Situated Collaborative Problem Solving

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The U.S. Defense Information and Analysis Centers are promulgating Technology Domain Awareness (TDA) as a framework to re-examine the relationship between government, industry, and academe and to propel it into the future [1]. The intent of TDA is to realize untapped potential for National Defense by crossing historical boundaries within and between these sectors. This open innovation can be addressed by utilizing processes that are at once agile and accessible to system-of-systems development and that, as such, have proven successful in recent experience with rapid acquisition. These lessons learned then can be made accessible to broader communities that can use them to self-organize remotely around a shared purpose. Open innovation would be an outcome of collective intelligence in these intentional communities without necessarily being an objective. The collaboration would be as selective as it is open because of the vetting that occurs naturally, if not by definition, in an intentional community. This selectivity within a broader range of participants will be essential in developing a broader Defense Innovation Base. This article describes some of the community processes we have utilized for selective open innovation. While applied to counterinsurgency operations, they generalize far beyond military situations.

Abstraction in a Generalizable Enterprise Architecture

Self-organization is an uncomfortable concept in the context of urgent needs for development of new or improved capabilities. How can we be assured that we will get a return on an investment in innovation if we don't know whom all the key participants will be? As demonstrated in the Global War on Terror since 9-11, conditions can be created to foster contributions from nontraditional sources and the attendant hybrid vigor that is auspicious for innovation [2, 3]. As in natural ecosystems, diversity and interdependence assures change from the status quo ante when there are new selective pressures [4]. The question for socio-technical ecosystems becomes how we create conditions that impose the right kind of selective pressures. Can we create socio-technical ecosystems that assure high-value innovation without a priori knowledge of what those innovations will be?

Observation of selective pressures in an ecosystem, or cause-effect relationships in any system of systems, reveals controllable conditions on relatively long time scales that constrain behavior of component systems without prescribing particular actions of those component systems on relatively short time scales. Awareness of stability limits and constraints on stabilizability can actually liberate systems to wander, explore, and experiment. Adaptive systems utilize such contextual information to ensure that emerging patterns of behavior are stabilizable and associated outcomes are bounded [5]. Adaptability thus depends on the availability and salience of information about constraints on behavior, in a sense, the fit between a system and its surroundings. As adaptive systems, communities can be both innovative and trustworthy to the extent that they are guided by information about critical constrains of the ecosystem in which they are embedded [6]. To ensure the availability and salience of such information, we need an ontology that describes the most important causal relationships within an ecosystem at various levels of analysis and from a variety of perspectives. Ontology logically precedes and guides epistemology.

The Federal Enterprise Architecture [7, 8] is a good starting point for designing trustworthy self-organization and innovation because it has evolved to help complex enterprises organize and operate through the loose coupling provided by information systems [9]. Architecture focuses attention on interactions in a system of systems at various levels of detail and scope. It thus facilitates integration and de-confliction of enterprise operations. Additionally, architecture enables rigorous evaluation of the enterprise with respect to its intended functions and the assumptions about cause-effect relationships in the enterprise. It reveals the contribution of various parts of an enterprise to the value provided by and throughout the enterprise. Thus it is invaluable in both verification and validation of an enterprise's system of systems.

The framework of the Federal Enterprise Architecture fits nicely with an analytical construct that has been utilized to understand means-end relationships in complex systems comprised of both people and technology (i.e., sociotechnical systems). The construct is referred to as an *abstraction hierarchy* [10, 11]. Complexity is captured in an abstraction hierarchy by recognizing that there are interrelated kinds of observables within a system that differ with respect to levels of abstraction. More abstract levels of the system generally refer to purposes and functions while lower levels typically refer to physical implementation [12]. In the context of an enterprise, levels of abstraction correspond rather directly to the levels in the Federal Enterprise Architecture. Five levels commonly are utilized in an abstraction hierarchy: (a) functional purpose, (b) abstract function, (c) generalized function, (d) physical function, and (e) physical form.

