Proud parent in Corvallis

BY TOM HAGER

Janet Placido is a proud parent. She can talk for hours about her baby—all the things she's taught it, how much smarter it is than other kids its size. Her enthusiasm shows in her face, always intense, often smiling.

But Placido's newborn is not just any kid. It gestated for five years, talks in Basic and does 6 by 6 matrix inversions in 2.5 seconds. It's small enough to cradle in one hand and loves to have its keyboard tickled. Its given name is HP Model 71B, but the beaming parents nicknamed it Titan.

The birth of the 71B was a joyous event, especially for Placido, who was a driving force in the design of its operating system. At 32, this dynamic, straight-talking computer scientist is already a project manager, who supervised a team of software engineers devoted to making the 71B the most powerful, most adaptable, most user-friendly handheld ever created.

Placido's "office" on the second floor of HP's Corvallis complex is a tiny cubicle lost amid a hundred others in a room the size of a football field. The only dividers are shoulder-high partitions. This is the design center, the brain shop where tomorrow's HP calculators and small computers take shape.

The walls of Placido's office are lined with Titan artifacts—design specs, software documentation and memorabilia going back to the beginning of the project in the late 1970s. The remaining space is filled by her small desk and computer terminal, a teapot, herbal tea boxes, a menagerie of small stuffed animals, and Peanuts, Andy Capp and Garfield comic strips papering most free surfaces. A colorful poster reading "Celebrate Titan" jostles for wallspace with a bright Van Gogh print and a framed photo of a lion.

"Don't leave my favorite out of the story" she jokes, gesturing toward another poster. "As you climb the ladder of success," it reads, "don't let the boys look up your dress."

A NEW CAREER

Climb she has. Born in Detroit and the daughter of a Chrysler engineer, Placido earned a bachelor's degree in math, with an emphasis in computer science, from Wayne State University in 1973. Her first job was in applica-

Placido, 32, supervised a team devoted to making the 71B the most powerful, most adaptable, most user-friendly handheld ever created.

PHOTOS BY LARRY MAY

tions support for IBM mainframes at General Motors. Wanderlust hit in 1976, bringing her to the University of Oregon to finish her master's in computer science. The northwest's endless greenery and low-key lifestyle convinced her to stay.

"After two weeks in Oregon, I knew I wasn't going back," she remembers.

After graduating in 1977, she worked for a year and a half at Oregon State University, Corvallis, on Control Data mainframe systems support. A friend told her that the HP plant in town was hiring.

That year, 1979, turned out to be a good year to be hired at HP Corvallis. The company was putting together a team to develop the 71B and HP was looking for just the type of knowledge Placido possessed.

"Management realized we needed computer science expertise to complement the strong mathematics and statistics we generally use in designing our calculators," Placido says.

From the start, the 71B effort was unique. It was being developed in the calculator division of HP, but was far bigger than any previous calculator project. That meant a far bigger design team.

"There was little precedent for a group the size of the 71B team," Placido explains. "If you have a closed box, things are simple. When you open it up to I/O and plug-ins, your whole operating system world changes. In the calculator division, we weren't used to handling large-scale software development."

While most previous calculator design had been done by one engineer or a small group, the numerous 71B designers had to be broken into three groups—software, mechanical and electrical. Placido was hired as a lowly member of the software group, but soon found herself acting as an unofficial project leader, coordinating documentation and making sure communication between members of the team was standardized and efficient.

BUILDING A BETTER MACHINE

The process started with a review of the 71B's predecessor, the HP 41. This calculator was a great success among scientists and engineers—the same sophisticated audience targeted for the 71B.

"We spent a lot of time studying the 41, learning and understanding its pluses and minuses," Placido recalls. "Our job was to try and improve on it."

Analysis of the 41 turned up some problems the 71B was designed to solve.

"The three most severe criticisms of the 41 were that it wasn't fast enough, there wasn't enough memory and it needed a more sophisticated programming language," says Placido.

Solving those problems required a basic design change.

"The first constraint was that the 41 box was too small," she continues. "We realized that to provide the features we wanted—file handling, memory and so forth—we needed a bigger display and keyboard. But the 71B had to be handheld or you defeated the whole positioning of the product."

