THE BASICS OF
DEPLOYMENT FLOWCHARTING
& PROCESS MAPPING

A User’s Guide to DFC
for
Know-how Capture and Process Design

by David Howard

Management-NewStyle
"Draw a flowchart for whatever you are doing. Until you do, you do not fully understand what you are doing. You just have a job."

"Words have no meaning unless they are translated into action, agreed upon by everyone. An operational definition puts communicable meaning into a concept."

"The first step in any organisation is to draw a flow diagram to show how each component depends on others. Then everyone may understand what their job is. If people do not see the process, they cannot improve it."

W Edwards Deming (1900-1993)

"The manager's job has changed. The people work in the system. The job of the manager is to work on the system to improve it continually, with their help."

Myron Tribus
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An early FlowMap for Getting the Work done on time and to Plan

Figure 1 - The author’s ‘deployed flowchart’ for a major facilities project he led for a US client in the early 1980s. It pioneered the first conjunctive use of systems thinking and process working in the construction industry in the UK. A team of some 15 construction professionals delivered the 170,000 sq ft project on-time, on-cost and on-spec in half the usual time and at half the usual professional services fee. The contractor delivered the commissioned complex in 16 months rather than the traditional 30 months for such a project.

Figure 2 - The Milton Keynes project upon completion in mid-1983.  
(Ref: Management Accounting February 1985 pp36-38)
1. INTRODUCTION

This pamphlet introduces, with a typical example, a simple but very powerful business process mapping technique known as deployment flowcharting (DFC). Deployment flowcharting, sometimes called swimlane or matrix flow-charting, is increasingly being recognised today as the preferred technique for capturing the operational details of business activities.

Figure 3 - A typical deployment flowchart. Note the header details, cast of characters and the disciplined layout of the charting. Connecting links are always horizontal or vertical, never inclined. Horizontal links denote co-operation; vertical links, time and shadowed drop-chart links, increasing detail.

Figure 4 - A deployment flowchart provides process understanding by virtue of the three vectors shown above - teamwork, timing and detail.
Deployment FlowCharting

Figure 5 - As process dependencies are mapped a heterarchy forms which graphically represents how an organisation is actually connected (i.e. many-to-many mappings). By contrast traditional organisation charts are hierarchical (i.e. one to one mappings) and show responsibilities but not the vital, often informal connectivities of process working.

The strength of a deployment flowchart lies in it's ability to display process knowledge clearly and insightfully. It thus encourages the subsequent improvement of process performance and innovation. All business activities consist of a sequence of related actions and tasks, which use resources to transform inputs into outputs, be they products or services. Such transformations are the source of all value creation for a business. They are also the source of all the added costs that tend to reduce productivity, efficiency and economic-quality. Process mapping based on the DFC technique thus helps identify the sources of both value and cost. Once the sources have been found then costs can be rationalised and value creation optimised. Product and service quality are consequently improved.

The ultimate purpose of all process mapping must be to bring about improvement and innovation. It is therefore most helpful to start mapping processes as they are, not as they could be. Changes to the process can follow once the initial condition is defined. Process mapping can also, of course, be used for planning new processes.

Deployment FlowCharts as Operational Definitions

A well-formed FlowMap serves as an operational definition of the way work gets done and time gets used. By virtue of its collaborative origins it uniquely defines how value is created by transformation of inputs to outputs and it serves as a basis for all subsequent improvement.

The process manager (owner and leader) is ultimately responsible for improving his or her assigned processes. However, experience shows that without the support of the people who work within the process it is not possible to bring about lasting improvement single-handedly. Contrary to received wisdom in traditional hierarchical organisations, everyone who has a job is part of, or owns, a process. There are no exceptions. Identifying the process may be difficult. But a process will exist. The question is whether it is a necessary, value-adding process or one that just adds cost.
2. GETTING STARTED

Once a candidate process has been identified for mapping agree a clear, short-name for it. It is important that this is done concisely - try to use no more than five words. Lack of clarity at this stage - particularly in the opinion of others outside the process - will only result in confusion later on. Avoid loose ends.

