Current Issues in Technology Management

FALL 2009
VOLUME 13, ISSUE 2

HOWE SCHOOL ALLIANCE FOR TECHNOLOGY MANAGEMENT

Communicating in a Changing World: Are You Ready?

Don Gulliksen

The Howe School Alliance has devoted several recent Roundtable meetings to managing the complexities of the virtual work environment through the use of the new communication tools, including social networking. In a similar vein, the Fall 2008 issue of this publication featured an article on how the virtual communication technologies can be used to overcome the potential for conflict in virtual teams. This article seeks to have you consider further the effectiveness of different modes of communication as they apply to today's changing business realities—and to your business.

Let's begin by discussing two fundamental modes of communication: synchronous and asynchronous. Synchronous communication requires that one person be able to communicate with at least one other person in real time. A face-to-face discussion, a phone conversation or a video teleconference all represent synchronous forms of communication. Asynchronous communication, on the other hand, doesn't require the listener to be present when the speaker speaks or types. The information coming from the speaker is stored until the listener has an opportunity to see or hear that information. First class postal service, telephone answering machines, and email servers are all common forms of storage devices that enable asynchronous communication. These models are bi-directional, where the speakers and listeners can change roles to form a "conversation".

Let's explore the difference between these two forms of communication a little more. The most important difference is the requirement that the speaker and listener in the synchronous model be in real time. That means that they both must be willing to dedicate time that is synchronized to start and stop at times that work for each person's schedule. For a meeting, teleconference, or web conference, those start and stop times are typically prearranged on each participant's calendar. For a phone call

Continued on next page

IN THIS ISSUE.....

STEVENS Institute of Technology

HOWE SCHOOL of Technology Management

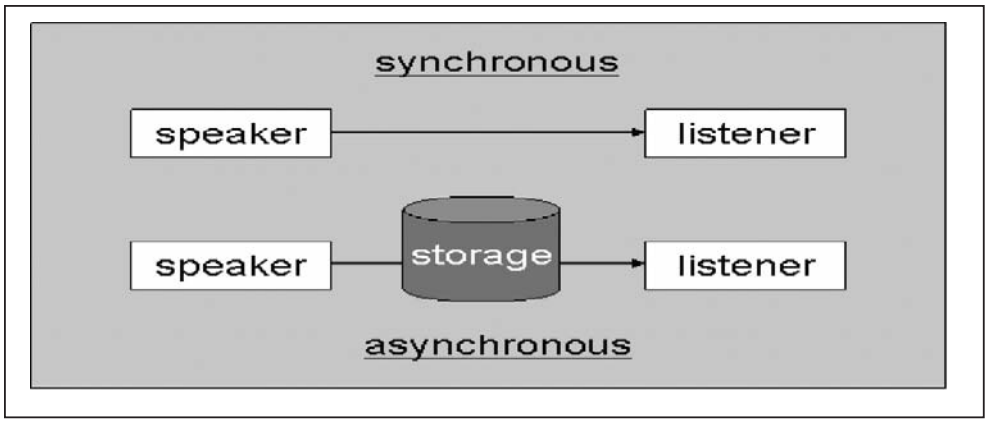
DIRECTOR'S NOTE

At the September 2008 Roundtable on Open Innovation, Don Gulliksen gave a thought-provoking overview on how people and organizations can collaborate effectively in the virtual environment. Many of us present began to see, for the first time, how some of the new social networking and communication tools like Twitter could be put to use by business and government. In the last year, application of Twitter and other social networking tools in business has grown extraordinarily quickly. In his article, Gulliksen leads us to consider further the effectiveness of different modes of communication as they apply to today's changing realities.

Richard Reilly offers a case study of how a team of experts from many different organizations was assembled and led effectively to tackle a challenging technical problem. The process described represents a best practice for bringing together experts to focus on a problem and produce a useful outcome in a short time frame. He outlines seven principles that should be followed to ensure a high performing team and a successful project outcome when leading experts are brought together for a focused, collaborative effort.

The 18th Annual HSATM Conference was held in June, on the topic ***Leading in a Changing Environment.*** *Eighty attendees heard from five stimulating and thought-provoking speakers. Alan Brown summarizes some highlights.*

Larry Gastwirt



to be effective as a synchronous form of communication it must also fit into each person's schedule – otherwise it becomes asynchronous, with the storage medium being a secretary, answering machine, or voice mail system.

There has been a strong preference for synchronous communication for many years because it is immediate and, apparently, efficient. That has led us to develop common calendaring systems that have broad access for those with whom we need to communicate regularly. Wouldn't it be great if we could all see each other's calendar and reserve times for those important phone conversations and meetings? Maybe not. Do you really want everyone else scheduling your work day? How much flexibility and privacy do you need to be effective at what you do?

Perhaps the best approach is a form of communication that automatically adjusts between synchronous and asynchronous depending upon your availability, capacity and interest…wouldn't that be cool!

That form of communication may just be what is broadly being referred to as social networking. It comes with its own new bag of tools and techniques that are more common to the emerging generation than to those that are departing. If you think a tweet is only a sound that a bird makes, then you are probably representative of the latter. (A glossary of terms – taken from Wikipedia, of course – appears on page 3).

So, do we need a new hybrid form of communication that can give us the immediacy we sometimes need, while also providing a shield against interruption overload? These are the questions we have to consider. How much interaction do you need to be successful? How broad are your communities of practice and interest? Do you work in a shop that builds piece parts to order or do you work in a global marketplace developing products with hundreds of suppliers and millions of customers?

Think about how the concept of a team has changed over the years. We used to think about functional business units, where the engineering team was pretty much autonomous from the marketing team – and we liked it that way. No need to talk to those guys on the other team as long as we have a good set of requirements chiseled in stone. When was the last time you had one of those? Maybe the Ten Commandments?

Next we decided that cross-functional teaming would help break down those walls between internal organizations by putting together a product or process team that had representatives from each part of the organization: marketing, engineering, production, quality and sales. It suddenly got a little harder to schedule meetings and get everyone together. Those in marketing thought they were wasting their time at the meeting whenever the engineers were talking, the engineers went blank when the production guys said they couldn't build it, the quality folks were discussing sigmas by themselves and the sales guy was on the blackberry selling the product before it existed. This was progress?

