Networked Electronic Logbooks

- an effective solution for sharing knowledge and ensuring a compliant, safe, well managed and efficient facility.
- a method of harnessing Process Information, Operational Knowledge and Facility Wisdom.

1 Abstract

Much information and knowledge about a facility lies untapped in the experience of operators, scientists, engineers and facility managers. Data and information embedded within the very equipment used to operate the facility is equally unused. Significant effort is expended on occasions – such as pending safety or compliance inspections – or after emergencies – such as breakdowns or accidents – to retrieve information in order to compile accurate reports on the true performance of the facility. Of equivalent – perhaps greater – cost to the facility is the loss of knowledge and information during staff transition and in inefficient operation of the facility by some operators, scientists and engineers.

Recent advances in network architecture and in electronic logbook design have enabled facility managers to provide seamless and non-invasive methods of collecting and retaining data in such a manner that relevant information is presented in context-sensitive locations and times. Such timely information has been shown to increase facility efficiency, improve preventative maintenance and ensure that regulatory inspections are simplified.

2 Overview

This paper explores the evolution of simple measurement systems – collecting DATA – used by facility operators and managers in the past (more than 30 years ago) to the current Information systems widely in use in various control rooms around the world.

It explores the relationship between data, information, knowledge and wisdom – and attempts to highlight how "best practise operators" are using all the available data and information and where current operational trends are leading facility designers. How will future complex systems use all the available data and information in a meaningful manner, so as to enhance these "super facilities" and ensure that they remain compliant, safe, well managed, well maintained and efficient.

The current operator is faced with plenty of data and a great deal of information. This paper shows how the majority of operators obtain their "knowledge" of the facility from years of experience, and very seldom from any systems created within the facility to provide them with such knowledge. The only source of operational "wisdom" that operational staff are aware of comes from – if at all available – from long-service staff or retired scientists!

With the operational needs of a specific facility as a background, the paper then explores the (very similar) needs of a plethora of non-operational interested parties, such as managers, shareholders, funders, government agencies, scientists, engineers, researchers, medical staff, equipment vendors and other facilities around the world.

An interesting observation arises from an examination of more than 1,800 control rooms around the world. [1] When questioned, 100% of all respondents state that given a highly unusual set of circumstances, they will turn to a more experienced person on their facility to obtain the benefit of their knowledge and for information on how to resolve the situation. Over 97% of all these facilities also maintain a handwritten, paper-based logbook. More than 90% of respondents claim that they examine old hand-written logs for important information.

The use of hand-written logs, "wise-old operators" and "knowledgeable, retired scientists" is surprisingly high, even within the most sophisticated and complex facilities in the world.

Reliance on hand-written logbooks and experienced staff is particularly high when inspection of the facility is required – by government regulators, safety or environmental inspectors.

This paper shows the benefits that can accrue from the correct use of networked, electronic logbooks – designed to capture not only information, but also knowledge and possibly – hopefully? – wisdom as well!

This paper is structured with two main sections; the FIRST SECTION being an evaluation of requirements, needs and problems associated with current control room practises; the SECOND SECTION being a brief examination of best practise use across various control rooms, making use of networked, electronic logbooks.

2.1 A glimpse at the future?

Significant advances in the accuracy and extensibility of measurement equipment have occurred over the past 30 years. The ability of people – operators, engineers, scientists, managers – to correctly interpret, analyse and use the supplied DATA has not kept up with the changes.

Systems have been developed to supply meaningful INFORMATION to operational staff and executives. Attempts have been made to evolve the information systems into KNOWLEDGE systems. (In a few cases, working examples of knowledge-based systems – particularly in the automotive industry – are being used).

Will the next few years see the evolution of an effective WISDOM system?

3 Section ONE – the Current situation in many control rooms

3.1 Introduction

Complex operating facilities such as particle accelerators have many locations in which relevant decision-making occur. These locations include control rooms, experimentation areas, maintenance workshops, laboratories, various offices, customer premises, research facilities, hospitals and meeting rooms in which scientists, doctors, engineers and managers design and plan programs.

Information and data collection technology has enabled decision-makers to receive large amount of information almost instantaneously. Data is often electronically manipulated so as to provide meaningful information to the decision maker, enabling them to make effective decisions without having to physically visit the source of the data. The data and information supplied to central locations has resulted in complex facilities being controlled – managed – by fewer staff. [2] The continuously increasing demands on these members of staff to make the correct decisions – important decisions (with large safety, environmental or cost implications) made as quickly as possible – relies on staff being highly knowledgeable of the facility, the equipment, the processes and the client requirements.

How does a new operator gain such knowledge (or facility wisdom) in a short period of time?

Distributed Control Systems and electronic Historians are capable of storing huge volumes of data at high speed. (Storage speeds of up to 10,000 datapoints per second – plus simultaneous retrieval and reporting – are possible [3]). Data presentation software enables users to view the data applied as information. This information enables meaningful decision-making. The actual decision made by the operator however is not recorded – nor the outcome of that decision? Was it a good decision or a bad decision? If the actual decision is recorded, it is most likely recorded in a hand-written logbook. The retrieval of such stored decision-making knowledge is limited to the finding, sorting and searching through old logbooks.

How can the valuable knowledge (decision-making wisdom) of experienced operators be easily stored and accessed?

Complex facilities such as a national, or multi-national particle accelerator, serve the needs and requirements of many different and disparate communities. Access to relevant data, information and knowledge is vital – and is often required at unusual, or inconvenient, times. Access may also be required in different locations – not only within the facility itself, but worldwide, even further complicating the time-of-day demands for information.

How can valuable data, information and knowledge be made available to a worldwide community?

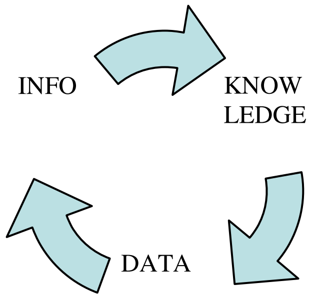
This paper explores what may be missing in a highly sophisticated, technical community that records data and information at an unprecedented rate and uses this data to make decisions that could – literally – kill or maim many people.

3.2 Data, information, knowledge, wisdom (& memory)

Data, information, knowledge and wisdom are the primary elements in the decision-making process. Some researchers add “memory” as a 5^{th} element. These elements are used by all of us in myriad ways throughout our lives.

The simplest example may well be:

- Data collecting. Is it hot or cold outside?
- Information collating: Will I be indoors or outdoors and how will the actual temperature differ?
- Knowledge assumption: How do I relate to this temperature? What are my needs for comfort?
- Memory retrieval: Last occasion when temperatures were similar, I was cold all evening!
- Decision making: I had best take a warm jacket along with me
- Wisdom improvement: Next time I will know better!



In an industrial environment, it can be shown [4]that:

- Data – both absolute and relative – can be measured.
- Information is the application of data to a given set of circumstances.
- Knowledge is the application of information within a given environment

Phsycologists have long argued that wisdom comes from years of applying knowledge to different circumstances. Some individuals are astute in behaving wisely – as they are able to apply learned knowledge from earlier circumstances – to new (and even very different) circumstances. Their behaviour is termed “wise”.

We could then argue, that in an industrial environment, that:

- Wisdom (operational wisdom) is the application of knowledge to a new (different) set of circumstances or environment.

It is the authors belief that future “knowledge-based” control systems will be adapted to become “wisdom-systems” that are capable of taking learned behaviour and applying such behaviour to new (future) circumstances.

Whether or not such electronic wisdom systems are likely to be developed, it is clear now that – in order to ensure that human operators are given all the relevant information with which to apply their decision-making skills – these operators are empowered with the highest levels of relevant data.

A brief examination of the elements of decision-making is required.

3.2.1 Data

Data is the first element in the decision-making process. At its most basic level, data is a specific, single measurement (or reading) taken at a specific location and at a specific time under specific conditions.

Many pieces of equipment have been developed to ensure that data is correctly measured and retrieved from the process being measured. It is particularly important to ensure that the very act of measuring does not affect the reading being taken.

Measured data can arise from any portion or region of a physical locality. Readings of temperature, pressure, voltage, current, pH, viscosity, gas content, speed are a few examples. Highly sophisticated measuring instruments have been developed for almost every type of data that could – or should – be measured.

Relevant data can also come from elsewhere – examples of this could include the composition of a chemical additive being supplied from a manufacturing plant elsewehere.

Data, inherently, is of a single dimension and is monomer. It is a specific snapshot of a specific portion of the behaviour of a specific process (or entity) at the exact time of recording. Unless other relevant data is available, most data is – taken entirely on its own – useless. For example, a single temperature reading of 4ºC means what, exactly? To answer that you need know what is being measured, what it’s properties are, whether that reading is static – or getting warmer or colder. Of what material does the storage unit comprise, and a myriad other relevant pieces of data.

Often, in order to interpret the data measurement correctly, additional pieces of data must be recorded simultaneously. For example, if a differential pressure measurement is taken across an orifice plate - in order to calculate the flow-rate of the measured fluid - it is necessary to know the temperature, pressure and viscosity of the fluid at the time & place of the measurement. (For high accuracy results it may be necessary to record the atmospheric pressure as well).

