Automatic data capture opportunities for health and safety in industry

Prepared by **Dr Carol David Daniel**
for the Health and Safety Executive 2003

RESEARCH REPORT 080

HSE
Health & Safety Executive

Automatic data capture opportunities for health and safety in industry

Dr Carol David Daniel
70 East Towers
Pinner
Middlesex
HA5 1TL
United Kingdom

This report documents the work carried out for the Health and Safety Executive based on a draft proposal submitted on 14 th February 2002 and attached in Appendix 1 at the end of this report.

The aim of the research project was to:

- Raise industry awareness of automatic data capture technologies for health and safety
- Survey problem areas in several industry sectors
- Identify what technology is currently used/available
- Identify opportunities
- Encourage feedback and pilot trials

The research was conducted through telephone interviews, site visits, presentations and use of the Internet and email. Details of the findings and response from the industry are all contained within this document.

The research project concluded with a presentation/seminar to which all respondents and contacts were invited. However, the turn out proved to be disappointing and this is an issue that will need to be carefully addressed in any future project presentations.

This report and the work it describes were funded by the HSE. Its contents, including any opinions and/or conclusions expressed, are those of the author alone and do not necessarily reflect HSE policy.

HSE BOOKS

First published 2003

ISBN 0 7176 2678 8

Contents of this Report

Introduction

This report documents the work carried out for the HSE based on a draft proposal submitted on 14th February 2002 and attached in Appendix 1 at the end of this report.

The aim of the research project was to:

- Raise industry awareness of automatic data capture technologies for health and safety
- Survey problem areas in several industry sectors
- Identify what technology is currently used/available
- Identify opportunities
- Encourage feedback and pilot trials

The research was conducted through telephone interviews, site visits, presentations and use of the Internet and email. Details of the findings and response from the industry are all contained within this document.

The research project concluded with a presentation/seminar to which all respondents and contacts were invited. However, the turn out proved to be disappointing and this is an issue that will need to be carefully addressed in any future project presentations.

Frontline Solutions seminar

Following negotiations with Frontline Solutions a venue for the seminar was organised and held in the open presentation theatre of the Frontline Solutions trade show, NEC, Tuesday 8th October 2002 for 10.30 a.m. – 12.30 p.m. The seminar provided an opportunity to introduce participants to automatic data capture technologies and to introduce the results of the research findings. Participants also had an opportunity to see the wide range of technologies and applications that have been developed for automatic data capture from the various exhibitors at the show. Contacts listed below and their colleagues were encouraged to pre-register for the event at: www.fse-expo.com. However, the attendance at the presentation was poor and did not reach expectations.

Investigations were carried out early in the project to identify one or two external speakers who could provide first hand knowledge of applications that relate to health and safety. Discussions were held with Ruth Shaw of Generics in Cambridge, Dr. Peter Harrop of IDTechEx and Tim Hankins CEO of Intellident Ltd. Generics eventually decided that the healthcare applications they are developing for clients were too confidential and that there was insufficient information that they could make public in the circumstances. Dr Peter Harrop was not available but did note that Hitachi had also been developing an application related to health. Tim Hankins (tel: 01494 787733) eventually agreed to provide a half hour presentation providing details of a health and safety related system they recently installed for the Offshore Oil Industry.

The agenda for the seminar was as follows:

- HSE Project Introduction
- Automatic data capture and related IT systems
- Applications and benefits
- Findings of the HSE study
- Tim Hankins, CEO, Intellident Ltd
- Health and Safety Applications

The PowerPoint presentation file is too large to accommodate it within this document so a copy was provided on CD-ROM to John McGuinness at the presentation.

A questionnaire was produced to accompany the presentation and provide feedback from attendees that could be used to plan future projects and is shown in Appendix 2.

Introduction to telephone interviews

Telephone interviews have been held with the contacts listed in the following sections roughly based on eliciting a response to the following questions:

- The most pressing health and safety issues/problems/applications in your sector, perhaps the top three?
- How you believe such issues might be or are being resolved/approached?
- Whether the industry is already applying automatic data capture technologies in health and safety or other applications?
- Do you believe the key issues might be amenable to the application of automatic data capture?
- Are there contacts in your industry sector you could give me who might input into this study and would be interested in the outcome?

Clearly it is not always possible to adhere rigidly to such a list of questions but they form a useful starting point for discussions.

Jacqui Hardy (HSE) provided all industry sector contacts and interviews were held on the telephone or meetings arranged in order to gain broader feedback and disseminate the opportunities for automatic data capture in health and safety related applications.

All interview responses have been noted and recorded in the following sections and show dates when contact was made or attempted. In some instances the highlighted contact was unavailable and a further contact is given in that particular section from which a response was obtained. Although a broad range of industry sectors were covered the scope of the project only allowed for a very limited number of respondents in most sectors.

Site visits and presentations

Mark Cockburn, The Mondi Group's Health & Safety Manager and John Lane,

Corrugated Packaging Association meeting held at Mondi Group's Plant in Coleville, 27/08/2.
Mark provided a tour of the plant and pointed out the issues that they are focussing on to improve health and safety practices. I provided more details on automatic data capture technologies and how they can be utilised and several applications were identified and discussed that may have potential in the plant.
In attendance were: John Lane (Corrugated Packaging Association), Ed Maxim, Simon Halls (site manager)
It was noted that there had been a recent severe accident at their Abbey plant that involved an individual caught in machinery. Mondi packaging currently use light guards and CCTV in various parts of the plant. In particular the light guards on the palletisers have improved safety and reduced time for maintenance. They use the Tenso system on some sights for access control; it is a short-range radio tag monitoring time and attendance. Access control is an issue not only for machinery but also for other parts of a plant including boiler rooms, chemical stores. Other problems occur from the 700 or so fork lift trucks used on their various sites.
Some of the issues highlighted and discussed during the visit were:

- Cost of many technologies is a problem and difficult to justify
- Applications in isolation are probably not cost effective
- Need to take a systems approach and consider the broader benefits of implementing a technology that has more than one application/benefit e.g. access control to site, machinery, plant zones, guarding, assets.
- Currently different technologies are used to fix different applications

Ivan Chu, Health and Safety Manager, North Surrey Primary Care Trust, tel: 01932 723543, mob: 07762 753911, email: Ivan.Chu@bcmhs-tr.sthames.nhs.uk,
Ian Wilson Health and Safety manager for Frimley Park Hospital, Reece Chahal, Health and safety advisor, site meeting with representatives from several Surrey hospitals
10/08/02.
There was a universal feeling that there were many potential applications for this technology to improve health and safety in hospitals including:

- Pat (portable appliance testing) testing
- General maintenance of equipment, medical devices plant etc.
- Access and security was raised as a key issue
- Baby tagging
- Trace ability of utensils and surgical instruments (currently only do this for sets and not individual items). Need for this has been driven by CJD concerns. Possible solution could be 2D bar codes such as the Marconi system, Reece Chahal asked for further details to be sent, it is almost certain that this technology will be seen at the show.

It was noted that although they are facing many problem in several areas there appears to be no definitive risk assessment, many activities and initiatives are reactionary having been triggered by an event or perhaps pressure from HSE rather than being pro-active. It was also noted that the focus for the HSE this year was stress where it may be difficult to find a definitive role for automatic data capture.

It was felt that whatever systems were adopted they should be standardised across the hospitals and not left for individual trusts to sort out.
Several attendees mentioned that some applications were already being trialed including smart cards for doctors records (inoculations), tagging in one or two maternity units (although this has now fallen out of favour) and the carephone system at Medway Maritime Hospital, used to improve security for staff.
One of the attendees noted that the latest version of the NHS Security manual was to be printed and that one of the participants in this was David Salter, Security Manager at the Hammersmith Hospital, there could be interest in including such information in the new manual.

Tony Strong - Kent, Surrey and Sussex Health and Safety Advisor - mob: 07968 907224 - his main H & S concern at the moment is managing asbestos security which involves keeping keys in a key safe - he thinks smart tagging technology could eliminate the need to manually track keys. Presentation arranged at HMP East Sutton Park.
19/09/02
Tony Strong's colleague Keith Sillitoe introduced the presentation.
Some 16 Health and Safety personnel representing various prisons across Kent attended the meeting. Feedback from the meeting indicated that there was a number of areas where automatic data capture might be usefully applied including:

- Monitoring/tagging young offenders on site and off site
- Guarding machinery (in this case a working farm with balers etc)
- Pat testing and maintenance of equipment
- Monitoring/tagging of utensils/tools whose disappearance can often lead to a complete shut down of the prison until the item is found.

Tony Strong advised that he would email me and arrange to distribute the details of the Frontline Exhibition seminar to all that had attended the meeting and other colleagues who might have an interest.

