Cultivating an Adaptive U.S. Marine Corps Enterprise through Rapid Development and Sustainment

White Paper

June 2016

Submitted to:
Headquarters Marine Corps
Deputy Commandant, Installation & Logistics (LP)
Headquarters Marine Corps
Washington, DC 22203

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The Problem of Time

Currently, the Department of Defense (DoD) employs an integrated, joint-service acquisition system in an effort to capture, manage and deliver capabilities responding to war-fighter requirements. In seeking to process service requirements through one integrated acquisition process, the DoD eliminates funding redundancies across services branches. However, the glaring problem in using the joint Acquisition System as a replacement to specific service-branch acquisition processes is that each branch can no longer effectively advocate for their specific end-user requirements — they must compete for vital support. Because this process collectively considers its service branches, unique service functions, cultures and requirements fail to be accurately reflected in the delivery of capabilities. Furthermore, capabilities acquired *en mass* often demand intense investment of time and resources, which produces a highly competitive atmosphere for vetting requirements producing the greatest benefit for the greatest number.

As an expeditionary "force in readiness", the US Marine Corps acts as first responders in the face of national crises. Like paramedics responding to the scene of an accident, Marine units deploy rapidly into a variety of volatile environments, often leading the way for other service responders: they go in, apply the tourniquet, suppress the bleeding, transition the patient to the hospital, and then ready themselves for the next call. Necessarily, the needs of the Marine war-fighter differ from those of other service branches, and this is reflected in both Marine training and culture. However, despite being the "smallest service with the greatest bang for its buck" within the DoD, the USMC struggles to align tomorrow's joint capabilities to today's war-fighting requirements. Even with the milestone short-cuts within the integrated Defense Acquisition System that allow for the rapid procurement of existing capabilities from industry, the delivery of capabilities to the deployed war-fighter significantly fail to meet USMC needs for both relevance and timeliness.

The Marine Corps requires an immediate, adaptive capability supporting robust and continuous innovation aligned to each deployment cycle. This white paper presents an overview of the process of innovation, its purpose and necessity for long-term competitive advantage, and its organizational support requirements for sustained innovation. We then lend this context to assess the relevance of a recent study recommending the adoption of the rapid, continuous innovation cycle of Hendrick Motorsports (HMS) as a business-process framework supporting USMC enterprise readiness. Using the analogy of the NASCAR race-cycle tied to the USMC deployment-cycle, this study demonstrates that incorporating a linear, networked decision-making, collaborative framework into the USMC organization will support capability life-cycle sustainment, bringing significant immediate benefit to deployed war-fighters and to the Marine Corps enterprise. Further, we propose that by releasing solution prototypes aligned to each next-deployment, the Marine Corps will generate and test new knowledge supporting future defense acquisition benefiting all service branches, and lending significantly to sustained global war-fighting advantage.

Defining Innovation

What is innovation? What does innovation mean to the sustainment of an organization?

According to Jack Morton, of the once megalithic Bell Telephone Labs, technological innovation is the **keystone** to economic productivity (1971). As a social process, innovation improves societal standards-of-living by increasing national economic productivity. As an organizational process, innovation mobilizes knowledge and technical skills, generating competitive, strategic advantages (Tidd et al., 1997). Simply stated, innovation refers to a systematized process of change, coupled with the purpose of producing improvements. Because market pressures continually select for adaptive products and services that meet ever-shifting social and demographic needs, organizations achieve sustainable growth through continual, responsive innovation. Through purpose-driven innovation, organizations contribute significant benefits that improve individuals, organizations and societies.

In the emerging knowledge society, business enterprises are becoming knowledge-processing organizations (Zand, 1981). The post-modern economic shift from the industrial- to the knowledge-based society means that organizations face new pressures not only to acquire and generate new knowledge, but to effectively process existing knowledge into products and services. And, in the digital age, there are more bytes and bits of information that require processing than ever before. Innovation both consumes and deploys knowledge in the form of both tangible and intangible products and outcomes. Therefore, innovation is an essential business process for managing sustainable growth (Tidd et al., 1997). Through the mobilization of knowledge, organizations acquire competitive advantages. The specific strategic advantages gained for the organization, however, depend upon the method of innovation employed.