Our natural senses are efficient "data collectors": Our senses of smell, sight, taste, hearing, touch and feel provide an endless source of data. By nature – and possibly because we are so highly attuned to "collecting data" continuously – each facility has a large amount of data to be collected. Most facilities throughout the world require someone, at some time each day, to take a pencil and paper and write down a data measurement (or many data measurements) for recording or analysis or decision making. (Most often, simply to be stored as a "record")

The important criteria surrounding the collection of data are:

- Accuracy of measurement and reading
- Time of measurement or reading
- Location of the reading (if the measurement device can move)

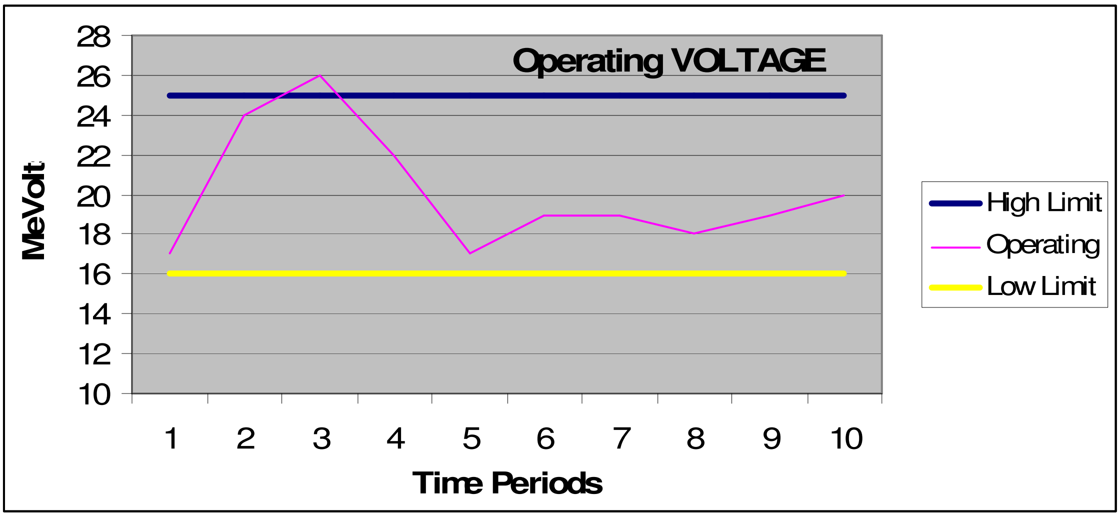
Other important criteria that should be taken into account, but often are not, include:

- Conditions of the measuring equipment
- Conditions around – near – the measuring device
- The exact time at which important relevant data is also recorded (for example, to calculate the flow rate, it's no use measuring the differential pressure, absolute pressure, fluid temperature and viscosity all at totally different times)

3.2.2 Information

As shown above, raw measured data without reference to anything else is often of little or no value.

The application of measured data to other data can result in information being made available. The most common example of this application is the comparison of various data measured at different times. Meauring a voltage at different times can – for example – tell the responsible person that the measured value is increasing – or decreasing – over time, or is approaching (or has exceeded) a threshold limit.



GRAPH 01: Time linear presentation of Voltage data

In order to extract meaningful information from measured data, it is almost always necessary to have another set of data alongside the primary data. This secondary data can be classified as;

- Comparative data – temperature from another location; voltage measured at a different place in the facility; pressure at sea level
- Time phased data – multiple readings taken at different times through the life-cycle of the process
- Structural data – often the primary data simply needs to be established within a "fixed framework" of parameters that do not necessarily change. In the case of a simple flow meter measuring the flow-rate of fresh water, given the differential pressure reading across an orifice plate is adequate data to measure the flow-rate once the (fixed) dimensions of the pipe inner diameter and orifice plate hole size are know. (This is because

the viscosity of water changes very little given wide changes in temperature and pressure). Note that this measured data will result in an instantaneous flow-rate being known. In order to gain information on the actual volume moved over a period of time, comparative data – or time phased data – will be required.

- Relative data – data measurement that can only make sense when understood in relation to a specific set of circumstances, such as temperature inside a pressure vessel. The temperature in this example only makes decision-making sense when the pressure within the vessel is also known
- Absolute data – in special circumstances, a measured data can be considered absolute. This is a special instance of relative data, and this fact needs to be known in order to correctly interpret the data.

Once enough secondary data is available, it is possible to apply the primary data alongside the structure created by the secondary data. Within the context created by this structure, an application of the primary data yielding information is possible.

It can be said that **Information is applied data.**

3.2.3 Knowledge

Once information is available to an operator – or decision maker – a series of activities can take place. The information can be used simply as confirmation, in order to increase a sense of security, to initiate an action or to get someone to sound an alarm or fill out a report.

Knowledge comes from having previously learned something – either academically, or by previous experiences, or through a process of re-inforcement of earlier partial knowledge (positive or negative re-inforcement).

As information is gathered and placed into a meaningful context, a decision-maker will compare pieces of the information with other information (either immediately available OR stored in memory) and will then come to some conclusion and act upon that conclusion. (A reasoned outcome). Once that decision – reasoned outcome – is acted upon, the results of that action will become evident over time. A GOOD decision will be welcomed; a BAD decision will be examined with regret. The results will – in due course – re-inforce the decision making process in the form of knowledge. That particular decision-maker (and others closely associated with the decision) will become more knowledgeable.

If the gaining of knowledge is time based, can the process ever be shortened? This is a crucial question when it comes to the design of Knowledge Systems, or knowledge-based systems.

What we can be sure of is that information, when applied by a "learning system" (usually a human brain), results in the acquisition of knowledge.

Thus, **Knowledge is applied information.**

3.2.4 Knowledge Systems

Knowledge systems were once considered the holy grail of the control world.

Fuzzy logic systems are examples of "self learning" (knowledge) systems. Electronic circuits able – at a simple digital level only – to make basic "what if" comparisons are used to make useable decisions.

Knowledge tools were developed to assist operators in making value-added decisions.

Consider the following example:

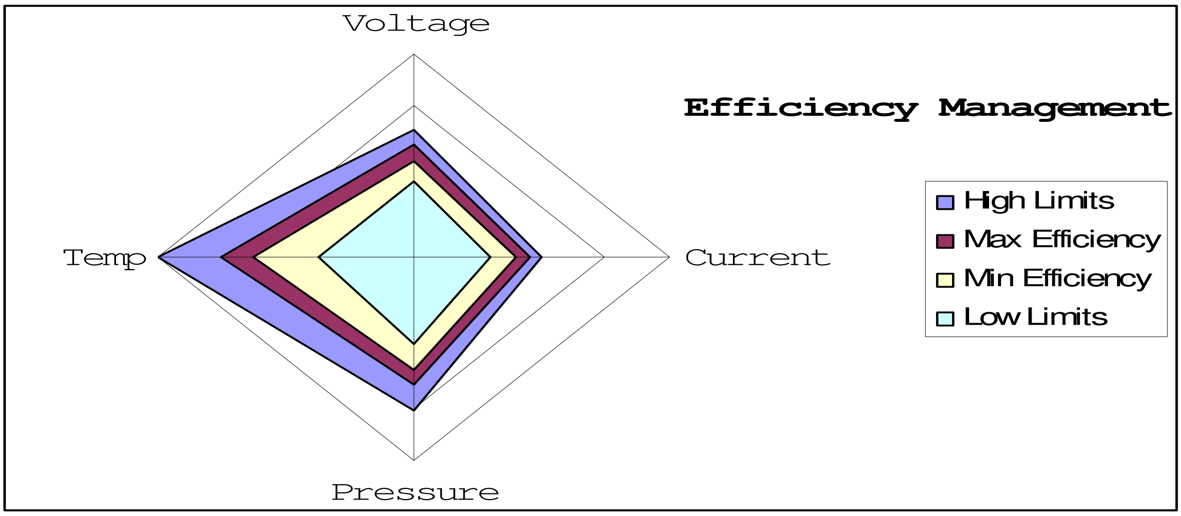
In a particular process, it is important to monitor and control the voltage, current, tremperature and pressure variables in order to complete the process.

For both safety and product quality reasons, each of these variables have a HIGH limit and a LOW limit above and below which the specific variable may not go without causing damage to the facility, or resulting in a poor quality – or even reject – product. (In most cases a further high-high limit , or low-low limit, is defined for safety reasons. Should the variable exceed these outer limits, an automatic shutdown will be initiated)

Traditional operations require the operator to control within these limts

Process scientists may identify another set of parameters (setpoints) within which the best possible product quality can result, or the maximum energy efficiency can be achieved, or the least machine wear will occur. These "inner limits" are often nowhere near the alarm limits and are usually interdependent – unlike managing the process on alarm limits which are exclusive to a single variable.

A process display which compares a variable against other variables – instead of on a time axis – is a simple tool which allows comparative decisions to be made.



GRAPH 02: DATA vs DATA representation of Information

Keeping the combination data points along the maroon curve will achive a specific set of objectives.

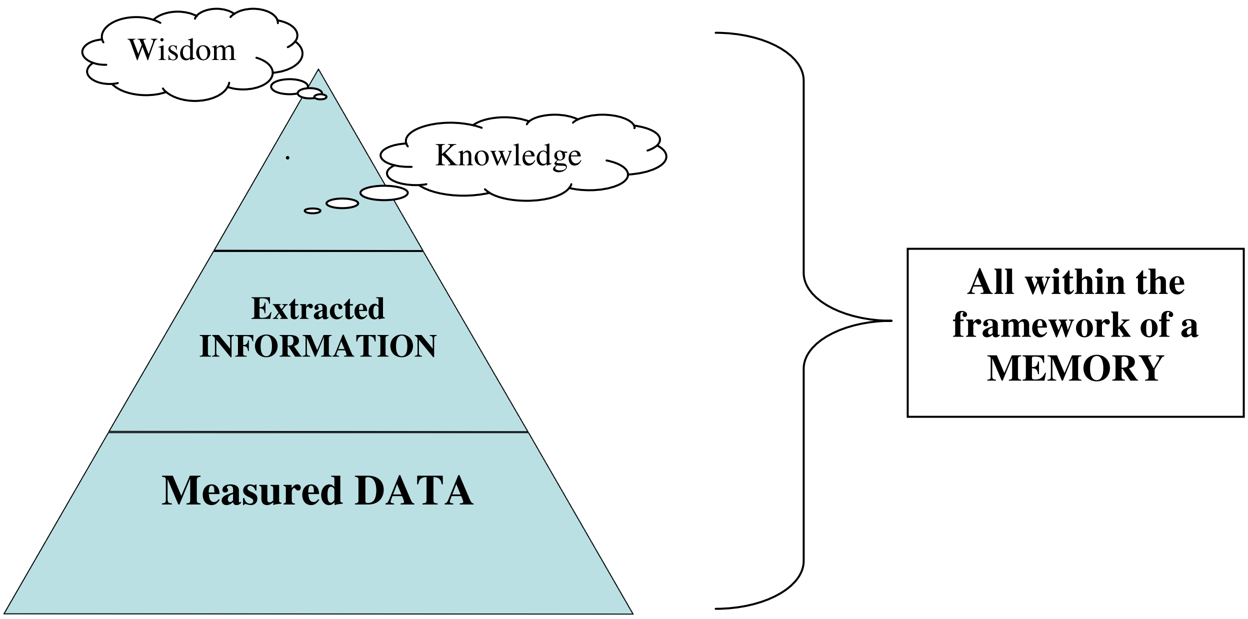
Self learning systems have evolved from the understanding that:

- Information (itself applied data) when correctly applied and placed in context can result in gained knowledge.
- When knowledge is used in the process of making a decision and acted upon, an outcome results.
- Outcomes can be examined to determine if they are good (positive) or bad (negative).