A process only flourishes when it is led. Left to itself it becomes inefficient. Whether it be dealing with a product or a service the process will only perform as well as the management provided by its leader. This leader can be seen as the process owner. The leader will generally be a 'manager' in functional terms (i.e. the person responsible for continual improvement of the process) if not in title. For high level business operations - the core processes of the organisation - the process owner will be a director.

The unambiguous identification of a process by concise title and owner's name constitutes the major first step forward in process mapping. Often allocation of ownership is one of the biggest hurdles to be overcome. The perceived manager is not always the one who carries actual delegated responsibility. Sometimes responsibility may appear shared; sometimes it will apparently not be owned by anyone!

It is also necessary to identify the person who will lead the process mapping exercise - the mapping steward. This person will generally not be the manager, but rather the process supervisor or team leader. This person will have worked within the process and knows about it in detail and also has the full support of the process team members.

Managers have often not worked in the processes for which they are responsible and thus are not best suited to leading the mapping exercise. Their contribution will be in enabling the overall exercise and removing the barriers to progress which can so easily arise, especially in the early stages of process mapping.

The people involved in the process represent the "cast of characters". Each one has a vital role to play in the transformation which is the focus of their attention. Just as with a troupe of actors who meticulously rehearse their roles, so the members of the process team are part of a cast-list which shares the responsibility for ever better performances with the passage of time and experience.

Finally, it is essential to clearly identify who the process customer is. It may be the next work team along the line; it may be another, distant, department; perhaps another factory in the same company or an outside business. Or, of course it may be that conventional exemplar of the customer, the end-user. It is never the boss!

3. TIMESCALE

Process mapping does not take a lot of time so long as it is approached in a carefully planned way. Each member of the cast must know what is expected of them. To ensure that everybody recognises that time is of the essence it is recommended that the time schedule for the mapping exercise be defined carefully.
Deployment FlowCharting

Process mapping tends to be iterative; the first map is rarely correct, but is a valuable step on the way to a final representation of how the work is done at present - the essential starting point for any programme of steady improvement. Iteration recognises that we do not have perfect recall and that we may need to reflect on our contribution to a process before we have a generally agreed, and operationally correct, baseline definition.

One of the many distinctions of deployment flowcharting is that it provides an operational definition of an added-value transformation of input into outputs - i.e. a process. Traditional flowcharting is never so rigorous or powerful since it fails to address the full scope of the inter-relationships that typify all process work. The unique power of deployment flowcharting is that it orchestrates co-operative teamwork.

By setting a reasonably demanding target date - perhaps a week - the intention to complete a process map without loss of momentum is made clear to all. A series of two or more meetings with a few days between each is probably an ideal pace at which to proceed - neither too rushed nor unduly drawn out. The objective in mapping any process is to achieve a clear map of how that process is performed currently and as agreed unanimously by each and every member of the "cast of characters".

When such an initial process map has been completed it should be defined as 'Revision Zero' and registered by the management steering group that has authorised the mapping activity. It is then available as the baseline reference against which subsequent process improvement can be determined.

This management group will probably decide to nominate one of its members as the registration officer. The registration officer must determine that the map accords with the agreed standards and terminology, format and symbol-set and that it is an agreed reflection of the way the process is currently executed. In other words that the map constitutes a valid presentation of an operational definition of the process.

The registration officer is not primarily concerned with judging whether or not the process is correctly mapped. That is the responsibility of the team and the process owner. Obviously business process mapping exercises benefit from having a process map of the organisation's mapping process itself!

4. MAPPING THE PROCESS

As the mapping of processes spreads within an organisation so the linkage of one process with another will become apparent. A pattern of hierarchical and heterarchical relationships will develop which cumulatively map the organisation's process architecture.

The mapping of business processes has traditionally been carried out by the process team gathered around a sheet of brown paper armed with sticky labels but the use of magnetic boards with tactile magnetic shapes offers a more tactile, transactional way of working. Experience shows that once a facilitated group has mastered the key transactional disciplines of process mapping a laptop computer with a video projector may be used to
Deployment FlowCharting

convenient effect, especially for large groups. Print-outs of progress can be distributed at meeting breaks so that participants can reflect on progress and resolve outstanding issues.

