



**PDHonline Course P181 (2 PDH)**

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**Program Scheduling and Execution -  
The Art of Doing it Right the First Time**

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## GLOSSARY AND DEFINITION OF TERMS

**RLT:** Reliability Test Lab.

The reliability test lab in most companies is structured to determine component life and the mode of failure when, and if, the component does fail. The most important consideration is not necessarily failure, but whether or not failure will bring about hazardous conditions to the end user. This lab also allows for repetitive life cycling of completed assemblies. There are various mathematical models that may be used to predict reliability and failure rate.

**DFSS:** Design for Six Sigma

Six Sigma is a statistical methodology that, in a manufacturing organization, drives quality. The term “sigma” is used to designate the distribution or spread about the mean ( average ) of any process or procedure. The sigma value is a metric that indicates how well that process is performing. With six sigma, the common measurement index is a defects-per-unit. A six sigma process is 3.4 PPM ( parts per million ). Six sigma is a direct measure that reflects process capability.

**PITS:** Product Information Tracking Schedule

A PITS list is a great documentation tool for following a component or a subassembly from the design confirmation phase all the way through to production and eventual inventory. Part number, drawing number, revision number, engineering change notice number, etc are noted for tracking purposes. I might note that ISO guidelines require a tracking system such as the PITS list.

**P & A:** Problem and Action

A problem and action check list is a great tool for tracking problems, ownership for investigating the solution and the drop-dead date for implementing a fix. It allows an engineering program manager, as well as the team members, the opportunity to review the status of problems that must be handled prior to production. One good thing about a P&A list: items aren't as easy to ignore and owners are selected to work the problems.

**BOM:** Bill of Materials

This can be a fairly simple list of parts or can be expanded into a spreadsheet that incorporates an add / delete component. It aids the engineering team's efforts to keep track of new parts, new vendors, revision levels, etc.

**“T” Reviews:** Technical Review

Technical reviews are primarily design reviews that discuss the status of the engineering design effort, the evaluation lab testing, the reliability lab testing and effects those areas have on the eventual launch date for the product. The review itself should be used to bring to the surface any problems that would be detrimental to implementation of the product launch. A “T” review is necessary also to discuss quality issues and preclude errors in design that might be incorporated into the final revision for the component, subassembly or complete assembly.

**“P” Reviews:** Program Review

Program reviews allow for the discussion of program timetables, marketing efforts, program costs, advertising initiatives, distribution methods and other items not covered by the technical reviews.

Marketing, sales, finance, service and other non-engineering functions are generally present during a “P” review.

**DG:** Design Guidance

This is the first phase of engineering effort that produces a prototype. It allows engineering and management to “kick the tires”. It also provides the evaluation lab an opportunity to perform cursory testing relative to any standards that will ultimately need to be met. This “first look” almost always involves quality, service and manufacturing representatives who provide input for the project management team. This rounds out the scope study that will provide information to management and sends the project into the DC phase.

**DC:** Design Confirmation

The second phase of the product build is design confirmation. At this phase of the project, all of the specifications for the project have been determined, as well as the product features. All marketing claims have been selected as engineering targets for incorporation. cursory laboratory testing and possibly reliability testing have been conducted to determine if there appear to be any major problems that will take time or additional money to solve.

**PP:** Pre-pilot

At the pre-pilot phase of the project a bill of materials, drawings, vendor selection, agency approvals, literature, etc have been accomplished. The project is approximately half finished. Also, from this PP build, field test models are selected that will investigate actual usage in “real world” situations. This will be the first time distributors will see the product and be allowed to comment upon the appearance and function. Depending upon the company, the pre-pilot products may be produced on an assembly line or in a work cell environment.

**PILOT:** At the pilot phase of the program, all of the products are considered “saleable items” and are produced on the assembly line or in a work cell. The evaluation lab testing has been accomplished as well as the ship testing. This is a pre-production phase of the project.

**PRODUCTION:** The first production of any product is always a time of stress, maybe considerable stress. After the first production, you pass out the cigars.

**1<sup>st</sup> Piece:** First Piece

First piece samples are just that components that come from dies, molds or processes for the first time. Usually, a company will require a specified number of first piece samples to accomplish measurements on all of the critical dimensions. Thirty samples are considered to be the minimum number required when a six-sigma process is being used. All measurements are taken on each of the samples and entered into a database for determining if DFSS goals have been met. There are those companies that will keep first piece samples for the life of the product.

