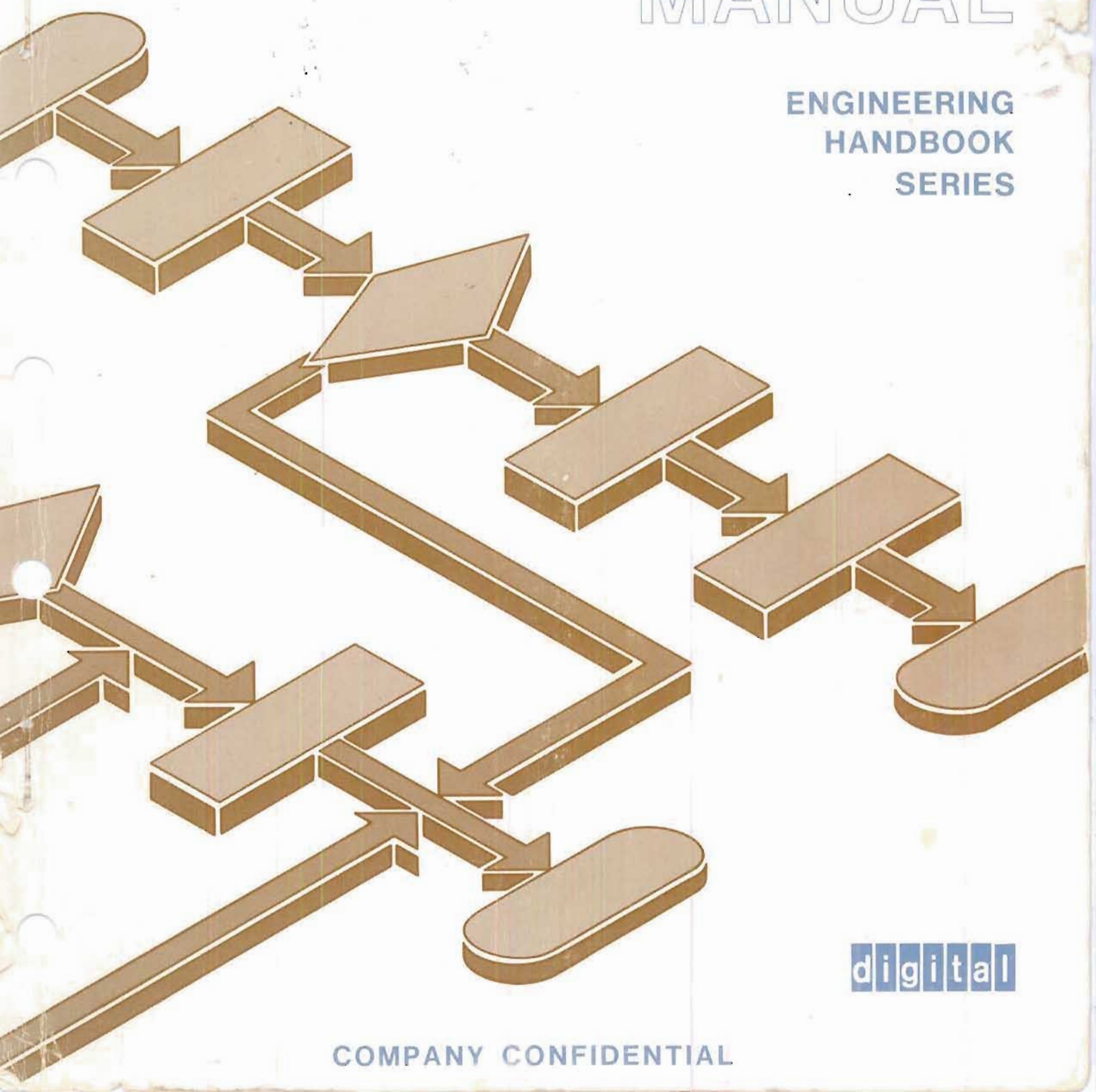
ENGINEER'S ORIENTATION MANUAL

ENGINEERING
HANDBOOK
SERIES



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COMPANY CONFIDENTIAL

ENGINEER'S ORIENTATION MANUAL

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PREFACE

As a new employee at Digital, you will feel quickly at home if you have a clear statement of the philosophy and values we believe have made Digital not only an outstanding success in the computer industry, but also a good place to work. Our philosophy has shaped our "style" and the environment in which you will work.

We want the *highest quality products* in the industry. When you ask current or potential computer users, "Who makes the best computer systems?" we want the answer to be "Digital!"

We want *leadership products* in every Digital market – products that do the job for the user better than those available from any other supplier.

The foundation of our success is our knowledge of computer technology; we must always strive to increase that knowledge.

We turn our technology into products through people. We have, and want to continue to have, the *best people* in the industry. We hire the best and we work hard to maintain an environment that allows them to contribute their fullest potential. The key elements of this environment are:

- **Individual responsibility** – we depend upon our people to use their heads, to reach out for responsibility, to make decisions.

- **Open communication** – there are no barriers to effective communication between people at Digital. Organizational boundaries and titles are, as far as communication is concerned, irrelevant. We believe in total openness on all issues, that issues are best resolved by direct interaction between people, regardless of different organizations or different levels of responsibility.

- **Good ideas** – they come from everywhere. We believe that our managers should encourage and promote the creative ideas that bubble up from people in the organization.

In the last several years, Digital has scored number one as the most *ethical* computer company in the industry. This is no accident. We want to be completely honest and open with our customers. We want them to get their money's worth when they buy from us; we expect to meet all our commitments.

In short, having hired the best people in the industry and provided a rich environment for them, we expect extraordinary performance. Work hard, produce good products, reach beyond the normal requirements of your job, and above all, *use your head,* and both you and Digital will grow and prosper.

We are happy to have you with us. We hope you, too, will enjoy working at Digital.

Larry Portner
Vice President,
Associate Head of Engineering

FOREWORD

The following text is reprinted with permission from "The Unwritten Laws of Engineering" by W.J. King, originally appearing in the May, June, and July 1944 issues of *Mechanical Engineering*. That the article has been reprinted several times during the last 36 years should bear witness to its usefulness. It offers much wisdom to young engineers starting their careers, and to older engineers who know these things perfectly well but who all too often fail to apply them in practice.

IN RELATION TO YOUR WORK

However menial and trivial your early assignments may appear give them your best efforts. Many young engineers feel that the minor chores of a technical project are beneath their dignity and unworthy of their college training. They expect to prove their true worth in some major enterprise. Actually, the spirit and effectiveness with which you tackle your first humble tasks will very likely be carefully watched and may affect your entire career.

Occasionally you will worry unduly about where your job is going to get you – whether it is sufficiently strategic or significant. Of course these are pertinent considerations and you would do well to take stock of them, but by and large it is fundamentally true that if you take care of your present job well, the future will take care of itself. This is particulary so in the case of a large corporation, where executives are constantly searching for competent people to move up into more responsible positions. Success depends so largely upon personality, native ability, and vigorous, intelligent prosecution of any job that it is no exaggeration to say that your ultimate chances are much better if you do a good job on some minor detail than if you do a mediocre job as section head. Furthermore, it is also true that if you do not at first make a good showing on your present job you are not likely to be given the opportunity of trying something else more to your liking.

There is always a premium upon the ability to get things done. This is a quality which may be achieved by various means under different circumstances. Specific aspects will be elaborated in some of the succeeding items. It can probably be reduced, however, to a combination of three basic characteristics:

(a) Energy, which is expressed in initiative to start things and aggressiveness to keep them moving briskly.

(b) Resourcefulness or ingenuity, i.e., the faculty for finding ways to accomplish the desired result, and

(c) Persistence (tenacity), which is the disposition to persevere in spite of difficulties, discouragement, or indifference.

This last quality is sometimes lacking in the make-up of brilliant engineers, to such an extent that their effectiveness is greatly reduced. Such dilettantes are known as "good starters but poor finishers." Or else it will be said of a man (or a woman): "You can't take him too seriously; he'll be all steamed up over an idea today but tomorrow he will have dropped it and started chasing some other rainbow." Bear in mind, therefore, that it may be worth while finishing a job, if it has any merit, just for the sake of finishing it.

In carrying out a project, do not wait for managers, vendors, and others to deliver the goods; go after them and keep after them. This is one of the first things a new engineer has to learn in entering a manufacturing organization. Many novices assume that it is sufficient to place the order and sit back and wait until the goods are delivered. The fact is that most jobs move in direct proportion to the amount of follow-up and expediting that is applied to them. Expediting means planning, investigating, promoting, and facilitating every step of the process. Cultivate the habit of looking immediately for some

way around each obstacle encountered, some other recourse or expedient to keep the job rolling without losing momentum. There are ten-to-one differences between individuals in respect to what it takes to stop their drive when they set out to get something done.

On the other hand, the matter is occasionally overdone by overzealous individuals who make themselves obnoxious and antagonize everyone by their offensive browbeating tactics. Be careful about demanding action from another department. Too much insistence and agitation may result in more damage to your personal interests than could ever result from the miscarriage of the technical point involved.

Confirm your instructions and the other person's commitments in writing. Do not assume that the job will be done or bargain kept just because the other person agreed to it. Many people have poor memories, others are too busy, and almost everyone will take the matter a great deal more seriously if he or she sees it in writing. Of course there are exceptions, but at times it pays to mark a third party for a copy of the memo, as a witness.

When sent out on any complaint or other assignment stick with it and see it through to a successful finish. All too often a young engineer from the home office will leave a job half done or poorly done in order to catch a train or keep some other engagement. Wire the boss that you've got to stay over to clean up the job. Neither the boss nor the customer will like it if another person has to be sent out later to finish it up.

Avoid the very appearance of vacillation. One of the gravest indictments of an engineer is to say: "His or her opinion at any time depends merely upon the last person with whom he or she has talked." Refrain from stating an opinion or promoting an undertaking until you have had a reasonable opportunity to obtain and study the facts. Thereafter see it through if at all possible, until fresh evidence makes it folly to persist. Obviously the extremes of bullheadedness and dogmatism should be avoided, but remember that reversed decisions will be held against you.

Don't be timid – speak up – express yourself and promote your ideas. Every young engineer should read Emerson's essay on "Self Reliance." Too many new people seem to think that their job is simply to do what they're told to do, along the lines laid down by the boss. Of course there are times when it is very wise and prudent to keep your mouth shut, but, as a rule, it pays to express your point of view whenever you can contribute something. The quiet mousey individual who says nothing is usually credited with having nothing to say.

It frequently happens in any sort of undertaking that nobody is sure of just how the matter ought to be handled; it's a question of selecting some kind of program with a reasonable chance of success. This is commonly to be observed in engineering meetings. The first person to speak up with a definite and plausible proposal has better than an even chance of carrying the floor, provided only that the scheme is definite and plausible. (The "best" scheme usually cannot be recognized as such in advance.) It also happens that the person who talks most knowingly and confidently about the matter will very often end up with the assignment to carry out the project. If you do not want the job, keep your mouth shut and you'll be overlookeded, but you'll also be overlooked when it comes time to assign larger responsibilities.

Before asking for approval of any major action, have a definite plan and program worked out to support it. Executives very generally and very properly will refuse to approve any proposed undertaking that is not well planned and thought through as regards the practical details of its execution. Quite often a young person will propose a project without having worked out the means of accomplishing it, or weighing the actual advantages against the difficulties and costs. This is the difference between a "well-considered" and a "half-baked" scheme.

Strive for conciseness and clarity in oral and written reports. If there is one bane of an executive's existence, it is the person who takes a half hour of rambling discourse to tell what could be said in a sentence of twenty words. There is a curious and wide-spread tendency among engineers to surround the answer to a simple question with so many preliminaries and commentaries that the answer itself can hardly be discerned. It is so difficult to get a direct answer out of some people that their usefulness is greatly diminished. The tendency is to explain the answer before answering the question. To be sure, very few questions admit of simple answers without qualifications, but the important thing is to state the crux of the matter as succinctly as possible first. On the other hand, there are times when it is very important to add the pertinent background or other relevant facts to illuminate a simple statement. The trick is to convey the maximum of significant information in the minimum time, a valuable asset to anyone.

An excellent guide in this respect may be found in the standard practice of newspapers in printing the news. The headlines give you 90% of the basic facts. If you have the time and interest to read further, the first paragraph will give you most of the important particulars. Succeeding paragraphs simply give details of progressively diminishing significance. To fit an article into available space, the editor simply lops off paragraphs at the rear end, knowing that relatively little of importance will be lost. You can hardly do better than to adopt this method in your own reports, presenting your facts in the order of importance, as if you might be cut off any minute.

Be extremely careful of the accuracy of your statements. This seems almost trite, and yet many engineers lose the confidence of their superiors and associates by habitually guessing when they do not know the answer to a direct question. It is certainly important to be able to answer questions concerning your responsibilities, but a wrong answer is worse than no answer. If you do not know, say so, but also say, "I'll find out right away." If you are not certain, indicate the exact degree of certainty or approximation upon which your answer is based. A reputation for dependability and reliability can be one of your most valuable assets.

This applies, of course, to written matter, calculations, etc., as well as to oral reports. It is definitely bad business to submit a report to the boss for approval without first carefully checking it yourself, and yet formal reports are sometimes turned in full of glaring errors and omissions.

IN RELATION TO THE BOSS

Every manager must know what's going on in his or her bailiwick. This principle is so elementary and fundamental as to be axiomatic. It follows from the very obvious fact that a person cannot possibly manage his or her business successfully unless he or she knows what's going on in it. It applies to minor managers and other individuals charged with specific responsibilities as well as to department heads. No one in his or her right mind will deny the soundness of the principle and yet it is very commonly violated or overlooked. It is cited here because several of the rules which follow are concerned with specific violations of this cardinal requirement.

Do not overlook the fact that you're working for your boss. This sounds simple enough, but some engineers never get it. By all means, you're working for society, the company, the department, your family, and yourself, but primarily you should be working for and through your boss. And your boss is your immediate superior, to whom you report directly. It is not uncommon for young engineers, in their impatient zeal to get things done, to ignore the boss, or attempt to go over or around the boss. Sometimes they move a little faster that way, for a while, but sooner or later they find that such tactics cannot be tolerated in a large organization. Generally speaking, you cannot get by the boss; he or she determines your rating and rates you on your ability to cooperate, among other things. Besides, most of us get more satisfaction out of our jobs when we're able to give the boss our personal loyalty, with the feeling that we're helping him or her to get the main job done.

Be as particular as you can in the selection of your boss. In its effect upon your engineering career, this is second in importance only to the selection of proper parents. In most engineering organizations the influence of the senior engineer, or even the section head, is a major factor in molding the professional character of younger engineers. Long before the days of universities and textbooks, master craftsmen in all the arts absorbed their skills by apprenticeship to master craftsmen. It is very much as in the game of golf; a beginner who constantly plays in company with "duds" is very apt to remain a "dud," too, no matter how faithfully the rules are studied. Whereas even a few rounds with a "pro" will usually improve a novice's game.

But of course, it is not always possible to choose your boss advisedly. What if he or she turns out to be somewhat less than half the person he or she ought to be? There are only two proper alternatives open to you; (a) accept the boss as a representative of a higher authority and execute his or her policies and directives as effectively as possible, or (b) transfer to some other outfit at the first opportunity. A great deal of mischief can be done to the interests of all concerned (including the company) if some other alternative is elected, particularly in the case of younger persons. Consider the damage to the efficiency of a military unit when the privates, disliking the leader, ignore or modify orders to suit their individual notions. To be sure, a business organization is not a military machine, but it is not a mob either.

One of the first things your owe your boss is to keep him or her informed of all significant developments. This is a corollary of the preceding rules: A manager must know what's going on. The main question is: How much must he or she know – how many of the details? This is always a difficult matter for the new engineer to get straight. Many novices hesitate to bother the boss with too many reports, and it is certainly true that it can be overdone in this direction, but in by far the majority of cases the executive's problem is to extract enough information to be kept adequately posted. For every time the boss has to say, "Don't bother me with so many details," there will be three times he or she will say, "Why doesn't someone tell me these things?" Bear in mind that the boss is constantly called upon to account for, defend, and explain your activities to the "higher-ups," as well as to coordinate these activities into a larger plan. In a nutshell, the rule is therefore to give him or her all the information needed for these two purposes.

Whatever the boss wants done takes top priority. You may think you have more important things to do first, but unless you obtain permission it is usually unwise to put any other project ahead of a specific assignment from your own boss. As a rule, he or she has good reasons for wanting his or her job done *now*, and it is apt to have a great deal more bearing upon your rating than less conspicuous projects which may appear more urgent.

Also, make note of this: If you are instructed to do something and you subsequently decide it isn't worth doing (in view of the data or events) do not just let it die, but inform the boss of your intentions and reasons. Neglect of this point has caused trouble on more than one occasion.

Do not be too anxious to follow the boss's lead. This is another side of the matter covered by the preceding rule. An undue subservience or deference to the department head's wishes is fairly common among young engineers. A person with this kind of psychology may:

1. Plague the boss incessantly for minute directions and approvals.

2. Surrender all initiative and depend upon the boss to do all of his or her basic thinking.

3. Persist in carrying through a design or a program even after new evidence has proved the original plan to be wrong.

This is where an engineering organization differs from an army. In general, the program laid down by the department or section head is tentative, rather than sacred, and is intended to serve only until a better program is proposed and approved.

The rule therefore is to tell your boss what you have done, at reasonable intervals, and ask for approval of any well-considered and properly planned deviations or new projects that you may have conceived.

REGARDING RELATIONS WITH ASSOCIATES AND OUTSIDERS

In all transactions be careful to "deal-in" everyone who has a right to be in. It is extremely easy, in a large organization, to overlook the interests of some division or individual who does not happen to be represented, or in mind, when a significant step is taken. Very often the result is that the step has to be retracted or else considerable damage is done. Even when it does no apparent harm, most people do not like to be left out when they have a stake in the matter, and the effect upon morale may be serious.

Of course there will be times when you cannot wait to stand on ceremony and you'll have to go ahead and "damn the torpedoes." But you cannot do it with impunity too often.

Note particularly that in this and the preceding item the chief offense lies in the invasion of the other person's territory without his or her knowledge and consent. You may find it expedient on occasions to do the other person's job in order to get your own work done, but you should first give the other person a fair chance to deliver the goods or else agree to have you take over. If you must offend in this respect, at least you should realize that you are being offensive.

Be careful about whom you mark for copies of letters, memos, etc., when the interests of other departments are involved. A lot of mischief has been caused by young people broadcasting memoranda containing damaging or embarrassing statements. Of course it is sometimes difficult for a novice to recognize the "dynamite" in such a document but, in general, it is apt to cause trouble if it steps too heavily upon someone's toes or reveals a serious shortcoming on anybody's part. If it has wide distribution or if it concerns manufacturing or customer difficulties, you'd better get the boss to approve it before it goes out unless you're very sure of your ground.

Promises, schedules, and estimates are necessary and important instruments in a well-ordered business. Many engineers fail to realize this, or habitually try to dodge the irksome responsibility for making commitments. You must take promises based upon your own estimates for the part of the job for which you are responsible, together with estimates obtained from contributing departments for their parts. No one should be allowed to avoid the issue by the old formula, "I can't give a promise because it depends upon so many uncertain factors." Consider the "uncertain factors" confronting a department head who must make up a budget for an entire engineering department for a year in advance! Even the most uncertain case can be narrowed down by first asking, "Will it be done in a matter of a few hours or a few months – a few days or a few weeks?" It usually turns out that it cannot be done in less than three weeks and surely will not require more than five, in which case you'd better say four weeks. This allows one week for contingencies and sets you a reasonable bogie under the comfortable figure of five weeks. Both extremes are bad; a good engineer will set schedules which can be met by energetic effort at a pace commensurate with the significance of the job.

As a corollary of the following, you have a right to insist upon having estimates from responsible representatives of other departments. But in accepting promises, or statements of facts, it is frequently important to make sure you are dealing with a qualified representative of the other section. Also bear in mind that when you ignore or discount another person's promises you impugn his or her responsibility and incur the extra liability yourself. Of course this is sometimes necessary, but be sure that you do it advisedly. Ideally, another person's promises should be negotiable instruments, like a personal check, in compiling estimates.

When you are dissatisfied with the services of another section, make your complaint to the individual most directly responsible for the function involved. Complaints made to a person's superiors, over the person's

head, engender strong resentments and should be resorted to only when direct appeal fails. In many cases such complaints are made without giving the person a fair chance to correct the grievance, or even before he or she is aware of any dissatisfaction.

This applies particularly to individuals with whom you are accustomed to dealing directly or at close range, or in cases where you know the person to whom the function has been assigned. It is more formal and in some instances possibly more correct to file a complaint with the head of the section or department, and it will no doubt tend to secure prompt results. But there are more than a few individuals who would never forgive you for complaining to their boss without giving them a fair chance to take care of the matter.

In dealing with customers and outsiders remember that you represent the company, ostensibly with full responsibility and authority. You may be only a few months out of college but most outsiders will regard you as a legal, financial, and technical agent of your company in all transactions, so be careful of your commitments.

PURELY PERSONAL CONSIDERATIONS FOR ENGINEERS

About 99% of the emphasis in the training of engineers is placed upon purely technical or formal education. In recent years, however, there has been a rapidly growing appreciation of the importance of "human engineering," not only in respect to relations between management and employees but also as regards the personal effectiveness of the individual worker, technical or otherwise. It should be obvious enough that a highly trained technological expert with a good character and personality is necessarily a better engineer and a great deal more valuable to his or her company than a sociological freak or misfit with the same technical training. This is largely a consequence of the elementary fact that in a normal organization no individual can get very far in accomplishing any worth-while objectives without the voluntary cooperation of his or her associates. And the quantity and quality of such cooperation is determined by the "personality factor" more than anything else.

This subject of personality and character is, of course, very broad and much has been written and preached about it from social, ethical, and religious points of view. The following "laws" are drawn from the purely practical point of view based upon well-established principles of "good engineering practice," or upon consistently repeated experience. As in the preceding sections, the selections are limited to rules which are frequently violated, with unfortunate results, however obvious or bromidic they may appear.

"LAWS" OF CHARACTER AND PERSONALITY

One of the most important personal traits is the ability to get along with all kinds of people. This is rather a comprehensive quality but it defines the prime requisite of personality in any type of industrial organization. No doubt this ability can be achieved by various formulas, although it is probably based mostly upon general, good-natured friendliness, together with fairly consistent observance of the "Golden Rule." The following "do's and don'ts'" are more specific elements of such a formula:

1. Cultivate the tendency to appreciate the good qualities, rather than the shortcomings of each individual.

2. Do not give vent to impatience or annoyance on slight provocation. Some offensive individuals seem to develop a striking capacity for becoming annoyed, which they indulge with little or no restraint.

3. Do not harbor grudges after disagreements involving honest differences of opinion. Keep your arguments on an objective basis and leave personalities out as much as possible.

4. Form the habit of considering the feelings and habits of others.

5. Do not become unduly preoccupied with your own selfish interests. It may be natural enough to "look out for Number One first," but when you do your associates will leave the matter entirely in your hands, whereas they will be much readier to defend your interests for you if you characteristically neglect them for unselfish reasons.

   This applies particularly to the matter of credit for accomplishments. It is much wiser to give your principal attention to the matter of getting the job done, or to building up your people, than to spend too much time pushing your personal interests ahead of everything else. You need have no fear of being overlooked; about the only way to lose credit for a creditable job is to grab for it too avidly.

6. Make it a rule to help the other fellow when the opportunity rises. Even if you're mean-spirited enough to derive no satisfaction from accommodating others it's a good investment. The business world demands and expects cooperation and teamwork among the members of an organization. It's smarter and pleasanter to give it freely and ungrudgingly, up to the point of unduly neglecting your responsibilities.

7. Be particularly careful to be fair on all occasions. This means a good deal more than just being fair, upon demand. All of us are frequently unfair, unintentionally, simply because we do not habitually view the matter from the other person's point of view, to be sure that his or her interests are fairly protected. For example, when a person fails to carry out an assignment, he or she is sometimes unjustly criticized when the real fault lies with the manager who failed to give him or her the tools to do the job. Whenever you enjoy some natural advantage, or whenever you are in a position to injure someone seriously, it is especially incumbent upon you to "lean over backwards" to be fair and square.

8. Do not take yourself or your work too seriously. A normal healthy sense of humor, under reasonable control, is much more becoming, even to an executive, than a chronically soured dead-pan, a perpetually unrelieved air of deadly seriousness, or the pompous solemn dignity of a stuffed owl. It is much better for your blood pressure, and for the morale of the office, to laugh off an awkward situation now and then than to maintain a tense tragic atmosphere of stark disaster when ever matters take an embarrassing turn. To be sure, a serious matter should be taken seriously, and a person should maintain a quiet dignity as a rule, but it does more harm than good to preserve an oppressively heavy and funereal atmosphere around you.

9. Put yourself out just a little to be genuinely cordial in meeting people. True cordiality is, of course, spontaneous and should never be affected, but neither should it be inhibited. We all know people who invariably pass us in the hall or encounter us elsewhere without a shadow of recognition. Whether this be due to inhibition or preoccupation we cannot help feeling that such unsociable chumps would not be missed much if we never saw them again. On the other hand it is difficult to think of anyone who is too cordial, although it can doubtless be overdone like anything else. It appears that most people tend naturally to be sufficiently reserved or else overreserved in this respect.

10. Give other people the benefit of the doubt if you are inclined to suspect their motives, especially when you can afford to do so. Mutual distrust and suspicion breed a great deal of absolutely unnecessary friction and trouble, frequently of a very serious nature. This is a very common phenomenon that can be observed among all classes and types of people, in

international as well as local affairs. It is derived chiefly from misunderstandings, pure ignorance, or from an ungenerous tendency to assume that a person is guilty until proved innocent. No doubt the latter assumption is the "safer" bet, but it is also true that if you treat others as depraved scoundrels, they will usually treat you likewise, and they will probably try to live down to what is expected of them.

Regard your personal integrity as one of your most important assets. In the long pull there is hardly anything more important to you than your own self-respect and this alone should provide ample incentive to maintain the highest standard of ethics of which you are capable. But, apart from all considerations of ethics and morals, there are perfectly sound hardheaded business reasons for conscientiously guarding the integrity of your character.

One of the most striking phenomena of an engineering office is the transparency of character among the members of any group who have been associated for any length of time. In a surprisingly short period each individual is recognized, appraised, and catalogued for exactly what he or she is, with far greater accuracy than that individual usually realizes. This is true to such a degree that it makes people appear downright ludicrous when they assume a pose or otherwise try to convince us that they are something better than they are. As Emerson puts it: "What you are speaks so loud I cannot hear what you say." In fact, it frequently happens that people are much better known and understood by their associates, collectively, than they know and understand themselves.

Therefore, it behooves you as an engineer to let your personal conduct, overtly and covertly, represent your conception of the very best practical standard of professional ethics, by which you are willing to let the world judge and rate you.

Moreover, it is morally healthy and tends to create a better atmosphere, if you will credit the other fellow with similar ethical standards, even though you may be imposed upon occasionally. The obsessing and overpowering fear of being cheated is the common characteristic of second- and third-rate personalities. This sort of psychology sometimes leads a person to assume an extremely "cagey" sophisticated attitude crediting him or herself with being impressively clever when he or she is simply taking advantage of his or her more considerate and fairminded associates. On the other hand a substantial majority of top-flight executives are scrupulously fair, square, and straightforward in their dealings with all parties. In fact most of them are where they are largely because of this characteristic, which is one of the prime requisites of first-rate leadership.

The priceless and inevitable reward for uncompromising integrity is confidence, the confidence of associates, subordinates, and "outsiders." Confidence is such an invaluable business asset that even a moderate amount of it will easily outweigh any temporary advantage that might be gained by sharp practices.

Integrity of character is closely associated with sincerity, which is another extremely important quality. Obvious and marked sincerity is frequently a source of exceptional strength and influence in certain individuals, particularly in the case of speakers. Abraham Lincoln is a classic example. In any individual, sincerity is always appreciated, and insincerity is quickly detected and discounted.

In order to avoid any misunderstanding, it should be granted here that the average person, and certainly the average engineer, is by no means a low dishonest scoundrel. In fact, the average person would violently protest any questioning of his or her essential honesty and decency, perhaps fairly enough. But there is no premium upon this kind of common garden variety of honesty, which is always ready to compromise in a pinch. The average person will go off the gold standard or compromise with any sort of expediency whenever it becomes moderately uncomfortable to live up to his or her obligations. This is hardly what is meant by "integrity", and it is certainly difficult to base even a moderate degree of confidence upon the guarantee that you will not be cheated unless the going gets rough.

Finally, it should be observed that the various principles which have been expounded, like those of the arts and sciences, must be assiduously applied and developed in practice if they are to become really effective assets. It is much easier to recognize the validity of these "laws" than it is to apply them consistently. The important thing here is to select, in so far as possible, a favorable atmosphere for the development of these professional skills. This is undoubtedly one of the major advantages of employment in a large engineering organization. Perhaps, even more important, as previously mentioned, is the selection of your boss, particularly during those first few years that constitute your engineering apprenticeship. No amount of precept is as effective as the proper kind of example. Unfortunately, there is not nearly enough of this kind of example to go around, and in any event it will behoove you to study the "rules of the game" to develop your own set of principles to guide you in your professional practice.

SECTION 1

CORPORATE OVERVIEW

1.0 SCOPE

Orientation means to familiarize with or adjust to a new situation; it also means to align or position with respect to a specific direction or reference system. Section 1 helps you become familiar with Digital Equipment Corporation in four ways. First, Ken Olsen, founder and president of Digital, relates Digital's own brand of philosophic autonomy in the areas of communication, compromise, and cooperation. Second, a short history of the company's achievements is provided. Next, "Digital Philosophy" provides you with positive, growth-producing values inherent to the operation of the company. Finally, Digital's management style and structure are broadly outlined. These topics in Section 1 provide you with a perspective by which you may meld your personal goals with those of the corporation to grow and prosper.

2.0 INTRODUCTION - KEN OLSEN

Before you select specific sections to read that may be of immediate interest to you, take a few minutes to read the following excerpts from a speech given by Ken Olsen to an engineering group.

> "Don't communicate with neighbors in your community about company matters; there is just too much information about what we do at Digital that reaches people outside the corporation. Sometimes we don't fully appreciate the importance of keeping our mouth shut because any one thing doesn't look all that significant. But altogether, things are really important. Any time we, as a company are so open and talk about company matters, we invest heavily in communication.
>
> "Everything is a compromise and we ought to consider every decision we make as a meaningful compromise. The whole art of engineering is compromise. Therefore, engineers of all people should be best at compromising. Often, however, they have the worst time in making compromises. You can't build a bridge, or an airplane, or a computer that's absolutely safe in every alternative. It would take forever, cost an infinite amount of money, and there wouldn't be enough weight left for cars on the bridge, you couldn't get off the ground in the airplane, and you couldn't meet your schedule.

"There is no absolute safety. We're professionals, we can't get away with saying 'I will go all the way, one way and be safe'. We must find the best compromise and then live with the ensuing criticisms. We just learn by our mistakes and do better. That's what we're paid for in our profession. There is a list of things in which we must compromise and identifying them, I think, will help us face the issue.

"The first area of compromise is in new technology. The only time we claim that we've ever been ahead of technology is the day we opened our doors and we've been behind ever since. There are a number of reasons for this. When we started, we had a handful of technology. After that we had to live with our previous product and with our customers who dictated what they wanted. In general, they didn't care about technology. They wanted the products to continue, they had problems to solve and that is what they were interested in. Compromises come because in the long run they use technology that gives the best product, the best solution to problems, the lowest price, and the best reliability. We must always face that.

"A few years ago, the world was promising great things in integrated circuits. The professors at MIT were promising then what we can just do today and the world hated us because we said it wasn't ready yet. We were the last ones to use integrated circuits, and then we were 6 months early! The argument that showed we were right said that we paid 60 cents per unit while others paid 4 dollars per unit because they started earlier than we did and their product was therefore that much more expensive.

"A few years ago, one of our development managers was very excited about magnetic bubbles. 'You can't lose' he said. 'We must jump on the bandwagon; we must be a leader or we'll lose out.' Even Gordon Bell said it was coming soon. We were reluctant to offend that development manager because he was so enthusiastic, but we said 'no'. Well, five years later, it doesn't look like we've lost all that much. Waiting until we're sure has been a good policy. On the other hand, you can't survive by saying 'no' to all new technology.

"The second area of compromise is merely red tape which includes scheduling and budgeting. Our engineering departments terrify me because I think we're training hundreds of people to be budgeters and schedulers and after awhile they'll all forget how to be engineers. Budgets and schedules are tools; they are not used instead of engineering. We've got to use them but that's all they are, just tools. We are engineers, and we are only useful as long as we're doing engineering.

"A third area of compromise is safety. There are many things that fail for which there is no excuse. We just really work to cover all the alternatives. Products shouldn't fail. In some areas there is no excuse for failure; the compromise comes in because you can't make everything absolutely safe.

"In engineering there are no excuses. It has to work. I sat at IBM for a year, which was the worst year of my life. I didn't have much to do, but I learned a lot there. I was representing MIT and the Air Force and I had to make certain the products were done right. I could nail them because they didn't have technical analyses on the steel racks, but I couldn't tell them to start at the joints because that wasn't in the requirements. I decided that all the people there were really making a list of reasons that if any failures occurred it wasn't their fault.

"We can't do that! We have to get the job done, make sure it succeeds and realize there is always some chance of failure. We mustn't make a list of reasons to show that if something goes wrong it wasn't our fault. When we schedule projects, the normal tendency of an engineer is to schedule the test point two years away; postpone the day of failure for two years. That's just not healthy. I have often thought I wouldn't hire my son at Digital. I think if I did I would have him go into our Computer Special Systems organization because they succeed or fail every month and learn from it. We should make all our mistakes easy ones, our failures small and have them come early, so we can learn.

"The fourth area of compromise that I worry about in modern engineering is the amount of time that people spend preparing presentations for marketeers (when they're not budgeting or scheduling). Let me tell you how it looks to an outsider. A group of engineers studies something, they think about it for months and they look at it from every angle. They know as much as can be known. They know exactly which way to go. But, either because they are cowardly and want someone else to take the responsibility for their decision, or for some mysterious reason I can't explain, they make massive presentations to marketing people and lay the question before them. Now the marketeers have never thought about the subject before. When engineers ask them for a point of view they get back from 100 people 100 points of view that become 1,000 points of view before the meeting is over. Because engineers have a project on which they don't want to do engineering, they'll work two years budgeting and scheduling, they won't do any work, won't read a magazine, won't look at a book, nor a catalogue and won't draw up our diagrams; because they won't do any real work until they have this 'buy-in' from marketeers.

"Another area of compromise comes in discipline. We follow sort of the New England tradition of revolutionary soldiers. We look and behave like rebels. We think we won the Revolution because the British soldiers marched in straight rows, fired their muskets in unison and never aimed, while the smart Americans fired at random from behind trees and stone walls. The real story is that whenever the British started shooting back, the Americans just ran. The whole fight that we're so proud of in Concord was one big mistake. The Americans were so undisciplined and disorganized they got the whole thing started by mistake. The Colonial rebels really didn't win until they hired some European officers who taught them how to march in straight rows, shoot on command, and stand their ground when the other side shot back. When they finally got discipline, they won the war.

"You can take all these great stories on discipline with a grain of salt. Complete discipline would be too much of course. It's a compromise. No discipline whatsoever and there's never any production at all. We have to have discipline in our organization, our lives, our way of doing things. Compromise comes in because too much, by definition, is too much.

"Another area of compromise is in management. Managers must always compromise. They can go to extremes. One extreme is to do it all themselves. The problem with this is that we can't get them to do anything right, because the projects have to stay small so they can do everything themselves. It frustrates the people working for them. It frustrates the boss. Nothing happens until he gets around to it. He's not a manager at all. The other kind of manager who maybe is even worse, abandons everything. Between these extremes comes the compromise. Managing is playing that compromise. The manager must realize this and always face it. There are all kinds of tricks you can use to help. One is to require people to schedule all their work and then submit reports. The preparation of these reports will, in fact, force people to comply and review the information they need to do their job. When something falls apart, you know it and can talk to the people who are in trouble. Engineering sometimes takes forever, but it always comes out. Those things we watch get done, and those we don't watch never get done. It's one of the tricks. Another trick to managing is to threaten people that you might do the job better than they.

"I had lunch with the editor of one of Boston's big newpapers and had been critical of him. As we were walking out he asked, 'Do you ever have trouble motivating these 30-35 year old people?' I said, 'Our trouble is we can't get them to go home!' My frustration with that newspaper is that the reporters don't know what they are doing. They report freely but don't know what they are writing about. I figured out what that editor should do. If he would say, 'Let it be known that every month I am going to become an expert on a new subject' but not tell anybody what those things were, it would change the whole organization.

"We used to work for Jay Forrester, one of the real pioneers in computers. We called his style pulse management. He would come in with one pulse. Pulse management can keep people on

their toes because they can't ever tell when you're going to come down and pulse them and know more than they do. It keeps the whole outfit sharp! They had better be awake!

"The other area in working out this compromise is to delegate. Of course you can't abandon a project either or nothing happens. One technique is to read a little about warfare. If you are an officer charged with defending a position, you go by every hour and check every single machine gun and the troops manning them. You make sure your men are not dead, that they're not sleeping, or sick; that they haven't run away. You make sure they're ready every hour. There is no such thing as losing the position and then saying, 'Well, things seemed okay when I checked yesterday'. When you're a manager, you have to manage so that you know everything that is going on. There is no such thing as, 'I trusted so and so and he let me down'.

"What happens to middle-aged people? In general, they want to get into management. Engineers want to retire from engineering. I think maybe society has forced us into doing that, and engineers ought to fight it. It's okay to be a manager; the company depends upon the availability of good managers. But we should never become managers because we want to 'retire' and get an easy job. There are no easy jobs. You ought to fight the temptation to retire and always take the hard jobs. Always work hard at it and when you become 40 or 50 you'll be in demand. During the last recession, many people in Massachusetts who were 45 and 50 were looking for jobs. They thought they couldn't find work because they were too old. I interviewed a number of them and consistently they said that they used to be engineers, or draftsmen, or machinists. But they got promoted into some administrative work for which they were paid very well. But now they couldn't find work. The secret of it, I think, is always to be something. Don't be a nothing. Be in demand. The interesting thing is that our society wants us to be promoted into a do-nothing administrative job. Be someone who's been something for 45 years and work hard at being GOOD at what you do."

3.0 FACTS ABOUT DIGITAL

Digital Equipment Corporation is the world's leading manufacturer of minicomputers, with over 150,000 computer installations. Digital is a leader in timesharing and interactive computing, and the foremost maker of logic modules. A Fortune 500 company, Digital employs more than 42,000 people worldwide. Digital's growth can be attributed to its continuing commitment to provide increased performance at a lower price.

Since the company's beginning in 1957, the commitment has been good for Digital and good for its customers. Digital's first computer, the PDP-1, broke the million dollar barrier in 1960, providing interactive computing capability for about $125,000. Digital's first minicomputer, the PDP-5, lowered the cost of interactive computing to about $25,000. (Its current day equivalent costs less than $2000!)

Digital's computer systems revolve around four central processor families:

- The PDP-8 was first used as a laboratory tool. Today, it functions in machine control, real-time monitoring applications, process control, and a host of business and commercial applications.

- The PDP-11 brought new technological advances to small computers. Compatible with processors from the LSI-11 to the PDP-11/70, it encompasses the broadest range of peripherals and software ever offered. These systems are used for everything from running a lathe to running a railroad.

- The DECsystem-10 was the first commercially available timesharing system designed to simultaneously handle timesharing, batch, remote job entry, and real-time tasks. DECsys-

tem-10s are used by more data service companies to provide timesharing services than any other system. The DECSYSTEM-20, a smaller version of our large computer capability, bridges the gap between the DECsystem-10 and the PDP-11.

- VAX-11/780 is a multiuser, multilanguage, multiprogramming, high-performance computer system. The system combines a 32-bit architecture, a virtual memory operating system, and efficient memory management to provide essentially unlimited program space.

To support this line of processors, Digital manufactures a full line of peripheral equipment including disk and tape systems, input/output devices, hard copy and video terminals, and communication interfaces. This large selection of peripheral equipment allows Digital customers to tailor systems to meet today's specific needs, with the assurance of expansion capability for tomorrow's requirements.

Complementing the hardware offering, Digital provides software products such as application packages, operating systems, higher level languages, and utilities. These products bring the full capability to meet its commitment of increased performance at a lower price.

Possibly more important, Digital provides resources and services to support all of its products:

- Software support services which range from getting a specialized system up and running to writing a customized application program.
- A Field Service organization of more than 6,000 engineers worldwide who are available to service and perform preventive maintenance on all Digital computer systems.
- Sales, Software Support, and Field Service representatives provide sales and service from more than 360 locations in the U.S. and 35 foreign countries.
- Over 100 computer related courses are available to all Digital customers at worldwide training centers.
- DECUS, the Digital Equipment Computer Users Society, the largest such group in the world, sponsors symposia, publishes newsletters, and administers a program library for its members.

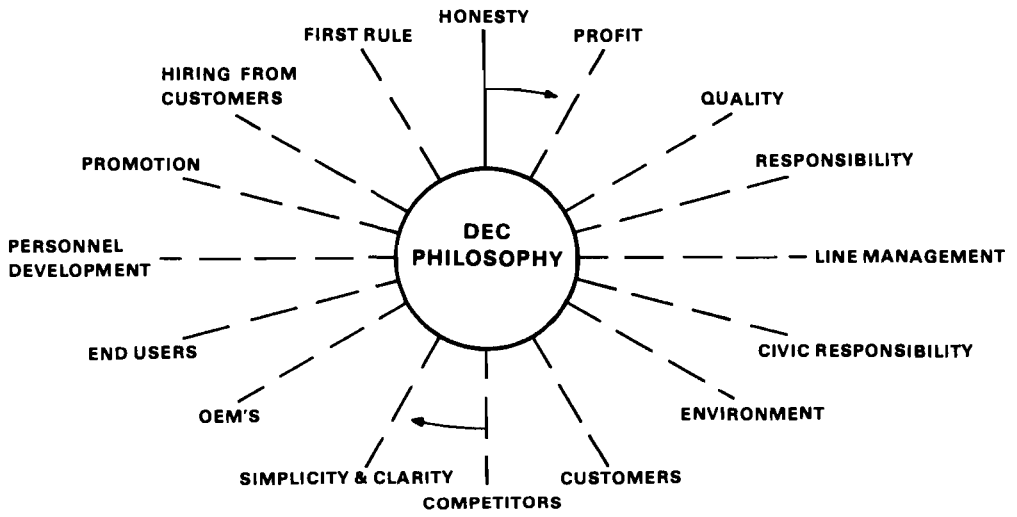

Figure 1-1 Digital Philosophy

4.0 DIGITAL PHILOSOPHY

Digital philosophy as represented by the following statements reflects the kind of company Digital prefers to be to its employees and to the outside world on a perpetual basis, exemplified via the Digital Perpetual Clock above.

HONESTY

We want to be not only technically honest, but also to make sure that the implication of what we say and the impressions we leave are correct. When we make a commitment to customers or to employees, we are obligated to see that it happens.

PROFIT

We are a public corporation. Stockholders invest in our corporation for profit. Success is measured by profit. With success comes the opportunity to grow, the ability to hire good people, and the satisfaction that comes with meeting your goals. We feel that profit is in no way inconsistent with social goals.

QUALITY

Growth is not our primary goal. Our goal is to be a quality organization and do a quality job which means that we will be proud of our product and our work for years to come. As we achieve quality, we achieve growth.

RESPONSIBILITY

Plans are proposed by managers or teams. These plans may be rejected until they fit corporate goals or until the Operations Committee is confident of the plans. But when they are accepted, they are the responsibility of those who proposed them. The impetus for the plan may come from outside the group making the proposal, but once accepted, the proposal is the responsibility of the one who proposed it.

LINE MANAGEMENT

We particularly want to be sure that line management jobs are clear and well defined. Because so many people are dependent on the plans of line managers, it is very important that the plans have regular automatic measurements built into them. Meeting financial results is only one measure of a plan; other measures are satisfied customers, development of people, meeting long range needs of the Corporation, development of new products, and opening new markets. We believe that our commitment to planning ensures our freedom to act.

SOCIETY

We are committed as a corporation to take affirmative action in providing equal opportunity for employment and promotion for all persons regardless of race, color, creed, or sex. We encourage all employees to take responsibility in community, social, and government activities. We are always open for proposals as to what the corporation or an individual on corporation time may want to do in these areas. However, activities done on company time or with company funds should have a formal proposal including ways of regularly measuring success toward goals.

ENVIRONMENT

As good citizens we have a responsibility to keep our environment free of pollution and to set an example.

CUSTOMERS

We must be honest and straightforward with our customers. Not only must they be told the facts, but we must be sure they understand the facts.

To the best of our ability, we want to be sure that the products we sell answer the needs of the customer even when that customer is too naive to understand these needs exactly. When we sell a product to a customer, we want to be sure the corporation fulfills the obligations we took on with the sale. We sell our corporation, not a single individual, to our customers and we must be sure all Digital commitments are met.

COMPETITORS

We never criticize the competition publicly. We sell by presenting the positive features of our own products. We want to be respectful of all competition, and collect and analyze all public information about competitors. When we hire people from competitors, we should neither press them for confidential, competitive information, nor should we use confidential literature they may have taken with them.

SIMPLICITY AND CLARITY

We want all aspects of Digital to be clear and simple and we want simple products, proposals, organization, literature that is easy to read and understand, and advertisements that have a simple, obvious message. We have thousands of employees and many thousands of customers. We have to keep things simple to be sure that we all work together. Our decisions must always consider the impact on the people who will be affected by them.

