AACE CERTIFICATION: MORE THAN THE “BIG BOX” VARIETY

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Knut Haanaes is a professor of strategy and international management at IMD, formerly senior partner and global leader of BCG’s strategy practice — where he is still a BCG Fellow. Through his work with clients, Knut has accumulated extensive experience in a number of industries on issues of strategy. He holds a Master’s Degree in Economics from the Norwegian School of Economics, a PhD in Strategy from the Copenhagen Business School, and has been a visiting scholar at Scancor, Stanford University.

Outside the Box will be a standing column designed to introduce new ideas and concepts from other resources and professions that may help stimulate a new way of thinking about total cost management. The views and opinions expressed are those of the authors and do not necessarily reflect the official policy or position of AACE International. We invite Source readers to send suggestions on other sources to editor@aacei.org.
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A year is a long time. A year is also a short time. I know, I’ve experienced both since I became AACE President in Toronto. We’ll come back to the long and the short of it in a moment. As you recall, we have been celebrating our 60th year since that meeting, and so it’s time to consider how we did and report on those objectives. When I started, I outlined two main objectives I intended to pursue as President. That’s where the year has been short.

First, I outlined that AACE needed to advance our on-line education delivery methods into the 21st century. This task was assigned to the Education Board under the leadership of former AACE President Mike Nosbisch, CCP PSP FAACE.

The Education Board started down the path to an online curriculum, about two years ago. It is a difficult road, as they had to identify where to start within our huge body of knowledge. They had to identify how long each module would be, learn how to convert written source documents into a cohesive, attention-holding, and educational format, and identify the optimum way to deliver it. They had to learn how to “story board” the technical content and then turn that story board into a finished product that is only vaguely similar to a PowerPoint presentation.

The Ed Board uses our Body of Knowledge that originates through the efforts of our volunteers as organized, developed, and coordinated by the Tech Board, under the leadership of Todd Pickett, CCP CEP FAACE. Access to this great technical content, as reflected in our amazing technical sessions we present in Orlando, is the primary reason professionals come to the Annual Meeting.

The ultimate goal of this effort is to develop a complete curriculum that can educate our current and future members and support and advance our certifications. These certifications, which are developed and maintained by the Certification Board under the leadership of Sagar Khadka, CCP DRMP PSP, are one of AACE’s great strengths and distinguishing features of our Association.

This is a lot to do and I am happy to report that the Education Board has advanced our work, and established a blue print for implementation in the coming years. But it will take years. Think about how hard 100 odd technical authors and presenters work to develop and put on our technical presentations here in Orlando. The Ed Board must do that in a more complicated formula, with no loss of quality, for each of the eventual modules.

The Cert Board, the Ed Board, and the Tech Board are some of our hardest working volunteers. It is their great work which makes our current and future certification, educational and technical offerings. This summarizes the progress on the first of my two goals identified last year.

The second goal was to make AACE better known in the industry by expanding and further penetrating the fields of cost engineering, project controls, risk management, and costs estimating. A year ago in Toronto we had just started an effort called Vision 20/20 whose immediate task was to plot a path toward a higher profile AACE. You will recall that part of that effort was an examination of our very name – AACE International - and whether that name should be retained or a new name developed that might resonate more with our current and future members.

The Vision 20/20 task force took polls, held
workshops, requested possible new names and generally solicited ideas. The response was good. A significant portion of our membership expressed their opinion about whether we should change the name, and if they thought it should be changed, offer alternatives. I collected hundreds of suggestions.

I admit, I thought that there would be a groundswell of opinion in favor a name change, as difficult as that would be. It did not happen that way. Almost half of the responding membership strongly thought that the name AACE International should be retained. The other half favored a name change, some strongly and some not so strongly. Part of the complication is that no roll-off-the-tongue name or initials sufficiently reflect our diverse professional interests. Importantly, all the responding members said that regardless of whether we changed the name, the Association needed to develop a robust marketing strategy and plan.

The Vision 20/20 task force has therefore recommended to the Board of Directors, and that recommendation has been accepted, that we: (1) retain the name AACE International; (2) adopt the name Association for the Advancement of Cost Engineering, that gives words to our initials, and (3) develop a new logo. Most importantly, we need to develop a marketing plan to make AACE better known. We have the new logo which will be unveiled later this month at the Annual Meeting. An exciting new look that will be integral to our marketing campaign. The Board of Directors has now reviewed a draft marketing strategy and in the next few months we will develop the tactics to implement our ideas.

The short time of a year has meant that while considerable progress has been made on these two objectives, there remains a lot for my successor, Charlie Bolyard, CFCC PSP FAACE, to do in addition to his own initiatives.

At the same time, a year is a substantial time-period and the membership can and should expect its President, Board of Directors, and Headquarters staff to make substantial progress on a host of issues important to AACE. Like all objectives, some have been more successful than others. At the top of the list, Headquarters has implemented a new and improved website and association management system to improve our visitors experience at our most important point of first contact. The newly implemented AMS system will allow our dedicated Headquarters staff to be more responsive and strategic, as we move forward. Further, there are more changes coming to our website that will improve membership communication and interaction through improved social-media alternatives.

Another successful aspect of AACE this past year has been the Regional Conferences. While the exact relationship between regional conferences and symposiums is not fully defined, our Regions and Sections have had a host of successful gatherings that both attract new members and allow those who cannot make the trip to the Annual Meeting, still get the experience of a great symposium. I have had the privilege of speaking at several such symposiums in the Americas and the Mid-East, while others from AACE have participated in symposiums throughout world.

Another area we have had success is our relationships with other professional associations and organizations. We have added or renewed five MOUs with domestic and overseas partners that assist us in spreading the work of AACE. We now have a total of 11 working MOUs.

We have had at least one area that has proved to be less successful that we wished - membership has remained stable this past year. It has not rebounded after the recession as we hoped and need. Certainly, an important part of the marketing effort is aimed at addressing this nagging problem.

As I leave the AACE presidency, I wish to acknowledge several groups that we neither recognize nor utilize sufficiently. First, I have had the advantage of knowing and working with AACE’s Past Presidents – not just my immediate predecessors Julie Owen, CCP PSP, and Martin Darley, CCP, who I consult with regularly. We benefit from a huge group of former AACE Presidents who volunteer their time or stand ready to provide perspective on outstanding issues. I would like to acknowledge these past AACE leaders and ask each of us to thank them.

A similar group that we have long had, but not properly recognized or utilized, are our AACE Fellows. We have partially remedied this with the first Fellows Group meeting in Orlando, where, we toasted to their long-term dedication to AACE and developed a system for all of them to remain active as volunteers.

I also want to recognize and thank our dedicated HQ staff. Under our Executive Director’s Charity Quick’s leadership in Morgantown, our staff works tirelessly on our behalf to improve our services and products. This professional staff assists our tremendous and dedicated volunteer group. Without these dedicated professionals, our volunteers would have great difficulty completing their work.

So, that brings up the volunteers of AACE who dedicate so much of their time. I see this volunteer effort everywhere I turn in the AACE community, whether it’s Regional Directors organizing symposiums, Graders reviewing submissions in support of CCP certifications, Section Presidents and Members who work hard to make AACE a great organization, or those that review the hundreds of technical presentations we profit from at Annual Meetings. I thank all of these volunteers.

Finally, I want to recognize those that indirectly work tirelessly for the AACE, even though they did not actually volunteer. I am speaking of my wife and generally spouses of our volunteers. I know my wife Caren, has made it possible for me to do this work as AACE President. While she has gotten to be friends with many AACE members and staff through repeated attendance at meetings, I rely on her patience, perseverance, counsel, editing capabilities and most importantly love, to allow me to do this important work. And she is not alone as many of our volunteers can only assist because of spousal support. To all the spouses that support AACE, I thank you.

Finally, thank you for selecting me you your president this past year. It has been a great honor. I am pleased to turn the imaginary gavel over to our next President Charlie Bolyard, CFCC PSP FAACE, and our new President-Elect, Dr. Alexia Nalewaik, CCP FAACE.

If you would like to contact our current president with questions or comments about The President’s Message please address your email to president@aacei.org. To engage in other discussions, check out AACE International’s Online Forums at web.aacei.org.
THE TOP 10 REASONS TO JOIN AACE INTERNATIONAL

TIME
Gain access to a wealth of resources that will save you time and money! You’ll stay informed about the complexities of the cost and management profession - plus you’ll have access to discounts on educational programs, publications, and more!

INFORMATION
Locate thousands of technical papers and publications in the Virtual Library. AACE’s database is keyword searchable for quickly locating appropriate reference articles.

CAREER
Members can post resumes at no additional cost in our Career Center and keep your career on track through information sources such as our annual Salary and Demographic Survey of Project and Cost Professionals.

LEARNING
We offer numerous online learning courses on estimating and project management. The Approved Educational Provider program helps maintain high quality development courses and providers. AACE also holds many seminars throughout the year.

RESOURCES
Starting with the TCM Framework and Recommended Practices that are available for free only to members to our bi-monthly publication Cost Engineering featuring articles for cost professionals around the world. Through the AACE International website, the Cost Engineering journal is a great current resource for members and as a member, you gain access to an archive of past issues.

