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EDUCATION AND TRAINING

# **THE NATIONAL SHIPBUILDING RESEARCH PROGRAM**

## **1995 Ship Production Symposium**

### **Paper No. 19: Experiences of Intro- ducing ISO 9000 & Total Quality Man- agement in U.K. Shipbuilding & Ship Repairing**

U.S. DEPARTMENT OF THE NAVY  
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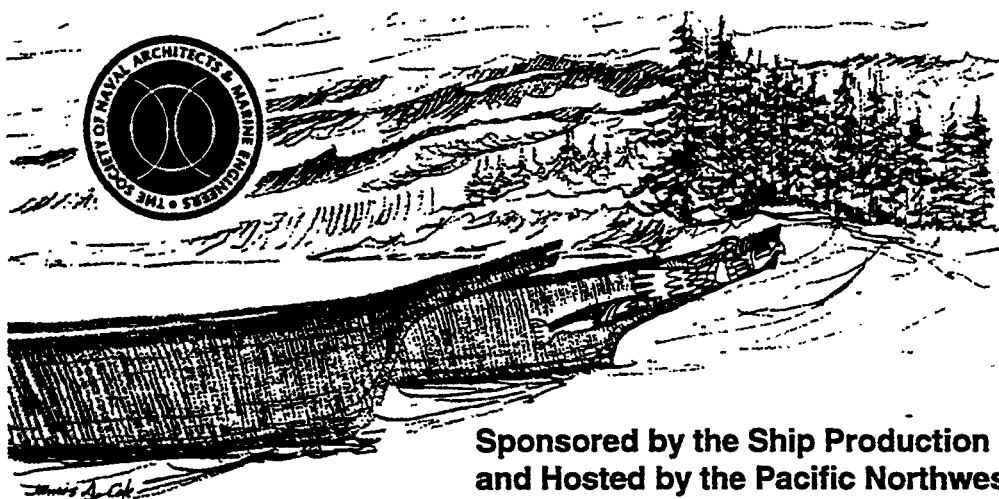
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# 1995 SHIP PRODUCTION SYMPOSIUM

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# Experiences of Introducing ISO 9000 and Total Quality Management in U.K. Shipbuilding and Ship Repairing

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## ABSTRACT

This paper is based on the authors' experiences of the development and implementation of ISO 9000 Quality Management Systems (QMS) and Total Quality Management (TQM) programs in UK shipbuilding, as Quality Manager of a large UK shipyard and an independent consultant respectively.

Implementing ISO 9000 will have the greatest beneficial impact on a company's operations if, at the outset, it is clearly established as the first step towards changing the culture of the company to one of 'continuous improvement.' This must be part of the overall process of getting the business processes of the company under control as a prelude to improving their efficiency and then effectiveness.

The reality of implementing both ISO 9000 and TQM, including conversion from AQAP-1 to BS 5750, are illustrated. The place of TQM in the context of transformational change programs will be highlighted. The factors that influence the success of an effective change management program are described.

## NOMENCLATURE

### ISO 9000

The International Organisation for Standardization's standard for quality management systems. In the United Kingdom the British Standards Institution also designate this as BS 5750; these designations are used interchangeably. An accreditation certificate is marked with both identifications as well as the European standard EN 29000.

### AQAP 1

Allied Quality Assurance Publication 1; until recently this was the standard applied to suppliers by the United Kingdom's Ministry of Defence.

### TQM

Total Quality Management.

### MRP II

Manufacturing Resource Management technique.

## INTRODUCTION

Merchant shipbuilding and boatbuilding companies in Europe and North America have faced a sustained period of turbulent change in their markets for over 30 years. Now the builders of naval vessels, especially in the United States of America, have entered a period of similar severe change in a shorter period. If an investment in assembly facilities, manufacturing hardware or design software alone were sufficient to ensure competitiveness and success, many European shipbuilding companies would have easily avoided liquidation.

Merchant shipbuilding can be characterized as a medium-level technology industry that is manpower-intensive. The primary task for a shipyard to exploit this market successfully is that the shipbuilder matches the customer-facing elements of the process (i.e. meeting or exceeding the owner's expectations for product design and finance) whilst mobilizing and managing the internal resources required to deliver the product on time and at a cost that also satisfies the company's shareholders. The stability of the international shipbuilding market is a fragile one given the clear intention of the Far East yards to retain dominance of the market and the recent emergence of the East European and Commonwealth of Independent States shipyards as suppliers of additional low cost capacity into the supply side of the market.

