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Earned Value Management: Part Three - The Project Reserve

By Dennis C. Hall, Visiting Professor, Industry Chair

In our Winter 2006 issue, Dennis Hall wrote an article entitled "Earned Value Management: Part One—New Applications for an Old Tool." In the Spring 2006 issue, he covered "Earned Value Management: Part Two - Implementation Challenges." In this issue, he focuses on a key and often controversial project management issue.

Introduction

The historical inability of IT projects to come in within budget, on time and delivering on their initial promise is well documented (Standish). Given this, one might assume that the prudent project or program manager would normally include a significant reserve in his or her budget and schedule. Unfortunately, this is not always the case.

The development, control and use of program or project reserves is not without controversy. While project reserves are recognized in the PMBOK® Guide, the American National Standards Institute's (ANSI) standard on Earned Value Management (ANSI/EIA Standard 748-A), and numerous implementing guidelines and policies , many practicing project managers are reluctant to identify discrete reserves in their budgets and schedules. It is this author's opinion, based on discussions with many of these managers and his own experience , that they often see the establishment of a reserve as a tempting target for financial controllers and senior management. The preferred solution seems to be to overstate the cost and schedule of individual activities within the project and trust that these hidden "reserves" will survive management review. The downside of this approach is that control account managers are a lot like project managers. If it's there, they'll spend it. So overstating the cost of an activity can represent something of a self-fulfilling prophecy.

Even setting aside the political or psychological issues involved, the guidance on the use of management reserves is somewhat contradictory, particularly when using Earned Value Management (EVM) techniques. Some guidance, including the PMBOK® Guide, indicates that the reserve is set aside for potential scope changes and therefore should not be included within the project baseline. For example, DoD's gold card, a summary of EVM terminology and procedures, clearly indicates that the management reserve is outside the Performance Measurement Baseline (PMB) and represents the difference between the Total Allocated Budget (TAB) and the Budget at Completion (BAC). This is reproduced in Figure 1.

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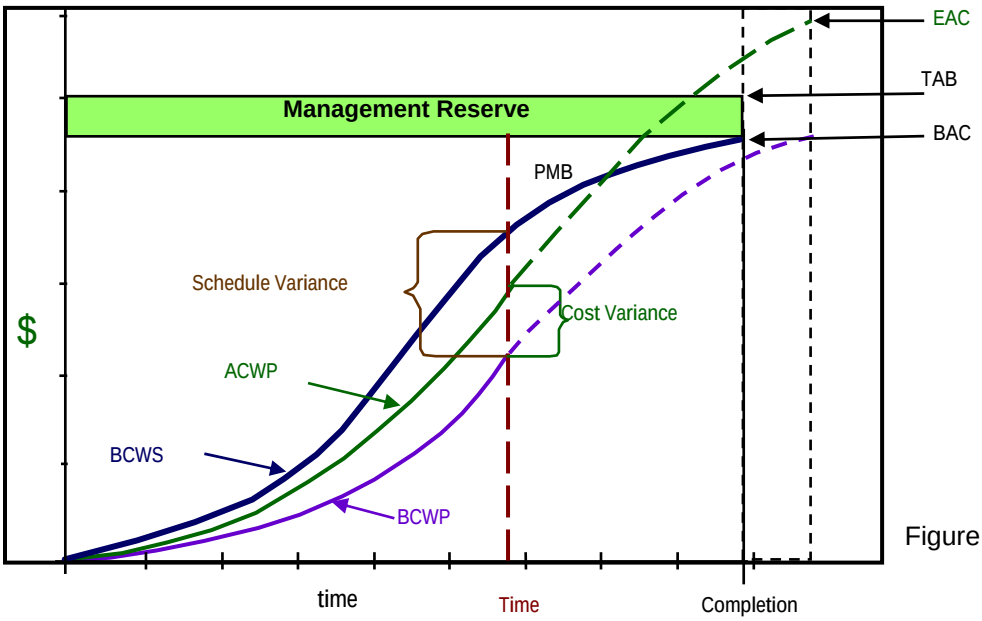

Figure 1: DoD Gold Card

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Other references (Mulcahy: 345) do allow a reserve within the PMB. One thing that is common to all references, however, is that the Management Reserve is not there to hide performance issues.