Each member of the process team (or 'cast of characters') is identified and listed (i.e. deployed) sequentially across the top of the chart (the end-user usually to the right). The agreed process actions, or steps, are plotted on the chart beneath the appropriate person. In this way the cast jointly develops the script for the process and records it in an agreed manner that minimises subsequent misunderstanding and confusion.

Providing process mapping participants with a hard-copy record of the progress made at the end of each session reinforces the importance of the mapping exercise (how often do minutes of meetings get provided at the end of the meeting?); it also reinforces in the eyes of the participants that the exercise is being taken seriously by management.

With each member of the process team able to take away a copy of the draft flowchart they can share a clear basis of understanding for informed reflection before the next mapping session. As the process map takes shape people will see that it is more than a simple linear flowchart. Because of the way each activity is assigned to the responsible person the deployment flowchart becomes an operational definition of how value is created.

Rather like sheet music it provides a consistent statement of intent that loses no essential meaning in the interpretation - something which cannot always be said about procedural statements with their many loopholes and opportunities for misunderstanding.

5. THE DFC SYMBOLS

The symbols used to chart the flow of events within a process are few in number. Experience has shown that significant progress can be made with just the four symbols shown in Figure 6 – the terminal, activity, decision and document symbols. Each is linked to the next in sequence by either vertical or horizontal solid lines in the positive (value-adding) direction of the process flow. In the early stage of process mapping restrict yourself to the basic four symbols shown below:

![Figure 6 – The four most important process mapping symbols.](image)

Simplicity is the key to overcoming the complexity which, through time, has overwhelmed the efficient conduct of many process activities today. At the outset and conclusion of drafting a DFC business process map the sausage-shaped terminal symbol is used.

This defines the limits of process activity. At the outset it is placed below the member of the cast of characters who actually initiates the process. Similarly wherever the process terminates the symbol denotes the end point of the mapping.
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The rectangle-shaped task or activity box is the most used flowcharting symbol. This is the fundamental component of all processes. This activity or task will form the basis of a work instruction.

As high level business processes are examined in detail it becomes necessary to map lower level, subsidiary processes. Two drop-chart symbols, shown in Figure 7, are used to indicate such linked charts – child and parent.

These symbols serves as reminders that further higher level context or lower level detail is available to support the understanding of the overall system of processes. The drop-shadow symbol (left) indicates a link to a separate process map containing the details. Similarly the drop-outline symbol (right) indicates a link to the parent of the chart on which it appears.

![Denotes link to child chart](image1)

![Denotes link to parent chart](image2)

Figure 7 – Chart connection symbols

Any process will involve decision making. These decisions can be mapped using the diamond shape. An important discipline in the use of this shape is to emphasise the process-positive outcome of the decision by ensuring that the bottom angle is used for the positive output. Where possible restrict the neutral or negative output(s) to the two lateral angles.

![Decision Diamond](image3)

Figure 8 – The decision diamond

Further, any process-negative flow out of the diamond should be mapped with a dotted or dashed line to highlight any re-work that is involved. This will serve as a reminder for early improvement action to reduce or eliminate the incidence of such process negative occurrences. Documentation, hard-copy or screen-based, features strongly in most processes and it is necessary to track it with the other activities and decisions.

There are many other symbols that can be used to powerful benefit as skill in process mapping develops, such as the 'judgement' and 'freedom boxes' which form an integral part of The FlowMap System DFC methodology. A 'judgement box' is used to remind readers that this particular task requires a formal (professional) qualification for completion. In contrast the 'freedom box' is useful in preventing a process mapping
exercise from stalling when it proves impossible at the first attempt to define the activity - for instance one requiring a special skill that cannot be easily learned by others without practice.

Figure 9 – The Freedom and Judgement symbols

While a 'J-box' will specify the qualification required and be a lasting part of a process map the 'F-box' is strictly temporary and must be replaced by an appropriate activity description (or sub-process) within a period of time agreed by the team at the time of it's use.

It is often important that a participant within a process is aware of some action or event although not centrally involved in it. Awareness that a meeting is taking place or a report has been issued may often be sufficient. The use of this symbol showing off-line involvement is a matter of style and choice within the team. It can be a useful means of supporting a need-to-know approach to process management.