This paper addresses the opportunities for beginning the process of effectively mobilizing and managing a company's resources. Experience from a variety of shipbuilding, and other, organizations indicates that a coherent and effective response to this degree of change is possible if the tools of Quality Assurance and Total Quality Management are employed within the context of a holistic approach to transformational change. Experiences in three organizations (both successful and less successful) that have contributed to the development of these views are summarized. Finally views are offered on how to manage a change program that will enable the organization to accept the degree of transformation that is required to succeed in the future.

The authors hope that this paper will also act as a stimulus to the shipbuilders of the United States to make the changes now that are needed before the

business environment becomes too hostile to make an effective response.

## CASE STUDIES

### Experience 1: Devonport Management Limited.

This organization had along and proud history of over 300 years of operation as a principal center for the repair and maintenance of Royal Navy vessels of all types, including nuclear submarines. It had naturally expanded greatly during the Second World War, and even in 1987 had a workforce of around 12,000 together with comprehensive facilities for practically every type of manufacturing and assembly process. It occupied one of the largest industrial sites in Europe.

The disturbance of major change first arose when the government of the day chose to divest itself of the responsibility for day-m-day management of the yard (and one other similar establishment). Private sector companies were invited to bid for management contracts; this brought an element of competition into the refit business that had previously been absent, with the attraction for the government of greater value for money. Within a short period of the award of the management contract AQAP1 accreditation was withdrawn by the Ministry of Defence.

The Deputy Managing Director was tasked with regaining the AQAP1 accreditation and he took this as a major opportunity to set the whole organization on the path towards a continuous improvement culture. A team of consultants from United Research (now Gemini Consulting) were engaged by the yard to assist in the management of the program.

When the AQAP campaign started there were eighteen weeks to prepare the yard for the assessment. In itself this represented a major exercise and the first task was to form a cross-functional task force, the AQAP team. There were eight main elements to the program:

- Scoping the task (Gap and Risk analysis),
- corporate procedure drafting,
- Engineering procedure preparation,
- Training and implementation,
- Internal housekeeping,
- Self review,
- Formal assessment by the Directorate General of Defence Quality Assurance, and
- Ongoing Quality Improvement Program.

Gap and Risk analysis This was a comparison of the existing procedures against the AQAP standard with the aim of identifying where no procedure existed (a Gap) or the procedure was inadequately written or implemented (a Risk). The results were presented and

reviewed with management and used as the basis for planning the remainder of the campaign.

Corporate Procedures Drafting these was the next step. In the past procedures had tended to be wordy documents, discouraging understanding and compliance. The new procedures were specified to be easily understood and readily usable by the first line supervisor, and capable of being audited. Flowcharts were used wherever possible and designed to fit pockets of overalls. The procedures were arranged so that managers were issued simply the procedures relevant to that department and provided with a software-based index that permitted easy updating of all revisions and rapid reference to generic subjects such as contracts or shop production control.

Engineering Procedures The third step was preparing technical process specifications. These defined key production processes such as welding and painting. The aim was to synthesize customer requirements and internal best practice in an easily understood and unambiguous form. A special sub-group of the AQAP team was setup to accelerate this process and by the time of the assessment, some 120 key processes were defined and implemented.

Training and Implementation The new procedures were cascaded through the organization, with managers taking full accountability for implementation in their departments. This required initial overview training by the AQAP team and then the training of trainers who introduced staff to the detailed content of the procedures. Compliance with the procedures had to be assured. Management ownership and commitment was demonstrated by requiring them to conduct compliance checks in other areas.

Internal Housekeeping In addition a major initiative was launched to improve standards of housekeeping and material care entitled 'Operation Safeguard.' This was taken to heart by staff throughout the yard and resulted in the removal of large quantities of scrap and general rubbish. It had an immediate and visible impact on awareness of quality standards and the benefits of compliance.

Ongoing Quality Improvement Plan The quality improvement plan was instituted in advance of the assessment as a means of capturing and planning for the elimination of non-compliances. This was specifically developed to pre-empt any tendency to 'revert to normal' afterwards. It was also used as the basis for developing a program change that has seen the introduction of statistical process control and the redesign and simplification of business processes.