ORIGINAL EQUIPMENT MANUFACTURERS

Standard products are the base of our business. At times, in certain areas, we will invest in software and hardware specifically for special markets. But we should never lose sight that the base of our business is our standard products. We are very dependent on selling to OEMs. There are more applications for our products than we could ever develop. In addition, there are many risks to be taken in developing new fields which we cannot afford. Therefore we are very dependent on OEMs, and when they take the risks and they are clever enough to be successful, we should be most respectful of their risks. When our OEMs are in trouble with a customer, we should tell them.

PERSONNEL DEVELOPMENT

We encourage people to develop technical skills, breadth of knowledge, and expertise in a specific area. We also encourage people to develop supervisory and management skills. We believe that individual discipline should be self-generated.

PROMOTION

We promote people according to their performance, not only their technical ability but also their ability to get the job done and to take the responsibility that goes with the job. Ability is measured not only by past results, but also by attitude and desire to succeed. Performance results are also used to decide if a person should remain in his or her current job.

HIRING FROM CUSTOMERS

We should be exceedingly careful when hiring employees from customers. Sometimes this is reasonable and desirable; but we should do it with all caution and by being sure that the employee first tells the customer and allows the customer the chance to compete against us.

FIRST RULE

When dealing with a customer, a vendor, or an employee, do what is "right" in each situation.

5.0 DIGITAL STRUCTURE

Digital operates on a matrix structure which is not used by many companies. Therefore, most people are not familiar with how it works. Briefly, a matrix organization is one in which many members are responsible to more than one person. It enables people from all areas of the corporation to communicate, work together, and see one another's viewpoints. This way, people feel responsible for more than one primary aspect of the business.

Figure 1-2, Digital Matrix Structure, three-dimensionally shows the interrelationships of the major corporate departments, the product lines, and field organizations.

A matrix organization is designed to provide checks and balances in decision-making as well as to ensure that major proposals receive full exploration from all interested parties. The matrix organization is one of Digital's greatest strengths, making it possible to view the overall business from a variety of perspectives. For example, it is possible to look at a single product across product lines from an Engineering or Manufacturing perspective. Sales may be viewed worldwide by product line. A single country, region, or district may be examined across functions and product lines. Product lines can develop and market products using the resources of Engineering, Manufacturing, and Customer Services organizations.

Figure 1-3, Digital Structure from an Engineering Perspective, generally illustrates the major corporate departments and major avenues of activity among them.

5.1 *Engineering* is the backbone and lifeblood of Digital, continually providing innovative products with greater capabilities. Engineering performs product development according to the plans agreed upon with product line Marketing. Engineering also performs advanced development and research, providing a high degree of technical specialization in Printer, Computer Systems, Software Engineering, and major corporate processes to maintain Digital as a major competitor in the marketplace. Engineering Services, Documentation Control, and Purchase Specifications are provided in support of Engineering.

5.2 *Product Lines* have most of the functions you would expect to find in a small company. Digital's three major product line groups are Commercial Products, Technical Products and Computer Products. The focal point for profit and loss measurement at Digital are the product

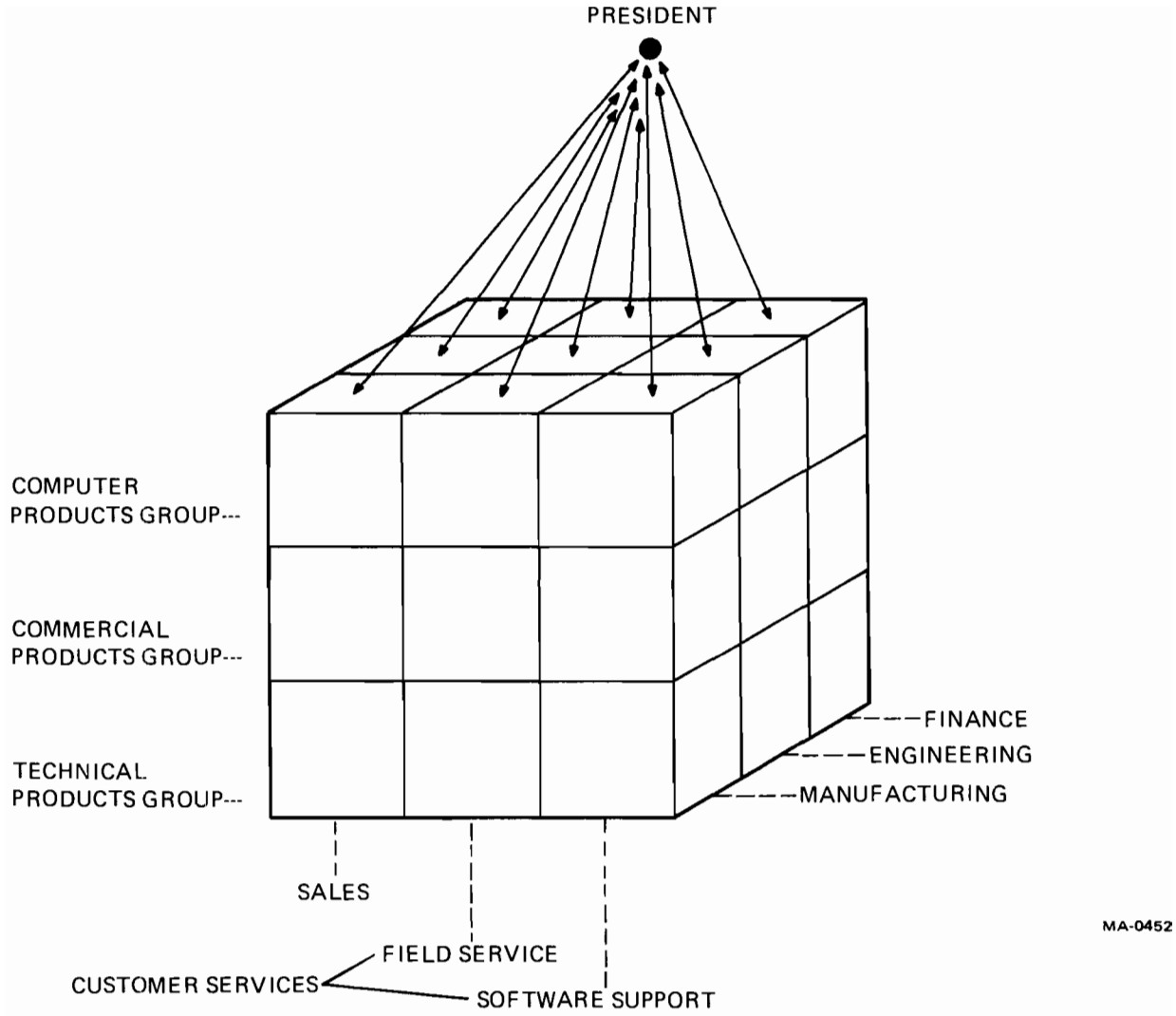

Figure 1-2 Digital Matrix Structure

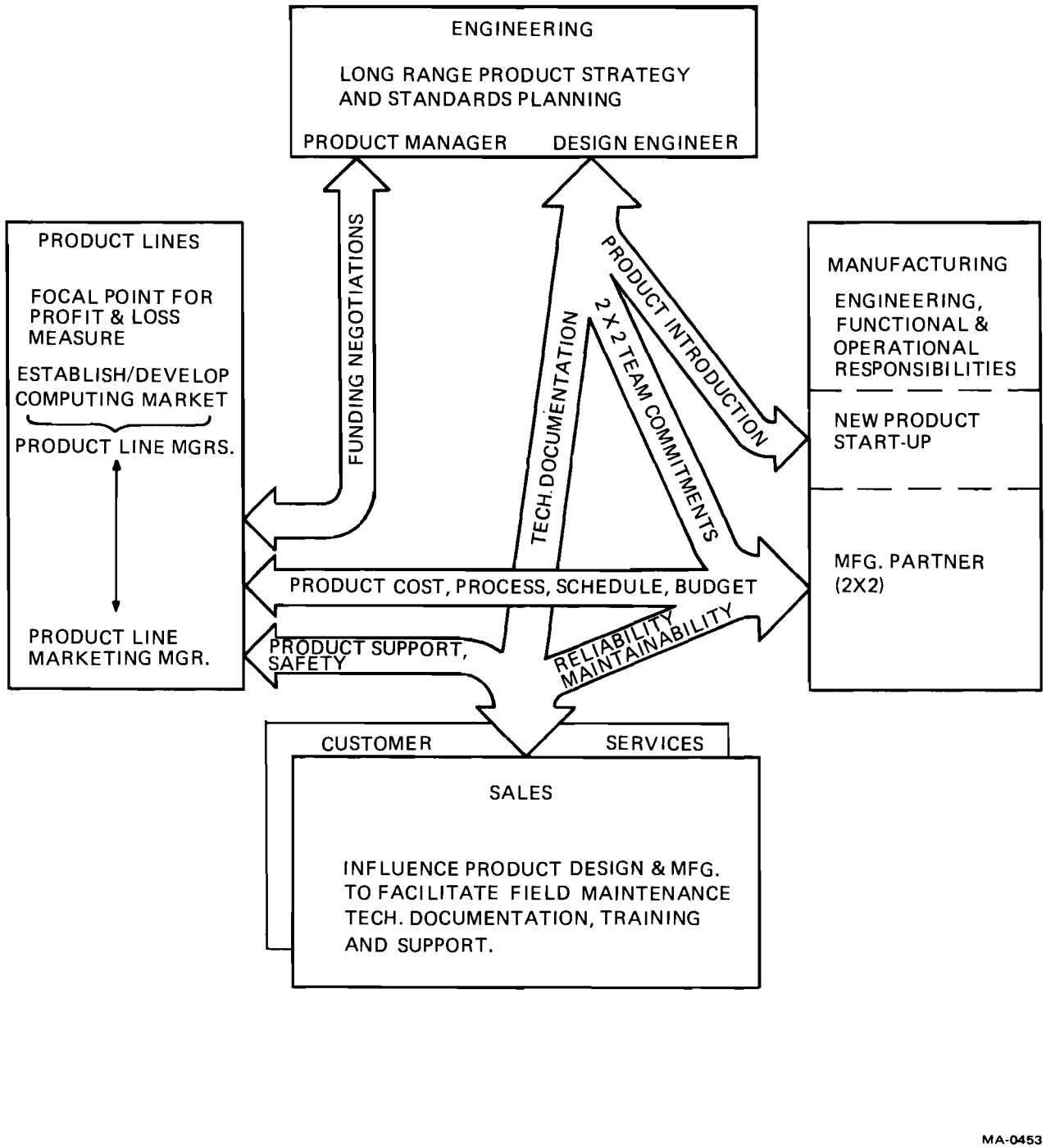

Figure 1-3 Digital Structure from an Engineering Perspective

lines. Product line managers are responsible for profits accrued by their market areas. One or more product lines within a market segment may be targeted at very specific markets with resident Engineering groups established to meet the needs dictated by product line market areas.

5.3 *Manufacturing's* function is to produce Digital's products at the product's specified quality level, at a manufacturing cost which maintains a competitive position in the market, and to a schedule that meets commitments that have been made to our customers. Manufacturing operations include approximately 26 facilities. United States locations are in New England, the Southwest, and the West Coast. International locations are in Puerto Rico, Canada, the British Isles, Germany, Hong Kong, and Taiwan.

Manufacturing has a matrix management structure composed of seven line organizations, Systems Manufacturing, Mass Storage Manufacturing, Terminals Manufacturing, CPU Manufacturing, Process Manufacturing, Component and Memory Manufacturing, and Far East Operations. Plant reporting is within these groups. The functional organizations cross all line organization boundaries. The key functions which reflect Manufacturing's activities are Manufacturing/Engineering, Quality Assurance, Materials, Distribution, Planning, Finance, Employee Relations, and External Manufacturing.

5.4 *Sales* have field offices in the United States, Canada, Europe, and General International Area locations to provide promotional and sales services. In order to serve the needs of the marketplace more efficiently, Digital's sales force is specialized; sales persons are trained to serve one or more specific market segments. For instance, there are sales representatives dealing with commercial markets, industrial markets, and educational institutions. Sales training is made available to the entire sales force.

5.5 *Customer Services* comprises many functions, three of which are Customer Service Systems Engineering, Software Services, and Educational Services. Customer Service Systems Engineering groups develop Field Service maintenance and business plans, hardware documents, training requirements, product safety requirements, reliability and maintainability programs, and evaluation of these functions during new product development. Software Services provides services to satisfy Digital's software needs in the field in the areas of warranty support, sales support, and consulting services. Educational Services provides curriculum training to anyone, customer or employee, interested in Digital hardware, software, or a variety of other computer-related topics. This group also designs and teaches custom-tailored courses to meet the special needs of a customer. They have extensive facilities in Massachusetts and in major cities around the world.

SECTION 2

FUNDING FOR PLANNED AND UNPLANNED PROJECTS

1.0 PLANNED PROJECTS

The preparation of Engineering budgets is actually a year-round activity. Engineering is continually involved in the refinement of product development tactics and the evaluation of product development issues and opportunities which arise during the year. These activities dictate a need for flexible budget modifications.

For the purposes of budgeting, Engineering divides its total allocation into two clusters: POTS and NON-POTS. POTS are product-related development activities, and NON-POTS are non-product-related development activities.

POTS Activities

- Commercial Systems
- Real Time and Computation
- Nets and Communication
- Small Systems and Terminals
- Base Systems
- Storage Systems
- Large Systems

NON-POTS Activities

- Product Support
- Development Tools and Technologies
- Research and Advanced Development (RAD)
- Administration
- Product Management

The term "POT" is used to describe each of six product/market segments outlined above. The term was originally coined as a "POT" of product development money. Each POT represents a grouping of

products based on the level of product integration and, in some cases, the degree to which a product is driven by technology versus marketplace requirements.

The primary goal of POTS is to couple market requirements with product strategies. Thus, formal management of each POT consists of a chairperson from a product line and a strategy manager from engineering. The remaining membership on each POT consists of 8 to 12 engineering managers appointed by the Engineering Board of Directors (EBOD).

The budget allocation process for product development (POTS) and non-product development (NON-POTS) is described in the steps that follow:

Step 1
The Office of Development (OOD) proposes a partitioning of the Engineering budget between POTS and NON-POTS. This proposal is then reviewed by EBOD. The allocations are driven heavily by historical considerations but they permit an adjustment of emphasis between short-term and long-term growth investments. The result of this step is a total product development budget figure and a comparable figure for non-product development.

Step 2
In a parallel effort, engineering managers and their team members from the product lines submit a "wish list" to the POT (that involves their strategies and product families) for consideration by the POT. The "wish list" includes both current product development efforts and proposed projects that are within the realm of current strategy.

Step 3
Each POT reviews its "wish lists" submitted to them and evaluates them against current strategy. Each POT then discusses alternative product development strategies and their implications to product line plans and marketing strategies. Additionally, each POT assesses the impact of not pursuing certain products. Finally, the engineering group develops a consolidated POT strategy and recommended budget for proposal to EBOD.

Step 4
EBOD reviews all of the POT funding requests and determines what the initial allocation will be for each POT. This allocation reflects the degree of emphasis EBOD believes ought to be given to the development efforts of each product/market category, considering the strategies of each. EBOD then sends its recommendations back to each POT, and steps 3 and 4 are repeated.

Step 5
At this step, EBOD can finalize the budget allocations, adjust the allocations among POTS, or it can go back to the Operations Committee and request a budget increase. At the same time, EBOD finalizes the budget for the forthcoming year, it establishes projected budgets for the two succeeding years.

Step 6
EBOD presents the final POTS budgets to the Marketing Committee for ratification. In addition, the Office of Development presents its final NON-POTS budgets to the Marketing Committee for ratification.

2.0 UNPLANNED PROJECTS

There are four sources to which engineers may turn for funding of unplanned projects. Unplanned projects may be funded by the Office of Development's contingency funds, by product line, by receiving cross-funding from another engineering group, and by the Research and Advanced Development (RAD) Committee.

Office of Development (OOD) Contingency Funds

Although POTS attempts to anticipate their yearly development efforts, they must also anticipate the actions of competitors, stay abreast of technological advancements, and adjust their developmental activities accordingly during the year. For these reasons, the Office of Development has a contingency fund (approximately 5% of the total budget) to finance a limited amount of unanticipated efforts without exceeding the established Engineering budget. A project manager or development manager has access to these funds.

Product Line Funding

If the project which the development or project manager proposes to undertake has application to a single product line, he or she can request direct funding by the product line. Each product line sets aside a certain percent of its net-operating revenue to be used for product line engineering. The engineering group within the product line can finance a proposed project, or Engineering can directly fund the project for the product line. A project manager or development manager has access to these funds.

Cross-Funding

In those cases where a engineering manager is supplying services, he or she may receive cross-funding from another engineering manager. A typical example would be the services of the packaging group being used by a CPU development group.

Research and Advanced Development Funding

Occasionally, projects evolve from such alternative avenues as informal discussions, reviewing the current technical literature, and changing market demands. An engineer's personal interest in a particular idea may result in a "lunch room" project, one which may ultimately benefit the company. To encourage and support such projects, Engineering allocates 1% of its research and advanced development budget each fiscal year for the research and development of unplanned projects. The total research and advanced development fund is 13% to 15% of the Central Engineering fund.

If you have a product which you believe will make a significant contribution to the future of Digital, submit your project to the Research and Advanced Development (RAD) Committee in the form of a preliminary project proposal. RAD will consider potential projects and permit you to sidestep regular management approval.

Your proposal should be submitted to a RAD Committee member or the technical coordinator of the RAD Committee, Dan Goor (ML12-2/E71 223-2895). It should briefly describe the nature of your effort, the resources required, the anticipated technical payoff, and the project's relationship to the organizational strategy.

The Research and Advanced Development Committee will review your proposal to determine if money should be spent to test the technical soundness of your project. RAD will then hold a follow-up review by qualified engineers. RAD may also allocate funds to articulate your project to other levels within Digital (e.g., Marketing, Manufacturing).

Because RAD receives more project ideas than it can afford to finance, money is allocated only to those projects which demonstrate promise. Roughly half of all project proposals receive funding for further research.

SECTION 3

LIFE OF A HARDWARE PROJECT

1.0 SCOPE

From product inception to steady-state production, a project involves considerable planning that addresses:

a. What to build

b. How to build it

c. Who is involved

This section addresses the three questions above by presenting an overview of the life of a hardware project. This information is intended to help you, the new engineer, (1) determine what your responsibilities are, (2) understand how you are involved, (3) know which groups you will interact with, and (4) know when to contact those groups during the process.

2.0 RESPONSIBILITIES

Your job is to find out what is right, and then do it. Digital's products are used in critical applications where malfunctions can be expensive for our customers, and in some cases, cause injury to people and property. You are the only one who understands your product completely, so decisions which affect these kinds of applications must be sound decisions.

It is not always sufficient to do what is right. You must convince others of what is right. This is in part a check on your ideas. One of the most difficult adjustments you may have at Digital is realizing that you have little authority over many aspects of your product, even though you are responsible for all of it. Therefore, good communication is essential for others to understand your ideas. You may begin by talking with your associates, putting it in writing, and picking up the phone. You should begin to wonder about your decisions when you can't convince others of the soundness of your ideas. Trying to persuade others of what you think is right also forces clarity in your thinking.

Because good communication is a very important part of what is right, you must understand how your specifications will be interpreted. You must be sure Field Service, Sales, and customers understand the limits and potential of a product's specifications. Malfunction from misuse by a customer is an acceptable excuse only if the customer has ignored clear and accurate information that what he or she is doing constitutes misuse.

If you bring honesty, integrity, and love to the people with whom you work, you are bound to succeed. Others who look upon Digital's method of product development as a silly game are bound to fail. It's up to you.

3.0 INTRODUCTION

Effective development and support of our products is essential. Remember that a product is more than hardware; it is software, documentation, Marketing, Manufacturing, and Field Service support. It is reliability and it is profitability.

The individual designated as product manager for a product has the overall responsibility for a product, and direct responsibility for pricing and marketing. The identity of a product manager may be found in the Option Module List published by the Office of the Chief Engineer (Section 5, paragraph 3.7). If a manager is not listed there for your product, then you, the design engineer, must assume that responsibility.

As a design engineer, or as a contributing engineer to a project, you must give your attention to the product manager and the product line(s) support and development people to coordinate activities in other areas. Be sure that the product manager does not overcommit you, yet keep in mind that you owe him or her the best product that money can buy. You owe your complete cooperation and self-respect to all of the people who work on your project.

The development stages of a hardware project are illustrated in Figure 3-1. Shown there are the milestones in the life of a hardware project. Sheet 1 outlines the processes that involve you and your 2x2 partner* directly. Sheets 2 and 3 show procedures carried out by Manufacturing, Field Service, Marketing and Sales, and Diagnostic and Reliability Engineering in parallel with you and your 2x2 partner. The paragraphs which follow explain Figure 3-1 in detail.

Refer to DEC Standard 130, Guide for Product Business Plans, for the complete product planning methodology used by Digital to initiate new product development. The standard describes the product planning process, the phases of product development, and the phase review process. (Contact Standards and Methods Information and Control, ML5-2/E56, 223-2954, for a complete listing and copies of DEC Standards.)

References to "Software Engineering" in this section are monitor or operating system groups which provide the software necessary for your hardware product to work. For an overview of the life of a software project, see Section 4.

* Your Manufacturing 2x2 partner is identified by your Engineering Manager, Manufacturing Group New Product Manager, or Joe St. Amour, manager of the Manufacturing New Product Start-Up Group.

3.1 PLANNING (WHAT TO BUILD)

Many people must work on a project besides those for whom and to whom you are responsible. Starting a project involves careful planning and requires much interaction and effective communication both vertically and horizontally at all levels of the corporation to insure that the many elements of a project work together in synchronization toward a common goal.

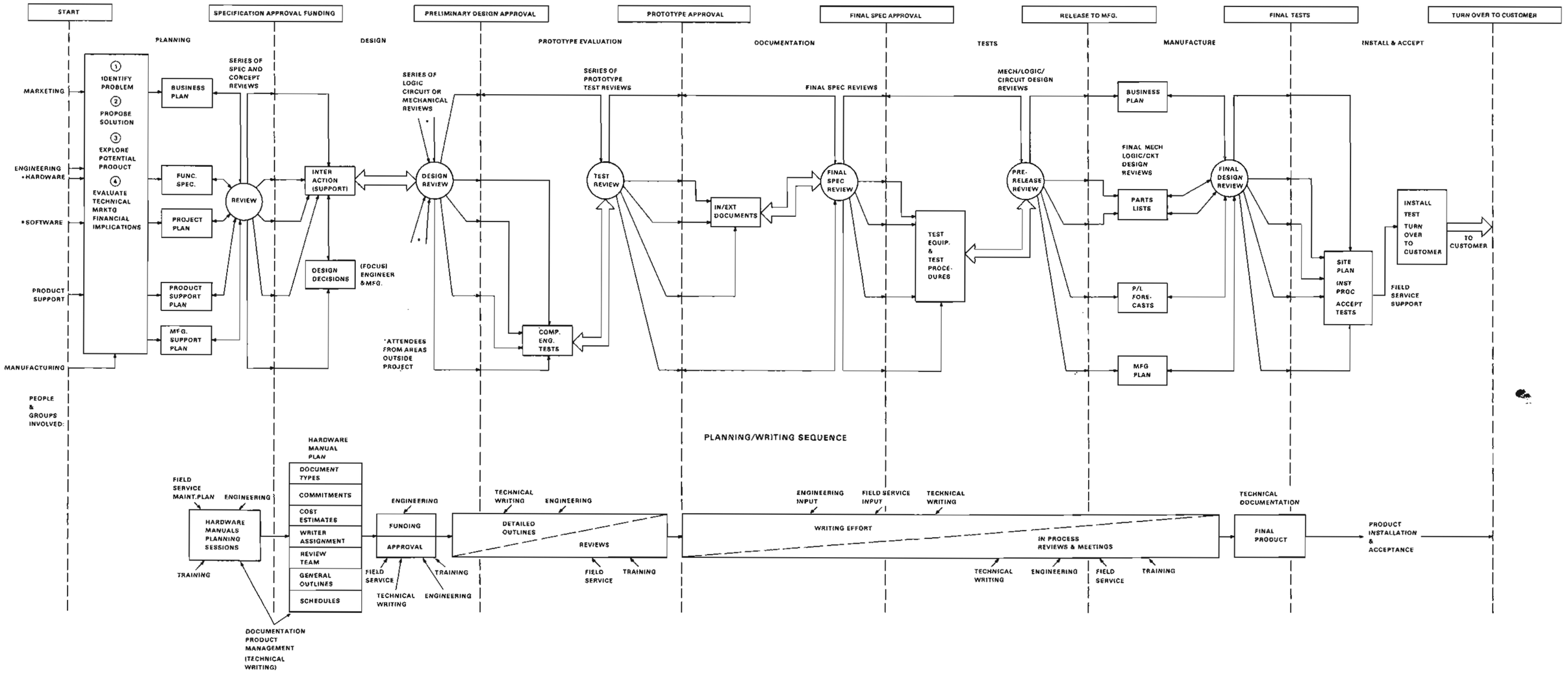

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Figure 3-1(A) Life of a Hardware Project

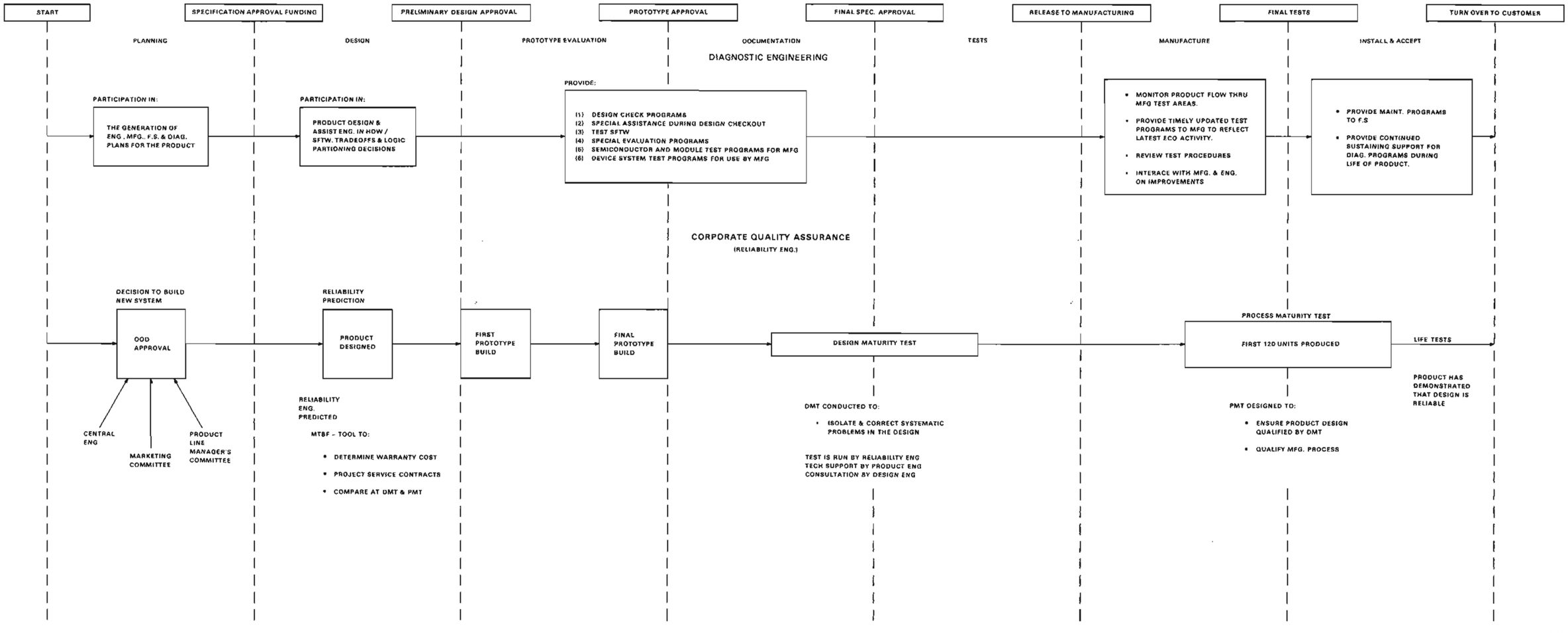


Figure 3-1(B) Life of a Hardware Project

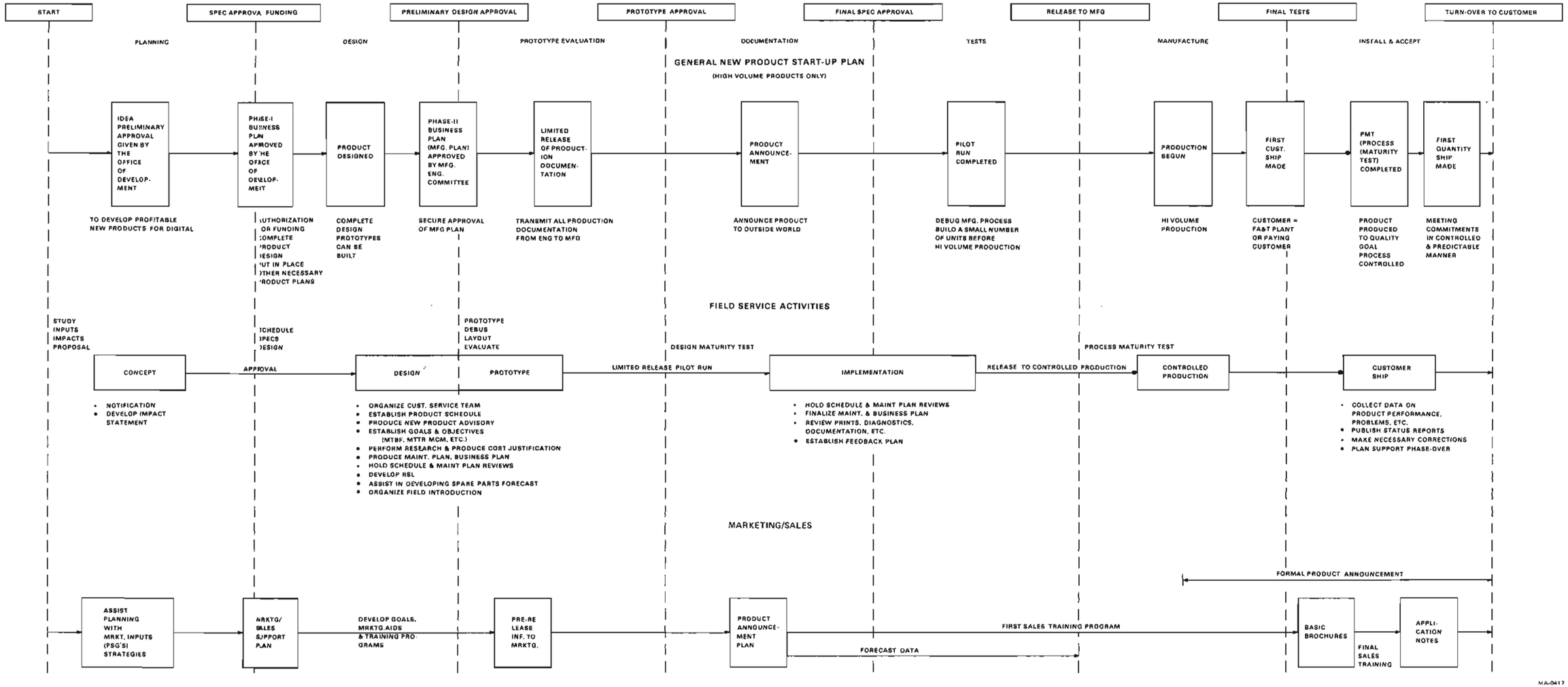


Figure 3-1(C) Life of a Hardware Project

The following paragraphs identify the objectives, the people and groups involved, and the tools necessary to ensure that Digital's products are both reliable to the customer and profitable to the corporation.

Objectives

- To identify a problem, a set of problems, or simply the needs of our customers, and propose a solution that will satisfy the customers and bring profit to the corporation.
- To explore and define a solution (a potential product) by evaluating its technical, financial, and marketing implications.
- To provide enough clear information to allow the people with the funds, or the appropriate POT Committee, to approve further planning. Delays in funding do not curtail development; planning continues unless all interested people are notified to stop.

People and Groups Involved

- Project Engineer
  > May be the same person
- Product Manager
- Product Line Manager(s)
- Product Line Marketing
- Software Engineering
- Customers
- Manufacturing

Tools

- Engineering Proposal (essentially, this is a project specification, refer to DEC Standard 009)
- Project Plan (scheduling – refer to DEC Standard 008)
- Product Business Plan (refer to DEC Standard 130)
- Manufacturing Support Plan (refer to "Manufacturing New Product Start Up" in Section 7, paragraph 1.0).
- Specification and Concept Design Review Process (refer to DEC Standard 007)

A project's plan typically covers three to five years once the project enters the design phase. For products already in support of equipment, project plans cover about five years. Major decisions on new products are usually made during the formulation of project plans.

It is often difficult to determine when the "What to Build" phase ends, but project approval in the forms of official funding and a Design Review of the functional specification are two indications that usually mark the end.

Do not assume that the "What to Build" phase is complete when the functional specification is written. Keep in mind that it may be 1) incomplete, 2) inconsistent, or 3) impossible for reasons you discover during the design phase. In such cases, the specification requires updating with the concurrence of at least the product manager and the product line marketing managers where major products are concerned, and the concurrence of at least two people (remember that the project engineer and the product manager may be the same person).

NOTE

The specific aspects of the Design Review process such as when they should be performed, what they should attempt to do, etc., vary according to your project, and as a result may not require all the reviews presented in this section. Refer to DEC Standard 007 for answers to the following questions:

- Which projects require Design Reviews?
- How is a Design Review Committee formed?
- When are Design Review sessions held?
- What are the responsibilities of the Design Review Committee?

The purpose of holding Design Reviews is to aid you in developing your project by allowing you to use available technical expertise from other areas in the corporation. Design Review Committee members are sounding boards for your ideas and concepts. Design Reviews also permit Product Safety and other concerned groups to ensure that your project meets applicable regulations and standards.

Before entering the Design phase, a *Specification and Concept Review* should be held to ensure that the specification:

a. Completely describes the equipment to be designed, including electrical and physical interfaces, and a functional relationship between inputs and outputs.

b. Outlines how the implementation of the design is planned, providing details such as block diagrams, flow diagrams, analysis, specifications for sub units, etc.

c. Includes proposed mechanical, thermal, and power requirements; requirements and concepts for packaging, testing, and maintenance.

The planning of a project does not happen overnight and sometimes seems to take an excessive amount of time. The purpose of spending time is to allow the business and support managers to implement the requirements of your project in their plans with the confidence that they are working on the same project as you. Give them time so that they may meet the scheduling commitments necessary for a successful product.

3.2 DESIGN: (HOW TO BUILD IT)

A 2x2 method of product development is used at Digital. Every product oriented project is managed by a two-person team, one from Engineering and one from Manufacturing. They make design decisions, decisions on how the product will be built, and both are jointly responsible for introducing the product into Manufacturing.

Engineering responsibilities include:

- Planning, Design, Testing, Documentation
- Coordinating Start Up (jointly with Manufacturing partner)
- Support of Production and Field Service
- Meeting cost goals
- Shipping on schedule

Manufacturing responsibilities include:

- Preparing and implementing Product Introduction Plan
- Influencing design to ensure manufacturability
- Capacity forecasting
- Ensuring volume production-documentation and successful implementation
- Prototyping

It is highly important for you to identify your 2x2 partner as soon as possible. Refer to "Manufacturing New Product", Section 7, paragraph 1.0, for direction to the right people to contact.

Objectives

- Design a product that the customer can use
- Design a product that is as compatible as possible with existing software systems
- Translate the functional requirements into a design that Manufacturing can build
- Provide a design that is serviceable by Field Service representatives
- Provide enough detail to allow support groups (Drafting, Educational Services Development and Publishing, Test Personnel, Programmers) to do their jobs

People and Groups Involved

The engineer and Manufacturing 2x2 partner do not do it all themselves. They require the assistance and services of many support groups to accomplish their task. The people within the groups listed below have developed special expertise in their own areas. The assistance they offer is presented in detail in other sections of this manual.

- Design Engineer

- Manufacturing 2x2 partner

- Software Engineering

  Defines software user documentation; helps to define schedules to relate to major operating system releases; helps to define software interface; creates drivers and defines intelligent tests and standards; helps define engineering specifications for compatibility, migration, and new functionality

- Component Engineering
  Helps research and specify component needs

- Purchasing
  Helps with vendor selection, sourcing, and problem solving

- Engineering Services
  Provides manual and automatic design drafting assistance, watches drafting spending and acts as a communication link for all Engineering Services

- Standards and Methods Information and Control
  Provides copies of DEC Standards

- Technical Systems and Services
  Provides resources for optimizing the manufacturability of printed wiring boards, modules, and backplanes

- Diagnostic Engineering
  Assists in hardware/software tradeoffs and logic partitioning decisions; generates diagnostics for your product

- Model Shop
  Supplies fabrication in metal, wood, plastic, clay, and foam; assembles prototype modules, small assemblies, and cable harnesses; provides PC board modules, hand testers, low volume blasting of PROMs and ROMs

- Educational Services Development and Publishing
  Provides technical documentation planning, technical writing services, publication services, printing and distribution services

- Mechanical Engineering
  Designs packaging, evaluates materials, measures heat transfer and flow, tests connectors; designs castings and molded parts

- Industrial Engineering
  Performs industrial design, formulates appearance and product design concepts (panels, colors, etc.)

- Customer Service Systems Engineering
  Helps design support features and plans for field support (the Support Plan introduces the product to all Field Service offices)

- Reliability Engineering
  Provides early Mean Time Between Failure (MTBF) predictions

- Appropriate Process Engineering Group
  Consult your 2x2 partner about Digital's way of manufacturing and testing a new product; if necessary, Manufacturing can design fixtures and tools to facilitate the manufacture and testing of a new product

- Manufacturing Test Applications
  Assists in Hardware/Software decisions to generate diagnostics for Manufacturing applications

Even though you may not need the services of all the groups listed above, you should know how they can help and at what stage of product development you should seek their help. You may find all of these services in the index of this manual.

Tools

- Module Manufacturing Standard with PDQ Questionnaire (refer to DEC Standard 30)
- Functional Specification (refer to DEC Standard 009)
- Engineering Project Plan (refer to DEC Standard 009)
- Field Maintenance Plan (refer to DEC Standard 117)
- Manufacturing Plan (refer to Manufacturing 2x2 partner)
- Other applicable DEC Standards

A logic circuit, and mechanical design review should be held prior to ending this phase. People from outside the project attend these reviews, offer their advice and help you find problems.

A *preliminary logic design review* should be held as soon as possible after completion of the design and prior to generation of board(s) layout. The data should include the logic diagrams, some form of specification, timing diagrams of critical paths, etc.

A *preliminary circuit design review* (not applicable to pure logic using chips) should be held as soon as the circuit is designed and the supporting analysis and critical portions have been breadboarded, and prior to the generation of artwork and detailed packaging. The data available should include the schematic, parts lists, stress calculation, stability analysis, power requirements, MTBF (Mean Time Between Failure) estimates, and supporting test data.

A *preliminary mechanical design review* should be held prior to generating a complete set of drawings so that inputs from Manufacturing, Field Service, and other attendees may be considered. You should show sufficient detail in the project specification, or on a separate mechanical specification, to ensure that the design will meet all requirements. You may include sketches, models, mock ups, and/or assembly drawings, analysis, and calculations to show thermal and structural integrity.

3.3 PROTOTYPE EVALUATION

Objectives

- To build a prototype and test it
- To shake the bugs out of your design
- To determine preliminary compatibility of software operating system support

People and Groups Involved

- Engineering
- Software Engineering
- Component Engineering
- Model Shop
- Diagnostics
- Environmental Engineering
- Reliability Engineering
- Manufacturing Test Applications

Tools

- DEC Standard 181 (Backplane Development Process)
- DEC Standard 030 (Printed Circuit Manufacturing Specifications)
- DEC Standard 142 (Prototype Development Process details)
- DEC Standard 102 (Environmental Standard for Computers and Peripherals)

To build a prototype, you will probably need the services of the Model Shop. They have the facilities to assemble prototype modules, small subassemblies, wire-wrap, cables, harnesses, etc. The Model Shop is described in Section 5, paragraph 3.4.3.

Digital has environmental test chambers that test for heat, humidity, supply voltage, frequency, and other factors that affect product safety. These factors may be isolated or coupled. Outside test facilities are used for additional testing as required by the constraints of a project.

Your test strategy during the prototype phase depends on the intended market, the intended manufacturing process, and the product itself. Component Engineering, the responsible Process Engineering group (CPU, Disk/Tapes, Terminals, Cross Products), and the Reliability Engineering can help with test strategy. The Reliability Engineering can also help in statistical analysis. You will also need Diagnostics to help test your products. Ensure that Diagnostic Engineering's schedule meshes with your own.

When you are satisfied with your design, Reliability Engineering will evaluate engineering prototypes and/or initial manufacturing pilot units. Environmental Engineering and Acton Labs will do the testing required by DEC Standard 102. Refer to this standard for more information.

A *prototype test review* is held to examine the results of prototype testing and to draw conclusions from the test data. This information should be presented to the reviewers and corrective action should be discussed in detail.

NOTE

This review is held only if the prototype evaluation has changed the specification.

3.4 PRODUCT DOCUMENTATION

You must provide all the detailed information necessary to allow in-house people to develop all the documentation required to build, sell, support, and maintain your product.

Objectives

- To describe clearly, accurately, and completely the product you plan to build
- To ensure that adequate documentation is made available to all users and maintainers

People and Groups Involved

- Creators of Documentation
  - Design Engineers and Technicians
  - Engineering Services
  - PC Layout (manual and automatic)

  Manufacturing, Maintenance, and Engineering (Reference) Documentation

Design Engineers and Technicians
Training (Educational Services)
Field Service Marketing
Educational Services Development and Publishing — User and Service Documentation
Software Documentation
Advertising

- Users of Documentation
  - Manufacturing
  - Field Service
  - Training
  - Customers
  - Software Engineering
  - Field Service Depot Repair

- Maintainers of Documentation
  - Engineering Services (ECOs) – Manufacturing, Maintenance, and Engineering (Reference) Documentation

Educational Services	User and Service
Software Documentation	Documentation

Tools

- Functional Specification
- Field Service Philosophy
- Applicable DEC Standards
- Parts List (DEC Standard 025)
- Complete Parts List, including part descriptions for all assembly levels of the product
  - Parts List – Engineering Responsibility
  - Part Descriptions

Documentation is required to allow Manufacturing to make your product, Field Service to service it, and ECO (Engineering Change Order) Control to implement document changes when specification changes are made. User documentation allows our customers to buy the appropriate products and get the best use from our products.

You should contact Educational Services Development and Publishing, Software Documentation, Advertising, and your Engineering Services satellite supervisor when you are setting up your schedule. They can help you with your schedule and your budget for documentation.

In general, the more information you put into your specifications, drawings, and product descriptions, the faster and better the documentation job. The biggest problem in the technical documentation area is access to good information. Try to make yourself available to answer questions. Shortcuts, skimpy information, and sloppy drawings greatly degrade the documentation. All documentation must meet the requirements of DEC Standard 182 (Engineering Documentation Acceptance Criteria).

Clear and precise documentation allows our Field Service people to save money. Most important, it makes them more efficient. This is especially important since the supply of qualified people is limited. You will obtain a significant cost of ownership savings for your product's customers by making sure you get the best documentation possible.

PC layout may be manual or automated. The manual job takes an average of 10 to 13 weeks. The automated job takes less time. For hex boards made to DEC Standard 030 with fewer than 100 ICs, automated PC layout takes an average of 6 to 8 weeks.

A *final specification design review* is held to ensure that the specification is correct, complete and acceptable. The data supplied to the reviewers is a complete specification including drawings.

Once you sign-off your product documentation, your drawings go under ECO (Engineering Change Order) Control, and you must sign off any changes made after that. DEC Standard 100 describes the requirements for an Engineering Change Order.

Make sure that the Training Department (Educational Services) is aware of your product and is scheduled to give courses at the appropriate time. They can give you feedback on how much documentation is necessary. If you do not supply the Training Department with the information they need, they will have to write the training materials themselves at a greater expense and with less general usefulness. It will cost them more because often they have less information with which to work. And their final product will not be as useful because training materials do not receive the same kind of distribution that standard user manuals receive.

3.5 REQUIREMENTS FOR TESTING

Equipment for testing, procedures for manufacturing, and field fault analysis procedures must be made available for testing prototypes and first-manufacturing builds.

Objectives

- To ensure that proper manufacturing testing equipment and procedures are available
- To ensure that proper testing equipment and procedures are available for installation and service
- To balance the cost of manufacturing and servicing the product with the cost of testers and test programs over the life of the product

People and Groups Involved

- Engineering
- Manufacturing 2x2 partner
- Test Strategist
  A representative from the responsible Process Engineering group (CPU, Disk/Tapes, Terminals, Cross Products).
- Customer Service Systems Engineering
- Technical Systems and Services
- Environmental Engineering
- Software Engineering
- Diagnostic Engineering
- Manufacturing Test Applications
- Reliability Engineering

Tools

- Test Strategy
- Business Plan (for projected volume, see DEC Standard 130)
- Manufacturing Plan

The people involved at this stage of your project should combine their technical know how in developing the Manufacturing and Field Service Strategies.

The responsible Process Engineering group will take care of the test requirements for volume production. Testers and module fixtures are handled through Test Equipment Manufacturing (Process Engineering group in Acton).

Pre-release mechanical, logic, and circuit design reviews are held as necessary to examine the details of changes required in prototype builds as result of something observed in testing. These are held prior to release for production. The reviews may be combined if changes are minor.

3.6 MANUFACTURING

Manufacturing will build your product in volume. To make this happen, you must first introduce your product to Manufacturing. It is imperative that the Manufacturing facility building your product, and your 2x2 team partner, be identified early in the life of your project.

