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Building Excellence in Project Execution: Integrated Project Management

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Building Excellence in Project Execution: Integrated Project Management

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Abstract

With declining defense budgets, the U.S. Department of Defense (DoD) has been forced to re-examine its mission, capabilities, and processes. As the DoD wrestles with reexamination of its priorities, so too does the acquisition community, and particularly those in the project management community have an important role to play.

The Honorable Frank Kendall, USD(AT&L), has championed the role the acquisition community can play in the effort to streamline, adapt, and innovate the way the DoD plans and carries out acquisitions. Kendall's Better Buying Power effort—currently in its third instantiation—illustrates many of the key areas that the acquisition and project management communities must address. Closely aligned with Better Buying Power's goals is the need to implement a system of project management that integrates the three foundational pillars of project management—scope, cost, and time—with the ability to adapt to a changing environment that meets customer requirements. Space and Naval Warfare Systems Center Pacific (SSC Pacific) is addressing this challenge by adopting and refining the CMMI Model, and building the tenets of integrated project management (IPM) into project planning and execution. This paper illustrates the guidelines for a project manager under this model.

Introduction

There is no such thing as "the typical project." No two projects ever seem to be the same—similar, yes, but they all have a uniqueness about them. Developing a plan to execute a project can be an arduous event but well worth the time and effort when the project plan lays the foundation for project execution. Working the details by incorporating the integrated project management (IPM) process allows for transparency and positive control throughout the life cycle of the project. The intent of this paper is to identify how there is a natural occurrence of IPM when utilizing the sound project management practices that comprise the five overarching process areas outlined by the Project Management Institute (PMI): Project Initiation, Project Planning, Project Execution, Project Monitoring and Control, and Project Close Out. A major emphasis is placed on the project planning phase and, as we note later, its level of detail that directly affects IPM and the execution, monitoring, and control of the project.

Project planning, although certainly not the sexiest part of a project manager's job, is a critical component to the success of the project and is the hallmark for cost, schedule, and technical performance execution. But here's the rub—as a project manager, we often feel that as soon as we have a project assignment and we have funding on hand, we are already behind schedule. In today's I-need-it-now environment, the moment the project is funded, stakeholders are already expecting results. One of the first processes in the life of a project is stakeholder identification, and it is critical to have this understanding from the earliest part

of the project. Managing stakeholder expectations is critical to the success of the project, and we must communicate the need to take the time for upfront planning; if performed properly, it will help drive the efficiency and effectiveness of project execution. This really allows us to take the first step in preparing to launch the new project and establishing the project charter.

So how do we define what a project is? Sometimes I think this is an age-old question, and the definition changes from organization to organization; however, the Project Management Institute (PMI; 2013) defines a project as "a temporary endeavor undertaken to create a unique product, service or result." This would indicate a definitive beginning and end to achieve a specific outcome of which a unique product, service, or result is achieved. However, some projects have a definite end before achieving completion due to constraints that preclude completion, be it funding, realization the outcome cannot be met, and so forth. Key components that must be considered are the most basic of a project: time (schedule), cost (budget) and technical performance (product/service/event), which form the core components (or pillars) of what we are embarked upon when taking on a project. This brings us to the crux of looking at project management with a slightly different filter; taking a look at how we can fully appreciate the development of true IPM, and the criticality of sequencing the five process areas that align to the project life cycle.

PMI (2013) states,

> Project Integration Management includes the processes and activities needed to identify, define, combine, unify, and coordinate the various processes and activities with the project management process groups. In the project management context, integration includes characteristics of unification, consolidation, communication and integrative actions that are crucial to controlled project execution through completion, successfully managing stakeholder expectations and meeting requirements.

Under the Capability Maturity Model Integration (CMMI), IPM is defined as "the integrated process for the project management which is tailored from the organization's standard process of project management" (Khare, 2013). We can take a look at some very specific areas that directly impact the project where their efforts are so intertwined it is incomprehensible to not identify them as integrated processes. However, before we jump directly into this, we need to have an overarching understanding and take a look at the project architecture, or process flow if you will, to better comprehend how and why an integrated process is so very important. Taking a look at the five process groups, we show how the project life cycle is directly impacted as we apply appropriate project management rigor based on where a project has progressed through its life cycle. As seen in Figure 1, the interrelated aspects of this interaction and the cyclical efforts continue throughout the project's life cycle.

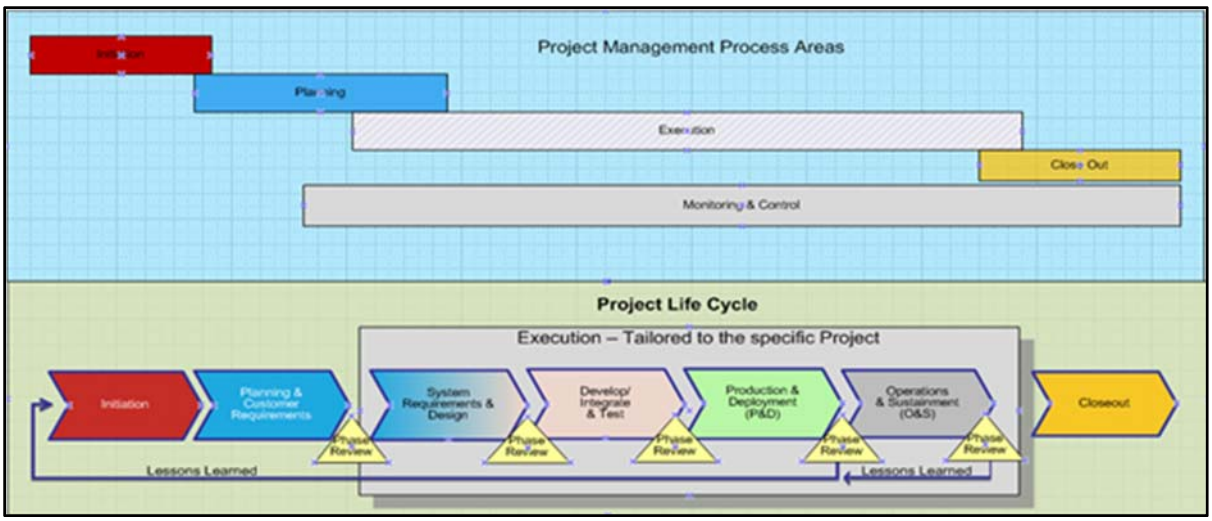

Figure 1. Interrelationship of a Project's Management Process Areas and Life Cycle