In Managing Innovation, Tidd and associates identify five specific modes of innovation, each tied to specific advantages. Novel innovations generate new products, services or processes, while competence-shifting innovations generate new industries. Innovation complexity keeps entry-barriers high by making technical knowledge difficult to acquire, and continuous incremental innovation continually shifts the cost/performance threshold against the new frontier. Finally, robust design stretches product or process life-cycles over extended timelines, reducing overall costs of acquisition. For each of these types of innovation, products, processes, or both may be innovated at different either systems or component levels. System-level innovation occurs less frequently with great impacts, while component-level innovation is less far-reaching and with lower risks. Similarly, sustained incremental change produces greater cumulative gains in efficiency than does occasional radical change over time.

Sustaining Innovation

What threatens innovation? How might the processes of innovation be revived and sustained? Writing in 1971, at the plinth of Bell Telephone Laboratories' power as a systematized research facility, Jack Morton, Vice President of Electronics Technology — known best for leading the team responsible for developing the newly invented transistor for mass distribution— published his perspective, Organizing for Innovation, which uses Bell Labs as a case-study for understanding the management needs for supporting innovation. Recognizing innovation as an engine for processing knowledge and information, Morton also recognizes the importance of interpersonal collaborative communication in joining together specialized knowledge for a common purpose. According to Morton, the central challenges that an organization must overcome in order to support innovation are total autonomy and isolation. Citing Bell Labs as a case study of one organization's successful mediation of these obstacles, Morton proposes the use of complementary bonds and barriers within the organizational framework that permit constructive dialogue, prevent destructive domination and optimize the flow of information across the enterprise.

Similarly, in a roundtable discussion at the University of Virginia, experts Rob Cross, Andrew Hargadon and Salvatore Parise identify three specific obstacles to effective innovation networks: (1) fragmentation; (2) domination; and (3) insularity. For Cross and associates, the key factor driving efficient innovation is the creation and sustainment of effective networks. As with Morton and Drucker, Cross recognizes innovation as a "flow of knowledge and capabilities into and across an organization" (2009). According to Cross, innovative breakthroughs are re-combinations of existing ideas or technologies, integrated through informal networks. The key to successful innovation within an organization, then, is through the mobilization of purposeful networks of relevant and diverse expertise. Most failures to innovate effectively and efficiently can often be traced back to two categories of network problems: (1) the inability to exploit existing expertise and networks; and (2) the inability to drive change through those networks. To avoid these failures, an organization must support the networked communication, collaboration and culture of their innovation process.

Both Cross and Morton recognize several challenges that undermine an organization's ability to adapt to

change through innovation. Together, these perspectives illuminate three necessary ingredients sustaining innovation: direct communication, networked collaboration and supportive cultures. As products and services compete for market resources, the complexity of innovation also increases, demanding reduced deployment cycles and leaner budgets to achieve ever greater results. To maintain a competitive edge, innovation efforts must bring together a depth and breadth of both internal and external expertise quickly and effectively. For this discussion, we define collaboration as the networked system of people and ideas, communication as the direct, linear channel of thought bridging end-users to the organization's global purpose. Finally, we define culture as the umbrella that reinforces the processes supporting (or suppressing) innovation.

Communication

Innovation requires two axes of direct communication: one horizontal, which bridges end-user needs to the manufacturing process; and one vertical, which aligns the organization's development capacity with the overarching strategic purpose. In the first channel, knowledge of the consumer is processed into products, processes and/or services relevant to the consumer. The second assures technological resonance with organizational objectives by bridging research and development (R&D) to strategy, and strategy back to technological innovation. Innovation processes must continually assess these communication channels for blockages that might give rise to fragmentation—Cross' first obstacle to sustained innovation.