A system can be built that considers the outcome, determines its acceptability, then adjusts the information gathering, the decision making and the outcome adjudication accordingly.

3.2.5 Wisdom

Control engineers have for some time referred to the possibility of Wisdom systems, with wisdom being the application of knowledge. In all cases, a MEMORY (Data, Information and Knowledge storage) is a requirement.



3.2.6 Memory

Human decision makers rely heavily on their memory – and the ability to recall (either deliberately or unconsously) – previously learned or experienced situations that apply to the current decision they are facing.

Experienced Accelerator Operators have a wealth of wisdom and knowledge, based upon years of operating facilities, often under difficult circumstances. Each time an unexpected situation arises and a decision has to be made, the operator gains knowledge and wisdom - regardless of the actual outcome of the decision!

Let us assume that such memory is faulty – or does not exist, as in the case of a new employee. What then? What if natural staff turnover has resulted – over the lifetime of an older facility – in everybody who experienced the initial start-up of the facility no longer being involved in any decision-making position?

Often an older facility, such as in this hypothetical situation, requires greater knowledge (and wisdom) to operate. The amount of available data and the depth or relevance of the information provided is far less than in equivalent more modern facilities. It is exactly these facilities that need to rely on wiser, more mature operators with deep memories and vast quantities of knowledge. Sadly, it is these exact facilities that do not have such qualified staff.

A networked, electronic logbook system can provide a meaningful solution in supplying the necessary "memory" in many situations.

3.2.7 The experience cycle

A WRONG decision will result in an operator gaining knowledge in what future decisions not to make, and in what circumstances to avoid! It's also likely that the more expensive the "mistake" the more likely the operator is to "learn" the lesson. Some researchers refer to such "learning expenses" as school fees!

A CORRECT decision will result in good decision making being re-inforced

It has been said that an Operator must experience at least ONE of each type of situation before that operator can be considered fully trained.

This is certainly true of all major "types" of situations, such as commissioning, start-up, shutdown, breakdowns, planned shut downs, phased start-up, etc

Clearly, the more complex the facility is, the longer the cycle. It's quite feasible for a highly complex facility to have an "experience cycle" of 10 years or even longer.

The longer the cycle, the more imperative it is for the knowledge and wisdom of experienced staff to be harnessed and recorded in such a manner that such knowledge and wisdom can be easily retrieved, examined and passed on to less experienced staff.

3.3 Operational Requirements

In summary, every industrial facility that requires some level of human intervention – or management – has similar requirements. In this context, industrial refers to any facility that contains any production or service equipment; produces stores or transmits energy; controls the movement of people, vehicles or goods; manufactures or produces food, pharmaceuticals, beverages or chemical products; that processes or manages processes.

These control rooms could house one or more people on a part-time or shift-structured basis. They include control rooms in fire stations or hospitals or 911 centres; control rooms in factories, power stations and transmission centres; control rooms at airports, harbours, traffic centres and military establishments; manufacturers of goods or food or vehicles; petrochemical facilities such as refineries, gas & oil terminals, oil wells and pipeline management centres; control rooms in nuclear research facilities, hospitals and even particle accelerator facilities.

All have essentially the same – or similar – requirements, namely:

- To operate safely
- To operate as efficiently and effectively as possible
- To be able to respond to changing situations very quickly, with as much relevant information available.
- To minimise breakdown (unplanned maintenance) occurrences
- To comply fully with all regulatory, safety and environmental requirements

- To minimise the need for extra reporting or explaining
- To communicate as efficiently and simply – without creating extra work – to management, researchers, engineers, planners and customers.
- To safely and effectively manage all visitors – including inspectors, field operators and maintenance staff – to the facility within the ambit of operating the facility.
- To streamline planned maintenance requirements – and consequent equipment lockout management – in a secure, effective and simple manner
- To handover to the next shift as quickly and effectively as possible, while ensuring that all necessary information is passed on.
- To be able to store and forward useful information as quickly and as easily as possible, and then retrieve that information when required.

3.4 What every Operator Needs

Operators – at the "sharp end" of the operational team – are primarily responsible for ensuring that the facility operates within specification, as safely and efficiently and effectively as possible, and complies with all regulatory and managerial requirements. They are responsible for ensuring the safety of staff in the facility during operating conditions as well as visitors and research scientists on the premises.

In addition to that demanding role, they are also responsible for allowing maintenance staff to perform scheduled maintenance: Too much maintenance and their efficiency figures reduce; Too little maintenance and breakdowns occur!

It's a tough job, and the last thing any operator needs is to have to fill in handwritten logs and copious documents.

In short, operators – the world over – require a simple, effective, robust, reliable,traceable system that enables them to:

- Maximise safety
- Maximise regulatory compliance
- Maximise efficiency – in fact support the increase in efficient operations
- Efficiently and easily plan workload (user requests, changeovers, etc)
- Maximise plant availability (more uptime….less downtime)
- Manage maintenance and lockouts
- Manage visitors and tours
- Quickly and easily provide information and reports
- Handover at any time (shift end in particular) seamlessly
- Commmunicate efficiently and easily with developers, scientists, engineers and management
- Train new staff efficiently
- Communicate with other operators in similar situations

3.5 What everyone else needs

Scientists: (Researchers, experiment developers, specialists, medical staff and others) require accurate predictive and historical information on when the facility will be available (and for how long, etc); what operational conditions will be like during those times of availability; what specifications are achievable; ability to seamlessly communicate with other researchers and operational staff.

Engineers: (Maintenance, Facility designers, Architects) require an accurate list of faults, problems, expectations, needs and availability schedules. They also require immediate notification of problems – breakdown and failure – upon occurance. Clear records of the time, date, duration and reasons for stoppages are important.

Vendors: (Equipment suppliers, Service suppliers, Consumable suppliers) can make valuable use of equipment performance data and information; also needs & expectations of Operational staff.

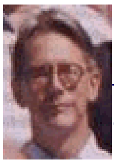
Management: (Corporate, commercial, financial and technical) require accurate summarised status, performance and cost information as fast as possible. When necessary, it is important to be able to "drill-down" into the actual data from which the information is derived.

Regulators: (Corporate or governmental, safety or environmental officials) They require detailed information on demand – or short notice: Security of data, traceability, quick response, audit trails, search capability

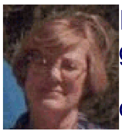
> **Pending notice story:** Your facility manager receives notice of a pending Environmental inspection. The Inspector informs you that he needs to see a record of Environmental Emission exceedences, operator reasons for the emission, with figures for analysis. He plans to create correlation graphs of operator versus emission and also reason code versus emission in Excel using the Pearson correlation function.
>
> The Facility management team turn to the Operational and IT staff for immediate assistance

Other facilities: (Similar facilities, equipment in parallel facilities, funding organisations, universities). Information that may be shared will include summaries of actual performance and selected key performance indicators. The behaviour of certain pieces of equipment is important information to share for improvement purposes. Logbooks such as one containing a Global Failure Database of critical systems is very valuable.

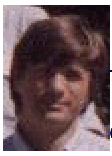
3.6 Seven very different Operational Requirements – case studies



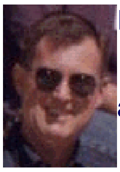
I want the technical and managerial staff to see first hand (without having to bother the operators in the control room) what is going on in the process and what ***the kinds of problems the operations division are encountering***. I want the system to create logs that report the information to the Intranet to keep all the relevant people informed. I want these logs attached to the daily report.



I need to ***record Environmental Emission exceedences, operator reasons for the emission***, get figures for analysis, create correlation graphs of operator versus emission and also reason code versus emission in Excel using the Pearson correlation function.



I want to use the LogBook to ***keep a track of the tasks being issued from the control room*** to the various operators in the field. Later I want to be able to verify how quickly operators have completed the tasks.



I want operators to use the LogBook as a ***shift changeover log where they record 10 key values*** at the beginning of the shift and then also at the end of the shift and make notes as to what actions have been taken to improve them.

The LogBook must manage operator notes with regard to the ***batch management of the chemical process.*** A special field must be created to show the batch number and this key will be used to attach the relevant logs to the batch information report.

I want to see the ***the operator logs next to the hourly averages of the production history***. I want the log table to be joined to the history table and a report to be created.

We have to monitor the reasons why there are fluctuations in the ***distribution of material in our chemical processing plant***. Because the process is a circuit, any stoppage in one area causes a problem in the next. I want the operators to enter reason codes for stoppages in four different control rooms which will provide the information for a group of central engineers to steadily improve the system.

4 Section TWO – Best practices in many control rooms

4.1 Introduction

Many professionally managed facilities have understood the importance of the embedded KNOWLEDGE in their facilities – instead of simply relying on INFORMATION and DATA. They have sought ways to apply the information so as to present system knowledge to operators, and they have sought to harness the knowledge already present.

ESRF, Grenoble, is one such facility [5]. They have embarked on a program to eliminate paper records from their various control rooms and convert detailed operator record-keeping to electronic log formats. During a recent set of incidents – of external cause and circumstance – a number of unplanned shutdowns occurred. It was determined that the facility cost Euro 14,000 per hour to run and that an unplanned shutdown resulted in a minimum of 10 hours lost income per incident. Euro 140,000 per incident.

Quality, searchable, electronically indexed information about each incident would clearly be hugely beneficial if such a record prevented even ONE future incident from occurring.

Other control rooms in industries such as Nuclear Power generation, Oil Refineries, LNG and Oil wells and shipping terminals, Pipeline management and Energy distribution utilities have equally demanding schedules and the pressure on Operators to maintain high standards of Safety and Environmental compliance is enormous.

Best practice facilities are finding that the value of Facility Wisdom, Operational Knowledge and Process Information is immeasurable.

This section attempts to show how some facilities are ensuring that as much information, knowledge and wisdom as possible is being captured. We will show this by examining a number of specific interventions, such as:

- Simple electronic logbook
- Interactive auto-logging electronic logbook
- Operator Order system
- Shift handover systems
- Inspection rounds

Later in this section, we will examine the impact of taking the control room logbook and placing it in the CENTRE of the facility, by connecting the logbook to the facility – and ultimately the enterprise – network. Many facilities have harnessed the power of enterprise-wide and global knowledge sharing through such networked electronic logbooks.