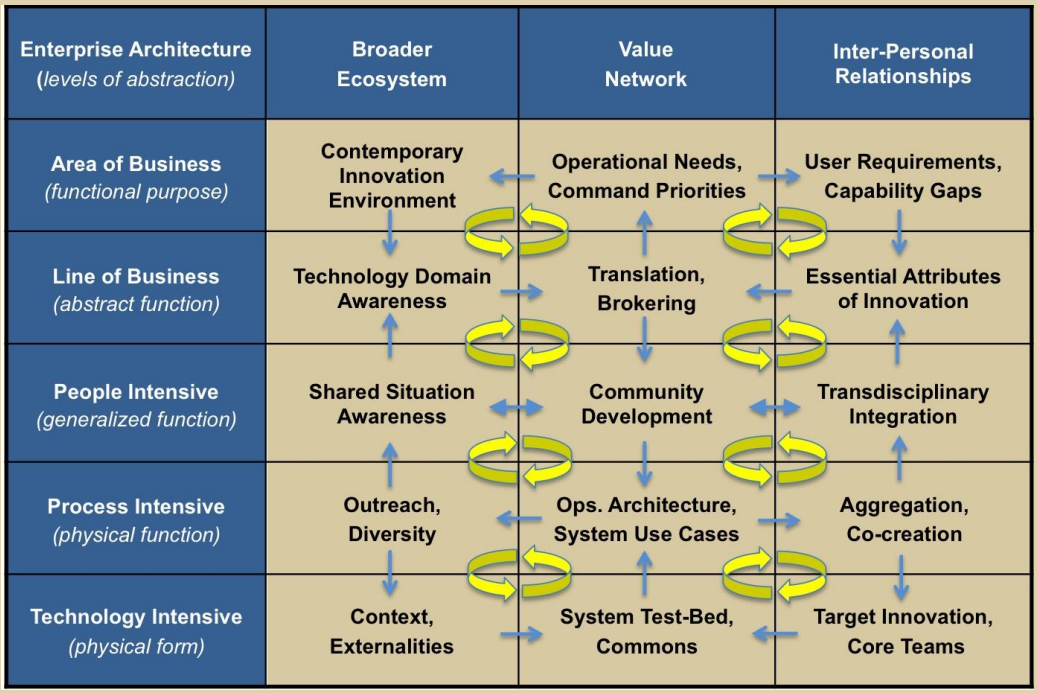

Figure 1. Different levels of detail and scope (columns) considered with different ways of thinking (rows) about an enterprise reveal means-end relationships that are observable and controllable. Arrows indicate predominant directions of influence.

An essential attribute of the abstraction hierarchy is the conceptual separation of levels of abstraction and decomposition that often are conflated in stack-based architectures. Levels of decomposition are represented as columns in a matrix while levels of abstraction are represented as rows. The columns represent part-whole distinctions. An important property of both rows and columns in the abstraction hierarchy is that they indicate how aspects of an enterprise are constrained from both conceptually supra-ordinate and subordinate factors. This enables a form

of constraint-based reasoning that helps manage complexity in complex systems [13, 14]. Constraints implicit in the relationships among rows and columns become the primary observables and associated exigencies for action.

The assumptions about means-end relations in an intentional community for TDA are presented in Figure 1. The top level (row) in the hierarchy addresses the needs and context for innovation in the DoD. While the demand side is potent throughout the hierarchy, the top row is where it dominates because it is where the value proposition is validated. The second level reveals the opportunities for innovation by addressing capability gaps and shortcomings through new relationships between supply and demand. The middle level focuses on expeditions that enable a community of shared purpose to organize around capabilities that are particularly in need of innovation. This is the most fundamental level in the hierarchy because it is where top-down strategic constraints and bottom-up tactical constraints converge to provide rich guidance for co-creation driven by well-defined problems with markers of near-term success and meaningful long-term outcomes.

Lower levels in the hierarchy support the middle level in that they make action possible in response to higher intent. The fourth level, for example, describes relevant processes for collective intelligence and co-creation in diverse communities of practice. Simultaneously, the lowest level inventories tools, devices, systems, and physical context that can be utilized in co-creation. Examples of these lower levels in the hierarchy are described below. The reveal ways innovation can be grounded in replicable methods and conditions in which intentional communities operate. This is *situated collaborative problem solving* that develops communities as much as it spawns innovation.