TECHNICAL DEVELOPMENT
Increase your knowledge and expertise by joining one of AACE International’s many technical subcommittees, subcommittees, and Special Interest Groups (SIG’s) at no additional cost to members. Discuss industry problems with your peers or help experts develop new and improved techniques and practices for the profession.

NETWORKING
By attending a local section or our Annual Meeting for interesting speakers, informational tours, social dinners and much more. The online Membership Directory is an excellent source for a list of contact information on thousands of members. Join one of our many technical subcommittees and participate in the AACE Forums - a great way to tap into the collective wisdom and experience of our world-wide membership.

EXCELLENCE
Our certification programs are independently accredited by the Council of Engineering & Scientific Specialty Boards. AACE certifications are a recognized credible standard in the cost management field. A recent study shows that individuals with an AACE Certification earn 17.4% more than their counterpart without a certificate.

DISCOUNTS
On products and services ranging from Annual Meeting registration fees, archived webinars and presentations, certification examination registrations, and more!

YOU!
We are your professional partner bringing you information and support you can trust. Join and become part of a unique network of individuals who are dedicated to improving the cost and management profession.
Why do people shop at Ace Hardware instead of Home Depot? Why do people eat at the local Mom and Pop diner instead of a large chain restaurant? Granted, Home Depot and chain restaurants oftentimes offer convenience, lower price, or some other immediate benefit. But there are times when people seek something more. There is an intrinsic value in the local hardware store or diner that people recognize and know is worth seeking. Those same people realize that, all things considered, these values truly outweigh the so called “big box” alternative.

AACE International certifications have much in common with the local hardware store or local diner. The AACE certifications are not normally recognized as a convenient or easy choice. There are other alternatives when seeking these attributes. When an honest choice is made with best overall value as the differentiator, AACE’s certifications will prevail every time.

The true value of AACE International certifications can be seen in many forms. Here are a few examples:

• **Useful**—The amount of knowledge and degree of expertise required to obtain a certification is useful for further career development. A certification candidate is challenged to exhibit a large degree of knowledge and expertise to successfully achieve the certification. Paraphrasing the old adage, “It takes more than being able to walk and chew gum at the same time to acquire a certification through AACE.” The skill level attained to become certified is a useful resource that will endure throughout a career.

• **Sustainable**—Maintaining a certification mechanically comes through the recertification program. More importantly though, is the ability to maintain and enhance the prerequisite knowledge and expertise after certification though other avenues offered within AACE. To truly sustain a high level of knowledge and expertise, advancement is necessary. One way to do this is by networking and collaborating with other AACE certificants. Another is to conduct research on relevant topics, present, and/or publish technical articles.

• **Gratifying**—A certain measure of gratification and confidence is a natural by-product of certification. Having the ability to state in a meeting or on a resume that you have attained one, or more, AACE International certifications is gratifying and adds confidence that upcoming endeavors can be accomplished successfully.

The value of AACE International certifications is there, but each certificant must recognize this value and take advantage of the opportunities available. Otherwise, the effort put forth to become certified is merely a display of letters on a business card with no true value. In that case, the “big box” option may have been a better choice.
Anel was born in Pretoria, South Africa. Her first six years were spent in Kempton Park, South Africa. Then her family moved to a small holding in Benoni, South Africa, where she attended Hans Moore Technical High School. She continued her education earning a national diploma in project design at the Academy of Draughting in 2003. She earned a Bachelor of Commerce degree specializing in management at the University of South Africa in 2012, and continued on to earn a certificate in business accounting at CIMA Global in 2014.

Anel started as a design drafter for Consolidated Power Projects in 2001, and as a structural drafter for Murray & Roberts in 2006. From there she went on to become the drawing office manager at Spartan Sheet Metal Works in 2007.

After working as a technical drafter and designer for many years, she was looking for a new challenge in her career. Being exposed to project management sparked her interest, especially her interest in the math involved in project control, and after realizing there is a definite market need for project control specialists not only in South Africa, but in Africa as a whole, she decided to steer her career in that direction.

Her project control life started when she became employed by POWER Engineer’s South African office (PEC Engineers (Pty) Ltd). She started as a senior structural designer in 2008, where she soon progressed into project control. She has been the project control specialist on every project at the South African office since 2010. Currently, Anel’s career is developing into project management as well, affording her the opportunity to be the project manager on projects.

POWER Engineers is an international multi-disciplinary engineering consulting firm, and is one of the largest consulting engineering firms in the U.S., with a reputation for high-quality, innovative engineering services for clients. From the South African office, POWER targets Africa and the Middle East, mainly focusing on the various aspects of power generation and delivery.

Association with AACE has opened her career up to expand into the market need in Africa for certified project control specialists. Her certification has also opened up new service avenues for POWER Engineers, who is now actively marketing the services that she can provide to existing and potential clients in Africa.
Since obtaining her CCT certification from AACE in March 2012, and her CCP certification from AACE in April 2014, Anel is one of only 36 CCP’s in South Africa at this time and recently completed a course in project management at the University of Pretoria. She is also a registered member of MENSA.

The AACE Annual Meetings especially offer an opportunity for networking, as well as providing exposure to other professionals, providing opportunity to exchange ideas and knowledge with those professionals, based on their experience, that she would otherwise not have access to.

Association with AACE has opened her career up to expand into the market need in Africa for certified project control specialists. Her certification has also opened up new service avenues for POWER Engineers, who is now actively marketing the services that she can provide to existing and potential clients in Africa. She has also found her skillset and the services she can provide is taken more seriously thanks to her certification – leaving clients with assurance that a certified professional is providing a service to them.

When starting out to follow a career in project control, a senior manager told her that she would not succeed, as she did not have what it takes to be one. She used that negativity as fuel, and proved him wrong. To that extent, she says that one should never give up when having decided pursuing something, but to work hard and push through until you have achieved your goal. In Afrikaans, her home language, there is a saying that translates to: “Impossible” is a word that is only found in the dictionary of shortsighted people.

“One should never give up when having decided pursuing something, but to work hard and push through until you have achieved your goal.” In Afrikaans, her home language, there is a saying that translates to: “Impossible” is a word that is only found in the dictionary of shortsighted people.
Melissa Pruneau was born in Edmonton, Canada, and grew up in a small farming community southwest of the city. Edmonton is the capital city of the Canadian province of Alberta, and is known as the “Gateway to the North,” as it is the staging point of several large-scale oil and gas explorations and facilities. Based on the infinite opportunities to pursue employment in the oil and gas industry, coupled with her passion to grow and learn, Melissa pursued a career in this fast-paced and dynamic environment immediately after finishing high school.

These ambitions steered Melissa toward SNC-Lavalin, a large international Engineering, Procurement, Construction Management (EPCM) company. There, Melissa was first introduced to project controls while completing labor, equipment and material cost auditing activities on major pipeline projects. This opportunity allowed Melissa to understand the necessity of project controls, which became the catalyst for her to pursue project controls as a life-long career.

Following this role, Melissa continued her interest in the oil and gas industry by working for Ensign Energy Services Inc., a global energy service company. During her time at Ensign as a project planner, Melissa worked with the lean manufacturing team to create standard work package templates and work breakdown structures for drilling rigs, which were later implemented at both rig-up facilities in Nisku, Alberta, and Houston, Texas. In conjunction with creating standard documents and procedures for project controls, historical data collection and benchmarking, Melissa also scheduled and reported the status of the rig builds to various oil and gas operators, such as Suncor. Travelling to various manufacturing facilities several days a week to confirm project status, Melissa received a greater understanding to rig components, task sequencing, resource requirements and cost management.

In 2013, Melissa returned to pipeline projects based on Melissa’s innovative nature, she sought out ways to improve the processes, tools and systems within Enbridge. This improvement strategy led her to AACE International, where she developed a keen interest in the technical publications, cost engineering education, and the many certifications offered by AACE.
when she began working as a project controls analyst on the Leak Detection Improvement Program at Enbridge Pipelines Inc., a global leader in pipelines and alternative energy. In this role, she used her cost and schedule background to control a Canada-wide program to install metering across the pipeline system for the early detection and prevention of oil releases.

Melissa was tenacious in her approach to providing program level information and analytics for the Leak Detection Improvement Program, which led her into her next role of project portfolio analyst in 2014. Today, Melissa continues to perform these duties for the Canadian projects department of Enbridge. Melissa uses and refines strategic portfolio management practices in order to analyze and report on project and program performance, with scope up to $1.5B at various stages of the project life cycle. As the corporate strategy has changed, Melissa has adapted her role to include the facilitation for the effective and efficient use of enterprise resources in order to minimize organizational and project risk, while maximizing fiscal spending. This capital investment strategy that Melissa supported provided the link to portfolio governance, operational efficiency and fiscal spending, including executing the right projects at the right time.

Based on Melissa’s innovative nature, she sought out ways to improve the processes, tools and systems within Enbridge. This improvement strategy led her to AACE International, where she developed a keen interest in the technical publications, cost engineering education, and the many certifications offered by AACE. Melissa joined AACE as an opportunity to develop her technical expertise in the field of cost engineering, as well as to meet others with similar interests. This passion for learning provided Melissa the opportunity to also participate in local section meetings. In 2016, Melissa attended the AACE Annual Meeting in Toronto, where she and her colleague presented a technical paper on Strategic Portfolio Management: Improving Capital Utilization and Competitive Advantage. At the conference, Melissa gained valuable networks and ideas for future personal growth opportunities, such as presenting a webinar, writing another paper or meeting her next mentor. Most importantly, Melissa enjoyed sharing knowledge with experienced professionals who could find value by implementing the tools and processes from her co-authored paper at their organizations.