As our companies grew, we realized that we couldn't do it all internally, so we merged with companies that could enhance our capabilities and took over those that might be a threat. The big decision was whether to bring them into our culture of doing business or let them go on operating the same way as they had. Should we reorganize to make workflow more efficient? Should we move people so they are co-located with their business units, or do we need to install more teleconferencing systems? Does casual Friday mean the same thing in southern California as it does in Manhattan? Does a handshake in Atlanta mean the same thing as a nod in Hong Kong? Some mergers and takeovers succeeded as spectacularly as others flopped.

Maybe this cultural hurdle is just too tough to get right as you start trying to deal with more geographies, time zones and languages. Maybe we could still get the benefits of working with more resources without the requirement of a permanent relationship. So we looked for organizations with which we could form partnerships and others to whom we could outsource entire functions.

...with today's global economy, our traditional ways of doing business are being replaced by a whole new set of best business practices. With new business practices comes a new way of communicating – not synchronous, not asynchronous, but a continuum of everything in the middle.

Functional requirements became all the rage, giving our partners and suppliers broader control over the details. Systems engineering became a science wrought out of necessity because if you didn't get the process right, there was no chance that the product would come together and work. All of this came at the expense of more time spent on the phone, in teleconferences and in airports.

Just when we thought we had pushed the corporate envelope to its limits the model got turned on its ear. Did you ever wonder how Amazon grew from an online book sell-

er to a one stop e-tailer for just about anything? It wasn't by growing its functional business units, developing cross-functional teams, mergers, takeovers, partnerships or outsourcing. They developed a flexible web-based platform for e-tailing, published directions on how to develop compatible extensions and opened it up to the world. Companies rushed to join in Amazon's success by jumping directly on their bandwagon, or in this case, their website. Amazon gets a piece of their sales, but doesn't have to develop one line of code while expanding their presence on the web many times over. A mashup of web-based retailers consolidated down to a single URL.

Did you watch Super Bowl XLIII? What did you think of the Doritos commercial? Apparently enough people liked it to vote it the #1 commercial for the show. Did Frito-Lay put together a market research team, a product development team or a production team to accomplish their goal? Nope. They simply published their requirements for a 30 second commercial to the world and promised a reward based on their success. That instantly created a crowdsourced product development team with no start-up costs and no managerial oversight, yet was enormously effective.

What's going on here?! Mashups and crowdsourcing? Doesn't anyone want to do anything themselves?!

That's not the point. The point is that with today's global economy, our traditional ways of doing business are being replaced by a whole new set of best business practices.

With new business practices comes a new way of communicating – not synchronous, not asynchronous, but a continuum of everything in the middle.

We've got to accept that the old idea of synchronizing everyone's calendar for the purpose of having a meeting just isn't going to work on a global scale. Neither is using email for critical, time-sensitive interactions. Most of us have lived with phones and email for decades and have seen them both become less and less productive forms of communication. How about our offices? Are they necessary, or are they a historical artifact from a prior business model? We need to be in touch all the time, wherever we are. Like it or not, that is where the world is at.

So… ditch the commuting, close the office and make it easier to get in touch with those with whom you need to interact, and ignore those who are wasting your precious time. Arm yourself with the tools of the emerging generation – a 3G smart phone that has access to your cloud-based email account, your Twitter account, your Facebook page, Google and a browser to get to your corporate apps. See if your contacts list keeps score on whether each person is more accessible through microblogs, wikis, instant messages, emails or phone calls. Know when to use each tool to your best advantage. Send an instant message asking when a good time for a phone call might be. Send an email when an issue doesn't require immediate attention. Review the tweets of your colleagues to get a general idea of what is

What happens when the generations cross paths? Does the new hire have the skills to meet with a new client over lunch, discuss a wide range of relation-building subjects and read body language to better assess how the client is reacting? Does the seasoned professional have the skills to maintain a continuing dialogue via instant messaging with a set of prospective new crowdsourced suppliers from around the world, using only thumbs, emoticons and common abbreviations?

Glossary of Terms

Cloud computing: a style of computing in which dynamically scalable and often virtualized resources are provided as a service over the Internet. Users need not have knowledge of, expertise in, or control over the technology infrastructure in the "cloud" that supports them.

Crowdsourcing: a neologism for the act of taking a task traditionally performed by an employee or contractor, and outsourcing it to an undefined, generally large group of people or community in the form of an open call.

Mashup: (web application hybrid): a web application that combines data and/or functionality from more than one source

Micro blogging: a form of multimedia blogging that allows users to send brief text updates or micromedia such as photos or audio clips and publish them, either to be viewed by anyone or by a restricted group which can be chosen by the user. These messages can be submitted by a variety of means, including text messaging, instant messaging, email, digital audio or the web.

Social network: a social structure made of nodes (which are generally individuals or organizations) that are tied by one or more specific types of interdependency, such as friendship, kinship, financial exchange, dislike, sexual relationships, or relationships of beliefs, knowledge or prestige.

Tweet: a micro-blog post on the Twitter social network site, or the act of posting on it

Wiki: a website that uses wiki software, allowing the easy creation and editing of any number of interlinked Web pages, using a simplified markup language or a WYSIWYG text editor, within the browser. Wikis are often used to create collaborative websites, to power community websites, and for note taking.

Continued on next page

going on with any particular process or project. Participate in wikis when iterative collaboration moves you toward your intended goal.

Is that the answer? Probably not, but it is important to glean the message from all of this. The breadth of what we are working on will continue expanding beyond any traditional sense of an organization, and the way we communicate will continue evolving to help us deal with that breadth. If we're not ready to consider crowdsourcing and social networks as legitimate business alternatives, we may be left in the dust.

For years we have talked about gaps in our organizations – generation, culture, skill, knowledge and others. Well, don't look now, but another gap is upon us. It is the gap between those who can read body language and those who only know how to read another person's thumbs. If you grew up in a time when you only discussed serious subjects face-to-face and sometimes did important business at a restaurant, you know how important it can be to pick up on a little fidget here or an uncomfortable look there. You know that trust came from sharing stories about your kids or agreeing on a favorite bottle of wine.

