IEEE 730 is a good standard to follow in creating a Software Quality Assurance plan for one project. But there is a lot more to creating a successful SQA plan than merely following a standard.

Perhaps the most important factor apart from using the standard is knowing the audiences that will be affected by the plan, and coordinating with them as the plan is being written. Too many SQA plans become shelf-sitting dust collectors because the needs of the people who must be involved with them were not considered when the documents were written. Even the most professionally prepared document will be ignored if it doesn’t fit the requirements of those who need it.

Audiences
There are many audiences for an SQA plan. The three that are most likely to determine a successful implementation of an SQA plan are corporate executive managers, project managers, and the engineering or development staff. The needs of these three groups differ widely, and often conflict.

In this article, we will take the point of view of the person writing the SQA plan. We will examine the needs of each of the three audiences, and finally, we will review selected sections of the SQA Plan Outline (Figure 1) from the perspective of each audience.

The creator of the SQA plan must consider the executive manager’s need to distribute the costs and benefits of the work over many projects. The expense of establishing an SQA program usually is too high to be borne by just one small- to medium-sized (under ten staff-years) project. The SQA plan creator must obtain management policies, techniques, standards, metrics, tools, and training to be used on this project. Collectively, these items are called support elements, and they are very expensive to locate and incorporate into an SQA program and to document in an SQA plan. Without funding allocation from corporate management, the SQA effort cannot be sustained.

Project managers focus on getting their current project finished and its product out the door. They are not interested in what happened on previous projects or what will happen on future projects. Often bonuses or incentive payments are tied to completing the project on time. A project manager will read an SQA plan with one point of view. Will it affect my schedule? If the SQA effort will shorten his schedule, or increase the probability of meeting the schedule, the project manager will enforce the program. Without the project manager’s enforcement, the SQA program will fail.

The engineering staff must be convinced that following the SQA plan will result in a high quality product. Workers will do a “good” job if they know what a “good” job is. The standard support elements documented in the SQA plan must answer for the engineer the following questions.

What am I supposed to do, and why?
How am I supposed to do it?
What am I supposed to produce and how will it be evaluated?
What can I use to help to do the job?
How do I find the answers to these questions?

If these questions are not answered in the SQA plan, each member of the engineering staff will derive his own undocumented solutions. Each person’s solution will be

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**Software Quality Assurance Plan Outline**

1. **Purpose**
2. **Reference Documents**
3. **Management**
   - 3.1 Organization
   - 3.2 Tasks
   - 3.3 Responsibilities
4. **Documentation**
   - 4.1 Purpose
   - 4.2 Minimum Documentation Requirements
     - 4.2.1 Software Requirements Specification (SRS)
     - 4.2.2 Software Design Description (SDD)
     - 4.2.3 Software Verification and Validation Plan (SVVP)
     - 4.2.4 Software Verification and Validation Report (SVVR)
     - 4.2.5 User Documentation
   - 4.3 Other
5. **Standards, Practices, and Conventions**
   - 5.1 Purpose
   - 5.2 Content
6. **Reviews and Audits**
   - 6.1 Purpose
   - 6.2 Minimum Requirements
     - 6.2.1 Software Requirements Review (SRR)
     - 6.2.2 Preliminary Design Review (PDR)
     - 6.2.3 Critical Design Review (CDR)
     - 6.2.4 Software Verification and Validation Review
     - 6.2.5 Functional Audit
     - 6.2.6 Physical Audit
     - 6.2.7 In-Process Audits
     - 6.2.8 Managerial Reviews
7. **Software Configuration Management**
8. **Problem Reporting and Corrective Action**
9. **Tools, Techniques, and Methodologies**
10. **Code Control**
11. **Media Control**
12. **Supplier Control**
13. **Records Collection, Maintenance, and Retention**

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*Figure 1. IEEE Standard 730, 1984.*
different, and the SQA program and plan will flounder.