As Melissa continued to become more proficient as a project controls practitioner, she realized that she needed to compliment her work experience by pursuing academic studies. Realizing that she wanted to do more in supporting a growing industry, Melissa embarked upon the long journey of attending night school and weekend classes, and was rewarded for her efforts as she received a diploma in business management from MacEwan University in Edmonton. These studies provided Melissa with the understanding of strategic and tactical planning, governance, organizational structure and many more aspects of business management.

Melissa is currently pursuing her Certified Cost Professional (CCP) designation through AACE International and is looking forward to gaining more valuable knowledge at the upcoming Skills and Knowledge Workshop offered by her local section. Melissa is also a member of the Rising Young Professionals Committee in hopes to bring valuable insight which focuses on strategies to increase young professional participation in AACE. Melissa looks forward to her continued support of AACE and hopes to market the opportunities she has been given through membership to other young professionals.

Melissa recognizes the benefits of what AACE International has to offer. Her success in completing her academic studies along with her many years of industry experience, complemented with her ambition to pursue certification, has provided her with a sound foundation, and positioned her well in further developing as a young professional. Melissa advises other rising young professionals to be passionate about what you are working for and find a mentor to push you beyond what you knew you were capable of. With dedication, commitment and great leadership, one can reach their full potential.

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Can Your Project’s Organization Be Agile?

Joseph A. Lukas, PE CCP

Abstract: Agile is a group of project methodologies based on iterative development, where requirements and solutions evolve through collaboration by self-managing, cross-functional teams. Agile has been effectively used with custom software and product development projects. Unfortunately, based on this success, the management in some companies is advocating the use of agile on construction projects. This article will describe the Agile Manifesto and the guiding principles for agile use. The differences between agile and waterfall life cycles will be explained, along with recommendations on when to use each life cycle model. Planning and team organization on agile projects will be discussed, along with two of the more popular agile methodologies, which are Scrum and Kanban. Even though an agile life cycle model is not appropriate for construction projects, this article will explain how to successfully use specific agile tools and techniques that can add value.

By definition, a project is a “temporary endeavor undertaken to create a unique product, service or result [1, p.553].” There are different types of projects done by project teams. Members of the cost management community typically deal with construction projects such as new manufacturing facilities, office and laboratory buildings, and infrastructure projects such as roads, bridges, and airports. These projects include planning, engineering design, build, and start-up phases.

However, projects also include product development, and with the advent of a world economy and the electronics age, getting to market quicker with new products has become a priority. With the development of modern computing after World War II, information technology has also become another important and growing category of projects. The point is that the world of projects is much bigger than just construction projects. Other categories of projects include the following:

- Research, such as a new drug development
- Business process change, such as automating the manual invoicing done by an accounting department
- Company reorganization, such as merging two business units
- Political campaign, with the project objective of getting a candidate elected

Historically, the life cycle method used to complete projects has been the waterfall model. The Total Cost Management (TCM) Framework summarizes waterfall as four sequential phases as follows [2, p. 39]:

- Ideation—Overall requirements are given, and the project team assesses alternative concepts for performing the project and selects an optimal performance strategy.
- Planning—The project team develops project plans that address the strategic requirements and selected performance strategy.
- Execution—The plans are implemented through the execution of planned project activities.
- Closure—The asset or deliverable is reviewed, tested, verified, validated, and turned over to the customer.

With the waterfall methodology, each project phase is typically completed before the next phase begins, even though projects can be done with some amount of phase overlap. In addition, the sequential phases can be recursive. For example, a project to construct a new sports stadium on an old and contaminated...
industrial site will include the four sequential phases for the environmental cleanup, along with the four phases for building the stadium.

While the TCM waterfall life cycle model has been effective for construction projects, it is not in alignment with the evolving expectations of clients. The Project Management Institute (PMI®) has done extensive market research with global companies to identify the project management skill employers need now, and in the future, from project professionals to deliver better results. The outcome of this research is called the talent triangle with the three legs as follows [3]:

- Technical skills such as risk management and critical path method scheduling.
- Leadership skills specific to motivating and guiding others.
- Strategic and business management skills that enhances performance and better delivers business outcomes.

The implication from this research is that clients want project personnel to have a business focus. This includes pre-project (also called genesis), which is where the business benefits and business case are established. It also includes post-project benefits realization, where the project benefits are brought to fruition. The measure of success for completed projects is no longer staying within budget and schedule, and delivering all scope functionality. The new project success measure is delivering the expected business outcome.

Based on this business management focus, a more complete waterfall life cycle model is shown in Figure 1.

While the waterfall life cycle model in Figure 1 is an improvement and can be used for most projects, it poses a problem when dealing with new product and large software development projects, where requirements are evolving, technology is rapidly changing, and speed-to-market is critical. In 1970, Dr. Winston Royce, an American computer scientist at Lockheed Software Technology Center, presented a paper which criticized sequential development [4]. Royce stated there was inherent risk in a single-pass approach and suggested an iterative and incremental approach for large software development projects [5].

In 1995, the Standish Group published a report that detailed the alarming failure rate of software projects using traditional waterfall methods. According to the report [6]:

- 16 percent of the projects came in on time and on budget
- 31 percent of the projects would be cancelled, some just before or even after implementation
- 53 percent would run over 189 percent of their original budget

Many other studies were done over the years for both product and software development, with the same dismal results by projects using a waterfall life cycle approach. The times were ripe for change and project teams experimented with different iterative life cycle approaches. An iterative life cycle is also called incremental development, and the basic idea is to do “mini-projects,” also called cycles, sprints, or iterations, lasting typically two or four weeks as shown in Figure 2. The goal for each iteration is to create some amount of useable product. With the iterative approach, requirements and scope evolve over the iterations.

In 2001, seventeen leading proponents of iterative life cycle approaches gathered at the Snowbird ski resort in Utah to discuss the future of software development. The attendees named themselves the Agile Alliance, and agile became the umbrella name for the various iterative methodologies [7, p.28].

This article will review the Agile Manifesto and the guiding principles for agile use developed at the Snowbird ski resort in 2001. The differences between agile and waterfall life cycles will also be explained, along with recommendations on when to use each life cycle model. Planning and team organization on agile...

Figure 1 – The Complete Waterfall Project Life Cycle

Figure 2 – Generic Iterative Life Cycle Model
projects will be discussed, along with two of the more popular agile methodologies, which are Scrum and Kanban. Even though an agile life cycle model is not appropriate for construction projects, this article will discuss how to successfully implement specific elements of agile that can add value.

The Agile Manifesto

One definition of agile is a “set of principles for software development in which requirements and solutions evolve through collaboration between self-organizing, cross functional teams [8].” Unfortunately, this definition focuses on software development only and in reality agile is frequently used for product development, research and business process change projects. Later in this article, how agile can be used for portions of some constructions projects, and how agile tools can also be applied to construction projects will be explained.

A suggested more encompassing definition for agile is *iterative project methodologies where the requirements and solution evolve through close collaboration between the team and client*. The key points with agile are the iterative approach and the evolving requirements and scope. Waterfall uses a philosophy known as big design up front (BDUF), where requirements are completely defined, the project scope is then developed to meet the requirements, design is done, product deliverables are completed, testing is done and the product is then put into production [7, p. 24].

The Agile Alliance gathering in 2001 at the Snowbird ski resort in Utah resulted in the manifesto for agile software development, which includes the set of values shown in Figure 3 [9].

It is difficult to argue that the items on the left have higher value. Interactions with individuals involved with the project will always be more important than processes and tools for project success. What good is comprehensive documentation if the product doesn’t work? Collaboration is also always preferable than contract negotiation. Finally, if a change is needed because of business conditions or the discovery of new information, that is more important than following a plan that may not deliver the optimal business benefits. In reality, the manifesto values really applies to any project life cycle, so it does not differentiate the agile and waterfall life cycle models.

However, the manifesto also includes a set of principles for agile methodologies. The principles, also developed at the Agile Alliance gathering at the Snowbird ski resort, distinguishes agile from waterfall. The principles are listed below, along with comments on how each principle relates to the waterfall life cycle used for construction projects [9].

- Our highest priority is to satisfy the customer through early and continuous delivery of valuable software. *Comment: Finished product is delivered with each agile iteration while waterfall delivers finished product only at the end of the project. However, an incremental waterfall life cycle model will be discussed in the next section of this article, and this model can also deliver finished product in iterations.*
- Welcome changing requirements, even late in development. Agile processes harness change for the customer’s competitive advantage. *Comment: A late change in a waterfall project can be expensive and delay the project finish, so this differentiates agile and waterfall.*
- Deliver working software frequently, from a couple of weeks to a couple of months, with a preference to the shorter timescale. *Comment: This seems to be redundant to principle #1.*
- Business people and developers must work together daily throughout the project. *Comment: This applies to any project. Having the business people and project team work together will help ensure a more successful project. Agile does have a specific role called product owner that will be discussed in the Agile Project Team section of this article.*
- Build projects around motivated individuals. Give them the environment and support they need, and trust them to get the job done. *Comment: This applies to any project.*
- The most efficient and effective method of conveying information to and within a development team is face-to-face conversation. *Comment: This applies to any project. With any project team, face-to-face communication is always the most effective.*
- Working software is the primary measure of progress. *Comment: Working product should be a primary measure of success for any project. Agile delivers working product with each iteration, so the client will see some working product sooner compared to a waterfall project.*
- Agile processes promote sustainable development. The sponsors, developers, and users should be able to maintain a constant pace
 indefinitely. Comment: A sustainable work pace makes sense for any project team regardless of the life cycle model used. For agile, it means the team decides on how much work can be accomplished with each iteration, and the team only commits to that amount of work.