The levels of decomposition in the abstraction hierarchy (columns) also are noteworthy. The lowest level of decomposition (rightmost column) represents working groups and stakeholders who are formally associated with integration and development of a particular capability. In a sense, this is the status quo of technology development. The leftmost column represents all niches in government, industry, and academe that are involved in development or use of capabilities that are relevant to a particular capability defined in the rightmost column. The challenge is in getting the insiders and outsiders to discover each other and to trust each other with a shared commitment of time and energy. The middle column represents this commitment, an intentional community that crosses organizational boundaries. The juxtaposition of columns defines an expedition: a reason to venture into a new domain in search of a particular resource while being open to the discovery of unexpected resources.

As with the middle level of abstraction, the middle level of decomposition is a fundamental level of analysis. It is where expeditionary communities self-organize around shared interpretations of higher intent that are revealed through situated collaborative problem solving by people who typically would not collaborate or even know about each other. The complex set of cause-effect relations in this self-organization are represented by arrows in the table. Observation and control of the enterprise is simplified by focusing on influences between adjacent levels of abstraction and decomposition. While influences generally are reciprocal throughout the abstraction hierarchy, the arrowheads represent the primary direction of influence. Accordingly, one can trace and manage the most important flows of thought and action within an enterprise. This enables collaboration and co-creation to be replicable, generalizable, and available to peer review.

People, Processes, and Tools

People must be separated from processes and tools to some degree to guide analysis, design, development, implementation, and evaluation in an enterprise. At the same time, they cannot and should not be separated completely because they come together in function and in outcomes. The interdependence of people with processes and tools is bi-directional. People come together in intentional communities for a purpose. Processes and tools help them pursue those purposes in tangible activities whether those activities are explicitly collaborative or not. Collaboration and co-creation are an inescapable means to the end of technology awareness across domains of government service (e.g., different service components, Defense vice other government organizations) as well as between government and commercial sectors and within the commercial sector (e.g., historical industry verticals, industry vice academe). Thus there is a downward flow of needs for processes and tools that support the superordinate intent for collective intelligence across domains.

There also is an upward flow of means-end relationships from processes and tools to communities. A commitment to certain kinds of processes and tools (i.e., methods) can stimulate and guide the organization of communities for which those methods instantiate common values. To be more specific, consider scientific communities. Communities are essential aspects of science [15-17]. Science and the communities that are necessary to its practice are more fundamental than the individuals who participate in them. Individual scientists and stakeholders come and go, even their results and conclusions can be ephemeral, but subjects and methods of inquiry endure over much longer periods of time. Individuals are drawn to the subjects and methods of science as they become scientists or otherwise come to participate in the scientific community. Particular communities develop new subjects and methods of inquiry but, more fundamentally, scientific communities are derivatives of the shared values implicit in particular subjects and methods of inquiry.

Consider, for example, the general ethical and deeply personal issues surrounding the use of animals in research. Most communities that utilize animals have strong beliefs about the appropriateness of this methodology especially when it sheds light on pernicious human health problems. Other communities arise to find alternatives such as computer modeling even if this puts them at an apparent disadvantage professionally. Sometimes the dissonance between communities transcends scientific dialectic because of the strongly held beliefs around which individuals in the communities organize. It can get quite personal.

The power of methodological commitments became apparent to many both inside and outside the scientific community through the clash between quantitative and qualitative methods in the behavioral and social sciences. The mutual antipathy was a powerful organizing force that Balkanized the scientific community for better or for worse it in the 1990s. Similarly, the romance with physics, especially in the 20th century, led to de facto cast systems and insurgencies that, to some extent, have divided the scientific community. As is often the case, the divisions have strengthened the bonds between individuals and their particular disciplines. And in every corner of the scientific community, the most vexing cultural differences derive from that variety of practices such as working at a desk within the purity of mathematics, in the laboratory diligently pursuing super-human control over nature, or in the wild with persistently humbling validity. Methodologies matter far beyond their testimony to human ingenuity and dauntlessness.