Figure 10 – The ‘dot’ symbol denotes awareness of the Activity

In high level processes, such as planning and reviewing work, there is a need to represent meetings of process participants and the sharing of information amongst them. Two composite symbols allow these elements of a process to be mapped clearly and accurately as shown in Figure 11.

Each can be constructed to differentiate between members of the cast who are involved in the meeting or sharing the information and those who are not.
There is no reason why a group of like-minded people should not devise their own more graphical symbol set if it increases participation and ownership of the improvement process itself. When designing a special symbol set remember that the symbols selected will need to be adopted as a standard by others within the organisation if confusion is to be avoided.

Elegant simplicity in communicating should always be the aim. Elegant so as to catch the interest of the reader; simple so as to convey the requisite information quickly, directly and clearly.

It is useful at this point to recall the difference between a 'procedure' and a 'process'. Procedures have conventionally been text-based statements by others (generally superiors) of how work should be done. The procedures file is usually not at the user's fingertips; more often than not it is out-of-date or waiting to have supplements collated into the appropriate sections. It is far from attractive to the routine reader. Accordingly procedures tend not to be used.

By contrast a process map has been prepared by the people themselves and can be an attractive graphical representation of the information to be communicated. By virtue of electronic networks it can be easily accessed, simply explored and because it is centrally maintained it can be relied upon to be up to date. As the library of FlowMap charts grows so linkages evolve heterarchically, as individual symbols connect to one or more other charts.

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**FlowMap's 'Rule of Five' Guards Against Undue Complexity**

Experience shows that crowded, or busy, FlowMaps are less successful in clearly communicating information to users than is imagined by their originators. Complexity may please the creator but is rarely helpful to the end-user. When creating charts remember the 'rule of five'.

Work on processes at the appropriate level of abstraction. Instead of mapping everything at once (e.g. Satisfying our Customers - which involves dozens of different people) work through the constituent sub-processes, typically: Capture the Customer; Take the Order; Arrange Payment/Credit; Deliver the Product; Complete the Transaction. A helpful test for suitability of sub-process definition is whether it involves more than five distinctive participants. If it does you may need to carefully review your selection of the sub-process boundary.

Likewise process name, process actions and other key comments should be as concise as possible. About five words is ideal but ten needs to be seen as a working maximum. Clarity of expression requires clarity of thought which therefore yields greater process accuracy. A typical deployment flowchart should not be over-crowded with symbols. A small multiple of five is a useful guide - between 15 and 25 symbols per FlowMap (A4 sheet) provides a good balance between detail, clarity and readability.
A process map is also a self-evidently auditable document and one which can be used to demonstrate due-diligence as and when required.

This latter aspect of deployment flowcharting is of growing importance in an increasingly regulated business environment.

However the over-riding purpose of flowcharting a process using DFC is to increase understanding and gain insights about how to improve the process and its output as well as discovering opportunities for process innovation.

6 – AN EXAMPLE OF PROCESS MAPPING

A company supplies its customers daily with a range of products. Each week a total of some 45,000 boxes of some 60 different lines is assembled to order for shipment to some 35 different destinations. Each week the company issues appropriate invoices for goods delivered and 21 days later payment is received so long as the delivery exactly matches the order. The weekly revenue is approximately £1 million.

It is noted in a regular review of business performance that trade debtor performance is routinely around five weeks, namely some two weeks behind the nominal value. Top management faced with reducing margins decided that it could no longer tolerate such a continuing loss of potential profit because of late payment (with the consequent borrowing to fund work in progress) and decided to identify and correct the root cause of late payments. It was agreed by all parties that improvement would only result from understanding the processes.

At the same time the company managing director has been looking at how he could develop his manager’s early views on quality management and this seemed to be a promising area for further detailed consideration. The finance director was not keen to lead the project - his department considered that it would not be worth the disruption. After all 'late payments' had been the norm for very many months, even years!