**RoHS:** Restriction of Hazardous Substances

The directive on the restriction of the use of certain hazardous substances in electrical and electronic equipment was adopted in February 2003 by the European Union and took effect on 1 July 2006. This directive restricts the use of six hazardous materials in the manufacture of various types electronic and electrical equipment. These restrictions apply to 1.) Lead, 2.)Mercury, 3.) Cadmium, 4.) Hexavalent chromium, 5.) Polybrominated biphenyls and 6.) Polybrominated diphenyl ether.

**WEEE:** Waste Electrical and Electronic Equipment Directive

The Waste Electrical and Electronic Equipment Directive ( WEEE ) sets collection, recycling and recovery targets for electrical goods and is a part of a legislative initiative to solve the problem of huge amounts of toxic e-waste. It is closely linked to the RoHS requirement.

**Gantt Chart:**

A Gantt chart is simply a project management method, or software, that allows for the tracking of programs. It basically provides for the breakdown of task elements relative to a timeline or milestone date, generally providing a “critical path” route that details the quickest time to launch. There are several “brand names” of software available; i.e. 1.) Microsoft Project, 2.) Merlin, 3.) OpenProject, etc

**IDO:** Industrial Design Organization

There are many names for this function but generally this group is responsible for providing the marketing and sales team feature designs that are in line with specifications for appearance. Engineering types can often be heard saying it looks great but no one can make it work. I think IDO generally does a great job and has the daunting task of “making it look new without costing too much” job.

**FW:** Fiscal Week

A fiscal week is numbered from the first week in January till the last week in the year. Most companies consider there to be 52 weeks in a year, although there are exceptions. ( Go figure!!!!!! ). This is a good way to track program progress and gives the engineer some allowances for unexpected occurrences. Having a due date of FW 12 is better than a due date of 29 April. Most projects can’t be managed that closely. I would definitely refrain from using Julian dates as due dates. This is much too restrictive.

**EPMS-RA:** Program Management Schedule Release Authorization

A documentation method by which elements of an engineering program may be enumerated and tracked over the life of the project.

**ECN:** Engineering Change Notice Number:

This is a method of documenting the launch of a new component for a subassembly of manufactured parts. It gives the part number, drawing number ( if different from the part number ), revision number, implementation date, affectivity date and those individuals responsible for approving the change. This method of accountability, or a comparable method, is required by ISO directives

**ADD / DELETE CHECKLIST:**

This checklist keeps track of new part numbers that replace older part numbers for an assembly or a subassembly. Let’s say we are redesigning a subassembly in which three part numbers are being replaced by one part. We have three numbers that “go away” and we are adding one new number. Inventory control definitely would need to be kept advised as to this change so they can order accordingly and not accumulate obsolete inventory.

**FMEA:** Failure Mode Effect Analysis

This is a process by which the cause / effect of a failure is investigated. If a component part fails on a PC board, how does that affect the operation of the board and does that failure produce a hazard of use? In other words, we want a part to always “fail safe” BUT we don’t want any part to prematurely fail as a result of normal usage.

**R: Red**

This visual indicator tells the engineering program manager that we stop until the “red item” is cleared up and a fix is brought into play.

**G: Green**

This visual indicator says proceed with the program

**Y: Yellow**

This visual indicator symbolizes marginal results. If we have a temperature specification of 85 ° C and we measure 84 ° C, we would designate that test data as yellow. It’s too close to failure and subsequent models may exhibit failing results.

# Program Scheduling and Execution

## The Art of Doing It Right the First Time

*Robert P. Jackson, P.E.*

### INTRODUCTION:

Program management is critical for proper execution of any product development endeavor. The potential confusion that could result from lack of planning represents a complete misuse of resources. Efficiency goes out the window when we fail to plan or when our planning is incomplete, relative to the scope of the project. We may sometimes feel that a “simple”, straightforward project requires less thought and planning than a complex multi-year development effort. Generally, the allocation of resources, both personnel and financial, drives the planning process. I am of the opinion that a project involving one person still requires careful thought, and it is definitely worth putting to paper. I am not talking about spending countless hours planning a ten-minute job, but if the work can present options and require decisions, we need to do some minimal planning. There is also a very real aspect to program management involving the authorization, usually from management, to move to the next step. Successful completion of each task will drive that authorization and provide the necessary documentation usually required for decision-making. Each member of the management team should be aware of the project status and contribute to the decision to advance to the next phase of the program. To do this, we must have a project management methodology that will identify those areas of concern and allow for review by all parties required for authorizing an engineer to “carry on“. We all feel more comfortable when this authorization or “sign-off” is formal and in writing.