We will take a brief look at:

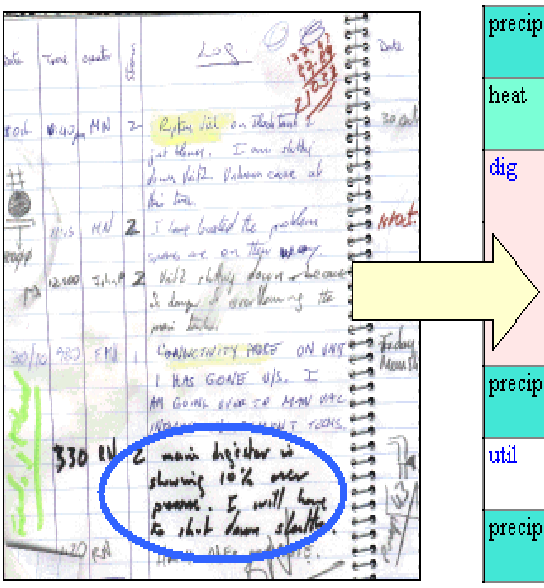
- Situation escalation
- Global Knowledge sharing
- Remote data collection
- Downtime management
- Experiment Management

The author's intention in section two is to highlight how Operations Departments in various facilities across various industries in various countries are using Networked Electronic logbooks – and associated technology – to:

- Communicate with various stakeholders within – and affiliated with – their facility
- Formulate operational policies and monitor their own compliance.
- Manage user requests for acess to the facility (maintenance, clients, customers, researchers, regulators)
- Train and expand knowledge across different levels within the organisation.
- Escalate concerns and problems to the correct level, efficiently and quickly.
- Share notes, thoughts, developments, problems, advances and ideas with relevant groups.

4.2 Going Electronic?

The Electronic Logbook, in its simplest form, allows an immediate capture of everything the operator would have written in a manual logbook – with no additional effort.



precip	3	29/10/01	22:02	We are starting to see out of spec granules in the lab tests on Unit 3. Suggest we take a closer look at what is	4
heat	2		23:15	Unit 2 heater needs an overhaul. I have notified the maintenance people.	1
dig	1	30/10/01	09:19	*Conductivity probe on Unit 1 has gone U/S. I am going over to manual. I have informed the instrument*	3
	2		15:20	**Main digester is showing 10% over pressure. Any more and I will have to shut this unit down.**	2
	0		16:04	Hand over to the next shift complete.	4
precip	2		23:07	Trying to increase the flow through stream 2 to compensate losses in Stream 1	
util	1	31/10/01	17:21	Turbine number 1 has tripped. Over temperature alarm given just before the trip.	1
precip	4	01/11/01	10:38	*New batch of tank cleaner arrived. Please make sure the quality does not affect our precip process*	3

The IMMEDIATE benefits of capturing logs electronically include:

- Clear readability
- Time & date stamping
- Traceability – and audit trails
- Keyword and field searches
- Ability to report and print
- Interaction with standard PC functionality.

4.2.1 What do we stand to gain by going electronic?

So, if we are going to replace the paper based Log Book with an electronic Log Book, what are the functions we would be looking for? Our wish list would probably look something like this:

Easy to Use: Our operators will only use the new Log Book if it is at least as easy to use as their existing log book AND they can see a benefit in it.

Networkable and Affordable: Instead of having to track down the information by phoning or physically hunting it down, we should be able to find it directly using our Intranet Browser on our computer in our own offices.

Configurable: Every site has different requirements; no two sites are alike. The electronic logbook must be highly configurable to satisfy all needs.

Look and Feel. We want to be able to select the fields we want displayed, the levels of priorities, the color coding, the format of the date etc.

Fields and Structure. We want to be able to add new codes for the different kinds of logs, add new sort fields, specify the options for different fields so that the operator can select them from a combo box etc. And we want to be able to do all this without changing any code.

Minimal Administration: We may quickly have 10, 20 or 30 users all having access to the LogBook so we want the system to support floating licenses to that anyone can get the info. And we don't want to have to load any software on the user computers. I.e. we want a true Zero Client Application.

Database of Your Choice: If you are going to store the logs electronically, we may as well have them stored in a database that you can integrate with the rest of our system. Now we can start tying together things like the Quality data with the Operator Logs into a single report. Or start getting statistics on how often a particular problem occurs. Above all, we want the information to be accessible via our normal skill set.

Configurable User Personalities: We should be able to give different users different capabilities depending on who they are. For example, some users should be only able to add logs for certain areas, some users should only be able to see certain logs, others may need to be logged off at the end of a shift etc. What we need is a flexible, industrial user management system.

Multiple Log Books: Instead of having just one place where logs can be entered, we now have the opportunity for logs to be entered by many more people. E.g. we could have our lab people entering information, or our maintenance people or even have operators in remote sites entering the information. Because the logbooks are networked, the information would be easily tied together to see correlations etc.

Searching & Filtering:We want to be able to quickly and easily find the particular log that we are looking for. It must be possible, for example to type in keywords like "Filter 3" and to immediately see all the records relating to Filter 3.

4.2.2 What do we want from an electronic logging package?

Minimal Administration: The LogBook is a true web server based application. There is no requirement to load ***any*** software on ***any*** of the client machines. This means that the on-line logs can be quickly made available to tens or even hundreds of users without any changes to the user computers whatsoever.

Really Industrial: Good electronic logbooks package should be designed specifically for use on Industrial sites. It is the evolution of systems that have been tried exhaustively for many years on many sites by hundreds of users. The designers should have experience with electronic logbooks in various industries including the Utility Industry, Oil and Petroleum, Chemical Processing, Water/Waste Water, Manufacturing, Mining, Military and other industries.

Easy to start and easy to change: The package should come with a standard set up so that you can immediately implement it on your site with a minimum of effort. However, as you become familiar with the concepts of electronic logs, you will probably want to customize the application to your specific needs. This is a simple fill-in-the-blanks process that enables you to customize not only the look and feel of the Logbook but also the structure.

Ability to change the Look and Feel of the Logbook: Just change any of the presentation parameters to see the immediate effect of your changes. There are on-line tool tips for each of the categories to help you make the choices. There are over 50 different parameters that you can choose from to vary the presentation of the layout from window sizes to font sizes to color codes to the order in which the records appear etc. All of these changes can be achieved through a simple fill-in-the-blanks form without having to do any graphical design. Most of the entries are available as options in a pull-down combos.

Ability to add site-specific fields: You must be able to add your own fields that are specific to your business. Just go into the configuration, click on the new field button and enter the name and format of the new field. The system will take care of the database transactions for you and add a new column to the table. You can now fine-tune the characteristics of the new field such as the presentation of the field and what valid options are for that field.

Attach any file to the Log Entries: You should be able to attach files of virtually any format to the Log Entries. (E.g. graphic files, Word or Excel files, Schedules, PowerPoint files etc.) When the user clicks on the Attachment link, the application (e.g. Word) is started on his or her system and the information is immediately made available. This makes it easy to understand the context in which the log was made.

Automatic entry of standard fields: Users should not have to fill in many of the standard fields like the time and date, console, shift number, and their user name. All these fields should be filled in automatically by the logbook. Additionally, the system will not allow the users to enter data outside of their assigned areas and will only give them the choice of options that are in fact valid for their areas.

Valid options should be selectable: It's important that you can specify the valid options for each of the fields. For example, for the priority field, you may specify the priorities 1 (emergency), 2 (warning) and 3 (standard). When the operator is adding a new log, these options are made available to him or her in a combo box. They are also made available when you want to filter the logs to find some specific information.

Good to be able to associate each option and category with a different color and style: To help your users easily identify the specific codes, you can assign colors and styles to these codes. For example, you can assign specific colors to the priority of the log, red for emergency, yellow for danger, etc. Likewise, you can assign colors to the different areas of the process, or colors to the different shifts. It then becomes clear for example when there is a shift changeover.

Must be powerful, yet cost effective: The pricing should be based on the number of user sessions that are simultaneously active. (For a site with say 100 people, you could purchase 5 or 10 concurrent licenses and make these available to all 100 users.)

Ability to add and expand easily, at any stage: To add more concurrent sessions, you simply order and pay for the new session licenses and we send you an updated license key. The software already on your system will recognize the new license and activate the new sessions for you.

Seats should be concurrent – not named: You can have as many users as you like on a given seat or viewing station. For example, if you have a system in the control room, you could have 5 different users for that one seat. Each user can have different personalities depending on their position in the organization.

Control is important: You need to be able to control who looks at the logbook and what they can see. For example, you may want one user to be able to see everything on one site but only be able to enter information in the utilities area. You can also make users reenter their passwords when they add information. If you like, you can make the system automatically log off a user at the end of a shift or when they have been logged on for a certain length of time.

On-Line Help: A comprehensive easy to use on-line help system should be available from the logbook. Browse through the system or go directly to a specific key word. There should be a tutorial that will help you get started.

Should be able to connect multiple control rooms over multiple sites: There should be no limit to the number of control rooms you can have. In fact any of the users can enter information into the logbook if necessary. For example, lets say that the maintenance manager who is working in his office wants to make a log based on the availability of personnel after hours. He can do this directly into his desktop computer without having to go into the control room to enter the data.

Database independence: You should be able to connect to various databases, the following as a minimum; ***Oracle, SQL Server, MySQL, Postgres or Microsoft Access***. Because all your data is stored in a standard database, you can access it with any of your favorite utilities such as Crystal Reports, Microsoft Excel, or the utilities that come with the database itself.

Internet user Access: Provided you have a Network connection (either Internet or Direct Connect or via modem) you should be able to access the information. The Logbook package should produce a standard html output which can be viewed using any standard browser like Firefox or Internet Explorer. The logs are presented in tabular form and are updated as soon as a log is added anywhere in the system.

Operators must find the Logbook easy to use: In our experience, operators do not have any problem in using the logbook. In fact, they quickly see the benefit of the logbook and are some of our most avid users. Why? Because it makes their lives easier! No longer do they have to receive phone calls from numerous parts of the plant asking for information and they can see the upstream and downstream processes without having to get on the phone themselves.

Storage of data should be limitless: There should be no software limit to the number of records that can be stored or the number of days of data that can be stored.

Users must be able to find the stored data easily and quickly: Finding information must be easy, like a click on the Filter Button and type in the word or keyword you are looking for and the grid will show all the logs that match your specification. If you type in two criteria for different columns, then the log will show only those records that match both criteria. There should also be a "Google like" search facility which will search for keywords not only in the database, but in any attachments (Word, pdf and other files)

Spell checkers should be included: Operators can check that they have the correct spelling before submitting the log.