Objective

- To translate your design into a product our customers can use

People and Groups Involved

- Engineer
- Software Engineering
- Manufacturing 2x2 partner
- Field Service
- Responsible Process Engineering Group
- Diagnostic Engineering
- Manufacturing Test Applications
- Technical Systems and Services
- Producibility Committee
- Design Drafting
- Marketing (Product Lines)
- Relevant Plant's Materials Manager
- Purchasing
- Component Engineering
- Purchase Specifications

Tools

- Printed Circuit Release Flow (DEC Standard 142)
- Wire Wrap Backplane/Module Release Process (DEC Standard 181)
- Product Line Forecast (Brown Book)
- Purchase Specifications (Component Engineering)
- Business Plan (DEC Standard 130)

The following items are necessary for introducing a product into Manufacturing:

- Training for Technicians (Manufacturing Training Courses)
- In-Plant Support (Diagnostic Engineering)
- Diagnostics and Tester Software
  Major systems use Automated Computer Testing (ACT)
  (Software for such systems must be budgeted separately) or Automated Product Test (APT)
- Tapes for insertion, or templates (Manufacturing Tool Generation, Acton)
- Models if required (Model Shop)
- Multi-sourcing for new components
- Incoming inspection procedures and test equipment > Component Engineering
- Testing Procedures for components

The Engineer, Customer Service Systems Engineering representative, and the Product Manager, with the assistance of the systems programmers, diagnostic programmers, and Software Services people should have combined their efforts in supplying the proper installation procedures to the Educational Services Development and Publishing group handling your documentation needs.

The Educational Services Development and Publishing group needs time to publish that information prior to the product delivery date. When the product is operating properly, after installation and testing, it is then turned over to the customer.

After the first product is built, *final mechanical, logic, and circuit design reviews* are held to examine problems and to propose corrective actions early in production.

3.7 PRODUCT ANNOUNCEMENT AND FIRST CUSTOMER SHIP CRITERIA

Before a product may be announced and subsequently shipped to the first customer, you must ensure that it has been properly designed, tested, and manufactured. You must also ensure that all the necessary support facilities are prepared, that Digital is shipping a quality product that does what it is supposed to do, and is fully supported in the field.

The following items generally constitute the minimum criteria which must be met by Engineering for hardware product announcements and first customer ship.

Announcement Criteria

1. All pilot tests using specified production test facilities are carried out. All equipment and procedure problems are corrected.

2. System Evaluation Engineering tests to verify functional specification, as well as bus compatibility. The process is complete when System Evaluation Engineering has written the final report that states the product works on a system and there are no outstanding problems.

3. Product conforms to DEC Standard 102 (Environmental Standard for Computers and Peripherals).

4. Product conforms to DEC Standard 60 (DEC Policy: National and International Testing Labs).

5. Product conforms to DEC Standard 119 (Digital Policy and Practices Relative to Product Safety).

6. Run Time and Coverage goals are demonstrated by responsible Diagnostic Engineering group.

First Customer Ship Criteria

1. All acceptance tests are completed.

2. Scheduled first customer ship diagnostics are signed-off by Field Service, Engineering, and Manufacturing.

3. Digital Diagnostic Center (DDC) diagnostics are signed off by Field Service.

For more information about Digital's Product Announcement and First Customer Ship criteria, including responsibilities for Product Management, Marketing, Manufacturing, and Field Service, contact John Shebell at 223-3101 for a copy of the Corporate Policy for Product Announcement and First Customer Ship.

3.8 VOLUME SHIPMENT

The purpose of this phase is to produce the product in a steady state high volume manufacturing environment. The product is usually optimized through one or more ECOs (Engineering Change Orders).

3.9 · PRODUCT RETIREMENT

The purpose of this phase is to develop an integrated retirement plan which will be coordinated with further new product development activities. A Phase out plan is developed by the Product Manager, with support from the Product Lines, Manufacturing, and Customer Services. The new product that is planned to replace the phase out product will cover the transition period.

SECTION 4

LIFE OF A SOFTWARE PROJECT

1.0 SCOPE

This section contains general information for new software engineers regarding computer facilities, quality methodologies, the software development process, and the Phase Review process. For the development of software products, this section addresses:

a. Who is involved

b. What documents/activities are required

c. When the documents/activities are required

This section is not intended as a substitute for the more detailed *Software Development Policies and Procedures Manual.* It is intended only as a pointer to that manual by providing an introductory overview of the software development process (Contact Gladys Pannell, ML12-3/E80, 223-6720, for a copy of the *Software Development Policies and Procedures Manual*).

2.0 GENERAL INFORMATION

Computer Facilities

Computer facilities for software engineers are located in the Maynard Mill, Merrimack, Marlboro, Reading, and Tewksbury. Each facility has a set of machines and supplies to help you do your job. If you sit down with your project leader or supervisor, he or she can tell you where paper is stored, how you may schedule machine time, how to get an account number, how to report a machine malfunction, and how to get it repaired.

Each major software development group has an operations manager who oversees the equipment and supplies for your group. In the Maynard Mill, contact Don Crowther (ML5-5/C10, 223-6531) for

general information about base level machines, time sharing devices, etc. In Merrimack, contact Jim Friel (MK1-1/K09, 264-6601). In Tewksbury, contact Pauline Nist (TW/D19, 247-2123). In Marlboro, contact Steve Jablonsky (MR1-2/E69, 231-6377), and in Reading, England, contact Frank Jackson (RE/x205).

How to Develop Quality Software Products

Software Development uses certain processes and tools to ensure the quality of software products. For example, *code inspections* carried out periodically in the development of software attempt to spot problems before they become expensive problems. The more bugs found early in the development process, the easier it is to maintain the product later. In the published literature on this topic, one study has shown that an error that might cost $50 to fix in the requirements stage costs $1800 to fix in the integration and systems test stage.

One method of spotting problems early is the process of using *base levels*. Base levels are stepping stones in the development of software. The Project Leader plans and controls what goes into each base level. These are functional stages (i.e., each base level is a testable unit that can run alone) which build on one another until code is developed which has many functions. Because many people must work on code beside yourself, the practice of using base levels allows others to integrate their base level functions with yours at various stages of coding.

Tests are performed after base levels are reached to build confidence that the code does what it is supposed to do as it continues to evolve. A clear advantage in using base levels is that as each level is tested and finalized, later debugging of the complete code can be kept to a minimum.

To further ensure the highest quality in software products, Software Development uses a standard high-level language for software projects. For this purpose, *BLISS* is the preferred implementation language. BLISS implementations are normally cheaper and easier to maintain than assembly language implementations. They also offer opportunity for reasonable portability for part or all of the program under development. For more information about Software Development's policy on BLISS usage, see the *Software Development Policies and Procedures Manual*, Section 7A3-2.A.

Another method of ensuring the quality of software products is the process known as DECnet *certification*. Certification is a method of validating a product's ability to carry out its DECnet functions with all other DECnet products. The purpose of this method is to establish a single set of standards to maintain general interconnectability among DECnet products. It is also used to ensure the compatibility of products at the user level. As Digital grows, certification will be used for most software products.

Ensuring quality software products also includes meeting the *minimum ship criteria*. The minimum ship criteria must be met prior to the submission of a software product to the Software Distribution Center (SDC) for shipment to customers. Before submission to the SDC, there is a 30-day "code freeze" period during which a product is installed, verified, and tested. Minimum ship criteria which must be met during this period include installing and verifying the code and publications, checking size, performance, and compatibility, and testing the product in intended market environments. Be sure to allow enough time during the development process for these criteria to be met. Consult the *Software Development Policies and Procedures Manual*, Section 7A3-1.A, for full particulars regarding the minimum ship criteria.

Software product quality extends far beyond developing programs with few bugs. Quality represents a multitude of factors often overlooked by people developing programs. Ultimately, it is how our products are perceived in the marketplace by the user. To this end, Digital is working toward improved user perceptions of installability, ease of use, human engineering, performance, maintainability, compatibility, and reliability.

3.0 SOFTWARE DEVELOPMENT PROCESS

The Software Development organization has developed processes for orderly and effective development and support of our software products.

The flow chart in Figure 4-1, entitled Software Product Life Cycle, depicts software development from many perspectives. It includes the six phases of product life, the people and groups (internal and external to Software Development) who plan, develop, test, promote, sell, and service the product. It also shows the documentation and reviews* required for software products throughout their entire life cycle.

Each phase of development has a particular set of activities, and in each a particular set of well defined events, called milestones, occurs. Usually the beginning and end of a phase are marked by milestones.

The six successive development phases are:

0 Strategy and Product Requirements
1 Product Plan Development
2 Implementation (including internal testing)
3 Product Qualification (field testing) and Release
4 Product Continuation and Exploitation
5 Product Retirement

Many groups of people are involved in the development process. The Product Manager is the chief coordinator of the development of a software product. He or she is responsible for coordinating the actual development (design and programming) with other activities which impact the product, e.g., Marketing, Sales, Training, Documentation, and Software Services. In general, the Product Manager ensures that all affected groups have an identified contact person for the project, and that those people are kept apprised of important information relating to the project and product.

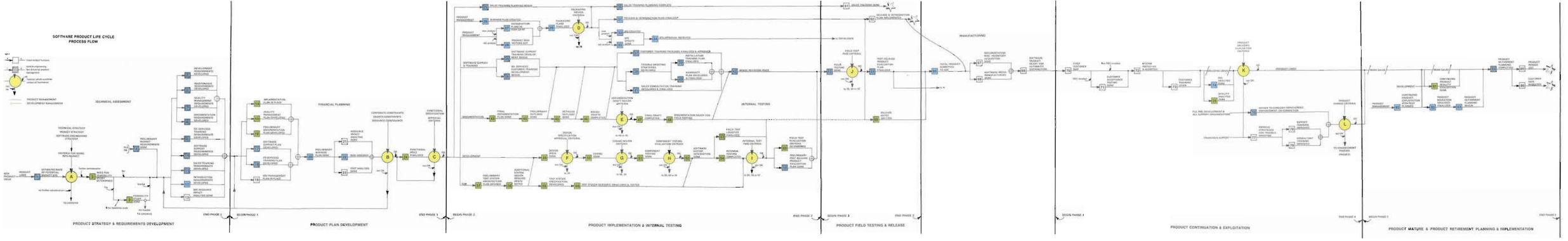
Note that not all projects have a Product Manager, but every project has a Project Leader. If there is no Product Manager, the Project Leader must establish communication with other support groups (Marketing, Sales, Training, Documentation, and Software Services).

The Program Manager, sometimes called the System Manager, makes sure that all development activities run according to schedule. He or she is responsible for the integrity of the system. While the Project Leader coordinates activities internal and external to Software Development, the Program Manager is responsible for coordinating internal development activities.

The actual design and development of the product remain the responsibility of the Software Engineers on the development team. The developers should view the Product Manager as a valuable team member and primary resource for expediting communication with other groups in the corporation. But developers must always remember that they remain fundamentally responsible for the success of the product as measured by the quality of the design and the success of the implementation.

In the development of a software project, the activities of various groups are concurrent. Greatly simplified, these activities are:

*See Section 4, Paragraph 4.0 for information about the Phase Review Process.


SOFTWARE PRODUCT LIFE CYCLE
PROCESS FLOW
PRODUCT MANAGEMENT
DEVELOPMENT MANAGEMENT
TECHNICAL ASSESSMENT
PRODUCT STRATEGY & REQUIREMENTS DEVELOPMENT
PRODUCT PLAN DEVELOPMENT
PRODUCT IMPLEMENTATION & INTERNAL TESTING
PRODUCT FIELD TESTING & RELEASE
MANUFACTURING
PRODUCT CONTINUATION & EXPLOITATION
PRODUCT MATURE & PRODUCT RETIREMENT PLANNING & IMPLEMENTATION
FINANCIAL PLANNING
INTERNAL TESTING

Group	*Activities*
Development	Plan, develop, test, package, release, and maintain a software product.
Software Quality Management	Represent user in-house by establishing quality goals, monitoring development activity, and assessing risk in shipping a software product.
Software Documentation	Write manuals for use by customers.
Software Distribution Center	Reproduce, stock, and distribute software and accompanying manuals.
Product Management	Manage the business aspects of a product throughout its life.
Software Services	Support customers in using a software product.
Educational Services, Software Services Training, Sales Training	Provide training courses for customers, employees, sales people and development personnel.

The software development process requires detailed documents at specified times. Consult the *Software Development Policies and Procedures Manual* for a complete list and description of all required documents. Four key documents are described below:

The *Project Plan* provides a conceptual overview of design objectives, an overview of required features both internal and external. It identifies interfaces with other projects and products, and it identifies all subsequent documentation requirements. It includes budgets, schedules, and staffing requirements. The Project Plan either contains the related plans or explicitly points to them. This document represents the commitments of the project.

The *Functional Specification* describes in detail the external characteristics of the software product. External characteristics are those observable to, or under the control of, the user of the product. All features of the system actively under the control of the user are defined. Those items which are only passively under user control, e.g., listing formats, diagnostic messages, etc., are described in sufficient detail to determine their applicability.

The Functional Specification is a design-to document and, as such, describes the product sufficiently for detailed design to commence. All hardware and software compatibilities, standards, compliances, dependencies, macro calls, interfaces, and files are identified as well as size and performance objectives. Furthermore, all known limitations or functional capabilities not implemented should be specified. This information should be sufficient for all support groups to proceed.

The *Design Specification* defines the internal design of a software product and becomes part of the Internal Maintenance Specification. It pinpoints the software technology involved and defines the internal structure and tables. It specifies intrasystem calls, delineates all interdependencies, and describes the method to be used for the implementation of the Functional Specification.

The Software Product *Business Plan* identifies and describes the software product to be developed, the goals and non-goals of the project, its assumptions and constraints, and the target

markets and applications for the product. It also includes an analysis of the competition, technological considerations and implementations, and a tabulation of the total five-year schedule for all products in your development group. The Business Plan also includes a quantitative summary that details product life-cycle costs, unit sales by product, and the projected revenue by the product. Project funding sources are included along with future needs for development funding. Finally, the Business Plan includes a section which addresses the issues, risks, and contingencies which may have an impact on your project.

4.0 THE PHASE REVIEW PROCESS

The Phase Review Process is a method used to manage software products. The process defines phases of a product's life cycle, specifying the plans, activities, and documents necessary at each phase. It helps to ensure that the documents exist and have been reviewed by the appropriate people and groups. Phase Reviews correspond to the end points of phases in the development process.

The Phase Review Process is the formal mechanism that brings together participants from each key group to acknowledge that the project(s) should proceed as planned. The process also serves to identify actions and responsibilities necessary to resolve issues that prevent a project's continuation.

The Phase Review Process is required for all software products and programs funded by Central Engineering.

The Product Manager, or in some cases, the System Manager, calls the meeting, chairs it, and documents the minutes within one week of the meeting. He or she then sends copies of the minutes to all attendees. Two weeks notice must be given to all attendees of a forthcoming meeting.

The Phase Review Process helps the Product Manager to:

- Coordinate strategies, plans, schedules, services, etc.
- Monitor all technical and support activities connected with a product's development to ensure that the product meets the functional requirements of the marketing organizations (Product Lines) and is consistent with their strategies
- Provide a return-on-investment calculations for approval of expenditures

The Phase Review Process monitors the status of a product during its entire life cycle. Product life consists of six phases (these are the same as the development phases), each with definite, associated activities. The descriptions of the phases which follow are intended only as brief overviews, and not complete lists of activities. Consult the *Software Development Policies and Procedures Manual*, Section 5D2-1A, for a complete list of documents and activities reviewed, people and groups involved, decisions made, and action taken following each Phase Review meeting.

Phase 0 Strategy and Product Requirements

The purpose of this phase is to explore and define a potential product or product enhancement by evaluating its technical, financial, and marketing implications. In some instances, a study is prepared to determine the project's feasibility. Development, Maintenance, Quality Assurance, and Documentation requirements are developed. Also developed are requirements for Educational Services Training, Software Services, Sales Training, and Advertising. A Software Distribution Center (SDC) Resource Impact Analysis is also prepared.

Phase 1 Product Plan Development

The purpose of this phase is to develop firm definitions of the product concept and to prepare the product and supporting activity plans. At the completion of this phase, groups are committed to product and support schedules, expense plans, design requirements, business forecasts, and distribution plans.

Phase 2 Implementation (including internal testing)

The purpose of this phase is to design and implement the product as committed with supporting services according to plan. Visible demonstrations, reports, test results, project reviews, etc., are compiled to provide confidence that the product meets the performance specification.

Phase 3 Product Qualification (field testing) and Release

The purpose of this phase is to confirm that the product meets the technical, market, and support objectives by external testing. Product announcements cannot be made until such a determination is made. Once the release criteria have been met, the Software Distribution Center (SDC) proceeds with software manufacture and customer distribution.

Phase 4 Product Continuation and Exploitation

The purpose of this phase is to continue monitoring the sales, maintenance, and delivery of the product. The product's profitability to the corporation is reviewed. Future enhancements to the product are planned based on market activity.

Phase 5 Product Retirement

Typically, this phase is considered as the Phase 0 of the replacement or enhancement product. When a product does enter this phase, action is initiated to retire the product from the market by reducing the support category and price. Shipment continues or the product is withdrawn from the Software Distribution Center (SDC).

A Phase Review meeting marks the end of each of the phases (a major change in strategy or market requirements is also cause for convening a phase review meeting). At the review meeting, participants and observers consider all aspects of the product's status and decide if the product should proceed to the next phase. Criteria for moving a product into the next phase include:

a. The satisfaction that all of the requirements for the present phase have been fulfilled
b. The acknowledgement of commitments from organizations involved in the next phase

The following table illustrates the documents and activities to be signed off by the responsible people and groups during each phase of the Phase Review process. A full list of attendees, decisions, and actions at each Phase Review meeting is contained in the *Software Development Policies and Procedures Manual*, Section 5D2-1.A.

Table 4-1 Documents/Activities for Phase Review Meetings

DOCUMENT/ACTIVITY	*PHASE*	*WHO SIGNS OFF*
Market Requirements & Product Requirements	0 0	Product Line Mgrs & Product Mgr
Preliminary Project Plan(s)	0	Documentation Mgr & Product Mgr
Preliminary Business Plan	0	Product Mgr
Product Plan Project Plan(s), final	1	Product Mgr, Documentation Mgr, Development Mgr, Standards Rep, Software Quality Mgr
Project Authorization Forms	1	Product Mgr, Documentation Mgr, Development Mgr, Financial Rep
Functional Specs, final	1	Development Mgr, Product Mgr, Standards Rep, Software Quality Mgr
RAMP Plan	1	Development Mgr, Software Services, Software Quality Mgr
Q/A Plan, final	1	Development Mgr, Software Quality Mgr
Preliminary Support Plan	1	Product Mgr, Development Mgr, Software Services, Software Quality Mgr
Preliminary Training Plan	1	Product Mgr, Development Mgr, Software Services, Software Quality Mgr
Preliminary Promotion and Introduction Plan	1	Product Mgr, Development Mgr, Software Services
Internal Test Plan, final	1	Product Mgr, Development Mgr, Standards Rep, Software Quality Mgr
Preliminary Field Test Plan	1	Product Manager, Software Services, Software Quality Mgr
Preliminary Documentation Plan	1	Development Mgr, Documentation Mgr, Software Quality Mgr
Business Plan, final	1	Product Mgr
Preliminary Migration Plan	1	Product Mgr

DOCUMENT/ACTIVITY	*PHASE*	*WHO SIGNS OFF*
Software Product Description, final	2	Product Mgr, Software Quality Mgr
Release Plan, final	2	Product Mgr, Software Distribution Center
Pricing Plan, final	2	Product Mgr, Product Line Marketing Comm
Sales Training Plan, final		Product Manager, Sales Training
Internal Test Results Review	2	Product Manager, Development Mgr Software Quality Mgr
Field Test Plan, final	2	Development Mgr, Product Mgr, Documentation Mgr, Software Services, Software Quality Mgr
User Documentation, final draft	2	Product Mgr, Development Mgr, Documentation Mgr, Software Quality Mgr
Documentation (for Software Support),	2	Product Mgr, Development Mgr, final Software Services
Support Plan, final	2	Product Mgr, Development Mgr, Software Services, Software Quality Mgr
Training Plan, final	2	Product Mgr, Development Mgr, Educational Services, Software Services, Software Quality Mgr
Software Distribution Center Plan		Product Mgr, Development Mgr, Software Distribution Center
Sales Update Article, final	3	Product Mgr, Software Quality Mgr
Digital Software Dispatch Article, final		Product Mgr, Software Quality Mgr
Field Test Results Reviewed		
Software	3	Development Mgr, Product Mgr, Software Services, Software Quality Mgr
Documentation	3	Development Mgr, Documentation Mgr, Software Quality Mgr

DOCUMENT/ACTIVITY	*PHASE*	*WHO SIGNS OFF*
Installation	3	Software Services, Development Mgr, Software Quality Mgr
Customer Training Services	3	Product Manager, Educational
Software Distribution Center Plan, finalized and approved	3	Product Mgr, Software Distribution Center
Sales Training Complete	3	Product Mgr, Sales Training
Entire Product Verification Completed	3	Product Mgr, Documentation Mgr, Software Quality Mgr
Product Post-Release Evaluation Plan Finalized	3	Development Mgr, Software Services, Product Mgr, Software Quality Mgr
Software Product Description Approved	3	Development Mgr, Software Services, Product Mgr, Software Quality Mgr
Minimum Ship Criteria	3	Development Mgr, Product Mgr, Software Services, Documentation Mgr, Software Quality Mgr
Release Plan Approved	3	Product Mgr, Development Mgr, Software Distribution Center
Product Evaluation	4	Product Mgr, Software Services, Development Mgr, Documentation Mgr, Software Quality Mgr
Preliminary Retirement Plan	4	Product Mgr, Product Line Marketing Committee
Product Retirement Plan, final	5	Product Mgr, Product Line Marketing Committee

The *Software Development Policies and Procedures Manual* will change as we change or gain a better understanding of our operation. It is quite possible that you, in your work at Digital, may be directly or indirectly involved in formulating or updating these policies. All the policies and procedures serve one overall purpose: to make it easier for all of us to exchange information that will help us produce top quality Digital software products.

SECTION 5

OFFICE OF DEVELOPMENT/ENGINEERING

As a new engineer you will often need to contact Engineering groups outside your local domain for assistance and services. The following pages describe the functions of various Engineering groups. Information is provided to help you determine when to contact a group and who to contact. Ten organizations make up the core of Engineering at Digital.

1.0 Computer Systems Development

2.0 Software Engineering

3.0 Technical Operations

4.0 Systems Architecture and Technology

5.0 LSI Manufacturing and Engineering

6.0 Storage Systems Development

7.0 Distributed and Mid-Range Systems Development

8.0 Large Systems Product Development

9.0 Corporate Research Group

10.0 External Resources

1.0 COMPUTER SYSTEMS DEVELOPMENT
Manager: Dick Clayton (ML1-2/E60, 223-3638)

1.1 PLANNING AND PRODUCT MANAGEMENT
Manager: Stan Pearson (ML12-2/E71, 223-2424)

This organization provides product management, product marketing, and strategic product planning for LSI products, video and hard copy terminals, and small hardware systems. They manage the processes by which these products are developed, announced, and introduced to the marketplace. The organization prepares and obtains formal approval for integrated product plans. They regularly mea sure progress against these plans, taking corrective action as required to preserve the objectives of each plan. Planning and Product Management also generates pricing strategies, and prepares sales updates to introduce new products or make changes to existing ones.

Product managers for products developed within Computer Systems Development are listed below.

LSI	Dick Loveland (ML12-2/E38, 223-7107)
Terminals	Ed Lazar (ML1-2/E29, 223-8927)
Small Hardware Systems	Ted Webber (ML1-2/E29, 223-7155)

1.2 LSI (LARGE SCALE INTEGRATION) DEVELOPMENT
Manager: Roy Moffa (ML1-2/H26, 223-3295)
Development Manager: Mike Titelbaum (ML1-2/E65, 223-3477)

This group manages the identification, specification, and development of PDP-11 MOS microprocessor chips and support chips for microprocessors (the LSI-11/23 and others).

The group consists of three technology development teams headed by Duane Dickhut (ML1-2/E65, 223-4304), Michel Depyrot (ML3-3/B91, 223-2996), and Bob Supnik (ML1-2/E65, 223-9439).

Questions about specific applications of microprocessor devices should be directed to the team managers above, Mary Ellen Lewandowski (ML1-2/E65, 223-6523), or Mike Phipps (ML1-2/E65, 223-4274). These individuals can help you focus on controller or system applications for the best use of designed microprocessor chips.

Additionally, contact Maurice Marks (ML3-5/E82, 223-2679) about microprocessor software and hardware development tools, and Gerry Dulaney (ML1-2/E65, 223-8574) about the availability of microprocessor chips. Questions concerning the MOS process or circuit design should be directed to the Microproducts group.

1.3 ADVANCED LSI ARCHITECTURE
Manager: Steve Teicher (ML4-3/T34, 223-3175)

The task of the LSI Architecture group is to work with engineers from Small Hardware Systems and LSI Development to develop a set of plans for building a 32-bit system that uses a LSI chipset. Once the chipset plans are in place, the group will specify other elements of the system, including storage systems, packaging, and communications.

1.4 TERMINALS

Manager: Dick Clayton (acting), (ML1-2/E60, 223-3638)

This group designs and develops both video and hard copy, high-volume, terminal-oriented products. Such products include the VF100, LA34, LA120, etc. The group focuses on advanced development, product development, corporate level product support, and planning for terminals strategy. The group's products require some of the highest volume electromechanical and plastics tooling in Digital. The group regularly supplies a customer level product design to Manufacturing. They also supply basic terminal components to which other groups add some function or specific application.

Contact the group for solutions to problems associated with designing, manufacturing, or using Digital's high-volume terminal products.

1.4.1 Terminals Technical Integration

Manager: Dick Clayton (acting), (ML1-2/E60, 223-3638)

This group provides technical leadership and management for common terminal components and architectures. Problems or requirements for keyboards, terminal communication features, standards, etc., associated with high-volume terminal products are handled by this group.

1.4.2 Hard Copy Terminals

Manager: Art Williams (ML1-3/E62, 223-3954)

This group designs printer terminals, including keyboards, heads, mechanisms, and packages, and is responsible for high-volume buyout line printers. They work closely with Manufacturing and Marketing.

Contact group members when you want advice about selecting specialized products, or if you need help in modifying a terminal. Group members can also evaluate vendor terminals (e.g., printers and card readers) that you may be planning to acquire.

Other groups within Hard Copy Terminals Engineering include:

Group	*Manager*
LA 34 Products	Frank Digilio (ML1-3/E62, 223-3778)
LA 120 Products	Paul Nelson (ML5-3/E12, 233-3528)
VT 162 Products	Dick Brewer (ML5-3/E12, 223-8448)

Printer Engineering Advanced Development, headed by Walt Tetschner (ML5-3/E12, 223-6788), performs technical explorations which support printer product development. Some examples of the work performed by this team include new keyboard technology, alternate printing technologies (thermal, electrosensitive, and electrophotographic), and extensions of impact matrix printing.

Contact group members during the planning and concept stages of your project with a description of your product plans and needs.

1.4.3 Video Development

Manager: Len Halio (ML1-2/H26, 223-5687)

This group designs and develops video products that can either serve as entry-level devices or be upgraded to more sophisticated systems. The group has three areas of concentration: video display

terminals, advanced terminals, and graphics. Contact the team leaders or the group manager when you are building or modifying a video terminal, or when you need general information on video or graphic architectural techniques.

The *Base Video* team, headed by Craig James (ML1-2/H26, 223-3915), is responsible for the design and development of interactive video display terminals. The VT100 video terminal that is presently offered is basic, i.e., it lacks intelligence. However, it has many features not found on competitive entry-level terminals, and it can be upgraded to higher levels of capability.

The *Advanced Terminals* team, headed by Len Halio (ML1-2/H26, 223-5687), is responsible for developing a new family of programmable, terminal-based systems.

The *Graphics Terminals* team, headed by John Elsbree (ML1-2/H26, 231-6939), is responsible for video-based graphics devices that include graphic terminals, graphic architecture, and ancillary graphic devices.

1.5 SMALL HARDWARE SYSTEMS DEVELOPMENT

Manager: Herb Shanzer (ML1-2/E60, 223-5159)
Development Manager: Avram Miller (ML1-2/E60, 223-9441)

Small Systems Development is responsible for systems products which sell for 16K or less. This includes the 11/23, 11/03 and PDT 150, PDP-11 based systems, and all PDP-8 products. Design responsibility includes not only the specific CPU hardware, but integration of complete systems offerings including software, peripherals, and packaging.

1.5.1 PDP-11 Systems Development

Manager: Lou Klotz (ML1-2/E60, 223-3471)

The PDP-11 Systems Development group develops 11/03, 11/23 and PDT systems, and Q-bus options that are of a cross-product nature, or that have sufficient product line volume to support central engineering development. The team supports existing LSI-11 products and is involved in advanced products that include system development and custom LSI development of both CPUs and special function controllers.

1.5.2 PDP-8 Systems Development

Manager: Paul Gardner (ML1-2/E60, 223-5937)

The PDP-8 Systems Development group is responsible for all PDP-8 products, integrated systems such as the VT-78 and Omnibus, and Micro-8 products. They develop new PDP-8 products and bounded systems, support existing products, and provide engineering support to product lines developing PDP-8 based products.

1.5.3 Mechanical Design/Advanced Development

Manager: Dick Gonzales (ML6B-2/E66, 223-4822)

This group provides mechanical engineering support in the development of products by Small Systems and Video Products. They also offer their services companywide for non-standard applications, i.e., the development of a single product for one product area or product line.

Group members stay abreast of new design techniques that might facilitate development of new products. They engage in advanced development of electromechanical devices and packaging techniques. They perform value-engineering reviews in accordance with DEC Standard 007. In addition, the group seeks to establish leadership and direction in plastics technology and its application.

Contact Dave Boudreau (ML6B-2/E66, 223-2257) if you want information about plastics technology or if you are interested in the direction of Digital's involvement in plastics fabrication.

1.5.4 Advanced Development
Manager: Russ Moore (ML1-2/E60, 223-4676)

This group is responsible for investigation and predesign studies on those systems issues which are crucial to our next generation products. Areas of activity include working with the CPU chip development group, bus structures and implementation, self-installability and ease of use, and packaging and manufacturing issues.

1.5.5 Small Systems Diagnostic Engineering
Manager: Dan Casaletto (ML21-4/E10, 223-3618)

This group (SSDE) supports the product development activities of Small Systems and Video Products. Specific products supported include PDP-8 and low-end PDP-11 CPUs, peripherals, and systems. The group also supports video and hard-copy terminals, printers, and LSI microprocessors.

This support includes hardware design consultation (for testability), micro coding skills, design verification, and prototype debug support for hardware engineering. The group provides unit, subsystem, and system test software to Manufacturing. They also provide repair, installation, preventive maintenance, software, and software packages to Field Service.

Small Systems Diagnostic Engineering provides testing for all hardware from the unit level through systems test. To accomplish this, SSDE works with other diagnostic engineering groups responsible for chip testing, automated program load system for Manufacturing, and system test tools.

2.0 SOFTWARE ENGINEERING
Manager: Bill (B.J.) Johnson (ML12-3/A62, 223-3982)

2.1 REAL-TIME/COMPUTATIONAL (RT/C) SOFTWARE SYSTEMS
Manager: Bill Heffner (TW/E10, 247-2701)

This organization develops competitive real-time and computational software products. They provide other Digital groups with base-level software systems on which these groups can build products. The RT/C organization includes four product development groups that design, implement, maintain, and enhance software products. Also included are product and quality management groups, and a publications group that develops user documentation.

Descriptions of these groups follow. Contact the appropriate group when you need information about products being planned or developed. Additionally, contact them when you identify future requirements that can be met by this organization's expertise.

2.1.1 Base Systems Quality Management
Manager: Brad Glass (TW/E10, 247-2700)

This group is responsible for software quality program definition and implementation for base systems software. Group activities include quality and test planning, all software field tests, product assurance, test systems development, and performance measurement of the VAX/VMS, RSX, and Small Systems (RT-11, FMS-11, etc.) software.

The group's emphasis is on providing a user-oriented, quality perspective of software development activities.

2.1.2 Software Product Management
Manager: John Rose (TW/E10, 247-2171)

This group is responsible for assessing the needs of the marketplace and defining what products (or enhancements to products) are required for the marketplace, and determining what proportion of money should be spent in each area of the Base Systems Software organization to accomplish their goals.

Product Management is also responsible for developing and tracking product business plans, and for initiating promotional activities in support of Product Lines and Sales. Product Managers are also responsible for orchestrating the Phase Review Process. All of these activities are accomplished with the support of many persons in groups throughout the corporation. Having limited resources of its own, Product Management is primarily an initiator, motivator, participant, and organizer of the above activities.

2.1.3 Small Base Systems Software
Manager: Gil Steil (ML5-5/E76, 223-5150)

The Small Base Systems Software group specifies, designs, implements, tests, and supports small real-time operating systems, intelligent terminal software, chip and board software, BASIC and PASCAL language implementations, all PDP-8 software (except word processing and typeset), some terminal firmware, and special, directly-funded software products.

The group also produces and manages the system plans for PDT-11 software, firmware, micro-computer software, and RT-11 software.

2.1.4 VAX/VMS Systems Development
Manager: Joe Carchidi (TW/D08, 247-2251)

This group develops and maintains operating system software for the VAX-11 family of computer systems. The software is general enough to serve as the base system for all market-oriented VAX-11 software products.

The group is also responsible for ensuring that all VAX-11 software products are perceived by customers as part of one, high-quality product offering. In some cases, they control the integration and release process for software.

2.1.5 RSX Systems Development
Manager: Frank Hassett (TW/C10, 247-2151)

This group develops, produces, and maintains a comprehensive and competitive set of real-time products as well as common base systems upon which other Digital products can be built. RSX Systems are concerned primarily with operating systems. However, the group works to ensure a total product set. In other words, the individual real-time products support auxiliary software products (including languages, networks, and data base management systems) so that the combination constitutes a competitive set.

The group is also responsible for the Record Management System (RMS) software for RSX, IAS, VMS, and RSTS systems.

2.2 COMMERCIAL ENGINEERING
Manager: Bob Daley (MK1-2/H03, 264-6183)

Commercial Engineering has a number of development functions, many of them software, some hardware. The organization's primary mission is to make high quality commercial systems and products a reality within Digital's total commercial market place. Thus, the organization's focus is on total program/system implications and integration issues, as well as life-cycle costs. To implement this objective, the organization translates commercial market requirements into integrated system strategies for centrally developed products. Commercial Engineering is responsible for the success of these products.

The organization's major developmental efforts are in commercial small systems, commercial timesharing systems, transaction processing systems, data base and data management, languages, compilers, and application software. Various groups also develop tools and methodologies, carry on program management, and coordinate and integrate all of Digital's centrally developed commercial systems and products, as well as those applications of interest to specific product lines.

Groups engage in such activities as coordinating and optimizing technical activities between product line engineering and Central Engineering groups, conducting schedule reviews, and communicating system, program, and product development activities to various product lines. The organization encourages the development of an environment that allows for cooperation among all groups oriented toward commercial engineering.

Brief descriptions of the five groups within Commercial Engineering follow. Contact the appropriate group managers when you have questions concerning their respective areas of expertise.

2.2.1 Software Quality Management
Manager: Ed Spuler (MK1-2/C02, 264-6720)

This group establishes objective, quality assessments for all products produced within Commercial Engineering. The group's responsibility also extends into other areas of the company on which Commercial Engineering depends for sub-systems and layered products.

The group also establishes methodologies for testing products, and quality metrics that can be used during the development cycles to help build quality into all Digital products.

Quality extends beyond the range of development. The group also ensures for quality through the maintenance of existing products, service in support of those products, and training, promotion, and sales efforts.

Specific to the development process, Software Quality Management monitors and participates in schedule reviews, the phase review process, field tests, and the verification and validation of final product specifications.

2.2.2 Commercial Systems & Information Management

Managers: Doug MacLean (MK1-2/H3, 264-6167)
Fred Howell (MK1-2/H3, 264-6023)

This group is responsible for information management and general purpose systems for commercial data processing. To carry out these responsibilities, the group develops certain software products and provides strategy and program management for development work performed by other engineering groups.

There are two major programs for which the group is responsible, Corporate Information Management Strategy and the Commercial VAX program. The group develops such products as DBMS, Datatrieve, RSTS/E, and Commercial Application/Terminal Support (CATS).

Contact this group on any of the following topics:

- Current or planned capabilities of any of the products listed above
- Hardware support of the RSTS/E operating system
- Commercial data processing capabilities of VAX and VAX/VMS systems
- Corporate Information Management Strategy

The Commercial Systems & Information Management group can provide you with project plans, functional specifications, technical strategy documents, and related materials.

2.2.3 Commercial Applications Systems

Manager: John T. Morgan (MK1-2/A08, 264-5672)

This group builds and supports software application systems, application packages, and application development tools. They also support certain mature software systems. To perform these activities, the group builds applications and customer application development aids using layered products and base systems.

The group develops interactive information processing systems and transaction processing systems (TRAX products, TMS-11, CMS-11, CPMS-11, TABS-11/ICS) on PDP-11 and VAX-11 processors. These processors are capable of terminal configurations which are used in such industries as newspaper publishing, manufacturing, and transportation.

Their application packages (e.g., ASSIST-11,) are interactive products installable on standard PDP-11 and VAX-11 systems. These products are used for such functions as telephone operator directory assistance and newspaper control.

The group also develops application development systems and tools to be used by customers for applications in their own environments.

2.2.4 Commercial Hardware Systems Engineering
Manager: Brian Fitzgerald (MK1-2/H32, 264-5553)

This group is responsible for the design, development, and support of PDP-11 and VAX-11 based hardware computer systems and related products that are used in commerical applications. Commercial computer configurations are designed around standard products developed by other engineering groups which conform to the corporate engineering strategy and design standards.

Commercial Hardware Systems Engineering integrates the appropriate corporate products and designs additional equipment as necessary to support commercial market requirements. This work may be accomplished directly, or through the services of other engineering organizations.

2.2.4.1 Diagnostic Engineering – Merrimack
Manager: Bob Misner (MK1-2/B06, 264-5949)

This group develops hardware diagnostic programs for peripherals developed or supported by engineering groups in Merrimack. These groups presently include Communications Engineering, Graphic Arts Engineering, Business Products Engineering, and Word Processing Engineering. Additionally, the group develops hardware diagnostics for Merrimack's turnkey and packaged systems.

The Merrimack Diagnostics group develops on-line diagnostics in support of any operating systems or special application packages engineered in Merrimack.

Programs developed are used for engineering design verification, Manufacturing (high-volume Final Assembly & Test), and Field Service.

2.3 10/20 SYSTEMS AND CORPORATE LANGUAGES
Manager: Dick Snyder (MR1-2/E37, 231-5062)

This organization develops virtually all languages for Digital's computers, from the PDP-11 through the largest DECsystem 10/20. There are primarily two divisions within the organization, Technical Languages and Commercial Languages. Additionally, the organization is composed of a 10/20 Operating Systems and Data Management group, and a Software Quality Management group.

2.3.1 Technical Languages
Manager: Norma Abel (MR1-2/E37, 231-6279)

The Technical Languages group is responsible for the compilers and object time systems for the PDP-11, VAX, and DECsystem 10/20 for "technical" languages. These languages include FORTRAN, APL, and PASCAL.

The group is located at two sites, Marlboro and Tewksbury. Bill Page (TW/C10, 247-2175) heads the Tewksbury group.

2.3.2 Commercial Languages
Manager: Jeff Rudy (MK1-2/J5, 264-6680)

This group develops and maintains language processors for several different computer languages. The languages are generally those that have industry-wide appeal in the development of commercial applications, although they are not limited to that area. Such languages include BASIC+2 and COBOL.

The group is also involved in the development of key utilities applicable to the use of compiler languages. These include SORT, VAX, Common Run-time Library, and the DEC Standard Editor.

They also address issues related to compatibility both within Digital and industry wide. Members of the group hold positions on numerous industry, architecture, and company standards committees.

Contact this group on questions or issues related to the products listed above. Commercial Languages can also provide more information regarding Standards in the areas of BASIC or COBOL languages, and the DEC Standard Editor.

2.3.3 10/20 Systems Software

Manager: Ron Criss (MR1-2/E37, 231-5243)

The 10/20 Software Systems group has within it the Operating Systems Group and the Data Management Group.

The Data Management Group is responsible for DBMS 10/20, RMS, and Macro/Link.

The Operating Systems Group, managed by Peter Hurley, (MR1-2/E37, 231-6183), includes:

The TOPS-10 team, supervised by Craig Fletcher (MR1-2/E37, 231-5008), is responsible for TOPS-10 monitor and TOPS-10 support utilities.

The TOPS-20 team, supervised by Sumner Blount (MR1-2/E37, 231-6328), is responsible for TOPS-20 monitor and TOPS-20 support utilities.

The GALAXY team, supervised by Larry Samberg (MR1-2/E37, 231-6338), is responsible for the BATCH, spooling, and network utilities for both DECsystem-10 and DECSYSTEM-20 products.

The Release Engineering team, supervised by Arthur Zina (MR1-2/E37, 231-5116), prepares DECSYSTEM 10/20 software for release to the Software Distribution Center (SDC). The team also ensures that components for 10/20 software products are complete and consistent for general release.

2.3.4 Software Quality Management

Manager: Richard Glantz (MR1-2/E37, 231-6031)

Software Quality Management ensures that for every high-volume software product developed in Marlboro:

- quality levels are specified in advance
- project plans offer a reasonable certainty of attaining these quality levels
- compatibility exists between customers' expectations and the commitments made by Software Engineering
- final products can meet their projected quality goals
- there is a process for gathering and introducing customer opinion into the overall development cycle

The group participates in the Phase Review process where problems can be discerned at an early stage before they become expensive problems. Members participate in the quality assurance segment of project plans, and both plan and monitor load test, field test, and release metrics.

2.4 SOFTWARE PUBLICATIONS

Managers: Norm Brimhall (ML5-5/E39, 223-4576)
Steve Heiser (MR1-2/E37, 231-5343)
Jim Padian (MK1-2/H03, 264-6816)
Armen Varteressian (TW/A14, 247-2056)

Software Publications is located in Maynard (Distributed and Mid-Range Systems), Marlboro (10/20 Systems), Merrimack (Commercial Engineering), and Tewksbury (Base Systems Software).

Composed of writers, editors, and production people, these groups are responsible for generating and maintaining software manuals for customers at all levels of experience. Members of the groups possess literary, technical, and production skills. Collectively their responsibilities include the planning, organization, completeness, accuracy, appropriateness, readability, and appearance of software publications.

To effectively design a software manual, groups gather information from software and hardware engineering, the product lines, software quality management, Software Services training, DECUS, and visits to customer sites.

These groups maintain a close professional relationship with other document-producing groups within Digital to promote compatibility, consistency, and uniformity among software and hardware manuals.

2.5 APPLICATION SYSTEMS GROUP

Manager: Ollie Stone (ML21-3/E87, 223-6617)

This group develops hardware and software application systems for the Retail Products Group, the Telephone and Utilities Group, other product lines, Manufacturing, Field Service, Engineering, and other organizations. As a systems engineering resource, Application Systems supports their systems by providing training, bug fixing, consultation, and other similar services.

Most of this group's application systems require high availability and reliability. These applications represent major investments in hardware and software development. For this reason, predictability of costs and schedules is imperative. To ensure such predictability, the group follows a written agreement on project functionality. The development process also ensures a continuous review of market requirements, resulting in high quality systems which are both on-time and within the budget.

Most of the projects undertaken by the group involve a PDP-11 as the base computer, and usually RSTS and BASIC+ as the base software, sometimes using RT-11 or RSX. The group has done some DECsystem-10 development and will be involved in numerous PDP-8 systems this coming year. Other expertise ranges from micro assembler (8080, 2901), through macro, to high level languages (FORTRAN, COBOL, PL/I).

The group has three teams which provide service in specific areas. Contact the managers listed below for more information.

Customer Applications	Tom Hayden (ML21-3/E87, 223-4408)
Internal Special Systems	Eve Bartis (ML21-3/E87, 223-2126)

Retail Products Development Gary Cole (MK1-1/A06, 264-7478)
Jack Lockhart (MK1-1/A06, 264-7487)

2.6 SOFTWARE ARCHITECTURE AND TOOLS

Manager: Bill Keating (ML12-3/A62, 223-7773)

This group is responsible for the management and coordination of Software Architecture. They own various architectural processes and provide technical leadership to resolve key strategic and implementation issues within Software Development. In addition to coordinating various software advanced development activities, the group provides tools and other means to improve the effectiveness of software development.

Contact the group for solutions to major software architectural problems. The group will also help you understand the process in place, and take suggestions relative to software advanced development.

2.6.1 Base Systems, Architecture, and Interface Management

Manager: Bob Bellman (ML12-3/A62, 223-5315)

This group creates and administers Base Systems and Interface Management Policies which govern the development of certain base system software, software layered on top of those systems, and software supporting key interfaces. The group also assists in the development of major software architectures, particularly those that require inter-organizational efforts.

Contact this group for assistance in planning projects that may affect base systems or key interfaces, in coordinating inter-organizational software projects, and in developing architectures in such areas as data management or distributed processing.

2.6.2 Hardware/Software Coordination

Manager: Jim Kapadia (ML12-3/A62, 223-7463)

This group is primarily responsible for coordination and planning between hardware and software. They try to minimize disjointed planning between the two by facilitating and influencing compatibility among plans, strategies, and activities. They also help resolve issues common to both hardware and software by providing a common point of interaction. The group addresses global issues impacting hardware and software, and over the long range, provides needed decisions for smooth and efficient cooperation between the two.

