant data on the manufac-

turing capabilities of a particular plant, information such as shop-floor equipment capabilities, equipment layout, and operating requirements, and limits. As part of this effort, researchers developed a knowledge-based software system that can extract process rules from the manufacturing process data — for example, "Given current equipment, interconnects may not be spaced closer than X." Such rules will improve the functioning of the system.

The combination of the full product and manufacturing models allows concurrent (simultaneous) engineering of component design, process design and component manufacturing. Studies cited by the consortium suggest the new technology can reduce time-to-market by 50 percent or more, double component quality levels and reduce development costs by 30 percent to 70 percent. The project's commercialization work is still underway, so it is not yet known whether these expectations will be matched by improvements in the quality of actual component design and manufacturing processes.

Initial Commercialization

Some of the technology developed by the PreAmp consortium has been adapted and incorporated into software tools by STEP Tools, Inc., an informal participant in the ATP project. STEP Tools developed a prototype STEP data application interface for the project. Afterward, the company enhanced the prototype to make it suitable for commercial use and incorporated it in the ST-Developer™, an application that already has several hundred customers.

The principal test-bed implementation of the models developed during the ATP project was carried out by PreAmp members. Boeing is conducting a pilot project to determine whether it can use the new software technology in its internal operations to increase the productivity of printed circuit board design work. The company is working with an ATP-project subcontractor in developing software to translate existing database information to work in the new product model system. It will probably be known by 1999 whether the Boeing effort succeeds. If it

does, the creation of commercial products will be much more likely.

Three members (Boeing, Hughes, and Rockwell) have arranged with SCRA for it to serve as the PreAmp agent with vendors interested in creating commercial software systems that include the ATP-funded technology. Consortium members, with the help of SCRA, proposed the enhanced STEP procedures to the International Standards Organization for registration, which is expected to be issued as STEP Application Protocol 210.

Studies cited by the consortium suggest the new technology can reduce time-to-market by 50 percent or more, double component quality levels, and reduce development costs by 30 percent to 70 percent.

Reorganization and company upheavals among consortium members, however, seem to be hindering further progress toward commercialization. Organizational energy has been siphoned off to deal with mergers and acquisitions. In addition, reductions in national defense work have caused turmoil in three of the four corporate members of the consortium that have been very active defense contractors. But if energy can be refocused on further developing the ATP-funded technology, it could be commercialized in several years.

Large Potential Benefits From Data-Sharing Standards

The new technology was intended for use in the production of printed circuit boards, and it has potential applications in the manufacture of other electronics components as well. If widely adopted, the product and manufacturing process models would provide a common language for the production process. In that case, the economic spillover benefits from widespread use of the technology could be large since so much of it involves data-sharing standards. Given the hundreds of millions of printed circuit boards produced for use in the United States each year, the benefits from this kind of standardization would be extremely large.