How do you build trust 140 characters at a time? That's the typical length limit for text messages sent from cell phones. Business is all about relationships. What does it take to build a relationship? Texting, phone calls, emails, blogs, wikis, video conferences, and face-to-face meetings all have varying degrees of efficiency and effectiveness. What is the right mix? How much skill does it take to communicate effectively using each of these tools?

The answers lie in the skills of those who use any particular mix of tools. A new hire out of college might be very good at building relationships with colleagues of similar age around the world, using the same social networking tools used in private life – IM, Facebook, MySpace, Twitter, SecondLife, etc. A seasoned professional will likely feel most comfortable relying on the social networking tools that served a similar age group throughout their careers – phone calls, emails, meetings, lunches, conferences, etc. What happens when the generations cross paths? Does the new hire have the skills to meet with a new client over lunch, discuss a wide range of relation-building subjects and read body language to better assess how the client is reacting? Does the seasoned professional have the skills to maintain a continuing dialogue via instant messaging with a set of prospective new crowdsourced suppliers from around the world, using only thumbs, emoticons and common abbreviations?

The answer is – probably not. We could be headed toward some very uncomfortable business relationship train wrecks unless we find a way to cross-train the gap out of our workforce.

I don't see our formal education systems providing the courseware, so it may be necessary to run training sessions in-house. Even there, getting qualified instructors may be difficult. Another approach could be mentoring programs. We typically think of associating the new hire with the seasoned professional so some of those years of experience can be taught to the new hire. In this case, the teaching needs to be bi-directional. Both need to learn more about each other's tool set. Not just the mechanics, but the subtleties of their use.

Some of the most effective businesses have discovered how to work in our global economy by employing new types of relationships with developers, suppliers, producers, and sales from cultures around the world, using all of the communication tools available. Some have tried and failed. Others haven't tried and just don't realize that they will fail if they try to stay with their old ways of doing business. ■

How about your business? R U ready?

Post Script: As you were reading this article, were you thinking "this doesn't really apply to our organization because our IT shop would never allow us to use any social networking tools or websites"? Today's business realities for many companies are such that protection of intellectual property and security of transactions often take priority over ease of use and open access. The deal killer is the 3G smart phone that is emerging as the must-have appliance of our day. People that are dependent on their social networks and adapt their use to business requirements won't use those controlled corporate computers, networks and servers – they will 'go native' in the social underbrush of tweets and twitters whenever or wherever they happen to be. Corporate control may not be an option, making training of responsible business behavior a necessity.

About the Author:

Don Gulliksen (gulliksendon@optonline.net) is Senior Scientist & Policy Advisor for JTSi. He has spent his 40 year career applying sound academic and business principles to real-life situations that support the vision and goals of a wide spectrum of organizations.

He has been director of information services at a large Army R&D installation (ARDEC – Picatinny Arsenal), with broad control over areas such as the enterprise applications, supercomputers, servers, desktops, networks, phones, A/V and libraries. He conceived and organized a nationwide network of weapons developers using collaboration tools, models and simulations. He holds a bachelor's degree in electronics and master's degrees in computer science and engineering management. He continues his academic pursuits through collaboration with colleagues at Stevens Institute of Technology.

Eighteenth Annual Howe School Alliance Conference Focuses on Leading in a Changing Environment

Alan S. Brown

The Howe School Alliance has held its annual conference for nearly two decades, yet its members have never convened in the face of such business turmoil before. "With major disruptions in the global economy, the crumbling of financial and industrial institutions, declining customer demand, the unrelenting need for continuous innovation – it's all about change," HSATM director Larry Gastwirt told the 80 attendees.

The conference theme, "Leading in a Changing Environment," sought to provide perspective on the implications for leadership. Five stimulating speakers illuminated different aspects of the theme. Slides and videos of the presentations are on the Conference website, http://howe.stevens.edu/pages/hsatm-conference-2009/

The Core Challenge of Leadership

Anthony Le Storti, president of IDEATECTS Inc. and senior associate with HSATM, applies the methods he learned as a U.S. Army Ranger to business teams faced with extreme challenges. He first discussed the reasons why as many as 70% of change initiatives fail.

An important reason is that leaders often fail to appreciate the complex nature of their organizations. Large organizations consist of interdependent components interacting dynamically with one another and their environment. Leaders who plan to start fresh tomorrow or simply change one division or one process often miss these connections.

Like other organic systems, organizations have deep roots. They have history, precedents, skills, and culture. Before a company can begin to change, it has to unlearn what it has done in the past. "Only then can it learn new things through trial and error and pilot studies, figure out new best practices, and lock in those behaviors," said Le Storti.

People often resist change, he continued. They may not see the problem or accept that they have to change personally. Some may lack the necessary skills to implement change. Others may question the goals. It takes a combination of techniques to overcome this resistance. Le Storti pointed to research that identified six interlocking change techniques. "Organizations that implement four of these initiatives have 10 times better results than those that try just one or two," he said.

The techniques are broken down into personal, social, and structural components. "At the personal level," he said, "link change to what people want to do because it's valuable to them, and over-invest in skill building so they can change."

"On the social side, harness peer pressure," Le Storti continued. "They say that change starts at the top, but people really change when the people you have lunch with are changing." He also called for social support through on-going discussions that let employees bring up issues.

On the structural side, Le Storti advised modifying the environment and aligning incentives to ensure accountability. "If there's no feedback, no consequences, why should anybody change his behavior?"

Change Rules

Picking up on the theme of corporate change failure, Peter Bregman, CEO of Bregman Partners LLC, asked the audience why most programs floundered. The audience listed the usual suspects, from lack of support and impatience to unclear objectives and fear. "I want to tell you how to get around these problems completely, not fight or work around them, but to avoid them completely," Bregman said.

"I don't think people resist change. People change every day, and they do it effortlessly," he continued. "People resist *being* changed. So we don't need strategies to counter resistance. We need strategies that don't create resistance in the first place."

Bregman offered several suggestions. First, companies have to share stories that show they are becoming who they want to be. "People remember stories that explain how we got here and where we are headed," he explained. "When the stories change – they used to exploit people, now they fire people who exploit others – the organization changes."

Companies must integrate any change program into their business processes. "Anything you do to make change gives people more to do," Bregman warns. "In moving change through an organization, figure out how to make it less to do. If you have to train people, have them train by doing their actual work."