Time settings need to be flexible – UTC (GMT standard) formats must be supported for multiple time-zone clients.

Time windows should be searchable: You can configure how far each user can look back when they first log on. For example, an operator will probably only be interested in the last day of information. Of course if they are interested, they can extend this information to view more information or choose a week of information say 3 months ago.

Important to be able to export log entries to Excel or other MS packages: Since the data is in a standard database structure, you should be able to use any of the normal tools to export the data. For example, if you have chosen Access as your database, you can get the information directly into an Excel spreadsheet by simply pointing to the Log table.

Email capabilities: You can set up the system so that it will email nominate logs of interest to specific people as soon as a log is entered or modified. For example, you could specify that information on any logs that have a high priority in a selected area should result in an email to the supervisor of that area.

Problem – or situation – escalation: It's vital to be able to inform a supervisor, engineer or manager of a specific condition or set of circumstances.

Control over the editing of past entries: Your operators may modify the records they have entered provided they make the changes within a 5-minute window of their data entry. If this five minute window (which is configurable) is exceeded, then the operators may not change the records they have entered.

4.2.3 Autologging – advanced electronic logbooks.

A significant advantage of an electronic (computer based) logbook over a paper logbook, is the ability to have various records and data and information automatically logged.

The obvious entries will include shift details, name of logged-in user, time and date of the log entry.

Pull-down menus – or auto-fill and type-forward features – will make standard and regular entries easier to do.

However, the REAL benefits accrue when additional facility information is gathered and entered automatically, resulting in the lagbook becoming a far more powerful tool than simply a log of manually entered information. Some examples include:

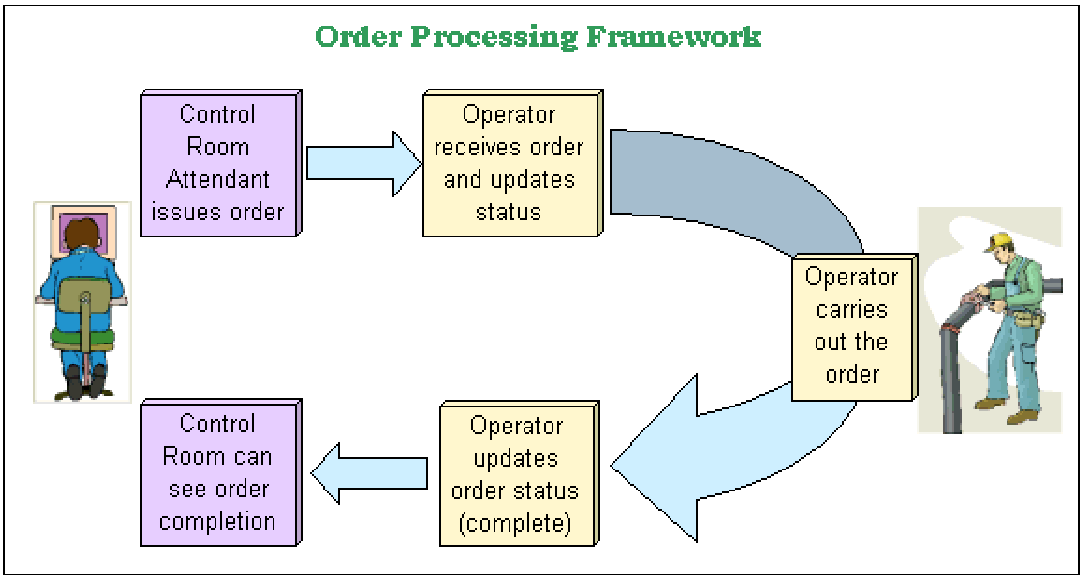
Alarm Monitoring: As alarms (all, some or specific combinations) arise, the time, date and detail of the alarm is automatically logged. The operator may be obliged to make an entry alongside the record. Failure to make an entry within a specific time period may result in an escalation email being sent.

Equipment status: Whenever a specific – or key – piece of equipment goes offline, the time & date of the occurrence is logged. The operator may need to supply a reason code. Failure to comment, or failure of the equipment to go back into service, within a reasonable time period could result in an escalation email being sent.

4.2.4 Automated Order systems.

In addition to all the features expected from any electronic logbook, the order book – as a special application – is designed to effectively manage the flow of orders that go out to field operators on industrial and technical facilities.

Control Room operators create the orders and enter them into their computer in the control room. The field operators receive the orders on their computers and, as the order is carried out, they update the status on their computers so that any authorised user can get a clear picture of the status of the work being done. The diagram below shows the basic order issuing and implementation scenario.



Why go to a Networked Orders Based System? The primary benefit to going to a networked Orders Base System is that the site personnel get a ***clear indication of the precise status of orders that are currently active*** and so can better manage the entire communications between control room based and field operators. ***I.e. people know exactly what the operations staff are doing at any one time.***

Additionally, there is ***no chance that an order could be forgotten or (possibly worse) duplicated***.

There is also a ***clear record and audit trail*** of who created the order, who is responsible for the order and when the order must be completed by. People know what they are responsible for and are credited with the work they have carried out.

Since the system is on-line, ***updates to the status of orders are made instantly available to everyone***. Supervisors, Control Room Attendants, Maintenance Personnell do not have to phone the control room to find out the status of a task. This means that there is a much better co-ordination level between the different disciplines.

High Priority, On Hold or Overdue orders can be highlighted so that the ***field operators can make the most effective use of their efforts***.

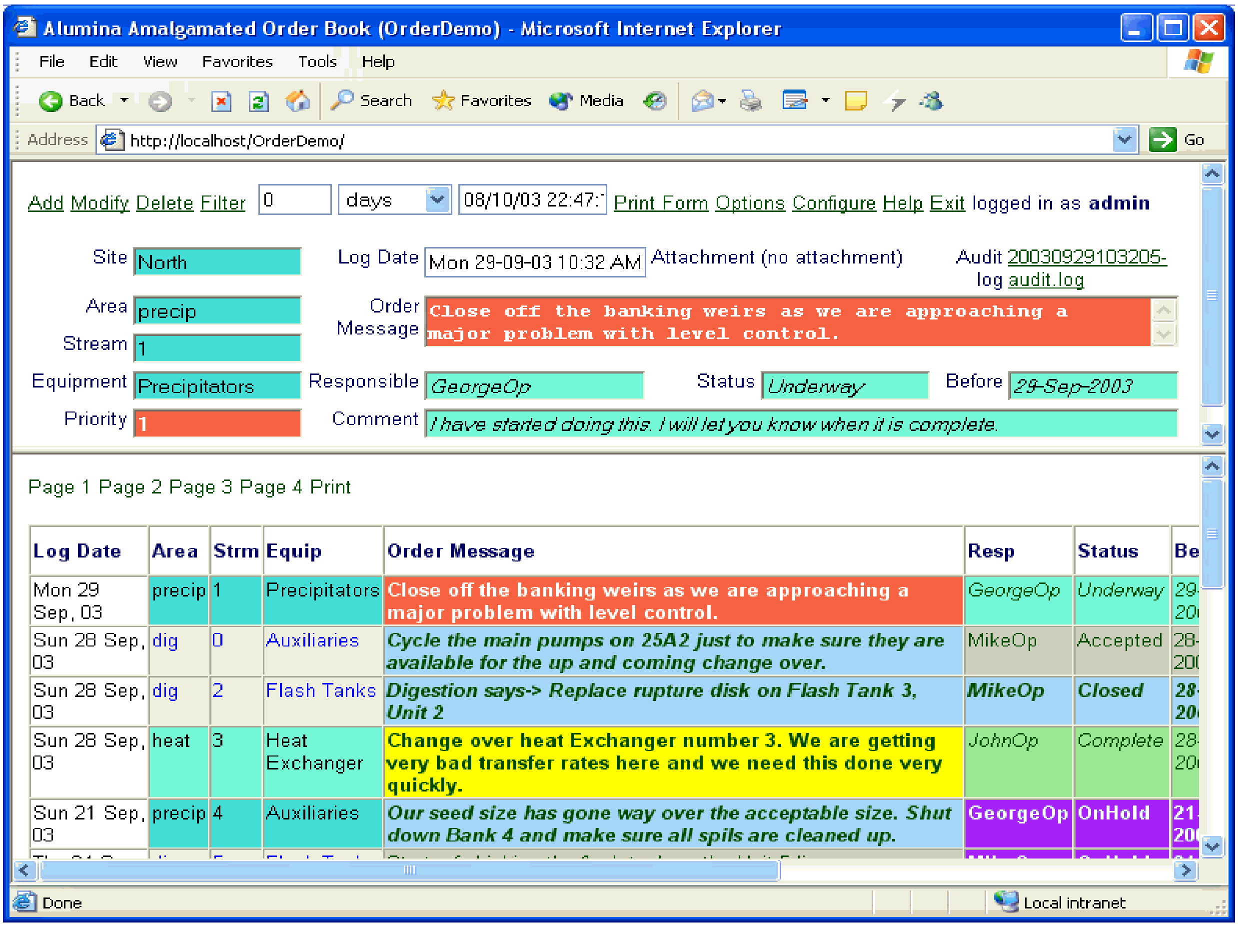
The orders are maintained in an easily searchable database so that the ***operating staff can easily find records of past orders to help improve their effectiveness***. For example, the user could search for all orders that have been carried out in the last year on a particular piece of equipment. Alternatively, they may be looking to see how long it took to do a particular task when it was carried out the last time.

What is an Order made up of? An order is typically an instruction issued by a control room operator (or supervisor) to the field personnel to carry out a task that is necessary to increase or maintain production or to improve or maintain safety.

The diagram below is a screen shot of a typical Orderbook showing the various fields of the Order. In particular, the following fields are important:

Process Fields: That define the area of the process, the equipment and the priority.
Log Date and Complete Before: These are the dates that the Order is logged (entered) and the date at which the order must be complete by.
Order Message: This is a description of the Order.
Responsible: This is the Field Operator who has been assigned the task to carry out the order.
Status: This is the status of the order. Generally, there would be the following order statuses:

Released: The Control Room Attendant has issued the order,
Accepted: The field Operator has read the order,
Underway: The field operator is actually working on the order,
On Hold: The job is on hold for a specified reason (E.g. waiting for equipment)
Cancelled: The Order has been cancelled,
Complete: The operator notifies the Control Room attendant that the order has been complete.
Closed: The Control Room Attendant closes the order and the entry is removed from the screen.
Comment: This is an area where the Field Operator can write messages about the order he or she is working on.