The Project Reserve

I would like to propose a use of reserves (time or budget) that combines the principles of risk management with the objectives of Earned Value Management. With just a little luck, this use might reduce the variances between planned and actual project performance.

To do this, let us consider a project reserve as having two components. The first, the Management Reserve (MR), will be held outside the PMB to be released at Management discretion to support changes that are external to the project, for example a major change to the requirements or such other issues that are outside the project manager's control.

A second type of reserve, the Contingency Reserve (CR), would be created as a result of risk management planning, would be within the PMB, and would be under the control of the Project Manager. There would be specific limitations on the use of that reserve, however. As with the MR, the CR would not be used to cover either planning inaccuracies or execution inefficiencies. It would only be used to accommodate those events that were identified during the risk planning activities.

The Management Reserve

Let me present an example of how the MR might be formulated and managed.

Certain projects are, by their nature, inherently risky and many organizations categorize these projects on the basis of very specific factors. For example, one financial institution has developed a Risk Rating Tool that identifies a project as High, Medium, or Low risk based on three categories of risk: project, organization and technical. They base this on an evaluation of 24 specific factors such as the anticipated process reengineering that may be required upon implementation.

Another indication that a project might have a high risk would be the receipt of a wide range of bids from prospective vendors in response to a solicitation. This should alert management to the potential for major difficulties in the understanding or interpretation of the statement of objectives. Both of these

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examples could be used as the basis for establishing a management reserve.

Under the situation just outlined, an organization might establish a reserve factor (MR1) of, say, 3% for a Low Risk project, 5% for a Medium Risk project and 10% for a High Risk project. Then, after receiving bids from prospective vendors, they might add an additional reserve factor, MR2, calculated by subtracting the price of the winning bid from the average price of the technically acceptable bids. The Management Reserve would then be the sum of MR1 and MR2.

This reserve would be managed by the sponsor or at least by someone external to the project management team and would be a "cushion" between the total allocated budget or program budget and the Performance Measurement Baseline (PMB).

The PMB would be the basis of measuring project performance. The MR is outside the PMB, as shown in Figure 2, and therefore would not affect the cost performance index. As new scope is added, the PMB would be adjusted and performance calculated as usual.

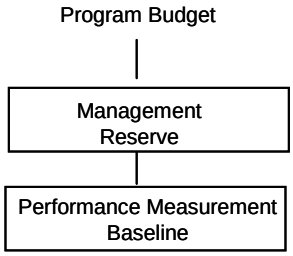

Figure 2: Management Reserve

The Contingency Reserve

In contrast, the contingency reserve would be based on the risk management planning conducted during the early phases of a project and would be managed within the project.

Most risk management processes include:

- ◊ Identifying the potential risks (risk events)
- ◊ Performing a qualitative risk analysis which prioritizes the risks based on their probability of occurring and the impact if a particular risk does occur
- ◊ Performing a quantitative risk analysis for the most significant risks
- ◊ Planning the response to identified risks: what can be done to reduce the probability of a risk event occurring and/or the impact if it does occur?

As a result of risk planning, a contingency reserve (CR) would be set aside to cover the potential cost of the accepted risks. Individual reserves are based on both the probability that the event will occur and the impact if it does occur. An example of such a calculation follows.

If the task is to install a fiber optic cable along a highway, then one of the major risks will be the amount of rock that exists along the route. While it would certainly be wise to investigate sub-surface conditions before the budget and schedule are established, there may not be sufficient time prior to the initiation of work to determine, with 100% confidence, that the route is, say, 50% loose soil, 25% rock and 25% clay. Therefore, the estimate for installation cost would be based on assumptions made as to the nature of the soil with a reserve established in case those assumptions turn out to be incorrect.

In our example the reserve might be established as the difference between the cost that will occur if you have 50% confidence in your prediction of the amount of rock you will encounter and the cost that will occur at the 80% confidence level (we will have more rock only 20% of the time). This is shown in Figure 3.

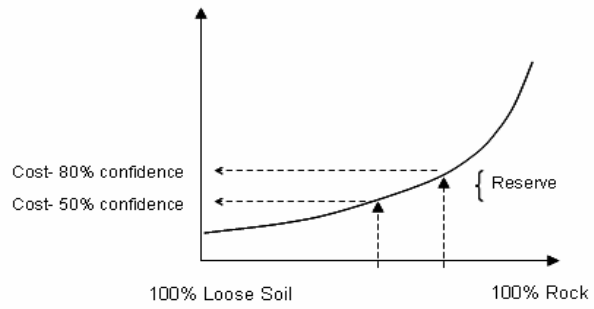

Figure 3: Risk Analysis

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Information Technology: Cheaper, Faster, Better, and Greener?!