Methodologies and subject matter draw individuals into scientific communities but peer review creates a sense of belongingness. It is the primary mechanism for developing trust and trustworthiness. Trustworthiness is at the core of scientific communities and scientific progress.

There is an extensive vetting of participants in the community over significant periods of time. While this varies from discipline to discipline, it always operates through a complex weave of formal peer review and less intentional exclusivity. Jargon and obscure publication outlets make participation of outsiders exceedingly difficult. At the same time, rigorous documentation protects intellectual property to varying degrees depending on the needs of the authors as long as it survives review by individuals with similar training and experience. For all practical purposes, access to people and information is controlled. Access control also will be important in communities that cross organizational boundaries for the purpose of shared awareness and co-creation. Selectivity of such open innovation will be a make-or-break proposition for many participants in TDA. The scientific community can be a useful model for this selectivity even if the formal mechanisms of access control are different in TDA.

The vetting process within an intentional community can be facilitated by the identification of roles, that is, the reasons for participation by various people. This is a relatively time-consuming process in systems for knowledge sharing and collaboration but not with respect to purposeful scientific collaboration or in product development teams. Moreover, in project teams and their associated practices, the utilization of personnel resources typically is tied to time-dependent or situation-specific tasks that can be defined by attributes. Attributes can be used to guide access to information or people in ways that have little or nothing to do with the characteristics of a person or even the person's role [18-19]. Attribute constraints on access can be useful in keeping working groups to manageable sizes. Both roles and attributes seem necessary in formal processes for access control that can help organize and sustain communities of practice. The state-of-the-art in attribute-based access control (ABAC) and role-based access control (RBAC) is developing rapidly in information systems that support knowledge sharing communities [20-21]. These are important trends to leverage.

A Case Study: The Wolfpack Enterprise

Access control can become arbitrary or onerous to the extent there is ambiguity or intractable cross-cultural complexity in a community of practice. Taxonomies for science and engineering communities can help alleviate the potential problem. Figure 2 depicts such a framework developed for the Wolfpack Enterprise [22]. It guided both the self-organization of this multi-organizational community and access control within it during a competition-sensitive development project for the U.S. Army. It was the basis for roles of various community participants in the aggregation and co-creation of knowledge to assure transition of new capabilities to Soldiers. Potential participants were recruited, assessed, and selected based on the extent to which their competencies relate to this framework.

A framework for access control also can be the basis for in-stride training of participants with respect to their role in a new community. The relationships among roles in a highly structured community (e.g., as represented in Figure 2) can provide guidance on who should be learning from whom as well as who should be vetting whom. New participants should be vetted and trained by established participants on whom their work will have the most direct consequences and vice versa. These will be people who have the most closely related roles. They also are people with whom new participants are most likely to have pre-established relationships or with whom they are most likely to form habitual relationships.

Surprising relationships developed in the Wolfpack Enterprise because of our explicit framework for technical, operational, and programmatic diversity and the exigencies for interaction and mutual awareness that it revealed. Collaboration emerged between cost analysts and technical

SME, for example, as it became clear how their respective assumptions and work products influenced each other. Such interdependencies became a topic of conversation in the community. It increased the richness of context for the work of individuals across otherwise homogeneous small groups. The shared awareness of interdependence became a motivation to develop relationships that, in a sense, had already been created conceptually by a common context. Such opportunities otherwise may never have occurred in the professional lives of the individuals involved. Individuals initiated relationships with others, without being told to do so, even when they lived thousands of miles apart.