- Continuous attention to technical excellence and good design enhances agility. Comment: This applies to any project.
- Simplicity—the art of maximizing the amount of work not done—is essential. Comment: This applies to any project since non-value adding work should not be done on any project.
- The best architectures, requirements, and designs emerge from self-organizing teams. Comment: Agile uses self-managing teams, so the role of the project manager does not exist. This is a difference with the agile life cycle model.
- At regular intervals, the team reflects on how to become more effective, then tunes and adjusts its behavior accordingly. Comment: This applies to all projects, and it is called lessons learned, which can be done at regular intervals, not just at project completion.

In summary, the Agile Alliance principles are really a list of best practices to achieve successful projects. Most of the twelve principles are just as pertinent for the waterfall life cycle model. What differentiates agile from waterfall is the delivery of some product with each iteration (principles 1 and 3), changing requirements (principle 2) and the use of self-organizing teams (principle 10). The next section of this article will explore the differences between the agile and waterfall life cycle models, along with recommendations on when to use each life cycle model.

**Differences Between Agile and Waterfall Life Cycle**

The waterfall life cycle model is plan-driven. Requirements are established and baselined early in the project, and a project plan is developed based on meeting the requirements. Each project phase is completed before the next phase begins, but on some projects there can be some phase overlap. A well-defined change control process is needed, and late changes can have a major impact on the project objectives. Waterfall also uses project teams with well-defined roles, and with a project manager in charge of the project. In summary, waterfall has been in use for a long time and is a disciplined approach for completing projects.

In contrast, agile methodologies are change-driven. Requirements and scope evolve over the life of the project, and increments of product are delivered in short time-frame boxes. Each iteration goes through a “mini-life cycle” of analyze, design, build and implement. There can be an iteration “0” where a high-level schedule, resource plan, risk register, communications plan and other project documents are prepared, but detailed plans are only developed for the next iteration. With agile, there is no change control process because changes are expected and welcomed over the life of the project. In addition, an agile team is self-managing and decides on the workload and plan for each iteration. The project manager role does not exist on agile teams. There is a team leader, often called a scrum master. However, the role is not leadership, but to provide process advice and to remove any impediments that may reduce team effectiveness, such as a client not providing timely feedback on system features.

The business case for agile is the faster delivery of useable product, resulting in an earlier return on the investment. With waterfall, product is not delivered until the end of the project. For a waterfall project with a one-year duration, there are project expenditures during the one-year period with no product income. With agile, product functionality increments are delivered every two or four weeks, at the end of each iteration. Product is released to the marketplace after multiple iterations, such as every three months.

<table>
<thead>
<tr>
<th>Waterfall</th>
<th>Agile</th>
</tr>
</thead>
<tbody>
<tr>
<td>Requirements established early in project</td>
<td>Requirements evolve over the project life</td>
</tr>
<tr>
<td>Waterfall phases are typically sequential</td>
<td>Mini-life cycles of 2-4 weeks typically used</td>
</tr>
<tr>
<td>Product delivered at the end of the project</td>
<td>Product delivered at the end of each iteration</td>
</tr>
<tr>
<td>Entire project is planned early</td>
<td>Limited early planned, detailed planning only done for the next iteration</td>
</tr>
<tr>
<td>Formally organized team lead by a project manager</td>
<td>Self-managed team with no project manager</td>
</tr>
<tr>
<td>Change management process used</td>
<td>No change management since changes are expected and welcomed</td>
</tr>
</tbody>
</table>

Table 1 – Summary of Waterfall and Agile Life Cycle Differences

**Figure 4 – Incremental Waterfall with Overlapping Phases**
for the one-year project. The result is that income is obtained by the early release of some product functionality to the marketplace.

An interesting point is that an incremental waterfall model, shown in Figure 4, can be used to closely mirror the advantages of faster delivery of usable product with the agile approach. The incremental waterfall model creates a series of mini-projects, with functionality delivered at the end of each mini-project. The example shown is using overlapping phases, which means mini-project #2 design starts once mini-project #1 design is finished and the build is being done.

Table 2 provides guidelines on when to use a waterfall approach and when to use an agile approach. Agile works best for custom-built software and product development projects, since these types of projects deal with new business processes and evolving requirements. Construction projects should use a waterfall approach since complete requirements and design are needed before construction starts to avoid rework. However, there are cases when a modified approach is most effective such as:

<table>
<thead>
<tr>
<th>Waterfall</th>
<th>Agile</th>
</tr>
</thead>
<tbody>
<tr>
<td>Well-established business processes</td>
<td>Exploring new business processes</td>
</tr>
<tr>
<td>Requirements can be defined early in</td>
<td>Requirements will evolve over the life of the</td>
</tr>
<tr>
<td>the project</td>
<td>project</td>
</tr>
<tr>
<td>Significant interfacing with legacy</td>
<td>Experimental approach is needed to find a</td>
</tr>
<tr>
<td>systems</td>
<td>solution</td>
</tr>
<tr>
<td>Client decisions involve numerous</td>
<td>Client empowers a person to make project</td>
</tr>
<tr>
<td>people</td>
<td>decisions</td>
</tr>
<tr>
<td>Team works best under a traditional</td>
<td>Experienced team that can self-manage the</td>
</tr>
<tr>
<td>team structure</td>
<td>project work</td>
</tr>
</tbody>
</table>

Table 2 – When to Use Waterfall or Agile

Figure 5 – Waterfall and Agile Blend for New Product Manufacturing

The key for making the core agile team successful is having dedicated team members, spending all of their time on the project. There can be some part-time project personnel involved in the project, such as an information security officer who advises the team and reviews some work products, but part-time personnel are not part of the core agile team.

Some of the key characteristics of successful agile teams equally applies to cycle is more appropriate since requirements for new product control software are probably not well understood.

The Agile Project Team

The core agile project team is typically five up to 12 people. The three major roles are as follows:

- **Product Owner**—This is the critical role on agile projects. The person must have the authority to make decisions on behalf of the client, and is expected to spend considerable time with the team to discuss the product vision and features, and answer questions. The product owner sets the product vision and roadmap, and manages the list of prioritized features and requirements.

- **Scrum Master**—This person is the expert on the agile process, removes any impediments to the project, and creates an environment that fosters collaborative decision-making. The scrum master replaces the project manager role, and is expected to facilitate, coach, and guide the agile project team.

- **Delivery Team**—The team is self-managing and decides on how much work can be done for each iteration, using the prioritized requirements list. The team prepares the detailed plans for each iteration and gets the work done. Roles and responsibilities are not firmly established, and cross-functional work is typical. For example, a designer on the delivery team may have expertise in using scheduling software, and that person handles preparation of the schedule task list for each iteration.
waterfall teams. This includes having dedicated team members, co-location of team members, empowered and collaborative team members, and a good working relationship with the customer.

Planning on Agile Projects

One of the myths associated with agile projects is that no planning is done, and that’s not the case. There are five levels of agile planning as shown in Figure 6, and the levels are as follows:

- **Product Vision**—This is what a new product or the next product version should look like.
- **Product Roadmap**—This is a high-level chronological depiction of how the product will be brought to market. This includes any construction projects needed to make, store and/or distribute the new product.
- **Release Planning**—This is the agile planning document that most resembles the project plan. The release plan includes the preliminary list of features to be included with each release and a high-level schedule. The release plan can also include other project documents such as a risk register and communications plan.
- **Iteration Planning**—This is done just before the start of each iteration. The team, working with the product owner, decides on the work that will be done during the next iteration, and the product functionality that will be delivered. The work that will be done during the iteration is planned at a detail level, including tasks, resources, hours and dates. Iteration planning is analogous to the two week look-ahead plan used on some construction projects. Agile uses brief daily planning and status meetings, known as daily scrums, and construction projects can also use daily meetings.

- **Daily Planning**—This is done each day during the iteration, and is also called the daily scrum. Daily planning meetings are used on some construction projects, such as a power plant shutdown for equipment and control upgrades. The core team assembles for a brief stand-up meeting to discuss three items:
  a. Work accomplished since yesterday’s meeting
  b. Work that will be done by tomorrow’s meeting

Agile Requirements

As discussed earlier in this article, with agile methodologies requirements and scope evolve over the life of the project. One of the key tools to uncover requirements on an agile project is the use of user stories. By definition, “a user story represents a small, concise statement of functionality or quality needed to deliver value to a specific stakeholder [10, p. 359].” The user story captures who (a user role), what (a necessary action, feature or quality) and why (the benefit or value received by the user). A typical format for writing user stories is shown in Figure 7.