So what does this really mean to the project manager that wants to get the job done and meet the customers' expectations? It provides a guideline for the project manager to establish a completely integrated project plan that will allow proper execution across the life cycle of the project. We look at what I call the "6 Pillars of Project Management" through all process phase areas. We spend a significant amount of time in the planning phase simply due to the fact that without proper and complete planning, it is nearly impossible to establish a truly integrated project management plan (IPMP), let alone execute and effectively monitor and control the project with a sense of realization.

It is consistently stated that a project manager must always be concerned with the execution of cost, schedule, and technical performance, also known as the three foundational pillars of project management: scope, cost, and time. They are so fundamentally connected in project management that they must be continuously monitored and measured for execution to ensure the project is intact and meeting its planned delivery. By implementing IPM, the project manager is inherently recognizing the interactions between these three foundational pillars and the processes that work together to ensure that project execution is on time and within budget while meeting the technical performance as laid out in the requirements. It is important to realize that IPM is implemented across the life cycle, from project initiation through closeout. In order for the project manager to ensure the objective of the project execution is being met, a plan must be in place that is forward looking. The threats and opportunities to the project known as risk should be identified, and the potential cost of those risks must be calculated should the need arise to implement a mitigation strategy or a contingency plan. Furthermore, the project manager must have a means to measure the success of the project as it is being executed throughout the life cycle. This could include gate reviews, testing, verification of requirements, and validating that what is being delivered is actually what was produced, in other words, a well thought out and detailed quality assurance plan. In order to make all of this happen, the project manager must manage all of the stakeholders and identify who he must communicate with, on what timeline, and to what detail. These three supporting pillars are those that cross all projects, allowing the project manager to ensure that all the necessary steps have been taken to achieve the end goal of the project. Figure 2 provides a graphical representation of the 6 Pillars of Project Management. These six pillars are common to all projects and span

across the project life cycle and are supported by all the processes within PMI's identified five process groups.

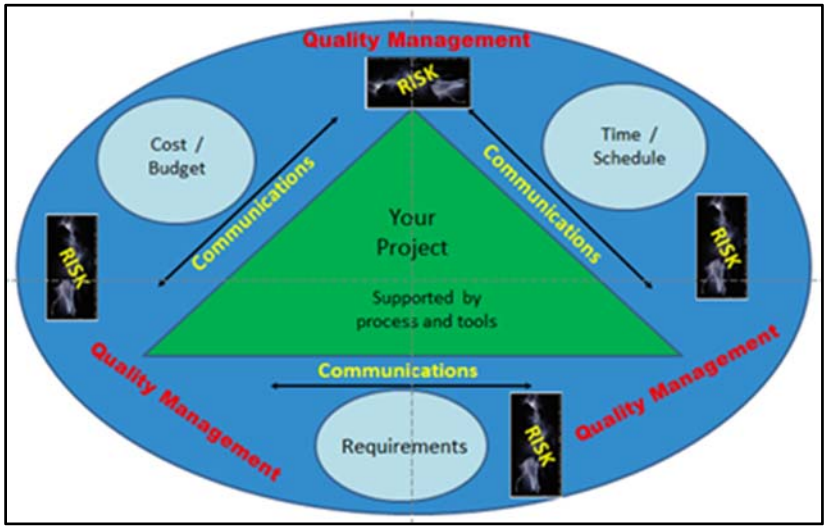

Figure 2. 6 Pillars of Project Management

PMI (2013) has identified 42 process areas that are categorized into 10 project areas with a concentration of five process groups. These can be found in *A Guide to the Project Management Body of Knowledge* (PMBOK), 5th Edition, in a table matrix; however, I have included the below diagram, Figure 3, from the PMBOK, 4th Edition, to highlight the process areas with relation to the three foundational pillars of scope, cost, and time, and the other three integration pillars of communications, risk, and quality management. Procurement processes are not necessarily a pillar to IPM as it is not universally applicable; however, they are critical to the cost component of a project when making decisions such as make/buy or market value. The integration processes are those that cross the spectrum of the project's life cycle and bring the integration together.

An interesting point to note is that one of the busiest and hardest parts of being a project manager is in the planning stage. One will notice, as represented in Figure 3, that there is more process area development and initiation in the planning phase of the project than in any other phase, yet it seems that many project managers never spend enough time planning their projects and understanding how the processes are interdependent on one another. Through a thorough understanding of IPM, project managers can better visualize the importance of proper project planning.