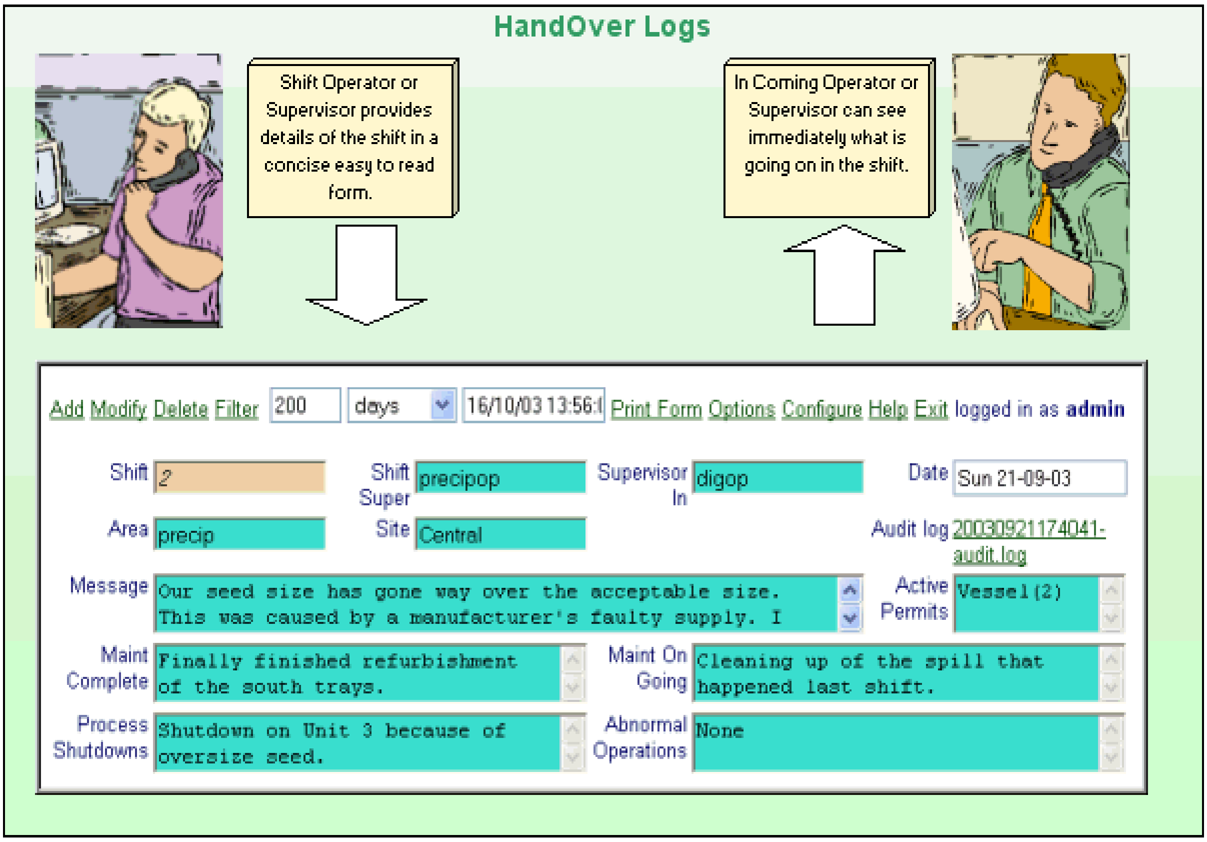
You can attach files of virtually any format to the Orders Entries. (E.g. graphic files, Word or Excel files, Schedules, PowerPoint files etc.) When the user clicks on the Attachment link, the application (e.g. Word) is started on his or her system and the information is immediately made available.

4.2.5 Handover and communication Systems.

One of the most valuable uses of an electronic logbook has to be the communications or handover logbook. In its basic format, **such a logbook is an electronic tool designed to effectively manage the information flow between incoming and outgoing shift personnel**. It enables important information to be captured, remembered and effectively communicated.

During the course of a shift, the Shift Operator or Supervisor keeps track of the many events and processes that occur. At the end of the shift, this information is entered into the HandoverBook. This is a clear and concise record of the key areas of the process that will be needed by the incoming shift operator or supervisor. When the incoming operator or supervisor comes in, he or she has a clear and concise summary of the status of the process at the start of the shift, and can make informed decisions as to the course of action needed to maintain and improve the process.

Other users such as field operators, technical personnel and managers can also monitor the Handover Logs to see how the shift went.



The Handover Log also provides a secure, searchable record of the status of the shift at handover which can be used for many other purposes such as the evaluation of process campaigns etc.

The primary benefit to going to a networked Handover Log system is that ***all the incoming shift workers start the shift well informed***. They have a ***clear and concise understanding of the status of the process as they start their work.*** This means that expensive and major plant upsets will be avoided because of better decisions.

Additionally, because the handover logs are visible to all, the quality of the handover steadily improves and the procedures are always carried out.

There is also a ***clear record and audit trail*** of the handover so that each operator knows his or her responsibility in the process. Once people are aware of their responsibilities, they take a pride in them and the quality of operations steadily improves.

The system is useful to different people in different ways. For example, an incoming maintenance manager would be interested in the maintenance fields while a supervisor would want to look at why there are continuing shutdowns in a given process stream.

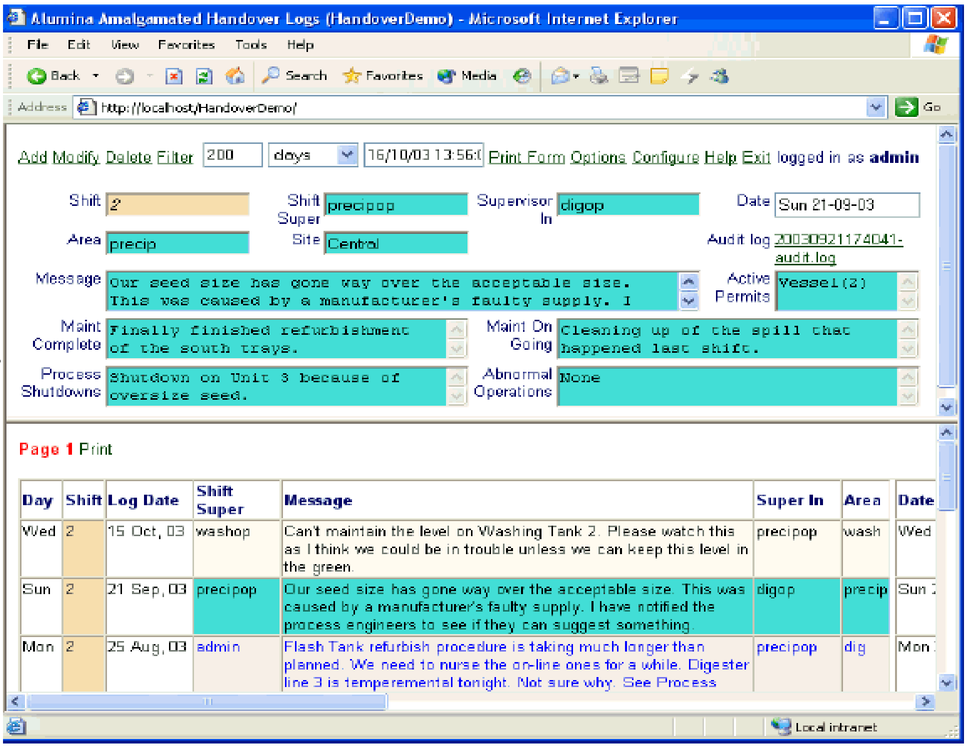
The handover logs are maintained in an easily searchable database so that technical and managerial ***staff can easily locate specific handover records.*** For example, an engineer could find out where a particular problem started to appear by looking back through the handover logs.

The structure of a handover log may be tailored to be exactly what you need for your site. Here are some of the fields in a simple, basic handover log.

Log Date and Shift: This is the date of the handover log and the shift number that the handover log relates to.
Area and Site: This is the Process Area and the Site. A single HandoverBook application can handle many Process Areas over many sites if necessary.
Shift Supervisor and Supervisor In: This is (i) the name of the person who will enter the data for the current shift and (ii) the name of the person who will be taking over the shift respectively.
Message: This is a general purpose description of the shift and what to watch out for in the process.
Active Permits: This refers to the type and number of permits or tickets that have been issued during the shift. Supervisors should be aware of where and to whom the permits have been issued.
Maintenance Complete and Maintenance On Going: This summarizes the maintenance issues that have been completed during the shift and the maintenance issues that are still being carried out.
Process Shutdowns and Abnormal Operations: These fields relate to any process shutdowns that had to occur during the shift and any abnormal operations that were carried out.

Handover Procedures

These can be as simple – or as complex – as required.



A good system needs to be able to allow many – and varied – parameters for the user to choose from in order to vary the presentation of the layout. Such changes need to be achieved through a simple fill-in-the-blanks form without having to do any graphical design. Most of the entries should be available as options in pull-down combos.

One must be able to add fields that are specific to your business. The system must take care of the database transactions for you and add a new column to the table. You could then fine-tune the characteristics of the new field such as the presentation of the field and what valid options are for that field.

All the standard fields like the date, area, console and user name must be filled in automatically by **HandoverBook.** Additionally, the system should **not** allow the users to enter data outside of their assigned areas and must only give them the choice of options that are in fact valid for their areas. Field operators too can only modify the status of Handover Logs that they have been assigned to.

You must be able to specify the valid options for each of the fields. For example, for the area field, you may specify the production areas as Raw Products, Utilities, Main Production, Recycle, Technical etc. When the control room attendant is adding a new Handover Log, these options are made available to him or her in a combo box. They are also made available when you want to filter the logs to find some specific information.

To help your users easily identify the specific codes, its important to assign colors and styles to these codes. For example, one could assign specific colors to the status of the Handover Logs.

4.2.6 Inspection Rounds.

Inspection Rounds is an extension of an Operator Order Book plus a Communication Logbook. In this application, specific contact between control room and field operators is streamlined and simplified. Pre-defined tasks, inspections and readings are coordinated and historized. Anomolies can be identified immediately and opportunity for re-reading or corrective action can be given with real-time response.

4.3 Why Networked?

The primary benefit in going to an electronic, networked system is the increase in visibility of the operations to all the users on the network. Instead of the information being hidden in a log on the operator's desk, anyone who has a computer can see exactly what the operations are doing in real time.