A key element throughout the campaign was the integration of a communications plan, both to the staff inside the yard and to the yard's customers, into the program. This comprised a publication ('Quality Matters') to all staff and regular briefings to managers.

After successful achievement of the AQAP accreditation the lessons were drawn out. Apart from

the specific lessons concerned with the form and content of the procedures, the greatest lessons were those around the process used to achieve the success. Having established and communicated a picture of the work to be done, the team was able to generate a sense of urgency, involvement and personal responsibility among staff in a way that created understanding of what process improvement means in practice.

## Experience 2: Swan Hunter Shipbuilders Limited

Swan Hunter Shipbuilders Limited returned to the private sector in January 1986 after eight years as a member of the nationalized British Shipbuilders corporation, by means of a management buy-out. The labor force was around 3,600 staff and the facilities were capable of constructing a wide range of surface vessels up to tankers, aircraft carriers and large auxiliary vessels. The yard had established a reputation for providing high quality products to its principal customer, the Royal Navy. Even so, after privatization it was appreciated that major changes had to be introduced if the yard was to be competitive.

The story of this yard from privatization to its present position (at the time of writing in receivership) provides a number of lessons, both positive and negative, on the process of integrating Total Quality Management into a program of major change.

The first major initiative after privatization to address the question of improving performance was a series of 'Vision and Image' workshops. These were attended by managers of all levels who spent two days examining the company's strengths and weaknesses. They proceeded to define their vision of what they would-like to see the company become. The results of the workshops were collated and re-presented to the managers so that a common vision emerged. This had the added benefit of showing clearly to the people involved that they now had a direct say in the future of the company and that their views would be taken into account. This was in stark contrast to the previous culture in which managers were excluded from significant communication and policy-setting processes. An outcome of these workshops was the implementation of a Management Development Program for all levels of management, including first line supervision and the Board of Directors. A range of training programs was sponsored from supervisory qualifications to an MBA degree. Over a four year period some 400 people participated in this program. 'Learning contracts' were established between the company and individuals whereby private study was matched by study the during the working day.

Another outcome of this approach was the natural evolution of a body of staff who communicated across departmental barriers in ways previously

unimagined, and who could express views and concerns in a common language with each other.

An important ingredient in the development of the company through this period was the understanding that 'what was said was what was meant.' This assisted in the introduction of a range of agreements with employed representatives including

- Rationalized pay structures with single table bargaining for all groups of employees;
- Common dining facilities for all;
- Common coveralls with regular laundering and exchanges;
- Improved safety and weatherproof clothing for all;
- A common team briefing process for regular communications to all employees within a set time; core briefs were supplemented by local information,
- Offices redesigned and upgraded, and
- All alcoholic drinks removed from the premises.

In late 1988, an initiative called 'Enterprise 90' was set up to ensure the submission of a successful bid for a batch of Type 23 frigates in 1990. Groups made up of company directors and senior managers recommended that the company should adopt a Total Quality culture. The process was led from the top. The group's interpretation of Total Quality Management was set out as six 'bullets':

- Everyone involved;
- Systems, procedures and everything you do;
- Elimination of waste;
- Continuous improvement;
- Customers come first; and
- cost of quality.

A Total Quality Board was constituted from all the yard's Main Board directors and was advised by general managers from the quality assurance, human resources and training functions. Reporting to the Total Quality Board, a Total Quality Steering Group was established from general managers in a number of different departments. These two groups began to define the methods to be used to implement TQM. The TQM message was passed to the rest of the company by means of a briefing cascade. A consultant was employed to assist in the process.

A multiplicity of different approaches was adopted for improving 'customer-supplier' relationships. The Steering Group's recommendation was for each department to identify its two most significant customers and suppliers and to establish a 'Service Level Agreement' with them. It had been intended that these agreements should form internal contracts that would be regularly monitored to improve service delivery. However the form and content of the

agreements varied widely, which led to criticism of the whole TQM process.