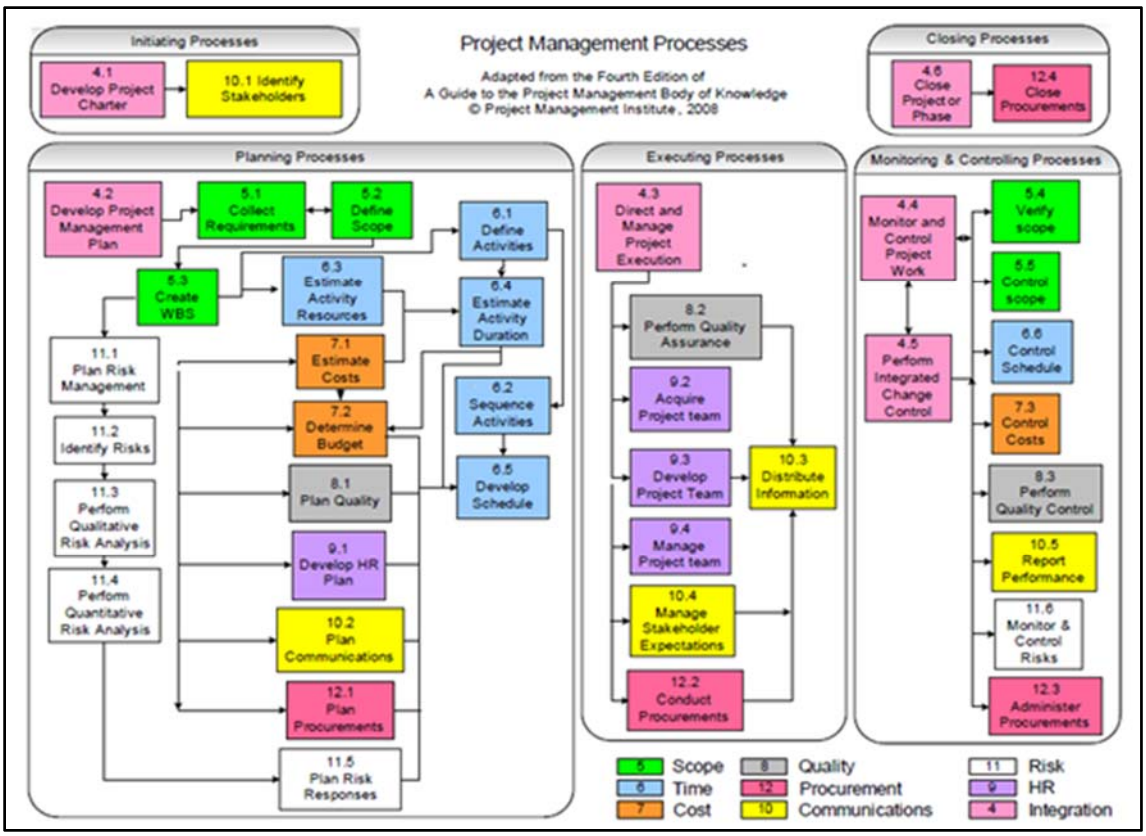

Figure 3. Figure Management Processes
(PMI, 2008)

Let's explore each of the three foundational pillars, scope, time, and cost, in more detail. As seen in Figure 2, all three are critical elements in the planning phase of the project.

They are all part of the IPMP. However, before one can consider the time and cost, one must fully understand the requirements behind the project. Requirements are represented at the base of the triangle (Figure 2) not because they are any more important than any other aspect of the project, but because requirements lay the true foundation for "Why We Are Doing" the project. Without requirements, there is no basis or guidance for executing a project.

For the purpose of this article, we consider scope and requirements as interrelated; however, there are some slight differences within the definitions in that *scope* takes into consideration time and budget as well as the deliverables. Lewis (1999) suggested that Performance Level (Requirements) + Budget Constraints (Cost) + Time makes up the scope of a project. PMI (2013) defines *a requirement* as "a condition or capability that is required to be present in a product, service, or result to satisfy a contract or other formally imposed specification." Requirements are normally provided in a requirements document. At times, requirements documents are not very specific which in turn requires the project manager working with the project team and the customer to define what the requirements are or determine if there really is a requirement for a project. It is important to note that not all projects will have clearly defined requirements such as some research and development projects where the specifications are unknown and the project itself is to help drive learning

to move forward. These are often high-risk projects where the real deliverable is the knowledge learned from executing the project.

For most other projects, when the specification is unknown but a specific end result is needed, the project manager will need to work with subject matter experts to help identify "derived requirements." In defense acquisition, it is stated that "derived requirements are definitized through requirements analysis as part of the overall systems engineering process (SEP) and are part of the allocated baseline" (Defense Acquisition University, 2012). This implies that in order to fully comprehend what is required, we need to understand the intent of the requirements and the deliverables needed to meet those requirements. It is the PM and the team's responsibility to work with the end users to define the requirements, both those that are known and those that are derived. Project managers should use a requirements traceability matrix to map the product requirement back to the origin that satisfies the customers' needs and product delivery. Within the acquisition community this normally goes back to the beginning of the program's initiation and a Mission Needs Statement that is developed to identify a warfighter requirement. They may not know exactly what the requirement is, but they can articulate the need, which should be clearly defined. This process is cyclical and is partially depicted in the fact that once you start executing the project, the execution, planning, and monitoring and control processes all overlap. This iterative process may drive changes to your project's scope and costs. It is however a necessary process since requirements and requirements definitions are critical to scope establishment, control of scope creep, and implementation of decision analysis and reporting, that supports overall control of the project.

In Figure 3, notice that the green boxes relate to scope/requirements which, once collected, determine the scope of the work needed. As Lewis (1999) indicated, the flow within the chart would have one realize the interdependence on cost and time. In order to fully understand what must be done, the project requirements need to be broken down to a level where work definitions or work packages are realized. This is done by creating a Work Breakdown Structure (WBS). The *WBS* is defined as "a hierarchical decomposition of the total scope of work to be carried out by the project team to accomplish the project objectives and create the required deliverables" (PMI, 2013). In essence, we are taking the high level requirements and separating them out in to components of work that can be measured and tracked. Having that level of detail allows for a couple of things to happen. First, it provides the project manager with a good understanding of the level of detail that must be completed to accomplish specific items of the overall project. With that knowledge in hand, the project manager can then calculate a good bottoms-up cost estimate. This is all a result of having the finite details that allows the project manager and the functional SMEs to assess the level of effort required to complete the specified tasks. The ability to break a project down to what is considered a work package level, or, as Lewis (1999) stated, "a detailed short-span job or material item, identified by the contractor for accomplishing work required to complete a contract. Work packages are discrete tasks that have specific end products or end results." In other words, a work package is work that is clearly distinguishable from other work on the project. It has a defined timeframe of work and when it must be completed. It may or may not have milestones to be measured, depending on the length/details associated with the work package, and it has the ability to be measured for success of work performed. The result of having finite requirement details is a bottoms-up estimate that can only be done with the knowledge of what level of task must be performed and by what skill level of expert is required to accomplish the work. For example, one would not want an apprentice welder to be working on an aircraft frame of a supersonic jet; instead, an expert level welder would be more desirable to include in the cost element. However, that apprentice welder may possess the necessary skill to weld the support arms for a tray rack on the galley lunch line.