In the market, when end-user needs are disconnected from the development of products and services, companies fail to compete. When the research is not aligned to the organization's purpose, research spending loses relevance to operations. Reciprocally, when corporations fail to leverage the potential relevance of technological developments, they inevitably fail to achieve or maintain their top-market status. Knowledge of both its customers and its suppliers helps shape the organization to develop from both ends of the supply chain. Within Defense, however, fragmented communication along these axes generate far-reaching effects that compromise war-fighting ability. War-fighting capabilities are subject to the same selection pressures as understood within the global market; although these pressures occur at a much more gradual pace, their effects carry tremendous devastating potential to national security.

To combat failure along these communication axes, Cross and associates identify two practices with which organizations can drive innovation through networks: (1) create a network-centric ability to sense and respond to new opportunities; and (2) develop an ability to rapidly test/refine an opportunity rather than get caught in grid-lock. Organizations can ensure relevancy to end-user needs by listening and adapting to the unanticipated consumer needs. Rapid prototyping ties manufacturing and development as immediate responses to consumer feedback, and enables further refinement and testing of a problem along scientific methods. Furthermore, rapid prototyping ensures that the internal discoveries of opportunities are not lost in bureaucratic procedure, but fielded for relevancy to consumers. Together, these practices support the development of new, competitive opportunities relevant both to the consumer and to the organization's strategic purpose.

Collaboration

As a process of information and knowledge flow, innovation requires mobile networks of relevant expertise distributed throughout an organization (Cross et al.). However, both the efficacy of these networks and the efficiency of innovation depend upon specific patterns of collaboration that support innovation. Several factors emerge as critical to the creation and maintenance of functional networks supporting collaboration. In Organizing for Innovation, Morton identifies interpersonal dialogue as an essential component supporting the inter-organizational collaboration necessary for innovation. In Managing for Innovation, Tidd et al. identify several trade-offs that make external collaboration via strategic alliances and coalitions both desirable and faulty.

Interpersonal communication is influenced by several factors, which include: language, space, movement of people, organizational structure, technology, and motivation. For example, when CEO Marissa Mayer announced the end of Yahoo's work-remote policy in 2013, she was resolving the factor of space. Distribution produces drag on team collaboration, she reasoned in an interview with Steven Levy of Wired:

> *"People are more productive when they're alone. But they're more collaborative and innovative when they're together. Some of the best ideas come from pulling two different ideas together" (FORA.tv, 2013).*

While this shift in policy represents as specific solution to a specific organizations problem, it nevertheless exemplifies both the significance of collaboration to the

process of innovation, and the need to for innovative organizations to manage specific organizational factors to support internal collaboration.

In addition to the need to manage internal-team collaborations, organizations must manage collaborative alliances external to the organization. Unlike the megalithic corporations of the 1970s and 80s, who's seemingly endless funding allowed for a systematized development of in-house technological experts, the modern organization must instead form integrated knowledge networks across a variety of scientific, engineering and technical fields. If innovation arises from the interplay of a diverse range of expert interactions, the organization's ability to access and harness external expertise in the service of its purpose is vital. External collaborations help to reduce the time, costs and risks of development while helping to achieve scale economies in production (Tidd et. al.). However, forging external partnerships is not without risk.

In Managing for innovation (1997), Tidd et al., identify several forms of external collaboration, which include: subcontracting, technology licensing, research consortia, strategic alliances, joint ventures and innovation networks. Of these, each carry specific benefits and risks to the motivations driving the need for alliance. For instance, in seeking to acquire or integrate new technological capabilities, an organization might pursue technology licensing as a strategy. This strategy lowers the risks, costs and time-scales associated with in-house development. However, for all these benefits, an organization trades its rights to ownership, and with that, the control of quality, cost and distribution. Many organizations, therefore, choose a specific strategy for approaching trade-off in acquiring external technologies or expertise, which is then reinforced by its corporate culture.

Culture

According to analyst Dale E. Zand, different organizational structures may exist concurrently, enabling enterprises to solve problems of varying complexity. In Information, Organization, and Power, Zand identifies two organizational structures that work well when coupled to specific types of problems: the authority/production-centered mode, and the knowledge/problem-centered mode (1981). For well-defined problems requiring routine work, the authority/production mode works best to mobilize people and equipment, and to maximizing output of finished products or services. Together, the well-defined problem and authority/production mode produce more output, more rapidly. By rejecting unsolicited innovation that may distract from the output, authority/production mode sustains organizational efficiency.

