ONE IN A SERIES OF WONDERWARE SUCCESS STORIES

Eastman Kodak Uses InTouch as Productivity Tool To Enhance Manufacture of Dental X-Ray Film

ROCHESTER, NY — Today’s growing emphasis on preventive health care has caused new growth in demand for Eastman Kodak Company’s dental film products, which are used by dentists around the world to monitor individual patients’ dental health.

Management of the Dental Finishing Department, located at the Kodak Park facility here in Rochester, needed to increase productivity to meet this growing demand, but in a tight economic climate they couldn’t justify the capital expense for new production equipment. Instead, they had to make better use of existing machinery to simply make more product. They upgraded the production machines — which originally had DEC K-Series logic controller boards, TI logic systems or hydraulic cam banks and relay logic — with Modicon 984 programmable logic controllers (PLCs), to provide better real-time control of machine task sequencing. They also used the new PLCs to gather more machine health status data and production data. The problem now became one of making that information more useful to machine operators and repair mechanics, to optimize uptime.

They accomplished this last portion of the job by adding a new man-machine interface (MMI) for use with the PLCs and production machines, using the Wonderware® InTouch™ MMI software program. The software was sold and supported by Wonderware distributor Niagara Electric Sales, in Rochester. This Windows-based tool allowed Kodak engineers to develop a supervisory monitoring and control system that lets everyone — machine operators, maintenance diagnosticians and management — see what’s happening in Dental Finishing manufacturing any time they need to.

The results have been amazing. In only six months of operation, film packaging mean time between failure (MTBF) has been doubled, and in some cases tripled,
because the highly graphical information supplied via the M M I tool makes it easier for Kodak Park shop floor partners to keep machines running with fewer interruptions.

**New Bottom-Line Results**

Finish production of dental x-ray film involves 10 different machines producing four different sizes of film, yet the same procedures are involved on each machine. The machines precisely combine three webs of vinyl, one layer of black paper, one layer of x-ray film and one layer of lead foil. The layers are fed into the machine and are interleaved, heat sealed and die cut into dental packets, for bundling into packs of 25, 100 or 150 units.

Each operator threads the material feeds into the entry points, and some machines have automatic splicers for continuous operation, but in most cases operators don’t know if all the layers are coordinated. It can take 2-3 minutes before product comes out the other end for die cutting, so even though all tasks are sequenced by the PLCs, it is still possible for problems to cause a machine stop. And that’s where the inefficiencies arise, because not only is production time wasted, but raw material is wasted in the ramping up and down to start and stop a machine.

Our intent with the system improvements was to take the power of the data that already was being collected by the Modicon PLCs and, using the Wonderware® software, put it in a format that our operators could readily use to enhance uptime,” explained Jack Sherwood, Department Manager. “They enjoy a graphical user interface because data is more meaningful. We don’t focus on downtime because we want metrics that are active. So our productivity measurement now is ‘bundles per stop,’ which is a variation on mean time between failure (MTBF).

“When a machine runs without stopping, the process generates low waste and since the operators aren’t hassled by the constant turmoil of starts and stops, they can focus on product quality and the material flow aspects of the job,” Sherwood said. “Our people are able to focus on continuous improvement activities. MTBF on our largest machine — the only machine in the world that creates that particular size product — and we’ve more than tripled MTBF in terms of bundles per stop, within five and a half months.

“The bottom line is that I, as a manager, get more good product with less waste, and operators are having more fun doing what needs to be done,” Sherwood added. “It may be hard to imagine having ‘fun’ in a factory, but many of our partners have internalized our new Equipment Health Monitoring System as a high end ‘video game’ where they are pitting their skills against their best prior performance. And we’ve even changed the algorithm so they get a ‘free life’ every four hours. And we don’t need to go build new machines. This is what I like to call applied ingenuity. Applied simplicity. It’s elegant.”

**System Implementation**

IrmaLAN 3270 emulator station, for interfacing to an IBM mainframe computer that is used for archival storage of machine history data as well as production data, waste data by machine, operator time reporting and master document data base. Six of the production machine PLCs are linked to Intouch via a Modbus+ interface, and the four largest machines communicate via standard Modbus over a Modicon bridge multiplexer.

Three screens form the heart of the Dental Finishing system, for “total shift” data, for “total stops” data and for a “machine health monitor.”