So, now that a work breakdown structure has been established, additional parts that drive level of effort work can be added in, as almost every project has some level of effort aspects tied to them. The end result is a sound estimate of what it takes on the surface to execute the project, that is, if everything works perfectly. But what about risk and the cost of risk? Those are factors that must be worked and then reworked into a project. The project manager must account for this; however, very early in the project planning phase, project risk has only been minimally assessed. Therefore, an element of management reserve needs to be calculated and identified as such for risk mitigation and contingency.

At this point, we have briefly looked at two of the core pillars of project management: requirements and defining them to lower levels so they can be accurately budgeted for and measured for quality. Additionally, we have looked at what it will cost to execute the project by identifying the lower level work packages that roll up to meet requirements and their associated cost. Furthermore, we have discussed the level of effort costs that will be assessed to make sure the project executes properly. However, we now need to look at how we actually pull it all together.

The project manager must understand the interdependencies between the elements within the work breakdown structure and the sequence in which those elements must be executed. The third core pillar to project management is to develop a schedule that tells the project manager whether the project is executing as expected, if it is behind, or, maybe, even ahead of the anticipated timeline. The work breakdown structure may give us a very good idea of where this sequencing may start; however, interaction with the functional subject matter experts will be critical to the proper sequencing of activity. This sequencing of activities is actually the establishment of a project schedule. Many project managers make the mistake of thinking that once they have the items within their project sequenced, they then have their schedule. The truth is that they do have a schedule, but they do not have a schedule that has been developed for implementation of an integrated project. In Figure 3, notice that the project schedule has many factors that are tied directly to it such as the budget. If we reflect back to Lewis' definition, each of these finite work packages has a beginning and end, and they also have specific funding attached to them from the budget. This budget is defined from several other supporting processes that are critical to define the cost of each of the work packages. An example would be the human resources process: who is doing the work, what is their skill level, what does that skill level cost, and so forth.

Is there risk associated with the specific work package? Discussion on risk will come later, but for now, it is good to know that it applies to the schedule and cost. We mentioned earlier that every work package has a quality factor to it as well. This has to be taken into account for the schedule. Is there testing? And to what level? Is there a visual inspection, a bench test, or maybe regression test? These all must be considered when developing an integrated project schedule. We can deduce that sequencing is an important first step, but for a truly integrated schedule other aspects must be considered and applied. For very large projects or major acquisition programs, this schedule definition can be daunting process, but it is not one that the project manager should attempt alone. It takes the effort of all the functional area leads—these are the experts in their field that lead the specific areas, such as software development, hardware integration, and so forth. Together with the project manager, this collaborative effort is paramount to flush out the schedule, by defining the requirements, determination of make/buy, time constraints imposed by the customer, budget availability, and so forth. If a system is being developed that provides a capability that will modernize the efforts of the end user, we may need to have several areas that must be considered and included. For instance, if the decision was made to completely design and develop a system from scratch because there was no commercially available capability,

something that is determined during an analysis of alternatives, we will need to identify or build the hardware for the system (first functional area) and we will need to develop the software (second functional area). Most would assume that those are the only two areas to consider; however, after further analysis, several other functional areas must be taken in to account. The security of the system or Information Assurance (third functional area) must be accounted for, as well as the logistics aspects, which include deployment, documentation, and sustainment (fourth functional area). We briefly discussed quality of the product, but quality goes much further than what is the final delivered product. Testing throughout the process is key to project execution and quality of the production; quite honestly it has a secondary benefit in keeping cost in check (fifth functional area). Furthermore, we may need to have an integration expert or other specialized aspects. It just depends on the project, its size, the complexity, and the scope that was identified. As you can see, developing an integrated project schedule can be a daunting, difficult job, but it is a critical component to project execution.

How the schedule is displayed or the tool that is used to create it is really not that important. What is important when developing the integrated project schedule is that each of the tasks listed are traceable to the requirements, the effort required for the task, the associated start and stop times, the interdependencies of those tasks with their predecessors and successors, and the resources assigned to them are all considered and accounted for. As depicted in Figure 4, the schedule may have many parts to it, but they all must have a common start and finish component. There may be a documentation development function that parallels the development effort, and it may complete well before the development is finished; however, the end result will be to deliver the product to the customer.

The aforementioned example depicts five functional paths for the project execution, with the System Engineering/Systems Design component being open. In this section you can see the resources that are assigned, the sequencing of the tasks and how they are all interrelated. Once the project schedule has been laid out, the critical path will then be easily identifiable. PMI (2013) defines the critical path as “the sequence of activities that represents the longest path through a project, which determines the shortest possible project duration.” Having knowledge of the critical path allows the project manager the peace of mind to know where there is room for float or slack in the schedule, allows for necessary resource decisions, and most importantly, informs the project manager on whether the project execution is moving along as planned. When developing an integrated and resource loaded schedule, the project manager will be able to quickly identify conflicts in resource allocation. As seen in Figure 4, the red highlights show that there is a resource conflict or overutilization of a resource. With this knowledge, the project manager can then use methods to better define the schedule to de-conflict between activities within the schedule. There may be a need to identify additional resources, or use additional scheduling techniques such as resource leveling, or apply critical chain method scheduling. It is evident that there can be considerable effort in developing an integrated schedule, more commonly referred to as a resource loaded schedule, but these few simple examples are just some basic evidence that the effort allows for early identification, reduction in risk, and efficiency in project execution.

