CASE STUDY: ENERCON

Aegis MOS transforms Enercon's quality and production information infrastructure.

Enercon, a Maine-based contract manufacturer, recognized that a single-source, realtime paperless documentation system would significantly improve their manufacturing execution. Accordingly they turned to Aegis Software, whose MOS product offered the industry-leading solution to the functionality they sought. This case study looks at Enercon’s background and requirements, and how these were fulfilled by Aegis’ MOS in terms of its features and its implementation across Enercon’s enterprise.

BUSINESS BACKGROUND AND REQUIREMENT

- Enercon is a contract manufacturer handling SMT and through-hole board assembly, cable assembly and chassis level integration.
- The company provides design, development, manufacturing, service and support to medical, defense and commercial applications.
- Enercon identified a need for an online MES system that could radically improve its manufacturing execution.
- This should critically include a single, universally visible document source providing real-time manufacturing and quality information.
- Aegis’ Manufacturing Operations Software (MOS) demonstrated the industry’s best ability to meet Enercon’s single source manufacturing execution and traceability documentation requirement.

BACKGROUND

Enercon Technologies is a privately held contract manufacturer serving Original Equipment Manufacturers (OEMs) and well funded high-tech start-ups. Founded in 1980, the company has grown and evolved over the last three decades. With state-of-the-art ISO and FDA registered facilities, Enercon’s capabilities range from product design and engineering through volume manufacturing to service depot support. Enercon works with its clients to streamline their development cycle, reducing time-to-market and total cost.

Enercon’s EMS operation includes SMT and through-hole circuit card assembly, cable assembly, and integration of these and other components into chassis and enclosures. About 70% of these assemblies start with Enercon design services, and production activities are distributed between Enercon’s two closely located manufacturing facilities in Maine. Enercon supplies 40% of their output to the medical industry, 30% into defense and 20% into commercial applications.

Enercon’s mission is to provide world-class design, development, manufacturing, service and support solutions, 100% on-time and error free to Original Equipment Manufacturers at best value. In 2006, as part of their strategy for mission fulfillment, Enercon identified a need for an online MES system that could radically improve its manufacturing execution. The key component of this was to be a single, universally visible document source providing real-time manufacturing and quality information. Costs of accessing and acting on this information should be driven significantly below those of the existing legacy systems.

Aegis was selected because its Manufacturing Operations Software (MOS) demonstrated the industry’s best ability to meet Enercon’s single source manufacturing execution and traceability documentation requirement, more cost-effectively and with less overhead. MOS was clearly the product most capable of delivering the information visibility, availability and speed of access identified by Enercon as essential to meet their process improvement goals. Especially with the inSite mobile device app, this unprecedented new level of information access was opened up across the entire Enercon enterprise, providing a ubiquitous information environment throughout and beyond its production areas.

CASE STUDY

A case study was recently conducted to highlight how Aegis MOS supports Enercon’s manufacturing environment, its key features, its use by both production and management staff, and the improvements to quality and cost control experienced. The study focused on a medical device for conducting pediatric eye screening that...
ENERCON’S EXPERIENCE

• MOS’ functionality was configured by Enercon’s production staff, with no software expertise needed.

• Aegis MOS has allowed a completely paperless solution administered from a single Documentation Control Center.

• Defect reporting times have been reduced from typically one month to real-time availability.

• Automated quality reports are generated weekly as well as immediately on demand.

• Top two weekly reported defects reduced by 90%: DPMO reduced by 80%.

• Aegis MOS with the inSite mobile device app provides a ubiquitous information environment.

FEEDBACK FROM ENERCON

• Aegis MOS has fulfilled its expected productivity and QC benefits throughout 5 years’ operation at Enercon.

• It has also radically improved Enercon’s defect management process.

• Enercon sees Aegis as a very strong system supply partner.

• Enercon enjoys continued benefits from Aegis’ ongoing innovation programme.

AEGIS CASE STUDY:
ENERCON

was originally presented to Enercon as a large suitcase-sized prototype, which Enercon designed down into a smaller scale device that now can be held in two hands. This device provides a particularly informative example as it concerns a cradle-to-grave product that Enercon, having modified the design, now processes through all their production areas – circuit card assembly, cable assembly and final enclosure-level integration. Beyond this, Enercon also handles product returns and repairs through an RMA process, taking responsibility for shipping repaired products directly back to the customer. Aegis MOS provides rich traceability of each unit’s life throughout this entire manufacturing process, critically including the RMA and direct returns procedures, which serves as the Device History Record (DHR) for each unit.