For ill-defined problems, however, the authority/production mode tends to push problems into pre-existing frameworks, regardless of their fit. In contrast, the knowledge/problem-centered mode is well-suited for the non-routinized work of ill-defined problems. Additionally, the knowledge/problem-centered mode easily shifts into the formal authority/production mode as problems become increasingly well-defined. In this organizational structure, knowledge is either processed or invented in order to solve ill-defined problems, devising better quality solutions more rapidly. Innovations to improve an organization's productivity are readily accepted. Whereas the solution focus for well-defined problems is on efficiency, here, the focus is on efficacy.

Within formal structures of organizations, studies reveal a tendency of the dominant, authoritative culture to not only reject, but to suppress departures to hierarchical, traditional processes. However, the culture necessary to support the adaptive innovation so vital to an organization's sustainable growth is one that must be unbound from the constraints of tradition and authority. One culture need not exclude the other — indeed, cannot — if the organization is to sustain a competitive edge. Traditional hierarchical modes support organizational efficiency, and the heightened efficacy of solutions gained by innovative teams support organizational adaptivity. Together, these modes may coexist as parallel organizational structures supporting a single, responsive enterprise.

The Race Analogy

As an adaptive enterprise, Hendrick Motorsports orients its business processes around one objective: to win. To this objective, Hendrick has developed a heightened capacity to sense and respond to unknowable change in variable environments. A recent study conducted by BMO Logistics and United Global Group for the National Center for Manufacturing Sciences assesses key differences between current USMC business processes and an industry example, which supports rapid innovation (Paige and Persely, 2016). Together, they assess the combination of features comprising the Hendrick Motorsports (HMS) strategy that lend to their dominance in the sport of NASCAR racing. Using the analogy of the NASCAR race-cycle tied to the USMC deployment-cycle, this study proposes that integrating a linear, team-oriented, de-centralized decision-making innovation framework into the USMC organization will

bring significant benefit to deployed war-fighters and to the Marine Corps enterprise.

Within this comparative assessment, key observations highlight Hendrick's capacities supporting proactive life-cycle sustainment of their race capabilities. First, HMS supports direct communication between engineers, maintainers, drivers and team leaders. Second, data-system integration across the organization enables the collaborative networking of information at all levels. Hendrick's capacities both for robust modelling and simulation, and for continuous innovation depend upon the integration of mass aggregates of disparate information through a single cloud-based platform. Third, HMS centers its culture around one motto: win each race. To sustain a "winning" culture, HMS empowers its team managers to make rapid, de-centralized, data-driven decisions in alignment with this strategy.

Communication. According to Paige and Persely, Hendrick Motorsports' business processes support "constant communication at all levels". For each stage in the race-deployment cycle, direct communication channels within each race team ensure the open flow of information across the entire organization. First, the Race Team Manager (RTM) integrates the Crew Chief's input within the next-race strategy. Configuration decisions then flow to the Car Chief and technicians. Next, the driver provides his feedback to the Crew Chief on the upcoming-race strategy. The Crew Chief assess the driver feedback and engineer-team analytics and sends an updated strategy to the Pit Crew. During the race, driver feedback continues to inform the Pit Crew. According to recently retired DuPont driver, Jeff Gordon,

> *"Really, my job to communicate is probably the most important thing. Because what I've got to do is send a message from the race car and the race track back to the team so that they can make the proper adjustments" (Williamson, 1999).*

The Pit Crew receives driver feedback while continually assessing vehicle and team performance against the strategy. Finally, post-race discussions between the Pit Crew Coach and the Crew Chief analyze the wins/losses, informing the next-race strategy. This constant communication feedback-loop proves vital to the continuous innovation process fueling this champion-level organization.