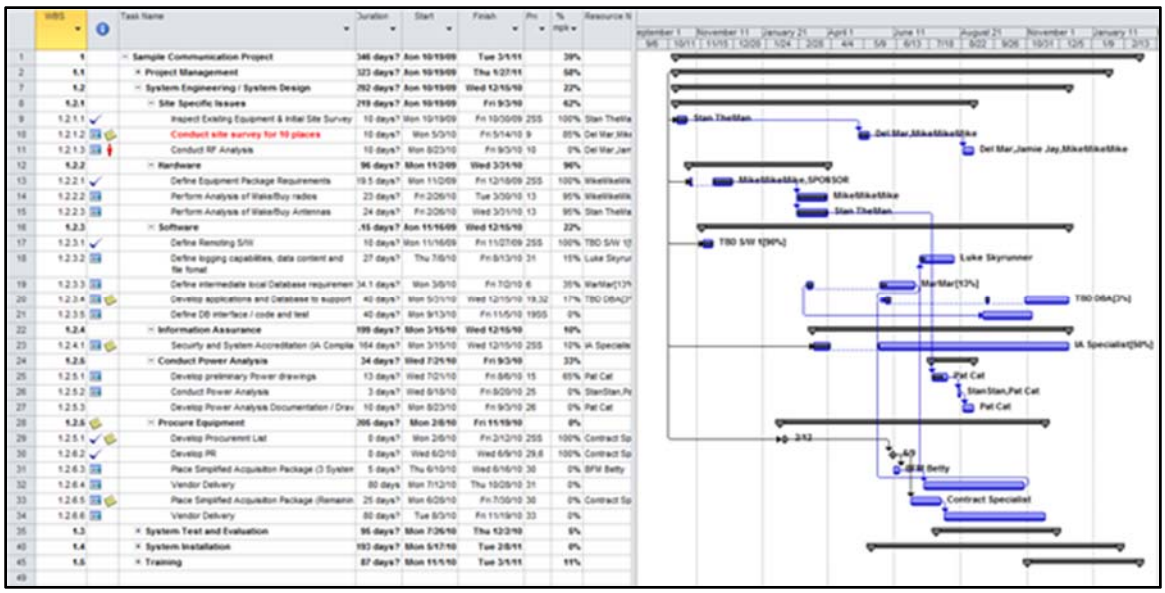

Figure 4. Project Schedule

Now that we have looked at the three core pillars of a project, we understand that requirements, cost (budget), and our schedule provide the solid foundation to project execution and development, be it a product, service, or event. But there is so much more. With every project, as in life itself, risk is inherently involved. As project managers, we cannot afford to just take risk by chance. Risk crosses every phase of the project life cycle, from identification of stakeholders in project initiation, to ensuring we properly close-out the project. PMI (2013) identifies risk as "an uncertain event or condition, that if it occurs, has a positive or negative effect on one or more project objectives." We commonly focus on risk as a negative aspect when we talk about project management, but it is important to understand that risk can be a threat (potential negative impact) or opportunity (potential positive impact) to the project. We should be prepared for either as both can impact project execution; however, we need to realize that the negative effects of risk have a far greater potential to derail our efforts and therefore, we will focus on what we should do and how risk can be handled.

Bart Jutte, a risk management expert and consultant, categorized the 10 Golden Rules of Project Risk Management (2014). Jutte's 10 Golden Rules lay a foundation that captures the essence of what a project manager and the team needs to accomplish to implement an effective risk management plan that spans the life cycle of a project. First, risk management should always be a part of the project. As we have discussed, risk management is so important to the project as it forms the first of the three supporting pillars as identified in Figure 2. Risk has the potential to affect the project from the very beginning and holds through until the project is closed.

Jutte (2014) stated that the project must start identifying risk early in the project. All too often, the project manager feels pressure to immediately start work and haphazardly identifies risks as they rear their heads. This is not risk management, but more crisis reaction management. Early identification of risk allows the project manager the ability to project ahead, plan for mitigations, or, if necessary, implement a contingency plan should the risk be realized.

So how is it that we identify these threats and opportunities to the project? Who is responsible for this activity? It is true that many projects have a risk manager assigned, but

that role is merely to administer the program, track the risk, and advise the project manager of the risk status. The reality is that no one person on a project, or aligned with the project, can see all the potential risks. Communication must happen early and often when it comes to risk identification, management, and tracking. Every stakeholder within the project has a vested interest in the performance of the project and where appropriate, should be included in the risk management process. Some common examples of stakeholders are as resource sponsors, customers (Program Executive Office, other government agencies), development partners, vendors, and end users. Stakeholder risk arises from the fact that stakeholders may not have the inclination or the capabilities required to execute the project, and when in a capacity to direct change, it can have a devastating impact to the project. Communication is key to managing stakeholders which will be discussed later.

Now that the risks have been identified, we have the first step of this cyclical process started; however, it is not enough to say, "I've identified something that has potential to disrupt what our team is doing." The project manager and the team must analyze the risk. This analysis is to determine the likelihood of occurrence and the impact that the risk will have to the project. There are many ways to execute the risk analysis, but regardless of the measure used to make the determination of the risk factor, there are still several steps that must be carried out. The risk needs to be categorized into a grouping that can be tracked and recorded. We need to determine how the risk will be handled. Do we assume the risk and watch it because the analysis reveals it will not have a major impact to the project? Maybe we retain the risk and come up with a mitigation strategy and contingency plan. Perhaps we transfer the risk to another party, an effective strategy when the project manager and his team may not have technical skills that the risk has identified. When the risk has potential catastrophic effects, another strategy is to merely avoid the risk completely and turn in a complete different direction. Regardless of the strategy, someone must be assigned the ownership of the risk. This is often a subject matter expert who has the expertise to understand what is going on with the risk and track it throughout until it is either no longer a risk or is realized.