British Glass Health and Safety Committee Meeting, 2nd October 10.30am at Glass Technology Services Ltd, Sheffield. Contact Mrs Alison Bettac, H & S Advisor, British Glass, Northumberland Avenue, Sheffield - tele: 0114 268 6201- fax: 0114 268 1073 - email: a.bettac@britglass.co.uk - Alison heads the secretariat for large UK glass manufacturers (British Glass Confederation) and also the Glass and Glazing Federation (mainly glazing and related trades - SME's, plus a number of larger concerns). She also sits on the board of Sheffield's Occupational Health and Safety Committee.
Following the presentation a number of attendees could see opportunities for using radio data tags for controlling access to machines in production. In particular Alison raised the prospects for funding a pilot study to examine the application of automatic data capture for glass manufacturing using moulds where historically it has been difficult to install conventional guards. This has apparently always been of concern to HSE. Many manufacturing operations have a common need to provide easy access for the operator whilst also having to guard against injury, a difficult task for conventional guarding methods.

Andy Collinson - BPI plc, site meeting to be held at plant in Bath, date still to be confirmed. Unable to make contact and time constraints mean that this has had to be cancelled. For telephone interview see next section.

Telephone interview responses

Tony Edwards, Group Health & Safety Manager
Balfour Beatty; tel: 01332 288467; e-mail:
tony.edwards@bbmp.co.uk.
12/08/02
Have operated two pilot schemes with Railtrack and a technology partner. System uses smart cards in order to record training, dates, access to site so that only authorised and qualified personnel are allowed onto site to work. Supervisors can swipe and query data held on cards by phoning into head office, but this has led to a large number of calls that are difficult to deal with efficiently. Balfour Beatty currently is contracted by Rail Track to maintain approx ¼ of rail infrastructure.
TE thought the scheme is desirable but perhaps a step too far too quickly.
Current scheme being looked at in the construction sector is the Construction Skills Certification Scheme (CSCS). Everyone will have one and this will formalise competence and provide health screening. In the rail industry they currently use Personal Track Safety (PTS) cards, essentially an ID card but with some extra printed data to verify the user is authorised/competent to work on the track.
With Railtrack there is only one client so that introducing a system into the sector is not too onerous, however in the construction sector there are many clients year on year and they all have different requirements and who are often price driven and will not pay for the system. There is too much focus on the contractor to take the initiative and pay for the systems and little attention is paid to the client who contracts the work. If there were legislation to force the clients to take certain measures then it would be less of an issue. Need to formalise the competencies within the construction sector and develop standards at the moment construction is far behind the rail industry. Standards within and across industry are clearly big issues that need to be addressed. Monitoring skills set/training of personnel, health screening (deafness etc – anything that inhibits or alters working practices) authority and access to site in order to perform job. Needs to be adopted by all otherwise the system breaks down if many in the industry do not buy into or participate in the system.

Chris Flint - Plastics and Rubber sector, HSE, Marshalls Mill, Marshall Street, Leeds, LS11 9YJ - tele: 01132 834200
12/08/02
Prime issues in the Plastics and Rubber industry are similar, Musculo Skeletal Disorders (MSD) and Slips, trips and falls (ST&F). For the former need to change work practices and take a preventative strategy. However it is acknowledged that the problem cannot always be removed. For the latter good housekeeping is needed to ensure that problems on the shop floor (leaks, spills, trailing cables etc) are dealt with immediately. Another common issue is the machine/human interface. Within the rubber industry it was noted that rubber dust and fumes had been a serious problem and was now under far better control. Asthma was also noted as being an issue within

the rubber industry. Within plastics there was a potential issue with the use of hand knives.

Mark Cockburn, The Mondi Group's Health & Safety Manager, tele: 07769 742075, email: mark.cockburn@mondipackaging.com
Home tel: 01772 611858, Work Tel: 01942 713721
Chase House, 16 The parks, Haydock, WA12 0JQ
12/08/02
Mondi convert raw materials into paper and eventually cardboard boxes, a vertically integrated business. They have the common problems raised by Chris Flint of HSE, STF, MSD and machine/person interface. They have trialed advertising to raise the issue of ST&F but it is only temporarily effective, they are now looking to adopt methods that will change behaviour and instil habits and raise observation/alertness at work. Other issues include;

- Giving persons with the competence access to equipment e.g. fork lift truck, pin access solution from the manufacturers expensive although highly attractive to users
- Need to prevent people without authority accessing machinery
- Site access, some use Tensa system a tag based system for clocking in and out. Helps monitor/identify who is on site etc. Too expensive for small sites due to profit margins

May be potential to take a systems view and aim to tackle a number of health and safety issues with one common technology on a particular site.
Mark offered to show me around a site and discuss issues further, I said I would call him back once I was further into the study and had a better perspective on the issues.
16/08/02
Contacted him again and agreed to meet him and John Lane at one of their major plants at Coleville, 27th August at 10.30 am.

John Lane, Corrugated Packaging Association, 2 Saxon Court, Freeschool Street, Northampton, NN1 1ST - tele: 01604 621002 - email: johnlane@corrugated.org.uk
13/8/02, 14.35
Association covers 95-96% of the industry and some 169 plants across the UK.

Most pressing problem areas;

- MSD
- ST&F
- Machine safety, where potentially there are more serious injuries

Approach to reducing the problems have been road shows to encourage industry to create action plans and to make such plans living documents. Need to reduce accidents measured in accidents/100 employees.
Need to get buy in at the top and push commitment down the ladder to staff.
Gave example of lady disciplined for lifting a pallet rather than asking for the forklift to move it. In another incident a person failed to isolate a machine during cleaning and the machine was activated leading to severe injury.

People taking short cuts/cannot be bothered/too much trouble can lead to potentially serious injuries.

Bar coding is currently used for tracking reels of paper.

Suppliers of equipment are now building safety features into the kit and the association publishes guidelines for suppliers.
There were 4 bad accidents in the first quarter of this year. Inspections are a problem and he cited an example of a machine guard that had been removed over 18 months ago and it was subsequently thought that the machine never had a guard.

John Lane is very enthusiastic and would like to meet up with Mark Cockburn at possibly the March plant. Will contact Mark to determine a date.

Andy Collinson - BPI plc - Mob: 07836 352981, Tel: 01270 589751, email: andycollinson@bpipoly.com
14/08/02, 15.55
Major polythene manufacturer with plants all over the UK, produce refuse bags, carrier bags, aggregate bags etc.
Top 6 areas being addressed are in line with HSE target areas (Revitalising health and safety);

- Workplace transport
- MSD
- Falls from heights
- ST&F
- Stress
- Occupational asthmagens

3% of accidents arise from machinery
Top two areas for BPI are;

- Hand accidents, predominantly cuts/slashes etc.
- MSD

Philosophy of continuous improvement/raising awareness/training. Employees from senior management to shop floor need to understand the requirements. Education programme provides intensive training course followed by an exam. Need to manage risk on site more effectively and improve the culture.

If you improve on areas that can give rise to minor accidents then this will also impact on the potential for more major accidents.

Maintenance could be a potential target for auto ID. Equipment needs to be checked routinely e.g. machine guards.

Another key area where there have been severe problems is forklift trucks. There were 99 fatalities last year and 50% came from transport/fork list trucks. Some way of disabling/alerting required to prevent accidents.

Offered to provide a site visit, they have major plants in Sevenoaks and Bath, the latter has an excellent safety manager, Joe. Will contact again to arrange a date.
16/08/02
Tried to contact him to arrange a site visit and left an ansaphone message and sent an email

Jacqui Hardy, HSE, Paper & Printing Industry
16/08/02, 12.30
Most of the problems are on the paper making side there are fewer issues in printing. Bailing machines in particular are a cause for concern. However, there are problems generally with machine safety and keeping people out of danger zones and areas. People still do not always lock off a machine before working on the problem. Perhaps there are some opportunities for initiating a lock off or providing alarms for cupboards and stores for chemicals when people are not authorised to access them.

Possible avenues for exploration are hence zone alerts, access control, machine lock off and authority to use/access/operate.

The safety culture in some parts of the industry particularly smaller businesses is still inadequate and there are unsafe practices.

Transport in the workplace and forklift trucks are an issue, overloading, incorrect height of forks speeding etc.

Possible future opportunities for reducing insurance premiums for accident/employer liability.