Collaboration. In 2002, Hendrick Motorsports experienced the most spectacular, devastating engine failure in its history when six engines died mid-race at the Talladega Superspeedway (Daniel, 2008). Although the race team captured "lessons learned" at the end of the race event, they were then subsequently lost, along with their potential future-value. At the time, the organization's vast amount of information was spread out across 25 physical servers, over 100 virtual servers, nine buildings and a 70-acre campus (Siemens, 2012). In 2003, HMS initiated an effort to harness disparate volumes of CAD models, CAM programs, digital simulation results, engine dynamometer data, chassis dynamometer data, wind-tunnel data, track test results, and marketing and licensing materials under one, holistic cloud-based Product Lifecycle Management platform (2012). Through various software applications, HMS now collects, manages and processes its once insulated data into readily accessible, organized information throughout the enterprise.

Paige and Persely observe the integral role of Hendrick's disciplined data-collection process and its comprehensive master-data management system to sustaining competitive configuration management and robust innovation processes. At HMS, the collection of data is overseen by appointed engineering and operations experts. The collected data serves specific purposes, and is stored regardless of its present-day value. Once collected, the data is immediate integrated into a comprehensive data management process, where it is managed and stored in a scalable data repository for future consumption. There, a Google-like search puts authoritative data into the hands of engineers, coaches and business operators. For HMS, the centralized data repository bridges spacial and temporal gaps that otherwise forestall the process of innovation.

Culture. Both communication and collaboration are culturally ingrained within Hendrick Motorsports—the organization expects the continuous, open flow of information throughout the enterprise, regardless of the situation. HMS employs an adaptive, team-level decision-making process oriented to its central mission: winning races. Open communication channels and accessible, expert-owned data facilitate this non-hierarchical organizational mode of informed decision-making. What more, the team-oriented mentality contributes to their winning culture. As DuPont Crew Chief and Team Manager Ray Evernham describes,

> *"We're all spark plugs. If one doesn't fire just right, we can't win the race. So, no matter whether you are the guy that's doing the fabricating or changing tires on Sundays and that's the only job responsibility you have, if you don't do your job, then we're not going to win. And, no one is more or less important than you are" (Williamson, 1999).*

HMS invests significantly in improving the relevant skills and knowledge within the race team. The skills and knowledge of every member are crucial to the continuous improvement of their high-performing equipment.

Sustaining the Marine Corps

Much like Hendrick Motorsports, the US Marine Corps must sense and respond to rapidly shifting factors in variable environments. Unlike HMS, however, the USMC requires life-cycle management for a larger density of in-service ground equipment than does Hendrick. Additionally, the USMC lacks a direct communication channel connecting integrating end-user requirements into logistics and technical capabilities. To communicate lessons learned, operators and maintainers must submit ideas and requests either locally, up the formal chain-of-command, or at Headquarters for maturation through the Defense Acquisition System (Paige and Persely, 2016). Whereas Hendricks maintains a process of continuous innovation and life-cycle sustainment, the USMC system responds to end-user and strategic requires at a much slower pace — instead of sustainment through robust design, potential Marine Corps solutions require multiple years to mature, if they are approved at all. Furthermore, the lack of networked knowledge throughout the organization encourages a culture of domination, where communities are fragmented and improvement efforts remain isolated.

Like Hendrick Motorsports, the Marine Corps must rally around a single focus aligned to the organization's strategy: to be a force in readiness. Furthermore, the practices that apply to Hendrick Motorsports lend themselves as a corresponding model for USMC management of in-service ground equipment. To evolve its capacity to sense and respond, the Marine Corps must shift its industrial-model constraints of an efficiency-oriented organization and emerge as an Adaptive Enterprise, better able to respond to unanticipated change. To do this, the Corps must evolve innovation-supporting business processes that not only support robust and continuous innovation, but also protect against fragmentation, insularity and domination. The USMC requires an immediate, adaptive capability supporting robust design and continuous innovation aligned to each deployment cycle. Through a collateral business process of robust and continuous sustainment, the USMC will generate an internal ability to rapidly transform war-fighter requirements into immediate capabilities, while also supporting existing capabilities as end-user requirements shift over time. Further, by releasing solution prototypes in alignment with each next-deployment, the Marine Corps will generate tested knowledge to inform the joint-capability acquisition of capabilities supporting all of the Defense service branches.

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