Every program manager dreams of running a project with flawless execution. It is a dream! Sometimes the unanticipated “unknowns” overwhelm the most experienced manager. Disasters can be avoided by having enough people with the right qualifications AND enough time to accomplish all of the tasks deemed necessary and critical. This course assumes the necessary people are available, either in-house or contract, and those people have the requisite competence necessary. It also assumes there will be a shortage of time. That’s why we plan! That’s why we schedule the work.

This course addresses the need within an engineering or architectural organization for a process. What if we could develop a “backbone”, a structure, a check list a method that would allow us to add or delete elements depending upon the scope and complexity of the project? A process that works whether it’s a two week, one-man job or a multi-year effort involving several teams working in various parts of the world. That’s what we want to present here. That process is called EPMS-RA or Engineering Program Management Schedule-Release Authorization. The concept was first postulated by the Roper Corporation and supplemented by the General Electric Company, Appliance Division. I have made several additions and modifications to the checklist to reflect work I have done over the years and what I feel to be important to any management of a

technical project. Design for Six Sigma, Reliability Testing and RoHS considerations have been added for completeness. The template or checklist for the process is given in the appendix to this document and forms the basis for the management method. As with any management tool, there probably will and should be necessary changes relative to the type of product and the ability of the company to manage the development activity. Nothing is chiseled in stone, and we cut the cloth to fit the pattern. Each company must decide what to toss out and what to keep. It should be noted that not all companies have engineering test labs, reliability test labs, packaging test labs, etc but that does not mean those functions are unnecessary nor undesirable. These services can be out-sourced to obtain adequate data that will allow engineering and management to make the necessary and proper decisions relative to marketing the product. This scheduling template will work whether your company is doing the work or having it “farmed out” to an independent concern. I have also included in the Appendix the following excel spreadsheets that will facilitate program management:

- 1.) Parts Inventory Tracking System ( PITS List )
- 2.) Add / Delete Component Check List
- 3.) Problem and Action Check List ( P&A List )
- 4.) Vendor Check List

These spreadsheets will facilitate program management efforts to track the status of each phase of the engineering effort.

Each will be discussed later on in this document.

## **DISCUSSION:**

This document will take the EPMS-RA format and describe each line item, discussing its significance to the overall process. First, let us take a look at the template. There are several observations that are critical to the application of the process. These are presented as follows:

- The life of the program extends from the initial program review, “P0 “, through a post mortem review.
- There are **program reviews** ( “P” Reviews ) and **technical reviews** ( “T” Reviews ) throughout the process.
- “P” reviews generally require the presence of marketing, sales, finance, service and the engineering program manager.
- “T” reviews generally require the presence of the engineering program manager, selected members of the design team, manager of the evaluation test lab, manager of the reliability test lab, quality control manager, a representative from the manufacturing operation, and a representative from the purchasing function. The engineer in charge of packaging may be called in during later reviews.
- Additional reviews may be structured depending upon the needs of the company and the wishes of the management team. Marketing reviews ( “M” Reviews ), service reviews ( “S” Reviews ), quality reviews ( “Q” Reviews ) etc, may be

added, if that action is felt to be needed. **Please note that the attendees would only be those people who drive those functions.** It is not at all necessary to involve personnel from other disciplines if they cannot contribute to a specific function. Meeting 95% of the time and working 5% of the time is a trap that some companies fall into. Avoid this at all costs.

- The project advances by progressing from “P0” to “P1”, “T1” to “T2”, etc and only when the elements of each review are met. You don’t initiate the first “T” review until the scope study is completed; you don’t go into a “T2” until a DG build has been successfully accomplished.
- There are several product-build cycles within the life of the program. These may be scheduled depending upon the complexity of the program. Generally, these are as follows:

- 1.) DG = Design Guidance
- 2.) DC = Design Confirmation
- 3.) PP = Pre-pilot
- 4.) P = Pilot
- 5.) Production

The product builds are used for various reasons such as: a.) Evaluation lab testing, b.) Reliability lab testing, c.) Ship testing, d.) Field testing, e.) Photographs for advertising literature, f.) Samples to develop use and care manuals and installation manuals, g.) Service reviews with field service people, etc. I would recommend that specific quantities be designated for each build and labeled so that tracking may be possible. DC-1 might go into the evaluation lab, DC-2 might go to the ship-testing lab, and DC-3 might go into the home of the marketing manager. For models going into service as field test models, survey sheets should accompany each field test model so that any problem might be noted and fixed. These survey sheets then will be turned into the engineering program manager and discussed during the appropriate technical review. The various labs will have their own documentation templates in which to collect the data.