Adrian Ling (Supervisor), HSE Rail RI3, Tel 01256 40400
On Holiday till September.
Spoke to Andrew Stretton one of his staff.
16/08/02
Big issue is the "contractorisation" of the railways. Monitoring and controlling the standards and working practices of the many contractors and sub-contractors on the railways are a major issue. He noted that there are many issues that are currently being addressed within the rail industry;

- Modern trains already record operational data e.g. speed, breaking distances, this is frequently downloaded for analysis to determine if operational improvements can be made.
- Trackside access through PTS cards, use of explosives and flags to warn of approaching trains
- Signalling centres with voice recording
- Traceability of parts fitted to rolling stock, using stamped parts, bar codes.
- Signals passed at danger, all data is collected to assess human or technical errors.

The three key issues they need to address are:

- Signalling management, the workload of the signaller who may be using a variety of signalling equipment all the way from traditional levers through to panels and computer systems
- Train driver management, competence/knowledge of train drivers
- Managing contractors, currently have PTS card that authorises access to track and level of competence, e.g. accompanied, unaccompanied, supervise staff. Cards can be checked by phoning and giving the number of the card to see if it is valid. Arrangements for controlling/managing contractors and sub-contractors are an issue, how do you monitor maintenance to the required standard?

Approach taken by HSE is to instil in management a culture of safety.

Some data is being captured to assist with safety but is it being used to advantage?

Colin Clifton, Railtrack HQ, Project Manager – Track Safety, Euston Direct Line; 020 7557 8505, Switchboard; 08700 002 020
He is on leave till 27th August.
Spoke to his colleague, Ian Stevens, email; stevensi.railtrack@ems.rail.co.uk
He suggested that he be the contact from now on.
16/08/02
Concerned with track safety – line side issues for both railtrack and contractors. Have piloted a smart card system to improve management of line side operatives but currently rely primarily on PTS. Track workers present the card and the details are telephoned to a call centre for validation. The smart card system is called Sentinel and supported by an organisation called NCCA. MetEngines provide the smart card and Panasonic the hand held reader.
For more details on some of the technologies employed on the railways need to go through the Technical Head of Engineering, the Chief Engineer (Andrew McNaughton, Tel: 020 7557 8738) who can then provide referrals to the relevant department.
Another technology available for line side safety includes "Hazard Scenario", this makes use of a hand held device to which a database can be downloaded. When used line side in a particular location it will provide local hazards. Looking at GPS for locating workers and providing protection but rely currently on explosives and flag warnings. He mentioned that GPS is already fitted by TOCS to their trains.

Jim Turner, South Central Trains, Safety and Standards manager, Tel: 0207 620 5506, email: jim.turner@southcentraltrains.co.uk
16/08/02
Areas of prime concern include;
- Crime, trespass and vandalism
- Train components
- Staff accidents
- On train emergency evacuation; how can evacuation be carried out fast and efficiently, how can personnel/passengers locate fire extinguishers, window hammer, ladder etc.

They have a group safety plan that adheres to the health and safety recommendations of a 40-page document from Her Majesty's Railway Inspectorate.

There is an issue with signals past a danger but believe this is currently under control. They are experimenting with a GPS fitted to 8 car trains that will allow only the appropriate doors to open on a 4-car platform.

Record keeping is an issue in order to retain data on work history for example drivers to keep a record of their training, past experience, accidents etc.

Safety audits is another area where they are looking to improve performance.

He asked for a copy of the background document (sent by email) and suggested I telephone again next week.

Called again 12/09/02 but he did not appear to have received the document so sent another copy and will call tomorrow.
13/09/02
Nothing to add to what he already provided

Brian Wright, Health and Safety Manager at D S Smith Packaging part of the D S Smith Group of companies. Personnel address; 60 St Lawrence Park, Chepstow, Monmouthshire, NP16 6DP. Email: brian.wright@dssp.com, mob: 07876 446536, tel: 01291 627463
19/08/02
Works for the corrugated division of the company and is also divisional personnel manager. Also engaged with the CPA. Revitalising health and safety has focussed on three prime areas;

- Machine safety, in simple terms guarding for machinery e.g. pressure mats, mechanical interlocks, light sensitive detectors – definitely a possible area where auto data capture could be valuable. Systems currently used have not been very innovative and have changed little over the years.
- Occupational health hazards e.g. MSD – not sure if there is a role for auto data capture here
- Slips, trips and falls – probably not much scope for auto data capture

Other areas of concern include;

- Maintenance procedures, repair and checking of machinery, diagnostics may involve running machinery, requires signed off permit to work by experienced maintenance person
- Controlling contractors, where are they/tracking, what are they doing/activities
- Transport safety, warehouse. Potential dangers from lorries, forklift trucks etc. 100 fatalities attributed to this last year.
- Control of substances hazardous to health (COSHH). Need to clearly identify products in containers and ensuring that the correct procedures and precautions taken during their use by authorised personnel. Might be helpful if data sheets could be supplied in electronic form with the products.

- Statutory inspections, making sure all work is correctly carried out for a variety of systems; boilers, lifting equipment, local exhaust and ventilation, portable electrical equipment.

Improvements have been made in the collation of data and its interpretation so that safety issues can be targeted.

The majority of ST&F are preventable, easily dealt with by good housekeeping. By instilling good practice so that the factory is kept safe and tidy you are creating a cultural change within the organisation that reflects in reduced accidents at all levels from minor to severe. What practices can be put in place to ensure the continued good health of employees is one of the key issues they are wrestling with.

Ian Wilson, Health and Safety manager for Frimley Park Hospital, Tel: 01276 526366, email: ian.wilson@fph-tr.nhs.uk
22/08/02
Confirmed attendance of a meeting arranged for the 17th September
23/08/02
Discussed the meeting details and said he would get his colleague Ivan Chu to contact me. He noted that they are currently employing a smart card based system to store the details of hospital doctors, they get some 50 new staff at the hospital every month so it can become difficult to keep a track of them and their details using a paper based system. Using tags for monitoring patients and baby's in maternity seem to be good applications for the technology.
The meeting date is actually 10th September at 2.00pm, Ivan suggested we meet up at the staff centre at 12.15pm for lunch. Ivan will arrange projection equipment for presentation at the meeting. Ivan can be contacted as follows:
Tel: 01932 723543, Mob: 07762 753911, email: ivan.chu@nsurrey.pct.nhs.uk
Address: St Peter's Hospital, Staff Development Centre, Guildford Rd., Chertsey, KT16 0QA.

David Lewis, Health Management Unit, HD A2, HSE, 6th floor Rose Court, 2 Southwark Bridge, London, SE1 9HS - tele: 020 7717 6290
12/08/02
Have been unable to contact him
19/08/02
Have been unable to contact him and have sent an email
22/08/02
He deals with policy issues and sees possible applications in the area of health records for employees that are kept up to date through health surveillance. These need to be kept by employers for 40 years but records get lost, companies disappear, get acquired, etc. leading to difficulties in the event of future treatment issues for conditions or compensation claims. For example through exposure over a period to noise, lead, asthmagens. Health records should now need to be portable for effective management, perhaps through the application of smart cards although I mentioned other possibilities include optical data cards and the similarity to electronic patient records. Such records would need to be accessed by employers, employees, health inspectors and GPs. Health records can cover a wide range of industrial activities

where the employees undergo health surveillance. The records would need to store a history of exposure to conditions under particular working circumstances including:

- Noise
- Vibration
- COSHH (control of substances hazardous to health)
- Dust & mines
- Lead – blood level monitoring
- Radiation

A contact he suggested for further discussions is Chris Taylor a senior manager at HSE responsible for the health sector, tel: 01582 444228.

Chris Taylor, HSE, Senior Manager Health Sector, tel: 01582 444228, chris.area08.taylor@hse.gsi.gov.uk
12/09/02
The key areas that lead to lost time and impact on clinical care include:

- MSD, particularly through patient handling
- Violence to staff
- Slips, trips and falls, not only staff but also patients i.e. falls from beds etc.
- Scalding from uncontrolled temperatures

These issues are currently tackled by addressing the following actions:

- Leadership
- Hardware, equipment
- Patient type, can they be moved? Are they totally immobile etc
- Staff training
- Is the correct equipment being used, e.g. lifting equipment, apparently often this is not the case.

The focus for HSE is the non clinical aspects of health and safety although often the HSE has prosecuted a trust for giving the wrong blood and the incorrect use of an infusion pump, information from investigations are passed on to the relevant bodies dealing with more clinical issues and clinical risk management; Medical Devices Agency and CNST. There is a complete scale of issues from electrical and boiler safety, within the HSE domain to clinical safety issues such as hospital infections and providing the correct patient treatment that fall outside the HSE remit.
Other issues include the need to keep accurate patient records that include care plans for the patient, are there particular handling needs and whether they carry infectious diseases. Efficient systems for capturing events and infection rates would be a boon. It was noted that scan able forms were being used in a hospital in Belfast to capture such information. He suggested I call Chris Ranger of the National Patient Safety Agency for more details, Tel: 0207 868 8971
Smart cards were being investigated for occupational health applications and to be used by doctors who tend to move frequently between hospitals.
Another application area for tracking systems would be to enforce the regulations for ionising radiation, where are they at any point in time? In Radio pharmacies it is necessary to have only authorised access, to sign personnel in and out and trace the

whereabouts of the ionising source. James Taylor who works in this area could provide further details on this.

