Ericsson Inc.

Unigraphics Connects with Wireless Communications

LYNCHBURG, VIRGINIA — With millions of people joining the world of wireless communications each year, it's no wonder Ericsson Inc. continues to raise the standards of wireless technology. As a designer, developer and manufacturer of communications products — including analog and digital cellular systems and mobile systems for private radio products — Ericsson is among the top three worldwide suppliers of mobile phones.

Recently, Ericsson's Private Radio Systems (PRS) division initiated a program to develop a new portable radio. The design of this radio would be based on an existing cellular terminal platform developed by a sister division of PRS. The project required that Ericsson's engineers around the world and their respective systems interface closely with one another as well as meet a number of highly specific goals:

- Reduce the number of Engineering Change Notices (ECNs) associated with new product development
- Reduce the standard size and complexity of its present mobile terminal products to that of a cellular terminal while still meeting rigorous, full Mil-810-E environmental requirements
- Reduce development cycle time from the typical two to four years to six months

William Jennings, a consulting engineer and an experienced Unigraphics user, led the mechanical design for the project. He knew that Unigraphics was the only CAD/CAM/CAE software system that could handle the complex tasks required of this project.

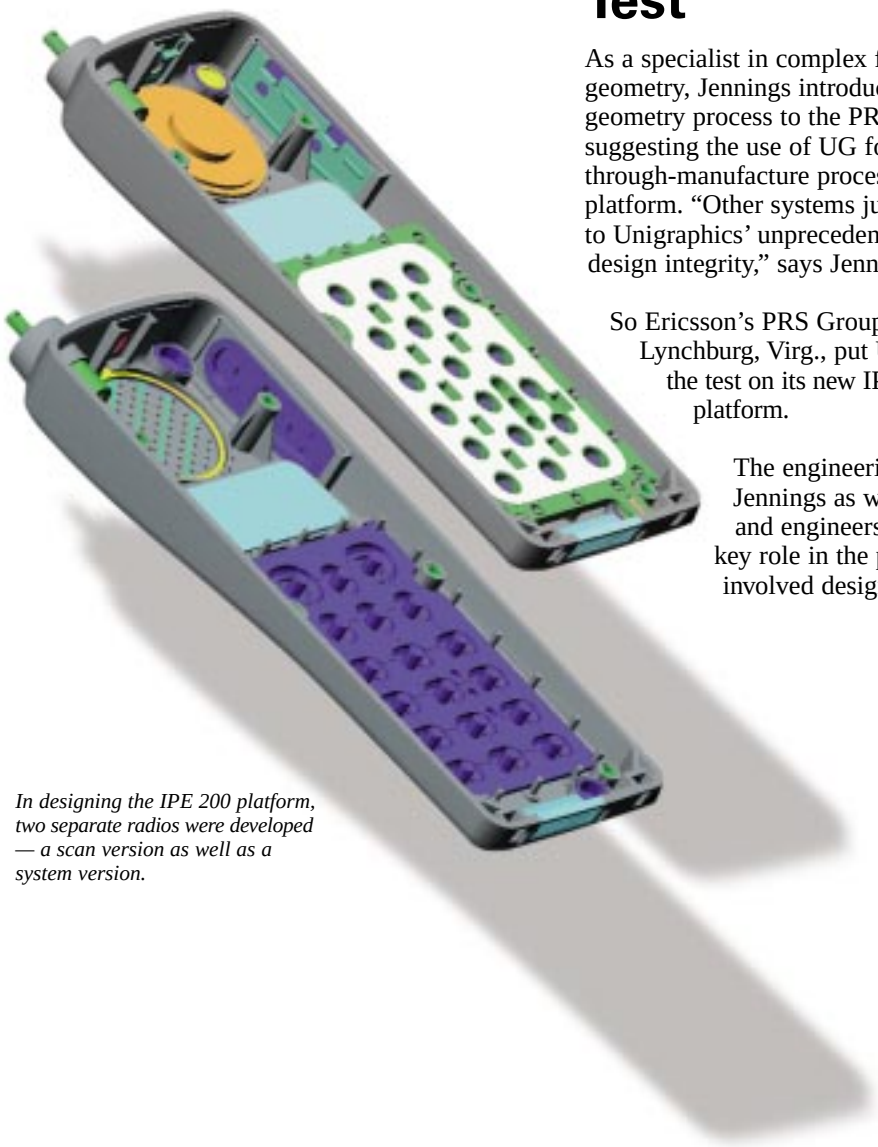
"As a super user, I know the strengths and weaknesses of many CAD/CAM/CAE systems," says Jennings. "I've worked extensively with various software, and Unigraphics is the only CAD/CAM/CAE system that offers unbeatable modeling capabilities and seamless integration with other systems."

Putting UG to the Test

As a specialist in complex freeform feature geometry, Jennings introduced a sculptured geometry process to the PRS group, while suggesting the use of UG for the entire design-through-manufacture process of the new radio platform. "Other systems just don't measure up to Unigraphics' unprecedented accuracy and design integrity," says Jennings.

So Ericsson's PRS Group — based in Lynchburg, Virg., put Unigraphics to the test on its new IPE 200 radio platform.

The engineering team included Jennings as well as four designers and engineers who each played a key role in the process. The project involved designing the entire radio



In designing the IPE 200 platform, two separate radios were developed — a scan version as well as a system version.

30 ECNs Reduced to One

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ERICSSON

PROFILE

Ericsson Inc.