For employees to buy into a change program, they have to feel their opinion matters. Instead of top-down communications, support should take the form of two-way conversations and coaching. Employees should set and measure their own change targets. When managers coach employees, they uncover information that can provide powerful insight into potential best practices, said Bregman.

Finally, it is more important to get it half-right than 100 percent correct. "Why are pilot change programs almost always more successful than the 'perfected' full implementation?" Bregman asked. "Because people have pride of ownership in what they build. Pilot programs succeed because everyone knows they are not perfect, so employees make lots of suggestions to make them better." Starting with a half-right program gives all employees a chance to contribute and take ownership of the results, he explained.

Managing Virtual Workers

Howe School Professor Emeritus Richard Reilly talked about managing virtual workers, the subject of his latest book (with co-author Karen Sobel Lojeski), *Leading the Virtual Workforce*.

Virtual workers, said Reilly, are separated by geography, but also by affinity and opera-

Continued on next page

tional distances. They may not share the same affinities - social norms, values, personal relationships, and interdependencies - that glue people together. Because they communicate primarily through e-mail and social media, they lack the operational closeness developed by large, centrally located teams. "Management by walking around doesn't work anymore. New approaches and new leadership competencies are required," Reilly said.

He has identified three core competencies of virtual distance leadership. First comes creating context. "Imagine a team spread all over the world," he said. "Teams change, people move in and out, but the leader stays the same. They can't see the leader, but he or she has to create a shared mental model so everyone sees things the same way." That model must explain how people working at different locations fit into the big picture. This goes beyond sharing a vision and goals, and includes explaining how their project relates to other projects and why individual contributions matter.

The second competency is cultivating communities. Teams that work in one location do this naturally over shared meetings, lunches, and parties. The virtual world precludes such close personal contact. "What we have now," said Reilly, "is a virtual workforce where the informal network becomes more important than the formal structure. Leaders have to build and cultivate communities to get the commitment needed to get their projects done."

Reilly's third competency is co-activating leadership. Virtual work is so distributed, it is naturally difficult to lead, he explained. One way of approaching the problem is through shared leadership, where all workers take responsibility for the work and its management. "Co-activating leadership is something like shared leadership, but is a little more active and inspirational. Leaders inspire people to take active roles in leadership," said Reilly. "They help team members understand cultural differences."

Leading in a Multicultural World

Steven Jacobs, president of Global BioPharm Solutions LLC, tackled cultural competency head-on. Culture, he explained, is like an iceberg: Only a small fraction of our cultural identity is visible in our behavior. The rest - our beliefs, the meanings we attach to behavior, and the ideals we strive to emulate - inform our thoughts and emotions even when we are not aware of them. Cultural competency, said Jacobs, begins with an understanding of our own cultural prejudices. Only then can we begin to see the hidden cultural assumptions of others.

Jacobs listed four essential cultural skills of a leader: cultural due diligence (preparing for the impact of different cultures); dialog (illuminating a venture's cultural underpinnings); mentoring (facilitating others to integrate cultures); and style-switching (switching behavioral styles when appropriate).

Executives need all those skills in a global economy where success can hinge on noticing often subtle cultural clues. For example, the most common failed overseas assignment for U.S. executives is Great Britain. The problem, says Jacobs, is that Americans assume the British are just like Americans, but the British have very different ideas about hierarchy. Cultural differences are not just limited to nations. Corporations, generations, and genders have their own cultural identities. Culturally astute managers learn to understand them rather than categorize them as "good" or "bad."

Entrepreneurial Bootcamp

Following a massive restructuring in 2002, Alcatel-Lucent's Belgium operation, which employed 1,800 people and 100 researchers, decided to make innovation everyone's business. Management announced an innovation contest with a new car as prize. The initiative generated 150 new ideas within five months.

What's wrong with that? Plenty, said Guido Petit, director of Alcatel-Lucent Bell Laboratory's Technical Academy. "The program rewarded only one person and made 149 other people unhappy," he said. "It created negative energy. It was not sustainable and - most important - the winning idea didn't make it into a product. In fact, none of the top ideas became products," said Petit.

Petit's team analyzed why the program failed. He found that Alcatel-Lucent did not really need new ideas. It needed new business plans based on innovative products that could generate $70 to $140 million within three to five years. To develop those business plans, Alcatel-Lucent launched its Entrepreneurial Boot Camp that taught employees to turn ideas into business opportunities.

Boot Camp had several unusual components. First, it used a process similar to speed dating to form teams of people in different parts of the company. People with ideas published them on a website. They met with people who wanted to work on a project. If the chemistry clicked, they formed a team.

Second, Alcatel-Lucent did not go it alone. It partnered with Flanders Business School and outside venture capitalists, who were more familiar with assessing new ideas and markets than company management.

Third, they provided an intense experience. Teams went on a retreat for three weekends. They learned theory in the morning and worked in the afternoon. Top management members coached teams in assessing technologies and markets and preparing presentations for a jury of senior managers, venture capitalists, and professors.

After six boot camps and 30 proposals, Alcatel-Lucent is incubating several prospects. The process fostered entrepreneurship within the company, and gave employees a way to advance their ideas and an opportunity to shine that they lacked in their jobs.

Petit's prescription for leading in a changing environment was quite different from the management techniques suggested by the other speakers. It had little to do with addressing virtual workers or cultural diversity. Yet if the attendees at the Alliance's annual conference learned anything from these diverse presentations, it was that there are many ways to lead change. ■

About the Author:

Alan S. Brown (insight01@verizon.net) is a freelance writer who covers engineering, science, and technology and how they impact business. He has edited numerous publications on topics that range from advanced materials to homeland security, and is an associate editor of ASME's *Mechanical Engineering*.

Creating a High Performing Team of Experts: A Case Study

Richard R. Reilly

Introduction

This case study describes the background, planning and organization for Phase 1 of a challenging project that brought together a team of 16 subject matter experts representing 12 different organizations, from industry, government and academia. It discusses the key factors that led to the development of a high performing team and a successful outcome of Phase 1 of this three-phase project.