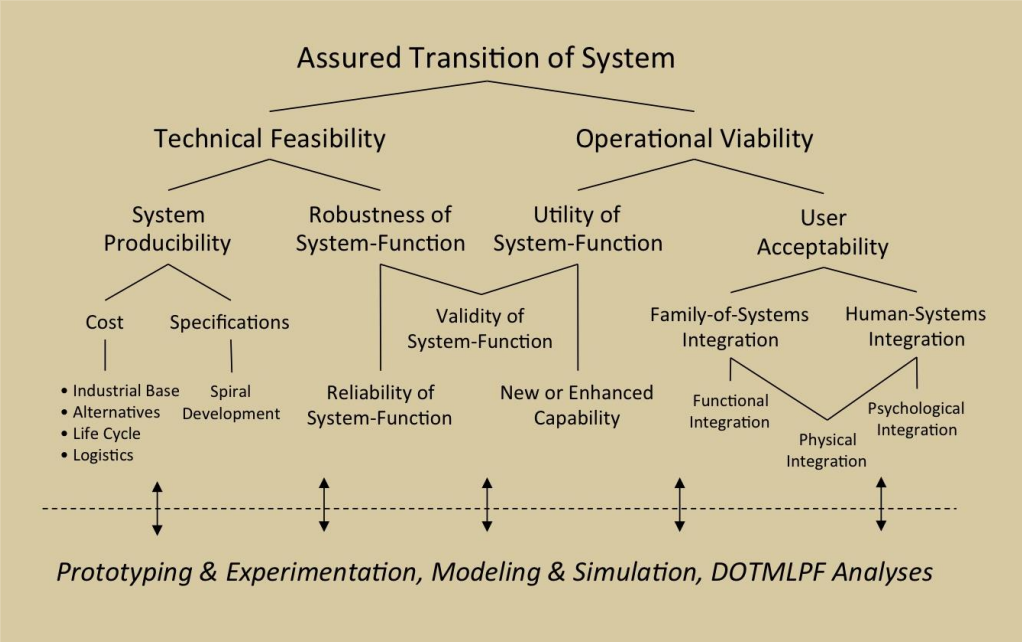

Figure 2. Partial role hierarchy for role-based access to information in an expeditionary community.

Some of the collaborative relationships had a unique and enduring impact on the professional development of individuals. In some cases, it changed the way they approached their work, and it changed the way they thought about the problems in their domain. For example, system-of-systems integration informed by operational architecture changed the design and selection of robots as both carried load and tactical resources. Momentary utility of the robots in a tactical situation, however concrete, was no longer sufficient for enthusiasm let alone for design commitments. In other self-organizing groups, cost analysts discovered that scientific abstractions enabled strategic sourcing in such a transformational way that their primary cost models came to be based on cost alternatives as opposed to some arcane convention of traditional cost analysis. Throughout the Wolfpack, the most elite operators often commented that work with scientists helped them achieve a deeper understanding of their knowledge, skills, and abilities. These were reciprocal influences and continuous two-way conversations as opposed to handoffs dictated by ordinally immutable Gantt charts and PERT charts.

The most significant influences among individuals in expeditionary communities typically occur in the juxtaposition of technical and operational issues focused by the practical constraints of funded programs. In the Wolfpack, technical-operational-programmatic (TOP) collaboration was most influential in the activities of science such as prototyping, experimentation, modeling, and simulation in which rich conversations occurred as scenarios were experienced and shared more or less in real time. We continue to increase the number and variety of ways that people can

participate in collaborative modeling and experimentation, remotely and synchronously. Science itself will be a force multiplier in the self-organization and collective intelligence of TOP working groups. Scientific methodology as well as the structure of scientific communities reveals interdependencies among groups with different roles [2, 6]. The well-established practices of scientific communities enable TDA and collaborative innovation to get to a finer grain of detail than the processes described in formal documents associated with the development of military capabilities.

Integrated Technology Search Events

In the Wolfpack Enterprise, we explicitly articulated the interdependencies among concurrent and sequential processes without comprehensively prescribing who should be coordinating with whom. Figures 3 and 4 depict this web of relationships among very different kinds of activities in the systematic development of an integrated capability for infantry squads. These relationships and activities provide a basis for determination of situation-specific need to know that can be helpful in managing access to information in a somewhat open collaboration. They lead to definition of attributes that can constrain access within and across roles to ensure that the right people get the right information at the right time. Identifying the right people is a nontrivial process with potentially transformational consequences in collaborative innovation that is open to an unusually diverse group of participants.