I highly recommend that the following actions and necessary conditions exists:

- An adequate time between each activity must be planned to facilitate accomplishment of that activity. Management determines this time. (NOTE: Most companies schedule from right to left. They determine when the product is needed and work the schedule backwards, laying in dates for completion of each task of the project. Engineers generally don’t like this because it tends to give the minimum amount of time for development and testing. We usually don’t get asked. )
- A system that indicates passing, failing or marginal results is needed. I have chosen and have used red, green and yellow indicators as visual representations of fail, pass and needs additional attention.
- A Post Mortem for all “A” and “B” programs. That should include, but not be limited to the following items:

- 1.) Did we hit our program schedule milestones? If not, why not?
  - 2.) Was our schedule too ambitious?
  - 3.) Did we have enough people, and the right people, on the program?
  - 4.) Did we obtain our program costs objectives?
  - 5.) Did we obtain our design objectives?
  - 6.) Did we meet the product target costs objectives of the marketing team?
  - 7.) I would definitely list “lessons learned”.
  - 8.) I would definitely make a list of those items that represent a best practice.
  - 9.) Did we obtain the quality and reliability objectives?
- There are several line items discussed each time a technical review is held. Examples are the P&A list, the overall design specifications, any open item from a previous review and the program schedule. It is very important to close out any open items from a previous review. Don’t let these “stack up “. Any red item should stop the progress of the program until a satisfactory “fix” is accomplished.
  - Schedule revisions occur; plan on it.
  - Sign-off by management, preceding schedule revisions, is necessary.

I would now like to take the template and discuss all of the major line items relative to that document. We will start with the information contained in the “header”.

### **HEADER INFORMATION:**

In looking at the information given at the very top of the form, it’s important to highlight Who, What and When. If the program has been funded money and manpower will be allocated to the overall effort. For this reason, it is important to provide some definition as to classification of the program and who does what. I recommend the minimum information:

**Engineering Project Number:** Most engineering departments start off with a number and not necessarily a name for the project. That’s just fine. There is no rush to put a name to the program but there does need to be some designation for the overall effort, if for nothing else, tracking purposes. In other words, what do we call this thing? If you have one project working it’s less important but what if you have twenty?

**Project Title:** This is optional since you have a project number. I can promise you the engineering staff will give it a name whether you want it to happen or not. “Program from Hell”, “Frank’s Folly “, etc. Engineering types are creative.

**Project Leader:** It’s important that a project leader be assigned from day one. Don’t ever think “the bunch” accomplishes the best work. Someone needs ownership if there is more than one participant. At all costs, avoid no one being in charge, and I recommend formalizing the pronouncement of the project leader.

**Project Staff:** Also critical! Who’s doing the work? I would definitely designate the entire project team here, if one has been assigned. Engineers, engineering test

technicians, draftsmen, CAD operators, reliability test engineers, quality, etc. Whoever has some responsibility for the work that ultimately will be accomplished. As the program develops, you may add or remove people from the team, but start by naming the team and add to or delete as necessary.

**Project Initiation Date:** The project initiation date is the date management structures the team or selects the team leader. This could also be the date the project is officially funded.

**Project Classification:** Also very important. The project classification will be determined by the following:

- 1.) Overall costs of the endeavor
- 2.) Complexity of the effort
- 3.) The time needed to execute the program
- 4.) Technical risk
- 5.) Business risk

Generally, an “A” program will be classified by 1.) Platform design or redesign , 2.) New product initiative, 3.) “Leapfrog” technology, 4.) Major sourcing initiatives, 5.) Significant technical risks, 6.) Significant business risks, and 7.) Major new manufacturing processes. A “C” program would generally be for 1.) Appearance changes, 2.) Low technical risks **AND** low business risks, 3.) Supplier changes, 4.) Documentation changes or upgrades and 5.) Brand-name alterations. There are those companies that will create a C-1, C-2 or C-3 program classification depending upon the work to be accomplished. Company management will decide as to what the classification is to be. You would think that an “A” program would involve technical complexity and require adequate funding and significant personnel resources. “B” programs lie somewhere in between and usually involve moderate technical risk and moderate business risk.

**Product Launch Date:** This is the first manufacturing date scheduled. It occurs some time after the pilot run and is considered to be the event in which all of the testing, design changes, etc are completed.