At this time the company's Quality Assurance systems failed an assessment by the Ministry of Defence against the AQAP 1 standard. This was the first time that *this* had occurred in Swan Hunter's history and was a major shock given the company's pride in the quality of its product. The company's decision was to be completely redesign the quality management system as a step in the TQM process. However this rationale was not communicated to the workforce and resulted in further loss of credibility for the TQM process. The task of rewriting procedures and work instructions was given to the departments, within the framework of a Company Quality Manual. This latter document took longer to produce than anticipated by which time some departments had already begun to write their own procedures independently.

The AQAP 1 re-assessment six months later was successful. Later the company changed the basis of assessment of its QMS from AQAP 1 to ISO 9000 in line with Ministry of Defence policy. The conversion process was much smoother than could have been anticipated because a comprehensive briefing and training program was put in place. Among the changes introduced at that time was self-verification by the operators leading to reduced inspection.

The widespread dissatisfaction expressed with the process of implementation of TQM during the AQAP 1 re-assessment led the Board and Steering Group to relaunch the TQM initiative. Performance improvement targets were set out and some thirty six 'facilitators' were nominated from each department. These met at regular and frequent intervals to discuss progress. The whole program was given a boost when the 'Enterprise 90' initiative bore fruit and the company won the bid for three Type 23 frigates. The need for success in improving performance was emphasized by the requirement that the third vessel had to be produced with 25% fewer manhours than the first. Furthermore, having already built one of these ships the normal 'learning curve' savings were not available.

The facilitators had a key role in the relaunch of the TQM program which included qualitative targets such as:

- Increased visibility for the program,
- Increased participation and commitment from individuals,
- Integration of TQM into normal working practices, and
- Improved team working.

Facilitators, the TQ Board and TQ Steering Group met at bi-monthly intervals in workshop sessions to exchange experience and develop solutions to identified problems. The facilitators then took projects away from these sessions to implement in their

own areas. The facilitators also had the role of acting as the 'thought-leaders' in their own departments for the tools and techniques to be adopted, and the measurements to be put in place.

Measurement was a topic that perhaps had the most potential for improvement in the way it was addressed. Although included as one of the original six 'bullets,' identifying the cost of quality was not properly followed through. The consequences of this were that a prime source of data was missed for identifying and prioritizing areas of opportunity for improvement. Again the quality of measures put in place varied from department to department. It was noticeable that where measurement was most specific, the identification of improvement was also greatest.

The TQM program was halted in its tracks in mid-1993 as the result of the company's failure to win a contract to build an order from the Ministry of Defence for a helicopter carrier and the immediate placing of the company into receivership. At the time of writing one Type 23 frigate remains to be delivered and negotiations are continuing with a potential purchaser of the yard.

The lessons to be learned from this experience can be summarized under the headings of 'Successes' and 'Lost Opportunities.'

#### Successes

- Widespread communication of the TQM concepts and progress was achieved using the 6 'bullets', team briefings, display boards and specific communication papers.
- There was involvement of all levels of the company.
- Tangible improvement in some areas of the company's operations was made.
- Quality was integrated into company operations, not treated as a 'bolt-on goodie.'
- The training associated with implementation of quality management systems also provided a foundation for the TQM program.
- Improved teamworking and breaking down of 'functional silos' was achieved.
- Departmental facilitators acted as champions of the process.
- The Management Development Program emphasised the commitment of the company to its investment in people as a reality.

#### Lost Opportunities

- The implementation process could have been coordinated from the outset to demonstrate a 'right first time' approach from the leadership of the program.
- A comprehensive and quantitative approach to measurement of baselines and improvement in performance would have provided a sharper focus for the program overall and emphasized the

business need for the program. (This will be referred to again later in the paper).

- It could have been possible to provide training in the tools and techniques of quality and performance measurement more widely to those who required it.
- The implementation process would probably have proceeded more smoothly if pilot schemes had been used to demonstrate the effectiveness of the process improvements before introducing them across the whole organization.

### Experience 3: Marine Projects (Plymouth) Ltd.

Marine Projects is one of the UK's leading builders of luxury powerboats and sailing yachts. Typically powerboats in this market segment are priced in the range from \$150,000 to \$1 million per boat depending on size and fit out. The product range is based on a number of standard glass reinforced plastic (GRP) hulls that are updated with increasing frequency and the internal fit can be heavily customized. From its foundation in the early 1970's to the late 1980's the company experienced continuous sales growth to around \$75 million per year at the peak. The economic recession finally caught up with the company's customers and forced the labor force to be cut for the first time from around 1200 to some 550 employees, and to retrench from four factory sites to three.