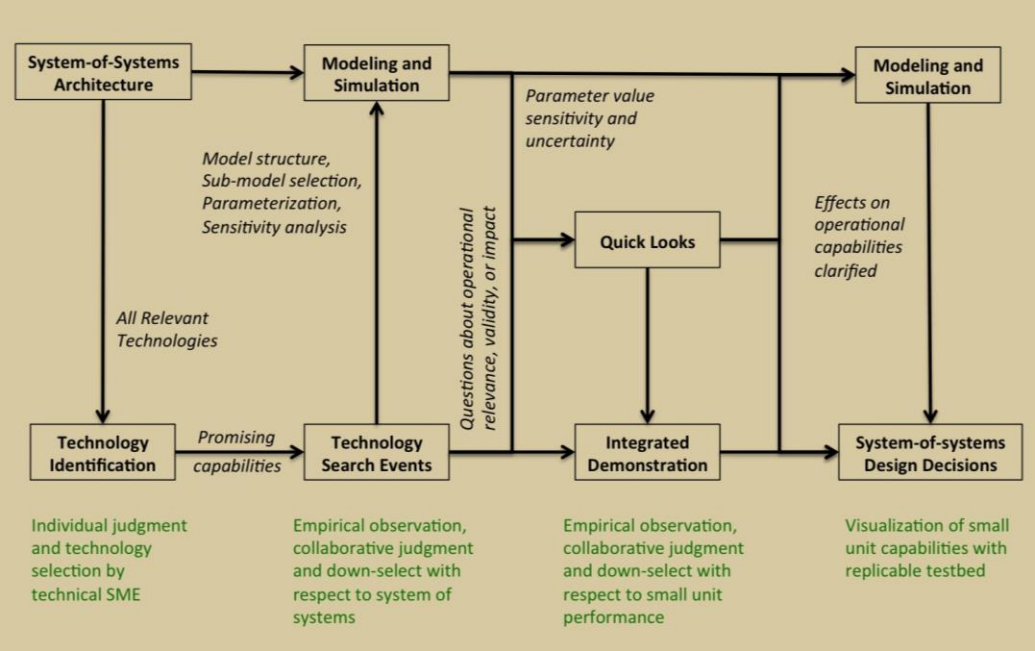

Figure 3. Flow of capabilities integration and development through multiple methodologies with implications about situation-specific need to know (attributes) and roles of various TOP SME.