Contact this group when there is an inconsistency between hardware and software plans (e.g., release dates, funding, support, etc.), products (e.g., design, architecture), strategies, or activities. The group will facilitate communication between the appropriate individuals and help resolve the issues. Proper visibility and focus will be provided to help achieve resolution.

2.6.3 Software Methods And Tools

Manager: Bill Segal (ML3-5/E82, 223-2433)

This group promotes the use of proven, state-of-the-art software engineering methods where applicable within Digital. They also develop and support tools for software engineers with a primary focus on increasing productivity and software quality and descreasing software life-cycle costs.

The Methods and Tools group will provide specific software tools along with documentation, training, and support as needed. Additionally, the group is interested in consulting on any area within their expertise such as implementation languages, debuggers, text processors, and software methodology.

Contact the group for information or support on any of the following:

- BLISS Compilers and Utilities
- DEC Standard RUNOFF
- Debuggers for VAX and PDP-11
- DIAMOND (Performance Measurement System)
- Electronic Mail System (DEC MAIL)
- Magnetic Tape Interchange
- Microfiche Utilities
- Documentation Tools
- Program Library Tools
- Transportable Software
- Software Methodology
- BLISS and MACRO-11/780 Coding Conventions

3.0 TECHNICAL OPERATIONS

Manager: John Holman, (ML12-2/T36, 223-5533)

3.1 POWER AND PACKAGING SYSTEMS

Manager: Phil Tays, (ML11-4/E53, 223-4144)

Power and Packaging Systems provides Engineering and Manufacturing groups with many key services. Groups within Power and Packaging Systems design power supply, power distribution, and power conditioning systems. They design and develop product packaging, conduct physical testing in six specific laboratories, and design Digital's products with attention to human factor analyses and product aesthetics. Power and Packaging Systems also tracks U.S. and international regulatory requirements.

3.1.1 Power and Packaging Product Management

Manager: Joe Smith, (ML8-3/T13, 223-8793)

This organization has product management responsibilities for many of the power supplies and cabinets developed by Power and Packaging Systems. They act as an intermediary among the entire group and outside organizations when one or more services are needed.

Product Management can help you determine hardware availability for power supplies and mechanical enclosures. They can also help you prepare business plans and proposals for hardware development.

Contact this group to gain an understanding of the existing families of packaging products which may apply to your design. To meet new power and packaging requirements, contact Product Management as early as possible in the product concept phase.

3.1.2 Packaging Development and Support
Manager: Jim Lawrence, (ML8-3/T13, 223-6744)

These groups are involved with the design, development, and support of mechanical interconnections, cabinets, packaging enclosures, shipping packages, and packaging test equipment. They evaluate heat transfer and acoustical performance, packaging materials, and are responsible for the Central Engineering environmental testing facilities. The individual groups which follow form the bulk of the organization and perform the indicated functions.

3.1.2.1 Interconnection Hardware Development
Manager: Jim Lawrence, (ML8-3/T13, 223-6744)

The development and support of interconnection products like connectors, cables, and device packaging are the primary responsibilities of this group. They also devise new backplane techniques and high-power connectors. The group monitors information about new materials, often evaluating the materials, and distributes information about their applications and reliability. Additionally, Interconnection Hardware Development assists in the development of the wet-process for printed circuit fabrication.

Contact this group during the concept stage of your project if you need their assistance.

3.1.2.2 Central Mechanical Engineering
Manager: Don Staffiere, (ML11-4/E53, 223-8656)

This team develops and implements new mechanical packaging concepts in cabinets and enclosures. Members design, develop, and maintain cross-product enclosures. Furthermore, they upgrade and modify existing products to meet evolving international safety and regulatory requirements; they analyze, evaluate, and resolve problems identified by Field Service and Manufacturing that relate to existing mechanical enclosures. They also support the manufacturing process for mechanical assemblies. Additionally, the team develops guidelines and standards for cabinet cabling and stability. They also work with Thermal Engineering to establish cooling guidelines for enclosures.

Team members also serve in a central mechanical engineering resource pool to assist in the development of new products on a project-by-project basis. They furnish consultation on packaging design problems encountered by other groups. Finally, mechanical engineering expertise on test equipment mechanical design, burn-in chamber design, and the mechanical packaging of power supplies is also provided.

3.1.2.3 Environmental Engineering
Manager: Frank Grimaldi, (ML8-3/T13, 223-4177)

Environmental Engineering supplies mechanical engineering consultation, and maintains testing services in the following areas:

Acoustics – product acoustic noise
Climatics – temperature, humidity, altitude
Dynamics – vibration, mechanical shock
Heat Transfer – product cooling, air flow
Statics – physical stability

Environmental Engineering personnel function as contracted members of new product design teams to help develop quality products that meet required environmental performance capabilities. They are also active in performing advanced development tasks, maintaining DEC Standard 102, Environmental Standard for Computers and Peripherals, developing design guidelines, and tracking external regulations.

Environmental Engineering consists of three subgroups, (1) Product Acoustics, (2) Environmental Test, and (3) Thermal Engineering. Each group maintains and operates laboratory facilities to support area activities.

Contact this organization as early as possible, preferably in the concept stage of your project, before mechanical design or project factors are frozen.

3.1.2.4 Central Labs

The Power and Packaging Central Laboratories, located in the Maynard Mill, provide a central source of physical testing capabilities to support all areas of the corporation.

Individual laboratories, whose capabilities and operations are the responsibility of area experts within Power and Packaging, currently consist of the following:

Laboratory	*Power/Packaging Group*	*Manager*
Acoustics	Environmental Engineering	Bob Lotz, ML8-3/T13, 223-5774
EMI/RFI	Electromagnetic Compatibility	Pete Boers, ML11-3/H19, 223-5452
Environmental	Environmental Engineering	Frank Grimaldi, ML8-3/T13, 223-4177
Materials	Interconnection Engineering	Jim Lawrence, ML8-3/T13, 223-6744
Package Sample Making	Industrial Package Engineering	Larry Nielsen, ML8-3/B96, 223-2588
Thermal Engineering	Environmental Engineering	Robert Hanneman, ML8-3/T13, 223-3349

A broad spectrum of testing services is available. If internal capabilities are insufficient for a specific need, laboratory personnel can identify outside facilities and arrange for testing there.

3.1.2.5 Industrial Packaging

Manager: Larry Nielsen, (ML8-4/B96, 223-2588)

This group designs shipping packages for many different applications. They create package designs for shipping piece parts between facilities, package designs for shipping sub-assemblies, and package designs for moving products within a facility. They also create package designs for products purchased from vendors, package designs that serve the needs of Field Service support, and package designs for shipments to customers.

Industrial Packaging also works closely with Purchasing to evaluate new packaging materials for use by Digital. They evaluate vendor packaging, and build prototypes of new product packages. The group coordinates site activities for on-site packaging engineers, and supports most Digital facilities with centrally run cross-plant projects.

Contact this group when you need shipping packages designed. Members will provide written cost and schedule quotes, and help you develop packing procedures. They will also perform the component engineering function in generating purchase specifications for all packing materials.

3.1.3 Hardware Design Assurance

Manager: Paul Rey, (ML11-3/H19, 223-2348)

This group's primary function is to ensure that there exists within Digital the necessary tools, standards, and organizational processes to enable Digital's products to fit into the marketplace relative to hardware oriented regulations, standards, and compatibility.

The group's strategy over the next two years includes driving functions which are necessary for adequate Hardware Design Assurance. These functions are organized within and external to the group depending on the most sensible strategy. The group presently has the nucleus of EMI, International Regulations, and hardware standards. This is a good base to which activities may be added that don't have a home. The group's long-term goal is to have Hardware Design Assurance as part of a Corporate Central Product Assurance group within five years.

Most of the group's activities are being shifted to a pay-as-you-go basis. Some of the services previously provided at no cost will be charged where appropriate. Central funding will be limited to corporate cross-product activities, and seed money to start new activities. All central funding is spent in the group's cost center with the exception of Product Safety funding. This funding is allocated to the Corporate Product Safety group for product safety service to central engineering.

3.1.3.1 Electromagnetic Compatibility

Manager: Pete Boers, (acting) (ML11-3/H19, 223-5452)

This group ensures that Digital's products meet international requirements for electromagnetic compatibility (EMC). To do this, the group monitors EMC regulations and tries to influence them through membership in industrial organizations that deal with EMC. Members develop corporate guidelines and standards to guide corporate strategy in complying with EMC regulations.

The group provides consultation on design problems in the EMC area. They integrate Engineering, Marketing, Manufacturing, and Field Service efforts relative to EMC, and determine what quality assurance programs are needed in manufacturing to guarantee consistent EMC characteristics in Digital's products. Electromagnetic Compatibility testing services are also provided.

3.1.3.2 Electrical Integrity

Manager: Pete Boers (acting) (ML11-3/H19, 223-5452)

The functions of this group apply to decentralized Engineering facilities that can justify local EMC support. Members of this group are local EMC engineers who will expand their scope to cover electrical integrity issues. They participate on hardware design teams, providing design guidance that pertains to electrical integrity.

They devise solutions to problems involving the electrical interaction of system components. They develop test methods for verifying electrical integrity. They also maintain working relationships with Manufacturing's Final Assembly & Test (FA&T) group and Field Service to ensure that Digital's products have electrical integrity. The maintenance of DEC Standard 186, Signal Integrity, is also a function of this group.

3.1.3.3 International Regulations
Manager: Dick Amann, (ML11-3/H19, 223-9837)

The primary function of this group is to ensure that Digital's products comply with general international regulations. The group monitors regulations, developing and guiding corporate strategy for compliance. They coordinate the efforts of Engineering, Manufacturing, Marketing, and Field Service in meeting regulatory requirements.

This group also provides Digital with an overview of international marketing needs relative to product design and testing. They assess risk and return-on-investment results, making recommendations on issues that concern hardware conformance to these marketing requirements.

You may consult with group members to help you identify reasonable goals in your product design. They can also help you with the implementation of DEC Standard 060 (Policy Requiring Certification for Digital Hardware Products to National and International Regulations), for which the group is responsible.

3.1.3.4 Hardware Standards
Manager: Paul Rey, (ML11-3/H19, 223-2348)

This group monitors Digital's market-related hardware standards, providing available product design information to interested groups. They identify market areas that might be adversely affected by a lack of related Digital hardware standards.

They also determine if existing regulations and/or market-related standards need revision. If such is the case, they then ascertain the person or group responsible for the existing or proposed regulation or standard, and obtain a commitment to revise or create the needed information.

3.1.3.5 Product Performance Data Base
Manager: Dick Amann, (ML11-3/H19, 223-9837)

This group is responsible for coordinating the compilation of hardware standards test information for insertion in a common data base management system. They also compile the corporate hardware product regulatory compliance listing. At present, the group is establishing an easily accessible data base for product test information. This data base will be integrated with a higher-order corporate information system for easy roll-up and distribution of summary results.

3.1.4 Power Supply Engineering
Manager: Henk Schalke, (ML8-4/E86, 223-7103)

Power Supply Engineering designs and introduces power supplies, power controllers, regulators, battery back-up modules, and power distribution assemblies into production. The group also reduces costs and enhances products by adopting different product technologies.

Consultation and design techniques for your power systems development, including AC power installation requirements, power distribution systems, and computer systems Uninterruptable Power System (UPS) requirements, are also provided.

Power Supply Engineering also maintains these standards:

DEC Standard 002 – AC Power Wiring, Grounding, Receptacles, Nameplates
DEC Standard 122 – AC Power Lines
DEC Standard 123 – Power Control Bus

Contact this group in the early stages of your project, and during the packaging of your product, at which time trade-offs on technology, packaging concepts and requirements, and partitioning of the power system are implemented.

3.1.5 Industrial Design

Manager: Dick Schneider, (ML11-4/E53, 223-2256)

The Industrial Design group develops and maintains product aesthetic designs that have broad applications. Services of this group encompass related aspects of aesthetics, human factors, product recognition, and product related graphics.

Group Objectives

Aesthetics

- To develop a distinctive and attractive appearance that denotes a high-quality product appropriate to the end-user environment
- To establish and maintain a strong physical resemblance among products throughout the product lines
- To ensure that products for the user are easy to understand
- To ensure that products are convenient, comfortable, and safe to use
- To ensure that the user-product relationship is efficient

Human Factors

- To ensure that products for the user are easy to understand
- To ensure that products are convenient, comfortable and safe to use
- To ensure that the user-product relationship is efficient.

Product Recognition

- To ensure that the basic configuration of a product relates well to other products in structure, materials, finish, and physical and mechanical attributes.

Product Related Graphics

- To design and develop product identification graphics such as logos, labels, nameplates, control graphics, and packaging graphics with attention to the selection and control of color.

Industrial Design can furnish you with human factor analyses. They can also help you develop instructional material for non-technical users. Members of the group generate mock-ups, models, and prototypes. They design artwork, documentation, and specifications for all forms of purchased labels, including class 36 labels.

Contact Industrial Design during the product concept phase. They need enough time to study and understand your needs and to relate your product to other Digital products.

3.1.6 Systems Integrity
Manager: Don Vonada, (ML3-3/E67, 223-2422)

Systems Integrity is concerned with the successful transmission of energy between a source and a destination. Group members represent a corporate technical resource for consultation on systems electrical integrity over a spectrum of media and technologies. They conduct analyses on crosstalk and impedance characterization of printed circuit etch and Unibus/Q-bus cable configurations. The group is also involved with advanced interconnect technologies such as fiber optics and high speed serial data transmission. Finally, the group provides product support for the Unibus, Massbus, and other traditional buses.

3.2 ENGINEERING PLANNING AND ADMINISTRATIVE SERVICES
Manager: Paul Bauer, (ML3-3/B91, 223-6581)

This organization oversees business planning, strategic planning, plant engineering, security, office services, shipping and receiving, telecommunications, and space and facilities planning for Central Engineering.

The organization's business and strategic planning activities are described in the paragraphs that follow.

Business Planning

This group, headed by Jeff Scott, (ML3-3/B91, 223-6743), maintains and develops:

- Product Business Planning Processes
- Product Contracting Processes
- Hardware Product Phase Reviews (not currently defined for Hardware Development)

They operate a Product Planning Data Base created from Product Plan Summaries (PPS). A primary goal of the group is to maintain an orderly means of monitoring product-level planning and development. The group ensures that products are integrated into the overall corporate product space.

Business Planning can supply you with Product Plan Summaries for products in development. A library of such summaries is maintained in the Corporate Library, (ML4-3) as well as in several remote locations.

The group can also furnish you with the Yellow Book that includes status versus plan information for products in development. The Yellow Book is closely coupled to the Business Planning Process.

Business Planning is a participant in and facilitator of the product life cycle approval process.

Your Product Manager is usually the person who deals directly with Business Planning. The Product Manager will need, from time to time, functional dependency, and cost and schedule information to support the business planning of a project.

Strategic Planning

This group, headed by Paul Bauer (acting), (ML3-3/B91, 223-6581), facilitates and administers the strategic and operational processes that lead to publication of the Red Book (Strategic Plan) and Beige Book (Operational Plan).

The Red Book is Engineering's statement of its plans to the Engineering Board of Directors (EBOD). The Beige Book is a set of Engineering internal documents to make sure that the budget and resources to achieve the Red Book objectives are in place.

You may be asked to help develop plans for products as much as five years away. The Red and Beige Books can help you make decisions based on the most complete product information available.

3.3 ENGINEERING INFORMATION

Manager: Dick Reilly, (ML4-4/E99, 223-2982)

Engineering Information has systems and procedures for the creation, control, maintenance, and distribution of part and option information. The organization operates some of these systems and procedures, and monitors most. Groups include Engineering Information Control, Corporate Micrographics, Standards and Methods Information and Control, Unit Charge Administration, and Engineering Computer Services. Engineering Information is also responsible for the functional management of all Engineering Services sites.

3.3.1 Engineering Information Control

Manager: Ray Melanson, (ML4-2/E90, 223-3025)

This group coordinates and expedites the Engineering Module Release Package (as defined in DEC Standard 142) between Design Services sites and Manufacturing Tool Generation. The group acts as a liaison and provides a scheduled van courier service to transport various engineering design-related media, supplies, and release packages to facilitate the Engineering Release Process.

Engineering Information Control also assigns blocks of part numbers and enters and updates part number data on the Master Parts File as requested by various sources (Chief Engineer, Manufacturing Financial Control, Packaged Systems, Field Service, and Design Services). It also aids and supports various Manufacturing stockrooms by generating and updating Manufacturing Bill of Materials upon request.

The group also provides a Central Engineering Archive Control by which all released data is duplicated for off-site archive storage. Archive control is responsible for providing engineering data recalls and controlling and checking retention dates.

The group is additionally responsible for maintaining and automating the Document Control File (DCF). The DCF is an automated file with document number, description, revision, ECO pending, and site location data. A long-term goal is to automate all existing documents (approximately 300,000).

Engineering Information Control receives and processes requests from Design Services groups to transfer engineering data from the Maynard Mill (or another site) to the requesting site. The process includes pulling the original engineering data from the Maynard Library, updating the DCF (Document Control File), processing a pink card microfilming package, and shipping via the group's central services liaison distribution.

Engineering Information Control is responsible for distributing (via TWX) all Maynard Mill ECOs (preliminary and final issue) to an ECO distribution of 58 people.

This group is also responsible for developing, writing, and conducting user training courses related to CAD (Computer Aided Design) systems. Training extends to CALDEC (Computer Aided Layout by DEC), IDEA (Interactive Design Engineering and Automation) systems, SUDS (Stanford University Design System), and PRTLST (Parts List).

They manage all libraries associated with CAD systems that are used by Engineering Services. These libraries include:

Special Features Library	Rennie Ellice (ML3-5/T28, 223-6604)
Physical Shape Library	Tom Witowski (ML3-5/T28, 223-4242)
Assembly Library	Ria Kruijk (ML3-5/T28, 223-4633)
Artwork Step and Repeat Library	Rennie Ellice (ML3-5/T28, 223-6604)
Schematic Symbol Library	Tom Witowski (ML3-5/T28, 223-4242)

Finally, the group is responsible for the issuance, use, and control of Engineering Notebooks. All Digital employees engaged in the design, development, support, or testing of Digital processes or products are responsible for obtaining an authorized Engineering Notebook, from Nat Rounds (ML4-2/E90, 223-9474), keeping it up to date, and returning it to Engineering Information Control. DEC Standard 141 provides more detail on your responsibility regarding Engineering Notebooks.

3.3.2 Corporate Micrographics

Manager: Bob Marshall, (ML4-2/B63, 223-3815)

This group is responsible for the creation of microforms from hard copy or source documents. The documents are filmed, processed, inspected, duplicated, and returned.

The group also performs Computer Output Microfilming (COM) in Merrimack. This technique produces microfilm directly from computer media, by-passing the requirements for drafting on paper. The master film is created, inspected, and duplicated. The finished products, 105 mm microfiche and duplicates, are distributed as requested.

Engineering Graphics, located at ML1-1, and also headed by Bob Marshall, performs document reclamation and enhancement in the forms of mats and wash offs. Mats are blueline, 7 mil. film sheets imprinted with a grid format used for laying out printed circuit boards for the GEMS (a semi-automated process of digitizing printed circuit layout) operation. DEC Standard 013 describes available mats. Wash offs are polyester-based photographic copies of original documents. These are generally full-sized, black line reproductions with matte finishes.

Microfilm Distribution, headed by Irene Fredette, (ML4-2/B63, 223-6745), microfilms new and revised engineering drawings using 35 mm film which is then mounted onto aperture cards. Duplicate diazo aperture cards are produced from silver negative cards and distributed to over 30 Digital facilities to create and update Engineering documentation aperture card files.

To support the maintenance print set business, photographic enlargements made from silver negative aperture cards are available on request.

3.3.3 Standards and Methods Information and Control

Manager: Joe Kurta, (ML5-2/E56, 223-8895)

This group is responsible for the administration and support of DEC Standards, general Engineering information, A-SP-7665xxx specifications, Engineering forms and formats, Engineering procedures and related manuals, certain categories of controlled memos, and over 150 distribution lists.

DEC Standards

DEC Standards are policies, guidelines, specifications, and procedural descriptions that establish company, Engineering, Manufacturing, and technical requirements for items, materials, processes, methods, designs, and organizational practices that are not product specific. DEC Standards are avialable in both hard copy and microfiche.

The purposes of DEC Standards are:

a. to establish procedures for interaction among different organizations (Engineering, Manufacturing, Field Service, Quality Assurance, etc.)

b. to provide realistic solutions to recurring problems

c. to establish common practices, procedures, and methods to ensure compatibility among company organizations

d. to provide the company's interpretation and methods for implementing external or industry standards

e. to increase the quality and profit of company operations by fostering uniformity in product design, symbology, configuration, testing, inspection, transportability, and interchangeability

DEC Standard 001, Section 0 describes the corporate policy for DEC Standards and provides general information about the management and administration of the DEC Standards system. It also defines categories and levels of standards.

DEC Standard 001, Section 1 describes the procedures required to create new standards and make changes to existing ones.

DEC Standard 001, Section 2 describes the format and minimum content requirements for DEC Standards.

You will find a listing of all avialable DEC Standards in the Appendix of this manual. Contact the DEC Standards Administration for more up to date information: 223-2954.

General Engineering Information and Specifications

Standards and Methods Information and Control is a focal point and authoritative source for the preparation and dissemination of general procedures and requirements for Engineering and other areas with which it does business.

Engineering Forms and Formats

In conjunction with Northboro Printing and Circulation Services, the group is the Engineering focal point for updating Engineering forms and introducing new ones. Examples include ECO (Engineering Change Order) and Work Order forms.

The group also works with Purchasing and Engineering Service sites to evaluate outside vendors who are contracted to print and produce specially formatted drafting materials in compliance with DEC Standard 013.

Manuals

The group's technical writing staff writes, edits, and updates manuals required to support Engineering information and communication processes. Such manuals include the Engineer's Orientation Manual, the DCF (Document Control File) User Manual, IDEA (Interactive Design and Engineering Analysis) Training Manual, the Producibility Handbook, the Symbology Manual, and the Engineering Handbook, to be available in 1980.

The Engineering Handbook is actually a set of books to help the engineer get the job done. Expanding the contents of the Engineer's Orientation Manual, the Handbook will contain detailed design, product development, Manufacturing, software, etc., information with emphasis on methods and procedures.

Distribution Lists

Standards and Methods Information and Control also maintains distribution lists essential to the dissemination of Engineering information. Over 150 lists are maintained. Copies of the lists and labels for mailing are available on request at no charge.

The group also ensures that pertinent information for engineers regarding changes to DEC Standards, procedures, and related subjects is made available to the *Engineering Newsletter*. The *Engineering Newsletter* is a vehicle for publishing essential processes and procedures that often cannot be disseminated to the Digital community via distribution lists.

Finally, the group can provide technical writing, editing, and consultation to anyone preparing a document to be under the group's control. If needed, they will expedite and contract outside writing, illustrating, and publishing services. Additionally, the group will provide guidance and prescribed formats to engineers who intend to prepare non-product-specific Engineering documentation.

3.3.4 Unit Charge Administration

Manager: Charlie Picariello (ML4-4/E99, 223-2848)

Unit Charge is a system by which Engineering Information and Service managers may track spending on a specific task within a project. It enables managers to determine what the charge for a service will be before the charge comes through at the monthly financial closing. When a manager receives a bill for unit charge, he or she is able to relate the dollars to the kinds of services performed.

Unit Charge helps service managers become business managers. Using the system, managers may accurately estimate future work load demands and personnel, capital, and inventory requirements.

Unit Charge also has a data base with historical information to assist those who would like to know more about the metrics of the design process. Unit Charge reports are generated weekly to be used as management information tools, not invoices. These reports back up the Corporate Discrete Project Cost Center Reports.

3.3.5 Engineering Computer Services

Manager: Dick Reilly (Acting), (ML4-4/E99, 223-2982)

Engineering Computer Services provides medium and large system data processing support to Digital's engineering organizations in Maynard. They are responsible for managing CAD's Maynard computer-related assets. There are two functional subgroups within Engineering Computer Services: CADnet Operations, and System Software Support.

3.3.5.1 CADnet Operations

Manager: George Vogelsang, (ML1-1/E24, 223-2248)

This group provides CADnet (Computer Aided Design Network) support for engineering organizations in Maynard. Both CAD tools and general time-sharing applications are available. The CAD tools are a specific set of applications that facilitate development of printed circuit boards and LSI chip design. The time-sharing applications are valuable in software and hardware development.

Table 3-1 lists the Engineering computer facilities located at various sites throughout Digital. The contact person at each site can give you access to the equipment. He or she can also give you an account number, tell you how to schedule machine time, how to report a machine malfunction, and how to get it repaired.

Table 3-1 ENGINEERING COMPUTER FACILITIES

SITES	TYPES OF SYSTEMS	PRINCIPLE USE	CONTACT
MR1-1	DECSYSTEM 20s	Marketing Data Center	John Gannett, 231-6456
MR1-2	DECSYSTEM 20s	Software Development	Steve Jablonski, 231-6377
MR1-2	DECsystem 10s	CAD, Software Development	Dick Stevenson, 231-6373
MR1-2	PDP-11s	Communication Networks	Steve Jablonski, 231-6377
ML1-1	DECsystem 10s	CAD	George Vogelsang, 223-2248
ML1-3	DECSYSTEM 20s	Storage Systems Development	Sue Goff, 223-3285
ML4-4	DECsystem 10s	Software Development	Jose Colon, 223-7747
ML4-4	DECSYSTEM 20s	DECnet, Diagnostics	Jose Colon, 223-7747
ML4-4	VAX	SDC Support, DECUS	Jose Colon, 223-7747
ML5-5	PDP-8s	DECnet	Joe Coviello, 223-2876
ML5-5	PDP-11s	Software Development	Joe Coviello, 223-2876
TW	DECsystem 10s	IDEA, SUDS, Time-sharing	John Lyons, 247-2704
TW	PDP-11s, VAX	Software Development	Fred Kilmartin, 247-2455
MK1-1	VAX, PDP-11s	Software Development	Jim Friel, 264-6601
MK1-1	DECsystem 10s	Software Development	Jim Friel, 264-6601
MK1-1	DECSYSTEM 20s	Software Development	Jim Friel, 264-6601
MK1-2	DECsystem 10s	Performance Evaluation	Roger Cady, 264-5045
MK1-2	PDP-11s	Performance Evaluation	Roger Cady, 264-5045

CX	PDP-11s	GEMS, Time-sharing	Wes Brown, 522-3105
CX	PDP-11s	Software Development	Wes Brown, 522-3105
CX	PDP-11s	Software Diagnostics	Wes Brown, 522-3105
CX	DECsystem 10s	CAD, SUDS	Wes Brown, 522-3105
CX	DECSYSTEM 20s	Timesharing	Wes Brown, 522-3105
WZ2	DECsystem 10s	CAD	Art Wessels, 238-2454
RE	DECSYSTEM 20s	Software Development	Frank Jackson, Ext. 205
RE	PDP-11s	Software Development	Frank Jackson, Ext. 205
PK1	DECsystem 10s	EPLS	Bob Murphy, 223-3714

3.3.5.2 Systems Software Support

Manager: Mike Mitchell, (ML1-1/E24, 223-8569)

This group provides software support for the CAD data processing sites. They also support system communication network interfaces, system strategy, and performance metrics.

3.4 ENGINEERING SERVICES

Functional Manager: Dick Reilly, (ML4-4/E99, 223-2982)

Engineering Services' satellites are located at various sites throughout the world. All sites, however, do not presently offer a complete range of services. Engineering Services provides the following functions:

Design Services – drafting, layout of printed circuit (PC) boards, and integrated circuits (ICs), Engineering Change Order (ECO) administration

Document Services – reproduction, library and documentation control

Model Shop Services – stockroom, metal fabrication, prototype assembly, model assembly

3.4.1 Design Services

Site	*Manager*	*Mail Stop/DTN*
(Hudson)	Jim Fleming	ML11-2/E83, 223-2287
Maynard 4-5	Jim McHugh	ML4-5/T38, 223-8892
Maynard 3-6	Dick Cook	ML3-6/E42, 223-2984
Acton	Al Raimondi	AC, 232-2466
Marlboro	Roger Pothier	MR1-2/E74, 231-6710
Merrimack	Joe Madden	MK1-1/B7, 264-6672
Tewksbury	John Wanamaker	TW/D17, 247-2551
Colorado Springs	Mike Elkins	CX, 522-3156
Phoenix	Art Huhtala	PN, 1-(602)-993-5111, X375
Westboro	Ted Kelley	WZ2, 238-2286
Nashua	Ron McCollem	NU, 264-6271
Costa Mesa	Larry Cleghorn	CW, 1-(714)-979-2460
Kanata, Canada	Ted Gillespie	KA, 621-2518
Reading, England	Brian Good	RE, [44]-(374)-58-3535, x239

Site	*Manager*	*Mail Stop/DTN*
Annecy, France	Roger Perret	AE, [33]-(50)-66-23-45
Munich, Germany	Ulrich Nielsen	MU, [49]-(89)-35-031
Stockholm, Sweden	Kaj Nilssen	SO, [46]-(8)-730-0800
Tokyo, Japan	Fujio Kawaguchi	TK, [81]-(3)-341-5481
Sydney, Australia	Bob Starkey	SN, [61]-(2)-428-2866

Design Services works with engineers to provide documentation support and design assistance. The sites listed above will help you generate the documentation necessary for Manufacturing to build your product and Field Service to maintain it. Services available include:

Mechanical Drafting

This service includes the mechanical design of metal fabrication, and all levels of assemblies; members also perform checking and expedite engineering change orders (ECOs).

Manual and Automated Electrical Drafting

For automated, electrical drafting, this service employs SUDS (Stanford University Drawing System) to formalize electrical diagrams, flowcharts, block diagrams, and circuit schematics.

Manual and Automated Printed Circuit and Integrated Circuit Layout

This service includes manual or automatic layout and taping by any of the following three methods:

IDEA – Interactive Design and Engineering Automation – a second-generation automated design developed entirely by Digital

CALDEC – Computer Aided Layout by Digital – an interactive tool providing automatic placement of components, routing of networks, and checking of special wiring rules

GEMS – A semi-automated process of digitizing printed circuit layout

Design Services can help you in other ways, too. Their data services include generation of physical drawing tapes, wire wrap data, and ROM and PROM data entry listings. They can also generate prototype tool tapes, photo artwork tapes, and drill tapes.

Not all Design Services satellites furnish all of the services listed above. Contact Design Services during the planning stage of your project. They will inform you of the kind of help you will need throughout your project's life. You must provide them with funding and schedules, sketches and drawings and, in the case of modules and options, an Engineering Services Work Request approved by the Chief Engineer, Dick Best (ML3-3/H14, 223-2273).

3.4.2 Document Services

Table 3-2 lists the Engineering Document Services facilities located at various sites throughout Digital. All sites create hard copies from microfilm aperture cards (these cards are stored in the Microfilm

Reference Library at the site). Some sites are equipped to create prints and make reduced prints of drawings. Some sites can make copies and reductions of non-transparent originals. Still other sites have their own Site Design Library for indexing, storing, and retrieving original drawings. Contact the site nearest you for services offered in addition to those listed in the table below.

TABLE 3-2 ENGINEERING DOCUMENT SERVICES SITES

LOCATION/ MAIL-STOP	SERVICES AVAILABLE	CONTACT/DTN
ML4-2/E27	D	Carol Fiorentino, 223-3931
ML6C-2/E27	A, B, C	Al Burke, 223-8526
MK1-1/B07	A, B, C, D	John Devin, 264-6671
MR1-2/E74	A, B, C, D	Dave Sireen, 231-6712
TW/D17	A, B, C, D	John Wanamaker, 247-2551
CX	A, B, C, D	Mike Elkins, 522-3156
PN	A, B, C, D	Art Huhtala, 1-(602)-993-5111, x375
AB	A, B,	Rick Gnekow, 1-(505)-345-3311, x2013
NP	A, B, C, D	Tony Chulada, 264-6274
WO	A	Bob McCarthy, 236-2496
WM	A, B, D	Ernie Nourie, 241-4295
BT	A	Joanne Gallant, 266-2243
RE	A, B, C, D	Brian Good, [44]-(374)-58-3555, x2396

Key
- A = Creates hard copies from microfilm aperture cards
- B = Creates prints of drawings you supply
- C = Creates reduced prints of drawings you supply
- D = Files original drawings and creates prints of filed drawings

3.4.3 Model Shop Services (Maynard)

Manager: George Gerelds, (ML5-3/E22, 223-2309)

Four groups provide a range of Model Shop services for any one who needs them. The *Stockroom* supplies component parts for your design. The *Mechanical Prototype Shop* fabricates metal, plastic, and wood units. The *Prototype Assembly Shop* assembles prototype modules and subassemblies. The *Production Model Shop* is concerned with model assembly. The specific functions of these groups are outlined in the paragraphs which follow.

Engineering Stockrooms

The various stockrooms stock company-preferred components to avoid the incorporation of obsolete or non-preferred parts into new designs.

Component requirements for a project should be submitted to the appropriate stockroom early enough so that a vendor's delivery schedule will not delay your project. You must supply the stockroom with a parts list showing Digital part numbers (see DEC Standard 012, Section 2, Inventory Class Codes). You must also supply an engineering charge number and fill out a work order form. Stockrooms will purchase components from vendors, and assemble kits in reasonable quantities. A good rule of thumb is to submit your parts lists just before submitting your new design to the Design Services group.

The Maynard Stockroom (#63) stocks components for prototypes and production models. It also expedites components and software supplies from other stockrooms. Stockroom #63 does not expedite LSI (Large Scale Integration) parts.

TABLE 3-3 ENGINEERING STOCKROOMS

LOCATION	NUMBER	CONTACT/DTN
ML5-3	#63	Jim Castano, 223-3774
MR1-2	#13	Sharon Lindsay, 231-6763
TW	#348	Bill McMahon, 247-2869
ML1-3	#132	Sue Goff, 223-3285

Mechanical Prototype Shop Manager: Ed Mayall, (ML1-1/E22, 223-2583)

This group fabricates sheet metal, machined plastic, and wood. It also provides machine shop services such as milling, grinding, lathe work, and heat treatments.

You must supply the group with sketches and/or blueprints. You may give verbal instructions, too, but written instructions are better. Because the prototype process often requires several passes, do not order more prototype units than you need.

Prototype Assembly Shop Manager: Jim Castano, (ML5-3/E22, 223-3083)

This group assembles prototype modules, small sub-assemblies, wire-wrap assemblies, printed circuit boards, cable harnesses, and other equipment. Not limited to providing prototypes, the group provides assistance in small-lot production jobs which cannot be handled cost-effectively in Manufacturing. The group will also do bread-boarding for you, check for errors in documentation, and advise you as to the volume producibility of your prototype.

The group's assembly rates are based on the number of module components and are competitive with outside vendors. You may contact the Prototype Assembly Shop on an informal basis, that is, you may walk in and describe what you want without having to submit formal documentation. Contact the group in the planning stage of your project.

Production Model Shop Manager: Brad Sparkes, (ML5-3/E22, 223-3255)

The Production Model Shop builds printed circuit board models and subassembly models (e.g., power supplies, power controls, cable assemblies) on request for Manufacturing to compare with production units. The group also generates hand testers for low-volume items, or for items that are not tested on automated module test (AMT), computerized module test (CMT), or standard test equipment.

In addition to building models, the Production Model Shop performs odd jobs that range from building wire-wrap boards and cable harnesses to assembling show mock-ups and filling low-volume customer orders. Group members will perform a quality control check on any item upon request. Finally, the Production Model Shop will create and verify a bill of materials (BOM) from an engineer's parts list or from information provided by Design Services.

If you want to use the group's services, you must provide some kind of documentation from which group members can work. Jobs for Digital customers require formal documentation. For other jobs, any documentation will suffice provided it is legible and easy to understand.

When you want ROMs or PROMs blasted, you must supply them, as well as a punched tape or programmed ROM/PROM.

3.5 ENGINEERING SYSTEMS

Manager: Pete Straka, (ML21-3/E87, 223-3189)

3.5.1 Diagnostic Systems

Manager: Glen Johnson, (ML21-3/E89, 223-4080)

This group provides software, methods, and tools in support of the PDP-11 diagnostic development. They work with Engineering programming groups to develop diagnostic strategies and implement methods and tools, off-line and on-line Diagnostic System software, and system exercisers.

The Product Enhancement Group, headed by John Vrobel, (ML21-4/E10, 223-3330), is a service group designed to provide fault-insertion support and the correction/enhancement of traditional Diagnostic Programs. They currently provide diagnostic support for existing PDP-11 and PDP-8 Diagnostics.

Traditional diagnostics may be defined as diagnostic software in the non-development, non-infant mortality stage. The individual Engineering development groups are responsible for software in the development stage. The development stage will end and the traditional diagnostic stage will begin four months after the initial release of the diagnostic product to the field. At that time, the Product Enhancement Group will assume responsibility for the product. They will schedule fault-insertion, and provide maintenance, support, and enhancements to these diagnostics.

The group also serves as a training ground for entry-level diagnostic engineers. From this base, a career path exists to other diagnostic engineering groups.

Diagnostic Release Engineering, headed by Cecilia Cinnamon, (ML21-4/E10, 223-6303), coordinates the release of diagnostic software for all processor families (8's, 10's, 11's, VAX). The group performs the actual release for all PDP-8 and PDP-11 diagnostics. Currently, the actual release for DECsystem-10 (and 20) and VAX diagnostics are located in MR and TW respectively.

The group administers and implements engineering change orders (ECOs) to diagnostics and maintains a history of each diagnostic program. They also coordinate the distribution of problem reports filed by customer services. They publish periodic summaries of these reports to all Engineering programming groups.

3.5.2 VOTE Group
Manager: Dick Beaven, (ML21-3/E87, 223-8681)

This group is developing a fault simulator for release in FY81. VOTE is a concurrent logic fault simulator to be used for test vector and diagnostic program verification. VOTE incorporates the latest techniques for accurate, efficient simulation and was developed by Ernst Ulrich, (ML21-3/E87, 223-5363). For more information, contact either Dick or Ernst.

3.5.3 CAD (Computer Aided Design) Systems
Manager: Luther Abel, (ML3-6/T28, 223-4221)

CAD Systems Engineering provides computer-based tools used in the engineering design process. These tools are used for the physical design of modules and backplanes, and for logic design at all levels. Such tools include:

- Register Transfer Level (RTL) Simulator used in architectural verification and micro-code development
- logic design and entry tools
- printed circuit and gate-array tools
- backplane design tools
- printed circuit design verification tools

The group creates new CAD tools or major enhancements to existing tools. They maintain expertise in many engineering disciplines. Group members are available for consultation on new tools or technological needs. Four groups make up CAD Systems:

CAD Systems Management

This group, headed by Andy Matthews (ML3-5/T28, 223-8489), is responsible for CAD technology management, long-range planning, and the management of development projects.

Layout Applications Development

This group is headed by Will Anderson (ML3-5/T28, 223-2742), and is responsible for printed-circuit and gate-array layout tools, wire-wrap tools, and ROM/PROM/PLA tools.

Data Structures and Interfaces Development

This group is headed by Phil Sweet (ML3-5/T28, 223-8762), and is responsible for working closely with Manufacturing on design verifications.

Engineering and Analytic Tools

This group is headed by Don Yelton (ML3-5/T28, 223-3437), and is responsible for developing engineering analytic software in the areas of higher level simulation and design layout analysis.

CAD Systems Engineering provides service to the entire Engineering community. Their aim is to provide the engineer with the finest, most cost-effective tools available. Engineers may find out more about what CAD tools do by attending the semi-annual CAD Symposium, by reading the bi-monthly CAD newsletter, or by contacting group managers directly.

It is important to recognize that CAD is both a great benefit and a potential limitation to the design process, especially with regard to technology new to Digital. The earlier you contact CAD Systems Engineering in the design phase, the sooner potential limitations can be removed from your project.

3.5.4 CAD Technical Support
Manager: Bill Wehring, (ML3-5/T28, 223-3223)

This is a user-oriented group whose primary responsibility is to ensure the useability and integrity of CAD tools at all Engineering sites. The group aids in the installation of CAD tools, provides consultation regarding the application of tools, coordinates modifications to existing CAD tools, and creates new ones.

The group also conducts acceptance testing on all software and hardware configurations developed by the CAD Tools Development group (or any other source that they have agreed to support), including problem fixes and enhancements to existing systems before release to production.

Finally, the group is responsible for the control, distribution, and archiving of all software related to CAD tools. These include Source Code, Executable Code, user documentation, and programming documentation.

3.5.5 Engineering Analysis and Reporting Systems
Manager: Jeff Haber, (ML12-B/B93, 223-6942)

This support group develops management and financial information systems for Engineering. The goal of this group is to provide tools to assist Engineering organizations in the planning, control, and overall management of their activities.

3.5.6 Product Descriptive Systems
Manager: John Hittell, (ML3-6/H27, 223-2653)

This group develops processes and systems for collecting, identifying, manipulating, disseminating, and archiving descriptive information about parts and documents. They develop and operate product description systems. Advances in documentation technology are also a function of Product Descriptive Systems.

Descriptive information management is a major problem for Digital. There are over 100,000 items carrying Digital part numbers, and over 600,000 controlled documents describing them, with a yearly growth rate for both in excess of ten percent.

3.5.6.1 Descriptive Engineering Information Process
Manager: Mark Olsen, (ML3-6/H27, 223-8781)

This group manages the requirements for and flow of descriptive engineering information. The goal is to make the business of engineering information simpler, faster, and more cost effective.

The group is currently working to define parts and documents and their relationship to each other. This includes defining methods of identifying and controlling changes to parts and documents, how a part and its document are linked, how parts are grouped to form products, and what the documentation needs are for different types of parts. It also includes identifying what information is needed to describe a part and how this information is stored and retrieved.

The group is also working to define the new product life cycle (release/change) process.

3.5.6.2 Engineering Product Library System
Manager: Carolyn Rodriguez, (ML3-6/H27, 223-9087)

The Engineering Product Library Systems (EPLS) is a central source of information about Digital's products. Using a computerized data base, EPLS collects, stores, and retrieves information.

Figure 5-1, EPLS Operations, illustrates how this group manages the flow of information. EPLS collects data from such groups as Engineering Services, Purchase Specifications, and the Office of the Chief Engineer. The data consists of such items as the Master Parts File (MPF), engineering parts lists, option-module lists, DEC Standard price lists, Bills Of Material (BOM), and Mean-Time-Between-Failure (MTBF) rate predictions. The data is then supplied to any group requesting information about Digital's products. Such groups include Engineering, Field Service, Sales, Revenue Accounting, Corporate Planning, Manufacturing, and others.

The operating philosophy of the system is that users are responsible for the validity of the information they supply. Product Descriptive Systems of which EPLS is a part, is responsible for the operation and development of the data processing system used to support the information structure. All user needs are coordinated by Product Descriptive Systems. If you have questions about the contents or use of EPLS, call the EPLS hotline, 223-6430.

3.5.6.3 Engineering Product System
Manager: Dee Stewart, (ML3-6/H27, 223-6109)

This group provides system analyses and design, programming, software support, and consultation to help make product information available throughout Digital. This information is disseminated primarily through the Engineering Product Library System (EPLS), described in paragraph 3.5.6.2.

3.5.6.4 Documentation Systems
Manager: Leroy Smith, (ML3-6/H27, 223-5757)

This group analyzes and develops new systems, and exploits new technologies for the recording, retention, reproduction, and distribution of Engineering documentation. The goal is to make documentation more readable, cheaper to produce, and faithful to actual product revisions.

3.6 SYSTEMS EVALUATION ENGINEERING
Manager: Andy Verostic, (ML3-3/E67, 223-5230)

Systems Evaluation Engineering is concerned with verifying that new products developed for the LSI-11, PDP-11 and VAX-11 families are integratable into the complete range of systems which will be

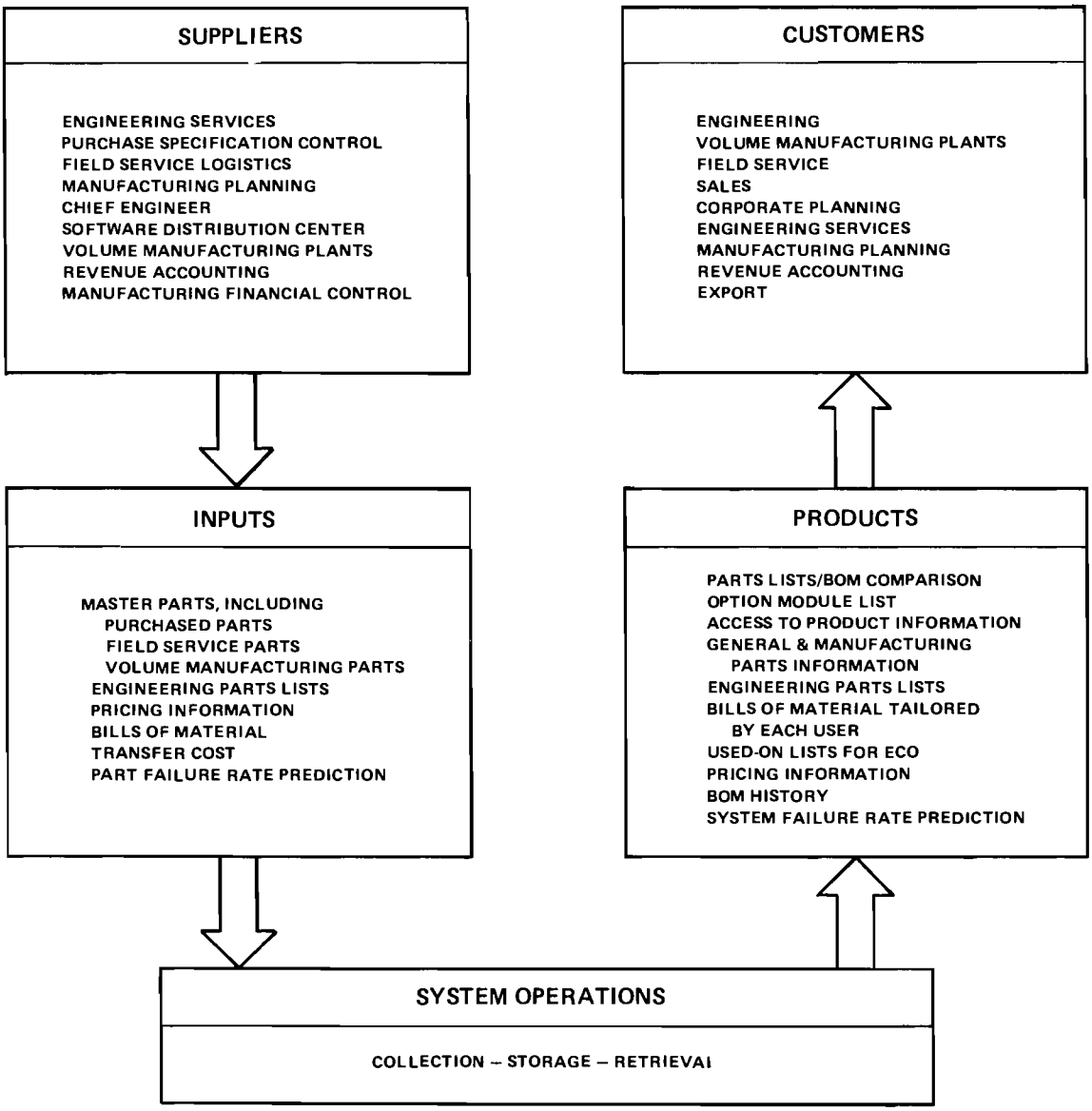


Figure 5-1 EPLS Operations

supported. In particular, the group provides services to development engineering which include the measurement of certain electrical parameters used to define configuration rules, verification of the electrical integrity of device interfaces, and testing of all supporting particulars such as diagnostics, operating systems, and check-out packages across the complete family of systems in which the product will be sold.