By Paul Flanagan

The mantra for Information Technology (IT) has always been cheaper, faster and better. In fact, these three words and the push to achieve them have defined the IT industry for decades. The conventional wisdom in the IT industry was if you felt your computer was not sufficiently fast, all you had to do was wait eighteen months. By that time the new computers would be twice as fast, hold twice as much data, and cost less!

Computers in the form of integrated circuits are found in almost all consumer products. We have come, as a society, to expect cheaper and faster consumer products. In some cases, people could not wait for their cell phone, Personal Digital Assistant (PDA), iPod or other consumer item to fail so that they could then purchase the newer, cheaper, and faster model.

While cheaper and faster are terms for users/consumers and suppliers can easily measure, "better" is a more abstract term. Now, in 2007, new concerns for the environment have entered into the common vocabulary. Carbon footprint and the cost of energy have muscled their way into IT purchasing decisions. These facts have added a new dimension, a green dimension, to the concept of "better" for the IT industry.

Now, in 2007, new concerns for the environment have entered into the common vocabulary. Carbon footprint and the cost of energy have muscled their way into IT purchasing decisions.

Data Center Power and Cooling Issues

It is ironic that the term "cool" is often associated with new computer gear. "Cool," as in interesting and fun, but not "cool" as in temperature. Heat is a by-product of smaller and faster integrated circuits. While dissipating heat is a common computer problem, keeping corporate data centers cool is a burgeoning problem and a major challenge for "green computing." Gartner analyst Rakesh Kumar provides three key findings for the next ten years: (1) the data center power and cooling problem will get worse; (2) data center energy bills will continue to rise; and (3) data centers will be forced to adopt new technologies to manage this problem. (Kumar, 2007)

Industry Solutions

IT industry leaders are aware of these projections for data centers and are striving to address these issues. Here are three examples:

1. Jonathan Schwartz, CEO and President of Sun Microsystems stated, "Just about every CIO and start-up I meet, says they're crippled by datacenter energy and space constraints." As a result Sun Microsystems, Inc. announced "Project Blackbox." This project integrates storage, network infrastructure, and high-efficiency power and cooling into a module which is the size of a standard shipping container. (Sun, 2006)

2. IBM announced on 10 May 2007, its "Project Big Green." This one billion dollar initiative "targets corporate data centers where energy constraints and costs can limit their ability to grow." An IBM press release estimates that clients that use Project Big Green expertise and energy smart innovations "should be able to achieve 42 percent energy savings." (IBM, 2007).

3. In August of this year, HP labs researcher Partha Ranganathan was named one of the world's top young innovators for his research in energy efficient systems for future computer environments. Ranganathan's research focuses on heat and power management at all levels of computers from the design of integrated circuits to running corporate data centers. HP thinks Ranganathan's methods "could produce millions of dollars in savings for large data centers." (Beckett 2007) Clearly, the IT industry recognizes its problem and these and other types of solutions will surface in the near future.

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Curtailing the power and cooling requirements of the corporate data center is just one facet of green IT. Clean manufacturing, reusing equipment and proper recycling of old computer gear are also a part of green computing.

The first step in solving any problem is awareness. Most people who use computers at home or at work probably do not stop to consider that computers are made up of toxic chemicals. Old computer equipment, like an old Cathode Ray Tube (CRT) monitor, could contain several pounds of lead and other toxic materials. Improper disposal (throwing the device in the trash) of this type of equipment is a significant environmental issue. Greenpeace and other organizations are addressing the awareness aspects of green IT. Greenpeace initially released a report in August 2006 called the Guide to Greener Electronics. This report ranked personal computer and handheld computer makers on multiple environmental criteria. It is the hope of the Greenpeace organization that this type of scrutiny will cause manufacturers to consider environmental concerns in their business decisions. The following website now has five editions of this report:

http://www.greenpeace.org/international/campaigns/toxics/electronics/how-the-companies-line-up