Examples of user stories are as follows:

- As a Facebook user, I want to update my profile so that potential friends may find me.
- As a telecommuting employee, I want to go seamlessly from my cell phone to my office phone while staying on the conference call so that I don’t have to leave and then re-enter the conference.
- As a production supervisor, I want a weekly summary report on yield and quality by crew so that I can save time.
- As a control room operator, I want a mix tank low level alarm so that I know when to add more chemicals.

In summary, planning on an agile project is not drastically different from a waterfall project. The product vision and product roadmap involve pre-project planning and are the same for agile or waterfall projects. The release plan is the agile planning document that somewhat resembles a project plan. The difference is that detailed scope, schedule and budgets are established on waterfall projects, while on agile projects scope, schedule and budget are done at a summary level. The agile iteration plan is very similar to the two week look-ahead plan used on some construction projects. Agile uses brief daily planning and status meetings, known as daily scrums, and construction projects can also use daily meetings.
User stories can be helpful early in the engineering design phase of a project, since it helps focus the client on needs, which are project requirements. In fact, a common synonym for architectural programming, which is the research and decision-making process that identifies the scope of work to be designed, is “functional and operational requirements” [11]. Programming is the responsibility of the owner, but the requirements provided by the owner can vary from vague to very specific.

Owners sometimes focus on scope without first considering project requirements. An example of this occurred at a pharmaceutical company. The client representative, Richard, wanted to construct a new breakroom for production personnel, since the existing cafeteria was too far away. Richard identified 600 square feet (SF) of unused warehouse space that could be renovated for the breakroom. But Richard was providing the “how,” the square footage. The architect and project manager moved the conversation back to the “what,” which is how many production personnel will use the breakroom on average and peak. That's an important requirement since states have building codes that restrict the number of people in a given area. For example, there is a sign in the entry area of restaurants indicating the maximum number of occupants. For Richard's project, over 1,000 SF was needed based on the planned number of production personnel that would be using the breakroom. If the breakroom had been built using the available 600 SF, the project would have failed once the local fire chief inspected the breakroom and saw the overcapacity situation.

On agile projects, a list of user stories is developed early in the project, and typically 60-80 percent of the user stories can be uncovered. The remaining user stories will evolve over the life of the project. The list of user stories becomes the product backlog, and the product owner has the responsibility to prioritize this list. The team, working with the product owner, uses the list of prioritized user stories to decide what work will be done during the next iteration and the product functionality that will be delivered.

User stories can be useful early in the engineering design phase of a construction project, when the owner has not done architectural programming. The difference is that user stories cannot evolve over the life of the project. All user stories need to be uncovered before design can be completed.

Sprint Planning Meeting

The sprint planning meeting is conducted at the beginning of each sprint. At this meeting, the team, working with the product owner, decides on the work that will be done during the sprint and the product functionality that will be delivered. The meeting starts by the product owner reviewing the prioritized user stories and any other backlog items such as documentation or reports. The team decides on the work that can be accomplished during the iteration, and develops detailed plans including tasks, resources, hours and dates. For a two-week sprint, the planning meeting is less than four hours. Sprint planning is analogous to the two week look-ahead plan used on some construction projects.

Daily Scrum

The daily scrum should be conducted at the same time every day, and most teams hold the daily scrum first thing in the morning. The meeting should take less than 30 minutes, and an effective technique is not providing chairs since sitting can promote long discussions. Each team member reports on work accomplished since the last meeting, work that will be done by the next meeting, and any obstacles and/or issues impeding progress. The daily scrum should not be used to resolve issues. Any issues should be handled immediately after the meeting by the people who can solve it. The daily scrum is just as applicable on construction projects.

<table>
<thead>
<tr>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sprint Planning</td>
<td>Daily Scrum</td>
<td>Daily Scrum</td>
<td>Daily Scrum</td>
<td>Daily Scrum</td>
</tr>
<tr>
<td>Daily Scrum</td>
<td>Daily Scrum</td>
<td>Daily Scrum</td>
<td>Daily Scrum</td>
<td>Sprint Review</td>
</tr>
<tr>
<td>Story Time</td>
<td>Daily Scrum</td>
<td>Daily Scrum</td>
<td>Daily Scrum</td>
<td>Retrospective</td>
</tr>
</tbody>
</table>

Figure 8 – Sprint Meetings

Scrum is probably the most popular framework for implementing agile. With scrum, the product is build using a series of fixed-length iterations, called sprints, which are typically two or four weeks. Figure 8 shows the various meetings held during the two-week sprints.
projects. The engineering design team and the construction team can use a short daily meeting to discuss accomplishments, plans and issues.

**Story Time**

In the middle of each sprint, time is reserved for a meeting called story time, which is used for grooming the user stories backlog. The purpose of this meeting, which is at least one hour, is to develop and/or update estimates on the amount of work for newly identified user stories. The team also identifies any user stories too large for a single iteration, so that the product owner can break the user story into multiple smaller user stories. Since story time is intended to 'groom' the list of evolving requirements, it is only applicable on construction projects when architectural programming is being done early in engineering phase.

**Sprint Review**

A brief review, typically one or two hours, is done at the end of each sprint with the client and other key stakeholders to show the work accomplished during the sprint. On agile projects, product is delivered at the end of each sprint, and the workable product is demonstrated and feedback obtained from the client. The feedback may result in changes needed for the demonstrated product, and the changes are added to the product backlog. For construction projects, client review meetings are equivalent to the sprint review. For example, a client review meeting may include review of completed engineering design drawings, or inspecting installed equipment and piping.

**Retrospective**

At the end of each sprint, the team holds a retrospective, which allows for learnings and insights to be captured. The goal for each retrospective is to identify one or two specific things to improve for future sprints, and to create an action plan to implement those changes. The retrospective typically ranges from one to two hours. The retrospective is essentially a lessons learned meeting. Lessons learned are commonly done at the end of any project, but can also be done during the project.

In summary, the scrum meetings are applicable to construction projects. Each sprint has a planning meeting which is analogous to the two week look-ahead plan used on some construction projects. The daily scrum used with agile can also be used on construction projects to discuss work accomplished, work that will be done by tomorrow, and any obstacles and/or issues impeding progress. Agile uses story time to 'groom' the list of evolving requirements, but it is applicable on construction projects when architectural programming is being done early in engineering phase. The sprint review is analogous to client review meetings for construction projects. The agile retrospective is essentially a lessons learned meeting.

**Agile Estimation Techniques**

The reason for creating estimates is to provide some measure of predictability for cost and schedule. Asking the person assigned to a task how many hours it will take has two problems. First, the person is probably not good at estimating; and second, the person will give you an answer anyway. This results in incorrect schedules and budgets.

Most people are really bad at estimating how long things will take, but people are good at relative sizing. For example, a person can pick the taller building when one building is two stories and the other building is five stories. However, as things get bigger our ability to perceive the differences in size decreases. Picking the taller building when one building is 92 stories tall and the other 94 stories tall would be very difficult.

The Fibonacci number sequence can be used for estimating project work since the sequence "increases at about the same rate at which humans are able to easily perceive differences [7, p. 124]." The Fibonacci sequence is comprised of integers where each number is equal to the sum of the previous two numbers: 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, and so on.

With agile, a two-step process is used to develop work estimates. The first step is to arrange all user stories by relative size, with the smallest on the left and largest on the right. The smallest user story is assigned a value of 1. The team then scans to the right looking for construction projects when architectural programming is being done early in engineering phase. The sprint review is analogous to client review meetings for construction projects. The agile retrospective is essentially a lessons learned meeting.

Figure 9 – Estimating Work with Fibonacci Numbers

![Figure 9 – Estimating Work with Fibonacci Numbers](image)
value of 3. The process continues until each user story has an assigned value. Typically, the Fibonacci sequence is used up to 34 or 55. Any user story larger than these values is called an epic, too large to be effectively done within one iteration, and the epic is broken into multiple, smaller user stories. Once done, all user stories with a specific value are grouped under that number as shown in Figure 9. The numbers are called story points, or just points, and by definition are a relative unit of measure for the amount of work needed to complete a user story [7, p. 122].

The last step in agile estimating is to complete work for some user stories and measure how long they actually take. Using the list of user stories in Figure 9, let’s assume the agile team completes user stories 1, 5, 6, 12, and 28 during the first two-week sprint, which means 44 story points were completed. For the second two-week sprint the number of story points completed is 48. By definition, the velocity is 46, which is simply the average number of story points completed per sprint. For the sample project shown in Figure 9, there is a total of 335 story points. With a velocity of 46 story points per sprint, the implication is that eight sprints are needed to complete the project (335/46).

A simple and logical extension to the agile estimating process is calculating hours. For the sample project from Figure 9, if the team consists of seven full-time team members, that equates to 280 hours per week, and 560 hours per two-week sprint. Therefore, each story point is equivalent to 12.2 hours of effort (560/46).

On construction projects the use of story points is not a useful concept. Estimating quantitative work such as installing 100 feet of 8” water main or constructing a retaining wall is easy using estimating database information. However, the use of a set of modified Fibonacci numbers, along with an agile estimating technique called planning poker [12, p. 56] can be very effective for estimating non-quantitative tasks such as design calculations and schedule preparation.