The group has available a complete range of Systems, major peripherals, and evaluation tools dedicated to the evaluation process.

Those responsible for new product developments on LSI-11, PDP-11 or VAX-11 Systems should contact the group early in the development cycle to insure proper plans can be developed. Testing normally is conducted on pilot units prior to full Manufacturing start-up.

3.7 OFFICE OF THE CHIEF ENGINEER

Managers: Dick Best, (ML3-3/H14, 223-2273)
Carl Noelcke, (ML3-3/H14, 223-6208)

The Chief Engineer's primary functions are controlling the option module numbering system, processing MTBF (Mean-Time-Between-Failure) data, furnishing specialized or historical data about options and modules, and administering Design Reviews.

Responsibilities of the Chief Engineer, Dick Best

- Assigns model numbers and adds them to the Option Module File in EPLS (Engineering Product Library System) along with a description, what it is used on, product category code, voltage code, status, and responsible people
- Maintains integrity of Option Module File by publishing owners' reports for each responsible person (Engineering Manager, Design Engineer, Product Manager, Field Service Manager, Manufacturing Representative, Major Supplier Stockroom Manager) shown on the Option Module File on a quarterly basis and resolving discrepancies in the data
- Provides data to the Master Part File, Corporate Price File, Manufacturing Hi-Bom File, Product Forecasting System, ECO Control, and Drafting
- Approves Printed Circuit Work Requests
- Approves nomenclature and assigns government code for exporting on DEC Standard Price List Maintenance Forms
- Publishes Option Module List (monthly and quarterly)
- Publishes Engineering Newsletter (monthly) containing technical data and systems and procedures that affect Engineering and Manufacturing personnel
- Provides technical and Engineering consultation
- Member of Engineering Review Board, Engineering Committee, and Patent Committee

Responsibilities of Carl Noelcke

- Administers Design Reviews
  (Each product development project that has been assigned a Discrete Project Number and has a well defined completion point is subject to the Design Review Process)

- Receives Design Review plans from Project Engineer and arranges to have Project Engineer present plan to Engineering Committee for approval

- Acts as Secretary of Engineering Committee
  - arranges agenda
  - writes and distributes minutes
  - signs off DEC Standards

- Maintains Reliability Prediction System

- Represents Engineering on Product Safety Committee

Referenced Material

DEC Standards:

007 – Design Review Process
008 – Project Scheduling System
012 – Unified Numbering Code
139 – Reliability Prediction

4.0 SYSTEMS ARCHITECTURE AND TECHNOLOGY
Manager: Sam Fuller (ML3-5/H33, 223-4562)

4.1 SYSTEMS PERFORMANCE ANALYSIS
Manager: Terry Potter (ML3-3/H24, 223-9749)

This group is responsible for developing performance strategies within Digital. They provide modeling, analysis, and tool development services.

A measurement service collects performance related data on systems and components and analyzes the data based on original study objectives. The analysis service evaluates design alternatives, system sizing, and capacity planning by offering analytical, statistical, and discrete modeling of systems and components. The tool development service develops both general and specific performance data collection and data analysis tools.

These services are used to carry out specific studies as well as to support other performance groups in Digital. Services are available on a charge-back basis to any cost center. Under special arrangements they are available to customers through the Product Lines and Software Services.

4.1.1 Methods and Models
Manager: Linda Wright (ML3-3/H24, 223-7366)

This group provides technical support and analysis primarily to development groups within engineering to help in the concept, design, and development of products. They often analyze the design alterna-

tives proposed by development groups to determine their impact on the systems' performance. They also help to develop methodologies and special techniques for analyzing, measuring, and predicting system performance, and for tuning and sizing current systems.

4.1.2 Performance Tool Development

Manager: Rick Fadden (ML3-3/H24, 223-6483)

The Performance Tool Development group develops both general and specific computer performance data collection and data analysis tools on systems and subsytems.

Contact this group anytime you need to collect or analyze computer performance data but do not have a data collection or data analysis tool available. The group will develop, under contract, the appropriate tool or make an existing tool available.

4.1.3 Measurement and Analysis

Manager: Paul Nelson (ML3-3/H24, 223-3425)

This group provides performance data by conducting performance studies on Digital's systems (hardware and software) and subsystems, and by conducting both analytical and empirical studies of competitors' software, systems, and peripherals. The group maintains a laboratory of competitive gear for examination.

Contact the group anytime measurements are needed on either a software or hardware product. The group will provide a formal, documented report containing the performance analysis requested. The report will include necessary back-up data and methodologies used in conducting the analysis.

To perform work requested, the group needs funding or access to funding for the specific system, peripheral, or software in question. Often the requested information is already available and can be forwarded at no charge.

4.2 STANDARDS

Manager: Pat White (ML12-3/E51, 223-4094)

Standards manages all of Digital's participation in standards committees sponsored by ANSI (American National Standards Institute), IEEE (International Electrical and Electronic Engineering), CODASYL (Conference on Data Systems Languages), ECMA (European Computer Manufacturers Association), and CCITT (International Telecommunications Standards).

The Standards manager defines guidelines for participation and funds travel for Digital representatives. These representatives are chosen from the line organizations by the Standards manager and appropriate development managers. The Standards manager pays the corporate dues to standards organizations.

The group serves as a focal point for information on approved or proposed industry standards. Consultation on the interpretation and implementation of standards is available.

Contact Standards when you are writing the project plan. The group can provide information about all U.S. and international hardware and software standards except safety standards and regulations. (For most internal DEC Standards, contact Standards and Methods Information and Control, ML5-2/E56, 223-2954.)

Also, contact Standards when you need information about Digital's involvement in industry standards committees, when you need help in getting a DEC Standard (software related) reviewed and approved, or when you need to know if a Digital product conforms to ANSI, ISO (International Standards Organization), or FIPS (Federal Information Processing Standards). Contact the group when you want someone to review a Software Product Description (SPD) or Hardware Equipment Specification that describes the product's conformance to industry standards, especially with regard to FIPS. Finally, you might want to contact the group for information on how other Digital products have followed a standard.

Standards can supply you with these documents and services:

- *Standards Reference Pamphlet* – a pocket size list of industry standards by subject; both approved and pending standards are included with codes that indicate status and how to order

- *Standards Summary* – brief abstracts of Digital and industry standards, and probable schedules for all pending standards; gives Digital contact for each standard; does not include standards relating to drafting, micrographics, or corporate processes (refer to Standards and Methods Information and Control for these)

- *Software Standards Notebook* – all approved corporate software-related and software documentation standards; includes description of standards process and complete listing of DEC Standards; distributed by subscription and updated periodically

- *Standards Status Report* – monthly report covering all pending software and industry standards; review dates for DEC and industry standards are included

- *FIPS Conformance Data Sheet* – listing all FIPS and a matrix showing conformance status of DEC operating systems

- *Interests Lists* – lists of people at Digital who are interested and qualified to comment on standards subjects; can be used as a source of names for Design Reviews for related projects

- *Standards Drafts* – drafts of DEC software and industry standards (ANSI, CODASYL, ISO, FIPS)

- *Standards Presentations* – on request the group will make presentations to internal groups and customers on standards issues

- *Consultation Service* – consultation on the interpretation of industry standards or referrals to experts in the company; group will review project plans, Software Product Descriptions (SPDs), and selected functional specifications to identify standards and compatibility issues

- *Standards Writing Help* – help in starting standards projects, professional technical editing, text preparation, printing, and distribution of selected standards

- *Standards Process Documents* – policies and procedures regarding the Software Standards process, format for the same, ECO/Revision control of techncial specifications and proposed DEC Standards, and participation in standards committees (these documents may be found in the Software Development Policies and Procedures Manual)

In order to successfully serve you, Standards needs copies of project plans for all products that would be affected by industry standards. These products include software products, terminals, I/O systems, instructions sets, and diagnostic systems that run under standard operating systems.

Standards also needs to review all Software Product Descriptions and Hardware Equipment Specifications that cite conformance to standards. These documents are legal commitments to conform as defined in the standards.

4.3 VAX-11 AND PDP-11 SYSTEMS ARCHITECTURE
Manager: Bill Strecker (TW/A08, 247-2130)

This group is responsible for the management of key Digital architectures. Management includes the functions of architecture definition, specification, maintenance, and development. The key architectures currently managed include the PDP-11 and the VAX-11 hardware architectures.

The group resolves ambiguities or errors in architecture specifications (e.g., the PDP-11 Processor Handbook, the VAX-11 Architecture Handbook, and the VAX-11 SRM). The group handles requests for changes to existing architectures. Additionally, it assesses the architectural impact of new hardware structures (e.g, bus structures).

Contact the group when you need architecture usage data (instruction statistics) or when you need additional architectures brought under formal architecture management.

4.4 DIRECTOR OF COMPUTER AIDED DESIGN
Manager: Bob Kusik (ML3-5/H33, 223-2320)

As a part of the Office of Technology, this group is responsible for establishing a strategy which will enable Digital to have the best possible CAD capabilities relative to its technologies and products. CAD capabilities include tools (programs), capital equipment, and development, support, and application expertise across the breadth of electrical design and CAM (Computer Aided Manufacturing). A group known as CADBOD (CAD Board of Directors) helps to ensure that the right voices are heard. CAD strategies are published annually in the CAD Redbook.

Because the adequacy of CAD can only be measured relative to technology opportunities and product development requirements, the group welcomes opportunities to interact with technologists and product developers especially during the planning processes of their projects.

4.5 TECHNOLOGY ASSESSMENT AND INTRODUCTION
Manager: Dan Goor (ML12-2/E71, 223-2895)

This group is responsible for assessing externally developed technologies and introducing them to the company when appropriate. They are also charged with comparing Digital's technology with that of its competitors and reporting on it.

The group also publishes a technology newsletter and a yearly "State-of-Technology" Report, a record of the corporation's state of technology and advanced development investments compared to external sources.

Contact the group anytime you require information about external technologies or advanced developments within Digital. They can inform you of new ideas for development and help you promote them within the company. In order to assist you in advanced development proposals, the group needs a clear description of the problem, the proposed solution ("deliverables"), and the required resources to carry out the project.

5.0 LSI (LARGE SCALE INTEGRATION) MANUFACTURING AND ENGINEERING

Manager: Jim Cudmore (ML1-5/E30, 223-2393)

5.1 MICRO PRODUCT DEVELOPMENT

Manager: Joe Zeh (WZ2, 238-2468)

Micro Product Development designs custom LSI circuits that are not available commercially, but are required for use in Digital products. The group should be contacted when you need custom-designed LSI devices and technology, or when you have an idea for an LSI product which could have corporate-wide application.

Micro Product Development is made up of the following groups. Contact the managers listed below for more information in their areas of expertise.

System and Logic Design	- Ken Slater (WZ2, 238-2261)
Semiconductor Circuit Design	- Jack Schneider (WZ2, 238-2355)
Computer Aided Design (CAD)	- Val Patel (WZ2, 238-2456)
Advanced Development	- Don Nelsen (acting) (WZ2, 238-2296)
Technology Applications	- Rony Elia-Shaoul (WZ2, 238-2295)
Computer and Graphics Applications	- Joe Zeh (acting) (WZ2, 238-2468)

5.2 LSI TEST ENGINEERING

Manager: Tom Marmen (WB, 237-2413)

This group is broken down into *class 19*, *class 21*, *memories*, *test process*, and *reliability* groups. The first three groups bring new LSI devices into the corporation. They are responsible for establishing contacts with vendors, generating test programs, qualification, and the overall support of LSI Manufacturing and Engineering.

The *test process* group is responsible for LSI test strategy and new test processes. The *reliability group* is responsible for new reliability techniques and new integrated circuit technology.

Contact the groups responsible for the class of devices you are considering bringing into the company. They can supply you with information on what is available, what is qualified, and what is a problem. The groups need to know what part is being bought and its application.

5.3 LSI PURCHASING

Manager: Dan Hamel (WB, 237-2212)

This group sources all standard LSI as well as custom LSI devices for Digital. It is an awkward fact of life in the 1980's that "standard" LSI devices are sometimes more difficult to source than custom LSI devices due to the increasing cost and time invested by any supplier who elects to copy his or her competitor's largest chips. Design engineers must therefore attend to questions of LSI sources. Sometimes, design engineers must take care to avoid poorly sourced LSI devices (in volume) despite actual

in-hand working samples. This must be done to preserve a likelihood that a hot new product with poorly sourced LSI devices will not interrupt a major part of Digital's cash flow. Get help from Purchasing.

5.4 LSI PROGRAM MANAGEMENT
Manager: Peggy Wesley (ML1-4/A97, 223-7854)

Each major Digital custom semiconductor program has assigned to it an LSI Program Manager who serves as a focal point for all activities associated with the design, manufacture, acquisition, and testing of the chip(s). The LSI Program Manager is responsible for working Digital's LSI design and manufacturing resource issues (people, equipment, tools, etc.) based on up-to-date product requirement forecasts.

The LSI Program Manager also gets involved in vendors/resource management as required to meet the program commitments. Communication between the LSI organization and Digital customers (Central Engineering, Product Lines, Volume Manufacturing) is a primary function of the LSI Program Manager.

Early in the product specification phase, the LSI Program Manager can contribute to the development plan by supplying estimated resource requirements for LSI design alternatives. The Program Manager is also available to participate in front-end negotiations with semiconductor vendors on technical and business matters.

Once the product is committed, the LSI Program Manager is actively involved in balancing the forecasted volume requirements with progress being made toward design and manufacturing commitments.

Usually the Product Manager or the Program Manager from Engineering is the person who contacts the LSI Program Manager.

6.0 STORAGE SYSTEMS DEVELOPMENT
Manager: Grant Saviers (ML3-6/E94, 223-9765)

Storage Systems Development is responsible for the development, strategy, and business planning for Digital's storage products. These products include semiconductor and other solid-state memory devices, arrays, subsystems, flexible disks (floppies), cartridge and cassette tape drives, 1/2-inch industry compatible tape drives, and removable and fixed media hard disk drives of all sizes. The organization supplies these products to the corporation by both developing and purchasing them.

In addition to large product development activities in Maynard and Colorado Springs, there are Product Management, Planning, and Advanced Technology groups which support the mission of the organization. Storage products are manufactured in Colorado Springs, Colorado, in Massachusetts (Westfield, Springfield, and Natick) and in Mountain View, California.

6.1 STORAGE SYSTEMS PRODUCT DEVELOPMENT (MAYNARD)
Manager: Bob Jack (ML1-3/E58, 223-6615)

This group is responsible for the design, development, support, and release to Manufacturing of storage devices and subsystem products. These products are used on all systems and sold by all product lines. They include:

- 1/2-inch magnetic tape drives, formatters, and controllers; these include low-cost, low-speed devices as well as expensive high-speed units; examples are the TS-11, TU77, TU78, and TM78

- floppy disk devices, controllers, and systems interfaces; examples are the RX01, RX02, and RX03

- tape cartridge devices, controllers, and systems interfaces; an example is the TU58

- RP07 large fixed disk subsystem (a "buyout" program)

- product support of disk products manufactured at the Springfield, Natick, and Westfield, Massachusetts plants; examples are the RK05, RK06, RK07, RX01, TE16.

This group also works interactively with Systems Engineering groups during the product planning, product design, and testing phases of new product development to ensure that the total DEC System meets its performance and competitive requirements.

6.2 STORAGE SYSTEMS PRODUCT SUPPORT
Manager: Steve Radoff (ML1-3/E58, 223-7601)

Storage Systems Product Support is the engineering design and development group whose main responsibility is to solve technical problems arising from the manufacture, maintenance, and application of disk and tape options.

For engineering problems with maturing disk and tape products currently in production or still in common use, the group serves as the focal point for research, design, and implementation of Engineering Change Orders (ECOs) for tape and disk products manufactured in New England.

The group works closely with Manufacturing/Engineering, Field Service, Product Line Engineering groups, and Product Management.

6.3 MEMORY SYSTEMS ENGINEERING
Manager: Dick Morris (ML21-2/E64, 223-3094)

This group develops most of Digital's electronic storage products. Choosing the optimum device and system technology, the group designs a product, builds its own prototype, and performs Design Maturity Tests (DMT) before releasing the product to Manufacturing, complete with documentation, test tools, and test programs.

The group has the product management function of logistics planning, and provides on-going support to resolve problems and provide cost reductions over the life of the product. They also work closely with Engineering Services, Technical Documentation, Field Service, Systems Evaluation, Diagnostics, and Software Engineering.

Contact the group if your product will need non-rotating storage. Members of the group possess expertise in developing low-cost, high-volume, reliable memory options.

The group needs to know your schedule goals, cost objectives, performance and reliability requirements, and form factor constraints.

6.3.1 Memory Device Engineering
Manager: Dave Dutton (ML21-2/E32, 223-6020)

Memory Device Engineering provides component support for a variety of read/write memory devices including bubble memories, dynamic RAMs (random access memories), and static RAMs. The group collects information about future memory parts, generates purchase specifications, defines incoming inspection tests, and performs device qualifications on current parts.

Contact the group if you are considering using memory devices in your project, if you need help in choosing current or future parts that best fit your requirements, if you need some applications help in designing these parts into your systems, or if you need samples for your prototypes.

Memory Device Engineering can supply you with a spectrum of available memory parts covering a range of cost, performance, density, and reliability objectives. The group can also provide a snap-shot look at future memory devices, availability, price, performance, and reliability. Finally, the group can supply you with a solution to a component or an applications problem.

In order to help you choose the right part, the group needs a list of device requirements, including cost, density, speed, power, reliability, and your expected schedule and quantity needs.

6.4 STORAGE ADVANCED TECHNOLOGY
Manager: Mike Riggle (ML1-3/E58, 223-5316)

The Storage Advanced Technology group is responsible for acquiring a technology base sufficient to allow Digital's storage products to be competitive. The group's efforts, then, are involved in a mix of technology acquisition and development. Advanced Technology generally develops or trades critical, fast-moving technology since it is hard to acquire it otherwise.

The group works with digital and analog circuits, magnetic recording, servos, memory subsystems, large scale integration, mechanical systems, recording and error correcting codes, component development, and solid state memories.

They also provide technology to product development groups working on storage products. Consultation on a variety of storage issues is also available.

The group is composed of two subgroups, Heads and Media and Components Development, and Storage Systems and Memories Advanced Development.

6.4.1 Heads and Media and Components Development
Manager: Bob Rottmayer (ML4-1/B32, 223-3259)

This group designs and develops magnetic recording heads and media. They also develop test equipment for heads, media, and servo writing. In some cases, the group specifies and buys media. The group's expertise lies in solutions to magnetic recording problems. They have specialized equipment, not generally available elsewhere, for the testing and measurement of magnetic materials.

Contact Heads and Media and Components Development whenever you have a problem with either heads or magnetic media in the areas of tapes, floppies, or rigid disks.

6.4.2 Storage Systems and Memories Advanced Development
Manager: George Hitz (ML21-2/E64, 223-3408)

This group works mainly in the areas of advanced development of electronic memory components and systems. They assess current technology, and interact with outside vendors to determine the characteristics of devices. They also conceptualize systems and build prototypes that use such devices as cache memory, main memory, and mass memory.

Contact the group when you need information about advanced memory technology, either for components or for systems. Also, contact the group when a specific memory system is needed. If you supply them with rough parameters (cost, size, etc.), the group can supply you with the technology to develop and design a memory system.

The group has information available about new memory technologies (e.g., bubble memory). They can supply you with a list of vendors, device specifications, availability, price, support functions available, and the like. The group can also supply layout rules, design guidelines, and basic system costs.

6.5 STORAGE SYSTEMS DIAGNOSTICS
Manager: Jim Lacey (ML21-4/E10, 223-3730)

This group designs and develops diagnostics for Digital's disk and tape products. They provide products and services to Engineering, Manufacturing, and Field Service. They also play a key role in the selection of vendor hardware. The group provides consultation and assistance in the early stages of product development to improve product diagnosis.

Storage Systems Diagnostics develops software for Engineering to verify that hardware is in compliance with hardware specifications. They provide software to aid in breadboard and prototype debugging. Additionally, the group provides software to evaluate vendor hardware and to aid in Design Maturity Testing (DMT).

The group also develops software for use in Manufacturing during Process Maturity Testing (PMT), unit production, and Final Assembly & Test (FA&T).

Finally, the group provides software to Field Service to verify complete system installation, to effect a high degree of fault detection and isolation (to speed up the Mean-Time-to-Repair), and to complement other tools in providing preventive maintenance services.

6.5.1 Memory Test Systems
Manager: Tom Lawnsby (ML21-4/E10, 223-2623)

This group develops memory test software. The group is responsible for developing memory component test software, and memory component evaluation software. They also develop life-test software operating systems for array and unit testing.

Memory Test Systems provides Storage Systems Development with all the test software to evaluate its new products. Also, this group provides Memory Manufacturing with software support for all test equipment unique to Memory Manufacturing.

6.6 SMALL DISK ENGINEERING
Manager: Phil Arnold (CX, 522-3170)

Small Disk Engineering develops and supports disk subsystems. The group has developed the RL01 - RL02, and RL11. In addition, the group has engineering support responsibility for the RM02, RM03, the RP05, and RP06. The group is presently engaged in designing new products in the removable media disk drive and low-cost, high-function controller areas.

Contact Small Disk Engineering for technical advice on any of the products listed above.

6.7 MEDIUM AND LARGE DISK DEVELOPMENT
Manager: Demetrios Lignos (CX, 522-3242)

This group is presently working on the R80/RM80 disk drive and the HSC50 intelligent controller. Members within the group work on servos and read/write circuits, and front end interfaces.

Mechanical Engineers work on complex, tight tolerance, mechanical assemblies such as rotary and linear actuators, and spindle assemblies.

Mechanical Packaging Engineers work on the sheet metal packaging of drives with attention to air-flow requirements because disk drives are sensitive to temperature variations. These people also define product styling requirements.

Logic designers within the group design the high-performance, sophisticated microprocessor-based control units. System/Software Engineers within the group define the subsystem architecture and write the software code (drives and control unit local microcode) for best performance at the subsystem level and overall system level of operation.

6.8 DIAGNOSTIC ENGINEERING - COLORADO SPRINGS
Manager: Bob Barnes (CX, 522-3200)

This group provides diagnostic engineering for the development and manufacture of storage subsystems. For Engineering, the group provides design assistance and consultation to assure maintainability (RAMP). They design verification software, and breadboard and prototype debug tools. They also aid in Design Maturity Testing (DMT), and assist in vendor selection and evaluation.

For Colorado Manufacturing, the group develops software based on the build requirements in the areas of Process Maturity Testing (PMT), unit production, and Final Assembly and Test (FA&T).

The group also provides the Field Service I/O Diagnostic Group with specification and diagnostic designs required to integrate a subsystem into any of the supported CPU families.

6.9 STORAGE SYSTEMS PRODUCT MANAGEMENT
Manager: Mike Gutman (ML3-6/E94, 223-5285)

This group is responsible for managing all products developed in Storage Systems Development. The group acts as a facilitator of information between technology and marketing, providing a window through which Storage Systems Development may view the marketplace, and Marketing may assess the current technology. The organization is involved in a product from cradle to grave, from conception and development through first-customer-ship and product phase-out.

The group integrates the marketing and development plans of several organizations, develops long-term product strategy, generates and obtains approval of business plans consistent with long-term strategy, and coordinates activities necessary for the successful introduction of sales and service of Storage Systems Development products. It also reviews and analyzes products against corporate profit and market objectives, and continually conducts analyses of the competition.

Products	Product Managers	Mail Stops/DTNs
RP02/03/04/05/06/07	Kevin Smith	ML3-6/E94, 223-5880
RS03/04 R80, TU77/78	Paul Feresten	ML3-6/E94, 223-4962
RM02/03/05	John Forde	ML3-6/E94, 223-3516
TU10/16/20/30/40/45/70, TS11	Ken Sills	ML3-6/E94, 223-5805
RL01/02	Wayne Galusha	ML3-6/E94, 223-3221
Floppy Disks	Phil Goldman	ML3-6/E94, 223-5669
DA, RK04/05/06/07, HSC50	John Woelbern	ML3-6/E94, 223-5015
Cartridge Tape TU58	Charlie Moeder	ML1-3/E94, 223-2267
Memory	Pete Durant	ML21-2/E64, 223-2147
	Celeste LaRock	ML21-2/E64, 223-8897

7.0 DISTRIBUTED AND MID-RANGE SYSTEMS DEVELOPMENT

Manager: Bill Demmer (TW/D19, 247-2111)

This organization is made up of four major groups: Advanced Systems Development, Distributed Systems Development, Mid-Range System Development, and Systems Planning and Product Management. The organization has a common Advanced Systems Development function and a tightly coupled Product Managment group to provide substantial emphasis on the sets of products Digital will require in 3 to 5 years.

7.1 ADVANCED SYSTEMS DEVELOPMENT

Manager: Jim Marshall (TW/A03, 247-2201)

This group works on new product development projects, having expertise in such disciplines as semiconductors, physical interconnect, CAD (computer aided design), communications, and fiber optics. The group is engaged in such activities as putting portions of VMS (Virtual Memory System) into firmware, investigating integrated-bounded systems, and determining hardware/software relationships in distributed systems.

7.1.1 Advanced Mid-Range Systems
Manager: Wayne Rosing (TW/B02, 247-2322)

This group develops new technologies for Mid-Range Systems. The group's focus is on developing technologies for semi-conductors, CAD tools, power and packaging, cooling, printed circuit board interconnect and connector requirements, system architecture, and microprogramming tools. The group also participates in long-range technical planning and top-level system engineering.

Contact the group if you are interested in any of the projects listed above. The group can supply you with technology skills, consultation, simulation data, and general help.

7.1.2 Current Product Engineering
Manager: Mike Powell (TW/C02, 247-2856)

This group provides engineering support for Distributed and Mid-Range Systems products currently in production. These products include the PDP-11 and VAX-11 families of CPUs. Support is also provided for older CPUs marketed by the Traditional Products Group.

The group becomes involved with a new product before its release to Manufacturing by the new product development team. During the first months of volume manufacturing the group assumes increasing responsibility. The transition into Current Product Engineering is complete after several months of production.

The group handles ECOs for safety requirements, adherence to specifications, cost reductions, product enhancements, and documentation. It also provides world-wide support for volume manufacturing, Systems Manufacturing, and Field Service.

The group also provides product support information to Marketing and Sales.

7.1.3 Packaged Systems Engineering
Manager: John Dennis (ML3-4/E81, 223-8467)

This group designs and documents corporate packaged systems. Members evaluate new products developed for the LSI-11, PDP-11, and VAX-11 families to guarantee systems compatibility. They also provide mechanical systems engineering support for the packaging of systems. Additionally, the group assists Systems Manufacturing by resolving systems problems and defining better systems products.

Contact Packaged Systems Engineering as early as possible in the new product design cycle to ensure that your product will be compatible with other Digital products.

7.2 DISTRIBUTED SYSTEMS
Manager: George Plowman (ML5-5/E97, 223-3329)

This organization is responsible for the architecture, development, and implementation of all DECnet products for all families of computers. Distributed Systems has four areas of communications technology for which it is responsible: Internal and External Software/Firmware Interconnect Development, Communications Hardware Subsystems and Devices, Hardware Interconnect Development, and Distributed Applications and Processing. The organization is made up of eight major groups.

7.2.1 DEC Interconnect
Manager: Mary Breslin (ML5-5/E97, 223-7535)

This group is responsible for the development of any product implementing Distributed Network Architecture (DNA), including X.25. The group develops funding and product implementation strategies. These strategies are aligned with the overall long-term strategy for all software DECnet products.

The group is basically engaged in product development, product support and maintenance, program support, and advanced development.

Contact the group if you have questions concerning DECnet certification, network test systems, DECnet performance criteria, and performance measurements. The group supports the DECnet-11M/S, DECnet-11M+, DECnet-RT, 3271/IAS, 3271/M, 2780/3780/RT-11, and the 2780/3780/VMS.

7.2.2 IBM Interconnect and Distributed Applications
Manager: Don Alusic (MK1-1/N34, 264-5187)

IBM Interconnect is responsible for the definition, development, testing, release, maintenance, and advanced development of products that interconnect between Digital's systems and IBM's systems. The group has responsibility for these interconnections on the PDT series, PDP-11 series, and VAX-11 series. This includes BISYNC as well as SNA interconnect products.

The Distributed Applications program deals with applications that work in a distributed or network environment. The development of such applications results in standard products. The group also seeks to better understand the distributed applications needs of customers. To date, most of the group's work has been in the area of electronic mail systems.

7.2.3 Hardware Interconnect
Manager: Dave Rodgers (TW/C04, 247-2369)

This group is responsible for the architecture, and first implementation and validation of hardware interconnect devices (formerly known as bus interconnects). Specifically excluded from the group's focus are internal memory to processor interconnects, and the UNIBUS and Q-bus. All other hardware interconnect devices are included.

Questions concerning the interconnection of DEC hardware should be directed to this group. Specifications and other information germane to hardware interconnection can be provided.

7.2.4 Communications Engineering
Manager: Roy Clites (MK1-1/M37, 264-5811)

This group develops corporate hardware communications products. It also supports over 20 communications products which are sold to OEMs and end-users. The group provides communications requirements, specifications, and data sheets on communications products. Contact the group when you have technical questions on data communications and communications systems. They have extensive knowledge of Digital and non-Digital modems.

7.2.5 Distributed Systems Architecture

Manager: Tony Lauck (ML5-5/E97, 223-6120)

This group is organized to provide a technical focus for the distributed systems program, to define the overall Digital Network Architecture (DNA), and to define and maintain the specifications of key interfaces and protocols which make up the architecture.

If you are developing a hardware or software product that is to communicate as a component of a distributed system, contact this group to receive assistance in understanding or interpreting a DNA interface or protocol. The group can also help you resolve incompatibilities between products which are supposed to adhere to the architecture. The group can also modify the architecture to satisfy the needs of new product development.

In addition to developing and maintaining specifications, Distributed Systems Architecture provides consulting services and operates the DECnet Review Group (DRG), a forum for product implementors to review and approve architectural specifications.

7.2.6 DEC 10/20 Networks

Manager: Tomas Lofgren (MR1-2/E89, 231-5170)

This group develops communication and network software for DEC 10/20 systems. Specifically, this includes DECnet 10/20, DECnet 10, ANF-10, IBM Communication on the DEC-10/20, and the KL10 console front-end software: RSX-20F.

Contact the group if you have a specific interest in any of the products mentioned above. Also, the group has extensive experience in data communications on larger computers. The group has done much work on front-ends.

7.2.7 Distributed Processing Program

Manager: Peter Christy (ML12-3/A62, 223-6110)

The Distributed Processing Program is responsible for developing the corporate distributed processing product and technical architecture objectives. The Program ensures the coordination of relevant plans for Engineering, Marketing, Sales, and Software Services.

The Program is concerned with all products that use multiple, interconnected computer systems (distributed processing). Specific product areas of interest include: networks, communications, interconnect, distributed data management, high availability multi-processor systems, electronic mail applications, and interconnected transaction processing systems.

Projects involved with software destined to run in a distributed processing environment should establish contact with the Distributed Processing Program. The Program will ensure that development groups are aware of work that is planned and in progress. It will communicate the technology and product strategy to the product developers. Furthermore, the Program will ensure that all related work is integrated into a comprehensive plan for distributed processing product development.

7.2.8 Distributed Systems Product Management

Manager: George Plowman (acting) (ML5-5/E97, 223-3329)

This group is responsible for the overall business management of Distributed Systems products. The group's three major areas of focus are long-range planning, sales support, and product management.

The group defines long-term development strategies, and prepares programs for inclusion in the Red Book. They also develop business plans for major aspects of the program. Furthermore, the group coordinates the program budgets and continually conducts analyses of the competition.

For sales support, the group coordinates product promotion, working with Software Services, Field Service, and Educational Services. The group also coordinates sales training, presentations, and product support.

As a product management group, they coordinate and facilitate all aspects of delivering Distributed Systems products to the marketplace. They manage the product business plans, product requirements, the phase review process, and provide product support for Field Service and the product lines.

7.3 MID-RANGE SYSTEM DEVELOPMENT (HARDWARE)

Manager: Brian Croxon (TW/C04, 247-2416)

This organization is responsible for the complete product development of systems, and enhancements to systems, that fall in the mid-range. In the PDP-11 space this includes all PDP-11s from the 11/34 up to the 11/74. This includes all future developments with similar cost and performance metrics in the VAX family.

Generally, the organization implements the Central Engineering product strategy in the mid-range, from initial product development to the complete release of the product to Manufacturing.

Mid-Range System Development is made up of three specific development groups and a diagnostic engineering group.

7.3.1 Mid-Range VAX Development

Manager: Steve Rothman (TW/D06, 247-2290)

This group creates the CPU logic design for the mid-range VAX system. They are also responsible for making sure all other pieces necessary for a complete system are done, including memory, power supply, mechanical design, etc.

Contact the group if you are working on a product that could be attached to the system. The group can supply you with knowledge and expertise on how a product should be designed to build a reliable, integrated system.

7.3.2 Low-End VAX and Small 11 Engineering

Manager: John Sofio (TW/D02, 247-2179)

This group is responsible for the design and development of new CPU systems in the product space named. New programs in product development begin in the Mid-Range Systems Advanced Development group. At some specified point (usually at the completion of a conceptual definition and a detailed project plan) program responsibility and some of the kernel project team come into the group to design, test, and release the new product to Manufacturing.

Contact the group when information about their products is required. The group should be involved in evaluating new products (e.g., peripherals) which fit naturally into the mid-range family. The group has expertise in UNIBUS systems hardware and can be called upon when a sophisticated level of technical support is required.

7.3.3 Large VAX and Large 11 Engineering
Manager: Pauline Nist (TW/CO4, 247-2123)

This group is responsible for the development of the VAX-11/780, the 11/74MP, and any enhancements to these products, such as the MA780 memory.

Contact the group when you are trying to add new hardware or peripherals to large VAXs or large 11s, when you have a VAX-11/780 support problem, or when you need specific hardware implementation or architecture information on large VAXs or large 11s.

If you provide the group with descriptions of hardware engineering issues or existing support problems, they can supply you with information about specific hardware implementations on large 11/70s and VAXs. They can also supply you with information about the status and function of hardware products currently under development, and information about the VAX-11/780 implementation of VAX architecture. Finally, the group can give you an estimate of the work involved to add on any peripherals in the large VAX and large 11 family.

7.3.4 Mid-Range Systems Diagnostic Engineering
Manager: Frank Bernaby (TW/F17, 247-2212)

This group provides diagnostic support for all VAX and UNIBUS-11 products and VAX non-magnetic I/O Subsystem products. Diagnostic support encompasses diagnostic requirements for Engineering, Manufacturing, and Field Service.

The VAX Diagnostic strategy is based on the premise that the VAX project will encompass a family of CPUs implemented over a period of years, eventually overlapping the price/functionality range presently occupied by the 16-bit UNIBUS-11 family. A goal of the group is to achieve consistently effective and consistently functional diagnostic implementation across the VAX family, while also maximizing inter-family diagnostic transportability. Through family orientation, the group supports a strong system-directed effort resulting in test structure/partitioning, packaging, and release control.

7.4 SYSTEMS PLANNING AND PRODUCT MANAGEMENT
Manager: Bernie Lacroute (TW/A08, 247-2113)

This group is responsible for supporting individual systems and products in the product management role. It integrates the overall system planning necessary to achieve a coherent Distributed and Mid-Range Systems product strategy.

The group acts as a facilitator of information transfer between technology groups and marketing, providing a window through which Distributed and Mid-Range Systems may view the marketplace, and Marketing may assess the current technology.

Systems Planning and Product Management integrates the marketing and development plans of several organizations, develops long-term product strategy, generates and obtains approval of business plans consistent with the strategy, and coordinates activities necessary for the successful introduction of sales and service of the development group's products. It also reviews and analyzes products against corporate profit and market objectives, and continually conducts analyses of the competition.

Contact the product managers listed below for more information:

High-end Systems – Peter Conklin (TW/A08, 247-2119)

Medium Systems – Bernie Lacroute (TW/A08, 247-2113)

High Availability Systems – Ed Slaughter (TW/A08, 247-2724)

Package Systems – Walt Colby (TW/A08, 247-2889)
Ed Wargo (TW/A08, 247-2120)

8.0 LARGE SYSTEMS PRODUCT DEVELOPMENT

Manager: Ulf Fagerquist (MR1-2/E78, 231-6408)

The primary goal of the Large Systems Product Development organization is to develop and implement the high-end portion of the corporate product strategy for VAX architecture-based systems and all DECSYSTEM 10/20 products.

The organization is made up of five major groups: Large VAX Systems Technology and Advanced Development, DECSYSTEM 10/20 Development and Peripheral Integration, Product Management and Strategic Planning, Operations Programs, and Marlboro Site Engineering, a group responsible for Large Systems Diagnostics, Information Services, Computer Services, and Engineering Services.

8.1 LARGE VAX SYSTEMS TECHNOLOGY AND ADVANCED DEVELOPMENT

Manager: George Hoff (MR1-2/E47, 231-6524)

This group is responsible for 32-bit System Programs and technology development for the VAX Program.

8.1.1 Large VAX Engineering

Manager: Sas Durvasula (MR1-2/E47, 231-4426)

This project group is currently developing VAX-11 processor units to be marketed in the $100k - $250k price range. The group includes senior engineers with experience in these technical disciplines: VAX architecture, high performance CPU design, floating point/array processor design, console design, cache/memory subsystem design, and microprogramming.

The group makes extensive use of SUDS (Stanford University Design System), IDEA (Interactive Design and Engineering Analysis), SAGE (Simulation of Asychronous Gate Elements), microcode simulation, and systems performance evaluation tools. The group is involved in the application of sub nano second technology and high-density components (LSI) to achieve high-performance processor structures.

Contact the group if you wish to investigate advanced implementations of the VAX-11 architecture, the application of high-performance technology to CPU structures, and advanced approaches in applying RAMP (Reliability and Maintainability Program) techniques to improve system availability. Although the group is focused on a specific project and not available to assume additional development tasks, they will provide consultation and assistance to any group requiring their expertise.

8.1.2 Technology and Advanced Development

Manager: Sultan Zia (MR1-2/E47, 231-6277)

This group provides engineering resources to assist in technology development for Large Systems products, both in the VAX-11 series and the DECSYSTEM 10/20 series. The group includes senior

engineers experienced in these areas: ECL (Emitter Coupled Logic) technology (10k and 100k), high-density gate arrays, complex multi-layer modules, circuit simulation (propagation delay and noise margin), LSI packaging and cooling, system level packaging, clock design and distribution, UL/CSA/VDE compliance requirements for large systems, computer-aided-design (SUDS, SAGE, Mincut), and power distribution.

Contact the group for information about high-performance technology. The group has extensive experience based on the development of KL10-based systems and KS10-based systems. As a functional group, they are chartered to provide support to development groups throughout Digital, resources permitting.

8.2 DECSYSTEM 10/20 DEVELOPMENT AND PERIPHERAL INTEGRATION

Manager: Bill McBride (MR1-2/E85, 231-6906)

This group is responsible for all 36-bit system programs, current products, and Large System peripheral integration. They are made up of five major groups: New Product Engineering, New Product Programs, Peripherals, Current Product Engineering, and Advanced Development.

8.2.1 New Product Engineering

Manager: Nat Kerllenevich (MR1-2/E85, 231-6440)

New Product Engineering for DECSYSTEMS 10/20 is concerned with all the engineering aspects of DECSYSTEMS 10/20 development. These include logic design and implementation, mechanical implementation, packaging, and power supply.

The group's goal is to satisfy the product requirements of performance, cost, and time-to-market. To meet this goal, they use available technologies and aids, and when required, the group sponsors the development of new methods and techniques (e.g., multiwire, CAD tools, simulations, etc.).

Contact the group if you need to make a physical interconnection to a DECSYSTEM 10/20 under development, or if you have an interest in performance specification issues relating to the group's products.

8.2.2 New Product Programs

Manager: Don Lewine (MR1-2/E85, 231-6430)

New Product Programs is concerned with the construction of new systems for the DECsystem-10 and DECSYSTEM-20 families of computers. The group is responsible for the coordination of all new component projects in a new system. Additionally, they are responsible for the smooth release of a new system into Digital's families of products.

This requires the coordination of the following Engineering groups: hardware logic design, Mechanical Engineering, circuit engineering, and Diagnostic Engineering. It also requires the coordination of TOPS-10 and TOPS-20 Software Engineering, hardware and software documentation, and course development, Marketing, and Engineering Services.

Any group with products, issues, or concerns affecting or affected by large computers should contact this group.

8.2.3 Peripherals

Manager: Roger Lawson (MR1-2/E18, 231-6522)

This group designs and develops I/O controllers and adapters for Large Systems. Additionally, the group is responsible for the integration of all peripheral devices for Large Systems. Controller and adapter development involves the specification and implementation of the I/O system requirements, the release of designs to Manufacturing, and the maintenance of products in the field during early shipments to customers.

Tasks within development include design, prototype building and debugging, coordination of Software's and Diagnostic's efforts, subsystem testing, and the generation and release of engineering documentation. Peripherals integration includes all of the above tasks except design.

The group is divided into two functions: Storage Systems (John Bloem, MR1-2/E18, 231-6209), and Communications/Unit Record (Paul Kelley, MR1-2/E18, 231-6401).

Contact the group whenever you have questions, problems, or suggestions about Large Systems I/O adapters or peripherals.

8.2.4 Current Product Engineering

Manager: Ron Setera (MR1-2/E18, 223-6213)

Current Product Engineering has three major functions: product support, product enhancement, and product qualification.

Product support was formed for the Large Systems' vast array of CPUs, I/O devices, and memories in the field. In this function, engineers provide expertise for solving design problems that were not discovered during the product's qualification and release phase. Product support includes resolving all problems in the areas of product documentation, hardware changes because of non-conformance to specifications, and safety-related changes according to international regulations.

Full product support lasts until the product is turned over to the responsible Manufacturing Engineering group. The product support function of Current Product Engineering will, however, continue to provide technical consultation and be responsible for safety-related changes.

Product enhancement involves designing new functions for current system products. Such enhancements include new instructions added to a CPU through microcode development, or the integration of a new I/O controller or adapter into the system. Product enhancement also tests new system configurations that Marketing groups would like to offer. All necessary testing, documenting, and releasing performed for a system development project are also done for product enhancements.

The group also performs a *product qualification* function. Engineers plan and schedule product qualification by performing an array of tests. They ensure that the product meets the product design specification, that it meets both internal and international standards, and that it completes Design Maturity and Process Maturity Testing. The product must also complete system parameter tests. In this assignment, the engineer learns the system in detail, and becomes familiar with the diagnostics, the operating system, documentation, and the hardware. Upon completion of all qualification tests, the engineer is equipped to support the product in the current product support function of the group.

8.2.5 DECSYSTEM 10/20 Advanced Development
Manager: Ron Melanson (MR1-2/E85, 231-6419)

This group will provide the necessary CAD (Computer-Aided-Design) tools for the design of next generation DECSYSTEM 10s and 20s. These tools will be used predominantly for integrated circuit design, specifically for bipolar technologies. One of the group's goals is to implement a hierarchical version of SUDS (Stanford University Drawing System), necessary for the support of VLSI chip design. Additionally, the group's work in the area of SUDS will encompass upgrading the SUDS graphic I/O to support the newly proposed Siggraph-ACM CORE graphics protocol.

8.3 MARLBORO SITE ENGINEERING
Manager: Roy Ryzak (MR1-2/E78, 231-4140)

The Marlboro Site Engineering group includes development and support functions that support both the Large Systems Engineering organization and the Marlboro product line/marketing groups. In addition, Marlboro Site Engineering is available to provide support to other groups.

Marlboro Site Engineering is made up of these groups: Diagnostic Engineering, Engineering Services, and Computer Operations (see Section 5, paragraph 3.4 for information about Engineering Services).