Another website that provides current information on environmental concerns in IT is:

http://www.greenercomputing.com/

Conclusion

The relentless pace of information technology is a fact of life for Chief Information Officers and for IT professionals. It is difficult to stay abreast of new developments and to match advancements with business solutions that benefit your organization. The topic of this article, Green IT, is an important, albeit emerging topic. More information about green computing will emerge and many differing points of view will be expressed. In any event, green computing is an important topic which introduces even more complexity into IT decisions. Professionalism and due diligence require that IT leaders know the latest facts about Green IT, understand the technology, and consider issues in greater depth in their organizations. And, yes, business leaders, end-users, and customers do want IT to be cheaper, and faster, and better, and now and in the near future they will want IT to be greener --- even if they don't know it yet.

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The Project Reserve (cont.)

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The project manager should establish reserves for each of the major risk events which have been identified during initial project planning. The sum of these individual reserves would be the contingency reserve and under control of the project manager. If and when risk events occur, a portion of the management reserve is released to cover the extra cost of the event. Note that an event may well take more from the reserve than was established for that event. Hopefully this will be covered by the fact that some events that occur will take less and some, if they do not occur at all, will take none.

Under this concept, the contract budget base would now include both the control accounts and the proposed contingency reserve (Figure 4). Since the contingency

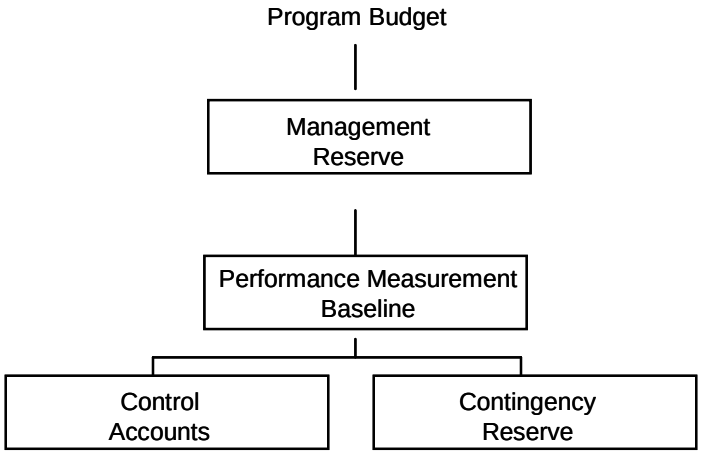

Figure 4: Contingency Reserve

reserve would be within the performance measurement baseline, it would be included in EVM calculations, but treated in a very specific manner to avoid hiding performance issues that will affect the estimate of the cost at completion (EAC).

The key question that must be addressed in managing the contingency reserve when using earned value is how to handle the cost performance index (CPI) so that it remains a valid predictor of the estimate of the contract cost at completion (EAC). There are several choices here.

One would be to release a portion of the contingency reserve to offset the cost (or schedule) impact of a previously identified risk event that has, in fact, occurred. In this case the budget would be transferred from the contingency reserve to the affected control account and the planned value of that budget increased by the amount of the transfer. Obviously, the contingency reserve would be reduced by the amount transferred to keep the Performance Measurement Baseline in balance.

To illustrate, assume a fiber installation project has a budget of $1100k, with $1000k assigned to a control account and $100k to a contingency reserve. The control account budget was based on an assumption that the installation teams would encounter 50% rock. However, since this was only an assumption, the PM added a contingency reserve of $100k to cover up to an additional 20% rock.

BAC_{Total}	$	1,100		
BAC_{CA}	$	1,000		
BAC_{R}	$	100		
Installation:			Assumption	Actual
PV	$	1,000	50% Rock	60% Rock
AC	$	1,060		
PV_{Tr}	$	50		
PV_{Adj}	$	1,050		
EV	$	1,000		
EV_{Adj}	$	1,050		
CPI_{Adj}		0.99		
EAC_{CA}	$	1,010		
Reserve				
PV	$	100	20% Extra Rock	
EV	$	100		
EV_{Tr}	$	(50)		
AC	$	50		
CPI_{R}		2.00		
EAC_{R}	$	50		
EAC_{Total}	$	1,060		

Table 1: Example

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After completing the installation, it's determined that there was actually 60% rock and the actual cost of installation was $1060k. Therefore, $50k is transferred from the reserve to the control account (Figure 5). This is transferred to both the planned and earned values of the control account and deducted from the EV of the reserve account. Note that only half of the $100k of reserve is transferred since only half (10%) of the contingency reserve of 20% rock was encountered. Note also that the "actual cost" to the contingency reserve was the amount transferred, $50k.