Terry Aston, HSE, Metals and Minerals Sector, FOD Wales and South West Division, The Marches House, Midway, Newcastle-Under-Lyme, Staffordshire, ST5 1DT - tele: 01782 602338 - (Ceramics and glass)
22/08/02
Briefly spoke on the phone he has received the introductory document but asked if I can call back tomorrow.
23/08/02
His work like many in other industries focuses on the issues highlighted by the HSE Revitalising programme, plus some peculiar to the industry:

- ST&F (slips, trips and falls)
- MSD (muscular skeletal disorders)
- Transport, loading and unloading, deliveries on site, authorising use of FLT
- Stress
- Silica/lead exposure, although it was noted that on the whole this traditional problem has now been brought under control through reductions in potency and ventilation
- Handling large structures and lifting equipment, a recent case involved loss of life whilst demolishing a kiln
- Kiln dangers from explosions and demolition and kiln crashes when pallets over turn and the situation needs to be recovered.

Other areas highlighted as causes for concern include contractor control and vehicle loading/sheeting.

Access control for only authorised users is also a problem in a number of areas, in kiln crashes for example workers need to get into a very hot environment temporarily to remedy the situation but their exposure to the heat needs to be monitored and limited, similar hazardous conditions occur in glass bottle/container manufacturing.

Palletisers are another problem area as the perimeter needs to be guarded with optical sensors that will let pallets through but not allow staff access. Need to strengthen the permit to work system. Forklift truck access although in some cases requires a pin typed into a keypad it can be abused. Not sure if a tag would be any better. Employees would be interested to know who uses trucks and for how long, the former information can be used for determining liability in accidents/damage etc.

Not convinced that tags will work here as reliability of the system would be of concern and many staff may not wear or remove their tags.

Responded positively to the possibility of using CCTV and image recognition to provide access control he thought this would probably work much better than a tag based system that must be worn all the time.

Has come across other industry issues from a previous position including the problem of job rotation that is of benefit where MSD is a problem and where concentration is required, rotation provides an opportunity for staff to constantly change their work.

However, monitoring this is actually happening is a problem, are people actually rotating? Could this be a possible use of automatic data capture?
In the health sector being able to monitor whereabouts of certain patients would be of real benefit.
In the transport sector they looked at mobile phones to help bus drivers etc but the bus companies did not want to pay the costs and did not feel it would provide a quick enough reaction to the situation given the need for dialling up.
In the food sector there is an issue with hygiene and gaining access to particular process areas in a factory.

Sarah Appleby, Food Standards Agency, Aviation House, 125 Kingsway, Holborn, WC2B 6NH - tele: 0207 2768442 - email: sarah.appleby@foodstandards.gsi.gov.uk (Sarah is heading the imported food team handling incoming consignments)
22/08/02
Not available today, sent an email
23/08/02
Concerned with food safety and tractability for imported foods. All goods imported must have certificates adhering to EU standards. Problems arise with paper certificates when the number of items does not agree with the certificate and the shipment has to be rejected and checked. Any inconsistency between documentation and shipment is a cause for concern. After point of entry goods get broken down and shipped to various customers, trace ability becomes an issue. They need to ensure that specified risk material e.g. BSE and other contaminants are prevented from going any further so that unfit animal products do not enter the food chain. They use health officers at points of entry to the UK as do other agencies such as customs and excise. Integration of effort to prevent double handling of shipments would free resource for other activities. Saw the benefits that could accrue from the application of tags and 2d bar codes to resolve trace ability issues and provide on product certification to eliminate the paper trail. Another colleague, Elizabeth Stockdale is concerned with trace ability and the food supply chain.

Mike Limb, Independent Waste Paper Producers Ltd, 25 High Street, Daventry, Northamptonshire, NN11 4BG - tele: 01327 703223 - email: admin@iwppa.co.uk
12/08/02
On leave for two weeks
12/09/02
Could not talk, call him in the morning
13/09/02
The key issue appears to be machinery and in particular horizontal balers (he noted a couple of recent fatalities and serious injuries) other issues include authorised and controlled use of forklift trucks.
Mike suggested that if every operator wore a tag then this would provide a threefold opportunity to; control site access (who, when where), allow only authorised personnel to use specific machinery and shut down machinery automatically if there is non compliance with health and safety practices i.e. on a baler shutting down the conveyor but not the baler when resolving a problem.
He mentioned a number of suppliers of baler machinery:

Bollegraaf, Tel: 0121 557 9700, MD - Greg Tierney, Engineer - Harald Vanderhoeven, email: harald@bollegraaf.co.uk, Harald noted that they use interlocks on their balers but mentioned a company called Safetech who supply a radio tag safety system for shutting down conveyors/machinery if personnel try to gain access with the machinery running. I suggested Harald attend the seminar and sent him details.
Dicom Ltd, Tel: 01773 520565, Mr J Frost

Chris Brown, The Medway NHS Trust, The Fire and Safety Dept, Medway Maritime Hospital, Windmill Road, Gillingham, Kent, ME7 5NY - tel: 01634 825058 - email: bronia.pyott@medway-tr.sthames.nhs.uk or chrbrown@lineone.net (his home email), chris.brown@medway-tr.sthames.nhs.uk
12/09/02
Chris Brown is the Safety and Fire manager and deals with all issues that are not clinical risk, although the latter reside in the same department.
Currently they employ a radio system (from Carephone) comprising a pocket device carried by staff in the A&E dept. that is able to communicate with a base station (up to 100ft away) connected to a telephone line. This provides an alarm and allows voice communication with another part of the hospital. The pocket device and the base receiver have unique numbers that allows the approximate location of any particular device to be known. It is proving to be useful for containing violence against staff and is expected to be rolled out to other departments in due course.
It was noted that hospitals until recently had not strictly adhered to correct health and safety procedures and this has had to change radically. Issues they are dealing with include:

- Staff assessment
- Reporting systems
- Security and access control

Chris Brown noted that a hospital was like a large city it comprises; patients, staff, visitors, contractors and third party staff (retail), managing this and ensuring the safety of all are not easy to achieve.
Staff assessment and reporting are currently paper driven activities and could be improved through automatic data capture. It was noted that a hospital in Belfast currently uses optical mark recognition for reporting, using a standard paper form with optional tick boxes that are machine readable, this gets around the errors associated with copy typing and re-keying data into an IT system.
Other potential areas where there are difficulties include: special care baby units, ensuring that the prescribed medication/procedure is actually applied to the correct patient and the use/misuse of medical equipment e.g. failure reporting, authorised use, tampering.
Outside health and safety Chris Brown noted there had been problems with asset and stock management.
Clearly there appears to be a case for using automatic data capture to improve the overall service supply chain within a hospital environment and to create transparency in its operations, this will not only improve working practices and patient care but have the spin out benefit of improving health and safety.

Lynn Watson, Regional Health and Safety Manager for American Airlines, Heathrow, Tel: 020 8750 1151, email: lynn.Watson@aa.com
20/09/02
Biggest issue they have is manual handling of baggage, at the check in desk, on and off the carousels, on the trucks and in the hold of the aircraft where loose loads are prevalent on narrow-bodied aircraft. However the incidence of injuries from baggage handling has been falling for some years. She did not think there was much opportunity for using automatic identification for such problems; they are currently dealt with through improved operator training and the use of baggage handling aids such as rollers. They have occasionally had incidences of containers causing injuries from dollies (the small trolleys pulled by tugs) but again cannot see how automatic data capture can help. They already use bar codes for pat testing on electrical appliances and have looked at using access control tags for airport vehicles. She said she would ask her colleagues for any other feedback and distribute details of the seminar on 8th Oct.