Application of standard
With the perspectives of these three important audiences in mind the writer of the SQA plan can assure that each viewpoint is addressed in each section of the document. Let's look now at how some sections of the IEEE 730 standard plan might be handled.

Section 3. Section 3 describes the ideal plan management, including organizational structure, tasks to be completed, and specific assigned responsibilities.

Corporate manager. The corporate manager requires that costs and benefits associated with the SQA plan be shared among a number of projects. Yet, the organizational structures vary from project to project. Some projects are small; some are large. Different project managers and technical leaders have unique styles and capabilities. The SQA plan must therefore be rewritten to accommodate new and different projects and those existing projects that undergo organizational changes. For these and many other reasons, it is difficult to write one SQA plan that satisfies the corporate manager's needs.

One approach to meeting the corporate manager's needs is to provide a generic set of job function descriptions that is not tied to organizational structure. Job functions are defined in Figure 2. The definitions have been derived from the purpose of each job and are the job functions that would be performed by one person on a very small project if there were no standards or SQA plan in place. These same job functions must be performed on the largest project. Descriptions of these job functions along with descriptions of normal project tasks could be provided in a document called a management policy. The writing of Section 3 for a particular project would amount to tailoring the generic management policy to the particular project. Then corporate managers would see their needs satisfied in the SQA plan.

Project manager. The needs of the project manager are not difficult to address in Section 3. Project managers must control projects. To do that, they need to know that every job function is accounted for, that every task is identified, and that responsibility for every task has been assigned. Typically, project managers document this information in a project plan. The SQA plan writer can satisfy the need of the project manager by referencing the project plan and highlighting the SQA tasks on that plan. (If a project plan does not exist, the writer might as well kiss this project goodbye and move on to another one.)

Product Development
(Creating the software)
The discipline of system creation: producing a software or hardware/software product to satisfy a customer need.

Product Evaluation
(Checking the software)
The discipline of verifying that the outputs of a life-cycle phase fulfill the requirements established for them during the previous life-cycle phase; validating that outputs of a life-cycle phase fulfill the system requirements; and testing the implemented product to identify differences between expected and actual results.

Project Assurance
(Controlling the environment)
The discipline of specifying the techniques, standards, metrics, evaluation criteria, tools, and training for a project; counseling the project team in the application of these support elements; collecting statistics on this application; and monitoring adherence to standards and procedures.

Configuration Management
(Controlling the product)
The discipline of identifying the parts of the configuration of a system at discrete points in time for purposes of systematically controlling changes to this configuration and maintaining the integrity and traceability of the configuration throughout the system life-cycle.

Project Management
(Controlling the staff)
The discipline of planning, organizing, staffing, directing, and controlling the job functions of software development, software evaluation, project assurance, and configuration management for the production of a software product.

Figure 2. Job function definitions.

Engineering staff. The engineering staff members will support Section 3 if it provides a description of what to do. The generic management policy provides a starting place. It describes not only what to do, but why it should be done on an average project. The project plan contains information about a particular project, such as its tasks, schedules, and assignments. When the information in the generic management policy is combined with the specific information in the project plan, the writer of the SQA plan can create a Section 3 that is satisfactory to the engineering staff.

Section 4. Section 4 of the SQA plan calls for a description of the documentation to be produced on the project and a description of how the documents will be checked for adequacy.

Corporate manager. The writer of the SQA plan can satisfy the corporate manager's needs in this section if a standard set of document descriptions is applied to all projects. The standard set of documents enables corporate managers to compare many products and projects easily. The actual size and number of documents will, of course, vary from project to project. Documentation for a particular product normally cannot be shared among projects, so the corporate manager's need to distribute costs cannot be realized in this case. Even though product documentation costs cannot be distributed, the ability to compare products and projects is a real plus for the corporate manager. He will support Section 4 if he is given the standard documents.