Starting with their new product introduction (NPI) effort, Aegis MOS establishes the single source of production information, and delivers to its staff at each location in every production line assured access to the detailed, correct and updated information for the product and version they are currently manufacturing. It also collects production and quality data from every area of the production process in real time, making it immediately visible to supervisors and managers irrespective of their location within or outside the manufacturing facilities. This data can be displayed and distributed within user-configured reports or in response to more detailed queries on demand. Crucially, this functionality was set up by Enercon’s production staff simply as a configuration exercise; no specialist software effort was needed or used. A closer look at the implementation shows exactly how Enercon used MOS to achieve the manufacturing execution improvements they sought.

THE DOCUMENTATION PROCESS

Enercon’s process engineers allocate a portion of their day to work instruction development which they perform entirely within Aegis’ iLaunch environment. Circuit board assembly instructions use easy to follow color-coded visual aids that utilize a CAD-intelligent image of the circuit board. This allows dynamic reference location searches, pan-and-zoom control with the ability to click on a component and see rich information about its part detail, and first article inspection to guide an operator through each location on the board. Cable assembly instructions also feature visual aids used to define wire lengths, shrink tubing, crimps, terminals and connectors, as well as information for assembly inspection and test.

Work instructions are also generated for enclosure level assembly and final integration. An operation at this level typically spans several pages, includes step-by-step instructions, and incorporates a generous array of digital images showing graphically how the work should be performed. Beyond the instructions developed in iLaunch, they also add documents and files created externally to Aegis — assembly drawings, schematics, standards, standard operating procedures (SOPs) for example — to Aegis’ ‘Reference Library’, from where they can be made visible to shop floor personnel using the Aegis MES browser. Aegis is also used to author test plans.

Documentation control for Enercon’s live manufacturing process is handled entirely by Aegis MOS, whose completely paperless environment has considerable advantages over the paper-based system it replaced. Their former method relied on a folder or binder for each assembly’s revision documentation, in which information was redlined, crossed out, and modified. Under these circumstances, revision control was difficult, and ensuring that every operator was working on the same, correct documentation was time-consuming and unreliable. Additionally, binder storage, paper costs, and labor for every change all added to the total documentation workload and cost. These problems have all been eliminated by Aegis, which is administered from a Documentation Control Center located at the heart of the production area. Its appearance is similar to a nurse’s station on a hospital floor and its role is just as critical.
One of the responsibilities in ‘Doc Control’ is to create jobs based on work orders that originate from SyteLine, Enercon’s ERP system. The work orders are reconciled with the BOM and work instruction appropriate to the target assembly and revision level. New revisions are created when necessary, based on an earlier revision’s documentation set updated with the changes to the affected operations.

If a job requires any exceptions, Job Exception Notifications (JENs) are raised and broadcast through Aegis. Unlike a revision, a JEN describes a temporary change to a process. Changes are presented as a PDF through the Aegis MES browser, which notifies operators when their current job is affected by a JEN. A third of all the jobs run on the production floor are affected in this way.

Unit ID registration is also managed by Doc Control, where barcode ID labels are affixed to the bare circuit boards. The Aegis MES browser, resident on all production floor screens, visually guides operators through the barcode scanning process to capture each unit’s ID and initiate their existence into the system.

The MOS software has had a huge impact on quality as well. Before its deployment, defects were recorded on ‘tick sheets’ and then keyed into an Excel spreadsheet for later analysis. The analysis was an intensely labor intensive process, so its conclusions were typically reported a month after data entry. This delay made the results less meaningful, and less effective for use in corrective strategies. By contrast Aegis, since its installation four years ago has been capturing defect data as it is generated from all locations across the production area and making it visible instantly. AOI machines collect defect data automatically for transmission to MOS via the Aegis-supplied xLink web service adapters, while inspectors enter the data by touching an affected area, component or connector within a product image displayed on an Aegis touch screen terminal.