The seventy and speed with which this reversal in fortunes occurred exposed some weaknesses that had been hidden, but dormant, during the years of expansion. These included:

- A lack of formal control over both the administrative and production processes, stemming from the industry's almost 'cottage industry' origins;
- Poor management information systems, and
- Reliance on individual incentive schemes to achieve output volumes.

The informality of the company's systems and procedures was identified as a weakness and the company set about obtaining accreditation to ISO 9002 (or BS 5750 Part 2). The responsibility for producing procedure documentation was left largely to the Quality Manager by departmental managers who were heavily engaged in day to day management of the business. There was little buy-in to, or support for, the new procedures, and a predictable outcome was that the first assessment was unsuccessful.

The appointment of a new Production Director was taken as the opportunity to introduce a radical program of change to the organization, under the slogan of 'Getting Our Act Together.' A Steering Group was

established that became known as the Blueprint Group composed of the senior managers in the organisation, some of whom had been recently recruited from outside the industry specifically to add greater breadth of experience to the management team.

The Blueprint Group established a number of initiatives to raise the performance and profitability of the company. These included:

- Introducing a MRP II planning and control system
- Manufacturing and assembly process improvements, and
- Obtaining accreditation to BS 5750 Part 2.

In the midst of this the marketplace intervened and required that a substantial set of product upgrades be introduced in order to offset the actions of the competition. This stretched the resources of an already lean management team to the limit, but not beyond.

The introduction of quality management systems was primarily undertaken to establish the control over business processes that had been lacking previously and to provide a firm foundation for the other improvement initiatives. One of the authors was invited to assist with this initiative. The role taken by the consultant was defined in terms of providing assistance and experience of managing this type of program; responsibility for the success or failure of the procedures was to remain clearly with managers at all levels.

A BS 5750 Steering Group was established from the senior managers and the Quality Manager. The role of this group was to confirm the overall plan and the timetable and to resolve any issues that could not be decided by any individual manager. The target for submitting to the assessment was only five months.

The initial task was to undertake a Gap and Risk analysis. The result suggested that a substantial amount of procedure rewriting would be required. Drafting of procedures and Work Instructions was carried out by groups of supervisors and operatives on the grounds that they were both the ones with greatest knowledge of the processes and also the ones required to operate to them. Training in the tools and techniques required was provided to these groups on an 'as required' basis.

A program of awareness training for all employees was established. This was followed by each manager taking responsibility for training the staff in the redrafted procedures. A program of compliance checks was put in place where managers and supervisors visited each others' areas and carried out a check to establish if specified procedures were being complied with. Not surprisingly, housekeeping figured heavily in these checks.

After successfully gaining the accreditation at the second attempt, the Production Director requested further assistance to establish performance measures, and the

management processes to review them, throughout the production areas as a structured mechanism for driving performance improvement.

## MANAGING TRANSFORMATIONAL CHANGE

### The Change Process

In this section the role of Quality Management Systems and Total Quality Management is placed into the context of what is required to transform an organisation from mediocre to outstanding performance.

An important first step towards this understanding can be summarized by a statement of the cruelly obvious:

**'CHANGE REQUIRES THAT INDIVIDUALS AND ORGANIZATIONS THINK ACT AND PERFORM DIFFERENTLY**

This begs the question of how the changes can be introduced and made to 'stic'; there countless cases of improvement programs that have generated activity for a while but then faded into oblivion when the next fad or crisis reaches the top of the pile.

One useful model of the change process is that originated by Kurt Lewin some 40 years ago and developed by Edgar Schein (1961,1969). This proposes a three stage process of:

### CHANGE

### REFREEZE

Thus change starts with something that prepares the organization or individual for change. In the case of industrial companies recently the most significant unfreezing agent has been the loss of markets. During this 'unfrozen' state considerable change can be accommodated until the time arrives when the desired new behaviours are embedded and a new period of stability can be accepted. In the light of the continued turbulence of the world's markets and the need to establish learning organizations the term 'refreeze' might be usefully redefined to indicate a state which is relatively easily brought back to the 'Change' state.

