Overview – *The Schaffner Group* is a world leader in the provision of components, test equipment and consulting services for electromagnetic compatibility (EMC). To provide a high quality product, the company has a continuing need to reduce defects and to meet product delivery deadlines. The purpose of the SPIRE improvement project was to develop and implement a set of management processes which could be adapted and used throughout all projects, regardless of size or focus. As part of this project, we refined and implemented a product development life cycle process model to support our transition to a more project oriented process. As a result of this initiative, a new process has been introduced for project management. In addition, with the introduction of documentation standards and reviews of interim products at various stages in the life cycle, the quality of interim products is continually improving.

However, not enough time has elapsed to track the level of reduction in defects of final products. The key lesson learnt from this project is that process improvement is itself a very complex process and the tasks and activities involved are rarely sufficiently well understood to provide an accurate estimation of the effort involved.

The Organisation and its Environment

Schaffner Limited is the Irish subsidiary of the Schaffner Group, established in 1982. The company is a major part of Schaffner's Test Equipment division involved in the design and manufacture of automatic test systems for use in testing Power Supply Units (PSU), and automatic test systems and instruments for Electromagnetic Compatibility (EMC) testing of electrical equipment.

Schaffner Limited currently employs 80 people full time in Limerick, with 23 people directly employed in product development.

Our strategic business plan is based on software systems that will provide control and integration of all test systems in a Power Supply or EMC test laboratory. An analysis of the company's strengths and weaknesses and of our defect reports clearly indicated a need for improvement in the critical processes involved in product development – in particular, software development.

Starting Point

Inconsistency in the quality of product design and development, together with a high defect rate and significant project overruns highlighted the need for an improvement in the design and development process, in particular for software.

Much of this situation was rooted in a change in our product range which resulted in a change in the relationship with our customers. With our existing business in PSU Test Systems, we developed long term relationships with our customers, starting with an extensive product commissioning phase during which modifications and product defects would be addressed. Our move into EMC Instruments and Test Systems meant higher customer expectations. In this market customers expected the product to work straight out of the box with no follow up support from the supplier. Therefore, we now needed to place a higher emphasis on quality and timeliness.

We used two sources of information to identify the areas to be targeted in the improvement project:

- Early workshops with the development engineers identified areas for improvement in both project management and requirements management.

- The Bootstrap assessment using the SPICE model showed that improvements were needed in all areas including project management.

In addition, staff morale was very low with many complaints about problems with planning and handling of time and resources. We decided that the focus of our improvement project would therefore be:

- *To develop a life cycle process which would provide clearly defined tasks to be managed, and*

- *To improve our project management capability, providing project managers with the visibility of the amount of time required for each task, and an understanding of the impact of moving resources between projects.*

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This would help us address the issues associated with poor project management, and assist us in the development of realistic schedules to create high quality products.

We already had a life cycle process defined and documented at a high level but it was not yet fully developed and implemented. We used this to help define the types of tasks that needed to be assigned and used it as a starting point for developing detailed procedures, document templates, and other supporting tools.

The Improvement Project

The planned approach was to present the concepts of Project Planning and Project Tracking to the engineers and to identify any changes that would be required to our existing process. From this we could refine the overall process to meet the objectives of these key process areas, in a workshop environment. Then following the workshop a small team would draft up the agreed changes to the process documents. The process would then be piloted on current development projects and refined as required. We achieved our objective, but not quite as we had planned it.

SPIRE Project Meeting

Early in June a management review of all development projects took place which resulted in a refocusing of development effort into two main development projects, each project comprising equal amounts of hardware and software development. At the same time the development group was restructured to have a more project-orientated focus - moving away from the traditional focus of hardware and software groups. This situation forced a review of the two existing hardware and software processes, and provided the ideal opportunity to pilot the revised process. In addition, a new Managing Director, Engineering Manager and Engineering Projects Manager

were appointed to oversee all planning and tracking activities.

During this transition time, the interest in Process Improvement was maintained by holding short workshops with both Hardware and Software Engineering groups, focusing primarily on Project Management, but also on some Requirements Management issues.

Through these workshops we have:

- *Listed the barriers to product design quality, and the improvements that need to be put in place.*

- *Analysed and prioritised these improvements.*

- *Provided training in the goals and activities of Requirements Management and Project Management.*

- *Defined and developed processes for the Product Development Life Cycle, Project Management and Requirements Management.*

- *Established a design document database and a document numbering database.*

- *Developed process template forms which have been piloted on the two major development projects.*