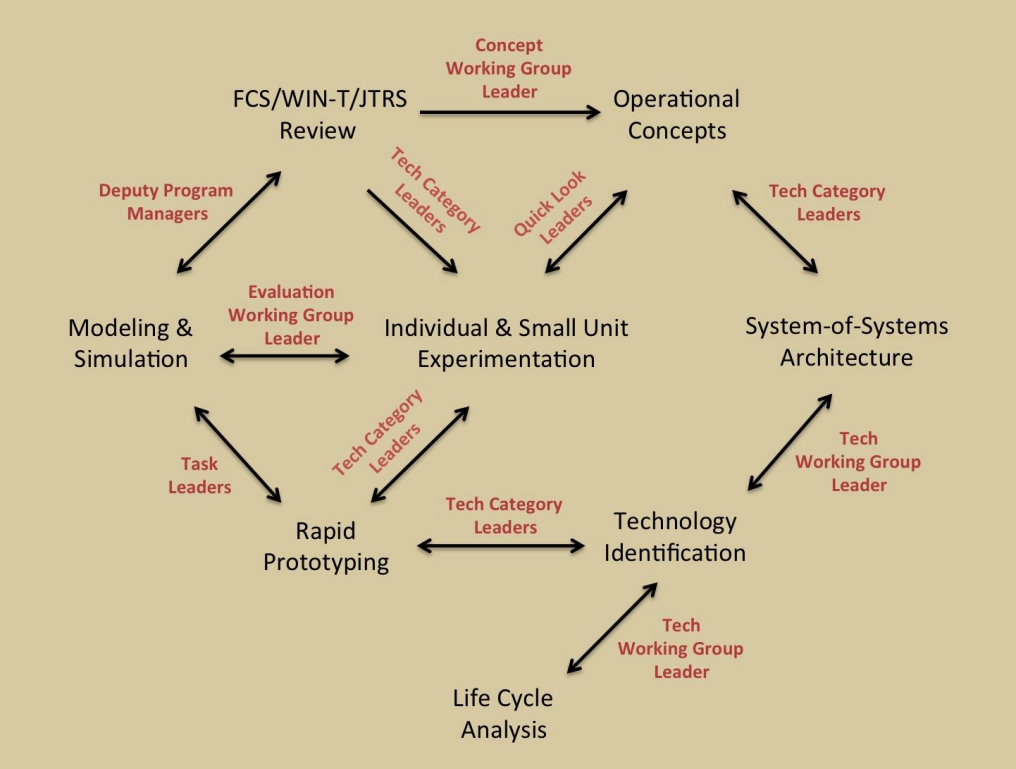

Figure 4. Team-of-teams structure of TOP SME in the Wolfpack Enterprise.

Consider the common task of conducting a trade study to identify products that are relevant to a particular need. It is one thing to conclude that a wider net should be cast to generate alternatives for either for cost containment or performance breakthroughs. It is another thing to know what those sources of outside innovation should be. To make this problem of broader sourcing a bit less arbitrary, one can conduct an integrated search for products that typically are used together and thus where one product can influence the performance of another product. For example, one might consider backpacks, under garments, outer layers of clothing, hydration systems, electronics, as well as tools and equipment to be worn or carried by an individual under demanding situations. In this kind of sourcing the whole is greater than the sum of the parts. It is manageable because there are plausible interactions among the products physically or in their concurrent use by individuals. Decisions about the kinds of products not to evaluate is as important as the decisions about what to consider in a particular trade study. Complexity must be managed lest the evaluation criteria become intractable.

In the Wolfpack Enterprise, these trade studies included technology search events in which a diversity of operational and technical experts would collaborate in hands-on inspection. These events did not involve use of the products as prototypes in operational scenarios. Nevertheless they elicited rich dialog unencumbered by jargon that would be inaccessible across cultures. The most noteworthy discussions came to address interactions, within a system of systems, that had not been anticipated. Experts in load carriage, for example, would find themselves in discussions with experts in clothing about the effects of a body worn hydration system on perspiration and evaporation through various kinds of clothing material. Experts in clothing would find themselves in surprising discussions with expert operators talking about acoustic signatures and stealth at the same time they would be discussing the effect of noise caused by relative movement across layers

of clothing with experts in electronic speech recognition who were developing innovative noise databases with which to conduct machine learning and evaluate speech recognition algorithms.

Integrated TOP assessments, in a sense, supplement technical specifications for particular products by adding information or conjectures about interactions with other products. While such interactions rarely are addressed in technical specifications for a product, they can be as important in selection, planning, and use as the technical specifications that are provided. This is more than interface control. It is about functional interactions. In the *Tech Search* events of the Wolfpack Enterprise, reliable information about interactions was used in modeling and simulation that explored overall performance of the system-of-systems under consideration and the squad level performance that it enabled. Conjectures about interactions became hypotheses that could be addressed in the field to develop more reliable information that could be utilized in modeling and simulation as well as in system-of-systems design. All these processes were woven together in a systematic traceable methodology to support decisions about acquisitions and further R&D. Implicit in these interdependencies is the value provided by rough prototypes that may look nothing like a product that ultimately would be fielded. Whether in a hands-on discussion or in field-based use, convenient prototypes can be used as props to foster collective intelligence and collaborative problem solving in an intentionally diverse community.

The key to self-organization and coexistence of disparate groups in an intentional community is a commitment to progress over time. To the extent that the commitment reflects both technical and operational values, there can be significant and measurable reduction of risk in a program of R&D (Figure 5). Formal risk management vastly increases the level of risk that can be tolerated at the outset of a program and thus enables the development of capabilities for more ambiguous or uncertain situations. One way to reduce risk is to utilize commercial items as prototypes in early assessment of concepts for new capabilities and in assessment of new ways to employ those capabilities. Even rudimentary prototypes can reveal possibilities for integrating new capabilities with extant systems and processes. This can accelerate the identification and thus management of risk. Risk management can be formalized in ways that doesn't suffocate innovation. It can become agile, experimental, and even scientific. An experimental approach to development of products in situ has been a commercial best practice for more than a decade (e.g., continuous beta), and this practice is becoming ubiquitous.