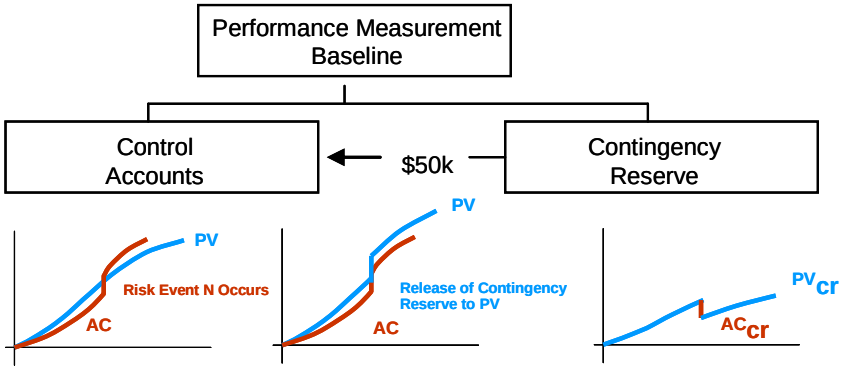

Figure 5: Alternative 1

The CPI's and EAC's for both the control accounts and the CR would be calculated in the normal manner: CPI = EV/AC and EAC = BAC/CPI. The total EAC for the project is the sum of the EAC's for the control accounts and the CR.

Another approach would be to consider the CR a separate control account with its own planned value, earned value and actual cost. The planned value for the contingency reserve would be the sum of the individual contingency reserves for each of the identified risk events allocated over the project schedule in accordance with the risk windows. The earned value would be the value of the reserves as the project progressed and as the various risk windows were entered. If the risk event occurred, the cost of the event would be considered the actual cost measured against the contingency risk control account, not against the other control accounts (for example Engineering, Procurement, etc). If the risk event did not occur, the actual cost would, of course, be zero. This is illustrated in Figure 6.

As in the first approach, separate CPI's and EAC's would be calculated for the control accounts and for the CR. The project EAC would be the sum of the individual EAC's.

There are certain advantages to each of these approaches and I will leave it up to the individual project manager to determine which best suits his or her particular project. The second approach, for example, might be simpler when there are many control accounts and the allocation of risk impact crosses multiple accounts.

Conclusion

The real benefit of the overall approach lies in establishing a management reserve based on a detailed risk analysis and then controlling risk budgets so that the

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...once a contingency reserve has been established in the manner indicated, it should be far easier to "defend" during management review.

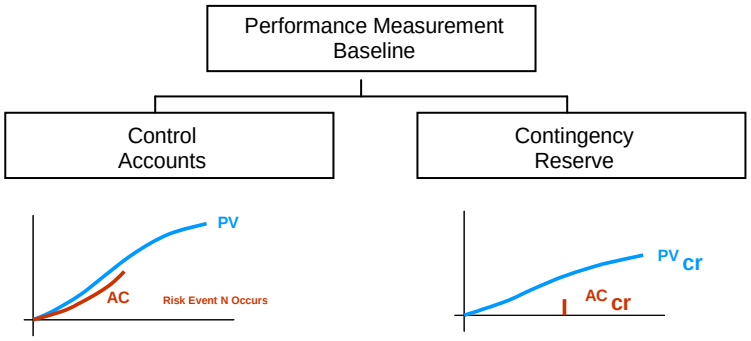

Figure 6: Alternative 2

The Project Reserve (cont.)

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earned value measures continue to accurately predict final cost at completion. In addition, once a contingency reserve has been established in the manner indicated, it should be far easier to "defend" during management review.

And then, remembering that a little luck is still required, we might begin to see projects come in much closer to original cost and schedule estimates.

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The real benefit of (this) overall approach lies in establishing a management reserve based on a detailed risk analysis and then controlling risk budgets so that the earned value measures continue to accurately predict final cost at completion.

Is America Ready for the Next Crisis?