A Product Development Process has been developed in accordance with the objectives set out in the SPIRE Project Plan. This process applies to the specification, design and development of all products and is divided into three main stages: Design Input, Design Implementation and Product Release. On completion of each phase a review of the relevant project deliverables is undertaken and based on the results of this review, a decision is made as to whether it is possible to move on to the next phase. (See fig.1). The Design Input Stage is described in more detail in fig. 2, showing a review of all project deliverables (Requirements Specification, Design Specification and Project Plan) during this phase.
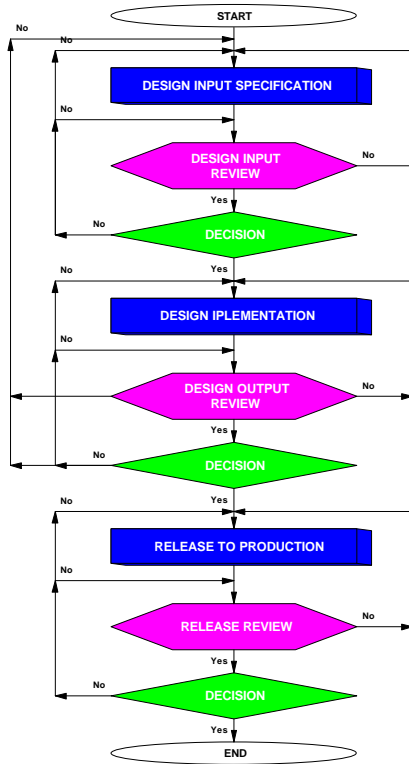
Fig 1. Three stages of the product development cycle

Fig 2. Detail of the Design Input stage

A Requirements Specification template has been developed, identifying both functional and non-functional requirements. The use of this template forces both a logical structure and a unique identification for each requirement.

A Project Management process has been developed and piloted on the two new projects. Based on this process, a Work Breakdown Structure (WBS) is developed for each task involved in the project, and the size of each work unit in terms of effort and duration is estimated. From these estimates, a project budget is also estimated. A Project Plan is produced and includes:

- Work Breakdown Structure (WBS)
- Size estimates for product work units
- Resource estimates
- Project schedule
- Project team organisation chart, defining roles and responsibilities
- The project development process. This includes the Life Cycle Process Model (customised for the project), procedures, design documentation plan, configuration plan and quality assurance plan.

The Results

So many changes were taking place simultaneously that it was difficult to gather measurements against original goals for SPIRE. However, we are very pleased with what we accomplished in such a relatively short timeframe. Our second Bootstrap assessment against the SPICE model showed an improvement in the capability of ten of the nineteen areas including project management (which increased from 0.25 to 0.75) and software requirements analysis (which increased from 0.25 to 0.5). Staff attitudes have improved dramatically with staff who were previously unhappy with the existing processes now making a conscious effort to improve them. A customer representative visited Schaffner towards the end of the project, to follow-up on a previous project audit. He remarked on the improvement in the development process, stating that he had a lot more confidence in Schaffner's ability to meet his needs.

Progress on project activities is now tracked by the Engineering Projects Manager, and schedules updated accordingly. As a result, we are now more effective in meeting our deadlines.
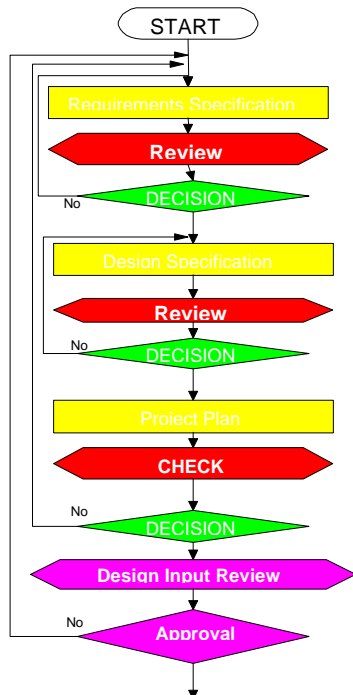
Reviews of interim deliverables are now in place which should lead to the early detection of defects.

In addition, the SPIRE process improvement team (Quality Manager, Engineering Manager, and Projects Manager) have gained very valuable experience in implementing change within the organisation and an in-depth knowledge and understanding of the Life Cycle Process Model.

Lessons Learned

♦ The implementation of a Process Improvement programme is much more difficult than it appears. Expertise in this area can only be mastered through knowledge and experience. Knowledge alone is not sufficient and you only gain more expertise through experience and learning.

♦ Goals need to be very well understood. Management commitment, and the commitment of everyone in the project is essential if the goals are to be realised. The level of project planning required at the SPIRE proposal stage and the initial Mentor assessment of our organisation helped greatly to clarify our goals and objectives.

♦ Success in implementing new processes is a multistage process itself. It requires a knowledge of best practices, and it requires a continuous and sustained effort to educate and convince the people involved of the benefits of process improvement.

♦ To have a reasonable and usable work methodology, the process must be well defined and understood by all those who will use it. This means that the people using the process are aware of the process objectives and agree that the process steps are a reasonable approach to meet these objectives i.e. the benefit to bother ratio is positive.

Plans for the Future

At this point we plan to continue to develop and refine all stages of our Life Cycle Process Model concurrently with our two major development projects. We expect to have addressed all stages of the process by year-end and have a satisfactory process in place. Next year we hope to consolidate the process and make further refinements as is highlighted by the results of quality audits and feedback from staff.

Acknowledgements

A critical factor in the success of our SPIRE project was the expertise, direction and support provided by our Mentor, Ms. Marty Sanders, Catalyst Software. Her experience and support made the difference and kept us going when our spirits were low. In our case, we had worked with our mentor prior to SPIRE so we had great confidence in her ability from the start of the project, and she was also familiar with our company's strengths and weaknesses. Right from the start our Mentor's assistance was very effective. For process improvement type experiments the Mentor's support and direction is crucial, and in a very short improvement project it is important that the Mentor becomes familiar with the client organisation's strengths, weaknesses and also its people.