Change can range in extent along a spectrum from 'Incremental-Continuous' to 'Major-Discontinuous'. In the context of United States shipbuilders' desire to re-enter the world's merchant shipbuilding market, the need is to achieve change that is 'transformational' in nature. Common to these types of programs are one or more overarching objectives that represent 'stretch' targets, such as:

- 30% increase in productivity in outfitting,
- 25% reduction in cost on the next ship, and/or
- 20% reduction in quality failures in 6 months.

### Structuring a change program

Structuring a real transformation program requires that strategic issues are tackled in parallel with the more tangible operational ones (see Figure 1).

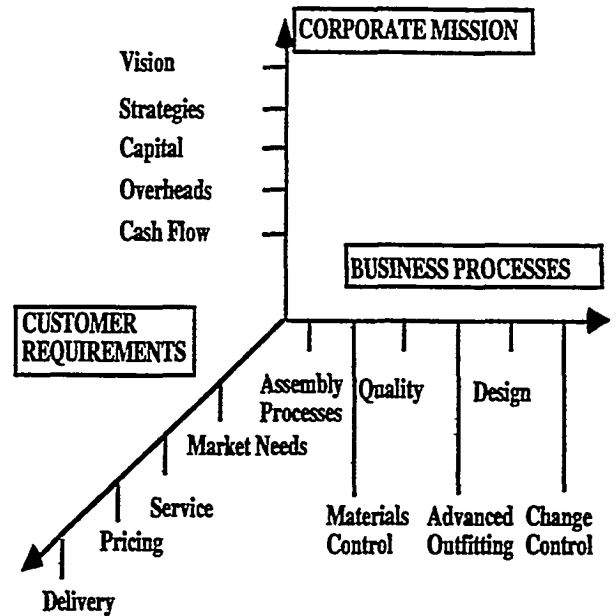


Figure 1 Multiple Dimensions of change

It is vital that there is a clear understanding of:

- What must be delivered,
- The current position,
- What must be changed and why, and
- The level of effort required.

If a transformational change program is to achieve its intended result it must also tackle simultaneously the three elements of organizational behaviour:

- Technical,
- Political and
- Cultural.

For the theoretical foundation of these concepts see Kanter, 1984, a practical application in General Electric is well described in Tichy & Sherman, 1993. There must be a clear focus and concentration on those areas of the business that will yield the greatest benefit. This is an argument for a Pareto-type assessment of the

initiatives that analysis will suggest are needed. It is in this context that measuring performance and driving performance improvement through a cyclical process of 'Plan-Do-Review' becomes a significant part of many successful programs particularly in manufacturing organizations where effectiveness of supervision is crucial for the efficiency of the operation. Shipbuilding clearly falls into this category of organization.

Inevitably this means that top-level management commitment is a critical factor for success; managers at all levels must 'walk the talk' since any lack of commitment will be spotted immediately by subordinates.

A typical change program will be phased in a way that reflects Lewin's change model (see Figure 2).

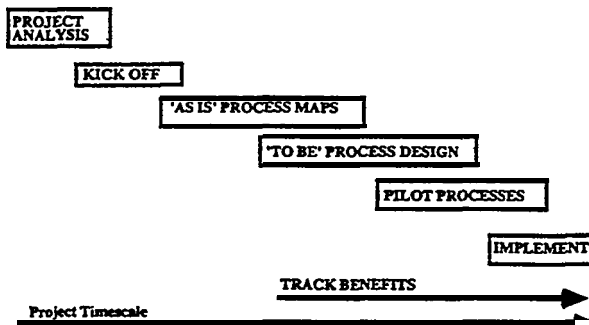


Figure 2 Typical project plan for a transformational change program

### Change and Teams

The process for delivering a program of transformational change must rely on the use of improvement teams to tap into the wealth of knowledge and expertise that lies dormant in almost all organizations. Teams are also the most effective way of developing the involvement and commitment at all levels of the organisation that are essential for making the change happen and 'stick' (see Figure 3).