8.3.1 Large Systems Diagnostic Engineering
Manager: Dick Maliska (MR1-2/E68, 231-6505)

This group develops diagnostic software, console microcode, and other programs to support a wide range of products including products from the Digital Components Group, Laboratory Data Products, Medical Data Products, Federal Systems Group, and the Large Systems (32- and 36-bit) Group. The group has senior diagnostic programmers with experience in these disciplines: CPU micro diagnostics, diagnostic monitors, console microcode, CPU functional tests, and systems exercisors. The group is also experienced in the development of on-line and off-line diagnostic programs for storage systems units, tape systems, unit record equipment, and communication subsystems.

The group has substantial experience in cross-group projects. They should be considered a valuable resource to support projects for any group that requires their expertise. The group has extensive experience supporting KL10-based systems and KS10-based systems, and should be consulted by those pursuing information or diagnostic development for high-performance systems.

8.3.2 Marlboro Computer Services
Manager: Tim Beers (MR1-2/E69, 231-6225)

This group is responsible for providing general timesharing support. They have established data centers to support Software Engineering, Hardware Engineering, Marketing, and CAD processing (SUDS and IDEA). DECsystem-10s and DECSYSTEM-20s are available for use. VAX-11 timesharing is planned for the end of fiscal year 1980.

8.4 OPERATIONS PROGRAMS
Manager: Len Kreidermacher (MR1-2/F18, 231-6617)

Digital develops individual products which must be integrated into a system. The system level integration assignment is performed by a Program Manager. The integration is a called a Program. This

group ensures that all products under development within Large Systems Engineering are part of a system and included within one or more of the programs.

The group works to ensure that development groups use the tools available to them during the product development process. Examples of these tools are: Product Business Plan Standard (DEC Standard 130), Software Product Phase Review Procedure (Software Development Policies and Procedures Manual, 5D2-1.A), and BURP (Business Review Program). The use of these tools varies depending on the interpretation of the tool by the user. This group coordinates the interpretation of these tools within Large Systems Engineering to ensure a high-quality and consistent development process.

8.5 PRODUCT MANAGEMENT AND STRATEGIC PLANNING
Manager: Per Hjerppe (MR1-2/E78, 231-6121)

This group formulates short and long-term product planning strategies for all 36-bit systems and large ($100k - $250k) 32-bit systems. The group negotiates and allocates funds to development groups. They translate market needs into requirements for specific systems to be designed by Engineering. They also participate in the phase review of each product's life cycle, from product inception through development, active market life, and retirement.

The group markets products to Digital's product line groups who then market the products to customers. The group also participates in product announcement and promotion, formulating product pricing and policy.

Contact the group for information regarding product strategy, funding, new functions and features of products, and product policy and pricing.

Product managers for Large Systems Product Development are listed below.

Large Vax Systems	Carl Gibson (MR1-2/E78, 231-6779)
Strategic Planning	Maria Tseng (MR1-2/E78, 231-6412)
New DEC 10/20 Systems	Per Hjerppe (MR1-2/E78, 231-6121)
Product Marketing	Leslie Hruby (MR1-2/E78, 231-6424)

9.0 CORPORATE RESEARCH GROUP
Manager: Jim Bell (ML3-2/E41, 223-2764)

The Corporate Research Group provides research, advanced development, information services, consulting, technical education, and technical staff services to the corporation, with particular emphasis on meeting the needs of Central Engineering.

Research

The group conducts an internal research program and also works with external researchers. The research activities consist of five major programs, each of which is composed of several projects. The five programs are:

- Languages, Data Bases, and Applications
- Small Systems and Terminals
- Distributed Processing

- Office Information Systems
- Computer Systems Architecture

Research is the group's largest activity. The *Research Group Annual Report*, *Research Group Strategy*, *Research Group Plan for Current Fiscal Year*, and *Research Project Procedures* are documents that contain information on what the organization is doing and how it is doing it. These publications are available to you on request.

The Research Group writes a monthly report which includes project status reports on every active research project. This report is also available to you on request, in your choice of two levels of detail. Every project has a plan. Periodic technical reports are issued for each project. Most projects have special interest lists for those who would like to receive memos and more detailed material on the topic. The best way to learn more about a project is to contact the Project Leader directly. A tabular summary of all projects, their status, and their project leaders appears monthly in the Engineering Yellow Book.

Project Leaders are anxious to consider research project suggestions from all within the company – let them hear from you.

Advanced Development

This activity complements both R&D's own research and the Advanced Development activities that are distributed among many other engineering groups.

Information Services (Corporate Library)

The Corporate Library, managed by Ralph Coffman (ML4-3/A20, 223-6465), is headquartered in the Maynard Mill (4-3) and is an information center for business and technical information. Its services are available to all Digital employees either remotely or through local branches (see index).

The Corporate Library provides reference books, periodicals, research reports, standards, Digital and competitors' documentation, audio and visual cassettes, inter-library loans, and SCAN searches (a service that finds out what has been written on specific job-related topics). Its Purchasing Department handles individual and departmental purchases of books, subscriptions, memberships, and competitive materials.

For more information, refer to the CORPORATE LIBRARY SERVICES brochure available upon request. For general inquiries, call 223-6231.

Consultation

The Research Group provides consultation on a wide variety of technical subjects, utilizing both internal and external resources. Contact Bob Swarz (ML3-2/E41, 223-2134).

Education

The Research Group serves as the primary technical link with universities. They solicit and fund research proposals from universities in cooperative research investigations for the benefit of Engineering. Additionally, joint research efforts with industrial and non-profit organizations are developed. For more information, contact Dick Eckhouse, University Relations Manager (ML3-2/E41, 223-8706).

The Research Group is also willing to provide technical speakers on a broad range of topics, including current research projects. For a list of topics and speakers, contact Mary Jane Molloy (ML3-2/E41, 223-7687).

The group also coordinates a monthly Engineering Seminar Series. Contact John Morse (ML3-2/E41, 223-5801) for more information.

Technical Staff Services

Research provides technical staff functions designated by the Vice President of Engineering, with emphasis on those services which are future oriented, are leveraged by a broad payoff, or serve to bind together the activities of diverse groups.

Current Research Activities

The five current research programs are described in the sections that follow.

9.1 LANGUAGES, DATA BASES, AND APPLICATIONS
Manager: George Poonen (ML3-2/E41, 223-3537)

This group is conducting research in languages, data bases, and applications. They believe that applications software is going to play an important role in Digital's future. For this reason, the group's goal is to develop expertise and provide tools in this field. Currently, the group's projects are divided into four areas:

- Software Methodology (SEER-software maintenance tool; MPG-business application tool)
- Languages (PL/I, ADA)
- Data Bases (Relational Model, Natural Languages)
- Applications (Computer Aided Instruction-research sponsored by Educational Services; Knowledge Based Systems)

The group's current strengths are in the areas of languages and data bases. They would be happy to provide consultation, tutorials, or other forms of assistance in the above areas.

9.2 APPLIED RESEARCH AND DEVELOPMENT
Manager: Bob Glorioso (ML3-2/E41, 223-5250)

This group's primary interests are in low-end systems and new physical technologies. The group has multi-project programs in Micro-Architecture and in Terminals, and additional projects in Multi-Micro Systems, Human Factors (hardware and software) and Low-End Software. Many applied R&D programs and projects are closely tied to activities in development.

The Applied Research and Development group provides consultation in human factors, and is responsible for tracking microprocessor and associated LSI activities in the semi-conductor industry.

9.3 COMPUTER SYSTEMS RESEARCH
Manager: Rick Peebles (ML3-2/E41, 223-8817)

This group conducts research and advanced development projects in the structure and implementation of computer systems. The group's current focus is on distributed processing and communications. They explore new software technology and attempt to transfer this technology to development groups.

Typically, the group works on projects three to ten years before the product is shipped. The group likes to work on advanced development problems that are a little too far out in time or too risky to be taken on by a development group. They stay abreast of current technology and research activity outside of Digital.

Computer Systems Research can supply you with consultation, prototypes, and analyses. To do their work, they need a clear problem statement and a commitment to continued interaction. One of the group's most difficult problems is managing the transfer of technology and keeping research/advanced development relevant to developers.

9.4 OFFICE INFORMATION SYSTEMS RESEARCH

Manager: Bob Swarz (ML3-2/E41, 223-2134)
Program Leader: Ken King (ML3-2/E41, 223-3066)

This group ensures that Digital has the ability to design products required by the office information systems market. The group assesses products and technologies that appear to be successful in the market. These are then compared to the company's existing products and technologies to determine what products and technologies must be developed to enable Digital to remain competitive.

Office Information Systems Research also sponsors advanced development projects for products that are essential in this market but are missing from the company's present offerings. For example, speech input and output are current study topics. The group also monitors basic research in relevant technologies and applications currently being developed in universities and other places to which they have access.

The group encourages the development or evolution of products oriented toward office information systems. In the short term, the group watches for opportunities to spin off commercially viable products from its advanced development efforts.

9.5 COMPUTER SYSTEMS ARCHITECTURE RESEARCH

Manager: Bob Swarz (ML3-2/E41, 223-2134)
Program Leader: Lloyd Dickman (ML3-2/E41, 223-6159)

The basic objective of this group is to provide insight and direction for the development of computer systems, with emphasis on establishing appropriately architected interfaces.

The Architecture Research Program provides support for development groups throughout Digital. The group investigates evolving architectural issues, collects data describing the behaviour of existing computer systems, and develops criteria for making architectural decisions.

The major beneficiary of the program is the development organization. Working with implementors and product management, the program contributes to product innovation and new product development by providing insights into the behaviour of existing products as well as exploring the implications of applying technologies.

10.0 EXTERNAL RESOURCES

Manager: Henry Crouse (ML1-5/B98, 223-2610)

External Resources is the corporate-wide organization that handles all of the purchasing and distribution needs of Digital. This runs the gamut from sourcing raw materials and parts to shipping final products. Groups described here include Purchasing, Corporate Distribution, Component Engineering, and Purchase Specifications.

10.1 PURCHASING

Manager: Jack Batten (ML1-5/B98, 223-3238)

Purchasing assures supply, competitive cost, timely delivery, and qualified materials. They develop purchase specifications, verify compliance, and ensure that we have one part number, one standard cost, and one face to the supplier.

Purchasing also influences strategic business decisions. They participate in the selection of materials to meet product, design, manufacturing, and administrative goals. The organization also supports Field Service and Marketing, and ensures a formal make-or-buy process at all levels in Digital. For further information, contact Barbara Birt, ML1-5/B98, 223-2634.

10.1.1 Engineering/New Products Purchasing

Manager: Tom Cavanaugh (ML5-3/E13, 223-3003)

The group serves the Northeastern engineering community with four distinct services: Support Purchasing, Project Purchasing, Materials, and Software and Systems Purchasing.

Support Purchasing services Engineering's everyday parts and equipment needs. These include inventory parts for breadboards and prototype requirements, new items, or out of stock items. They handle consultant, maintenance, and service agreements. They can also provide rentals of equipment and capital equipment such as testers. The group will also assist you in locating sources for engineering support materials. Finally, the group can find out who makes any part.

In order to assist you, the groups needs specification details, part numbers, and catalogue data if available. They also need quality standards, if applicable. An authorized Internal Purchase Requisition is also necessary for the group to do business with you. This authorizes the group to commit to a Purchase Order with an outside vendor. It must be completed by the requisitionor with all the necessary signatures. Without this information, order placement may be delayed. For more information on what is required of you, contact:

Phil Buscemi (ML5-3/R13, 223-5153)
Anita Spinney (TW/B15, 247-2645)

Contact the group whenever an engineering stockroom can't supply your needs. For common breadboard components, it's possible that the material will be in stock.

Because it costs Digital about $35 to place an order, administrate it, and generate a check to pay the vendor, it makes sense to group your small items whenever possible.

Project Purchasing works with design groups to source all new components including fabricated plastic and metal items. The group is organized by commodity specialty, handling active devices, passive devices, fabrication, and plastics.

The group establishes cost-effective sources, evaluating component and metal parts availability, lead time, and the capacities of outside sources. They communicate sourcing risks to both Manufacturing and Engineering, recommending effective risk management. Project Purchasing can also negotitate the most favorable preliminary standard cost, reflecting the proper balance among quality, technical conformance, and expected volumes of lot sizes. The group can also provide a "value analysis" using their external resources or vendor base.

Contact the group early in the concept stage of your project. They need sketches or preliminary line drawings with essential dimensions, and specifications. The format of these requirements is not important in the early phases of your project. For more information, contact:

Matt Habinowski (ML5-3/R13, 223-3229)
Bill McAllister (ML5-3/R13, 223-8946)
Charlie Sullivan (TW/B15, 247-2628)

Materials exists to aid design engineers in obtaining, controlling, and planning material for prototype builds. They act as an interface to Project Purchasing. As a project oriented group, Materials aids in documentation control at the preliminary stage by using a PCA (Purchasing Change Authorization) System. The group also structures and maintains, by way of the Parts Lists, an engineering Bill of Materials using software developed by Engineering New Products Purchasing specifically for this purpose. They maintain a product materials cost data base. Finally, the group drives processes for the timely resolution of materials issues among Manufacturing, Engineering, Purchase Specifications, and the Manufacturing plants.

In order to assist you, the group needs an Engineering Parts Lists, documentation (format unimportant), a willingness to work with the Purchasing Change Authorization (PCA) System, and an Engineering Business Plan (see DEC Standard 130) for a new product. Contact them during the concept stage of your product. For more information, contact:

Lino E. Mion (ML5-3/R13, 223-8987)
Vic Bellemare (ML5-3/R13, 223-8372)
Pam Hansmire (TW/C15, 247-2170)

Software and Systems Purchasing assists in locating and obtaining software packages, competitive hardware, and EDP (Electronic Data Processing) consulting services.

The group can supply you with the best available software to fit the function described. The group acts as a "clearing house" for the purchase of competive hardware. (Do we already have it? Should we buy it? Lease it?) The group can also put you in contact with those consultants who are able to perform the specified task in the time required. They will also handle all contracts, licenses, and agreements associated with the above.

The group needs a functional specification or a work plan to assist you. They would like to be involved in the concept stage of your project, or as soon as an outside acquisition is considered. For more information. contact:

Steve Hyde (ML21-1/T27, 223-4852)
Bob Mendelsohn (ML21-1/T27, 223-7519)

10.1.2 Corporate Purchasing/Commodity Management

Manager: Tom Grablick (ML21-1/P66, 223-2614)

This group prepares 2 to 5 year Business Plans for puchasing major commodities and critical raw materials. They ensure that suppliers have the capacity to provide for Digital's expanding material requirements.

The primary responsibilities of the group include coordinating all purchasing activities of today and the next 5 years and ensuring strategies are in place to improve the dollar value of expenditures under contract. Furthermore, the group attempts to reduce raw material costs and material acquisition costs, measure supplier performance, enhance buyer knowledge, and allocate resources and material.

10.1.3 Administrative Purchasing

Manager: Paul Mantos (MS/B87, 223-8317)

This group purchases office services, furniture, construction, travel, maintenance, computer supplies, telecommunications, and mail services.

10.2 CORPORATE DISTRIBUTION

Manager: Carl Kooyoomjian (ML1-5/B98, 223-9735)

This group plans, implements, and directs the efficient flow, storage, and handling of raw materials, in-process inventory, and finished goods from their point of origin to their point of consumption. They have representatives in Digital's plants, product lines, subsidiaries, and administrative groups.

The primary focus of Corporate Distribution is on making an efficient distribution network throughout Digital. Elements of the network include transportation, field distribution centers, warehousing operations, associated systems for communications and control, and handling and storage methods.

To assist you, the group can provide a profile of their product design criteria, and an estimate of warehousing and transportation costs and trade-offs. Finally, the group can give you an understanding of the impact of distribution costs on the end user.

If your product needs new distribution schemes, contact the group during the design phase of product development by calling:

Joan Labelle (Corporate Distribution) ML1-5/B98, 223-7192
Darlene Hoover (Domestic Distribution) NR1-2, 234-2375

Questions which must be considered for any new product include: Can the product be stored in our existing warehousing systems? Will a slight design change reduce the storage space required? Can the product be easily handled by Digital and external personnel and equipment? Is the product designed within the requirements for transportation? Can we cost effectively and safely, with a minimum of product damage, move the product?

10.3 COMPONENT ENGINEERING

Manager: Jim Ring (acting) (ML1-5/B98, 223-6607)

Component Engineering is an organization made up of three coordinated efforts: *Resident Component Engineering* (a component engineer is assigned to a specific design engineering group), *Corporate Component Engineering*, and *Plant Component Engineering*. These three groups are united in a phased plan to give support to the planning, introduction, and maintenance of purchased parts.

Component Engineering's goal is to ensure that Manufacturing uses high-performance, available, and cost-effective purchased components to build cost-competitive, quality Digital products.

The organization provides technical support and direction to Manufacturing and Engineering on the selection of purchased components. They provide the documentation to ensure that parts are procurable, testable, and compatible with Manufacturing processes.

Component Engineering knows vendor processes and materials which apply to Digital's needs. They can relate information concerning components from the part level to the application and system level.

They also have an awareness of industry trends, and the technology, strengths, and weaknesses of individual suppliers. They can anticipate and solve purchased component problems. Additionally, the organization has extensive lab facilities to evaluate components.

Component Engineering can provide you with consultation on application analysis, component evaluations, industry trends, and problem solving. There is also available an ECO (Engineering Change Order) service to cross products, the Assembly Library Module (ALM) - a library of physical dimensions and pin layout of various components, and data bases for CALDEC and IDEA systems used by Design Drafting.

For information about component vendors, the organization can supply you with a Qualified Vendor List, Master Parts File (contained in EPLS – Engineering Product Library System), component marking and identification, and purchase specification and qualification procedures.

Regarding component usage, Component Engineering can provide you with a BOM (Bill of Materials) Analysis (a rating of preferred parts used as listed in all BOMs), a used-on listing, and trends in component usage.

For component test and evaluation, the organization can provide you with incoming inspection specifications, and plans, procedures, and programs for inspections and tests.

Resident Component Engineering provides many services to Design Engineering. These include direction on new or preferred technologies for components, vendor liaison for specifications, testing methods, schedules, qualification requirements, and assistance in getting the product to Manufacturing by interacting with Purchasing, Specification Control, Incoming Inspection, Process Engineering, and Manufacturing.

The Resident Component Engineer can also communicate engineering requirements to Corporate Component Engineering. These requirements include schedules, Part Number Request Forms (PNRF), In Process Parts (IPP), and special projects.

Finally, the Resident Component Engineer maintains a knowledge of other componant group activities outside the domain of Component Engineering. These groups include fabrication, metals, chemical, LSI, etc. For more information on Resident Component Engineering, contact:

Leo Tiernan (ML6-3/E21, 223-2663)

Corporate Component Engineering provides many services to Design Engineering. These include application data, reliability data, and consultation on the manufacturing of components, orientations to component engineering procedures, training, and failure analysis. The failure analysis includes SEM (Scanning Electron Microscopy) evaluation, component cross-sectioning, photography, and Xray qualification labs.

To qualify components, typical tests include mechanical, electromechanical, electrical, electronic, life-testing, temperature cycling, flammability, humidity, gross leak testing, package integrity, chemical, hipot, solderability, and critical mechanical dimensions.

Component Engineering offers a half-day seminar for the Design Engineering community. They provide designers with the information required to make optimum use of Component Engineering resources. Topics covered include:

- New Part Introduction Process
- Engineering Change Orders
- Information Resources – The Purchase Part System
- Component Engineering Services

To enroll in the seminar, or for further details and manuals, contact Component Engineering at 223-4797.

Contact Component Engineering early in the design phase of your project. Prior to releasing your product to Manufacturing, the resident component engineer can assist you in introducing your product to Manufacturing. For more information contact:

Vic Valenti (Quality/Reliability) ML6-3/E21, 223-3067
Paul Nix (Electromechanical, Passive/Discrete/Magnetics) ML6-3/E21, 223-4558
Leo Tiernan (Integrated Circuits) ML6-3/E21, 223-2663

10.4 PURCHASE SPECIFICATIONS

Manager: John Peachey (ML5-2/P67, 223-2322)

For Engineering, Manufacturing, and vendors, this group writes, controls, and distributes all of the specifications required to purchase the materials needed to produce Digital's products.

Purchase Specifications is a central repository containing a wealth of purchased parts information. The group performs a variety of tasks:

Digital Part Numbers – Each properly completed and approved Part Number Request Form (PNRF) is assigned one of these numbers.

Purchase Specification Generation – The group researches, writes, and edits specifications to established formats.

ECO Processing – The group researches, writes, and processes ECOs to purchase specifications.

Electronic Data Processing Entries – Purchased parts data are coded and entered into the Purchase Spec Data Base and are batched processed daily into the Engineering Product Library System.

Purchase Specification Distribution – Purchase specifications are distributed via microfiche (updated weekly) and microfilm. These are distributed to reproduction and microfilm areas.

Component Index Books – The group writes, edits, publishes, and distributes these books which fall into three categories: multi-class, 90 class, and FCD (Functional Code Descriptor). All indexes are updated periodically and are available to you.

Bulletin Listing All New and ECO'ed Part Numbers – Every two weeks the group publishes this document with all new numbers recently assigned (with related data). It also includes recent ECOs received (with related data).

Incoming Inspection Procedures – These procedures are maintained under ECO control and distributed on microfilm and microfiche.

ROM/PROM Coordination – The group assigns pattern numbers, supplies "how to" information for documenting patterns, and coordinates the information with the Design Library, the LSI Test Center, and vendors.

VSMF (Visual Search Microfilm) – These are microfilm cartridges containing most vendor catalogues. By providing a vendor's name, you can be supplied with vendor address, phone number, local sales office and phone number, a list of products offered, and a catalogue sheet of these

products. If you know what type of commodity you want, the VSMF can supply you with information about which companies manufacture it, and catalogue sheets from those companies. The VSMF also contains Military, ASTM, and UL Standards.

Qualified Vendor Listing – This information is sorted by Digital Part Number and available on microfiche machines. No hard copy distribution is available.

Purchased Parts Lists – This information is sorted by vendor part number and name and available on microfiche machines. No hard copy distribution is available.

Vendor Code File – This file provides you with the address, phone number, and vendor code number of each Digital supplier.

The group needs complete specification information from you in order to assist you. Sometimes you may be asked for additional component and vendor information to complete your purchase specification. You will be asked to review and sign-off a finished specification. Give the group sufficient lead time to establish priorities for completion, review, and approval of the specification.

A convenient "one-stop-shop" method of having your *Part Number Request Form* approved is to leave it and any attached data with Component Engineering. Component Engineering will arrange full approval and submit the PNRF to Purchase Specifications for part number assignment. If you desire, you can bypass the "one-stop-shop" method and obtain approval signatures and part numbers without assistance.

The Following DEC Standards will help you do business with Purchase Specifications:

DEC Standard 012 – Unified Number Code – All purchased parts must reflect a Digital assigned part number (e.g., 10-99 class) before parts lists/BOMS can be finalized, before Purchasing can order, and inventory control can process material.

DEC Standard 055 – Purchase Specifications – This standard establishes the general instructions and responsibilities for the preparation and control of Digital Purchase Specifications.

DEC Standard 100 – ECO Procedures – This standard establishes the procedures for writing, obtaining approval, and submitting the ECO to the Purchase Specifications ECO Coordinator.

For more information, contact:

Jim Boice (ML5-2/P67, 223-3187)
Carl Bull (ML5-2/P67, 223-5124)

SECTION 6

PRODUCT LINE GROUPS

Digital's three major product line groups are Commercial Products, Computer Products, and Technical Products. Each major product line group is made up of a number of discrete product line groups. The product line groups have been described as small companies within the larger corporation, each responsible for its own marketing, advertising, finance, production operations, and engineering (when needed), with a primary responsibility for marketing and market planning.

Most product line groups are based on a particular industry and its needs. The OEM (Original Equipment Manufacturers) product line groups, for example, exist to expand Digital's repertoire of OEM customers and to provide them with the support they need. ECG, the Education Computer Systems Group, caters to the education market: schools, universities, and armed forces training facilities. By adopting Digital's products that fit individual marketplaces, the product line groups are able to provide a wide range of specialized equipment and services geared to solving a customer's data processing problems.

Product line groups structure their product offerings around the needs of their particular customers. This structuring is based on a knowledge of how customers do business, what their problems are, and how our products can be designed to solve their problems and help them run their businesses more efficiently.

Therefore, it is very important that you have a clear understanding of customer needs. A product's capabilities and applications are valuable only if they are marketable. State-of-the-art equipment will remain just "art" unless there exists a customer for such equipment. Obviously, design engineers cannot design and implement products in a vacuum. They must look at products from the perspective of the customer.

Products which truly service the needs of the marketplace are more likely to happen when communication is developed between Engineering and the product line groups. Most of this communication and coordination of efforts is performed by Product Managers from Central Engineering. But they can't do it all. For this reason, it would greatly benefit you and the company if you gained some knowledge of the ultimate use and destination of products developed at Digital.

The following pages contain descriptions of what product lines exist, what products they market, what their applications are, and who to contact for more information.

1.0 COMMERCIAL PRODUCTS GROUP

1.1 COMMERCIAL OEM GROUP
Manager: Dave Schroeder (MK1-2/H32, 264-5502)

This group sells small business computers through resellers who add hardware or software value and resell the systems in commercial applications areas.

The group is the main OEM supplier in the commercial marketplace. Through this channel, the Commerical OEM GROUP has aquired 10–15% of the small business computer market, primarily in the general purpose data processing environment. The major strengths of the group are in the size of its current distribution network (over 500 commercial OEMs) and the strength and breadth of Digital's Field Service network.

The DEC Datasystem 150 (PDT), the DECstation series (PDP-8 based), both the DEC Datasystem 300 and 500 families (PDP-11 based), as well as word processing systems and the DECSYSTEM-20 and VAX 11/780 are available to OEMs through this group. In addition, the group sells hardware components to commercial "iron" (hardware only) OEMs.

The group is chartered to evaluate and develop marketing programs, support programs, and OEM policies on behalf of the entire Commercial Products Group. OEMs are selected by an OEM Review Committee following analysis of a prospect's marketing plans, financial statements, and cash flow figures. Commercial OEMs who choose to apply and who meet Digital's certification criteria are known as Authorized Digital Computer Distributors.

1.2 TELEPHONE AND UTILITY GROUP
Manager: Peter Jessel (MK1-1/D29, 264-7207)

This group provides computer systems to all telephone operating companies, postal telephone and telegraph administrations and telephone equipment manufacturers for telephone central office and business office applications.

Products sold by this group include PDP-11s, VAX 11/780s and associated peripherals and software. They also sell unique hardware and software products, and special services such as TELCO configuration control.

In the telephone industry, these products have applications in "switch" (i.e., exchange) monitoring and control, transmission monitoring, billing data acquisition, central office administration, order entry, directory assistance, off-line billing, and collection, verification, display, communications, and data network systems.

1.3 MANUFACTURING, DISTRIBUTION, AND CONTROL GROUP
Manager: Bob Savell (ML5-2/E50, 223-2239)

This engineering group develops systems based on PDP-11s and the VAX family of computers. These systems are sold as standard products to customers composed primarily of Fortune 500 companies engaged in manufacturing or distributing tangible products.

The systems are true distributed systems, designed as systems and not as a collection of components, to be maintainable and programmable from the host processor. The part of the system designed by MDC is the DEC DATAWAY, a 15,000 foot multidrop hardware and software communications system that allows the host to communicate with up to 64 remote, general purpose, small processors such as the LSI-11 or 11/23, or with terminals that have very high data integrity.

The group also designs terminals used on both the DATAWAY and on EIA (Electronic Industry Association) RS-232-C lines for a variety of data entry and data dissemination tasks. The combination of these products allows distributed system configurations for practically all applications in a manufacturing or distributing company. Examples of such applications include time and attendance, material control, labor reporting, work-in-process tracking, inventory control, order processing, word processing, and electronic mail.

The group also designs a line of process I/O modules. The systems configured around process I/O modules are used in applications from monitoring a single machine tool to controlling very large refinery processes.

2.0 COMPUTER PRODUCTS GROUP

2.1 WORD PROCESSING PRODUCT LINE

Managers: Bob Gray, Hardware Engineering (MK1-1/J14, 264-5874)
Bob Beck, Software Engineering (MK1-2G10, 264-5962)

This group designs and sells display oriented turn-key word processing systems and word processing software packages to all end-users and certain OEMs.

Word processing itself has been defined as "the transformation of ideas and information into a readable form of communication through the management of procedures, equipment, and personnel." From a practical point of view, it refers broadly to the increasingly sophisticated hardware and software that permits rapid and efficient production of ordinary paperwork and related communication media.

Word Processing's four major applications include general correspondence, the creation of contracts and other lengthy documents, the printing of personalized form letters, and asychronous communication possible with any conversational remote computer.

The Word Processing Product Line presently offers both word processing products and communications software.

2.2 COMPUTER SPECIAL SYSTEMS GROUP

Manager: Jerry Butler (HD, 264-6209)

This group is devoted to filling those customer needs not otherwise satisfied by Digital's standard volume offerings. In performing this function, Computer Special Systams (CSS) engages in two mutually complimentary and supportive businesses. First, they design and develop special hardware, software, or turn-key systems for specific customer applications. Second, they design and develop a wide range of hardware and software products which are application-oriented or complement Digital's standard product offerings.

To this end, the group has its own Marketing, Engineering, and Manufacturing organizations for software as well as hardware. CSS is spread throughout the world. In addition to having three Engineering/Manufacturing facilities in the United States, CSS has facilities in Canada, Australia, Japan, UK, France, Sweden, and Germany. Each facility has a marketing, engineering, and production staff, and is capable of designing and manufacturing products to special order.

CSS projects vary from very small, to large and complex, and from essentially "standard" products to tailored one-time systems with special hardware and software.

2.3 GRAPHIC ARTS PRODUCT LINE

Manager: Steve Gross (MK1-1/D11, 264-6118)

This group designs and markets typeset, classified advertising, editorial, and business Text Management Systems (TMS) based on the PDP-11 computer. The group's products have applications in printing (newspapers, in-plant, commercial), publishing (books, magazines), and radio and television. The group is also responsible for developing add-on equipment, and upgrading the more than 450 typesetting systems presently in use.

The Graphic Arts Product Line provides customers with four sets of turn-key applications packages: TMS, CPMS, EMS and CMS.

These products are used in pure typesetting systems for newspapers, trade typesetters, and captive plants. It is also used to provide text editing for business Electronic Data Processing applications programs written specifically for newspaper and commerical printers, and subscription fulfillment for magazine publishers.

This hardware may also be used for business Electronic Data Processing tools for development of individual programs (COBOL, RPG II, FORTRAN, DIBOL), and interactive page make-up systems.

2.4 TRADITIONAL PRODUCTS GROUP

Manager: Jack Learson (MK1-1/D11, 264-5761)

This group provides continuing engineering support to the customer using older systems and add-on hardware. The group also provides an outlet for used equipment, excess equipment, and small volumes of larger systems to support on-going needs in certain segments of the marketplace.

The group assumes product responsibility for most CPUs no longer actively marketed and manufactured. The group sells refurbished equipment, PDP-11/35, 40, 45, 55, XVM Systems, and PDP-15 Graphics. Its older traditional products include PDP-8, 8I, 8S, 8L, PDP-11/15, PDP-11/20, PDP-12, Industrial 14, PDP-16, and other 18-bit processors (PDP-10, DECsystem-10 and -20 traditional products are handled by the Engineering Systems Group, Paragraph 3.3).

All of the group's factory refurbished equipment is electronically and cosmetically perfect, updated to the latest ECO levels, and all of the equipment is subjected to the same rigorous testing as Digital's new equipment.

Employees may purchase equipment from this product line group for personal use. Contact the group for more information.

2.5 RETAIL PRODUCTS DEVELOPMENT GROUP

Manager: Ollie Stone (ML21-3/E87, 223-6617)

This group sells small computer systems bundled with application packages and associated products directly to small businesses through company operated retail stores. The group offers both products and services: computer systems, supplies, and accessories, seminars and training classes, and brochures, manuals, and system documents to keep customers fully informed about their application packages.

The group presently offers only one basic computer system with no choice of memory size. The customer gets one or two dual RX01s, optional WPS communication software, a choice between two printers (LQP or LA180), and a choice of six application packages. Aimed at the small business, the general purpose business application package consists of accounts payable, accounts receivable, payroll, invoicing and inventory control, and general ledger. Other application packages and computer systems are being developed for future sale.

2.6 ACCESSORIES AND SUPPLIES GROUP

Manager: Phil Campaigne (MK1-2/B14, 264-6804)

This group consists of two product line groups: Digital Computer Supplies, and Customer Spares – the product line group which supports Digital's self-maintenance customers.

2.6.1 Digital Computer Supplies

Manager: Phil Campaigne (MK1-2/B14, 264-6804)

This product line group offers a complete line of supporting products for Digipal's major products. Organized to provide responsive service to the world-wide Digital customer base, the group carries items that complete or complement a computer system. A distribution network allows 24-hour turnaround time for 95% of the products. Products supported by the group include: processors, storage systems, software systems, and communication terminals. Contact the managers listed below for more information about the group's products:

Processors and Software Systems, Walt Dunham (MK1-2/E13, 264-6811)
Communications and Terminals, Dave Gagnon (MK1-2/E13, 264-6807)
Storage Systems, Steve Grinley (MK1-2/E13, 264-6804)

2.6.2 Customer Spares

Manager: Phil Campaigne (MK1-2/B14, 264-6804)

This group supports customers who choose to perform their own maintenance. Customers are able to conduct a productive self-maintenance program because this group provides a number of services and products. For example, group members assist customers in establishing proper spares inventories.

The group develops spare kits for processors, tape units, disk drives, terminals, and other peripheral devices. It also offers a maintenance documentation service (MDS) – a microfiche library (available by subscription to customers) of all documents (except engineering drawings) used to maintain Digital's hardware products. The group also provides tool kits, maintenance equipment, and test equipment for Digital's products.

Contact the following managers for more information about their products:

John Gallagher (CPUs, Memories, Tools, Test Equipment) MK1-2/C15, 264-6982
Arnold Beauregard (Printers, Terminals, Communications Equipment) MK1-2/C15, 264-6980
Ed Young (Storage Systems Devices) MK1-2/C15, 264-6979
Jim Butler (LSI, Small Systems) MK1-2/C15, 264-5271

2.7 TERMINALS PRODUCT LINE

Manager: Chuck Bickoff (MR2-1/M64, 231-6629)

This group designs and sells terminals and terminal related products. The primary functions of the group are to develop and maintain high-volume distribution of selected terminals and related equipment, and influence Digital to develop and manufacture better, more reliable, and lower cost system components.

The group markets teleprinters (LA34, LA36, LA120), character-oriented printers (LA180), the VT52 and VT100, and intelligent terminals (PDT11/110, PDT11/130, PDT11/150) to large volume purchasers. They also sell several specialized versions of these products. These products are aimed at meeting customer needs in an endless variety of data and communications applications. Typical applications include timesharing, data capture, inquiry and response, transaction processing, telecommunications, desk top computing, word processing, and small, stand-alone business systems.

2.8 MICROCOMPUTER GROUP

Manager: Jim King (MR2-1/M64, 231-6632)

The primary function of this group is to market unbundled LSI-11 systems at the board level to customers who will purchase a required minimum volume. The group serves three classes of customers: high-volume users, low-volume users, and the home hobbyist.

The group sells the LSI-11 and its options, giving users the flexibility to buy the absolute minimal system and expand it to meet the requirements of the application. They also market tools for hardware and software development, such as the PDP-11V03 and PDP-11T03 development systems and evaluation kits. General purpose interfaces, clocks, analog-to-digital, and digital-to-analog converters, and communication options are available for the LSI-11/PDP-1103. Operating system software, including RT11 and RSX11S with languages, is also available.

These products have been designed to supply users with reliable, low-cost systems that can be used in industrial process control, inventory control, data formatting, preprocessing, and as developmental systems. A home hobby distributor uses many versions of the LSI-11 to provide his or her customers with kits. A photographic laboratory uses a version of the LSI-11 to obtain color separation balance when processing color films. A manufacturer of sheet plastic uses LSI-11s to control the thickness and the mix of the materials in the manufacture of the product.

3.0 TECHNICAL PRODUCTS GROUP

3.1 TECHNICAL OEM GROUP

Manager: Joe Meany (PK3-1/M86, 223-2837)

The OEM (original equipment manufacturer) buys Digital's products, adds substantial value, and resells or leases the products to a third party who is a separate corporate entity. If the end application of a computer is to be the management or control of a process or product, the OEM is defined as technical.

Applications for Technical OEM products include engineering and scientific (such as simulation, computer-aided-design), instrumentation (instrument control and processing of instrument readings), medical (patient monitoring equipment, CAT scanners, etc.), industrial, government and telecommunications, and computer system products where Dcgital's product controls the OEM's product, such as the Xerox page printer and COM (Computer Output Microfilm) equipment.

The value of OEMS may be found in the several contributions which they offer. They multiply the effectiveness of the sales force. They are a stimulus to high-volume manufacturing, resulting in lower product prices for everyone. They provide greater product exposure to first-time computer users who later may buy Digital's end-user products. Technical OEM sales account for approximately 20% of all corporate sales.

3.2 EDUCATION COMPUTER SYSTEMS

Manager: Charlie Rose (MR1-1/M40, 231-4360)

This product line group is a leading supplier of educational computing equipment, offering a range of products from small single-user systems to large mainframes.

This group provides minicomputer systems, related software and support materials for instructional applications in educational institutions, government, and industry. They also provide computer systems to assist in the financial and operational administration of educational institutions.

The group markets standard corporate PDP-11 and VAX-11/780 products. In addition, VAX-11 PASCAL, WISE, DECAL application software, and packaged systems are designed and sold.

They also provide DECsystem-10 and DECSYSTEM-20 mainframe computer systems, related software and support materials for administrative, instructional, and research applications in educational institutions worldwide.

3.3 ENGINEERING SYSTEMS GROUP

Manager: Pete Smith (MR1-1/M42, 231-5160)

This group provides PDP-11s, VAX-11/780s, DECSYSTEM-10s and -20s, and associated graphics and peripheral devices with computer aided design applications to industry segments and engineering disciplines.

For industry, these products have applications in manufacturing, government and utility engineering departments, architectural and consulting engineering companies, design and build companies, and construction companies.

For engineering disciplines, these products have applications in structural engineering, electrical and electronic engineering, and civil engineering.

The Engineering Systems Group has made major investments in generic engineering software and specific engineering applications software. Engineers interested in learning more about applications software packages in the areas of structural analysis, electronic design, or mechanical design, are invited to contact ESG. The product line group can supply you with information about functionality, Digital system configuration, availability terms, and contacts for specific programs. For specific application areas, contact:

Rick Gimbel (MR1-1/M42, 231-5154) Electronics
Lloyd McDaniel (MR1-1/M42, 231-5162) Mechanical Design
Jim Morrison (MR1-1/M42, 231-5159) Structural Analysis

The group also publishes an *Engineering Systems Software Referral Catalogue* twice a year. The most recent edition lists nearly 200 programs for such disciplines as Architectural Design, Structural Analysis and Design, Electrical/Electronics, and Management and Control. All packages run on PDP-11, VAX-11/780, DECsystem-10, or DECSYSTEM-20 systems. Catalogue copies can be ordered from Printing and Circulation Services in Northboro, order number EJ-17954-37.

3.4 GOVERNMENT SYSTEMS GROUP
Manager: Dana P. Lajoie (MR1-1/M85, 231-5467)

This group sells all of Digital's products to governments outside the U.S., and to the U.S. Government in Command, Control, Communications, Weapons Systems, Intelligence, and general Automated Data Processing (ADP) areas. They sell to prime contractors in the Command, Control, Communications, Intelligence, Weapons Systems (C^3IWS) business. They also sell products to all 36-bit Original Equipment Manufacturers.

Government Systems Engineering services the needs of these market segments and provides both hardware and software products. The group also provides consultation for the product line group on all products.

The Government Systems Engineering group has specialized expertise in computer networking, including ARPANET, interconnectability, high-speed channel interfaces, TEMPEST product engineering, and High Availability Systems.

3.5 LABORATORY DATA PRODUCTS GROUP
Manager: Bill Avery (MR2-4/E79, 231-6805)

This group provides computer systems, related software, and supportive materials for research and scientific applications in educational and non-profit institutions, medical research, industry, and government institutions.

The group seeks to address the following scientific and research applications:

- Realtime and/or off-line acquisition of scientific and research data
- Graphic display of this data
- Multifunction (real-time, batch, timesharing) manipulation and management of scientific and research data
- Control of and data acquisition from scientific instruments and experiments
- Development of programs for acquisistion, manipulation, simulation, and display of scientific and research data

The group's hardware development area can supply you with specifications, trade-offs, interconnection to other hardware, etc. The group can also tell you more about their applications, market size, and customers.

To assist you, the group needs a general product description with a statement of the impact of the new product on internal products. They also need developmental costs, a realistic schedule, a first-customer-ship date, and volume schedule. They would also appreciate major specifications with an analysis of the competition.

3.6 MEDICAL SYSTEMS GROUP

Manager: Raff Ellis (MR2-4/M79, 231-6928)

This group sells computer systems related software and supportive materials to the medical marketplace. The group sells specific products (e.g., GAMMA-11, a system used in nuclear medicine; MUMPS, a system used in clinical labs) to end-users and OEMs. They also sell equipment relating to clinical care, including patient data, to the medical marketplace.

Contact the group during the new product business planning stage at which time the Medical Systems Group may indicate a high level of interest.

The group can supply you with specifications, trade-offs, and interconnections to other hardware. They can also supply you with their applications, market size, and customer profiles. Other items include long-range and high-volume planning, inventory, and member's names for Product Steering Groups.

For hardware development issues, contact:

Bill Avery (MR2-4/E79, 231-6805)
Bernie Geaghan (MR2-4/E14, 231-6944)

For software development issues, contact:

Dirk Brinkman (MR2-3/E70, 231-5637)
Terry Weichmann (PK2/M21, 223-5911)
Bruce Bayuk (MR2-3/E70, 231-4046)

To assist you, the group needs a general product description, with a statement of the impact the new product will have on internal products. They also need an estimate of developmental costs, a realistic schedule, a first-customer-ship date, and volume schedule. They would also appreciate major specifications with an analysis of the competition.

SECTION 7

PROCESS MANUFACTURING
Manager: Will Thompson (ML1-5/E29, 223-8845)

1.0 MANUFACTURING NEW PRODUCTS
Manager: Joe St. Amour (ML1-5/E29, 223-2596)

This group coordinates Manufacturing's overall capabilities and strategies for Digital's future projects, managing the introduction of new products into Manufacturing.

The group can tell you who to contact for information about product costs, process design, schedules, and budget estimates. They will assign you a temporary Manufacturing 2x2 team partner for your "Before the Beginning" phase*. This will enable you to get Manufacturing commitments as you need them, before your permanent Manufacturing 2x2 partner is identified. The "Before the Beginning" phase is also a time when the group will help you put together your New Product team. At that time the plant that will build your product is identified and commitments from the plant are secured.

* Figure 7-1, General New Product Start-Up Plan, shows the major milestones in the life of a project from a Manufacturing perspective. Manufacturing must be allowed to participate in the planning of your project before the Phase 1 Business Plan is written. To achieve this, Engineering and Manufacturing must communicate with each other early in the new product's development. We call this working together "Before the Beginning". It plays a crucial part in our mutual goal of introducing Digital's new products on schedule, at quality, at cost, and to budget.