Project manager. The project manager is in a real predicament when it comes to documentation. His primary concerns are budget and schedule. Documentation production costs staff effort and time on his schedule. But if he chooses to do little or nothing about documentation, he will increase dramatically the probability of product failures during the final stages of testing, a major cause of most project overruns.

In order to be valuable to the project manager, Section 4 must answer four very important questions.

1. What is the document or document section to be produced in each task of the project?
2. How much effort and time must be invested to produce the document or document section?
3. How will each piece of documentation be evaluated for completeness, correctness, and consistency?
4. What are the consequences of not producing documentation or of producing faulty documentation?
The answers to all these questions do not have to be documented in the SQA plan. They may be explained verbally or perhaps documented in other respects. But however they are communicated, they must be made clear to the project manager if he is to support the SQA plan.

**Engineering staff.** The engineer needs to know from Section 4 what documents he must produce. Telling the engineer what documents to produce involves much more than just itemizing names of the documents and providing outlines for them. An engineer wants to know how to write a document that his peers will consider "good." This means the SQA plan must describe the characteristics of "good" documentation for the different sections of each document. Then the engineer will be able to find in Section 4 (or in standard document descriptions) the names of the documents he is to produce, outlines of those documents, and criteria for evaluating the contents of each section. The engineer, like the project manager, needs to know how his documents will be evaluated for completeness, correctness, and consistency. If the engineer has this information before he starts work, he probably will support Section 4.

**Section 13.** Section 13 often gives the SQA plan writer a great deal of trouble. Section 13 provides a description of record collection, maintenance, and retention. This can include any measurements or metrics or the software development process and product. The difficulty lies in that every audience wants to use the measurements a different way.

**Corporate managers.** Corporate managers want to have measurements of the software development process and products for all job functions on all tasks. The process measurements typically include expense expended on each task, time spent on each task, and number of failures discovered in the product created in each task. The product measurements usually include factors regarding size, complexity, and quality of the products developed in each task. Corporate managers would like to use these measurements to evaluate the productivity of software development. If measurement documentation is collected on a project, it could be used to make improvements on the next project.

If the person writing the SQA plan includes this information to satisfy the corporate manager, he probably will have trouble with the technical staff. Typically, the technical staff will be concerned that the measurements will be used to evaluate individual performance. Actually, the measurements can be used only to evaluate the support elements (management policies, techniques, standards, metrics, tools, and training). Any attempt to use the measurements for individual performance evaluations will prove impractical. There are too many other factors affecting individual performance to consider these metrics useful for that purpose. Some of these additional factors include interaction with and dependency on others.

The measurements in Section 13 should be included to satisfy the corporate manager's needs. At the same time, the corporate manager must be aware of the limited applicability of the information.

**Project manager.** The project manager is obligated to meet a schedule. The schedule is derived from estimates of time and effort required and resources available to complete the project. Accurate estimates are based on a thorough understanding of the product to be built and on histories of previous projects. The project manager tracks progress day-to-day and week-to-week against the estimates monitoring the measurements defined in Section 13. He will continue to use those measurements if he can see clearly how they help him make updated estimates and enable him to adjust resources to meet his schedule.

**Engineering staff.** Engineering staff members will support the measurements if they understand how the measurements serve them. The measurements can help the engineer by enabling him to evaluate the environment in which he works. For example, if the process and product measurements indicate that an investment in tools would increase productivity, the engineer can justify improvements in his working environment.

Section 13 also can provide important evaluation information for the engineer. A comparison of a product's measurements against the standard measurements provided in Section 13 gives the engineer a quality index for his work. The engineer, like the corporate manager, must understand that these measurements are not meant to be used in individual performance reviews. With that understanding established, the engineer is likely to support the measurements documented in Section 13.

Many people have written SQA plans. Most of those plans are not being used. Perhaps we can increase the use of SQA plans by documenting a list of concerns that should be considered in their creation. We have touched on some of these concerns here, but we have just scratched the surface. We need to continue to add to our list. As always, we welcome ideas from our readers.