To use planning poker, each participant is given a set of cards with a modified Fibonacci sequence of 1, 2, 4, 8, 16, 24, 40, 64, 80 and 120 hours. The technique consists of the following steps:

- The task owner provides a short overview of the task scope
- The team asks questions and discusses to clarify the task scope
- Each team member lays a card down with their estimate of hours
- Team members with low or high estimates offer their reasoning and the team discusses
- Steps 3 and 4 are repeated until consensus is reached

Typically, consensus is reached within three cycles. If the team believes a work item is greater than 120 hours the task should be broken down into smaller components.

**Agile Information Radiators**

One common characteristic of scrum teams is co-location. The scrum team work area will have walls covered with hand-drawn charts, and a task board of sticky notes indicating tasks not started, tasks in progress, and completed tasks. These low technology tools are known as information radiators [7, p. 102], and a radiator example is shown in Figure 10.

**Velocity Histogram**

As discussed earlier in this article, story points are relative measures of the effort and size of a task. A task worth two story points is twice the work compared to a task worth one story point. Using agile estimation techniques each task is assigned a story points value. By definition, the number of story points completed during a sprint is called the velocity. A histogram can be used to plot the velocity for each sprint as shown in Figure 10, and the data from the first three iterations can be used to calculate an average velocity of 46 for the project.

Story points and iterations are concepts that cannot be used on construction projects, so the velocity histogram is not an applicable tool. But, since the velocity histogram measures
the amount of work completed, in units of story points, the comparable technique for construction projects is earned value management. Earned value is the percent of the total budget actually completed at a point in time [13, p. 2], so earned value also measures the amount of work completed. A histogram of earned value earned for each time period can be generated using monetary units for the vertical axis, and that is equivalent to the velocity histogram.

**Burndown Chart**

Books and websites are evenly divided on whether the term is burn down or burndown; this article will use the single word version. A burndown chart displays the remaining work for a specific iteration. The remaining work is typically shown as story points, but as discussed earlier, story points can easily be converted into hours.

The burndown chart is also used to show the remaining work for a release, which consists of multiple iterations. Figure 10 shows the burndown chart for the second product release on a project. The chart shows actual values for iterations 7, 8 and 9; and forecast values for iterations 10, 11 and 12.

**Kanban**

Agile lifecycle models, such as scrum, are based on iterative and incremental development. The exception is kanban, which was developed by Toyota in the late 1940s. Kanban focuses on the continuous flow of work, and does not use fixed-length iterations like scrum. The key metric with scrum is velocity, which is the number of story points completed during the iteration, and this provides a measure of the amount of work done. The key metric with kanban is cycle time, the amount of time it takes for a unit of work to travel through the project process.

Kanban is a Japanese word and roughly translates to “card system.” The cards were used to create a “pull” system in the production line, rather than the common approach of letting material queue up for the next step in the process. For example, the team that attaches the doors to the car frame delivers a card, or “kanban,” to the team that assembles the doors to signal they will soon need more doors. This signals the door assembly team to make more doors. Although the signaling technology has evolved over the years, this system is still at the core of “just in time” manufacturing [14].

Applied to projects, kanban matches the amount of work to the team’s capacity by limiting the Work in Progress (WIP) at each step in the process. Once the team completes a task, they start work on the next task from the prioritized task backlog. The product owner is able to re-prioritize the “to do” list as new user stories are developed without disrupting the team. Provided the most important user stories are at the top of the “to do” list, the agile team is assured of delivering maximum value to the business. The WIP limits highlight bottlenecks in the project process due to procedures, people and/or equipment problems. The plan-do-check-act (PDCA) cycle is then used to eliminate bottlenecks and improve the project process and cycle time.

A key tool with kanban is the task board, also known as the signaling

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**Figure 11 – Kanban Signaling Board for Engineering Project**

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**Table:**

<table>
<thead>
<tr>
<th>To Do</th>
<th>Design</th>
<th>Drafting</th>
<th>Reviews</th>
<th>Finalize</th>
<th>Done</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>WIP Limit = 2</td>
<td></td>
<td>WIP Limit = 2</td>
<td></td>
<td>WIP Limit = 1</td>
</tr>
<tr>
<td></td>
<td>In Progress</td>
<td>Done</td>
<td>In Progress</td>
<td>Done</td>
<td>In Progress</td>
</tr>
<tr>
<td>Bay 14</td>
<td>Bay 11 Separation</td>
<td>Bay 9</td>
<td>Bay 8 Feed Tanks</td>
<td>Bay 4</td>
<td>Bay 1 Mix Tanks</td>
</tr>
<tr>
<td>Bay 15 Packaging</td>
<td>Bay 12 Separation</td>
<td>Bay 10 Reactors</td>
<td>Bay 7 Feed Tanks</td>
<td>Bay 3 Mix Tanks</td>
<td></td>
</tr>
<tr>
<td>Bay 13 Dryers</td>
<td>Bay 13 Reactors</td>
<td>Bay 6 Feed Tanks</td>
<td>Bay 5 Feed Tanks</td>
<td>Bay 2 Mix Tanks</td>
<td></td>
</tr>
<tr>
<td>Bay 1 Mix Tanks</td>
<td>Bay 2 Mix Tanks</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Work Flow**

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**SOURCE JUNE 2017 23**
board, shown in Figure 11. The signaling board shows work not started, work done and work in progress and done for each step in the process. For example, a software development project could have process steps of design, build and test.

The signaling board is a tool that can be applied to construction projects. The example in Figure 11 is for the engineering design phase for a new chemicals manufacturing facility. The process steps are design (equipment and pipe sizing), drafting, reviews and finalize. With kanban, work in progress limits are placed on each process step in order to match the amount of work to the capacity of the team.

Conclusion

The waterfall life cycle model is plan-driven. Requirements are baseline early in the project, and a project plan is prepared to meet the requirements. In contrast, agile methodologies are change-driven. Requirements and scope evolve over the life of the project, and increments of product are delivered in short time-frame boxes.

Agile cannot be used for an entire construction project. Agile can be applied to part of a project such as developing production control software for a new manufacturing facility. In addition, an incremental waterfall model can be used to closely mirror the advantages of faster delivery of useable product with the agile approach.

Planning on agile and waterfall projects are similar. The agile release plan resembles a project plan. The difference is that scope, schedule and budgets are established at a detailed level on waterfall projects, while done at a summary level on agile projects.

Many of the agile meetings and tools are also used on construction projects, but with different names. There are agile concepts that will add value on construction projects, such as the use of Fibonacci numbers, along with a technique called planning poker, for estimating non-quantitative tasks such as design calculations and schedule preparation. Your projects organization can become more agile by implementing the applicable agile tools and techniques discussed in this article!

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3. Project Management Institute, Skills Employers Need from Project Professionals, December 17, 2014.

ABOUT THE AUTHOR

Joseph A. Lukas, PE CCP, is with PMC Centers USA. He can be contacted by sending e-mail to: joe.lukas@pmcentersusa.com

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Do an “advanced search” by “author name” for an abstract listing of all other technical articles this author has published with AACE. Or, search by any total cost management subject area and retrieve a listing of all available AACE articles on your area of interest. AACE also offers pre-recorded webinars, an Online Learning Center and other educational resources. Check out all of the available AACE resources.
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Contact Sharon Hardman at shardman@aacei.org, by calling 304-296-8444 or go online to web.aacei.org/membership

UPCOMING AACE ANNUAL MEETINGS

- 2017 Annual Meeting - June 11 - 14
  Hyatt Regency Orlando, Florida, USA

- 2018 Annual Meeting - June 24 - 27
  Manchester Grand Hyatt San Diego, California, USA

- 2019 Annual Meeting - June 16 - 19
  Sheraton New Orleans, Louisiana, USA
Arabian Gulf Section

The Arabian Gulf Section, represented by Ahmed Al-mulhim, CCP CEP EVP PSP, President, has signed a memorandum of understanding with the Dr. Adel Shaheen Al-Dossary, Dean of College of Environmental Design, King Fahd University of Petroleum and Minerals on May 2, 2017, at KFUPM, Dhahran, Saudi Arabia. Prof. Mohammad Saad Al-Homoud, Vice Rector for Academic Affairs, Prof. Soliman Al-Mohawi, Chairman, Construction Engineering and Management Department, Dr. Baqer M. Al-Ramadan, Chairman of Architectural Engineering Department, and other faculty members were also present during the signing ceremony.

With this agreement both organizations agreed to support and reinforce the strategic partnerships between them in an efficient manner and to unify efforts exerted by both the parties. Further, in order to strengthen the cooperation between the University and the Arabian Gulf Section, it was agreed to work together by setting up a joint framework to identify the current and future modes of cooperation in the field of various scientific and research studies etc.

It was also agreed to promote the AACE International activities such as certification courses, etc., to enhance the cost and project management professionals in the university by supporting and encouraging training courses for the management faculty, staff members and students.