The Lead Free Manhattan Project (LFMP) had its genesis in two European Union directives banning the use of lead in electronics manufacturing. The directives, which went into effect in 2006, spurred commercial manufacturers to phase out the use of lead in electronics manufacturing. For over 50 years manufacturers have used an alloy of 37% lead and 63% tin for soldering in electronic components. Tin-lead, or SnPb solder, has a number of desirable properties that make it ideal for electronics manufacturing. It is easy to work with (solderability), relatively inexpensive, has a lower melting point and creates stronger joints. Perhaps the most important feature of SnPb is that it essentially eliminates the growth of "tin whiskers", singular crystalline structures that form on tin and can lead to unintended short circuits and metal vapor arcs. Whiskers can also break off, creating foreign debris within the component. Any one of these problems can cause the catastrophic failure of a system. Failures due to tin whiskers have been documented in commercial satellites, medical equipment, telecommunications, missile and radar systems, nuclear utilities and computers. Apart from tin-whiskers, major reliability problems have been encountered with lead-free alternatives.

The objective of Phase 1 was to develop a report that outlined baseline or best practices in lead-free electronics across the life-cycle of a product. LFMP Phase 1 brought together 16 of the world's leading subject matter experts (SMEs) in the area of lead-free electronics for a focused two-week project, sponsored by the Office of Naval Research. The analogy to the Manhattan Project was drawn because this project brought together leading experts in a specific, challenging area of technology from multiple organizations, it used a structured process and resulted in an end-product in a short time span.

Figure 1 shows an overview of the project flow. The project began with an initial vision articulated by two SMEs who eventually became the project co-leaders. Planning took place over several months with consistent communication amongst team leadership via teleconferences during which SME team selection occurred. Once the team was assembled, team building took place and sub-teams were formed. A structured process enabled sub-teams to quickly focus on their task and develop the final report. An important feature of the process was a set of feedback loops that served as a communication link between each of the project steps. For example, the vision was continually refined until the report was completed.

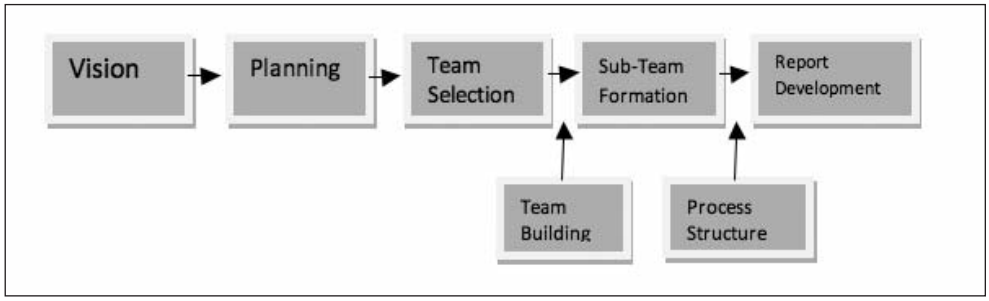


Figure 1 – Overview of LFMP Phase 1

Developing the Vision

Much of the success of Phase 1 of the LFMP project can be attributed to the development of a clear vision. The development of this vision began with two industry leaders from Boeing and Lockheed-Martin. They posed the question, "wouldn't it be great if we could do something about the lead-free problem"? The conversation led to the idea of creating a highly focused project that would bring together the leading experts in lead-free electronics to identify current best practices, develop a roadmap for what needs to be done to address the challenges of lead free electronics, and carry out the necessary research and development. A phased approach was planned. Phase 1 would focus on identifying current best practices in lead-free and would identify baseline practices where no best practices existed. Phase 2 would focus on developing a roadmap for the work that needs to be done in research and development. Phase 3 would be a multi-year effort aimed at conducting the R&D necessary to develop reliable and sustainable Pb-free electronics in Department of Defense applications.

The initial vision for the first two phases was stated as follows:

The objective of this effort is to capture industry-wide Pb-free electronics best practices and to develop an integrated industry/government plan to mitigate future risks posed by the worldwide transition to Pb-free electronic products. The scope of this effort will be to assemble leading Subject Matter Experts (SMEs) and have them collectively define the current set of best practices in use to mitigate the risk associated with Pb-free electronics usage in DoD applications and then to develop an action plan to mitigate future risks.

Pre-project Planning

Pre-project planning began in February of

Continued on next page

2009 with a teleconference that included the conference coordinator, the two co-leaders and a facilitator. It was determined that Phase 1 would be a two-week, intense effort that would bring together 16 of the leading SMEs at one location.

Teleconferences were held every two weeks until the project start. Topics covered in these meetings included logistics for the conference, outside speakers, the work structure, the facilitation process and the desired outputs. Drafts of a possible structure and schedule were circulated and commented upon and there was an eventual consensus as to how the two weeks would be structured, a detailed schedule, how the work flow would be managed, how issues related to team process would be handled and what the outputs would be.

Team selection

A critical step in the process was the selection of the team of SMEs to participate in the two-week session. The primary objective of the team selection process was to identify individuals with the best combination of experience, knowledge and expertise in lead-free electronics. Two constraints were added. The group should broadly represent the Aerospace Industry and DOD service organizations. A second constraint was that the group should be limited to 16 participants.

The selection began with one of the co-leaders identifying four well-known experts in Lead Free Electronics to serve as an advisory panel. Potential SMEs were drawn from industry, academia, government and research organizations. Through emails and teleconferences the advisory panel identified a group of experts with the requisite qualifications. The advisory panel then did a preliminary ranking of the identified individuals. At this point the members of the Industry Advisory Board (IAB) of the Navy Mantech Electronics Center of Excellence, seven director-level representatives from industry, were asked to review the list and add or subtract names. Once this list was developed, the IAB and the advisory panel re-ranked the names. The rankings from each individual were then sent to the co-leaders who aggregated them by taking the average rank across all SMEs and IAB members. A consolidated list of 37 SMEs was prepared and sent back to the IAB for review. Individuals were then invited to participate in the LFMP according to their overall ranking. If an individual could not participate for any reason the next-ranked name on the list was invited until a total of 16 SMEs had agreed to participate.