Stockholm, Sweden

Established 1876

Design, develop and manufacture communications products

85,000 employees worldwide

Unigraphics Solutions customer since 1987

mechanical package (the actual mechanical design of the radio) in 3-D, generating various proof-of-concept prototypes, overseeing the development of all new components and hard tooling, producing a full 2-D documentation package, interfacing with manufacturing and meeting Mil-810-E requirements.

With facilities throughout the world, including, Sweden, Spain and Brazil, Ericsson often develops products collaboratively using diverse engineering groups. For example, in developing the IPE 200, numerous cellular design concepts originating in Ericsson's R&D facilities in Lund, Sweden and Research Triangle Park, Raleigh, N.C., were evaluated and incorporated into the IPE 200 design by the team in Virginia.

In addition to a global development process, Ericsson's day-to-day operations include interfacing with a number of CAD/CAM/CAE systems. Bottom line, Unigraphics' test was an aggressive one.

William Jennings, consulting engineer

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IPE 200 Design Process

The initial concept for the IPE 200 was designed in a 3-D styling package, producing a surface model that defined all external, visible features — namely the front and back cover, and the battery pack of the radio. Color renderings and machined mockups were generated from the model for design approval. The surface model was then translated via IGES into Unigraphics for the mechanical development of the system.

The IPE 200 radio is shown here with all external, visible features — namely the front and back cover, and the battery pack of the radio.

Throughout the project, Ericsson integrated data from a variety of sources into one central database using Unigraphics. This significantly reduced time to market and product costs by providing one standard interface for data retrieval. Unigraphics Solutions' data translators, IGES and STEP were used extensively in the process. "Unigraphics' translator functionalities work extremely well," says Jennings. "The interface between the styling package and UG is exceptionally robust."

The individual surfaces — which included the translated surface model and extracted defining isoparametric curves — were analyzed. Since arc and line geometry in the surface model are changed to splines in the IGES translation, some splines were replaced with simple arc and line geometry as was originally designed in the surface model. The new geometry was used to generate freeform features that were then used to sculpt solid models.

In parallel to this effort, layout work began on the printed circuit board (PCB) in order to determine PCB surface area and component volume requirements. The design and development of the multi-layered PCB, whose components are all surface mounted and auto-inserted, were completed using Mentor Graphics — a participant in the Unigraphics Solutions Alliance Partner Program.

The front and back cover solid models were hollowed and the resulting data information was used to design and allocate component locations. A 3-D PCB outline — the defining PCB perimeter — was developed with 3-D component location areas defined. This information was translated into .brd and .lib format and downloaded to Mentor Graphics. The PCB layout designer utilized this information to populate the PCB by placing 3-D electrical components that were pulled from a library of parts. Each successive PCB layout (complete with 3-D PCB electrical components) was translated back into a .brd and .lib format.

This file was then translated into a .prt file, inserted into the mechanical assembly and analyzed for form, fit and function. The primary objective was to ensure there were no interferences between the populated PCB and mechanical components.

The IPE 200 development process boasts the shortest assembly time and the highest yield of any other Ericsson portable radio.

Low-Risk Platform Allows Patent Pending Breakthrough

In designing the IPE 200 platform, Ericsson actually developed two separate radios — a scan version as well as a system version. The system version has a full alpha numeric and function keypad while the scan has only function keys.

Additionally, two internal design approaches were pursued. The first — a patent-pending elastomeric connector interface between a multi-functional flex film and the PCB — greatly aids in the assembly of the radio. However, it was high-risk from a development standpoint. The second design uses a zero insertion force (ZIF) connector interface between the aforementioned flex strip and the PCB. This particular design was extremely low risk in terms of development and implementation. Both were developed in parallel, so that the high-risk approach could be proven out and implemented as soon as possible, while allowing a low-risk design to also be in place to ensure the product would meet the development schedule.

Not Just Meeting Development Schedules, Actually Beating Them

The IPE 200 development process boasts the shortest assembly time and the highest yield of any other portable radio produced at Ericsson. Rework and scrap for mechanical issues was minimal. Supplier costs also were significantly reduced. Other than tooling vendors, all mechanical development of the IPE 200 was completed in house.

The IPE 200 project team reduced time to market by 75 percent using Unigraphics — a process that used to take two to four years was slashed to just six months. With UG's superb modeling capabilities, the availability of solid models early in the design cycle allowed soft-tooled samples of mechanical components to be available long before hard tooling was finished. Consequently, test fixtures, manufacturing processes as well as software could be generated using production quality soft-tooled parts in parallel to the hard-tooling development. These tasks previously occurred in a series, with a significant down time between the hard-tooling phase and full production.

In the development of the IPE 200, the number of ECNs was reduced from the typical 30 plus to only one. This is a tremendous metric for a precedent-setting development cycle. Communication between the various development disciplines and their respective software packages aided the IPE 200 success. These flawless interfaces allowed the design to progress rapidly and efficiently. It also enabled the design to be largely proven out on the computer, long before CNC prototyping.

With Unigraphics' CAM software, every major mechanical component of the IPE 200 was prototyped for proof of concept early in the design cycle using direct downloaded Unigraphics CAD files to CNC mills. This was followed by soft tooling of these same components for early design verification of the physical model. Nearly all of the tooling was generated directly from Unigraphics files. Every tooling vendor met or beat the scheduled time frame.

Unigraphics met its first test at Ericsson with high marks. "The ability and option to design without parametric constraint was the most important factor in choosing Unigraphics," says Jennings. "Utilizing basic and sculptured primitive geometry, I was able to move through the design process much faster and with more flexibility than with constrained models. Furthermore, I was able to react to and accommodate changes in the design far more readily than with fully parameterized models. Other CAD/CAM vendors just don't have those capabilities." ◗

William Jennings

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The backcover of the IPE 200 is shown here.