Early discussions with the various departmental managers - sales, production, marketing, credit control and distribution - were however more fruitful in not only better defining the issue (order errors spotted by customers who then returned the unpaid invoices with corrections for re-processing) but in also discovering that the warehouse manager wanted to improve his operations but had, until now, no wider basis on which to operate. With this project he would be able to implement some of the paperwork changes that his despatch crews needed but were of no interest to the accounts team.

It is decided to map the Trade Debtor process at high level and then follow it through to the operational sales and distribution processes. By using the deployment flowcharting notation the way the work is done can be carefully examined in full detail. Traditional linear flowcharting would not so precisely define who did what, when and where. It was recognised that the solution to the problem would most likely reside in the small-scale detail; all the normal large-scale solutions had been tried many times before and always failed to win lasting improvement.
Figure 12 - A FlowMap showing high level mapping of the trade debtor process.

Suitable training and coaching was provided to the individual members of the various teams involved with the distribution process and early meetings held between them with the sales and order planning teams.

The picture became clearer. The warehouse distribution operation had a long term error rate of some 185 units per week. Expressed as an error rate of 0.4% this seemed 'reasonable' but when expressed in the unit of world-class performance, parts per million, it was an error rate of 4,100 ppm. Further when the previously ignored weekly error figures were examined in a run chart over the past few months the SPC chart showed a very stable system at work.

Only by means of a major change to the way the work was carried out on a daily basis could the situation be improved. The weekly errors were randomly spread across all customer depots and at any one time were holding up payment of about one half of all invoices issued.

Only detailed re-design of the process could reduce the defects figure to the long term target of below 100 ppm arbitrarily set by the managing director. A FlowMap of the overall trading process was prepared, initially at high level and then progressively at lower more detailed levels all the way 'down' to individual work instructions. Key sub-
Deployment FlowCharting

processes, such as pallet assembly, credit control etc., were identified and their detail was also mapped. During the mapping exercise the cast of characters learned a number of lessons. Firstly the importance of only mapping how the work is actually done at the time. Resist attempting to improve the process before you have defined clearly and unambiguously how it actually really operates on a routine basis, the ‘Revision Zero’ condition.

Don't try to capture the process in one session. It inevitably takes two or more iterations to get to Revision Zero. Further, make sure that there is a change control system in place so that any change made to the Revision Zero map is made with everyone's knowledge.

Enthusiasm can, and does, run away with operators when they discover the power and the joy of doing their job efficiently for, often, the first time in their working life. Good ideas can derail the entire operation if individual members of the cast forget that they are now part of a team based upon co-operative working rather than competitive advantage.

Once Revision Zero had been mapped to the satisfaction of the "cast of characters" the process was followed without change for about ten weeks. During this period the error rate dropped to 2,300 ppm. This was primarily due to the result of the initial process

Figure 13 - A FlowMap for a pallet loading process. When improving a process it is important to ensure that the customer is made aware of any changes that are introduced.
mapping tidying-up the work and removing special causes of variation which are the responsibility of the operators themselves.

The result was a more ordered way of working which had been clearly defined, and was fully owned by the operators, not their manager. The manager, whose responsibility is to remove common causes of variation, had made it possible for the supervisor and operators to put their expertise to work by changing the overall system of work to introduce process mapping.

During the settling-in period for Revision Zero the operators began seeing opportunities for further improvements. They also saw that there was a need for a means whereby such suggested improvements could be widely discussed and only incorporated with complete agreement of everybody in the process cast of characters. At the same time the cast decided to set a target for error reduction. They chose the simplest method for agreeing the target - a halving of the current rate within six months, followed by further halvings until they beat the 100 ppm target.

In fact when the new changes were mapped and implemented (Revision #1) the process error rate had fallen to 1570 ppm within three months by which time the team decided it was time to move to Revision #2. This in turn, once settled-in, was found to operate with an error rate of 760 ppm after a further three months.

Subsequent revisions reduced the error rate to 410 ppm and some two years after the improvement programme was implemented the rate stood at less than 150 ppm well on the way to the new target of 50 ppm set by the MD! Needless to say the large reduction in shipping errors resulted in a significant improvement in payment interval and a stable figure of 3.25 weeks was achieved.