A Basic programming language was chosen to replace the low-level programming language used in the 41 because Basic was well known and easy to use. But to program in Basic, a qwerty keyboard and larger display were needed.

To increase speed, a processor was developed that was ten times faster than the 41's. Built-in RAM was expanded from a maximum of 3.5k in the 41 to a standard 17k in the 71B, with the potential for 512k of addressable memory in the future. A whopping 64k of ROM was allocated to the operating system.

Then there was the problem of retaining what was good about the 41—the HP-IL interface for communications, the ports in front for custom ROMs and added memory, and the card reader and I/O. But the 41 has only two ports, which means you give up a ROM or memory port if HP-IL or a card reader is used. Four ports were designed into the 71B.

After deciding what was needed, Placido's group began setting up the code to make new features work in harmony. They built in typing aids on the keyboard so that full words required in Basic could be typed with a single keystroke. They added special keys for file management and display routines that made maximum use of the 71B's advanced dot-matrix display.

They changed the calculator mode from Reverse Polish Notation (RPN), used in all other HP calculators, to Calc Mode, an algebraic system more consistent with the ma-

"We spent a lot of time studying the 41. Our job was to try and improve on it."

chine's Basic programming capabilities.

"It gives you automatic typing aids and does partial expression evaluation (intermediate calculation results) as you go, to make using an algebraic system as easy as using RPN," Placido explains. The Calc Mode system, along with the math ROM, lets the user review and correct long equations and checks for typing errors. "It tries to help you," Placido says.

PACKING IN POWER

"We tried to keep the friendly calculator flavor even though we were adding a lot of power. That was hard because of size limitations."

Placido's software team was eagerly writing more and more operating system code, but found itself running over the limit.

"We needed more ROM, more memory to store what we were writing," she remembers. "But there was a limit because we physically couldn't fit it or it would make the final price too high. We had to sit down and decide what to cut. That was painful." Eventually, the operating system was pared back to 64k.

In the end, they developed a machine that could do most things the 41 could—and more. The added memory and processing speed make it possible to write and run longer programs faster. The machine's power reaches its peak in the ROM-based Math Pac.

"It's awesome. Our algorithms for mathematical operations are very precise," Placido says.

"The biggest improvement over the 41 is the documentation, the fact that we consciously chose to open this machine up from the start. That's something HP doesn't have a reputation for."

Long before release, HP decided it wanted independent input and customization capability with the 71B. The company opted to open up all the internal design specifications with source code and schematics.

"Part of the reason was Apple," says Placido. "They opened up their machines and were very successful."

Opening up the 71B was no easy matter, however. Mountains of documentation had to be organized, kept up to date and in synch—a change in code in one place had to be double-checked in a dozen other places. Engineers accustomed to working solo had to become team players.

"The big challenge for marketing is that the 71B is deceptive. It's more powerful than it looks."

"The close proximity, informal attitude and open environment here at HP helped a lot," Placido says, indicating the activity visible from her desk. It was during this time, the final year of development, that her skills as a manager led to her promotion to project manager for the software group.

The documentation effort added at least a year to the development time, according to Placido. It was not the most stimulating year.

"Documentation is difficult for engineers because it simply ain't fun," she laughs. "It goes downhill. Design's fun. Implementation's probably the best because you get to see it work. Testing is a pain because the more you test the harder it gets. Then all you've got left is documentation, which is thankless work."

The only thing that may stand in the way of immediate success, Placido thinks, is the 71B's hybrid nature.

"People look at this and say, 'Where's the calculator?' "

But while users may be looking for a simple calculator, the HP marketing staff had to be taught to look for something more.

"The big challenge for marketing," says Placido, "is that the 71B is deceptive. It's more powerful than it looks."

With Titan now a reality, Placido is winding down her efforts, taking a breather from the intensity of the past four years. She's working on custom procedures, looking at new applications and putting together a software library for users.

She's proud of the way the 71B turned out and is still amazed that she helped design a machine that has become a reality.

"I have to thank HP for the . . . well, this sounds corny, but it's the privilege of letting me work on this," she says, turning a 71B over in her hands. "I mean, here it is; and I helped put it together. And it's good. It's inexpensive, it's portable and it moves information pretty fast."

She smiles with obvious pride.

"It's our baby. It's like having a kid." □

Tom Hager is a free-lance science writer in Eugene, OR.