By Les Pang

The Federal Government had to reassess its role and capabilities in emergency preparedness subsequent to 9/11 and again after Hurricane Katrina. As a result, many Federal agencies underwent a dramatic transformation to better respond to future threats.

The Bethesda Chapter of the Armed Forces Communications and Electronics Association (AFCEA) invited a panel of key leaders from the Department of Homeland Security, the Department of Health and Human Services and the National Guard Bureau to discuss this transformation and how it impacts the management of future disasters -- whether man-made or natural. These panelists included:

◊ Cheri McGuire, Deputy Director, National Cyber Security Division—Department of Homeland Security (DHS)

◊ Tina Burnette, Director, Office of Acquisition Management, Federal Emergency Management Agency, DHS

◊ David Howell, Chief, Office of Emergency Preparedness and Coordination, U.S. Citizen and Immigration Services, DHS

◊ COL Kenneth McNeill, Deputy Director, Command, Control, Communications and Computers Directorate and Chief Information Officer (J6/CIO), National Guard Bureau

◊ Lew Newlin, Associate Director for IT Infrastructure Emergency Preparedness, Information Technology Services Office, Centers for Disease Control, Department of Health and Human Services

◊ Mike Nicholson, Director, Requirements Office, Information and Technology Division, National Protection and Programs Directorate, DHS

The most immediate concerns over the next five years involve the following:

- Formulating a common operating picture (COP) of the environment impacted by the disaster. Often times, conflicting standards prevent the integration of information need to come up with this picture. One example is the use of various GIS standards making difficult to consolidate a physical view of an affected area.

- Establishing interoperable communications among first responders. One panelist discovered firewall policies preventing information to flow among key stakeholders.

- Agencies are over-relying on technology. Success requires more than technologies – it requires well-trained, dedicated people and sound effective business processes and procedures.

- Total asset visibility should be improved to readily discover what resources are available during a disaster. This requires well-developed acquisition processes and trained professionals.

A number of initiatives are underway to ensure that the Federal Government does a better job when the next crisis appears:

- Improved spectrum management will help the military communicate with the State and local emergency officials.

- Satellite communications will offer a viable alternative to cell phones and traditional landlines in time of crisis.

- Efforts such as the Multi-agency Horizontal Information Content Delivery Network will hopefully facilitate information exchange.

- SIMNET is a national exercise simulation network that involves live, virtual and constructive simulations. Participants include members of the gaming community, network operations center, emergency operating centers, Wal-Mart, UPS and the DHS training center.

The panelists offered the following recommendations:

- Get familiar with the National Infrastructure Protection Plan, HSPD-7, the Federal Advisory Communications Act and the Information Sharing Analysis Center.

- Well before a disaster, agencies need to establish a relationship with emergency operations personnel. Establishing this relationship immediately before a disaster is much too late.

- A strong collaborative effort among all key players is needed to ensure success in emergency preparedness.

So is America ready for the next crisis? It appears that the Federal government will be more prepared than when 9-11 and Katrina occurred. However, there is still much to do to ensure that the Federal government will meet the public's expectations on emergency preparedness.

Parallels Between Running A Race and a Project

By Paul Flanagan, Les Pang and Russ Mattern

As avid runners, we have identified a number of key lessons learned on what to do before, during and after a race. Upon reflection (obviously during many of our races), we noted that these lessons learned have parallels in running a project. We would like to share some of these parallels with you.

The running-related lessons learned are listed below along with the project advice which is provided in *italics*.

Preparation

Select achievable goals – do not do a marathon until you are ready.

Do not embark on a complex project until you are properly prepared.

Seek advice from experts and people who previously have run the marathon course.

Identify and gather the right experienced personnel for the job.

Training is important to get your body prepared for the long race.

Training your project team is key to ensure that they have the skills and abilities to do the job.

One needs to study the course map closely and identify any challenging terrains and other obstacles.

One needs an architectural roadmap to define the path of the project and prepare for any obstacles.

Divide the course into individual segments.

Use a divide-and-conquer approach toward the project. Break it up into definable, measurable segments.

Get inspiration whenever you can – from other runners, the crowd, and friends and family.

Include a "champion" on your project team at the senior level- who can remove barriers and motivate the team.

One needs a dose of high-energy such as a gel or a caffeinated drink. Eat carbs the day before the race.