Setting and Schedule

The two-week session was held at the headquarters of the American Competitiveness Institute (ACI) in Philadelphia. The full team met in a large conference room set up with audio-visual equipment, including a projector and teleconference equipment. The larger group was organized into five sub-teams, each with their own breakout room. Each of the five groups was charged with reporting on one of the following topics: design, testing, reliability, manufacturing and sustainment. For the full-team sessions audio recordings were made via individual microphones assigned to each of the SMEs. In addition, selected video recordings were made during the two weeks.

Each day began at 8am. A "tag-up" session was held at the end of the day. These sessions were intended to review outstanding issues, problems, questions and lessons learned. Key points were recorded on an easel and posted in the large conference room.

The first two days were set aside for introductions and an Industry Forum. The purpose of the Industry Forum was to accommodate a larger group of SMEs who could not be physically present but whose expertise could help to augment the current understanding of issues and solutions for the LFMP team. Day 3 was intended to allow the LFMP team to discuss, synthesize and react to the Industry Forum speakers, as well as provide an opportunity for team interaction and beginning discussion of the vision and objectives of Phase 1.

Days 4 and 5 were set aside for discussion of the deliverable and the initial report outline. At this time, five sub-teams were formed with responsibility for Design, Manufacturing, Testing, Reliability and Sustainment. This structure was elected because it was a logical extension of how products are developed within the DoD framework. Initial outlines were developed and discussed within the team and storyboards were introduced to permit formulation and synthesis of thought before writing draft textual material. On day 6 sub-teams gave overviews of their storyboards and other SMEs provided feedback which encouraged convergence to a shared conceptualization of the approach and objectives. Days 7, 8 and 9 were devoted to writing reports, and sections of the sub-teams' reports were posted for review and comment. On the final day teams completed their initial drafts and agreed on follow-up activities. The final day ended with a recognition event at which certificates were awarded by the Director of the Office of Naval Research ManTech Electronics Center.

The LFMP Phase 1 is an example of a project that could be replicated for other technical areas... it represents a best practice for bringing together experts to focus on a problem and produce a useful outcome in a short time frame.

Development of Team Norms and Project Culture

Development of team norms was an important enabler to project success. Early in the project, a session was held with the entire team to solicit their input on a "code of conduct" for the two weeks. For purposes of discussion the code of conduct was organized around four categories of team behavior: communication, conflict management, self-management and process review.

- **Communication**

  The team agreed on the following principles:

  o All team member listen attentively to other speakers and allow speakers to

finish before speaking

- o If a team member wants to speak he or she must raise their hand and be recognized
- o Team members will avoid dominating discussions and allow everyone to share in the discussion. A three-minute rule was adopted; i.e., any single speaker who speaks over three minutes will be stopped.
- o Leadership will monitor and reinforce these behaviors during the two week period

- **Conflict Management**

The team agreed on the following ground rules for managing conflict:

- o Ok to disagree respectfully
- o Respect minority opinions
- o Don't avoid tough issues/questions
- o Goal in discussions is to arrive at a win-win resolution
- o In the final analysis debates should be settled by data where possible ("data talks")

- **Self-Management**

The following rules were agreed upon for self-management of the LFMP team:

- o Three-knock rule: when the team or discussion got off point or involved side conversations the co-leaders or any member could knock three times as a signal that the group should be quiet and listen to the speaker.
- o 3 Minute Soap Box Rule: no speaker should be allowed to speak over 3 minutes.
- o Necessary & sufficient: discussions should last no longer than that which is necessary and sufficient to cover the points.
- o Content over volume: the content of discussions should be emphasized over the volume of the speech.
- o There should be a scribe for each session to record key points and issues for feedback and review
- o Issues that cannot be addressed immediately should be captured in a "parking lot"

- **Process Review**
  - o End-of-day tag-up sessions where candid discussions of issues, progress and team comments were used to review any team process issues
  - o If the process is not working, fix it immediately

Artifacts

The LFMP culture was characterized by several artifacts that helped to keep the team focused on their end objectives. Artifacts included a professionally done brochure, initial outlines, LFMP storyboards, and a "baseball bat".

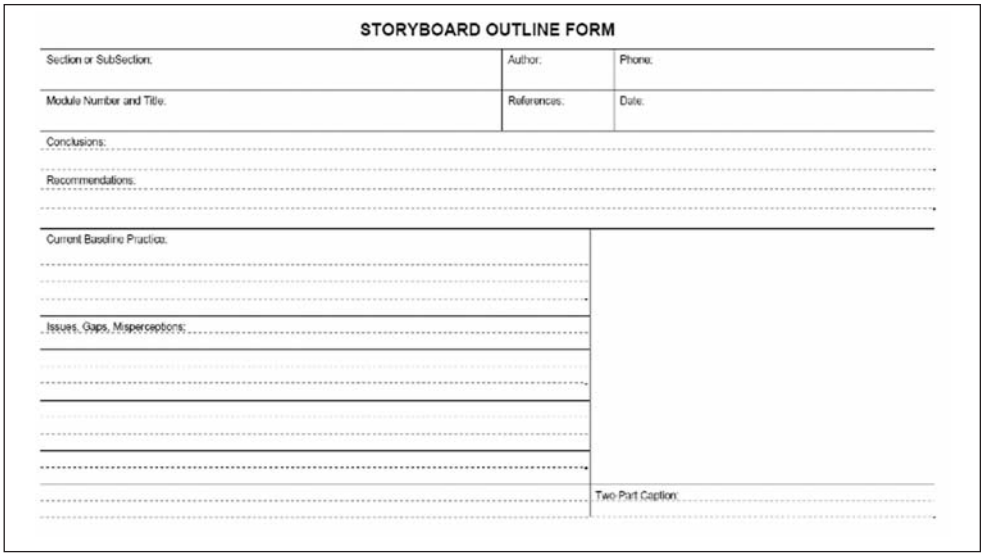
The brochure included an overview of the project and outlined the schedule and agenda. The brochure also included biographical information on each SME.

The storyboards provided an organization structure for the sub-team to assemble their initial ideas and share them with the other SMEs. Storyboards included the following sections: A heading for the module, identifying information for the authors, references, conclusions, recommendations, the current baseline practice, issues, gaps and misperceptions and a space for figures, charts or pictures with captions. Figure 2 shows the Storyboard Outline Form. As storyboards were prepared they were posted on the wall under the relevant topic and other SMEs could review and post comments.