Enercon has been specific in identifying reporting improvements and defect level reductions achieved since the MOS installation. The Quality reports and reviews, which are now automated, are generated weekly by default instead of monthly, as well as immediately on demand. Defect Pareto distributions are also automated, with the top two weekly reported defects now being 90% less than four years ago. Defects per million opportunities (DPMO), entirely automated within Aegis MOS, has levels 80% below those of three years ago.

This transformation of data availability has been timely for Enercon as their clients increasingly expect them to possess, and respond rapidly to, information about their built products. Enercon’s management has also come to rely on Aegis for quality and traceability information. Accordingly they enjoy better awareness of current production status and more informed decision-making for corrective actions and control. Aegis generates, schedules, and emails weekly defect reports every Sunday through the Data Miner application that provides ad hoc historical data analysis. This includes running pre-defined templates to return results in chart, pivot table and report form. It also allows investigation of quality issues through drill-down bar charts, referenced by product, customer, inspection point, inspector, defect code and other criteria. DPMO is also automatically calculated.

Enercon recently upgraded to the current software release to enjoy the benefits of inSite, Aegis’ manufacturing visibility mobile app for iPhone or iPad devices. This provides production awareness by showing numbers of units scanned, together with pass and failure rates. It also reveals work order and job progress. Additionally, inSite provides quality information in terms of yield, defect analysis and unit traceability. In product recall situations, inSite identifies units containing specific part number lots.
The DHR generated for each unit is a key repository for production history and traceability. Product route history includes records of operator performing assembly tasks together with the date and time, physical work location and WIP status. Genealogy is also recorded, relating serial numbers of ‘parent’ enclosures to those of their constituent ‘child’ boards and cables. Additionally, parametric values including MAC addresses, purchase part numbers, temperatures subjected to, torque values, and set points are stored. Each unit’s DHR also defines exactly how it should be built as it includes the unit’s revisions approval record and any JENs currently applicable during manufacturing. Defect/repair records are also maintained; a particularly important point as repaired units are shipped directly back to enduser customers.

AEGIS MOS FEATURES AND IMPLEMENTATION

So far, we have focused on the production and quality information that MOS produces. However, much of MOS’s transformation of Enercon’s documentation infrastructure is due not just to the information itself, but also to how it is collected, distributed and presented. Data collection is facilitated by the extensive and growing xLink library, which removes integration issues for AOI machines and most other sources of production and inspection data. At the same time, data processing and presentation is handled by Aegis’ six core modules that reside on a single SQL database, referred to as iServer. This single data backbone ensures free information exchange, reduces data entry and simplifies system integration and expansion. The core shop floor modules in use at Enercon include iView, iTrac and iQ (described below) ensure that operators, supervisors, and management enjoy the information they need, when they need it. This information is presented primarily as CAD-intelligent visuals, which allow operators to easily see areas of interest within the products they are working on, and to drill down to more detailed information as required. So, let’s take a look at how Enercon has implemented the MOS modules to achieve the information environment they sought:

Information is displayed on touch screen-enabled thin client workstations distributed throughout all production areas. Training new operators typically takes around 60 – 90 to become comfortable with the browser, which appears on each workstation as users’ primary window into MOS. Operator log into the system using badge scanning instead of typing in a user name and password. Their next step is to scan a work order or unit barcode to automatically retrieve the appropriate work instructions. An on-screen message advises if any JEN is active against these instructions, and the operator can review the JEN document, also on-screen.

iView also features visual aids to support hand assembly of components onto circuit boards. The browser displays the board image in which the components to be installed are highlighted and color coded by part number. The operator can interact with the display by searching on a part’s reference location or touching a board component to dynamically list its AML (Approved Manufacturers List).

For first article inspection of a completed circuit board, an inspector steps through each location using the touch screen, reviewing all polarized components. After each step the selected component’s color changes to indicate it has been reviewed. For mechanical and cable assemblies, operators step through each instruction where the area of interest is highlighted in a zoomed view and instruction information is prominently displayed.

Knowing where all work orders and units are located throughout the production area has always been particularly challenging. However under Aegis’s plant-wide coverage this information becomes naturally available, and as such is presented within the iTrac process tracking and control module. iTrac handles product WIP tracking, route enforcement, genealogy and parametric data collection. Operators scan the barcode on serialized units to start work on the product. They can finish
the transaction and streamline their throughput by simply scanning the next unit’s barcode. For non-serialized units and primarily cable assemblies, operators enter the quantity of units completed.