Houston Gulf Coast Section

At the Houston Gulf Coast Section’s April 11 dinner meeting, Darren Elliott, Director, NASA and Oil & Gas Project, gave a presentation titled, “Improving Capital Project Execution through Joint Analysis of Cost and Schedule.” Darren has 24 years’ experience in major system and operational financial, cost engineering analysis, conducting risk analyses and enhancing risk management processes for NASA and oil and gas clients. He spoke about integrated analysis of cost and schedule as a business process to support highly complex projects (including NASA, DoD, construction, and oil & gas), to completely integrate cost, schedule, and risk. The analysis allows projects to immediately determine the cost impacts of schedule growth, assess where potential schedule alignment issues occur, and identify risks or activities that are the major drivers for the schedule. The results from the analysis directly helps stakeholders in making adjustments to the plan, determining the level of required funding, and supporting identification of external commitments for time and money.
On March 7, at the Houston Gulf Coast Section’s evening meeting, Dennis Allen Sr., CCP, VP from Hill International, was welcomed as the speaker. His interactive presentation titled, “Claims Avoidance for Owners and Contractors” was excellent and well attended. Dennis has 40 years of experience with contractors, owners, and developers in overall project development, preparing and monitoring project cost controls and helping to manage risk throughout the construction and operational processes. He stated that claims avoidance involves identifying and implementing techniques necessary to mitigate risk and avoid disputes. He highlighted the importance that parties must recognize and anticipate circumstances that turn to claims and develop effective and affirmative strategies for addressing them. Careful organization and coordination of the contracting parties is essential.

Also on March 7th, several members of the HGCS traveled to Texas A&M University for an outreach program. The topics included an introduction to AACE, an overview of cost engineering and a look at what a career in cost engineering looks like. The students welcomed the group and was very receptive to the interactive presentations. They look forward to us returning next year.

**Montreal Section**

The Montreal Section enjoyed a panel discussion in February 2017 entitled “Risky Business: A Roundtable Discussion on Risk Management”. The moderator was special guest and Risk Management Expert, Adam Malkhassian with over 40 years in estimating, cost engineering and risk management and many years as VP Corporate Risk Management for SNC-Lavalin Inc.

The distinguished panelists included Chantale Germain from Hydro Quebec representing the owner perspective and Denis Dagenais from Hatch providing the consultant and contractor viewpoint. The evening began with an introduction by Adam and review of the best practices, expectations, challenges and opportunities associated with risk management. This was followed by discussion of questions addressed to the panel as well as the audience.

Themes addressed in the discussion included project vs. enterprise risk, ownership, corporate risk appetite, the risk management process and cycle, qualitative and quantitative risk analysis, project control vs. risk management roles, contingency, client reserves and risk as well as risk management tools, trends and success factors. The 50 in attendance enjoyed a lively and interactive technical meeting.

The moderator for the Montreal Section panel discussion was Adam Malkhassian, with over 40 years in estimating, cost engineering, and risk management and many years as VP Corporate Risk Management for SNC-Lavalin Inc.
Adam Malkhassian explains risk management at the February 2017 Montreal Section panel discussion.

Montreal Section member Fadi Najdi makes a point during the section’s February meeting.

Montreal Section panel members Chantal Germain and Denis Dagenais are shown during the section’s February meeting.

Professor Osama El Sayed Moselhi, P.Eng., and Serge Pressoir, P.Eng., both past Section presidents with the Montreal Section, attended the Section meeting.

Alain Sanders, Hagire Emrani, Chantale Germain and Pierre-Luc Normand at the December 2016 Montreal Section meeting.

Alain Sanders, Robert Broca, Pierre-Luc Normand and Chantale Germain at the December 2016 Montreal Section meeting.
The Montreal Section and Hydro-Quebec sponsored a technical meeting entitled “Procurement Optimization – Investment projects and exploitation in the energy sector” which was held on December 6th, 2016. It attracted close to 40 guests including owners, engineering firms and university students. The presenters consisted of Pierre-Luc Normand, Manager – Strategic procurement at Hydro-Quebec Innovation, Equipment and Shared Services, and Alain Sanders, Eng., MGP, Advisor – Planning and Scheduling at Hydro-Quebec Innovation, Equipment and Shared Services.

An introduction of the company was done by Chantale Germain, Manager of Scheduling and Estimating department at Hydro-Quebec Innovation, Equipment and Shared Services. Then Pierre-Luc Normand explained the initiatives that have emerged from multidisciplinary groups called ‘AFIE’ (Approvisionnement /Procurement, Finance, Ingénierie/Engineering, Exploitant). The mission of these groups is to create value in line...
with global procurement. Alain Sanders explained the model developed by Hydro-Quebec that promotes value creation in collaboration with all groups and divisions. The topics covered in the evening included model development, integrated scheduling of procurement requirements and organizational communication. In the end, the audience contributed to a memorable evening with great comments and questions.

In November 2016 the topic at the Montreal Section’ technical meeting was “An Overview of Cost Forecasting of Construction Contracts” presented by Hagire Emrani and based on a paper presented at the Annual Meeting in Toronto in 2016 along with co-author Syd Daneshyar, CCP.

Hagire is the Director of Cost Control at SNC-Lavalin Infrastructure in Montreal and Syd is manager of project controls at SNC-Lavalin Hydro and Director of an AACE Technical Committee, based in Vancouver.

Hagire discussed that an on time and reliable cost forecasting is the common (and often elusive) goal of owners and contractors alike and proposed a comprehensive cost forecasting formula driven by contract types and project definition phases.

The presentation also described the prerequisites of a successful cost management system that creates the right platform to achieve the right cost forecast and identified some of the common pitfalls that can hinder the process of cost management and its results. The topics included prerequisites of successful cost management, a modified cost forecasting formula, EAC=AC+ (BAC–EV) +TR and its variations in different contract types and project definition phases and Success (or Failure) Factors: Level of details, Owner, Management Support and Change Management.

A traditional start to the Montreal Section season is the “Top Picks from the Annual Meeting”. This year was no exception in September 26, 2016, following the 60th AACE International meeting in Toronto. Several attendees of the annual meeting contacted speakers and presented some highlights. Hosted by Les McMullan, FAACE, Regional Director, Region 1, provided an overview of the annual meeting themes, following by three short presentations.

Chantal Germain of Hydro-Quebec summarized EST-2201 – Parametric Contingency Estimating by Matthew Schoehardt that
discussed recommended practice 43R-08 for contingency determination using parametric estimating and described a new project systemic contingency tool for small projects developed by a Canadian oil and gas company.

Next, Zaher Hmayed of Examine summarized CDR-2192 Different Allocation Methods for Indirect Costs by William Schwartzkopf and Cory Milburn. This paper compared the results of using a cost allocation base of direct labor hours to other allocation methods such as actual cost compared to adjusted, cost per day and period based costs.

The final subject presented by Lise Bouchard, CCP, of Hatch, and covered PM-2204- Can Your Project’s Organization be Agile? This paper by Joe Lukas, CCP, compared the agile and waterfall methods and described how and when to use agile and how to add value by using specific agile tools.

Another highlight of the evening was the presentation of two Montreal Section scholarships. The recipient included Marwa Hussein Ahmed who has completed a Masters in Construction Engineering and working on a PHD at Concordia University in Civil Engineering and Yousef Saadati, a PHD student in the mechanical engineering department at ETS in Montreal. Both gave gracious and heartfelt acceptance speeches and were congratulated by all in attendance.

St. Louis Section

On Tuesday, March 14, the St. Louis Section toured the St. Louis Arch museum renovation and expansion project at the Gateway Arch in downtown St. Louis, Missouri. The meeting was at the offices of CityArchRiver and started at noon with a 30 minute presentation, followed by a tour of the construction site. The meeting concluded at about 1:15 p.m. Arrangements were facilitated by Lonny Boring of the Green Rivers Gateway organization. The tour guide was Anna Leavey, Director of Construction for CityArchRiver. Attending were: Pradeep Juturu, Bob Mabry, CCP, John Morton, CCP, Viola Pancratz, CCP, Andy Paster, Paul Percich, David Price, and Marvin Woods, CCP.

Patricia Cuartas-Villegas 1970-2015

September 28, 2015, will forever mark the day that Augusta and the world lost a beautiful soul. Patricia Elena Cuartas-Villegas, surrounded by loving family and friends, made her transition into God’s loving arms after two and half years of a learning experience with colon cancer.

Elena was a prior member of AACE International and was a Certified Cost Professional (CCP), having obtained her certification in 1999.

Elena was a feisty young woman with sparkling eyes and mischievous smile, who was loved by many here and abroad. She was incredibly intelligent, and was admired and respected by all who worked with her over the years at the Department of Energy at the Savannah River Site as of June 2009. There she led the development of the DOE-SR Risk Management Plan and annual updates. She worked alongside contractor and DOE department managers cultivating a great deal of respect for her impressive efforts, Project Time & Cost and MWH Global both in Atlanta. Her Engineer brain kept her in charge, and she was born to lead! Coworkers frequently sought her counsel and were grateful for the quality she brought to every project.

Born in Fort Sam Houston, Texas on March 14, 1970, she grew up globally with her military family. Elena attained her engineering degree from Missouri University of Science and Technology. Elena loved to travel and spend time with her beloved family, her father Dr. Francisco Ignacio Cuartas H. (now deceased), her mother Ariana Villegas, her brother Juan Francisco and Andrea Cepeda and her dogs, Kahlua and Blizzard.

She had a special gift of caring for others even above herself, and carefully planned surprises for those around her. Her two and half years experience with colon cancer was difficult, but she never allowed her spirits to sag far, shoring up those around her, even until the end. Elena positively touched many lives, and her indomitable spirit is a legacy that will stay with us always.