The baseball bat was a humorous symbol used to "enforce" the ground rules, and to keep the SMEs on track for their primary objective.

Benchmarking and Best Practices Review

Early in the project an overview on benchmarking and identifying best practices was presented to the team by the facilitator, an organizational psychologist. Standard definitions were presented for best practices. After a thorough discussion the SME team reached a consensus that the term "best practice" did not apply to many areas that were being addressed in the LFMP. Many of these issues lacked sufficient data and experience to make a determination as to whether a practice was best or not. An alternative definition was agreed to as follows: A process or practice that describes the current state-of-the-art as a baseline against which future improvement can be measured. It was also agreed that where a baseline practice was a best practice it would be so identified.


STORYBOARD OUTLINE FORM

Section or SubSection:	Author:	Phone:
Module Number and Title:	References:	Date:

Conclusions:

Recommendations:

Current Baseline Practice:	
Issues, Gaps, Misperceptions:	Two Part Caption:

Figure 2

Project Outcome

Overall, the LFMP team functioned extremely well and was successful in meeting the objectives. Although the schedule was demanding and the task was difficult all the sub-teams were able to produce first drafts by the end of the two week period. Although follow-up work was needed to turn the drafts into a final report, the majority of the work was completed within the two weeks.

Continued on next page

The Keys to Success

The successful outcome of the LFMP was made possible by seven factors that characterize high performing teams[1]. These included clarity of vision, leadership, team selection, knowledge management, effective collaboration, a structured development process and a good technical support system.

Clarity of Vision

The vision for the project was clear and more importantly was communicated to all team members in several ways. First, the written material sent to team members in advance outlined the objectives of the project. As the team met over the first few days, the vision was discussed, refined and agreed upon by the entire team. The team had a common understanding of the vision and was able to achieve what team researchers call a "shared mental model[2]". This allowed the team to see the entire vision for the project and how each of the elements fit together interdependently. This shared mental model was enhanced by frequent feedback from the co-leaders and fellow SMEs as the project progressed. A simple example of how the shared mental model was expressed was in the agreement of teams to use a common set of colors for visuals: green for no change, yellow for minor change and red for major change.

Leadership

The two co-leaders contributed to the ultimate success of the project in several important ways. First, they set the vision for the end-product and continually clarified and reinforced the vision so that all team members developed a shared mental model. Secondly, the co-leaders kept the team on task by providing feedback on the schedule and the content of each sub-team's contributions. Third, the co-leaders participated fully in the process, leading review sessions, contributing knowledge and expertise, helping to integrate the various elements provided by sub-teams and writing sections of the report. Finally, the co-leaders motivated the team through their encouragement, obvious commitment and exemplary behavior.

Team selection

The LFMP project recruited the "A Team", a group of the top experts on Pb-Free electronics available. The process used to select these individuals was systematic and incorporated the judgment of a sizable group of knowledgeable senior managers and leaders in the field of electronics. In addition to bringing their experience, knowledge and expertise, team members, without exception, also brought a passion and commitment to the issue of Pb-Free electronics manufacturing. This combination of expertise and commitment was an essential combination for success. There was also a social networking element to the team's effectiveness. Prior established relationships with one another through professional groups and meetings allowed team members to move quickly past the initial stages of team development and begin working together effectively quickly. Social networking with experts outside the team also allowed information to be obtained and assimilated through the outside speakers and "lifelines" (experts in a particular area of Pb-Free) that could be called upon for information or advice on specific key issues.

Knowledge Management

The LFMP Phase 1 was a complex undertaking with a large amount of knowledge and data to be presented, discussed and assimilated. The effective management of knowledge during the two weeks was accomplished in several ways.

- **Outside Presentations & Review**

Industry forum presenters were selected to provide useful, and in some cases, provocative information for the SMEs. Following each day of presentations a review session was held to discuss the presentations and highlight what one of the co-leaders called "aha" or "hmm" reactions. That is, were there insights or thought-provoking aspects of a particular presentation that might have implications for Pb-free electronics manufacturing? These follow-up sessions were lively and gave SMEs an opportunity to discuss their own views and thoughts on the same topic, to indicate that something new had been learned, or to agree that much more data was needed.

- **Tag-up Sessions**

Tag-up sessions were held at the end of each day to review progress, outstanding technical or team process issues, scheduling issues and any other topics that might come up. These sessions often included the exchange of information or a discussion of process issues that helped all SMEs to stay on schedule and understand the perspective that other sub-teams were taking with respect to particular issues.

- **Tacit knowledge exchange**

Much of the knowledge about Pb-Free is not codified, but resides with SMEs. This tacit knowledge was exchanged through Industry Forum presentations, SME team discussions, and discussions within and between sub-teams.

- **Storyboarding and Posting**

Storyboards provided a concise way of presenting information and allowing the review and comments of all SMEs. Once storyboards were completed actual text and visual material was posted for review and comment and allowed all SMEs to track the progress of each sub-team.

- **Co-leader Review and Feedback**

The co-leaders provided continual feedback during the two weeks and added additional thoughts and information. Co-leaders were able to take a broader and integrated perspective by reviewing the progress of all sub-teams and providing feedback to sub-teams and the full SME team in general sessions.

Effective Collaboration

The larger team was able to collaborate effectively in the early stages of the project by adhering to the code of conduct and engaging in constructive conflict. Ground rules were generally followed, with occasional reminders about hand-raising and use of the three-knock rule. Sub-teams also functioned effectively and the sub-teams met with one another to discuss interdependencies

[1] *Lynn, G., Reilly, R. (2002). Blockbusters: Developing Award-Winning New Products, Harper-Collins.*
[2] *Mathieu, J., Heffner, T., Goodwin, G., Cannon-Bowers, J., Salas, E. (2005). Scaling the quality of teammates' mental models: Equifinality and normative comparisons. Journal of Organizational Behavior, 26, 37-56.*

and ensure that issues were being handled consistently. Conflict during the sessions was always about the task or the process and never about individuals. As one of the SMEs remarked on the last day of the project "nobody's ego got in the way and nobody came with an agenda". The sub-teams interfaced effectively and helped one another when it was appropriate, even writing specific sections for another sub-team in some cases.