If you do not know who to contact in Manufacturing, call the New Product Manager responsible for the type of product you wish to introduce. This person will either help you himself, or direct you to the right people. New Product Managers and product types are listed below:

Al Smith (AC/B38, 232-2450)	- CPUs
Ed Tompkins (ML1-5/B95, 223-2523)	- Terminals
Guido Ciannavei (ML1-5/B94, 223-9724)	- Disks and Tapes
Gene Stringer (NI, 261-3058)	- FA&T (Systems Integration)
Ken Slater (WZ2-1, 238-2261)	- LSI
John Harrington (ML1-4/B21, 223-9452)	- General Manufacturing

Figure 7-1 GENERAL NEW PRODUCT START-UP PLAN

	1	12	3	55	67	68	69	70	71	72	73
MAJOR EVENT	IDEA PRELIMINARY APPROVAL GIVEN BY THE OFFICE OF DEVELOPMENT	PHASE I BUSINESS PLAN APPROVED BY OFFICE OF DEVELOPMENT	PRODUCT DESIGNED	PHASE II BUSINESS PLAN (MANUFACTURING PLAN) APPROVED BY MANUFACTURING ENGINEERING COMMITTEE	LIMITED RELEASE OF PRODUCT DOCUMENTATION	PRODUCT ANNOUNCEMENT	PILOT RUN COMPLETED	PRODUCTION BEGUN	FIRST CUSTOMER SHIPMENT MADE	PMT (PROCESS MATURITY TEST) COMPLETED	FIRST QUANTITY SHIPMENT MADE
PURPOSE OF EVENT	To develop profitable new products for Digital.	To receive authorization for funding & other resources to complete product design, and to put in place other necessary product plans.	To freeze product definition and complete design to sufficient degree so that program can proceed on schedule & prototypes can be built which are of a design that manufacturing can build & product planning can be controlled.	For New Product Team to publish & secure approval of a Manufacturing Plan which specifies & facilitates product schedule, quality, cost & budget so that every team member knows what to do & when, & so other parts of the company can proceed with product's plans based on New Product Team's commitment	To transmit all the product documentation from Engineering to Manufacturing, under change control, that manufacturing requires to begin securing material, people, & process equipment to be ready for the Pilot Run	To announce the product to the outside world such that orders can be solicited & booked with full assurance that company contract commitments can be met	To debug the actual mfg. process all the way through mfg. by building a small number of units before production of a large number of units is begun.	To produce units for sale, - on schedule - at quality - at cost	To meet contractual commitment to first customer of the product.	To conclusively demonstrate that the mature stabilized product is being produced to quality goal by a stable process so that process can be controlled	To complete process of - initial product build meeting commitments - Product documentation - Introduction strategy - Transfer to steady state manufacturing organization in controlled & predictable manner
TASKS REQUIRED FOR EVENT TO OCCUR	1. Two page preliminary business plan written. 2. Preliminary business plan approved by ODD, RE, Corporate Policy Memo 75-8, DEC STD 007. 4. Market projection evaluated as favorable & initial sales projections made. 5. Market strategy defined & approved to fit with overall strategy by the Product Line Managers. 6. Manufacturing capability/strategy reviewed & approved. 7. Field Service inputs received. 8. Engineering project head is identified. RE Corporate Policy Memo 75-8. RE There is no Business Plan without inputs by Manufacturing people.	1. Customer need defined. 2. Solution defined in form of product. 3. Proposed product passed Design Review, DEC STD 007 Steps 2, 3, & 4. 5. Preliminary product documentation completed such that prototypes can be built 6. Product design coordinated as appropriate with Mfg., Field Service & Product Lines.	1. Product Specification including A. Functional specification, B. System configuration definition &, C. Reliability performance have been completely defined & frozen. 2. Product Specification is under change control. 3 Product Specification has been translated into design Mfg. can build 4 Design has passed Design Review, DEC STD 007 Steps 2, 3, & 4. 5. Preliminary product documentation completed such that prototypes can be built 6. Product design coordinated as appropriate with Mfg., Field Service & Product Lines.	1. All parts of the Mfg. plan are completed, specifying product schedule, quality, cost & budget goals. 2. The strategy & resources for achieving goals have been identified by/for team members. 3. Plan has been approved by M-E Committee 4 2 X 2 Managers have been hired and installed. 5. Plan has been published & committed to by New Product Team. 6 All key functional New Product Team Managers have been hired & installed. 7 Provision has been made for the plan to be updated (rev control) 8 The Phase II Business Plan has been approved of which the Mfg. Plan is a part. Phase II requires a completed prototype.	1 At least one prototype has been built, debugged, & is operating to the published product specification functional specifications 2 And to selected system configuration(s) specifications. 3 All build product documentation is complete including fab, logic, assembly, etc., & 4 Is the same as the prototype unit 5. Has been signed off by both the Mfg. & Eng. 2 X 2 Team members 6 And is under change control. 7 DEC STD 007 Design Review Steps 5, 6, & 7 passed	1. The 2 X 2 Team has made final commitment to Mfg. cost. 2 Product pricing is finalized by Product Lines, 2 X 2 Team & Product Lines have agreed & commited 3 To build schedules 4 To build numbers and. 5 Configuration mix 6 Product design has been sufficiently tested such that 2 X 2 Team can commit to product performance & reliability on a schedule 7 Announcement package is complete 8 First Customer Ship is 3-6 months away 9 Product has been announced.	1 DMT, SMT, 102 & 060 tests have sufficiently qualified product design to justify risk of Pilot Run 2 Product Lines & 2 X 2 Team have agreed & commited A To build schedule, B To build numbers C. To configuration mix 3 Pilot units have been built only A Using latest rev product documentation. B Using latest rev process documentation C In selected Mfg. plant, D By Mfg personnel E Using process equipment & documentation to be used at production commencement F. Completed pilots as product will be shipped to 1st customers, has been successfully evaluated for 1) Unit functionality. 2) System functionality 4 All process documentation is under change control. 5 New Product Team agreed process sufficiently debugged to begin production 6 Pilot strategy/ method determined for future options, enhancements & configurations 7 Product availability commitment for Field Service evaluation & training has been met	The following tests qualifying product design (on prototypes) have been completed, proving the product to the Product Specification 1. Design Maturity test for reliability & functionality 2 System Maturity Test on selected (2 X 2 Team) configuration(s) for functionality 3 DEC STD 102, 060 environmental & safety 4. Pilot run has been completed 5 Continuous availability of sufficient material personnel & other resources are assured 6 PMT Plan is final drafted 7 PMT has begun 8. Construction of production units has begun 9 Plan for transfer of product mfg responsibility to steady state plant organization agreed to by plant 10 Field Service & 2 X 2 Team have agreed & committed to Field Service spares schedule & spares test process 11 Design Review DEC STD 007 has been completed (Step 8) 12 Final release of design documentation has been made	Shipment of the 1st product unit has been completed 1 At quality plan goal - unit & system level 2 Field Service has accepted product. 3 Customer has accepted product.	The PMT plan has been carried out & has conclusively demonstrated using a representative sample quantity of the product, that the process is sufficient to produce product at the desired end goals specified in the Mfg. plan of 1. Product at cost, 2 Product at quality 3 Product at quantity 4 A strategy/method plan exists for PMT of future process changes, ECO's & Product enhancements & options	1. Product is being shipped to schedule 2 Product is being shipped at final quality goal 3 Product is being shipped at interim cost goal 4. Above has been achieved at Quantity, I.E., at a monthly rate which is 65% of the average of the monthly rates projected for the next 12 months 5 PMT is completed 6 Suitable product documentation is available for External Mfg. or another plant. 7 New Product Team members have been reassigned 8 Plant organization has taken over responsibility for product manufacture

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There are many sources of information about new products and their introduction to Manufacturing. The following list contains these sources and names of people to contact:

Source	*Contact*
General New Product Start-Up Plan A road map guide of what needs to be done to introduce a new product into Manufacturing	Group or plant new product managers or Brenda Buchanan (ML1-5/E29, 223-4278)
New Product Introduction Reference Library Collection of tools, policies, and sample plans relating to new product introduction; includes sample Manufacturing and PERT plans for various types of products	Group or plant new product managers or Brenda Buchanan (ML1-5/E29, 223-4278)
Project Planning Package Users handbook for planning a new product introduction and how to use PERTX, the PERT-based computer program for project scheduling	Brenda Buchanan (ML1-5/E29, 223-4278);also available in the Corporate Library
Slate Book Manufacturing plans to improve its new product introduction process	Joe St. Amour (ML1-5/E29, 223-2596)
Polka Dot Book Quarterly review of budgets, schedule, revised forecasts, etc., for all new products being introduced into Manufacturing (distribution is restricted)	Mel Black (ML1-5/F31, 223-5091)

Source	*Contact*
DEC Standard 130 – Guide for Product Business Plans The how and what to write for Phase I and Phase II business plans which are required to secure authorization and funding for new products	DEC Standards Administration (ML5-2/E56, 223-2954)
Manufacturing/Engineering Organization Directory A Who's Who? in Manufacturing	Barbara Burnham (ML1-5/E29, 223-2580)
Project Scheduler Training Manual A self-paced instruction guide on PERT scheduling	Brenda Buchanan (ML1-5/E29, 223-4278)

You can get assistance on two additional areas of interest to you. Process Consultants are available to explain the benefits and use of the Project Planning Package. They can assist you in the hiring and training of Project Schedulers. Additionally, Project Planners, members of the New Product team, are catalysts and keepers of the new products introduction plan. For more information, contact Brenda Buchanan (ML1-5/E29, 223-4278).

2.0 CORPORATE QUALITY ASSURANCE

Manager: Gene Mondani (ML1-5/E30, 223-2933)

This organization is made up of three groups: Reliability Engineering, Quality Assurance, and Manufacturing Product Safety. These groups are described below.

2.1 RELIABILITY ENGINEERING

Manager: Art Sturgis (ML1-5/E30, 223-4979)

This group ensures that a low-risk, economical product is introduced to high-volume Manufacturing. Normally this is accomplished through Design Maturity Testing (DMT).

Usually Engineering prototypes are submitted to the group for independent third party evaluation. Through a Review Action Team (RAT) with members representing Engineering, the group, and Manufacturing, a detailed plan is generated with Mean-Time-Between-Failure (MTBF) goals specified.

Contact the group during the design stage of your project. You should have established initial Engineering MTBF goals. Reliability Engineering will assign an engineer to chair the Review Action Team and issue the DMT plan.

2.2 QUALITY ASSURANCE

Manager: Darby Checketts (ML1-5/E30, 223-4414)

This group drives the certification of products and processes within Manufacturing. Product Managers and Project Managers should contact this group to understand the requirements for certification. The certification of a particular product means that:

- The product complies with all DEC Standards
- Design Maturity Testing has been completed successfully
- Process Maturity Testing is complete and a plan exists to ensure ongoing reliability
- Fundamental elements of a Manufacturing system to control for quality are in place
- Clear quality contracts exist between supplying plants and consuming plants
- Quality emphasis is on prevention rather than detection and correction
- Early product performance meets quality goals (functional performance as well as visual and mechanical quality)

These accomplishments make it possible for other organizations to reduce their dependency on retesting and other double checks. This way, Dock Merge, Field Merge, and other process optimization programs become possible.

The group can also supply you with overall direction to Digital's Quality organization and programs.

2.3 MANUFACTURING PRODUCT SAFETY

Manager: Bill Fischer (ML1-5/E30, 223-4198)

This group is the focal point for product safety and customer protection issues within Manufacturing.

The group ensures that manufactured products comply with DEC Standards with regard to product safety, consumer protection, and international regulatory issues. They provide functional direction to individual plant product safety coordinators to ensure safety issues are addressed in a uniformed and controlled manner.

The group also provides Manufacturing with an understanding of the requirements of outside regulatory agencies. They act as the principal liaison with these agencies on compliance issues.

Finally, the group is a focus for Manufacturing to address issues raised by the Corporate Product Safety Committee regarding product safety and consumer protection.

3.0 CENTRAL MANUFACTURING/ENGINEERING PLANNING

Manager: Arun Dube (ML1-5/E30, 223-7060)

This group manages the planning process for Process Manufacturing. They publish the "Manufacturing Technology Statement," which states the goals, strategies, and tactics of various Process Manufacturing groups to accomplish future product objectives. They coordinate the publication of the "Process/Product Technological Strategy," documents reflecting the strategy of processes in place and technical migration plans supporting product manufacturing objectives. These documents represent information from all Manufacturing groups.

The group also manages and funds Manufacturing Research and Development (PL97) projects so that Manufacturing's technological strategy is properly supported by projects to make the migration goals possible.

Contact the group when you wish to either know or influence Manufacturing technological goals, strategies, or tactics. Also, contact them when you wish to have new process capabilities funded or developed.

It will help the group if you communicate to them potential technological process applications for Manufacturing. If you have future technological needs dictated by design requirements, give the group time to initiate action.

4.0 INTERCONNECTIONS PROCESS

Manager: George Wood (AC/E44, 232-2300)

This organization makes up the bulk of Process Manufacturing. Major groups within Interconnections Process include Interconnections Process Management, Boards and Metals Process Management, Technical Systems and Services, and Manufacturing Test Applications. These groups are described in the pages that follow.

4.1 INTERCONNECTIONS PROCESS MANAGEMENT

Manager: Jim Melvin (AC/E48, 232-2310)

This organization is made up of several process management groups responsible for developing, implementing, and maintaining the strategic and operational plans to supply sub-assemblies to assembly Manufacturing:

Modules	- Ron Bohlin (AC/E48, 232-2576)
Power Supplies	- Tom Porada (AC/E48, 232-2442)
Backplanes	- Ed Sullivan (AC/E48, 232-2377)
Cables	- Hank Rauch (AC/E48, 232-2548)
Manufacturing Test Strategies	- Ed Gianetto (AC/E48, 232-7536)

The group develops five-year requirement and capacity plans with supporting strategies. They understand and manage the controlled growth of process technology, including

- Providing process operational information to groups developing new processes
- Working with process developers to determine new process acceptance criteria
- Supporting the implementation of new processes and process enhancements
- Determining the capabilities of existing processes and Digital's competitive manufacturing position

The groups also develop appropriate business and performance measurements. These measurements are used to realize the potential of processes.

Contact the organization if you would like to learn about interconnections processes including their current status, capabilities, and future plans. The groups can also tell you what techniques and technologies are being developed.

The groups can provide you with standard process documentation and explain how interconnections processes work. They can also tell you the status of Manufacturing locations, capacity, and loading.

The groups need from you designs which allow them to use the current processes to maximum advantage. They also request that you work with Producibility groups (see Section 7, paragraph 4.3.1) when designing new products.

Finally, when the capabilities of the existing processes do not meet the needs of future products, the Interconnections Process Management groups need time to react and information on how to react.

4.2 BOARDS AND METALS PROCESS MANAGEMENT

Manager: John Caulfield (AC/E44, 232-2544)

This group is made up of Process Management – Printed Circuit Boards, Central Mechanical Manufacturing Engineering, and Process Management Quality Assurance.

4.2.1 Process Management – Printed Circuit Boards

Manager: Don Pucci (AC/E44, 232-2534)

This group is responsible for developing, implementing, and maintaining the strategic and operational plans for the supply of printed circuit boards to Manufacturing.

They develop five-year requirements and capacity plans with strategies to meet such plans. They understand and manage the evolution of technology and its impact on in-plant environmental and safety aspects.

They determine Digital's competitive Manufacturing position, developing business and performance measurements. They also build new boards shops, developing the "make versus buy" strategy for printed circuit boards.

The group provides corporate commodity management for printed circuit raw materials and capital equipment.

Contact the group if you would like to learn more about the printed circuit board process including its current status and future plans. Also, contact the group if you would like to know what techniques and technologies are being developed.

The group can explain how the printed circuit board process works and help you understand the process capabilities. The group needs from you designs which allow them to use the high-volume process. They also request that you work with Producibility groups (see Section 7, paragraph 4.3.1) when designing new products.

4.2.2 Central Mechanical Manufacturing Engineering

Manager: Fred Oldfield (ML5-1/E31, 223-2235)

This group develops specific manufacturing processes that optimally suit the parts. They define and develop manufacturing tooling, inspection processes, and instrumentation. They also verify the process and quality capabilities of vendors.

For tooling engineering, the group designs, develops, and evaluates all new product tooling requirements, inspection guages, instrumentation, and assembly fixturing for production sites. They also evaluate and endorse all high-volume tooling contracts for concept and cost.

For mechanical computer-aided design/manufacturing (CAD/CAM), the group's goal is to integrate engineering and manufacturing functions, and to subsequently spread the technology throughout Digital. This is being accomplished by maintaining a computer laboratory used for both development and production. The development applications include pure Research and Development, training, system engineering, and special software generation. The production use includes design engineering, tool engineering, and N/C (numerical control) programming.

For advanced processes, materials, and technology, the group provides consultation and advice on all materials and process technology pertinent to the company's needs. They also verify and define new or improved technology.

When mechanical parts are involved, Manufacturing new Product Managers should contact Central Mechanical Manufacturing Engineering at project inception, where a Manufacturing team (consisting of Manufacturing, Quality Tooling Engineers, Process/Materials Specialists, and New Product Buyers) will work with the Design and Production organizations to develop schedules, budgets, tooling requirements, inspection techniques, and product cost goals. This team will remain part of the New Product task force until volume production goals are met.

An ad hoc product review committee evaluates the above requirements at the development of the Project Proposal. Participants of the review committee are:

- Design Engineering Team (2x2)
- Manufacturing Engineering and Department Specialists
- Tooling and Process Engineers
- Purchasing Team
- New Product Manufacturing Team (2x2)

This approach is useful in establishing a mutually agreed upon project strategy. It also unites the key participants in a cooperative working team.

To assist you, the group must be notified of your intention to introduce a new product into Manufacturing. They need preliminary engineering specifications and design concepts. They also need your participation in ad hoc product reviews and your intended volume production requirements.

4.2.3 Process Management Quality Assurance

Manager: Dave Baldessari (AC/M38, 232-2555)

This group develops and maintains an effective quality system for the Mechanical and Printed Wiring Board processes. They ensure maximum product quality levels in conjunction with other Process Managment objectives.

In addition to managing process quality functions and providing short and long-term direction, the group:

- Ensures adequate feedback exists between consumers and suppliers
- Manages the Material Research Lab to control paint and standards requirements (see DEC Standard 092, Finish and Color Standard)
- Establishes and implements necessary Manufacturing process standards
- Promotes product uniformity across Manufacturing facilities and vendors

- Promotes the full use of resources through such projects as:
  - ship-to-stock
  - source inspection
  - plant quality engineering resource sharing
  - printed circuit board qualification techniques
  - consultation on new plant inspection techniques
  - plant assistance to optimize internal controls

If a new plastic is being considered for use on a product, contact Dana DeBlois (ML5-1/P55, 223-3058) for U.L./C.S.A. testing. Contact the group if you are concerned about interplant product uniformity, or if you need clarification on printed wiring board or mechanical workmanship/quality standards. The group can explain to you the capabilities and limitations of inspection equipment used in the process.

To help you, the group needs designs that fit well within Manufacturing capabilities, and designs that enhance quality predictability. They need your attention to 1) tolerance interference considerations, 2) the standardization of similar parts when possible, and 3) clear identification of critical dimensions. When possible, limit the variety and introduction of new colors.

4.3 TECHNICAL SYSTEMS AND SERVICES

Manager: Len Greaney (AC/B24, 232-2447)

This organization provides Manufacturing with the resources for optimizing the manufacturability of printed wiring boards, modules, and backplanes. To do this, the group works with Engineering and Manufacturing to ensure that interconnect product designs are producible and make full use of Digital's Manufacturing capabilities. Additionally, the group generates and provides specialized (software) tooling to all sites for production builds.

These services are provided through two major groups: Producibility and Post Processing.

4.3.1 Producibility

Manager: Bob Marcucci (AC/E24, 232-2551)

Advanced Producibility – This is a project or systems-oriented group that supports Engineering and Manufacturing groups through DEC Standard 030 (Module Manufacturing Standard) and the Producibility Handbook (both of these documents are available from Standards and Methods Information and Control, ML5-2/E56, 223-2954).

DEC Standard 030 describes the module manufacturing capability of Digital and the circuit layout standards and procedures that allow that capability to be optimized. The standard contains all the rules that ensure the circuit design engineer a fast and economical module.

The group is responsible for developing tools and systems for applying design and documentation rules. They also educate Design Engineering and Engineering Services with regard to the requirements and benefits of Producibility. The group also works closely with the Advanced Manufacturing Technology Group (see Section 7, paragraph 4.5) offering their technical assistance.

Contact the group for an interpretation or clarification of producibility elements, design requirements, or constraints. Also, contact them when you have a need to change DEC Standard 030, or other documentation and control standards.

Pre-Design Producibility – This group, managed by George Ross (AC/B72, 232-2596) provides producibility guidance to Design Engineering, Engineering Services, and Manufacturing/Engineering groups at pre-design and design phases of interconnection products.

The group can provide guidance on how new boards should be designed to optimize manufacturing in all Digital Manufacturing plants. They can give you an understanding of the design constraints imposed by high-volume manufacturing. Pre-Design Producibility can also give you a complete description of board, module, and backplane fabrication, and assembly operations and methods.

Other services include developing Manufacturing and assembly operations and methods, costs, and design alternatives. The group will help analyze the impact of standard and non-standard designs on producibility.

The group maintains chairmanship of the Producibility Committee. This committee coordinates producibility issues with Engineering and Manufacturing on a scheduled basis.

Contact the group at the initiation of the design phase, at the development of a new packaging concept, or simply at the re-design phase of an existing product.

Pre-Design Producibility support services are available after you have filled out the Pre-Design Questionnaire (PDQ) as outlined in DEC Standard 030.

4.3.2 Post Processing

This group provides both systems and facilities for post processing (converting) the Engineering design data (part of the engineering release) into a form that can be used by Manufacturing build sites to produce boards, modules, and backplanes. This task is addressed by two groups: Data and Software Systems Engineering, and Manufacturing Tool Generation.

4.3.2.1 Data and Software Systems Engineering

Manager: John Ardini (AC/B72, 232-2380)

This group supports Manufacturing Tool Generation (MTG) by engineering the process of tool generation in the forms of systems and process development. Additionally, the group defines the interaction between Engineering and Manufacturing Tool Generation, and between Manufacturing Tool Generation and Manufacturing sites.

4.3.2.2 Manufacturing Tool Generation

Manager: Dave Symmes (ML1-1/H28, 223-8716)

Manufacturing Tool Generation is made up of two groups which provide services to Engineering and Production Manufacturing sites. These groups are Manufacturing Tool Generation Operations and Methods Engineering.

Manufacturing Tool Generation Operations

This group, managed by Mike Taplin (ML1-1/E24, 223-3513), develops the initial tooling package for the appropriate Manufacturing build site. They also support any subsequent product transfer and other Manufacturing needs for soft tooling.

The group provides an array of tooling to Manufacturing sites:

Board and Backpanel Fabrication

- Numerically Controlled Tapes for Drill Machines
- Master Artwork for Image Application
- Master Artwork for Soldermask
- Continuity Test Files for Bare Boards

Module Assembly

- Process Files for Insertion Library System (ILS)
- Numerically Controlled Tapes for Component Insertion
- Pantograph Templates
- Component Overlays on Mylar

Backplane Assembly

- Wirewrap Data and Listing Files for Wirewrap Using Gardner Denver (GD) or Numerical Control, Semi-automatic Wirewrap Machine

- Data and Listing Files for Either Automatic Wire Tester (AWT) or Backplane Automatic Test Systems (BATS)

Test Equipment Manufacturing

- Artwork and Drill Tapes for Testhead Manufacture (PCB)
- Wirewrap and Drill Tapes for Testhead Manufacture (UBON - Universal Bed Of Nails)

Methods Engineering

This group, headed by Leo Crosby (AC/H28, 232-7410), receives board, module, and backplane Engineering releases. The group ensures that tooling packages are acceptable and complete before transferring them to the appropriate Manufacturing site. This includes determining the method of manufacture, identifying tooling needs for Data and Software Systems Engineering and Manufacturing Tool Generation Operations, assuring producibility, and coordinating the completed tooling package for the Manufacturing site.

By reviewing the release packages and prototype hardware, the group identifies specific needs and areas of producibiltiy improvement for high-volume manufacturing. The group also coordinates the manufacture of prototypes.

Contact the group when you need information about how to release data packages.

To assist you, the Methods Engineering group needs to know what Manufacturing site you have in mind. They also need advance notice and copies of the board and assembly release documentation as soon as possible. Refer to DEC Standards 142 (Printed Circuit Release Flow) and 181 (Wirewrap Backplane and Wirewrap Module Release Process). This will make scheduling, package reviews, and producibility analyses easy.

The group also needs assurance that no short cuts were taken in the physical design process. You must stick to agreements identified in the pre-design producibility review. Finally, you must identify any unique requirements of the design that may not be evident in the release package documentation.

4.4 MANUFACTURING TEST APPLICATIONS
Manager: Bill Moran (ML5-2/E77, 223-5661)

This organization is made up of five major groups: Automated Manufacturing Systems, Module Test Programming, Manufacturing Test Support, Advanced Test Systems, and Power Supply Test Systems.

4.4.1 Automated Manufacturing Systems
Manager: Bill Schauweker (ML21-3/E87, 223-6059)

This group designs and develops software and hardware for Manufacturing systems that load and monitor test programs for CPUs, peripherals, and subsystems. They also develop software for equipment that automatically inserts components into circuit boards.

Manufacturing systems are designed also for online data collection and report generation. Systems supported are APT (Automated Product Test), ACT (Automated Computer Testing), and ILS (Insertion Library System). APT development and support is the group's primary function.

4.4.2 Module Test Programming
Manager: Jim DeBlasio (ML5-2/E77, 223-4512)

This group, primarily funded by individual Engineering groups, writes diagnostic software for automated test equipment used in testing modules at Manufacturing sites. This effort currently includes the GENRAD GR1792A and the ZEHNTEL TS400.

The group also evaluates new automated test equipment to be used as part of our standard Manufacturing process. Upon qualification and acceptance of the new tester, the group will assume programming responsibilities.

The essential focus of the group's responsibility is educating new design and test engineers on the requirements, capabilities, and limitations of the various automated test equipment available for testing their products in Manufacturing.

The group also gets closely involved with module designers early in the design process to determine if testing problems exist. "Testability" recommendations then are made so that they may be included prior to the completion of the design. The close working relationship is maintained throughout the project to incorporate design changes into the software in a timely fashion.

Digital Module Test

This group, supervised by Dick Danek (ML5-2/E77, 223-9467), creates testing packages for use in testing Digital modules on the GENRAD GR1792A. This effort involves writing and debugging diagnostic software, designing interface circuitry and "Bed of Nails" fixturing, and creating documentation for the package.

Analog And Hybrid Module Test

This group, supervised by Chandrakant Shah (ML5-2/E77, 223-5679), develops in-circuit inspection test programs for testing power supply and hybrid modules on the TS400. This effort involves writing and debugging the diagnostic software, designing "Bed of Nails" fixturing, and creating documentation for the test package.

4.4.3 Manufacturing Test Support
Manager: Ray Lechevet (ML5-2/E77, 223-4555)

This group provides internal and external diagnostic support for module, subassemblies, and components. The group is divided into four functions: Field Support, Central Standards, Hardware Support, and Internal Support.

Field Support

This group, supervised by Tim Kelley (ML5-2/E77, 223-5289), provides diagnostic program support to Manufacturing on modules, subassemblies, and component test systems. The group supports the GENRAD GR1792A and ZEHNTEL testers.

Central Standards

This group, supervised by Walt Carlson (ML5-2/E77, 223-5278), supports the GR1792A, ZEHNTEL, APST (Automated Power Supply Test), Integrated Circuit Tester, and the Dedicated Tester. The group's primary responsibility is to support, coordinate, and control the release of test program standards, ECOs (Engineering Change Orders), problem reports, and quality assurance programs during the product life cycle of Manufacturing diagnostics for modules, subassemblies, and components.

Hardware Support

This group, supervised by Steve Garner (ML5-2/E77, 223-5253), supports the GR1792A, ZEHNTEL, and APST (Automated Power Supply Test). The group also supports and coordinates the hardware fabrication and documentation needs of these test systems. They work with Manufacturing sites on resolving integration and fixture problems.

Process Support

This group, whose principal engineer is Allen Williams (ML5-2/E77, 223-7659), provides diagnostic training for the test systems used within Manufacturing Test Applications. The group also trains Manufacturing site support personnel. Additionally, they are responsible for supporting the module test process at Manufacturing sites.

4.4.4 Advanced Test Systems
Manager: Dick Albright (ML3-4/T35, 223-7738)

Advanced Test system is made up of three groups: Advanced Development, Component Test Systems, and the Dedicated Test Group.

Advanced Development

This group, supervised by Van Spirose (ML3-4/T35, 223-7738), provides Digital with expertise in software to determine where automatic test equipment is needed. The group identifies needs for in-house designed equipment, and evaluates the test equipment of vendors.

Component Test Systems

This group, supervised by Paul Hale (ML3-4/T35, 223-3882), supports Component Engineering with two activities. First, they provide test software for SSI and MSI components and participate in release and support activities. Second, the group provides software tools to aid component engineers and reduce test development time.

The group also provides software tools for the Digital Module Test group, and models LSI devices for the Digitest simulator.

Dedicated Test Group

The group, supervised by Bharat Patel (AC/B73, 232-2326), writes Dedicated diagnostic programs for specific applications in Manufacturing. They also modify existing diagnostics for specific applications. Finally, the group acts as the Manufacturing liaison to specific Engineering diagnostic groups for future products.

4.4.5 Power Supply Test Systems
Manager: John Friedrich (ML5-2/H15, 223-6909)

The Power Supply Test Systems (PSTS) group is responsible for the test portion of the standard power supply test process. This includes systems, applications, and support.

System Development

This group, supervised by John Herrmann (ML5-2/H15, 223-4664), is responsible for developing hardware for test systems that test the power supply manufacturing process.

Applications Development

The group, supervised by Ralph MacKenzie (ML5-2/H15, 223-3507), develops test software and fixturing for supplies that are tested on the APST (Automated Power Supply Tester).

Product Support

The group, supervised by John Friedrich (ML5-2/H15, 223-6909), provides plant support for products (hardware and software) developed by Power Supply Test Systems, or other groups.

4.5 ADVANCED MANUFACTURING TECHNOLOGY
Manager: Joe Chenail (ML1-5/E29, 223-2421)

This group is responsible for forecasting and investigating new technologies necessary to manufacture Digital's products over the long term. For any new process, it is necessary to demonstrate its feasibility and determine the return-on-investment to ensure the long-term competitiveness of Digital Manufacturing.

Advanced Manufacturing Technology works specifically in three technology areas:

- Module Assembly Development
- Module Test Development
- Printed Circuit Board Development

Following the investigation and initial development, new processes are refined and introduced into Manufacturing by the Applied Technology Group. In addition to being active in new process development, this group is closely involved with certain new product introductions. Those new products that seem to have a significant impact on a manufacturing process are selected to be introduced via the Applied Technology Group where intensive effort may be applied toward the development or refinement of the manufacturing process for those particular products.

The success of this group depends heavily upon an accurate understanding of long-range trends in Digital product designs and applicable technologies. Contact the group when any new product requires a change in manufacturing processes. This must be brought to the attention of the group as early as possible. For more information, contact:

Module Assembly Development, Dave Widder, (232-2240)
Module Test Development, Nick Wells, (232-2441)
Jerry Jeansonne, (232-2478)
Printed Circuit Board Development, Gowri Sankar, (232-2506)
Applied Technology, George Katronge, (237-2344)

SECTION 8

INFORMATION SERVICES

1.0 DIGITAL LIBRARIES

There are several libraries located throughout Digital. The largest is the Corporate Library located in the Maynard Mill (ML4-3/A20). This central information bank for business and technical information is available to all employees, regardless of location.

The Corporate Library provides reference books, periodicals, research reports, standards, Digital and competitors' public documentation, audio and visual cassettes, inter-library loans, abstracts, definitions, industry news, and SCAN searches (a service that finds out what has been written on specific job-related topics). Their Purchasing Department handles individual and departmental requests for books, subscriptions, memberships, and competitive materials.

Table 8-1 lists the many libraries located throughout Digital. Not all libraries carry a full range of services. Contact the librarian at the branch nearest you for further information.

TABLE 8-1 Digital Libraries

NAME	LOCATIONS	LIBRARIAN/MANAGER	DTN
Maynard	ML4-3	Ralph Coffman	223-6231
Marlboro	MR1-2	Michelle Johnson	231-5040
Merrimack	MK1-1	Nancy Jones	264-5482
Salem	NI	Charles Mathews	261-2254
Tewksbury	TW	Mary Jane Zanca	247-2643
Westboro	WZ2	Joyce Ward	238-2544
Westminster	WM	Karen Delbert	241-2537
Colorado Springs	CX	Chris Blake	522-3116
Software Standards	ML12-3	Pat White	223-4094
DEC Standards	ML5-2	Doris Bellemare	223-2954
Market Data Center	PK3-1	Mary Headley	223-2504
VSMF	ML5-2	Carl Bull	223-5124

The Corporate Library is not the only place you can go for information. Another library is the Software Standards library. This library maintains a file of ISO, ANSI, FIPS, ECMA, CCITT, and Corporate Standards. Standards and Methods Information and Control can supply you with hard and microfiche copies of DEC Standards. The Market Data Center is a source of marketing and competitive information. The VSMF (Visual Search Microfilm File), maintained by Purchase Specifications, contains manufacturing information, vendor information, industry manuals, specifications, and standards, and military and federal specifications and standards. Some of these libraries are described in detail elsewhere in the manual (see index).

2.0 INTERNAL DATA SERVICES AND PRODUCT SUPPORT

Manager: Bill Svirsky (PK1/E33, 223-3615)

This organization manages the Corporate Data Center (CDC). The Corporate Data Center provides timesharing services and auxiliary processing with a minimum of production type processing. Additionally, the CDC specializes in the installation and support of user-dedicated medium and large scale DECsystems.

The CDC handles matters ranging from document generation to software program development. The group can supply you with many services:

- Timeshared services on a DECsystem-10 and a PDP-11 running RSTS/E from 8:00 A.M. to 6:00 P.M. everyday (Eastern Time).
- Public terminal areas are located at ML3-5, PK3-1, and MR2-1.
- Remote Job Entry stations (RJEs) are available at the public terminal areas listed above, providing fast and convenient turnaround to the user of small to medium-sized listings. Listings may be printed the sites listed above. Deliveries are made by Central Services.
- Support for all standard DECsystem-10 software including

  FORTRAN (Formula Translator)

  COBOL (Common Business Oriented Language)

  MACRO-10 (Assembly Language for the DECsystem-10)

  BASIC (Beginner All-Purpose Symbolic Instruction Code)

  ALGOL (Algorithmetic Language)

  BLISS (Programming Language)

  MIMIC (A Major Simulation Package)
- Support for all standard PDP-11 (RSTS/E) software.
- Support Preparation (provided by Corporate Information Handling Services) puts handwritten material into machine readable form, including *editing* for RUNOFF output (RUNOFF is a program that allows clean-looking printouts of ASCII files), *transcription*, and *assembly/compilation*.

To assist you, the group needs your project number and your programmer number. They also need your password. You may obtain these items by contacting Customer Assistance (Norman Shakespeare, PK1/E33, 223-4247). Request a CDC Systems Access form.

Customer Assistance is primarily a liaison between users and other groups within the Corporate Data Center. However, they are ready to respond to any questions or problems you may have regarding systems hardware or software, systems policy, or systems procedure.

Customer Assistance also offers monthly seminars on topics of interest to the CDC user community.

DECsystem-10 manuals, and RSTS/E manuals, are available from the Software Distribution Center (SDC) in Maynard (ML11-3) to assist both the novice and experienced user.

3.0 MARKET DATA CENTER

Manager: Jerry Todd (PK3-1/S52, 223-3631)

The Market Data Center provides a central source of marketing and competitive information that can be used by all product lines groups, Sales, Planning, and Engineering personnel. There are three areas that make up the Market Data Center: the Market Data Research Center, the Customer History Data Base, and the Prospect Data Files.

3.1 MARKET DATA RESEARCH CENTER

Manager: Mary Headley (PK3-1/S52, 223-2504)

The Research Center collects and organizes marketing-related information, answers reference inquiries, aids in research for specific projects, lends reports to requesters, and distributes the monthly Market Data Center Memo, a review of newly acquired reports. They maintain a collection of market research reports, directories, competitive files, and various marketing statistics and publications. Most notable are the following:

- *Market Research Reports* – The current collection consists of over 700 reports with subjects that range from in-depth analyses of specific products to broad overviews of certain industries. Information programs subscribed to include the following:

    - Stanford Research Institute's Business Intelligence Program
    - International Data Corporation's Corporate Planning Service
    - Quantum Science's MAPTEK Program

  These services supply marketing reports of all types on a regular basis.

- *Competitive Files* – These files consist of general, publicly available information on Digital's competitors. Information in these files is collected from current newspaper and magazine articles, news releases, company brochures, and manuals. A selected group of product manuals is also maintained, including manuals of IBM, Data General, Hewlett Packard, Honeywell, and Sperry Univac.

- *Reference Manuals* – Auerbach, Datapro, and others

- *Annual Reports* – Fortune 500 Companies

- *Consulting Organizations/Data Sources* – Organizations involved with marketing research
- *International File* – Contains market-sizing information on the foreign marketplace
- *Reference Books* – Including Dun and Bradstreet Directories, Thomas' Register, Moody's, Standard and Poors, State Industrial Directories, Who Owns Whom Directories, Industry Surveys, Industrial Outlook
- *Periodicals* – Including Harvard Business Review, Journal of Marketing Research, Sales Management, Fortune, Duns, Forbes, Datamation, Computerworld, Electronic News
- *Industry Newsletters* – Including Electronic Data Processing (EDP) Industry Reports, Autotransaction Industry Report, EFTS Industry Reports, Small Business Computer News, Micrographics Newsletter, Packaged Software Reports

3.2 CUSTOMER HISTORY DATA BASE

Manager: Jerry Todd (PK3-1/S52, 223-3631)

This is a computerized data base of Digital's U.S. and Canadian customers, showing bookings back through the fiscal year of 1972. At present, there are only a limited number of scheduled output reports (all quarterly). There are volume analysis reports for NORAM, NORAM Regions, National Accounts, and Product Lines. All other requests are handled on an individual basis. Normal turnaround is two to three business days.

3.3 PROSPECT DATA FILES

Manager: Tony Kramer (PK3-1/S52, 223-3672)

These files provide computerized data bases identifying and describing computer installations. They include International Data Corporation's Worldwide Computer Installation Data File, International Data Corporation's OEM/Systems House Data File, Mini-Micro Systems Annual Market Survey Data File, and selected portions of Dun's Marketing Identifier data file.

Printouts of these files are maintained and custom-tailored prospecting runs can be arranged.

SECTION 9

CUSTOMER SERVICES

Manager: Jack Shields (PK3-2/A58, 223-2548)

The Customer Services group is made up of four major organizations that are crucial to the continued development of Digital's business: Educational Services, Field Service, Customer Service Systems Engineering, and Software Services. These organizations are described in the paragraphs below.

1.0 EDUCATIONAL SERVICES

Manager: Del Lippert (BU/E17, 249-2200)

The primary purpose of this organization is to communicate information. The organization helps customers and employees make better use of Digital products by acquiring new skills and knowledge.

Over 1200 employees produce courses and instructional packages. They also produce technical publications (in print and microfiche), and offer book and media services. Last year the organization operated 218 classrooms at 19 worldwide training centers, presenting 251 different courses. They provided 500 computer systems for use in 2.1 million student hours of instruction.

They also produced 20,000 color slides, 11 million microfiche sheets, and published nearly one million volumes of technical manuals.

Basically, the organization is a conduit for technical information. They gather, interpret, organize, and then disseminate information in the most effective and efficient medium.

The organization has tied their course development people and technical writers to Digital's seven Engineering sites across the U.S. and Europe. Their goal is to make sure that courses and publications reflect state-of-the-art information via the latest media and methods. For example, the organization develops new audiovisual courses, uses modern instructional technology, and employs computer-generated graphics, visuals, and typesetting.

Using information from Engineering, Marketing, Software Services, and Product Support, the organization transforms this data into three basic products:

- *Instructional Services and Products*
  (lectures and lecture/lab documentation, self-paced and computer-aided instruction)

- *Technical Documentation*
  (tech manuals and microfiche, and published books by Digital Press)

- *Media*
  (corporate wide resource for artwork, video tapes, slides, photography, audio tapes, and educational writing and editing)

Educational Services serves customers, Field Service technical and management people, Corporate Information Service, and any other group that needs their services.

Engineers should contact the group on any of the following occasions:

- When you want to take one or more courses
- When you want to work with course developers (from the start of your product design)
- When you want to work with technical writers on documenting your new hardware product
- When you want to write a book for Digital Press
- When you need visuals, typography, editing, writing, or audiovisual support services for an upcoming paper or presentation

To enroll in a course at one of the training centers, or at an ILC (Individual Learning Center), contact Bedford (249-2976).

To obtain an Employee Catalogue and more information about courses available, contact Joluut Vanderhooft (U.S. Employee Education Manager), BU/E06, 249-2201.

For technical documentation and course development assistance, contact Joe Santini BU/E02, 249-2387 or any of the site managers:

Maynard:	Jack Cromwell (PK3-1/T12, 223-2487)
Merrimack:	Jack Cromwell (MK1-2/M26, 264-6600)
Tewksbury:	Judy Jurgens (TW/D04, 247-2621)
Marlboro:	Bob Hymes (MR1-2/T17, 231-6238)
Colorado:	Dick Lennard (CX, 522-3120)
Bedford:	Don Elias (BU/E06, 249-2207)
Reading:	Stuart Smith (RG, [44]-(734)-58-3535)

For Media Services, contact Lee Katz (BU/E35, 249-2067).

For Digital Press, contact Marcia Kenah (BU/E44, 249-2072).

2.0 FIELD SERVICE

Manager: Dick Poulsen (PK3-2/S87, 223-7429)

Field Service administers installation, repair, and FCO (Field Change Order) service to all of Digital and its customers.

In-house Field Service, managed by Ed Dorr (PK3-1/S16, 223-2132), repairs equipment and performs the reconfiguration of equipment. They will install new parts, move equipment, and maintain all of Digital's equipment on a contract basis.

Field Service Product Support, managed by Mike Kallagher (PK3-2/S17, 223-2124), is responsible for equipment installation and warranty work for all of Digital's product line customers. This is a separate product line group with profit and loss responsibilities.

Field Service provides preventive as well as remedial maintenance on a wide variety of products. The group has more service locations, personnel, and resources to offer customers than any other minicomputer vendor. There are over 350 strategically located facilities and 5800 systems-trained service representatives worldwide. Product support from district, regional, and corporate headquarters is available to all locations.

Field service should be contacted when technical questions about installation occur. The group can address such issues as power requirements for installation, environmental impact, cooling and space requirements, etc.

Field Service provides the customer with these services:

- Fast response time
- Guaranteed uptimes
- Penalty clauses
- National service agreements
- Price Flexibility
- Optimal configurations for uptime/maintenance considerations
- Maintenance of non-Digital supplied equipment

Field Service maintenance groups offer assistance to branch or district groups by providing engineering expertise for products in the field. These groups work closely with engineers designing and developing a product so that Field Service will be able to maintain it later.

3.0 CUSTOMER SERVICE SYSTEMS ENGINEERING

Manager: Don Busiek (PK3-2/S17, 223-2361)

This organization introduces new hardware and some software products into the field, ensures that reliability and maintainability strategies are in place to keep product life cycle costs low, and conducts research studies in branch office modelling, life cycle costing, repair strategies, and logistics. Groups which make up the organization include Maintainability Engineering, Customer Service Engineering, New Methods, and RAMP (Reliability and Maintainability Program).

MAINTAINABILITY ENGINEERING

Groups which make up Maintainability Engineering participate in the design of new products (both hardware and software) in order to supply the Engineering development team with:

- Reliability, Maintainability, and Availability requirements
- Service delivery requirements
- Cost trade-offs that help generate lowest life cycle cost

- Competitive service information to help set goals for cost of ownership at both option and system level

In this role, these groups will develop Field Service Maintenance and Business Plans as well as the project schedule.

Contact the Maintainability Engineering groups during the planning process of product development. Contact should be made as early as possible, i.e., when product proposals and the Phase 0 proposals are being developed.

Maintainability Engineering groups can provide financial and technical information during the initial planning phase. The groups can help ensure that the Business Plans are complete and help you avoid surprises after the major product goals have been established. They will be stressing cost of ownership and reliability as a major project objectives.

The Maintainability Engineering manager coordinates the activities of the Customer Service group (See Figure 9-1, Customer Services and Engineering Development) to provide maintenance plans and schedules. The manager will assign an engineer to the project during the initial planning and design stage. After receiving specifications, schedules, and cost estimates, the engineer will generate:

- Impact Statements
- Maintenance Plans
- Field Service Business Plans
- Cost/Benefit Studies
- Schedules for Coordinating Customer Service Activities

The engineer also alerts the Pricing Policy Committee of new product activities for product support and announcement.

In order to help you, Maintainability Engineering needs from you a Project Specification, Business Plan, Project Schedule, Product Test Plan, Product Field Test Plan, and a Certification Plan. Additionally, performance data is required for all network products.

The following groups make up Maintainability Engineering:

3.1 SMALL/ HARDWARE
Manager: Art Zins (PK3-2/H17, 223-2010)

This Maintainability Engineering group is responsible for the PDP-8, advanced PDP-11 products, memories, tapes, disks, terminals, power systems, and mechanical packaging.

3.2 SMALL/MEDIUM SOFTWARE AND COMMERCIAL SYSTEMS
Manager: Henry Adelman (PK2/S44, 223-2638)

This Maintainability Engineering group is responsible for new applications systems products and systems products of small and medium software and commercial systems, excluding large systems and Digital communications products. Product lines supported include Graphic Arts, Computer Special Systems, Word Processing, TELCO, and Commercial OEM (Original Equipment Manufacturer).

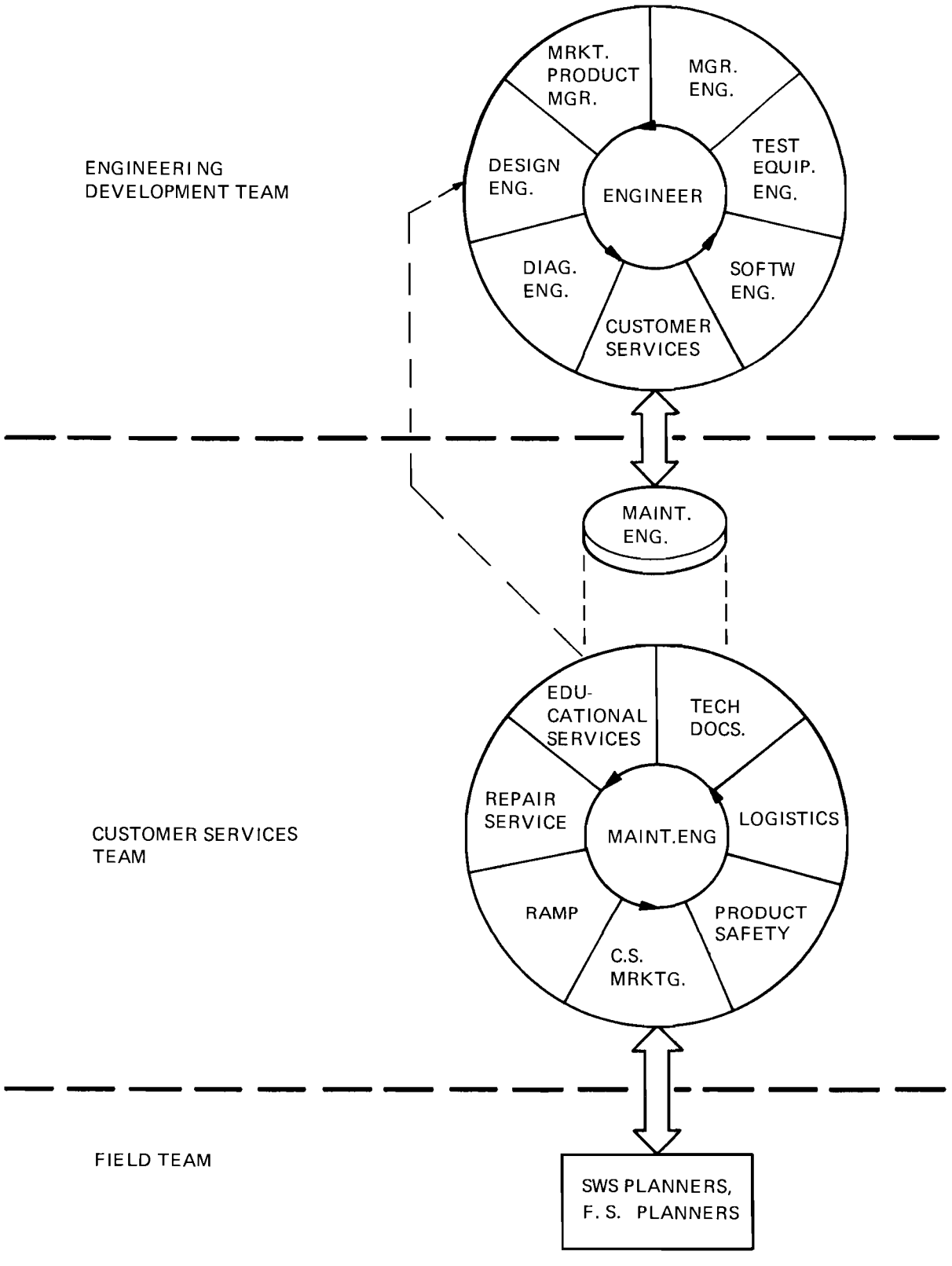

Figure 9-1 Maintainability Engineering

3.3 DISTRIBUTED SYSTEMS
Manager: Dick Pigman (PK3-2/S17, 223-7982)

This group is responsible for the serviceability of networks and network products. This includes both hardware and software communications products.