Users of these systems report an unprecedented improvement in the coordination between different departments and sections and amongst the personnel because of this increase in visibility.

Additional benefits are also apparent, for example, since these logs are categorized with different key words, it is easy to sort the logs and find the information you are looking for by pointing and clicking. Not only for the last day but say over a three month period.

Anyone who has a standard browser like Internet Explorer® or Firefox can view the logs at any PC either on the site or (if authorized) from a remote site.

Let's start with a horror story!

Something went horribly wrong yesterday. Production was down and blood pressures were up. Maintenance people were rushing around with a wild look in their eyes. There was a spillage in Area 2. The quality was way below spec and....no one seems to know what started it all!

The production manager barks at you..."Find out what happened so it won't happen again!"

A quick look at the trends...Ouch! It is not pretty but what started it all off? You gallop off double time to the control room. "WE don't know the operators say...it wasn't OUR shift!" Your eyes fall on a grubby little notebook in the corner of the room... The ubiquitous Operator Logs.

You are in luck; the operator on yesterday's shift is a regular Steven King. Bit difficult to read because of the coffee stains but there it is in black and white (and brown)..."High pressure spike on main filter. Should be changed out."

A light bulb turns on in your mind! So Dr Watson, it is elementary, the operator saw it, he noted it just before finishing his shift and no one put two an two together (let alone saw the entry) to avoid the inevitable sorry tale of woe!

Surprisingly, stories such as the one above are all too common even on supposedly modern sites where every tag is scrupulously monitored. Why is it that some of the most important data..."what the operator saw and did" is not logged?

So you say. "Why don't we just get the operator to log the data into the computer and arrange it so that everyone can have access to it on the network?"

Sounds toooo easy doesn't it? Well, with a good electronic logging package it is just that easy. But....

Will people use it? You bet!

Will it save production? Yup!

Will it mean we can avoid disruptions? Yes Sir!

Will it mean everyone will know what the control room is doing? Right!

So the fiasco in the story above would have been avoided? Exactly! Both the incoming shift superintendent and the maintenance manager would have seen the Mr King's entry on their screens or in the changeover report and the future would have been very different!

Is it expensive? Nup!

In fact, the moment you put in an electronic logging system, you will suddenly notice that everyone on site is aware of the pulse of the process and they are all starting to make informed decisions.

But an Industrial Operator Log Package is much more than just a replacement for your existing "hard paper" log.

Reasonable expectations of a networked, electronic logbook.

A properly configured, industrial networked electronic logbook can supply or be configured to be any or all of the following:

Knowledge repository

Interactive communication portal

Lockout management and control system

Immediate notification of any set of circumstances or conditions

Alarm system summary portal – with operator notes

Interactive and maintainable policy representation

User request management system

Online bulletin boards

User management system

Best Practices template schedule

Problem log

e-mail escalation portal

Global Failure / issue database

PDA communication interface system

Downtime manager

Workorder management

Historian

Experiment manager

Regulatory issue monitor and control portal

Traceability analyser

The close coupling of technical information, operation performance data, maintenance status and operator targets allowing for improved operability

Operator needs (Exponential increase in the requirements of Operations departments) support system

Safety monitor

Environmental compliance monitor

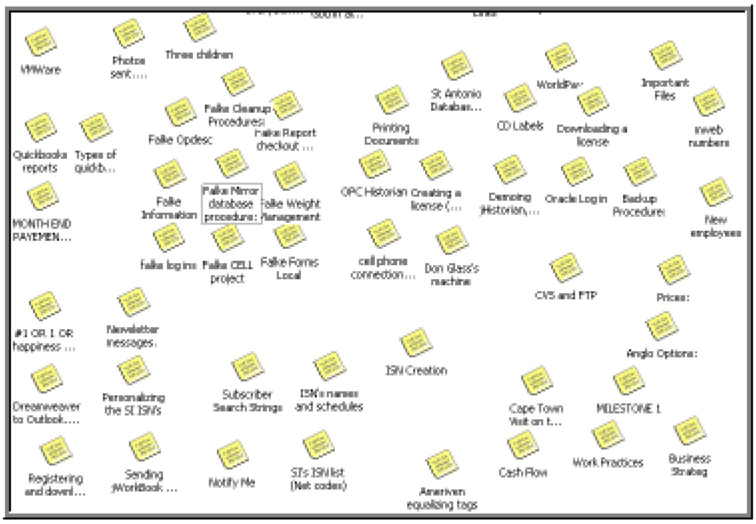
Efficiency monitor

Staff allocation and presence bulletin board

Maintenance requirement capture system

Client (customer) demand management system

4.4 Knowledge systems. Based on the efficient communication of relevant Information.



Each one of us has an enormous store of knowledge that enables us to do our jobs efficiently. We all develop our own way of trying to keep track of this information. Some of us use Post It notes, some of us try to track the information in diaries. Most of our home built tracking systems don't work that well - even for ourselves.

Although we are amazed at the amount of knowledge there is "out there", we are equally frustrated at how

simply agonizing it can be to get hold of even the simplest piece of information. Dare I say we sometimes can't even find our own information let alone get information from one of our colleagues who could be on a different shift. Gulp!

In fact, we probably find that a very large proportion of our time is spent ***"Looking*** **for the Knowledge" and not "*Using* the Knowledge"!**

So I hear you say. "Why don't we provide an easy tool that will enable **all** our workers to make a note of **all** their important information and then collectively network that information ***so that everyone on the site can get any of the knowledge*** using a powerful search technique?"

What do we stand to gain by networking our knowledge?

What **if** there **was** an easy to use tool that enabled all of us to quickly organize our information and for that information and everyone else's' information to be right at our fingertips at the click of a button.

What would that actually give us?

Would it mean:

That I could bring up all the information I use at the click of a button?
That everyone on the site would suddenly be as organized as I would be?
That we would not keep losing stuff and having to re-invent the wheel?
That we would all be talking the same language since we would all have access to the same information?
That people would actually use this tool?
Do tools like this Exist?

Are they expensive and difficult to use?

In fact, the moment you put in a networked knowledge system, you will suddenly notice that everyone on site starts "talking the same language" We start building on the knowledge, not spending our time scratching to find it.

But an Industrial Knowledge base System is ***much more than just a replacement*** for our swarms of Post It notes!. ..***Much much more.***

What do we want from a networked knowledge base system?

So, **if** we are going to replace our myriad's of home-built knowledge tracking systems, what are the capabilities we would be looking for? Our wish list would probably look something like this:

Easy to Use: It's got to be much easier to use than our existing system.

Networkable and Affordable: Instead of having to track down the information by phoning or physically hunting it down, we should be able to find it directly using our Intranet Browser on our computer in our own offices.

Configurable: Every site has different requirements; no two sites are alike. The networked Knowledge base must be highly configurable to satisfy our needs.

Look and Feel. We want to be able to select the fields we want displayed, the levels of priorities, the color coding, the departments, the disciplines etc.

Fields and Structure. We want to be able to add new codes for the different kinds of knowledge, add new sort fields, specify the options for different fields so that we can select them from a combo box etc. And we want to be able to do all this without changing any code.

Minimal Administration: We may quickly have 10, 20 or 30 users all having access to the knowledge base so we want the system to support floating licenses to that anyone can get the info. And we don't want to have to load any software on the user computers. I.e. we want a true Zero Client Application.

Database of Our Choice: If we are going to store the information electronically, we may as well have them stored in a database that we can integrate with the rest of our system. This means we will be able to start tying together things like the Quality data and the Knowledge Information into a single report. Or start getting statistics on how often a particular problem occurs. Above all, we want the information to be **accessible** via our normal skill set.

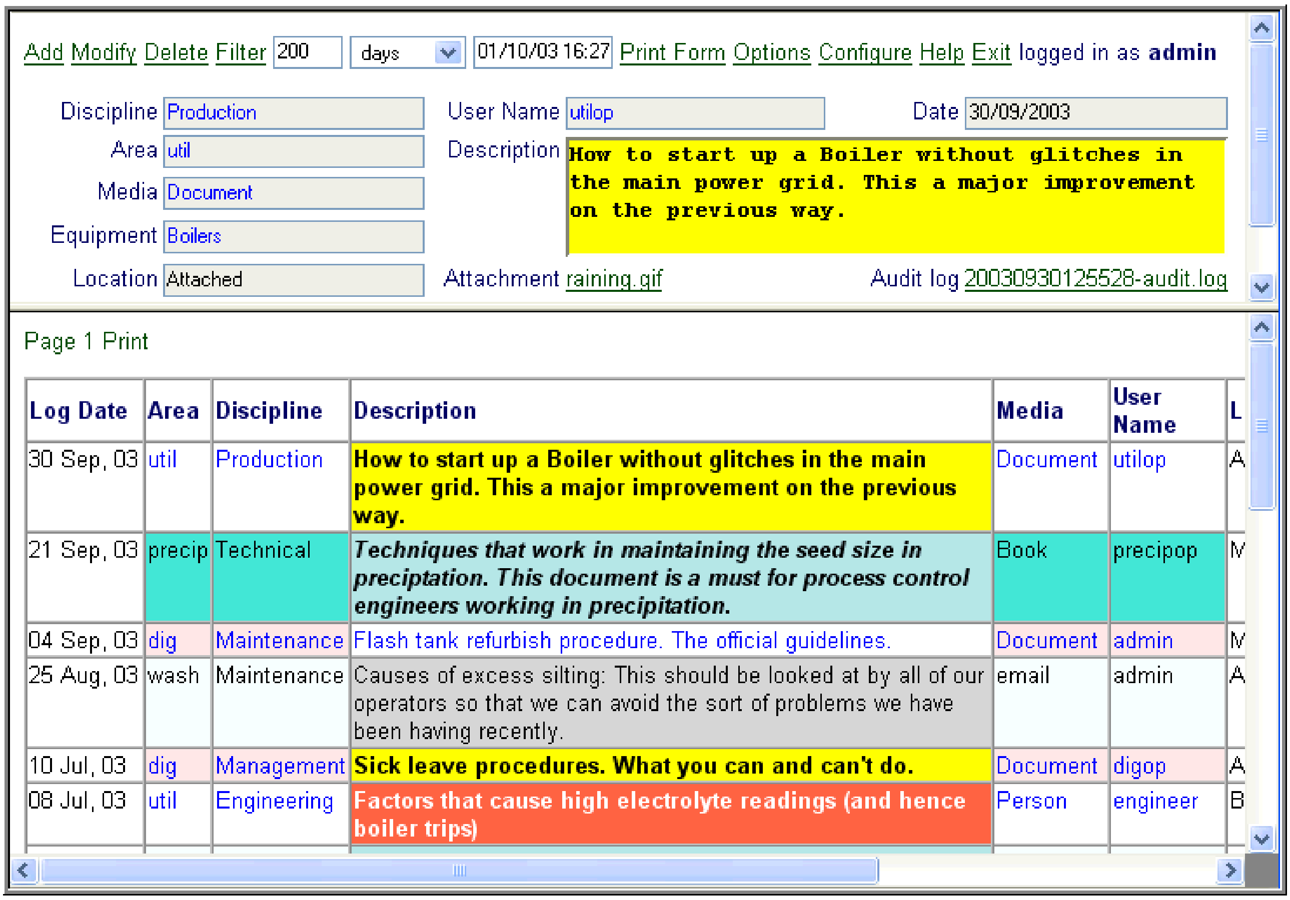
Configurable User Personalities: We should be able to give different users different capabilities depending on who they are. For example, some users should be only able to add knowledge for certain areas, some users should only be able to see certain information that is related to specific areas, others may need to be logged off at the end of a shift etc. What we need is a flexible, industrial user management system.