### **Program Classifications:**

I have given below what I feel might be the reviews required for the various program classifications

#### **“A” Classification:**

T1, T2, T3, T4, T5, T6

P1, P2, P3, P4 and post mortem

**“B” Classification:**

T1, T3, T5

P1, P4 and post mortem

**“C” Classification:**

T1, T3, T5

P1, P4

**Revision Level:** Due to complexity of the program and unforeseen events, course changes may be needed. Allowing for document revisions should indicate this. When a revision occurs, it becomes necessary to track the revisions. This is usually done by revision number and revision date. **NOTE: It is very important to circulate the REV number among management to announce all revisions and implementation changes.** The appropriate people need to know and understand why a revision was necessary. I would certainly include on that circulation list the representatives from the following functions:

- Director of Technology
- Director of Manufacturing
- Director of Finance
- Manager of Marketing
- Manager of Quality
- Engineering Team Leaders
- Manager of Laboratory Services
- Project Leader

Drawing revisions during the project do not need a **program** REV number and / or date. These occur frequently as the project is worked and do not need to be highlighted when they occur. I certainly do recommend each and every drawing revision be designated by using a **drawing** revision number. The type of changes that would require program revisions are as follows:

- Moving the implementation or product launch date. ( I can promise you that if this project is for the DOD, they will want to know why the date has moved. )
- Delays in tooling delivery.
- Major changes in vendors.
- Test failures affecting a product claim or third party approval
- Any delays in third party approval that would affect the product launch date
- Discovery of issues that will effect usage and produce safety hazards.

You get the picture. Only delays that affect the ultimate product launch date or affect quality need to be noted here.

## REVIEWS:

You will notice from the template that there are “P” reviews ( program reviews ) and “T” reviews ( technical reviews ). Some companies have “M” reviews ( marketing reviews ), “S” reviews ( service reviews ), etc. The number of reviews will be dependent upon the classification of the program and the number of departments needing input into the process. If at all possible, keep the number to a manageable level so the people who can work do work. I would like to highlight the program reviews and the technical reviews at this time and indicate what elements I recommend it be included with the review process. One thing that is very important and should be noticed at the very outset; there are two program reviews before the first technical review. In other words a “P0” and a “P1” review before a “T1” review. This will allow management, marketing, sales and finance to develop program definition before any engineering scope study occurs and will save hours of time and engineering effort. Each review will address additional items as the program progresses. A “T3” review will take a look at BOM ( bill of material ) releases. That does not occur prior to “T3”. I recommend that the following reviews be conducted relative to the program classifications:

Again, design the reviews to your own needs. If it is not necessary, don’t do it. The items that might be considered in a “P” review are as follows:

- Market requirements for the proposed product
- Some idea as to which distributors will receive and sell the product
- Product features relative to those market requirements and competitive products
- Any marketing claims that can be made should be listed at this phase of the review. Claims such as “quietest product on the market”, “most energy efficient consumer device available”, etc. **( I certainly would make every effort to test and substantiate all marketing claims prior to launching the product. )**
- Make sure that all product claims are reflected in the laboratory and reliability evaluation plans.
- Comparison to any competitive products.
- Industrial design models finalized ( or at least presented )
- Complete product definition and preliminary product plan.
- Declaration of estimated annual sales for the first five (5) years of product life
- Any aftermarket needs such as kits or equipment adders
- Estimated service call rates
- Critical path schedule for project completion. ( Engineering will want to contribute to this project schedule. )
- Manpower needed.
- Cost projections for total project; i.e. manpower, tooling, manufacturing fixtures, etc.
- Marketing and technical overall risk assessment
- Five (5) and ten (10) year reliability goals
- Key vendors
- Long lead-time tooling

- Factory impact. Do we produce in this country or move the product production overseas
- Manufacturing capacity requirements
- Any modification to manufacturing facility layouts and the associated costs involved with changes.
- Transportation considerations

There may be other elements to a program review and those will depend upon the product and company needs and requirements. These elements will be tracked throughout the life of the program and until product launch.