Once we have analyzed and identified our strategy to handle the risk, we need to document them so they can be tracked, which is normally done via a risk register. Again the tool that is used is immaterial to the process; the importance is the activity and the understanding that risk identification, analysis, and determination of action and ownership is a process that happens throughout the life of the project, from inception through closeout. More importantly, early risk analysis has an impact to the core pillars of the project; cost, schedule, and performance.

In that risk has the potential to have such a great impact to a project, we must determine how we are going to measure risk for tracking. In many cases, we can use the simple qualitative method of merely classifying it as high, medium, or low. This is based on the risk factor determined when analyzing the risk and having an understanding of the cost of the mitigation strategies. However, the size and complexity of the project may require we use a quantitative method to determine the potential cost, requiring we go deeper and capture a quantitative analysis of the risk which uses measurable and objective data to determine the value of the risk and the mitigation strategy. This is done through probability and regression analysis using such things as Monte Carlo simulations and the use of simulation tools like Crystal Ball and @Risk which fit probability distributions to the data set in order to make determinations of probabilities.

Regardless of our methodology, we want to capture the cost of the risk as a part of our integrated project. This factor is then captured within the overall cost of the plan, integrating the risk association with the schedule. This seems like a lot of effort and cost on

what appears to be a mostly administrative process; however, it is one of those processes which when executed from the onset of a project, actually reduces cost. The fact that potential threats or opportunities to the project are identified early allows for the necessary adjustments before they become so big that they cannot be dealt with and become an issue. The old adage, pay me now or pay me later, is really the case when it comes to risk management.

At this point we have worked to establish our foundation with requirements, identified the cost and schedule of the project and identified threats and opportunities in our project by implementing solid risk management. This is a solid start, but how do we know that what we are doing will deliver the quality product that meets the requirements we set out to accomplish? The answer lies in the next supporting pillar to IPM, Quality Management.

When we start planning our project, we need to make sure we build in quality from the beginning. By doing this, we avoid the pitfalls of blindly moving forward without verifying that what we are doing makes sense and is meeting the requirements. PMI (2013) defines *quality* as "the degree to which a set of inherent characteristics fulfills requirements." By implementing concrete quality assurance, we are creating a planned and systematic means that will assure we are meeting the defined standards, practices, and procedures that are necessary for the project (Gallagher et al., 2011). But we must ensure that we differentiate between quality assurance and quality control. All too often these terms are used interchangeably; however, they are not. Quality control stresses the testing of the project products in order to identify defects that drive decisions by management, normally through processes like decision analysis or change management. The defect may drive a decision to halt production (development) and consider other factors. On the other hand, quality assurance endeavors to improve and stabilize production and avoid, or minimize, issues which can lead to the defect(s).

When we consider the scope of quality management planning, we understand that it identifies the quality policies and procedures applicable to the project for both project deliverables and project processes. Having established a Quality Management Plan means that we are looking at the total project. There are four components to developing a Quality Management Plan as outlined in a study at Virginia Tech (2013): quality planning, quality assurance, quality control, and independent verification and validation.

When we break this quality management down, we can see how it fits directly into the life cycle of a project and thus lives up to being a pillar of project management. Project planning is normally conducted in the planning phase of the project while quality assurance takes place during project execution. Making sure we have the right processes in place supports the project manager's ability to properly execute and run the project. Project control is an integral part of Project Monitor and Control because as we move through our project, we must measure our progress to identified measurements and metrics. Not all projects implement the fourth element of the quality management strategy but they should. Independent validation and verification is the testing and reviews that provides the project manager with an unbiased independent view of the project deliverables.

Having a well-designed quality plan means that we have been forward looking to ensure our quality plan is integrated. Through thoughtful insight, quality processes, techniques, and strategies will be executed, with identification of those with the responsibility for their particular quality assignment. By implementing the necessary quality control in the project, we are implementing the techniques and activities to ensure we are fulfilling the project's requirements. As stated, quality is more than just doing testing during the execution phase of the project; it is also ensuring we have the necessary processes implemented and

that our documentation is accurate and relevant to the project. For example, ensuring that we have a requirements matrix that allows us to trace requirements to the needs statement and then validating that all requirements are testable and have the appropriate testing events identified against them is critical documentation that guides the project's success.

The sixth and final pillar to project management is the one that is overlooked the most often yet it is the one that is used more than any other: communication. When you think about the importance of just about anything in life, communication is a grounding element. And we rarely take the time to plan our communications strategy covering the who, how, and when we need to engage, and both in written and oral formats. Every project has many communication requirements. The stakeholders that we have identified in the initiation phase all have a piece of the project action/responsibility. We have to have a plan on how to communicate with them and how to manage their expectations. At times, certain stakeholders will have a more active role than others; regardless, we need to have a communications strategy and plan in place that guides the project's actions. Obviously, the size and complexity as with all processes speaks to the level of complexity of a communications plan we need. But regardless, a strategy is needed to guide how we will engage, when we will engage, and with whom we will engage, on what area(s).

One of the most important aspects of a communications plan is establishing a strategy that will help the project manager and team manage stakeholder expectations. Managing stakeholders is a critical part of project management, and one of the 42 process areas identified by PMI. According to the PMBOK (2013), stakeholder identification is one of two process areas that should be accomplished in the initiating phase of a project, and a key component to understanding the breadth of relationships that must be managed and to what level of communication will be required to manage expectations, independently and as a group. Depending upon the complexity of the project, it may not be a difficult thing to manage; however, in large complex projects, having tools to help manage responsibilities and interactions provides the infrastructure to drive to success. One of these tools is a responsibility assignment matrix (RAM).