Having mapped a process in detail it can now be seen in the context of the process vectors of economic-quality, namely teamwork, timing and level of detail (see Figure 4). Analysis of the process may be considered in four parts: Process Clarification; Process Simplification; Process Acceleration and Process Innovation. The practice of deployment flowcharting and the creation of process maps is based on answering a succession of questions. In so doing clarification is gained of the way the work gets done and how the time gets used. The precise arrangement of the completed maps enables inspection by informed parties with a view to process simplification based on knowledge rather than intuition or guesswork. Process acceleration results from the use of process maps to remove rework and flow imbalances. As experience grows in the analysis of deployment flowcharts so opportunities for process innovation - even radical (root and branch) re-design - become apparent.

7 – METHODOLOGY

It is important that a process mapping exercise is carried out with careful attention to detail. This will require that a standard process of mapping processes is adopted and the foregoing sections of this guide may be used as a starting point in creating a specific
Deployment FlowCharting

methodology. It is best if the precise details of the selected methodology are, in reality, developed, or at least endorsed, by the key participants, thus ensuring local ownership.

The methodology will need to encompass two special aspects: 1) the document classification process, and 2) a definition of the process change process. Producing process maps that are not clearly classified will result in subsequent confusion as chart numbers increase. Failure to define how process changes are documented and distributed will result in a further muddle. The following four pages offer typical process definition work sheets.

![FlowMap Work Sheet # 1](image)

**Identify the Process**

1. Describe the process as concisely as possible:

2. Agree a short name (about 5 words) for the process:

3. Itemise the process inputs, special resources and output(s):

<table>
<thead>
<tr>
<th>Inputs</th>
<th>Special Resources</th>
<th>Output(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td></td>
<td></td>
</tr>
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<td>b</td>
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<td>d</td>
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</tr>
</tbody>
</table>

4. Name of the process leader/process owner:

5. Name of the mapping steward:

6. Notes:
## Identify the People

1. Are there any uncertainties over process ownership:  **YES / NO**  
   (see footnote*)  
   (encircle)

2. If **YES**, state by whom they will be resolved, by when and on whose authority:

3. Identify the cast of characters within the process:

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<thead>
<tr>
<th>Name</th>
<th>Location</th>
<th>Position/Job Title</th>
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</thead>
<tbody>
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</tbody>
</table>

4. Name of the mapping steward:

5. Identify process customer(s):

* Only proceed beyond (2) if answer to (1) is NO.
### Define the Time Schedule

1. Date of the first mapping session for this process:

2. Target completion date for Revision Zero mapping:

3. Target date for submitting uncontrolled Rev 'a >' map to Registration Officer:

4. Date of publication of first controlled copy (Rev 0) of process map by Registration Officer:

5. Diary of process mapping exercise (initial each entry **):

<table>
<thead>
<tr>
<th>Date</th>
<th>Description</th>
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6. Name of Registration Officer:

* Work-up FlowMaps can be given a, b, c... Rev # until ready for Registration as Rev 0. ** Use back of this sheet for further entries.
Work Sheet # 4

Define the Process Hierarchy

1. Name of process:

2. Name of parent process:

3. Identify downstream ‘customer’ processes:

<table>
<thead>
<tr>
<th>Customer Process Name</th>
<th>Reference</th>
<th>Revision</th>
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4. Identify critical upstream ‘supplier’ processes*:

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<th>Supplier Process Name</th>
<th>Reference</th>
<th>Revision</th>
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* Critical upstream processes outside the host organisation’s control.
8 - CONCLUSION

Over the past two decades experience has shown that there is no better means than deployment flowcharting to fully understand how a process actually works. And knowing this is the key to finding out what opportunities there are for improvement and innovation. Such charting forms the starting point for SPC or the study of process behaviour and capability. (See our companion booklet *The Basics of Statistical Process Control & Behaviour Charting* for details of getting started with SPC).

But deployment flowcharts do more than just drive improvement. They also provide the key documentation for compliance with such management systems as the ISO 9001 2000, ISO14000 and OHSAS 18001. And beyond that they also provide a firm basis for staff training as well as a re-assuring basis for demonstrating due diligence – something which will be increasingly required by insurers and regulators alike in the coming years.