A technical review, “T” review may contain the following elements:

- “T0” review should have a complete “scope” of the technical feasibility relative to the design. Can we design and successfully test the model for eventual production according to the required marketing specifications?
- A complete concept design review should be completed before deciding upon initiation of the engineering design work. This occurs at T1. This will surely present the need for a DG ( design guidance ) build and some cursory testing.
- Create an engineering test evaluation plan and determine the technical staff that will be conducting the test. Name those people; i.e., Bill Smith, test technician, Juan Castillo, co-op assisting Bill, etc.
- If you are using a design for six sigma ( DFSS ) methodology, these matrix numbers should be factored into the scope of the project. A DFSS program will require “critical to quality “ dimensions measured over multiple samples of the part or product. This data will form the base for a statistical determination as to the compliance with specifications.
- The reliability estimates for the product should be presented early in the program including an estimated service call rate(s).
- ALL product technical specifications must be reviewed each time there is a review.
- Review all competitive products, if existent.
- Review all marketing claims for feasibility. This is accomplished at T1.
- Review all potential manufacturing processes to determine if there are issues presenting difficulties with production.
- Create an initial bill of materials
- Create a list of possible RoHS issues
- Create a potential list of vendors
- Begin working towards specifications for each component part needed for the design
- Determine what vendors, if any, produce in foreign countries and ascertain issues with availability and procurement.
- Conduct a risk assessment analysis
- If third party requires, conduct an initial FMEA

- Determine what standards; i.e. UL, CSA, IEC, NSA or local standards etc govern the product
- Determine what, if any, long lead-time tooling exists that must be ordered quickly to meet targeted product launch goals
- Create a procurement schedule
- Begin a patent search to make sure there are no infringement issues
- Determine if any special packaging requirements are necessary.
- Create a reliability test schedule
- Create a field test schedule, if needed.
- Create a program schedule with “T” and “P” reviews as well as DG, DC, PP, pilot and production dates. This is generally a Gantt chart.
- Make a list of those tools, jigs, fixtures and special equipment needed for production. Ask manufacturing to start considering who will “spearhead” the acquisition of that equipment.
- Create a PITS list, a P&A list and an ADD / DELETE list. This should be done at T1 or prior to the T1 review.

Again, a complete list of items for review can be developed by the company depending upon the product and the distribution of the product. The company may find that items may need to be added to the list and that the number of reviews can be shortened. Again, cut the cloth to fit the pattern.

#### **SIGN OFF:**

I think it is critical to have the right people informed at all times during the execution of a project. For this reason, the EPMS-RA needs a sign-off list. The people on the list represent the functions usually included in the information cycle for project completion. You may have others; add them. It’s always better to be over-informed than under-informed.

#### **APPENDIX:**

In addition to the EPMS-RA template, I have included four excel spreadsheets in the appendix. A description of each is as follows:

**P&A Check List:** The Problem and Action checklist is nothing more than a spreadsheet that will note each and every significant problem during the program, assign an owner and bring about a timely fix. Usually the issues that make the list are considered “show-stoppers” if not addressed. I have used the “red”, “yellow” and “green” color code to designate the status of any fix needed for advancement into the pilot and production phases of the program. I recommend that the P&A Check List be started by T1 and maintained by the engineering program manager. Owners are assigned for each problem and those owners are expected to give a status at each review or as often as the program manager requires.

**ADD / Delete Check List:** As you work through a program you will probably be affecting the components and / or an assembly of components. You will probably replace parts with other parts. This is merely a method of keeping up with additions and deletions relative to part numbers made obsolete part numbers created. This is to preclude the purchasing function from ordering parts that are no longer needed and developing a purchase schedule for those new parts that will be needed.

**PITS List:** The Parts Inventory Tracking System ( PITS ) List is primarily for tracking part numbers relative to new vendors. This one is primarily used by purchasing but should be maintained by the engineering program manager. It's also one that I recommend be initiated by T1 and maintained throughout the entire program. You may certainly combine the Add / Delete List and the PITS List if that facilitates your efforts and provides for lesser quantities of paperwork.

**Vendor Check List:** This list is simply a tracking mechanism for new parts **AND** tooling that may be needed in the manufacturing process. It's important to have a list, updated frequently, that will give all of the vendors involved with the program. Again, I recommend this list be maintained by the engineering program manager **OR** the purchasing manager. Please note, one but not both. You will post this spreadsheet so that all may have access to it but only one person should have the authority to alter the list. One owner.

#### **NOTES OF CAUTION:**

I would like to issue now some notes of caution relative to the EPMS-RA. Things I have ( sometimes ) learned the hard way and would like to pass on now.