A top strategy for ensuring cohesive communications within a project and integrating communications across the life cycle is to establish responsibilities for each stakeholder. A RAM is a tool that allows the project manager to understand how the project participants interact with the activities of the project, based on the work breakdown structure. Additionally, it provides the interaction of who is responsible for, consulted with, informed of, or needs to support a specific activity. For example, a technical expert who must be consulted on several activities may not be the person responsible for completing the activity, but their expertise is critical as a consultant providing support, or the management approvals that are required before initiating an activity, and so forth. Using a RAM can be very beneficial in ensuring that all aspects of the project and associated tasks and responsibilities are well covered before you actually start work on the engagement.

> On larger projects, RAMs can be developed at various levels. For example, a high-level RAM can define what a project team group or unit is responsible for within each component of the Work Breakdown Structure (WBS). Lower level RAMs are used within the group to designate roles, responsibilities, and levels of authority for specific activities. The matrix format shows all activities associated with one person and all people associated with one activity. (PMI, 2013)

Having this level of understanding helps the project manager not only manage the internal stakeholders, but also provide insight into who is doing what activity and where to derive information to be able to update external stakeholders.

Communications is so fundamental, and managing stakeholder expectations is so critical that we need to be decisive and direct in how we go about ensuring we have clear lines of communication established. Will the RAM chart provide the organization needed to ensure this clear and concise communications flow? There is no absolute answer to this question; some plans are very complex, and some are very simple. It all depends on the level of complexity of the project and the desire for documentation. A foundational start though is to identify the tasks within the project via a solid project plan developed using a WBS, and then identifying those stakeholders that are important to each of the tasks. It is also important to identify stakeholder's roles within the project and the specific task that they impact or that impact them. This determination is captured in whether they are responsible, consulted, accountable, or informed (RACI). A simple layout would be to develop a RACI matrix with the activities on the vertical axis, a direct output of the WBS, and the horizontal axis of Team Members/Stakeholders, and then identifying their participation level (people-project interaction) within the matrix.

There are many categories that can be identified for the people—project interaction. Again, this will be determined by the complexity of the project. According to Egeland (2010), some additional areas that can be identified (not all-inclusive) are

- Document reviewer
- Input requested
- Must be notified
- Approval required
- May be notified
- Support
- Participant
- Gate reviewer

The RAM can be a valuable communication device as it displays the project participants and their implied relationship to one another as well as to the specific areas within the project. There are a number of resources available on the Web to help you develop a RAM for your project.

Table 1 is an example from a PM-Tips article, "The Responsibility Assignment Matrix" (Egeland, 2010). The matrix is simple enough to understand the concept, yet allows you to get the feeling that you can define in detail the level that you need.

Table 1. Example of a Responsibility Assignment Matrix

WBS Element	Project Team Members					Other Stakeholders		
	I.B. You	M. Jones	R. Smith	H. Baker	F. Drake	Sponsor	Clnt Mgt	Func Mgt
1.0.1.1 **Activity A**	N				R			
1.0.1.2 **Activity B**		R	C					
1.0.1.3 **Activity C**	R		S			A		G
1.0.2 **Activity D**			R		S			A
1.0.3.1 **Activity E**			R			N		
1.0.3.2 **Activity F**				R				
1.0.3.3 **Activity G**	R			S		A	A	
1.0.4 **Activity H**		R			C	N		

Key: R = Responsible, S = Support Required, C = Must Be Consulted, N = Must Be Notified, A = Approval Required, G = Gate Reviewer

The key across the bottom of the matrix brings clarity to the activity level of the individual as it relates to the task. The tasks are broken down by WBS and Activity Name. Obviously, the more complex the matrix, the more critical the identification key becomes.

So we have explored and spent a lot of time looking at the 6 Pillars of Project Management and why they are so important to the development of a truly integrated project plan. We understand that 20 of the process areas of project management are actually done in the project planning phase of the project. That means there are really 22 more that are done in the execution and the monitoring and control phases of the project, the area where we get the thing done that we set out to do. Of these 22 processes (including the two from project initiation), eight are in the execution phase, 10 in the monitoring and control phase and the last two in the closeout phase of the project. This tells us something critical to project management and why we need to spend the time up front planning for the project.

Having looked at the planning phase of IPM and the importance it plays is critical. Once the project manager has taken the time and made the effort to start off the project by establishing the framework that comprises of the six pillars of IPM, the project can move forward into execution with confidence. With a comprehensive understanding of what the requirements are, the level of expertise needed for each of the tasks, the associated risk, and how we will measure and control the project, the project manager can move forward into executing the project.

The integrated project plan as developed provides the roadmap for the execution of the project. The team can be assembled based on a complete understanding of the requirements, the skill level needed to produce results for the specific tasks that will occur, along with the project's schedule that has identified the development flow that includes efforts for quality control. This pre-planning allows for effective resource utilization and reduces waste in manpower, time, procurement, logistics (to include documentation), and product use. Having this level of detail allows for project execution that has the right personnel in place at the right time in the schedule. It provides the necessary insight for

procurement of products that minimizes logistics costs and sets integration timelines. Couple this with early and continuous risk management, and we are able to track our progress with levels of certainty that would not be achievable without having an integrated approach.

The Risk Management Plan is executed continuously throughout the project life cycle. Regular risk reviews that incorporate key project leadership allow for appropriate decision-making to make the project as economical as possible while still meeting the requirements of the project. When risks are realized, a plan has been laid out and cost identified so the project team is prepared to deal with any issue. Because there was preplanning, the project knows how to move forward and make adjustments, as well as communicate with the stakeholders that are appropriate for the situation.

Our schedule allows our quality control to be as effective as possible. The implementation of a task oriented schedule allows for application of testing and validation of product, service, document, and so on, in order to achieve maximum efficiency and effectiveness. Catching defects as early as possible is always much more cost beneficial than allowing them to compile and then identifying them when it is time to deliver the completed product. This has been known to be so costly that entire projects have been scrapped as the recovery was insurmountable.