Searching and Filtering: We want to be able to quickly and easily find the particular information that we are looking for. It must be possible, for example to type in keywords like "Filter 3" and to immediately see all the knowledge relating to Filter 3.

KnowledgeBook is a corporate wide networked Knowledge base system designed for Industrial conditions.

KnowledgeBook is designed to efficiently collect and distribute the information to the complete spectrum of personnel who need this information. (Managers, Supervisors, Maintenance Engineers, Technical Personnel, Process Engineers etc.

KnowledgeBook is also completely configurable so that it can be made to fit the special requirements of virtually any Industrial Site.



In order to successfully operate a process control plant, personnel rely on various items of "Know How" or Knowledge Items.

Typically, these items of Know How are held in various locations and in various forms. For example, an important maintenance procedure may be in a document in the maintenance library whereas a flow diagram of a new operating paradigm may be in a Word document. Each of these items is a Knowledge Item. The Knowledge Book either stores the Knowledge Item itself or indirectly tells the user where he or she can get hold of the item.

The primary benefit to going to a networked Knowledge Base System is that site personnel spend ***less time looking for data and more time using it***. Additionally, because the data is maintained in a structure, it is generally up to date and "good" which means the users ***are better informed and make better decisions.***

Additionally, the existing ***Knowledge becomes secure and now becomes a firm foundation for growth***. Instead of searching for information, the information is quickly located and made to work. This gives the users more time to enhance and extend the knowledge. (Instead of spending all their time looking for it.)

Because there is now a networked expandable system, knowledge that was ***previously only known to one or two people is now easily accessible by anyone*** with a computer. This means the expertise and know-how of the whole site quickly ratchets up and people start talking the same language.

Since the system is on-line, ***updates and enhancements to the knowledge can be made instantly available to everyone***. And if an employee leaves, the knowledge doesn't go with him or her, but remains with the corporation.

5 Is there a Future?

A variety of issues persuade us that there is a very strong future in store for professional, industrially hardened, system independent, networked electronic logbooks.

Amongst these issues is the feedback we receive from operations departments in almost every industry across the world, indicating that data, information and knowledge demands are increasing at a rapid pace, while the availability of trained staff and the time to train new staff appears to be shrinking equally quickly.

Facilities are becoming more and more complex and many control systems are failing to keep pace with the complexity.

We end this paper with a brief look at some relevant requirements in the Particle Accelerator industry.

5.1 Accelerator requirements

Global Failure Database

The continuous improvement of operations within Particle Accelerator facilities worldwide is a common objective amongst all operators. One important tool in assisting with this endeavour is the accurate, comprehensive and meaningful analaysis of all failures of equipmenmt and processes and services associated with the operations.

In order to analyse these failures an accurate – and completely comprehensive – database of all failures (with correct reasons, details of the circumstances and associated equipment) must be maintained.

A simple and effective method of capture should be made available for all facilities to use.

If designers, vendors, service suppliers and operators all make use of the same data, such a system has a greater chance to become a reality.

Improved Maintenance Scheduling

The possibility of utilising a networked electronic logbook as a 'diagnostic tool' to enable the monitoring of recorded operational data to identify 'trends' leading to component failures with a view to preventing the unscheduled shutdown of the machine.

Experiment Manager

A communication logbook – interlinked with the facility calendar – designed to manage and communicate the facility workload (client and researcher’s experiments) would benefit many people.

Downtime Manager

This is a system by which specific equipment (or groups of equipment) will have their status automatically logged into a networked electronic logbook. Should the equipment go off-line for any reason, or should the equipment exhibit a pre-defined behaviour – or exceed certain parameters – an entry in the logbook will be automatically generated – and (if required) an alarm will be sounded.

If required, maintenance staff (or service staff, or technical experts or management) can be summonsed by phone, sms or e-mail.

The return to normal operating conditions can also be logged, with additional opportunity for added reasons and explanations.

The operator will be given opportunity to categorise the failure – or event – and give reasons.

If necessary, the matter can be automatically escalated – phone, sms, email or report – should the situation be unresolved, or should an explanation not be logged within specific time limits.

Cooling Requirement monitoring

Heat generated by Electrical currents flowing in the accelerating structure and in the coils of electromagnets are sufficiently high to require cooling so as to prevent melt down of components.

In addition, temperature increase causes metal to expand, thus affecting the size of cavities, waveguides, etc.The frequency at which a cavity resonates changes with temperature. Frequency variations are unacceptable for the proper operation of an accelerator since very careful synchronization of the cavity frequency to the timed passage of the beam bunches is required.

Water cooling is used in most conventional magnets (except superconducting magnets) as well as other elements of the accelerator and remains an integral part of accelerator design and construction

It is therefore important for the cooling system to be continuously monitored to ensure proper operation.

Vacuum

If particles in the accelerator beam collide with any air molecules, they are knocked out of the beam bunch and lost. Extreme low pressures are required to minimize the chance of such collisions. Wherever two sections of an accelerator or beam transport line join there must be a close-to-perfect seal, to prevent air from leaking in.

Any leak or scheduled maintenance that requires a shut-down of the vacuum system costs considerable time. Typically, it may take more than a day to get the entire accelerator system pumped out to the desired level before resuming operation.

Here again, it is important for the vacuum system to be continuously monitored to ensure proper operation.

Beam Transport

Accelerator operators must also monitor the beam at many points along an accelerator facility. Various beam diagnostic elements may be employed to determine the size, position and energy of the beam. Information which again is vitally important for the successful running of the facility since this will directly affect users such as medical, industrial and experimental staff.

Hand-held data & information capture

Any system that ensures that data is captured as close to the source as possible, and any system that minimises the delay and loss of accuracy between control room and field operations staff WILL result in improved operations.

PDA, tablet PC and wireless interface devices as front-ends to Electronic Logbooks provide such a benefit.

Accelerator control

Any networked electronic logbook that has the ability to interface seamlessly with existing 'Accelerator Control' methodologies and facilitates, coordinates and makes this information accessible to all interested parties either directly on site or from any location via the Web, is advantageous and desirable for the successful operation of any accelerator facility.

6 References

[1] Frost & Sullivan report: *Control Engineering* magazine; April 2007

[2] Staffing trends: *Control Engineering* magazine; January 2007

[3] In a test conducted by the Technical Manager of St James Software in April 2000 and using a Pentium III PC with 512 MB Ram, it was shown that 600,000 meaured data points PLUS 600,000 meaurement quality references (that's a total of 1.2 million data records) could be stored per minute by the jHistorian software.

[4] *Instrumentation, Sensors and Process Control:* Ouachita Technical College; Paper Dec 2006

[5] Public and Informational brochures about ESRF, Grenoble, France.

7 Authors

Dr Nicholas Hurley

Dr Donald Glass (Presenter)

Mr Giorgio Guasco

7.1 Nick Hurley

Nicholas Vector Hurley is the founder and Managing Director of St James Software. He has a PhD, MSc and BSc in Engineering (Electrical) He has 30 years experience in the research and development of software for the process control industry with an emphasis on the collection and presentation of real time and operator entered Industrial Information.

Hurley lives in Cape Town, South Africa. nickh@sjsoft.com

7.2 Don Glass

Donald Eric Glass has a PhD in Engineering (Knowledge Management), BCommerce (Business data processing) and BSc(Electrical Engineering). He has 32 years Industrial experience, primarily in production and manufacturing industries – including Nuclear power generation, Petrochemical and electronic manufacturing (telecommunications) facilities.

Glass lives in Cape Town, South Africa. dglass@sjsoft.com

7.3 Giorgio Guasco

Giorgio Guasco has 14 years experience in process control, 10 of these years were spent at iThemba LABS (previously CSIR National Accelerator Centre) involved in the design of the central region of the Solid Pole Injector Cyclotron. Fields were measured using models to investigate the focussing properties of the ion-source aperture for the acceleration of 4 MeV, 8 MeV and 16 MeV protons and heavier particles with orbit simulation programs. In addition, he was also involved in the calculation of the Trim Coil and Harmonic Coil magnetic fields as well as in the investigation of the dissipation of heat due to high energy beams striking diagnostic elements of the Separated Sector Cyclotron. Finally, design and development of a PC based process control package with graphics capabilities used in the measurement of the magnetic fields of a 'Beam Spectrometer'.

Guasco lives in Cape Town, South Africa guascog@icon.co.za

j5 and j5 LogBook are products supplied by St James Software.

St James Software Pty (Ltd) is based in Cape Town, South Africa
www.sjsoft.com

Filename: Networked Electronic Logbooks.doc
Directory: C:\Documents and Settings\user\My Documents\j5\j5-trunk\docs\Marketing\Presentation CD\CD Content\Technical Paper
Template: C:\Documents and Settings\user\Application Data\Microsoft\Templates\Normal.dot
Title: Networked Electronic Logbooks
Subject: The use of networked Electronic Logbooks in the Particle Accelerator Industry
Author: Don Glass
Keywords:
Comments:
Creation Date: 18/09/2007 18:32:00
Change Number: 2
Last Saved On: 18/09/2007 18:32:00
Last Saved By: Don Glass
Total Editing Time: 1 Minute
Last Printed On: 18/09/2007 18:46:00
As of Last Complete Printing
Number of Pages: 25
Number of Words: 11,812 (approx.)
Number of Characters: 67,333 (approx.)