As serialized sub-assemblies are installed into an enclosure for final integration, operators scan their barcodes as ‘children’ of the enclosure. iTrac validates these barcodes after checking for correct revision, no failed statuses, complete sub-assembly and not installed in another parent. Parametric data including MAC addresses, serial numbers of purchased parts, temperatures experienced by the part during assembly and set point values is commonly captured for the assemblies.

xLink facilitates automated data collection from production equipment including Ekra, Fuji Flexa, Vitronics MyReflow, and other machines. They also handle data from CR Technology and Orbotech AOI systems, as well as generic functional test equipment. xLink converts all these machines’ disparate data streams into IPC’s standard CAMX format. Data exchange with SyteLine ERP is managed using Aegis xTend middleware.

Collecting defect and test data on circuit boards, enclosure-level assemblies and cables for management information and access by repair technicians is handled by the MOS iQ module. As part of the MOS user environment, iQ is based on intelligent visuals of the product. Operators can immediately see and interact with assembly, component or connection level defects using the touch screen rather than text input. Once detected, defects are automatically related to detailed elements of the product design. This CAD intelligence approach facilitates ongoing manufacturing improvements as well as accelerating the defect identification and capture process.

Technicians at the repair station can recall visuals, complete with defect markup, for a product by scanning its barcode. They can then perform the appropriate repair action accordingly. Data collected and presented by iQ frequently improves repair productivity by allowing technicians to address repairs by common issues instead of unit by unit.

**INSTALLATION REVIEW**

The Aegis MOS system has been installed and running for over five years; enough time to demonstrably fulfill the expected benefits of improved manufacturing productivity and quality control through a single source paperless documentation environment. Additionally, its quality system has radically improved Enercon’s defect management by collecting information in real time from all areas and making it immediately available within analysis and reports, rather than after a month’s intensive effort as previously.

“Aegis has always been, and continues to be a very strong system partner,” commented Ryan Marcotte, Enercon General Manager. “We were impressed with how Aegis overcame the installation’s challenges, committing the resources to ensure delivery of the promised platform on time and within budget. Additionally, we have benefited from Aegis’ position as the industry leading manufacturing operations solution provider, as they continue to deliver new and innovative functionality such as the inSite app. This in turn allows us to offer ever-improving solutions and value to our customers”.

The ‘Before and after Aegis’ table below provides details of MOS benefits and their true value.
Aegis has been granted the highest level of Microsoft partnership available. Microsoft Gold Partnership status requires independent lab testing of Aegis products as well as educational and testing certification of Aegis staff in IT-related competencies. This ensures Aegis products will function properly in your IT environment, and that Aegis engineers are fully qualified to work with your IT staff and within your IT infrastructure.

### BEFORE AND AFTER AEGIS

**Comparison Table**

<table>
<thead>
<tr>
<th>ACTIVITY</th>
<th>BEFORE</th>
<th>AFTER</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Process documentation</td>
<td>Paper based system</td>
<td>100% On-line</td>
<td>Instant updates; no more paper chasing</td>
</tr>
<tr>
<td>Route enforcement</td>
<td>Paper based system</td>
<td>100% On-line</td>
<td>Enforced via scanning</td>
</tr>
<tr>
<td>Access to process information</td>
<td>Varied</td>
<td>100% On-line</td>
<td>Immediate access to present and all historical processing.</td>
</tr>
<tr>
<td>Manufacturing and Quality report generation</td>
<td>Hours per week</td>
<td>Automatic</td>
<td>Reports are automatically generated and emailed to individuals and groups for action</td>
</tr>
<tr>
<td>Response to customer inquiries</td>
<td>Varied</td>
<td>Still varies but on like requests, significant improvement</td>
<td>Data is all on-line and easily retrievable.</td>
</tr>
</tbody>
</table>

---

**Microsoft GOLD CERTIFIED Partner**

Aegis has been granted the highest level of Microsoft partnership available. Microsoft Gold Partnership status requires independent lab testing of Aegis products as well as educational and testing certification of Aegis staff in IT-related competencies. This ensures Aegis products will function properly in your IT environment, and that Aegis engineers are fully qualified to work with your IT staff and within your IT infrastructure.

---

**AEGIS CASE STUDY:**

ENERCON

[www.aiscorp.com](http://www.aiscorp.com)