Ensure that you have adequate resources for the long haul before embarking on a project. Have a great kick-off meeting to motivate the team.

Use the right equipment (shoes, head gear, running clothes) and understand its benefits and limitations.

Select the right tools and technologies but realize that you need to know how to use them effectively.

Manage expectations – do not expect that you will beat the Kenyans!

Manage expectations – do not over-promise to your sponsors!

Make sure that your family supports your racing.

Gain upper management support for your endeavor.

Execution

Stick to what works – the day of a race is not a good time to experiment. Do not try new shoes, socks, running clothes or even tactics. The most likely outcomes of trying something new are decreased performance, discomfort and possibly injury.

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Stick to what works – new software tools such as CASE code generators promise increased performance, but on the initial project there is a learning curve and performance may get worse before it gets better. Similarly new methodologies may increase performance in the long run, but slow down the first few projects. Take this into account in your project estimates.

Expect some adversity. A completely healthy runner has never started a race, nor has there ever been perfect running day on the day of the race. You and your running partners are human and therefore not perfect. If your training partners are not with you or are not keeping pace with you, then you have to press on without them.

Expect some adversity. Programmers and other key personnel may leave the project before completion. This is not an excuse for poor performance. You need to press on without them. People get sick, have children, and lose interest in projects. You need to understand this and take these facts into account.

You will not make up for lost time – in a foot race you have to start fast so that you can run at your pace and not the pace of the pack. If you are not able, then you will lose time and energy. You will not be able to speed up later in the race to compensate for the lost time.

You will not make up for lost time – you have to organize your IT project professionally and move out smartly in the initial phases. If you hit delays, your project will be delayed. Adding additional resources can and will increase delays. This is a well documented observation; your project will not be different.

Running is hard but satisfying work. You do not see many runners smiling while they are in a race. But there are a lot of smiles and much satisfaction for a hard job performed well after the race.

Running an IT project is hard but satisfying work. You do not see many smiling IT workers during an IT project, but there is great satisfaction when the project is successfully completed.

Most runners fail to achieve their personal goals in a race. Some even fail to finish the race.

Most IT projects fail to achieve all of the functionality that was originally envisioned. Some IT projects do not even finish.

It is not uncommon for elite runners to stand at the finish line and encourage less talented runners. Running is inherently different from other sports, where the elite do entirely different activities than the less successful players. The winner of a race and all of the other runners do the exact same thing and cover the exact same course, to the best of their ability. In some sense, they are colleagues, not competitors.

Every IT professional knows the frustration and the satisfaction inherent in building information systems. While every IT project is different, each project is similar enough that colleagues can relate to the challenges and successes of others.

One needs to maintain a steady pace, particularly when going up and down hills.

Avoid under- or overworking your team members.

Celebrate the completion of each race segment, such as after climbing a steep hill.

Celebrate success at each project milestone.

Do not under-hydrate. Drink enough water even when you are not thirsty.

There needs to be constant flow of resources in order to continue the project.

Do not worry about things that you cannot control such as weather. Just prepare for them.

Do your best under the circumstances given to you but beforehand, identify risks and develop mitigation strategies.

Continually monitor your time in completing each segment.

Establish key metrics to ensure that your progress rate is sufficient. Consider the use of Earned Value Management.

Prepare for chafing in the strangest places.

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Parallels (cont.)

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Expect internal issues (project and personnel) to occur and prepare to address them.

Find someone who is running at your desired pace and keep up with him or her.

Identify key role models and emulate them.

Know where all the restrooms are along the course.

Know when you and your project team need to take a break.

Show gratitude to all the supporters, race workers, and security personnel. Learn to say thank you.

Show your appreciation to those who have supported your project.

Prepare to find a place to relieve yourself along the course if necessary.

Expect emergencies to occur during the course of the project.

Avoid challenging others with a mini-race.

Focus on your project rather than competing with others.

Finish strong.

Market the success of the project completion.

Post-Race

Reflect on how you did in the race and capture lessons learned in a diary. Apply these for subsequent races.

Capture lessons learned and metrics for use on future projects.

Pain is natural after the race. Continue your running.

There may be some pain after the effort but that is something natural with all projects. Move on to the next effort.

Celebrate your final success by indulging in normally forbidden food.

Have a post-project party.

Have fun during the entire experience. The journey is the reward!

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