Elena was inquisitive and spiritual. She leaves behind many precious family members and friends, including aunts, uncles and her cousins in Colombia, South America. A celebration of her life was conducted at St. Mary’s on the Hill at 4 p.m. on Thursday, October 1, 2015. Thomas Poteet & Son Funeral Directors, 214 Davis Rd., Augusta, GA handled the arrangements.

This obituary has been reprinted from The Augusta Chronicle newspaper.
When Will Your Section News Submission Be Published?

The digital Source magazine includes all “Section News” submissions. Source has a submission deadline of two months in advance of the issue date. Please review the following production schedule. It lists the submission periods for the six bi-monthly issues of Source magazine in 2017.

2017-2018 Source Section News Submission Schedule

February 2017
• Items submitted from Oct. 16 - Dec. 15, 2016

April 2017
• Items submitted from Dec. 16 - Feb. 15, 2017

June 2017
• Items submitted from Feb. 16 - April 15, 2017

August 2017
• Items submitted April 16 - June 15, 2017

October 2017
• Items submitted June 16 - Aug. 15, 2017

December 2017
• Items submitted Aug. 16 - Oct. 15, 2017

February 2018
• Items submitted from Oct. 16 - Dec. 15, 2017

April 2018
• Items submitted from Dec. 16 - Feb. 15, 2018

June 2018
• Items submitted from Feb. 17 - April 15, 2018

This production schedule is based upon production schedules at AACE headquarters, as well as our printer having two to three weeks production time to take our in-house files and convert them to the Nxtbook software for posting. Enhanced features like audio, video, website links, and more will be a part of each issue of the Source. Some technology features will require additional production time and earlier deadlines. The magazine is to be ready for posting by the first of the month.

Within 2 to 3 business days of submitting a “Section News” item, you should receive a return confirmation e-mail that your submission was received at AACE headquarters.

How to Submit Text and Photos

Please submit any and all text as a part of the e-mail or as a Microsoft Word file attachment. Please submit any photo or photos as individual attachments in tiff or jpg formats. Do not embed photos in Microsoft Word files.

For photos to be used, we require either large original files or print size photos at 300 dpi (dots per inch). We can convert large 72 dpi submissions into the required 300 dpi. This process shrinks the size of the original submission. We cannot use photos taken on cell phones. For photos to be published, they must be in focus, of print quality, and wide enough to fill the width of the column layout.

Please include the names and titles of each person shown in any photos. Please list names from left to right or refer to those shown as being above left or right. For group photos please list names from left to right, beginning with the front row and working to the back. Do not list the Section officer first unless he or she is photographed on the left with guest speakers on the right.

All submissions should be e-mailed to editor@aacei.org. Please use the official name of the Section as approved by the AACE Board when the Section’s charter was approved. Never refer to the Section as a chapter.

Contact AACE Concerning Missing Submissions

Generally, all submissions received in the above scheduled times will be published in the listed issue. Items are not held because of space restrictions. There is no waiting list and no preference is given to one Section over another. Questions about incomplete submissions or failure to follow these submission guidelines could delay publication. Text will be published without submitted photos if the photo does not meet the listed quality requirements.

If a submission is not included in the designated issue, please e-mail or call the Managing Editor to ensure that it has not been lost or misplaced. Call or e-mail if you do not receive a confirmation e-mail within 3 business days of submission.

AACE reserves the right to edit all submissions and/or to refuse to publish any submissions determined by the Managing Editor or the Art Director to not meet the standards of the journal. Any appeals of these decisions will have a final decision determined by the Executive Director.

Any Section representative with questions is advised to e-mail editor@aacei.org or call the Managing Editor during regular business hours (9 a.m. to 5 p.m. Eastern Standard Time, Monday-Friday, except holidays and special closings.)
On March 2-5, the San Francisco and Southern California Sections hosted the 56th Annual Western Winter Workshop at Indian Wells, CA. To kick off the weekend, Oracle Engineering and Construction hosted an exhilarating and unique social event at the BMW Performance Center in Thermal, California. This event took social and business networking to a new level. Close to 100 attendees had the opportunity to experience 425 turbocharged HP and legendary BMW M car handling in several driving events. There were timed trials on a challenging spaghetti track, drag races, wet track and hot lap, capped with an exhilarating all-drift lap with a BMW pro at the wheel! This event proved to be an incredible team building opportunity, as well as adrenaline-pumping fun in the sun to be remembered by all.

With almost 300 attendees from nine countries and over 200 cities, the WWW again proved itself as a stand-out industry event, offering unique networking and learning opportunities with key decision makers for major capital project delivery organizations, as well as cities and agencies, service providers, technology and software vendors, and contractors, etc. The WWW offered a robust technical program with over 50 capital and technical presentations on planning and scheduling, cost engineering, BIM, earned value, program and project management, forensic claims analysis, risk, estimation, and emerging technologies on the jobsite, as well as some other stand out panel discussions.

The capital management program track showcased key decision makers from a variety of public agencies such as LA Metro, the Port of Long Beach, and San Francisco Public Utilities Commission highlighting upcoming capital programs, challenges, successes, management philosophies and needs.

The innovation collaboration forum consisted of two moderated panel discussions which looked at emerging trends and the challenges cities and owner agencies face (innovation enablers included the Innovative Mobility Research Group, the City of Long Beach, LA Metro, Los Angeles Cleantech Incubator and Southern CA Edison) and then the companies that provide the solutions (innovation providers included Autodesk, Oracle, KPMG and HDR). These discussions revolved mostly around smart cities initiatives, infrastructure, transit, and emerging tech.

Looking through a different lens than the owner, the contractor best practices panel explored innovative ways contractors streamline their project management processes including cost/schedule and change management. Also, common issues and concerns in the current construction market. Participating companies included: Skanska, Clark Construction, McCarthy Construction and Morgner Construction Management.

The Western Winter Workshop is a regional event put on by the San Francisco Bay Area and Southern California Sections of AACE International. The association, AACE International, is a 501(c)3 non-profit professional organization widely recognized as the technical authority in cost and schedule management. Beginning in 1961, AACE was starting its 6th year as an Association when some of the founding members on the west coast decided to create a workshop.
Starting in Pebble Beach and later moving to Monterrey, Lake Tahoe, and now Indian Wells, the event continues to evolve and serve to connect stakeholders in the industry involved with delivering projects and programs. Regional events with AACE International have continued to grow with events now in Alaska, Houston, Philadelphia, Peru, Chile, and Sydney. Other events are currently planned for Portugal, Spain, France, Norway, Italy and Brazil. The growth and uptick of these regional events is a true testament to AACE’s growing global presence. They are a great way to get familiar with pertinent topics within the total cost management fields. They are a great way to network with local businesses, individuals, technology providers and capital owner organizations locally and for attendees to bring the knowledge shared back into their organizations.

For more information on the WWW, visit: https://www.youtube.com/embed/qY2GGRtmUU8

THE COST ENGINEERING JOURNAL AND SOURCE MAGAZINE ARE ALL DIGITAL!

AACE Members, be sure to start every month in digital mode and log on to AACE International’s new website at web.aacei.org to view the new digital issue of the Cost Engineering journal or Source Magazine.

BE SURE TO GET 100% OF YOUR MEMBER BENEFIT BY READING THE COST ENGINEERING JOURNAL AND SOURCE MAGAZINE.
### COMING EVENTS

#### JUNE 2017

**1**  
**CMAA SCC Small Business Summit,**  
The LA Hotel Downtown  
Los Angeles, CA  
Contact: www.cmaasc.org

**5-8**  
**Air & Waste Management Association Conference,**  
Pittsburgh, PA  
Contact: www.awma.org/ace2017registration

**8**  
**CMAA SCC Breakfast of Champions: RCTC and SBCTA Transportation Capital Updates,**  
Riverside Marriott  
Riverside, CA  
Contact: www.cmaasc.org

**8**  
**CMAA Seminar: Millennials in Construction,**  
Long Beach Marriott  
Long Beach, CA  
Contact: www.cmaasc.org

**8**  
**Disaster Conference,**  
Minneapolis, MN  
Contact: www.disasterconferences.org

**8-10**  
**Professional Construction Management Course,**  
4801 Airport Plaza Drive,  
Long Beach, CA  
Contact: www.cmaanet.org/PCMcourse

**11-14**  
**AACE International’s 2017 Annual Meeting,**  
AACE International,  
Hyatt Regency Orlando, FL  
Contact: phone 1-800-858-COST  
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web.aacei.org

**15**  
**CMAA SoCal TECHEXPO2017**  
The Grand Conference Center  
Long Beach, CA  
Contact: www.cmaasc.org

**22**  
**CMAA Dinner: LA Area K-12 Districts Capital Program Updates,**  
The LA Hotel Downtown  
Los Angeles, CA  
Contact: www.cmaasc.org

**22**  
**CMAA Seminar Building Commission and Optimization,**  
Long Beach Marriott  
Long Beach, CA  
Contact: www.cmaasc.org

**27**  
**Principles of Cost Engineering Online Course,**  
Cranfield University  
Contact: www.cranfield.ac.uk

**28-30**  
**IFRS Based Accounting for Oil and Gas,**  
Long Beach Marriott  
Long Beach, CA  
Contact: training@mobilityoilandgas.com

**29**  
**Disaster Conference,**  
Minneapolis, MN  
Contact: www.disasterconferences.org

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*Please submit items for future calendar listings at least 60 days in advance of desired publication.*

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