- When you are developing the literature, make sure that you understand if English, Spanish, French, etc is required and your product is covered with the appropriate translations. English **AND** French are required in Canada. If you are using Sears to distribute your product, they will require English **AND** Spanish. This not only means the Use and Care Manuals and the Installation Instructions but also any warning labels and caution labels affixed to the product.
- Fully investigate the shipping methods that will be used to distribute your product. A great product designed well will be of no use if it gets to your customer in pieces. Don't assume the package you used in the past will suffice for your new design. Most universities that have a college of engineering will have test equipment that can adequately test for the rigors imparted during shipment of equipment. Here is a very brief list of those tests that may be necessary:
  - 1.) Six corner drop test
  - 2.) Impact
  - 3.) Impact with hazard
  - 4.) Random vibration, single height
  - 5.) Random vibration with equipment stacked "X" high

- Retain all test data from the evaluation lab, reliability lab and packaging lab. This data will be useful during the post mortem review and throughout the life of the product. ( **NOTE: Some companies have document retention policies that require disposition of data. If that's the case, follow the policy.** )
- Beware of “bad documents”. Do not allow your people to make declarations such as “ this damn thing will kill the first customer that uses it”, “ that wasn't such a bad fire for the first prototype “, etc. We all know that sometimes initial prototypes can have “glitches”. They always get fixed but making a pronouncement that could eventually get into the courtroom is not wise. Most juries have no idea as to what an engineer goes through in developing a product. Always address your comments to pass / fail statements relative to the test procedure you are using. Added comments should be focused on the type of failure. We live in a wonderful age and imbedded JPEGs can really add to the description of failures and clarify to the project team possible “fixes”. Once the “fix” has been made, tested and approved, delete the digital photograph and move on.
- **ALWAYS** be absolutely up front with all third party test agencies; i.e. Underwriter's Laboratories, CSA, IEC, etc and make sure you have the most up to date standards for the product you are designing and testing, including addenda. It has always been amazing to me how much help a third party can give if you are up front and discuss with them the difficulties you are having.
- If you must deal with the CPSC ( Consumer Product Safety Commission ) be absolutely truthful and “tell it like it is”. They also can help you immensely if you get in trouble. It's far better to go to them with a problem than have them come to you.
- During the development process, make sure you have all local codes that govern the product and the product installation. Codes such as the Chicago Building Code, Southern Building Code, etc can cause you some real grief if ignored.
- If a member of the management team cannot attend a meeting, make sure you copy him or her the latest “P” or “T” reviews. Too much information is better than too little information. “I didn't know” is an excuse and not a reason.
- As much as possible, use the power of e-mail to keep your team informed.
- When conducting reviews, use the Intranet and don't distribute “paper”. It's much easier to keep track of revision levels when you access a server as opposed to wading through mounds of paper. Each member of your team can get the latest information they need in this manner and it's always current. This is the meaning of a **living document**.
- I would always recommend testing multiple products of the same model number. A test sample of one will give you no statistical assurance that you are meeting product requirements. If you are close to failure, but passing, always go for additional testing on more models. Usually a sample size of five (5) will give assurances that will allow you to sleep at night. **IF YOU ARE DEALING WITH SIX SIGMA METHODOLOGIES, THE ONLY WAY YOU CAN VERIFY THE DEVIATION IS BY USING MULTIPLE SAMPLES OF EACH MODEL NUMBER.** Let's say you are designing a new door for a range. Some companies will require a “test matrix” using three product platforms and

- three new doors. Move the doors from platform to platform and in this manner, you will have nine blocks of data to evaluate. This would be a statistically significant grouping and will certainly satisfy engineering management.
- Keep your test equipment current and calibrated on a regular basis. The data means nothing if the equipment is out of calibration.
  - Don't cheat on your homework. If it fails it fails. Bite the bullet and fix it.
  - Everyone works hard but working from dawn till dark-thirty gets old and is counterproductive. If you find your are consistently falling behind schedule, ask permission to add manpower. Fatigue is one of the biggest problems encountered today in engineering establishments.
  - **Never** assume a supplier has the specification or the most up to date specification needed for compliance. When you submit an RFQ ( request for quote ) to a vendor, always include the drawings, specifications, etc you wish them to quote against. That includes the very latest addenda. This is a common mistake and one committed frequently.
  - If you are using an external test lab, make sure they are certified to run the tests you need and that certification is acceptable to the third party agency you have to submit the data to.
  - If you are dealing with the European Union, you will have to comply with their RoHS and WEEE standards. Be ready for it.
  - I would recommend you keep all of your first piece samples, "just in case".
  - I would recommend you store your agency test samples until the product goes out of production.
  - Last but not least, engineers always want to make it better and probably can do so to some extent but there comes a time to "kill the engineer". For the sake of the schedule, we need to go with what we have unless there are issues with not meeting the specifications or there are hazards associated with the product.