The total shift screen provides a view of all machines, by shift, for up to four 12-hour shifts. Data is displayed on the number of bundles produced since the operator started the shift, how many machine stops were encountered, and how many bundles were produced per stop (the MTBF figure). The data is animated with color keys so that high bundles-per-stop figures are displayed in green, medium production levels are in yellow, and low production figures are shown in white, and they blink to call attention to problems. If a machine is not running, the display window shows zero.

To examine details of any machine’s operation, staff can click on an individual machine and call up the total stops
This will show, for example, that machine #34 had 22 total stops since the start of shift at 6:00 a.m., and the causes will be displayed in priority, such as seven band jams, five mis-splices, three 10X jams, two dial jams, two die toggle jams, etc. It will also indicate how many bundles had been produced and what the average was per stop.

“This information is collected from the PLCs by InTouch and loaded into Excel via DDE, where it’s sorted and ranked for display so all staff can tell at a glance what problems have been encountered and what the results have been,” said Alan Phillips, Senior Manufacturing Technician, who designed the system.

“We’re monitoring 10 machines and collecting data on 60 different stops for each, using just 22 tags in the InTouch database. Rather than have all of these tags connected via hot links, I let Excel do the work and just poke the data into InTouch, in a DDE transaction, as needed.

“I’ve set Excel up so it doesn’t bother to send all 60 stops for each machine, since not all will be represented at any one time,” he continued. “But we display the top 10 machine so that the operator can prioritize his attention for resolving problems and our maintenance people can more easily see any patterns so they can address larger issues related to that machine’s health. In effect, this operates as an SPC function without having all the complex detail of a true statistical process control program.”

The Machine Health Monitor screen provides a real-time chart display of individual machine production so that patterns can be discerned more easily as well. Kodak staff can instantly change the chart scales and time values of the displays to see more detail. The chart scale can be selected by a “pushbutton” to show 50, 100 or 400 bundle per stop relativity. The chart time length can be viewed in one, four and 12-hour increments. Data can be selected via pushbutton for viewing different lines for different products, such as Polysoft, Easy Open 1 and 3, and Easy Open 2.

This system has made a dramatic difference in our time between stops, and the number of bundles per stop, so operators can now do additional things, such as being more involved with their own quality inspections, taking more time to do splices, doing cross-training on other equipment, doing minor maintenance, studying other computer applications such as MRPII — all kinds of things they’ve never had time to do before because they were always working on the machines,” he added.

“Our network configuration is a constantly changing thing, because we keep finding ways to increase efficiencies,” he said. “As an example, thanks to this network we’ve been able to cut costs for our dedicated 3270 gateways. We used to have 10-12 users authorized to access the mainframe, and at $35 to $40 a month per node, that was a pretty stiff budget item. We’ve now removed all of those single coax stations and replaced them with one network node that’s licensed for 32 users, so we’re only paying for one node. This has allowed us to further automate all our data collection and reporting to the mainframe, and it’s more efficient anyway since it’s pre-processed by Excel and InTouch.”
Phillips is looking at upgrading overall network performance by adding newer PCs. “I’m going to propose that we off-load our 386 machines to office automation users and replace the production systems with 486 or better machines,” he added. “In addition, we’d like to add a networked CD-ROM drive for direct access to libraries of FDA regulations and medical device libraries. We’re already MRP II Class A and ISO 9002 registered, yet we may soon use LAN-based CD-WORM technology instead of the mainframe for manufacturing documentation and FDA device master history records.”

All of this capability has created a “culture change” in the Dental Finishing group, according to Sherwood.

“To paraphrase John Naisbitt, many industries are drowning in data but are starving for knowledge,” Sherwood commented. “What we’ve done is taken the data that has meaning to us in our application, and put it in a form that our machine operators and maintenance people can understand. This allows them to get out of the old mode of mechanics responding to complaints from operators. It allows everyone to become proactive. That’s a real culture change.

“Change like this can’t be mandated by management; there has to be something in it for the partners,” he added. “If it’s in people’s own self-interest, it adds value to them. That’s what this system has done for us, and we’re proud of what our people have accomplished.”

The MMI application that makes the system work runs on five IBM PS/2 Model 70 computers, which are 386-based machines. Each has six megabytes of main memory and a 120 megabyte hard drive, and all are connected to a 3COM Ethernet network running Novell NetWare 3.11. This network also includes three Macintosh computers and 12 other PCs that are used for general office computing. The network has an