One important feature of the LFMP was the co-location for two weeks of all team members. This provided fertile ground and a contributing environment for the exchange of tacit knowledge between team members that would have been otherwise difficult or impossible without collocation. The use of outlines and storyboarding promoted collaboration as it allowed all sub-teams to understand what was being covered, where there might be overlap, where there were inconsistencies, where there might be a need for cross-team collaboration, and where there might be gaps in what was covered. In addition, most team members were housed in the same hotel, allowing off-line discussions and relationship building that helped the team to continue to work together effectively. This was further enhanced by nighttime team-building activities (an evening dinner, a major league baseball game and a dinner cruise) during which the team was able to relax and share some fun time together.

Structured Development Process

A structured development process enabled the team to quickly engage in their task within a common framework. The process began with a template for the reports which was then turned into outlines by the sub-teams. Following the development and review of outlines the sub-teams developed storyboards which addressed specific elements of their report. Finally, storyboards were turned into draft reports. As noted, an important element of the process was the posting of material at each step. This allowed feedback, coordination, identification of overlap or other issues that needed to be addressed. One other element of the process that should be mentioned is a hard deadline for completing the drafts imposed by the co-leaders with a well-defined schedule. The deadline served to mobilize and focus the efforts of the team and made keeping on schedule essential. Specific milestones were used by sub-teams and the co-leaders to monitor progress.

Effective Supporting Technology

Supporting technology was used to help the team achieve its goals in several ways. First, most outside speakers were not on-site so Web-enabling technology and teleconferencing equipment was used to allow speakers to present information and dialogue with the LFMP SMEs. Second, all SMEs had access to the internet which allowed them to search for information and communicate via email with other experts. A local FTP site was set up so that sub-teams, co-leaders and individuals could both upload and download documents as they were prepared. In addition, resource materials were uploaded and resided on the FTP site so that they could be used by SMEs at any time. Breakout rooms had wireless connections and projectors so that sub-teams could share focus on material as it was being developed.

...the seven principles described here – Clarity of Vision, Leadership, Team Selection, Knowledge Management, Effective Collaboration, a Structured Development Process and Effective Supporting Technology – should be followed to ensure a high performing team and a successful project outcome when leading experts are brought together for a focused, collaborative effort.

Conclusions

The LFMP was an unusual project in several respects. It brought together leading experts, drawn from multiple organizations, in a specific area of technology, it used a structured process and resulted in an end-product in a short time span, hence the analogy to the Manhattan Project. The LFMP Phase 1 is an example of a project that could be replicated for other technical areas. As such, it represents a best practice for bringing together experts to focus on a problem and produce a useful outcome in a short time frame. It is suggested that the seven principles described here – Clarity of Vision, Leadership, Team Selection, Knowledge Management, Effective Collaboration, a Structured Development Process and Effective Supporting Technology – should be followed to ensure a high performing team and a successful project outcome when leading experts are brought together for a focused, collaborative effort. ■

About the Author:

Richard R. Reilly (rreilly@stevens.edu) is Emeritus Professor in the Howe School of Technology Management. Before joining Stevens, Dr. Reilly was a research psychologist for Bell Laboratories, the Educational Testing Service and AT&T. He has been a consultant to Fortune 500 and governmental organizations on issues related to organizational performance. He is on the Editorial Board of Personnel Psychology and the International Journal of e-Collaboration, serves on the advisory board of the Institute for Innovation and Information Productivity, and is a Technical Advisor to the Office of Naval Research ManTech Center of Excellence. He has co-authored four books and over 70 publications related to organizational behavior and project and team performance. He holds the Ph.D. in Organizational Psychology from the University of Tennessee.

HSATM

HOWE SCHOOL ALLIANCE FOR TECHNOLOGY MANAGEMENT

INFORMATION AND UPCOMING EVENTS

Combined Roundtable and HSATM Advisory Board Meeting

November 18, 11:30 AM - 4:30 PM, Babbio Center, Fourth floor, Room 430
Stevens Institute of Technology, Hoboken, NJ

The 2009 HSATM Advisory Board meeting will take place on Wednesday, November 18 from 12:30-1:30 PM, followed immediately by the November Roundtable meeting. A networking buffet luncheon will be served from 11:30-12:30. All attendees are encouraged to attend both the Advisory Board and the Roundtable and to partake of the luncheon.

The Advisory Board meeting is devoted to a brief review of HSATM activities for 2009 and a discussion of plans for 2010. At the Roundtable meeting, from 1:45-4:30 PM, four Howe School faculty members will present selected research findings and discuss potential business implications. This meeting with faculty has become a tradition at the November Roundtables and always makes for very stimulating sessions.

Dress code is business casual. For further information and to confirm your attendance, please contact Sharen Glennon (sharen.glennon@stevens.edu or 201-216-5381).

HSATM Research Grants Awarded for 2009

Two seed research grants have been awarded for 2009, in the amount of $10,000 each: Tal Ben-Zvi and Don Lombardi for their proposal titled "Network Evolution: The Dynamics of Social Structure and Its Impact on Technology Management", and Carol Brown and Kevin Ryan for their proposal titled "Mobile Technologies as Healthcare Delivery Innovations".

Five proposals were received, which were reviewed by three Howe School senior faculty members and representatives of seven HSATM Partner organizations. We thank all faculty members who submitted proposals and those who served as reviewers, and of course the HSATM Partners for their generous and continued support which makes the grants possible.

With these latest grants, HSATM has contributed a total of $275,000 for faculty seed research projects over the past 12 years. This funding has generated considerable additional funds in subsequent external awards based on results of the seed grants, thus providing an important vehicle for advancing faculty research.

INFORMATION

For further information on HSATM activities or to submit an article, contact Dr. Lawrence Gastwirt at **212-794-3637 • Lawrence.Gastwirt@stevens.edu**

Visit the HSATM website: **http://howe.stevens.edu/HSATM**

To download articles from past issues: **http://howe.stevens.edu/HSATM/Newsletters**

Wesley J. Howe School of Technology Management
Stevens Institute of Technology, 1 Castle Point on Hudson, Hoboken, New Jersey 07030

Sharen Glennon 201-216-5381 or Sharen.Glennon@stevens.edu

STEVENS Institute of Technology