# APPENDIX

**RELEASE AUTHORIZATION**

<b>PROJECT NUMBER:</b> _____	<b>PROJECT LEADER:</b> _____	<b>PROGRAM LAUNCH DATE:</b> _____	<b>DATE:</b> _____
<b>PROJECT TEAM MEMBERS:</b> _____			
<b>PROJECT TITLE:</b> _____			
<b>PROGRAM CLASSIFICATIONS ( Check Box ):</b> _____		<b>A: B: C:</b> _____	
			<b>REVISION NUMBER:</b> _____

		PRELIMINARY SCHEDULE COMPLETION	DATE	R/Y/G	SCHEDULE REV 0	R/G/Y	SCHEDULE REV 1	R/Y/G
		FW			FW			
P0	PROGRAM REVIEW							
	SCOPE STUDY							
	PROJECT QUALITY PLAN							
	EVALUATION TEST PLAN							
	MANUFACTURABILITY REVIEW--CONCEPTUAL							
	INITIATE PITS LIST							
	INITIATE P&A LIST							
P1	PROGRAM REVIEW							
T1	DESIGN REVIEW--CONCEPTUAL							
	DESIGN GUIDANCE (DG) BUILD--ESTIMATED QUANTITIES							
	EVALUATE DG BUILD							
	PRELIMINARY EVALUATION TESTING							
	SAFETY REVIEW							
	MANUFACTURABILITY REVIEW							
	WIRING REVIEW ( IF REQUIRED )							
	SERVICEABILITY REVIEW ( IF REQUIRED )							
T2	DESIGN REVIEW							
	REVIEW SUMMARY OF T1 REVIEW							
P2	PROGRAM REVIEW							
	DESIGN FREEZE							
	FINAL PROGRAM SCHEDULE							
	MODEL REPORTS AND SPECIFICATION SHEETS (IF REQUIRED )							
	INITIATION OF COMPONENT QUALIFICATION TESTING							
	FEATURE CONCEPT FROM IDO FINALIZED							
	DESIGN CONFIRMATION (DC) BUILD--ESTIMATED QUANTITIES							
	EVALUATE DC BUILD							
	INITIATE PRODUCT LIFE TESTING							

	REVIEW PITS LIST						
	REVIEW P&A LIST						
	REVIEW EVALUATION TESTING						
	INITIATE SHIP TESTING						
	INITIATE FIELD TESTING						
	LITERATURE REVIEW (PROOFS)						
	MANUFACTURABILITY REVIEW						
	SERVICEABILITY REVIEW ( IF REQUIRED )						
	SAFETY REVIEW						
	WIRING REVIEW ( IF REQUIRED )						
T3	DESIGN REVIEW						
	REVIEW SUMMARY OF T2 REVIEW						
	REVIEW PITS LIST						
	REVIEW P&A LIST						
	BOM RELEASE						
	DRAWING RELEASE						
	RoHS DETERMINATIONS						
	1ST PIECE DISPOSITION						
	LITERATURE RELEASE						
	AGENCY APPROVALS						
	PHOTO/SHOW MODELS ( IF REQUIRED )						
T4	DESIGN REVIEW						
	REVIEW SUMMARY OF T3 REVIEW						
	REVIEW PITS LIST						
	REVIEW P&A LIST						
	PRE-PILOT (PP) BUILD--(ESTIMATED QUANTITIES)						
	SAFETY REVIEW						
T5	DESIGN REVIEW						
	REVIEW SUMMARY OF T4 REVIEW						
P3	PROGRAM REVIEW						
	PILOT BUILD--(ESTIMATED QUANTITIES)						
	SAFETY REVIEW						
	REVIEW PITS LIST						

	REVIEW P&A LIST						
T6	DESIGN REVIEW						
	REVIEW P&A LIST ( IF INCOMPLETE )						
P4	PROGRAM REVIEW						
	PRODUCTION READY						
	P&A FOLLOW UP PLAN						
	POST MORTEM REVIEW						
P5	PROGRAM REVIEW						

SCHEDULE TEAM:	INITIAL DATE
PROJECT LEADER	
RELIABILITY ENGINEER	
PURCHASING PROGRAM MANAGER	
EVALUATION LAB MANAGER	
CAD/BOM REPRESENTATIVE	
AGENCY ENGINEER	
PRE-PILOT TEAM LEADER	
PACKAGING ENGINEER	
APPROVED BY:	
ENGINEERING TEAM LEADER	
QUALITY MANAGER	
MARKETING MANAGER	