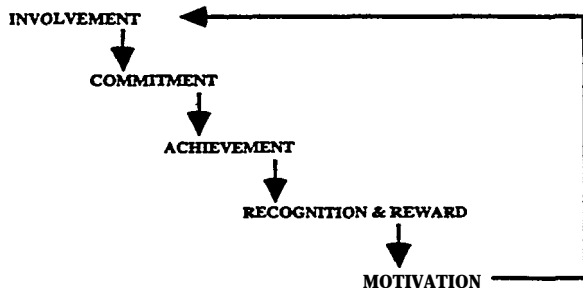


Figure 3 Positive Feedback Loop

Managing change requires that the management of resistance to change is successful. The agents of change must be skilled in applying established techniques that minimize resistance and have the interpersonal skills to apply them appropriately. Multi-level, multi-functional teams are essential in this context and particular attention must be paid to setting clear expectations of the goals to be achieved and the new behaviors that are expected to be displayed. The key objective must be to establish a critical mass of 'believers' or 'champions' to win over the majority who will be willing to comply with the change.

A central 'Change Team' is almost mandatory if the necessary enthusiasm and pace of change are to be sustained over an extended period. With appropriate guidance from the central team a large number of staff can quickly be equipped to apply a wide range of tools and techniques to achieve their goals. In addition to the established Total Quality tools these can include

- Structured problem solving,
- Process flow analysis,
- 'Day in the life of' studies (DILO),
- Responsibility charting,
- Meeting management,
- Coaching and Feedback and
- Benchmarking.

### Investment in Change

It is almost a truism to say that the greater the investment that is put into the change process the more certainty there is of achieving the desired result of lasting change; the effort must also be carefully directed.

For a variety of reasons the case studies have involved the investment of significant amounts of management and staff time. The use of external consultant input was in each case relatively small and used primarily in a facilitation role to ensure that the projects were kept on track. In each case study the primary drive came from the companies' managers themselves. To illustrate this point the staff input at each of the case studies is summarized below.

**DML** The core AQAP team was made up of the Operations Director, Quality Manager and three consultants. In addition there were around thirty staff assigned full-time on producing operating procedures. All managers were expected to lead the training of their staff in the implementation of new procedures and to take part in the compliance checks of their peers. Management briefings punctuated the whole period.

**Swan Hunter** Eight directors and three General managers forming the Total Quality Board met bi-monthly over the period. The Steering Group met monthly and involved twelve General Managers. There were 36 facilitators from 22 departments who met bi-monthly in addition to their locally based activity. However those listed above were expected to devote

some 5-1070 of their time to the TQM program. A consultant was engaged part-time for around 18 months.

**Marine Projects** The BS 5750 steering group met fortnightly for around two hours to assess progress and to resolve major problem, it was made up of the eight most senior managers. Sub-teams from each department spent around half a day per week mapping and devising new procedures in the period up to accreditation. The operation of the performance measures process involves managers and first line supervisors in ongoing weekly Plan-Do-Review meetings lasting around half an hour; meetings between shop managers and the Production director are on a monthly basis and last around one hour.

The staff input required at any particular site will be shaped by the unique characteristics of that organisation's change program. Investing in change is primarily an investment in people.

### Quality Management Systems & Total Quality

Experience suggests that there is a part for both Quality Management Systems and Total Quality Management to play in a transformational change program. ISO 9000 can be a good vehicle for establishing control over the business as a precursor to more radical process improvements. The ISO standard is, after all, simply a template for good business practice; it must never be seen as an end in itself or just as a marketing tool.

Equally the concepts, tools and techniques of Total Quality can provide a sound basis for structuring the business process improvements that are required to deliver performance improvement now and into the future.

### CONCLUSION

It is hoped that this paper has demonstrated through the case studies that appropriate implementation of quality management systems and Total Quality Management can contribute significantly to the improved performance of a complex business such as shipbuilding. Moreover they have a place in the framework of any transformational change program that United States shipbuilders must implement if competitiveness on a world scale is to be achieved.

There is a window of opportunity for the shipbuilders of the United States to take advantage of the forecast upturn in the world's shipbuilding market. If business performance levels can be raised by a significant but achievable amount, and exchange rates remain at their present levels, it should be possible to capture a large enough share of the orders available to ensure along term and profitable future for a substantial number of the yards currently in operation. To do so will require that the lessons available from companies

with a similar background are learnt quickly. The need is to welcome and embrace the opportunity for transformational change as the starting point for a holistic approach to realising a step-change in business performance.

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