Nick Hitchcott, Engineering Sector, MSECE, Engineering and Utilities Sector, Mclaren Building, 35 Dale End, Birmingham, B4 7NP - tel: 0121 607 6305 - email: nick.hitchcott@hse.gsi.gov.uk
19/08/02
Unavailable on the telephone so have sent an email
22/08/02
Received an email in which he noted his area was machine tools but needs time to think over possible applications.
12/09/02
Out of the office till Monday next week.
20/09/02
Mainly concerned with machine tool safety, he suggested I call Richard Griffiths, Technology Manager at the Machine Tools Technology Association, tel: 0207 298 6400, he works on European standards and production applications.
In the machine tools sector they rely mainly on conventional safe guarding systems such as interlocks on mechanical guards, pressure mats and optical scanners. The only example he new where radio data tags were frequently used was in the identification of tools for picking by the machine. Tools are often loaded into a pocket in a magazine and it is essential that the correct tool is loaded into the correct pocket otherwise this could lead to a serious accident from an ejection of the tool or components from the machine. The tagging system provides a means of obviating any problem with correct loading of the magazine as the machine can identify each tool from the tag. The same principle could also be applied to machine chucks that have different speed ratings to safeguard against over running the chuck and causing a potential ejection of material. There have been a number of fatalities from the ejection of material from machines.
Problems often occur from operators getting around the safety interlocks there may be an opportunity to apply the same type of product that has been developed by Safetech for conveyor systems. Current interlock systems use a variety of products such as switches on guards, pressure mats and optical scanners. Whatever technology is applied it must conform to the Supply Machinery Safety Regulations, essentially what happens if the device itself fails? Can it lead to a dangerous situation for the operator?

The system needs to have high integrity and be approved as a safety device. Removing the opportunity for human error and preventing operators from disabling safety features can help reduce accidents.

Peter Wormald, Health and Safety, Gatwick Airport Ltd, Tel:01293 505284, peter_wormald@baa.com
19/09/02
Called but received no reply.
20/09/02
Left an answer phone message
23/09/02
They have all the usual problems with MSD, ST&F plus vehicles and trolleys. They already make use of automatic data capture in two areas:

- Maintenance of equipment using bar codes: fire doors, extinguishers, mechanical lifting (3,500 items), electrical, etc, they have 20,000 appliances that require testing
- Access control using swipe cards and readers, in some cases this has been augmented by the use of key codes.

They are one of seven airports implementing bar code systems for maintenance recording following its adoption by Heathrow.
They are currently looking at improving incident reporting systems, currently they use electronic key entry records and are considering a tick box form that provides the same information as the electronic record that could be scanned.

He has looked at Scaf(?) tags, RF data tags that can be read and written to using a hand held device. Allows maintenance records to be easily kept and up dated without the need for online access. This would be a tremendous improvement over linear bar codes that require a number to be looked up on a server. With tags all the data is located locally with the item and he believes that at approximately £3/tag the cost is very little for a huge gain, there is the added benefit of possible extended applications including theft protection. He believes the insurance industry supported by the institutes covering mechanical, electrical engineering and possibly fire should insist on electronic records and data capture to improve maintenance procedures.

He asked for details of the seminar to be sent to him and recommended that two of his colleagues should attend the event; paul_Boynton@baa.com, steve_redwood@baa.com

Trevor Allan, HSE's Construction Division, Rose Court (3SW),
tel: 020 7717 2211, e-mail: trevor.allan@hse.gsi.gov.uk.
09/08/02
Sent an email to which he has responded that he is collating information from colleagues and will reply end of the month.
05/09/02
Contacted by Brain Neale, Tel: 0151 951 4632, email: Brian.S.TD.Neale@hse.gsi.gov.uk, he is away till week beginning 16/09/02.
19/09/02 tried contacting again but away on business till Wed 25th Sept.

26/09/02
He is a Chartered Civil and Structural Engineer and is currently responsible for the safety of structures and the refurbishment of buildings. He has been well aware of automatic data capture technologies and has reviewed the situation from time to time over the last 10 years. He sees the prime area where it may be beneficial is as part of a quality management system where at the moment there appears to be too much focus on the system and its associated paper work than dealing with quality and improvements to health and safety. The paper based systems are what discourages their use particularly amongst smaller businesses that do not have the resources.
In the highway works arena for example in the repair of the hundreds of road central barriers that get damaged each day they seem to have a well established process. This could perhaps be built upon using automatic data capture to develop further improvements.
Current problems within construction include:

- Falls from heights
- Transport
- Collapse of material

There appears to be rather poor statistics available about accidents as the reporting methods are not strictly adhered to. A discussion document has recently been released that looks at some of the issues.
A key issue is making sure that the processes on sight are performed efficiently and effectively. This means getting the supply chain in order and ensuring the right materials of the right quality arrive at the right time (as little storage space is generally available), that qualified and authorised personnel are available to do the work and that the correct plant and equipment is in good repair and in place to do the job. This will allow personnel on site to do their job more easily and with less trouble, putting them in a good frame of mind to concentrate on the job in hand and preventing the creation of situations that eventually lead to accidents; not having the correct equipment/material when required leads to making do in some cases and possible accidents, personnel waiting for processes or events on site so that they can compete their job can lead to fatigue and health issues etc.. Technology is already helping to make operations safer through mobile platforms to allow steel erectors a safe viewing area, CCTV allows work to be surveyed and quality approved.
One area where ID cards are issued to show competency to work is the CSCS competency scheme. This currently uses printed cards and could be up graded to employ smart cards possibly contact less ones that provide a complete history and a more secure system to prevent fraud. This would provide a more manageable way of monitoring and controlling personnel on site and allow further applications to be developed e.g. access control, authorisation. By coupling the system with a biometric measurement it would reduce the potential for forged cards or card swapping.

Dale Wallis, National Health & Safety Manager, British Printing Industries Federation, Farringdon Point, 29 - 35 Farringdon Road, London, EC1M 3JF - tel: 0161 886 8412 Direct dial, s/b tel: 0161 886 8400 - mobile: 07736 828 450 - email:dale.wallis@bpif.org.uk
12/08/02
Spoke very briefly on the telephone to introduce the study.
13/08/02

Away till early September
20/09/02
Out on business till next week, might be reachable on his mobile on Monday
26/09/02
The federation represents only 20% of the sector and of those 80% have less than 20 employees. A major issue for them is the overburdening of the industry with legislation and how such information can be passed to members to keep them up to date, currently they are considering a news bulletin.
Key areas of health and safety include:

- upper limb disorders (MSD)
- dermatitis from the chemicals used in the industry
- machine safety, access control and isolation
- transport, including fork lift trucks
- Electrical appliances, pat testing

He thought that in the area of transport and pat testing there was an opportunity to employ automatic data capture. Another area that could be improved is the HSE passport scheme for training. It appears that there are currently 8 schemes for several industry sectors including construction, electrical, which hold different information about the person including information like site familiarity. Standardising this information into one format that can be used in all industries and up dateable would be a major improvement. This could be achieved through a smart card system, it would allow information to be kept locally for easy access through a simple reader and pda. Furthermore information could be standardised for all industry sectors and only the relevant data fields used for a particular application as required.

Paul Evans, Chemical Risk Assessment and Control Unit, Room 326 Magdalen House, Bootle - tel: 0151 951 3281 - fax: 0151 951 3595, email: paul.evans@hse.gsi.gov.uk
19/08/02
On leave till 27th August
20/09/02
Still not available, try next week, sent an email
26/09/02
He is an occupational hygienist and assesses the risks to toxic substances. They have a hierarchy of controls for dealing with hazardous substances:

- Substitution, trying to replace hazardous substances with less hazardous ones
- Control by removal of the hazardous substance through better ventilation, extractors and other safety controls
- Containment, ensuring the material is only used locally and that only authorised personnel have access

It was felt that possibly the last two were areas where there might be some potential applications; one was maintenance of control equipment to ensure it was safe and functioning correctly. Containment using access control systems is a classic application for data tags and could be used as a basis for the wider aspect of site access control and authority to use plant and equipment.