3.4 LARGE SYSTEMS GROUP AND PRODUCT LINE HARDWARE AND SOFTWARE
Manager: Walter Manter (MR1-1/S35, 231-6503)

This Maintainability Engineering group is responsible for new Large Systems Group hardware and software products. Product lines supported include Digital Components Group, Manufacturing Distribution and Control, Technical OEM, Engineering Systems Group, Commercial LSG, Government Systems Group, Laboratory Data Products, Medical Data Products, and Educational Products Group.

3.5 CUSTOMER SERVICE ENGINEERING
Manager: Chris Ball (PK3-2/H29, 223-3040)

Remote Diagnosis Engineering develops the remote diagnosis maintenance tools for PDP-11, VAX, and the DECsystem-10 and DECSYSTEM-20 families of products on a worldwide basis. The group provides support to existing and planned Digital Diagnostic Centers. This support takes the form of new host software development, host software enhancements, problem resolutions, and support to existing hardware designs (consoles). For existing hardware designs, support includes problem analysis, the incorporation of ECOs (Engineering Change Orders), modification of equipment for other countries, and approval by Postal Telegraph and Telephone authorities for hookups on their telephone lines.

The Remote Diagnosis Engineering group provides consultation to CPU and Peripheral design groups for the purpose of making new products remotely diagnosable. They also provide the analysis required to determine if new opportunities are possible by remote diagnosis.

Contact the group, via the Customer Services engineer assigned, during the conceptual phases of any central processor or intelligent subsystem that is to be remotely diagnosed. The group will provide the remote diagnosis plan that will include hardware to be connected to the unit under test, and the diagnostic script to be run in the host computer. You will be required to furnish the group with a set of maintainability goals and objectives for the product, and specify the Remote Diagnosis port interface.

Small Systems Engineering, managed by Scott Johnson (TW/C18, 247-2531), develops portable, self-contained, computer system testers. The testers are used to reduce service time and increase the number of service calls a service engineer can make in a given day.

This group will provide support and consultation to new products (Maintainability Engineering) groups, and help them define diagnostic and engineering hooks into their products. Small Systems Engineering will also provide the direction and analysis required to determine new opportunities and ensure continued development of the service strategy for the small systems marketplace.

Contact the group, via the Customer Service engineer assigned, during the conceptual phase of the new product to establish applicability. A functional description and preliminary specifications defining the product are required. Small Systems Engineering will supply you with a functional specification, defining the interface hooks necessary for using testers in your product, along with an orientation about the application.

Product Safety, managed by Ron Minezzi (PK3-2/H10, 223-3122), ensures that all hardware products meet the requirements of DEC Standards 060 (Digital Policy Relating to Nationally and Internationally Recognized Testing Laboratories) and 119 (Digital Policy and Practices Relative to Product Safety).

All applicable products must be UL listed, be certified by the Canadian Standards Association (CSA), and they must comply with International Electrotechnical Commission (IEC) 435. Furthermore, for products marketed in Germany, the appropriate VDE requirements must be met.

Listings and Certifications are always obtained through the Product Safety Group. You should subject your product to Product Safety Reviews at the conceptual, breadboard, and prototype stages. The group will consult with the engineer on Product Safety design requirements, they will review and test the product for compliance with DEC Standards, and they will obtain all U.S. Listings, CSA Certifications and similar test house approvals. You will be required to supply Product Safety with product specifications, a product demonstration, and samples.

The Product Safety Group also investigates all potential product safety problems. You are required to support all such investigations regarding your product until all problems are solved.

Micro Products, managed by Joe Belliveau (PK3-2/S77, 223-3983), investigates and recommends new service techniques required by the increasing use of LSI (Large Scale Integration) devices and micro processors. The group also conducts technological investigations and determines the field reliability of components, making recommendations for improvement.

Contact the Micro Products group via the Customer Services engineer when information is needed about the performance of components in field applications. Also, contact the group when you need information about the impact of packaging schemes on serviceability. Micro Products can provide you with information about component performance when you make a detailed request.

3.6 NEW METHODS

Manager: Steve Davis (PK3-2/S53, 223-3884)

RAMP Measurements Group, managed by Sy Feldman (PK3-2/S53, 223-7822), monitors the measured Mean-Time-to-Repair (MTTR) and the Mean-Time-Between-Failures (MTBF) of all major options in the field. For more information, contact Betty Hopper, 223-5973.

Management Science Group, managed by Bob Levasseur (PK3-2/S53, 223-5960), is responsible for all Management Science/Operations Research studies for Customer Services. Some of the key areas include branch office modelling, life cycle costing, repair strategies, and logistics.

3.7 RAMP (RELIABILITY AND MAINTAINABILITY PROGRAM)

Manager: John Shebell (PK3-2/S53, 223-3101)

This group provides consultation and strategic planning for the Customer Services Systems Engineering group. The group's focus is on improving the RAMP profile of Digital's products and systems with an eye on improving the perceived market value of Digital's products and services while reducing total life cycle costs.

The group tries to maintain expertise on what the competition is doing in the RAMP area. They look at the effect of emerging technologies on the service groups, and they coordinate Customer Services role in the product development process.

Contact RAMP Engineering for information about the RAMP features of competitive products. The group should be involved in the strategic planning process from product inception. Also, contact the group whenever a general liaison to Customer Services is needed on Engineering activities which are not product specific.

RAMP Engineering can supply you with evaluations of Digital's competitors, Red and Beige Books and other strategic vehicles, and a liaison to Customer Services as outlined in the previous paragraph.

The group requires early contact and visibility. They need information of all kinds relating to Project Plans, technologies, and Engineering strategies.

4.0 SOFTWARE SERVICES

Manager: Bruno Durr (PK2/S56, 223-5199)

The primary goal of this organization is to satisfy the software services needs of Digital's customers. The organization ensures that software products and services are easy to sell, install, use, and maintain.

Field Software Services – The field consists of three areas: the United States, Europe, and the General International Area (GIA). Field Software Services is responsible for providing four basic services to customers.

- *Warranty Services* are described in the Software Support Categories Addendum to the Software Product Description. These services may include installation of supported Digital software products, answers to written or telephoned inquiries on remedial service and usage questions, and on-site visits when necessary.

- *Sales Support* – Software Services is part of Digital's sales team and as such is responsible for all technical aspects of the sale of software products.

- *Applications/Consulting* services are customer funded. They may take place before the product is delivered, during warranty, or after warranty expiration. These services are intended to give the customer full use of his or her product.

- *Software Product Services* are preventive and remedial maintenance services to keep the system software current and resolve reported software problems.

Product Lines – There are four Software Services Product Lines:

- *Applications and Consulting Services* (PL090) This is a customer funded, one-time applications software and consulting service. These services range from one-time calls, to resident services.

- *Software Maintenance Services* (PL009) The sale of manpower-related preventive and remedial services for Digital's software products.

- *Software Self-Maintenance Services* (PL091) The sale of software updates (and subscriptions to updates) and software information.

- *Software Products* (PL085) Sales of special software products developed to meet a specific marketing requirement in Europe. These products are normally in the form of emulators.

Operations Group – This group provides centralized support to enable the Software Services Organization in the field to meet its objectives. Their principle activity is to furnish technical support. They also

coordinate training and administrative activities, and act as an intermediary between Field Software Services and other corporate groups.

The Operations Group is made up of the following groups:

- The *Technical Support Group*, managed by Dave Backman (AK, 246-2278), provides backup support to the field, cooperates with other corporate groups in giving Software Performance Reports (SPRs) to customers, performs training functions, and develops support tools.

- The *Training Group*, managed by Tom Fleischmann (PK2/S44, 223-8702), identifies, develops, and implements training for the Software Services Organization worldwide in conjunction with Educational Services.

- The *Management Information Services Group* (MISG), managed by Bill McCullough (PK3-2/S29, 223-4876), designs, develops, and runs internal programs which aid Software Services in managing, controlling, and evaluating its operations.

- The *Administration Services Group*, managed by Angela Cossette (PK2/E49, 223-4511), supplies administrative support services for employees and central services for customers. The group maintains Software Performance Reports (SPRs), Software Product Descriptions (SPDs), coordinates the field testing of new products, and publishes dispatches, bulletins, and reviews needed to meet warranty and maintenance commitments to customers.

Contact the organization whenever you have questions about the field testing of software, Software Performance Reports, Software Product Descriptions, or software support problems.

The organization needs from you high quality software products to minimize increasing support costs. Products, ideally, should be easy to sell, install, use, and maintain.

The organization also asks your cooperation in providing prompt Software Performance Report replies to customers. They also need assistance in establishing effective field testing of new and revised software products. Furthermore, Software Services needs technical assistance in the support of software to meet their goal of having satisfied customers. They also need accurate information to publish Software Product Descriptions.

For more information, see the Software Services Reference Guide (available from Carol Bibbins, 223-8766).

SECTION 10

REFERENCES AND RESOURCES

This section references information about Digital's publications, committees, and services. Listed here is information that can help you obtain copies of promotional materials, hardware and training materials, software documentation, and financial information. Additionally, some company policies, standards, and specifications are described briefly. For your information, lists of company newsletters, library publications, and current committees are included. Finally, this section highlights resources available in the Digital Telephone Directory as well as what you should know about company transportation and employee training and education.

1.0 PRINTING AND CIRCULATION SERVICES (P&CS)

This organization warehouses and fills orders for sales and service promotional materials, training manuals, hardware manuals, procedure and reference manuals, software product descriptions, and blank standard and custom forms.

To help you locate and order printed materials, Printing and Circulation Services issues three indexes: Sales Promotion Publications Index, Technical Documentation Index, and Forms Index. Each index listing includes a title of the publication, a catalogue number, and in some cases, a restriction code or releasing authority.

To order any or all of the indexes, submit your request in writing. Include your name, badge number, cost center, and location. Mail to Printing and Circulation Services, Mailing List Maintenance, NR2-2/M15. State which index(es) you wish to receive.

To order printed materials from the indexes, obtain a Request for Literature form (found in the P&CS Indexes). Fill out the form indicating quantity needed, catalogue number, title, and date required. Mail phis form to Printing and Circulation Services, Request for Literature, NR2-2/M15. Telephone orders and incomplete requests cannot be processed.

2.0 COMPANY POLICIES, STANDARDS, AND SPECIFICATIONS

DEC Standard 001
This document is available from Standards and Methods Information and Control, ML5-2/E56, 223-5924. In three sections it describes the corporate policy for DEC Standards and provides general information about the management and administration of the DEC Standards system. It describes the procedures required to create new standards and make changes to existing ones. It also describes the format and minimum content requirements for DEC Standards.

DEC Standard Index
This index is published quarterly in the Engineering Newsletter and is also available from Standards and Methods Information and Control, ML5-2/E56, 223-5924. DEC Standards in the index are arranged by number and areas of interest. The index contains abstracts, responsible persons, departments, revision level, and date of revision.

Personnel Policies and Procedures
This manual is available from Andy Kurtz, PK3-1/C19, 223-4229. It contains corporate personnel notices and administrative procedures. Distributed to all cost center managers on request.

Corporate Policy Memorandums
This document is available from Win Hindle, ML10-2/A53, 223-2276. It contains general information and guidelines regarding company policy. Distribution is restricted.

Software Development Policies and Procedures
This manual is available from Gladys Pannell, ML12-3/E80, 223-6720. It contains policies governing the process of developing software products, including plans, specifications, and a description of the phase review process. Available by subscription.

Software Standards Notebook
This document is available from Pat White, ML12-3/E51, 223-4094. It contains all approved corporate software-related and software documentation standards, including a description of the standards process and a complete listing of DEC Standards. Distributed by subscription and updated periodically.

Software and Industry Standards Summary
This document is available from Pat White, ML12-3/E51, 223-4094. It contains brief abstracts of Digital and industry standards, and probable schedules for pending standards. It gives the company contact for each standard but does not include standards relating to drafting, micrographics, or corporate processes. Published twice a year, it is available on request.

Index of Engineering Specifications
This index is available from Jody Batsford, ML5-2/E56, 223-9475. This is the Master Index of 7665 series Engineering Specifications #A-SP-7665000-0-0 through #A-SP-7665999-0-0. The index and individual specifications are available on microfiche in the documentation departments of every plant. It includes titles, specification numbers, and rev numbers.

3.0 RAINBOW BOOKS

Rainbow Books are reports produced and distributed by various organizations in Engineering and Manufacturing. The following list identifies these reports by color and title, distribution, and responsible contacts.

Red Book
Management Summary and Justification of Central Engineering Development Budget.
This book is produced in the Fall and Spring of each year. Distribution is limited and strictly controlled. Available from Sy Lyle, ML12-1/T39, 223-7311.

Beige Books
Product Strategy by Product Class and Family.
There is a Beige Book prepared for Computer Systems Development, Software Engineering, Technical Operations, Technical Director, LSI Engineering, Storage Systems Development, Mid-Range and Distributed Systems, Large Systems Product Development, and the Corporate Research Group. Distribution is limited and strictly controlled. Available from Sy Lyle, ML12-1/T39, 223-7311.

Blue Book
Manufacturing Management Report.
Produced monthly, the Blue Book has limited distribution. Sections of the Blue Book referencing company plans of a highly confidential nature are strictly controlled. Available from Pete Bagg, ML1-4/P69, 223-8533.

Green Book
Manufacturing Cost Reports.
Produced monthly, the Green Book is distributed to Product Line group managers, controllers, and corporate management. Selected pages are distributed to plant management. Available from John O'Brien, ML1-5/F31, 223-3197.

Pink Book
Option and Basic System Actual Cost Report.
Distributed quarterly, the Pink Book is strictly controlled and confidential. Available from Ralph Lent, ML1-5/F31, 223-3841.

Brown Book
Product Line and Area Financial Statements.
Produced monthly, the Brown Book has limited distribution and is strictly controlled. Available from Walter Clancy, MS/F11, 223-4668.

Yellow Book
Engineering and Products Yellow Book – Detailed Description of the Status of Engineering Projects.
Produced monthly, the Yellow Book has limited distribution and is strictly controlled. Available from Susan St. Croix, ML3-3/B91, 223-2196,

Black Book
Management Overview of Process Strategies, Planning, and Budgeting.
Produced periodically and available from Arun Dube, ML1-5/E30, 223-7060.

Slate Books
Strategies by Process and Function, Planning and Budgeting.
Produced periodically by managers of Manufacturing processes and functions. The books have open distribution. Contact Jim Melvin, AC/E48, 223-2310, for more information.

Polka Dot Book
Manufacturing's Report on New Products Being Introduced into Manufacturing. Produced quarterly, the Polka Dot Book has limited distribution and is strictly controlled. Available from Joe St. Amour, ML1-5/E29, 223-2596.

4.0 FINANCIAL INFORMATION

Chart of Accounts
This document is available from Suzanne Rose, MS/F33, 223-4143. It contains general ledger accounts, cost center numbers, discrete project numbers, product line numbers, sales activity codes, and expense activity codes. Copies are usually sent to all cost center managers.

DEC Standard Price List and Addenda
This document is available from Valerie Corbin, PK3-1/S18, 223-4936. It is published quarterly on the first Monday of each fiscal quarter. Addenda are published monthly. Distributed on request.

Standard Cost Listing
This document is available from John Zinn, ML1-5/F31, 223-7859. Produced by Manufacturing Financial Control, this document is distributed monthly on microfiche. It lists parts on the Master Parts File, with a description, costs, and the latest ECO.

5.0 GENERAL REPORTS AND DOCUMENTS

Bill of Material
This is a list of parts that go into another part or option. For a packaged system, this is a list of options to be ordered and assembled in Final Assembly and Test. The document is used by Manufacturing Materials and Planning. Copies available from Frank Corbett, ML1-4/P69, 223-8535, (see also the Engineering Product Library System, Section 5, paragraph 3.5.6.2, for more general Bills of Material).

Component Index Books
This is a guide to purchased components in use at Digital. Primarily a design engineering tool, it is available in hard copy and microfiche. It is issued in three separate volumes: multi-class, 90 class, and FCD (Functional Code Descripter). Available from Ginger Pierlo, ML5-2/P67, 223-2642.

DECUS Program Library
The DECUS Program Library, available to both Digital and outside DECUS members, is a clearing house for user programs. It provides a reproduction and distribution service only. No programming assistance can be given. If a program does not work as stated, the problem should be documentated and sent to DECUS. It will be forwarded to the author for comment. If the program is deemed inoperable as stated by the author's documentation, the program will be removed from the library.

The description and availability of the software products described in the foregoing catalogues are subject to change without notice. Distribution shall be in accordance with the Standard Policy for each software product.

DECUS Program Library Catalogues

- PDP-11
- PDP-8, FOCAL 8, BASIC 8
- DEC 10/20

DECUS catalogues are published twice a year. Updates are published periodically as well as becoming part of newly published catalogues. The following is a list of DECUS Program Library contacts:

- Accounting or Pricing Information - Leslie Dube, MR2-3/E55, 231-4135
- Program Orders and Information - Cheryl Barber, MR2-3/E55, 231-4272
- New or Proposed Library Submissions - Donna Portosa, MR2-3/E55, 231-4178

Document Control File (DCF)
This is an automated file with Engineering document number, description, revision, ECO pending, and site location data. For access, contact Frank Alla, ML4-2/E90, 223-9878.

Document Retrieval System
Master List contains project plans, standards, important memos, and other software-related documents and is available on a restricted basis. Master List also tells how to use the system. Available from Rose Dunnigan, ML11-2/B39, 223-4953.

Field Service Summary of Failure Rates
This document contains a summary of componenp failures sorted by hardware type, device, and failure description. Also, it summarizes failures by modules and systems. Distributed on a restricted basis monthly. Contact Ron LeBlanc, PK3-2/S53, 223-3088.

Field Service Installation Quality Report
This document is distributed monthly to all Quality Control managers. Contact Bob Schaller, PK3-2/S17, 223-4205.

Market Data Center Memos
This index of new reports, recent findings, abstracts, and financial marketing reports is published monthly. Contact Jerry Todd, PK3-1/S52, 223-3631.

Minicomputer, LCG, VAX, and KS10 Libraries
Microfiche compilations of all Digital documentation useful to Field Service engineers. Library contains hardware manuals, diagnostics, and all maintenance-related documentation. Index to fiche is included. Available from Mary Antonelli, 249-2019, Bedford.

Option Module List
This document is available from June Payne, ML3-3/H14, 223-2912. It contains designations of all equipment which has been, is, or will be available for sale by Digital. The list is sorted by model number, and gives the responsibility for and status of each model number (including CSS and Software items) as well as a description and, generically, where it is used. Two versions of the list are published. Both are in hard copy and microfiche.

Version 1 is updated quarterly on hard copy and monthly on microfiche. Status 0 (cancelled), status 1 (unannounced), and status 7 (really obsolete) entries are not shown. To be added to the distribution list, contact Jane Hanley (223-6493) or Kathy Murray (223-2886).

Version 2 is updated monthly and is a complete listing of options and modules. The list is confidential and is distributed on a need-to-know basis. For a copy, contact Dick Best (223-2273) or June Payne (223-2912).

A *Computer Special Systems* subset of all options and modules is also available on a need-to-know basis. Copies are available from Carleton Davenport (264-6654, NP).

An *Option Module Software Subset List* is also available from Jeannette Sutton (ML11-3/E52, 223-4245). This list contains option numbers, responsible person, design engineer, product manager, manufacturing representative, status code, product category, description, and what it is used on. Distribution is monthly and restricted to a need-to-know basis.

Purchase Specification Microfiche
This data base contains purchase specifications on those components purchased by Digital. It is available to the user at the Purchase Specification Department (ML5-2/P67) or through distribution by contacting Carl Bull, 223-5124.

Reliability Reports, Mean-Time-To-Repair Options, Summary Reports This report contains detailed information from the field on systems and options. Available on request from Dori Cohen, PK3-2/S53, 223-2440.

Revcon Listing
This is the current list for all shippable modules, subassemblies, power supplies, cables, and logics. Available on microfiche through a valid discrete project charge number. Distribution is open. Contact John Holt, ML4-2/E90, 223-2455.

System Software Information
Distributed to Field Service, Sales, and Software personnel, this manual is a reference guide for support information concerning Digital software products. It supplements information found in the software product descriptions. The manual is available from Gladys Pannell, ML12-3/E80, 223-6720.

VSMF (Visual Search Microfilm)
This is a subscription service containing vendor catalogue data on many products and technologies supplied by U.S. manufacturers. It is updated monthly and is available for viewing at the Purchase Specification Department. Contact Helen Monsen, ML5-2/P67, 223-2642.

6.0 COMPANY NEWSLETTERS

The list below represents only some of the newsletters published by Digital organizations. The intent has been to list those newsletters pertinent to Engineering personnel. To receive a newsletter, contact the corresponding responsible person.

Newsletters	*Contact/DTN*
Access (Manufacturing, Distribution & Control)	Sue Vezina, 264-5437
Added Value (Technical OEM)	Bob Niro, 223-9696
CAD Newsletper	Liz Van Twuyver, 223-8757
Central Commercial Engineering News	Jim Harnedy, 264-5680
CLAS Software Dispatch	Anne Bulger, 223-5886
Component Engineering Newsletter	Maryann Reardon, 223-4797
Consultant's Reference Guide Newsletter (New Products Marketing)	Roger Handy, 223-3550
Decminster (Westminster Manufacturing)	Beth Newell, 241-2018
DECsystem-10 Bulletin and Dispatch	Anne Bulger, 223-5886
DECSYSTEM-20 Bulletin and Dispatch	Anne Bulger, 223-5886

Newsletter (Cont'd)	*Contact/DTN*
DECUScope	Cheryl Lickteig, 231-4131
Digital Software News	Anne Bulger, 223-5886
Digital This Week	Available at all facilities
DMS-11 Software Dispatch	Anne Bulger, 223-5886
Educational Computer Systems Newsletter	Barbara Morin, 231-4337
Engineering Newsletter	June Payne, 223-2886
Feedback (Corporate Information Services)	Marian Anderson, 223-3867
Friday Package (Laboratory Data Products)	Jim Andrews, 264-5851
IAS Software Dispatch	Anne Bulger, 223-5886
Large Buffer (Software DEC 10/20)	Marie Ford, 231-6374
Large Computer Group News	Arlene Lysik, 231-6352
Mainely DEC (Maine Manufacturing)	Jack Gallant, 271-2203
Market Data Center Memo	Jerry Tood, 223-3631
Microware Newsletter	Bill Vaillancourt, 223-7108
MINC-11 Software Dispatch	Anne Bulger, 223-5886
Mountain Matter (Colorado Springs Manufacturing)	Dot Nelson, 522-2303
Package Engineering Newsletter	Bill Roberts, 223-3177
People Paper (West Springfield Manufacturing)	Carolyn Malloy, 244-2145
Personnel Newsletter	Andy Kurtz, 223-4229
Please Post - Library Newsletter	Corporate Library, 223-5821
Purchase Specification Biweekly Bulletin	Pat Davan, 223-2275
Quality Newsletter (Corporate Quality Assurance)	Darby Checketts, 223-4414
Que Pasa? (Albuquerque Manufacturing)	Joyce Cardin, (505) 345-3311

Newsletter (Cont'd)	*Contact/DTN*
RSMX Software Dispatch	Anne Bulger, 223-5886
RSTS-E Software Dispatch	Anne Bulger, 223-5886
RT-11 Software Dispatch	Anne Bulger, 223-5886
Salem System Highlights (New Salem Manufacturing)	Sue Brander, 261-2455
Secretarial Views	Maureen Cybolski, 223-9428
Sights and Sounds (Woburn Manufacturing)	Michelle Barrett, 236-2586
Small Buffer (Software PDP-8/11)	Anne Bulger, 233-5886
Software Engineering News	Maddie Anastas, 223-2339
Software Tools Development and Methods	Steve Gutz, 223-4342
Sun DEC (Phoenix Manufacturing)	Carol Monyer, (602) 993-5111
The Minute Man Newsletter (Software Product Service)	Rosemary Eash, 223-8309
The Readout (Westfield Manufacturing)	Becky Tayler, 242-2700
U.S. Area News (U.S. Field Personnel)	Lea LaFlamme, 223-8446
VAX Newsletter	Pat Ward, 223-6600
What's Up DEC (Burlington, Vermont Manufacturing)	Prudy Sullivan, 266-2244

7.0 LIBRARY PUBLICATIONS

Accessions List
This is a monthly publication that includes a select list of new books, reports, proceedings, magazines, and cassettes received in the library. This list is available by subscription. Contact Virginia White, ML4-3/A20, 223-6105.

Periodicals in the Library
This is a semiannual publication listing all magazine titles held in the library collection. All serials, i.e., journals, periodicals, and magazines are listed alphabetically by title. Information also includes the size and format of holdings. Serials on order are also listed. A subject breakdown of the periodicals is provided in a separate section at the end of the list. Available from Helen MacFadyen, ML4-3/A20, 223-6232.

Audio/Visual Course Listing
This is a periodic publication listing by subject all audio and video cassette courses available in the library. Annotations include length of tape, course objectives, and other relevant data to help you determine the benefits of taking a course. Available on request, or distribution by contacting Betsy Cane, ML4-3/A20, 223-6233.

Library Link Lists
These are bibliographic compilations that reflect the library's collections on specific subjects, e.g., finance, word processing, quality of work life, women in management, etc. Publication of these lists is irregular. Special topical requests can be researched. Contact the Reference Department, ML4-3/A20, 223-6231.

Microfiche Edition of the Card Catalogue
This is a quarterly compilation of all items in the library's collection. Available on request, or by distribution by contacting Virginia White, ML4-3/A20, 223-6105.

8.0 DIGITAL COMMITTEES

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CAD Board of Directors	Bob Kusik, 223-2320
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Career Development	Mary Beatrice, 223-9694
Corporate Information Services Standards	Norm Horne, 223-5075
Critical Materials	Jack Batten, 223-6727
Cross Products	Dan Goor, 223-2895
DEC BASIC Standard	Tom Harris, 264-6779
DEC COBOL Standard	Jeff Rudy, 264-6680
DEC EDITING Standard	Bob McKenzie, 264-6681
DEC Standard 012 Steering	Joe Kurta, 223-8895
Drafting Communications	John Carter, 231-4245
Engineering	Allan Kent, 223-8701
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Engineering Review Board	John Murray, 223-5118
Environmental	Ed Spuler, 264-6720
Field Management	Ted Johnson, 223-5942
Finance/Administration	Al Bertocchi, 223-5311
Investment	George Chamberlain, 223-5305
Language Standards	Jeff Rudy, 264-6680
Low End Research and Development	Dick Loveland, 223-7107
Major Contracts Review	Ed Finn, 223-8300
Manufacturing	Joe St. Amour, 223-2596
Manufacturing/Engineering	John Holman, 223-5533
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Marketing Task Force	Glenn Reyer, 264-5974
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Order Administration Managers	Les Norman, 231-5811

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PASCAL Internal Standards	Leslie Klein, 247-2653
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Research and Advanced Development	Dan Goor, 223-2895
Software Performance	Dave Kosko, 247-2344
VAX Architecture	Dileep Bhandarkar, 247-2021
Wire Wrap Communications	Joe Kurta, 223-8895
Workmanship	Norm Green, 242-2466
1990s (Manufacturing)	Bob Hopely, 223-3864
1990s (Space)	Al Bertocchi, 223-5311

9.0 DIGITAL TELEPHONE DIRECTORY

The Digital Telephone Directory contains a plethora of information about the many resources available to you at Digital. The directory is available to all employees at Office Supplies Stockrooms throughout Digital's facilities. Your department secretary can direct you to the proper source or get one for you.

The following information and procedures are contained in the directory:

- North American Customer Assistance
  - Extension and location
  - Important numbers to know within Digital facilities in Massachusetts
- How to update your listing
- Metropolitan Boston Telephone Service
- Dialing instructions for
  - Digital Telephone Network (DTN)
  - WATS lines
  - Metropolitan Boston
  - Long distance
  - International calls
  - Local calls
- Special Telephone Services
  - Credit Card calls
  - Telephone service requests
  - Conference calls
  - Transferring calls
- Corporate Message Services (RCS)
- International Suggested Calling Times
- World Holidays
- Domestic Suggested Calling Times

Separate instructions for each facility's edition

- Mail Services
  - Post Office
  - Interoffice
  - Field Office
  - Mail arrival/departure schedules
  - Special Services
  - General Information
- Location Codes
- Order Processing Groups
- Personnel Listing
- Departmental Listing
- Domestic Office Listing
- Canadian Office Listing
- European Listing
- General International Area Listing
- International Distributors
- Emergency Numbers

10.0 TRANSPORTATION

Interplant
Aircraft and van transportation services are available to and from the various Digital facilities in the New England area. Van schedules are posted on bulletin boards throughout facilities. Aircraft schedules are posted at the entrances to the facilities and paper fliers are available from receptionists or security guards. Scheduled freight flights (allowing up to 2 passengers) leave Boston every Saturday afternoon for Dublin, Ireland and Frankfurt, Germany. Contact Parker Street travel at 223-5522 for reservations and information.

Commuter
Digital encourages employees to form car pools and van pools to travel to and from work. In fact, Digital will provide a commuter van to anyone who can round up at least 10 riders including a driver. If you are interested in joining a car pool or a van pool, or starting either one yourself, contact the Commuter Transportation Department, MS/B88, 223-8484.

11.0 EMPLOYEE EDUCATION AND TRAINING

Employee education exists to improve employee job performance by delivering quality education products in a timely, cost-effective manner. General training is open to any employee on a first-come, first-serve basis. The organization offers total programs for groups such as Software Services, Corporate Information Systems, and Field Service. They also provide programs for specific job functions such as Clerical Skills, Word Processing Training, Software Training, Hardware Training, and a variety of other programs.

Courses are scheduled at Bedford and other Digital facilities. On-site courses are available by arrangement. Self-paced instruction and audio-visual courses are offered at six Individual Learning Centers – Maynard, Bedford, Princeton, New Jersey, Rolling Meadows, and Los Angeles.

For programmers and their managers, eight generic courses in the audio-visual format are continuously offered at the six Individual Learning Centers. Lecture/lab software courses cover VAX/VMS, RSX, RSTS, DEC 10/20, BLISS language, Standard Editor, etc.

New and current users of Word Processors can obtain introductory, basic, intermediate, and advanced courses. Users of DEC 10/20 hardware and software can learn the hardware, software, and overall capabilities of the systems as well as specific skills like text formatting and editing. In Communications, courses are offered on the Internal Message Switching system (RCS) and the Electronic Mail System (EMS).

The *Employee Education Course Schedule*, published quarterly, details offerings at U.S. locations, announces new courses, and contains information about current educational resources.

The *Employee Education Catalogue* is published yearly and contains a complete description of course contents, prerequisites, and objectives. Both publications are automatically sent to all U.S. cost center managers, personnel representatives, and personnel service administrators.

To receive copies of these publications, or to make arrangements for on-site courses, contact Employee Education Marketing, BU/E06, 249-2300.

To register for courses, or to arrange for housing and transportation while in training, contact the Employee Education Registrar, BU/C2, 249-2675.

APPENDIX I

How To Protect Digital's Intellectual Property

Unquestionably, Digital is a high technology company and a leader in the computer industry. In order to maintain this leadership Digital must continue to develop and protect its various forms of proprietary information and knowledge. Such information and knowledge can take the form of ideas embodied in products (both hardware and software), processes to build, assemble, or test those products, business information concerning sales and marketing figures, published information contained in books, manuals, engineering drawings, and other internal information such as new product planning strategies and developments.

Each piece of such information is a valuable asset. Not only can it give Digital a competitive advantage in the marketplace, it could be very valuable data to our competitors. It is, therefore, of the utmost importance that each employee, and in particular those employees dealing with research or product development, be aware that Digital's knowledge and know-how must be properly safeguarded from competitors.

Digital protects its proprietary information, often referred to as intellectual property, by using various methods provided by law. There are four principal areas of intellectual property law to protect this information, namely, patents, trademarks, copyrights, and trade secrets. Several staff patent attorneys form part of Digital's Law Department and are responsible for servicing Digital's Engineering groups, particularly with respect to matters involving intellectual property. When issues are raised involving patents, trademarks, copyrights, and trade secrets, the patent attorney responsible for the particular engineering group should be contacted. If a potential problem is recognized involving Digital information and the patent attorney is contacted, measures can be taken to adequately protect Digital's information.

The following is a brief overview highlighting the basic concepts involved in the law of intellectual property. It is intended to aid you in spotting these intellectual property issues.

Patents

Congress has passed laws to protect idea information. One form of idea information, inventions, is protected by patents. The grant of a patent is in effect a contract between the government and an inventor. In exchange for a public disclosure of an invention, the government grants the inventor the right to exclude others in this country from making, using, and selling the invention for 17 years. Similar provisions apply in other countries.

An engineer. in the course of his or her work, may develop an "invention" (a new and useful mechanism, article, or method) which has a degree of novelty or uniqueness greater than what a skilled technician or engineer would develop in performing his or her day-to-day work.

It is important for you to continually review your work to determine whether it qualifies as an invention. You are not expected to know whether the invention is patentable or not. The cognizant patent attorney will determine this. However, you should be able to identify those things which contain some ingenuity and which, to your knowledge, were not previously known or invented by someone else. Once it has been established that an invention has been developed, the invention should be disclosed to the Law Department.

To aid in the protection of inventions incorporated in our products, Digital has established a Patent Committee responsible for determining whether or not to file patent applications on inventions made by Digital personnel. The committee has formulated a basic patent policy under which Digital will attempt to find (and file patent applications for) at least one patentable invention in each product we expect to sell in volume. A patent on our important products may range from protecting a feature in the product to the entire architecture of the product. Although the company is more likely to file for patents or inventions actually incorporated in products, Digital will file for patents on other inventions.

Since the grant of a patent is dependent upon the invention meeting certain timing criteria established by the law, all inventions considered for patenting should be brought to the attention of the Law Department before any disclosure outside the company. This would typically be at the prototype or breadboard stage, or before they are incorported into products which are announced, shipped, or described in publications. When an invention disclosure is submitted, the cognizant patent attorney should be advised as to when a public use, sale, or publication of the invention is comtemplated.

Patents obtained by Digital are used to prevent other people from making the product. Digital also licenses the use of its patents so it is paid a royalty for each product made which is covered by the patent. Business factors will determine if we should share the idea by licensing others to use it.

As part of your responsibility to protect new ideas of the company, all personnel performing scientific or technical work in the fields of research, development, and engineering should maintain accurate and complete records of their work. The purpose of maintaining these records is to have a legal record to substantiate the conception of inventions covered by patent applications. The Digital Engineering Notebook system is a valuable tool developed for this purpose. It is the responsibility of Digital technical personnel to maintain Engineering Notebooks, particularly in those instances involving a description of a development that may be patentable (See Section 5, paragraph 3.3.1 of this manual).

Trademarks

A trademark is one or more words, a name, symbol, device, or slogan used by a manufacturer to indicate the source of the goods or services and to distinguish his or her goods and services from those of others. Digital trademarks inform the customer that the product was manufactured by Digital and not someone else. By using a trademark, the owner of the trademark is, in effect, guaranteeing that the

trademark product is of the same quality as similarly trademarked products acquired in the past. A trademark is a valuable asset since it provides a highly recognizable link between a customer and the products of the company.

Digital has invested significant amounts of money to associate its trademarks with its products. Marks such as DEC, DECUS, PDP, and the Digital logo are well recognized in the industry and throughout the industrial world. However, trademarks must be protected or they can be lost. It is relatively easy to protect and care for trademarks. The following is a list of some of Digital's more prominent current trademarks:

DEC	**DIBOL**	**PDT**
DECnet	**Digital logo**	**RSTS**
DECsystem-10	**EduSystem**	**RSX**
DECSYSTEM-20	**IAS**	**UNIBUS**
DECUS	**MASSBUS**	**VAX**
DECwriter	**PDP**	**VMS**
		VT

In addition, Digital is constantly coining new marks. Before a new trademark is announced or used, it should be submitted to a patent attorney for a trademark infringement search. This will help us to determine if our new trademark will infringe a trademark already belonging to someone else. By having the trademark search performed early, most legal problems will be found before the company incurs advertising and other costs.

If you encounter any suspicious use of our trademarks by a party outside of Digital, or are planning or participating in the process of choosing a trademark for a new product or service, a patent attorney should be advised.

Copyright

A copyright is a legal right to prevent others from making copies of an author's work provided the work is marked with a proper copyright notice when published. However, a copyright does not protect an author's ideas. It protects only his or her individual expression of those ideas. Ideas expressed in a copyrighted work may be freely used by anyone; however, if someone copies the same expression or modifies it slightly, he or she is not free to use the copy or modification.

Digital information protected by copyright is generally written information. This includes engineering drawings, software, and manuals, but may also be audio visual training courses and other items. Under the law, as long as we put a copyright notice on our publication (a "c" within a circle, year of publication and owner, i.e., © 1979 Digital Equipment Corporation) we have performed the minimum procedures required to obtain copyright protection. DEC Standard 197, Legal Guidelines for Digital Publications, contains requirements for controlling proprietary information and protecting Digital against liability.

At Digital we make a substantial investment in copyrighted information that we publish. We disseminate to our customers a great deal of desired information about our products. At the same time, we use the exclusivity that copyright laws provide to prevent unfair use of our publications. Such unfair use occurs when a similar product is made by a competitor and our copyrighted material is used to describe the similar product.

You should, therefore, be aware that any written works that are expected to be published must have appropriate copyright protection. In the same manner, we must be careful not to violate the copyright of others when we are using their works.

Trade Secrets

In some situations the patent system is not a suitable method of protection for a company's products or processes. A commonly used alternative is to protect the intellectual property as a trade secret.

The law of trade secrets is based on the recognition that it is unjust to permit the misappropriation of technical or commercial know-how which is not in the public domain. The law provides a legal right to prevent, or to recover damages for, an unauthorized disclosure or use of technical or commerical information which is a trade secret. A trade secret may be any confidential formula, pattern, device, or combination of information used in one's business which gives him or her an opportunity to obtain an advantage over competitors who do not know or use it.

A trade secret must be kept "secret" so that it does not become publicly known. A trade secret may be lost by disclosure to others without any limitations. However, the law of trade secrets can be extended into the marketplace by means of contractual arrangements binding the recipient of information to keep it secret.

To adequately prevent a trade secret from becoming publicly known, appropriate internal procedures must be undertaken. These procedures should include as a minimum:

a. Insuring that trade secret information is not provided to customer or vendors except under appropriate agreements;

b. Restricting access to the information to those employees and agents having a "need to know" and informing those employees and agents having access to the information that it is confidential, and;

c. Maintaining general security precautions on the premises, avoiding leaving confidential information in open or uncontrolled areas, restricting access to those locations having sensitive information, etc.

Digital invests a great deal of money and resources to develop its software as well as its hardware products. Because the software products, once on the market, are easily reproduced and copied (the vast number of delivered Digital computers are a ready market for Digital software), it is important that our company legally protect its software products against improper duplication and distribution. Digital has elected to protect its software by both copyright and trade secret theories, with patent protection also attempted in rare cases.

A software license agreement is the legal vehicle under which our customers are licensed to use the trade secrets and copyrights incorporated in our software. Without some form of license agreement, our trade secrets and copyrights in our software products may not be protected when software is provided to customers. For this reason, Digital places extreme importance in providing our software only under an appropriate licensing agreement.

Sometimes during the course of business we may disclose trade secret information that relates to new products before they are announced. If a business decision is made to disclose Digital information, an appropriate non-disclosure agreement must be signed by the recipient. Although the non-disclosure agreement provides some protection, the best protection, of course, is not to disclose the information. Once released by an outside party, whether accidentally or deliberately, Digital confidential information may become public property and subject to unrestricted use. The first approach always should be to try to find a way to conduct transactions without disclosing or transmitting Digital confidential information. This is particularly true for very sensitive and highly proprietary information.

Just as we do not want to disclose our confidential information without restrictions, neither do our customers and vendors. At times we may visit a customer's plant or see what is going on in his or her

business, and often the customer may ask us to execute a non-disclosure agreement to protect his or her trade secret information. This is a dangerous situation. We are a large company with a great deal of internal development work. Also, we are exposed to a large number of ideas from our customers. If we internally develop or receive an idea from a third company which resembles information received under a non-disclosure agreement, Digital's legitimate use of the idea could compromise the customer's proprietary information, even if we have not done so.

It is Digital's general policy not to execute non-disclosure agreements. We refuse to receive any trade secret information submitted to us from companies or persons outside of Digital. If for significant business reasons an exception to this policy must be made, then a specific non-disclosure agreement must be negotiated by the Law Department. An appropriate Vice President must sign the agreement on behalf of Digital.

It must be remembered that all Digital employees are obliged to respect the trade secrets of former employers. Thus, no person at Digital is to be given any information which one has reason to believe is a trade secret of a former employer.

The foregoing should aid in the understanding of how and why Digital protects its information. As individual employees, we can each contribute to the protection of Digital information by accepting the following responsibilities:

a. Reviewing our work to determine whether we have developed an invention, maintaining good records concerning the facts related to such inventions, and submitting innovative ideas to the Law Department;

b. Appreciating the fact that all Digital intellectual property, including trademarks and copyrights, are valuable assets and should be properly cared for;

c. Taking appropriate precautions to maintain in confidence Digital's trade secret information so that it is not disclosed outside the company without proper protecting agreements; and

d. Avoiding receipt of confidential information from outside Digital and contacting the Law Department if such receipt is felt to be justified by significant business reasons.

If you have any questions concerning the above, feel free to contact a patent lawyer in the Law Department.

APPENDIX II

Digital Standards Arranged by Subject and Categories of Information

TITLE	DEC STD
DESIGN/DRAFTING SERVICES	
Checking of Drawings	010
Unified Numbering Code	012
Sizes and Formats	013
Drawing Revisions	014
Abbreviations	015
Lettering	
Casting Standards	020
Harness Drawings	021
Cable Drawings	022
Drawing Directory	024
Parts List	025
Distinctive Shape Logic Symbology (Logic Circuit Schematics)	056

Digital Standards Arranged by Subject and Categories of Information (Cont'd)

TITLE	DEC STD
Engineering Change Orders	100
Dimensions and Tolerances	114
Packaged Systems Documentation Structure	126
Module Documentation Structure	140
Printed Circuit Release Flow	142
Engineering Documentation Acceptance Criteria	182
Archiving Microcode in the Documentation System	183
Documentation of Computer Media in the Engineering Documentation System	185
Archiving Engineering Information: Policy and Procedures	188
DOCUMENTATION	
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Purchase Specifications	055
Engineering Change Orders	100
Field Maintenance Print Sets	117
Packaged System Documentation	126
Integrated Circuit Documentation and Test Systems Control	133
Module Documentation	140
Engineering Notebook Policy and Requirements	141
Digital Magnetic Tape Labels and File Structure Standard	149

Digital Standards Arranged by Subject and Categories of Information (Cont'd)

TITLE	DEC STD
Micrographics: Format and Quality Requirements for Microforms	162
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Standard for Documentating Systems Messages	170
ROM/PROM Documentation: Process and Requirements	184
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Digital Standards Arranged by Subject and Categories of Information (Cont'd)

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HARDWARE ENGINEERING:HUMAN FACTORS

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Distinctive Shape Logic Symbology	056
Environmental Standard for Computers and Peripherals	102
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Digital Standards Arranged by Subject and Categories of Information (Cont'd)

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Finish and Color Standard	092
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Digital Standards Arranged by Subject and Categories of Information (Cont'd)

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Reader's Comments

Your comments and suggestions will help us in our continuous effort to improve the quality and usefulness of our publications.

What is your general reaction to this manual? In your judgment is it complete, accurate, well organized, well written, etc.? Is it easy to use? _____

_____

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What features are most useful? _____

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What faults or errors have you found in the manual? _____

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Does this manual satisfy the need you think it was intended to satisfy? _____

Does it satisfy *your* needs? _____ Why? _____

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☐ What kinds of information would you like to see in the next edition of the Engineer's Orientation Manual?

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223-7793

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