So what is it that provides us all this insight? Monitoring and control. As noted earlier, there are 10 processes within the monitoring and control phase of the project life. As previously discussed, when developing an integrated resource loaded schedule, time was allocated to build into those activities that would allow the project manager to monitor and control the project, to include testing and reviews. The reviews provide a milestone time to evaluate the project to determine whether the project has met the expectations desired to continue to move forward. These would include phase reviews (commonly called gate reviews), as outlined in Figure 1, which allows the project to move from initiation, to planning, to execution, to closeout with the knowledge that they have completed the necessary requirements for each phase of the project life cycle.

Having a testing and review plan developed and integrated in the project plan provides the project team with the knowledge of how they are progressing. It allows them to identify defects early, make necessary adjustments, or apply appropriate fixes. Additionally, it provides the project team the opportunity to identify risk early and review risks and mitigation strategies in a defined process throughout the project life cycle.

Monitoring and control provides the project manager the ability to measure how effective his project is executing. With an IPMP that has incorporated the 6 Pillars of Project Management, the project cost can be tracked in concert with the schedule that has laid out a sequenced approach for the project execution. With this information of what each task takes, the resources needed (manpower and cost), coupled with the time phasing, stakeholders will be able to ascertain how effectively the project is being executed against both budget and schedule. And with some certainty, barring any unforeseen scope changes, an estimate at completion can be determined at almost any time during the project's life.

All too often, a project is deemed to be in the final stages of its life cycle—the development has been completed, the product has been delivered, documents have been prepared, and the project has completed 95% of the WBS items. However, one important step is still missing. If the project manager has taken the time to build an integrated project plan, it is known that the project must be closed out. This is a much abused aspect of project management but one that is highly important. Closing out the project affords the project manager the opportunity to help the organization in several ways that will support its future endeavors. The project manager must capture the lessons learned and succinctly report on

the project actions providing input to the Organizational Management Repository. This action helps the organization learn from both successes and failures experienced and provides insight into what to expect in similar projects. Additionally, it provides actual costs of the project. Through all the ups and downs, having the complete insight allows for these actual costs to be used for analogous cost estimating of future work that is of similar nature.

One of the most important aspects of closing out a project is determining what we do with our personnel who have diligently and devotedly supported the project effort. Projects do not run without personnel, and they are the greatest and most valuable asset. Based on our task-based plan, we have been tracking and executing on these human resource requirements throughout and we now need to execute the final moves of our personnel. This planning ensures no surprises and a smooth transition.

Finally, we must close the books on the project. There are a few actions that must be accomplished. We must plan to close out our contract actions, ensure we capture all the deliverables and provide contractor feedback, and rate the contractor performance. Furthermore, we must begin to close the financial books, something commonly forgotten, especially if we are still waiting for contract billings to clear or maybe a vendor bill is still outstanding. Our efforts must be to fully realize these last minute costs, return the funds that remain that are unexecuted, and close the project in the financial system. This, too, then becomes a repository and authoritative record of the financial aspects of our project that can display all of the financial actions taken.

With a shrinking defense budget yet a real need to meet the warfighter demand for increased capability, the defense acquisition community needs to become more efficient and effective, not only in program management where the president's budget is realized, but also within the project management for those non–program-of-record efforts being executed. Whether at the Echelon 2 or Echelon 3 command level, realizing the importance of implementing the most cost effective and transparent project management is critical. This can be done only through development of an integrated project plan.

As you can see, the 6 Pillars of Project Management, when developed with integration in mind, provide the basis to build a solid integrated project plan. They provide a basis for making the project effective and efficient, meeting the goals of better buying power as applied to execution of a defense acquisition project. They provide an understanding that everything springs from the foundation of requirements that are traceable and testable to the warfighter needs. It determines a cost based on known factors of time, resources, and applying anticipated cost of risk. It identifies and applies appropriate expertise with the necessary skills to execute the tasks that have been identified through decomposition of the requirements. Building in a quality control plan, which is phased in to the project schedule, supports early identification of defects and allows for appropriate reviews that are designed to meet milestone objectives. Of course none of this is possible without the project managers pinning everything together with communications that are well thought-out and designed with intent and purpose.

References

Defense Acquisition University. (2012). *Glossary: Defense acquisition acronyms and terms* (15th ed.). Fort Belvoir, VA: Defense Acquisition University Press.

Egeland, B. (2010, April 14). The Responsibility Assignment Matrix. Retrieved from http://pmtips.net/Blog/responsibility-assignment-matrix

Gallagher, B., Phillips, M., Richter, K., & Shrum, S. (2011). *CMMI for acquisition: Guidelines for improving the acquisition of products and services* (2nd ed.). Boston, MA: Addison-Wesley.

Jutte, B. (2014). 10 golden rules of project risk management. Retrieved from http://www.projectsmart.co.uk/10-golden-rules-of-project-risk-management.php

Khare, R. (2013, August 28). What is Integrated Project Management (IPM) under CMMI Maturity Level 3? Retrieved from http://www.cmmiconsultantblog.com/cmmi-faqs/what-is-integrated-project-management-ipm-under-cmmi-maturity-level-3

Lewis, J. P. (1999). *The project manager's desk reference: A comprehensive guide to project planning, evaluation and control* (2nd ed.). New York, NY: McGraw-Hill.

Project Management Institute (PMI). (2008). *A guide to the project management body of knowledge (PMBOK Guide)* (4th ed.). Newtown Square, PA: Author.

Project Management Institute (PMI). (2013). *A guide to the project management body of knowledge (PMBOK Guide)* (5th ed.). Newtown Square, PA: Author.

Virginia Tech. (2013). Quality assurance. Retrieved from http://www.itplanning.org.vt.edu/pm/qualityassurance.html

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