Karen Niven, President of the British Institute of Occupational Hygienists (BIOH). Karen works in the NHS and her contact details are - tel: 01382 346030 (same number as her pa, Lynn Summers) – can also be reached occasionally on tel: 01383 428400, email: karen.niven@tct.scot.nhs.uk and karen.niven@ohsas.scot.nhs.uk
19/08/02
Spoke briefly on the telephone, asked her pa to arrange a time when she could talk. Sent an email for background.
23/08/02
Spoke to her PA Lynn Summers who said that Karen was not sure she was the right person to talk to, Karen is making contact with colleagues for feedback and will get back on 9th September. Sent her a follow up email confirming the details.
02/09/02
Karen said she would like to get feedback at a meeting to be held on 20/09/02 as she does not feel confident that she has the information I am seeking. I noted that any feedback as soon as possible would be useful.
23/09/02
Karen noted that the consensus from colleagues was that the best person to talk to would be:
Mr Andrew Wong, Scottish Director and manager of healthcare adverse incidents scheme,
Scottish Healthcare Supplies
Telephone 0131-551-8402 (direct line)
andrew.wong@shs.csa.scot.nhs.uk
He deals with all incidents involving products and supplies and, we are sure, would be able to add a great deal of insight to your project.
Tried to contact him and left a message.
27/09/02
Concerned with the investigation of medical devices for NHS Scotland. They collate incidents and events (perhaps several hundred per annum) through email, telephone, letter etc. (unstructured communication channels) and co-ordinate investigation of the issues that have lead to problems with medical devices. They liase with the MDA and the NPSA the agency that looks after all aspects of improving patient safety including drugs, clinical practice, medical devices. There appear to be a large number of uncoordinated activities from various agencies that all have their own remits. It was uncertain how automatic data capture could play a role here, perhaps there could be an opportunity in incident reporting but the numbers are not huge. He was familiar with the use of bar code surgical kits and the use of key codes for infusion pumps but all they can do is make recommendations. He suggested contacting Paul Pike (tel: 0131 551 8699) if I required feedback on supply chain issues

Andrew McNaughton, Railtrack Chief Engineer, contact details from Ian Stevens, tel: 020 7557 8738.
19/08/02
PA suggested it would be best to talk to Andrew Newby at the Kings X office he works for A McNaughton. Tel: 020 7557 8000 extension 0054980, mob: 07771 612671, email: newbya.railtrack@ems.rail.co.uk. Tried to reach him without success.
22/08/02

Andrew Newby not available, sent an email to him and his PA; Laura, crangael.railtrack@ems.rail.co.uk
12/09/02
No reply to date, called again but at a meeting, sent another email.
16/09/02 received an email stating that a co-ordinated response would be forthcoming from Keith Watson (Assurance and Safety department, tel: 0207 557 8512, email: watsonkj.railtrack@ems.rail.co.uk) and Richard Harris (Safety Systems Manager, tel: 020 7557 8449).
26/0//02
Left a message for Keith Watson to reply.
27/09/02
Currently they have a very big safety agenda and are very focussed on getting this job done and are not easily diverted at the moment. He noted that Richard Harris was new to the position (4 months) and is still gaining experience.
Some of the issues they are addressing include:

- Track condition monitoring using a high speed recording vehicle
- Effects of different train suspensions on the track
- EMC compatibility between trains and track circuits
- Collecting accident data, currently data is collected into a Safety Management Information System (SMIT) by key entry. But they are exploring the use of hand held devices and drop down menus
- Competence of people, SENTINEL – records details of competencies, monitoring people working on site, have trialed a system using smart cards and purchased 100 smart card readers and terminals.
- Monitoring rail vehicles on the network, looking at GPS but worried about switch off
- Possession and possession management. Need to control a length of track and stop trains when doing maintenance e.g. replacing a bridge. Need to hold signals on danger. Issues include where will the limits of the possession be, how is it to be booked and managed and for what period is possession required, in some cases planned two years in advance

Keith Watson noted that they do not see major changes from their current plans but acknowledged that they are looking at automatic data capture techniques. Send him details of the seminar and he will circulate to colleagues.

Richard Griffiths, Technology Manager at the Machine Tools Technology Association, tel: 0207 298 6400, recommended by Nick Hitchcott, HSE.
26/09/02
Not available until Monday next week
30/09/02
The potential problem areas within the industry fall into 3 general areas:

- Guarding and authorisation of use of machines
- Ensuring correct tool selection
- Safety critical machinery and control equipment

Richard Griffiths noted that tags could potentially be used in all these areas.

Within high volume manufacturing for military, aerospace and car manufacture a wide range of complex and sophisticated machines are employed having a wide range of hazards and risks associated with them. Currently machines may be fitted with enclosures and interlocks to prevent access whilst the machines are operating. For setting and maintenance certain skilled personnel need to have access to equipment. Some machinery such as expensive transfer lines can be particularly hazardous, they tend to involve the use of conveyors and robots for processing sub assemblies or performing manufacturing operations can be very long and cover a large area. In such large operations there is a danger of operators facing unforeseen shutdowns and needing to maintain the equipment and the possibility that equipment could be restarted whilst the operator is still in the plant. Other manufacturing operation may involve manual feeding of presses and operators with low skills levels involved in semi-automatic operations. Being authorised to use equipment is also an issue particularly with hazardous processes that may involve lasers, water jet and heat cutting etc. Another area highlighted and related to authorisation is the possibility of sabotage by disaffected employees.
He was not aware as Nick Hitchcott had mentioned of the use of tags for identifying machine tools so that the correct tool is always available for the job but did note that mechanical fittings had been traditionally used to resolve the problem.
HSE had highlighted the problem of safety critical control equipment and programmable electronic controllers. In some cases fail safe systems have been built in that use a second control channel if one fails. But it is the upgrade of machine tools both from a mechanical and software perspective that raises concerns. If motors and other items are replaced and performance can be improved through new software how can the safety integrity of the new system be guaranteed? These issues have been raised in a document covering electronic control and the law. The software for upgrading machine tools needs to be correctly handled through authorised distributors and only applied to suitable hardware.
Telemetry is already widely applied to machinery to allow monitoring and maintenance from anywhere in the world. Tags could be used with operators to authorise use and monitor performance.
Another issue arose from Germany where it was thought that too many safety systems to prevent people doing things they should not be doing was impinging on productivity. By law in the UK the system must conform to standards and if no safeguards are in place they must be explained satisfactorily in the documentation perhaps citing that it can only be used with a person qualified to some level. By introducing tagging systems it may be possible to introduce safeguards for the use of machinery that are highly invisible and do not impede productivity.
Sent him details by email of the seminar and he indicated interest in attending.

Abid Dost, BRMA (British Rubber Manufacturers Association), Tel: 020 7457 5027
19/08/02
Exceedingly busy at the moment and unlikely to be able to participate till October. Suggested he may have 15 mins to spare early next week.
20/09/02
Still not able to reach him
30/09/02
They are currently working to bring the accident statistics in line with industry averages. They have seen a 20% decline in accidents over the last 4 years. Manual

handling (MSD) and slips, trips and falls (ST&F) constitute some 50% of all incidents.
It is a very traditional industry and falls into 3 sections:

- Large tyre companies with international presence
- Re-treading companies, small operators
- Small companies producing a variety of rubber based products.

Industry capacity has fallen sharply over the years and there has been a general decline primarily due to foreign imports.
Factory supervisors are on the whole poorly trained and the initiatives they have taken to improve safety practices have been down to earth practical procedures that are low in cost. Providing more training for supervisors who normally are only concerned with production and who are now being trained in health and safety has been one approach.
Given the scenario above there did not appear to be much scope for introducing new safety technology in a rather staid and declining industry with little financial capacity.

Unavailable contact.

Chris Money, Exxon Mobil - he represents the European chemical industry (CEFIC) and is based in Brussels, so the best way to contact him would be by e:mail at: chris@moneycoomes.free-online.co.uk
19/08/02
Sent an email
27/09/02
Sent a reminder but still no reply

Research findings

The contacts provided by HSE and interviewed fell into the following industry groupings:

- Prison service
- Airline/airports
- Healthcare
- Packaging
- Printing & paper
- Plastics and Rubber
- Chemicals
- Railways
- Construction
- Ceramics and Glass
- Food
- Engineering

The feedback recorded in the previous sections from interviews and meetings were collated to show the issues that were raised most frequently and to identify groupings for such issues that would help with the analysis.
The results were as follows:

- Access Control
    - Guarding machinery
    - Hazardous zones
- Transport
    - Fork Lift Truck
    - Other vehicles

- Maintenance
  - PAT testing
  - Plant and equipment
- Security
  - Safety for staff, contractors, visitors etc
- Track & Trace items/people
- Personnel Monitoring
  - Training and competence
  - Skills/experience
  - Exposure/treatment
  - Activities at work
- MSD, ST&F, Stress
- COSHH
  - Environmental
- Incidence reporting
- Collapse of structures

Issues peculiar to an individual industry sector were left out of the analysis as the aim was to identify common issues and hence common solutions that could be addressed with automatic data capture technologies. As the interviews were conducted with a variable number of representatives from the different industry sectors it was felt inappropriate to consider the number of times an issue was raised by any one sector. Furthermore it should be noted that these are the actual responses from the interviews and does not cover potential issues that were never cited by an individual.

By tabulating the above issues against the responses from the representatives of the key industry sectors the following results were obtained:

Table of Health and Safety issues as a function of industry sector. The blue areas indicate that an issue has been raised by that particular industry sector.

	Access Control	Transport	Maintenance	Security	Track & Trace Items	Personnel Monitoring	MSD	ST&F	COSHH Environmental	Stress	Incident Reporting	Structural Collapse
Packaging	■	■	■			■	■	■	■			
Healthcare	■		■	■	■	■	■	■	■		■	
Prison Service	■		■	■	■	■						
Air transport		■	■				■				■	
Paper&Printing	■	■	■			■	■		■			
Plastics&Rubber		■	■				■	■	■	■		
Chemicals	■								■			
Railway	■	■	■	■	■	■					■	
Construction	■	■	■			■					■	■
Ceramics&Glass	■	■				■	■	■	■			■
Food					■							
Engineering	■											

The table shows that of all the issues raised several are far more common across industry sectors than others and are frequently cited as being important issues. As a

benchmark if an issue has been raised at least four times by different industry sectors then arguably it should be worthy of further consideration and hence has been included in the following applications list:

- Access control and guarding of machinery
- Transport and in particular the control and use of fork lift trucks
- Maintenance of plant, equipment and PAT testing
- Tracking and tracing items such as food products and individuals
- Personnel monitoring is a rather broad issue covering monitoring of skills, training, qualifications, health and exposure records and monitoring activities of individuals at work to reduce the prospects of accidents e.g. repetitive actions, limiting time of activities.
- Muscular Skeletal Disorders (MSD)
- Slips, Trips and Falls (ST&F)
- COSHH and factors such as exposure to hazardous environmental conditions e.g. radiation, dust, excessive temperature
- Incident reporting, the reporting of accidents and the gathering of accurate statistics

Security, Stress and Structural collapse although cited by more than one industry sector do not appear to be highlighted sufficiently to warrant further consideration within this report.

However, from the records of discussions that have taken place with contacts the emphasis has clearly been in four key areas, if we only select the issues that have polled more than half the industry sectors, then there are 4 clear winners:

- Access control
- Fork lift trucks
- Maintenance
- Personnel monitoring

The above issues crop up regularly and respondents have articulated the problems they are facing in much greater depth.

To determine possible automatic data capture solutions for all the above issues, information was gathered from the interviews and the Internet based on the key technologies identified in the original proposal document, see Appendix 1.

The results of the research indicate a wide range of actual and potential health and safety applications some of which have undergone pilot trials or are established using commercially available products. The applications identified and the relevant technology are summarised in the list below, further details for selected applications are given in the seminar presentation slides:

- Monitoring fork lift truck access and use – sensor tag from Shockswitch, commercial product
- PAT testing and plant/equipment maintenance – bar code and radio frequency identification (RFID) from Intellident and Robotag, many commercial systems readily available
- Exposure to hazardous environments, toxic gases and radiation – sensor tag, pilot projects

- Monitoring ground traffic at airports – real time location finding (RTLF), pilot project
- Monitoring personnel location and providing security for prisons and University campuses etc– RTLF from Wherenet and others, many commercial systems available
- Guarding machinery – RFID from Safetech, commercial product
- Incident reporting – Optical mark forms and hand held terminals, several commercial vendors
- Personnel records and authorisation cards – SMART cards undergoing trials with Railtrack and Hospitals, many commercial systems available
- Tracking and tracing surgical instrument sets – bar code, many commercial systems available
- Safety for staff at Medway Maritime hospital – sensor tag from Carephone, commercial system
- Monitoring animals and tracking from farm to slaughter house, tracking picked produce for food safety – RFID, several commercial products available
- Zellweger toxic gas monitor with cassette – RFID, commercial product
- Access control to, equipment, secure area, PC, airport security etc – RFID, biometrics, identify fingerprint, voice etc, several commercial products

From an understanding of the functionality of automatic data capture technologies and the applications uncovered from the research it is possible to tabulate the type of automatic data capture technology against the identified health and safety issues that may be addressed or can assist with such issues. This has been done in the table below:

Table showing health and safety issues in relation to automatic data capture technologies

	Access Control	Transport	Maintenance	Security	Track & Trace Items	Personnel Monitoring	MSD	ST&F	COSHH Environmental	Stress	Incident Reporting	Structural Collapse
RTLF	■	■		■	■	■						
RFID	■	■	■	■	■	■			■			
Sensor Tags		■							■			
Hand Terminals			■			■					■	
Optical Forms											■	
SMART Cards	■			■		■						
Biometrics	■			■								
Bar Codes	■		■	■	■				■		■	

The table only plots those technologies against applications where a clear cut application exists, has undergone pilot trials, or where an opportunity can be clearly seen. No obvious applications exist for the technology in the areas of MSD, ST&F, Stress and Collapse of structures.

It can clearly be seen that there are a range of established solutions for a number of health and safety issues:

- Access control
- Transport
- Maintenance
- Security
- Track & Trace
- Personnel monitoring
- COSSH and environmental
- Incidence reporting

However, we need to prioritise these issues so that focus is placed on the most pressing problems and the most readily available solutions, on this basis the high priority areas mentioned earlier also appear to be very well matched to the available solutions:

- Access control and in particular machine guarding
- Transport and in particular fork lift trucks
- Maintenance e.g. PAT testing, plant and equipment
- Personnel monitoring, maintenance of skills, training, experience and health records

It is recommended that any further studies or possible pilot studies and trials focus on the above application areas in the first instance.

However, in order to ensure that the correct approach is taken to implementing any solutions to the above problem areas a number of strategic and technical issues need to be addressed.

At a strategic level the following should be considered before embarking on any projects:

- Cost of technology, often difficult to justify, a Cost Benefit Analysis is often required to put the case to management
- Capital Cost v Consumable, in some cases it can be difficult to release funds for capital investment that could impact on operational costs
- Management & Staff buy in, alienating a particular group in the implementation process may create problems downstream
- A systems approach is required; multiple applications from one key technology, ideally the system put in place for one application should have the potential to migrate to others
- Get the service/product supply chain right: visibility, quality and efficiency, this will have spin off benefits in areas such as health and safety
- Need for standards – both on the technology and applications side
- How will the new solution interface to the legacy IT system or is a new IT system required?

Furthermore careful selection of the appropriate technology for the application needs to be undertaken, this often requires consideration of the following issues:

- Can a trade off be made between the required specification and cost or can greater benefits be gained by extending the scope of the application for marginal extra cost
- Try to focus on generic applications rather than those peculiar to your industry
- Use existing ADC applications or trials as a model
- Try to adapt or use off the shelf solutions or use solutions from other applications
- Does it integrate well with, or show a progression from, existing practices?
- Is it possible to leverage existing systems in particular IT to help reduce implementation costs?

Conclusions

In conclusion the research study has shown that:

- The potential for ADC has been well received by those in the industry
- A number of industry focused presentations have helped to disseminate information about ADC and how it can be applied as well as provide feedback
- A number of common Health and Safety issues have been identified that are amenable to the application of ADC technologies
- Key application areas identified are:
    - Access control
    - Transport
    - Maintenance
    - Personnel monitoring
- Several industry sectors already make use of ADC technologies for health and safety applications
- Many systems applications are readily available on the market
- The technology is not a panacea, choose your application carefully
- There has been some interest from respondents in taking this further through pilot studies or trials

Appendix 1

Draft Discussion Proposal to HSE 14 February 2001
Prepared by Dr Carol David Daniel

This proposal sets out a programme to raise awareness and encourage the application of automatic data capture technologies for improving health and safety standards within industry. It is hoped that the proposed programme will encourage participants to find out more and begin to implement pilot projects.

Background

This proposal follows from discussions held with Mike Wilcock and Tim Watts whilst the author was with CEST. Following a more recent meeting with Mike Wilcock and John McGuinness on the 5th October at Rose Court it was suggested that the author propose a programme along the lines discussed at the meeting and presented below.

What is automatic data capture?

Automatic data capture technologies are means for capturing information about an item or person without the need for manual data entry. To date the focus on hardware platforms, communications and software applications has meant that little attention has been paid to how the data for such systems will be captured. Automatic data capture is the front end that provides the reliable data needed for IT applications to function effectively.

It encompasses technologies from the humble bar code to far more sophisticated techniques including radio data tags and GPS (global positioning system) modules. By attaching an identifier, bar code or tag to an item a reader can be deployed to capture information from the tag and hence the item to which it is attached. Taking the person out of the loop for capturing information about a transaction or operation considerably reduces the error rate leading to greater efficiency and effectiveness. It also provides an accurate audit trail to make errors easy to correct and to provide an overview of operations for data mining purposes. The process improvements gained by implementing automatic data capture technology often lead to knock on benefits not always identified at the out set including the reduction in waste and improvements in safety.

Technologies

Automatic data capture technologies are very diverse in their functionality and specification and the market is very fragmented. Choosing the right technology for the application is critical to its success.

Listed below are some of the technologies currently available on the market listed in order of cost and functionality;

- Linear bar code, many standards exist for the method of encoding data into black and white bars including Code 39, Interleaved 2 of 5, EAN, etc. A bar code only provides a unique number that can be used to identify an item, this usually points to a record on a database so that the details of the item can be retrieved.
- Metal bar codes often employ inductive rather than optical techniques for reading and can be used in severe environments where a printed bar code is inappropriate.
- 2D bar code, several hundred different standards exist although only a handful are in common use e.g. pdf417, this is a Symbol proprietary code far more resilient than a linear bar code and capable of storing 2 kilobytes of data. Much more than an identifier, it is often used where a database is not available.
- EAS (Electronic Article Surveillance) tags are commonly found in retail environments to discourage theft. They use special magnetic materials and are cheap to produce. However they only carry one bit of information.
- Multibit magnetic material tags are based on the same principle as the ubiquitous EAS tag. They allow more data to be stored typically up to16 bits and cost several pence.
- RF ID (Radio Frequency Identification) uses a fully-fledged radio transponder in a minute package, typically a 1 mm silicon chip attached to a printed antenna to form a radio label tag. Numerous advantages arise from radio data capture including covert operation, longer range, more data storage, simultaneous reading of several tags, high reliability and ruggedness.
- Infrared transponders have been developed for a number of specialist applications. They are essentially like RF ID but use an infrared link to send data from the tag over several metres. One application uses such tags as badges for monitoring staff movements in a building.
- RF ID with location capability employs readers that can fix the position of the tag to less than a metre. A number of vendors have developed such location finding systems that do not employ GPS.
- Similarly a number of systems have been developed to locate the position of mobile phones, a mobile phone can be considered a sophisticated RF tag with increased capability.
- GPS is the global location finding system but the tags are expensive and to combat this some vendors have developed a simpler approach also using satellite technology.
- Other devices and systems that usually fall into the category of automatic data capture include wireless PDAs (personal digital assistants), these are often display driven where the operator employs pre-set menus. Other techniques include image recognition systems and sensors.

The area is constantly expanding as developers find new ways to capture data. However, it is in the more mainstream bar code and tag technologies where the commercial opportunities and quick gains are achieved as the technologies are widely available, relatively mature and falling in cost.

Costs

With such diversity of technology it is not surprising that cost variations are enormous;

- Bar codes require a printer typically costing several hundred pounds and bar code readers can be bought for less than two hundred pounds, the costs for 2D implementation are not much higher.
- RF tags typically range from tens of pence to hundreds of pounds depending on the functionality required. The top of the range tags can have global visibility (GPS), substantial memory capability and in some cases the ability to read other tags. Readers can range from hundreds to thousands of pounds. A typical application using Gemplus RF tags priced at 50 pence each might user a reader costing several hundred pounds.

Applications

The applications for automatic data are as diverse as the technology but all involve reducing the transaction cost of monitoring or acting upon a process and providing an accurate audit trail. Although some industries have seen the benefit of using such technologies in their operations there are still too many industries that do not understand the technology or its implications for their business.

Some areas where automatic data capture is employed include;

- Security e.g. access control, tamper evidence and authentication
- Waste Management e.g. automated weigh bridge system
- Logistics and Distribution e.g. parcel tracking
- Manufacturing e.g. process control
- Warehousing e.g. locating products
- Asset management e.g. control of items on lease such as beer kegs
- Marketing e.g. lock and key applications, drug and dispenser
- Transport e.g. monitoring vehicles and route planning
- Leisure industry e.g. locating visitors in a leisure park
- Eliminate the paper chase, replace cards, forms, entries on paper e.g. blood products carry 2D bar code with all data thereon

The number of applications being developed is expanding all the time as industry becomes more aware of the capability of the technology.

Health and Safety Applications

There are several industry sectors that could benefit significantly from the application of the technologies described above to improve health and safety. They include;

- Agriculture
- Construction
- Health Service
- Railways
- Nuclear
- Paper
- Leather
- Textile
- Oil

Many of the applications in the above sectors will involve the correct use and maintenance of equipment and the following of good practice and procedures. As with the applications described earlier one of the key aims in automatic data capture is to take human error out of the equation and clearly this is one of the key issues in health and safety.

Some particular examples where automatic data capture might be employed in the above industries include;

- Authorise personnel access to plant and machinery
- Compliance with procedure through a set of operator initiated events
- Disabling the operation of machinery/equipment in the vicinity of personnel
- Effective maintenance and repair of equipment with audit trail
- Isolation of a plant and access control
- Verifying correct shut down procedure for plant and machinery
- Use of safety equipment before commencing work

Proposed Programme

In the first phase it is proposed that four key industry sectors are identified to research the current practice, problem areas and potential for applying automatic ID technologies. In consultation with HSE suitable candidates will be identified and interviewed on site to establish the potential opportunities. A report will be produced on the findings and will be used as introductory presentation material at the proposed follow up seminar. Furthermore it is suggested that a questionnaire is produced that can be issued to participants of the seminar and collated later to establish industry interest and the prospects for taking such technologies forward.

The second phase will be a morning seminar/workshop for an audience of up to 200 industry participants perhaps in conjunction with an existing event where participants can gain a wider view on the technologies and discuss their interests with a range of suppliers. HSE will employ its network within industry to promote the event and create the attendance list. The seminar will also provide an opportunity for participants to feedback their understanding

and the opportunities they see for automatic data capture in their own industries. The proposed agenda is as follows;

- Welcome
- Introduction to Automatic Data Capture
- Current Applications of Automatic Data Capture
- Guest Presentation on a real world application and experiences
- Findings of the research into health and safety applications, where do the opportunities lie?
- Present and issue questionnaire for participants
- Buffet Lunch
- Close

Following the seminar and a short interval of approximately 2 weeks a follow up summary of the response from participants will be collated and appended to the report.

My research to date indicates that there are two possible events that may be suitable for such a morning seminar:

- Eurotag, 30th May 2002, London
- Smart Labels, 4-6th September 2002, Cambridge

The latter event is likely to be the most interesting as it will also have a small range of exhibitors of the technology rather than be entirely seminar focussed. Other possibilities are being investigated through AIM but in any event it is recommended that the summer period from late June to end of August is blanked out from the diary as in my experience few participants tend to be available for such events. If it is not feasible to run a parallel event for logistical reasons the fall back position may well have to be a standalone seminar.

Estimated resources and cost to implement programme

Research Phase

11 days @ £500/day = £5,500
+ Expenses

Questionnaire preparation, follow up and collation

3 days @£500/day = £1500

Prepare presentations and organise Seminar/Workshop Phase

4 days @ £500/day = £2,000
+ Expenses

Until a decision is made on the venue it is difficult to provide a detailed costing of conference room hire, coffee and buffet lunch, however a budget of approximately £2,000 would not be unreasonable.

Total Estimated Cost of Project = £11,000 + Expenses

Appendix 2

Frontline Solutions, NEC, 8th October 2002, HSE Seminar
Questionnaire: "Opportunities for Health and Safety applications using Automatic Data Capture"

To provide feedback and help shape any potential future programmes we would be grateful for your response to the questions below. Please take the time to respond before leaving the presentation today.

1) Contact details:
   - Name……
   - Organisation……
   - Telephone……
   - Email……..
2) Which industry sector?
   - Industry……..

3) Do you have Health and Safety (H&S) responsibility?
   Yes □ No □

4) Was the seminar useful to you?
   Yes □ No □

5) Are you interested to learn more?
   Yes □ No □

6) Do you believe there are H&S opportunities for automatic data capture in your sector?
   Yes □ No □

7) If yes, are these just niche opportunities or are there wider implications?
   Niche opportunities □ Wider implications □

8) Were any of the examples given of relevance to your sector?
   Yes □ No □

9) Do you intend to act on any of the information from the seminar?
   Yes □ No □

10) Would you be interested in developing a pilot application?
    Yes □ No □

11) Are there practical and organisational obstacles to taking the ideas from the seminar forward?
    Yes □ No □

12) Can you provide examples of such obstacles?
    - Obstacles……

Thank you for your time. If you have any queries please contact:
Dr C. D. Daniel, Tel: 020 8868 2427, email: cddaniel@talk21.com

Printed and published by the Health and Safety Executive
C1.25 02/03

MAIL ORDER
HSE priced and free
publications are
available from:
HSE Books
PO Box 1999
Sudbury
Suffolk CO10 2WA
Tel: 01787 881165
Fax: 01787 313995
Website: www.hsebooks.co.uk

RETAIL
HSE priced publications
are available from booksellers

HEALTH AND SAFETY INFORMATION
HSE InfoLine
Tel: 08701 545500
Fax: 02920 859260
e-mail: hseinformationservices@natbrit.com
or write to:
HSE Information Services
Caerphilly Business Park
Caerphilly CF83 3GG

HSE website: www.hse.gov.uk

RR 080

£10.00

ISBN 0-7176-2676-8

9 780717 626762