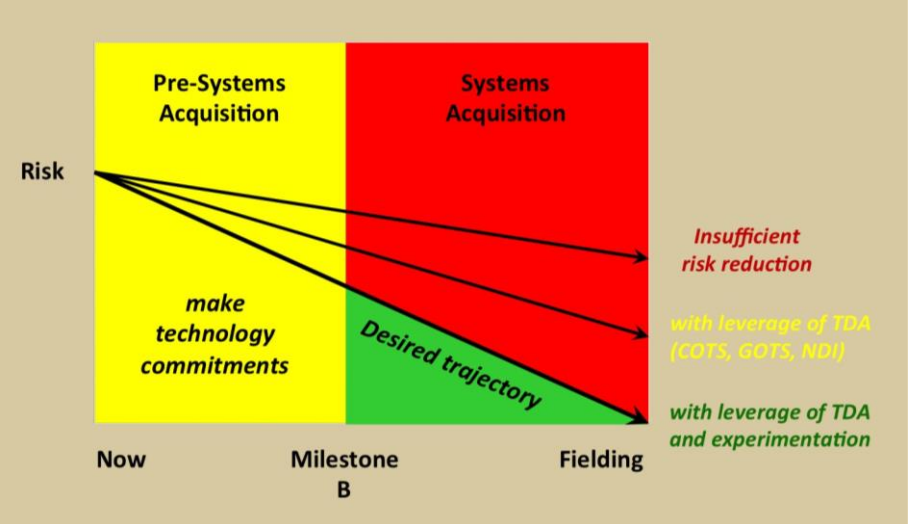

Figure 5. Risk reduction in capabilities integration and development

Quick Look Events

One of the methodological innovations in the Wolfpack Enterprise was a process for collaboratively reflecting on experience fragments of operational SME that pertained to the capability in question. Typically, the time scale over which this telling and reflection took place was longer than the experience that was being described. This allows one to get inside the head of the Soldier with respect to their experience of the operational situation. We came to refer to this level of discourse as *micro-experiences* [6].

Discussion of micro-experiences allows technical and operational experts to reflect on behavior and performance as task directed and organized, that is, as purposeful and operationally relevant to a team. It is best if these experience fragments are discussed in the progressive tenses. This is not the most natural way to tell a story but, even when used occasionally, it helps a working group stay in the moment and avoid lapsing into third-person descriptions. An even more radical practice of TOP working groups is to try to talk about micro-experiences in the second-person voice. Typically that is quite difficult when conversations don't refer to events unfolding in the present. It requires a level of shared experience that mere conversation generally cannot achieve, thus it requires another methodological innovation.

Collaborative reflection on micro-experiences both requires and enables a deeper level of shared experience. It requires that technical and operational experts participate together in live vignettes that ground their conversation and collaborative reflection. The vignettes around which this reflection centers are in many ways as detailed and connected as a script for a play or at least as the framework for an improvisational play. We refer to these improvisational shared experiences as *Quick Look* events. Unique and essential attributes of Quick Looks are highlighted below:

1. Situated collaborative problem solving in which dialogue is grounded in aspects of a situation that are collectively observable and verifiable and thus less obfuscated by differences in jargon and unspecified assumptions. Shared experience in a rich setting of relevant observables provides a plethora of boundary objects that facilitate communication and connections among disparate communities of practice [24]. This is as important in bridging the gap between different scientific disciplines as it is between Soldiers and scientists [25].

2. While not necessary, outdoor settings are very effective for Quick Looks. The reason for an outdoor setting often is confounded with the need for full immersion in an environment that allows for mobility, multiple vantage points, and omnidirectional perception (e.g., land navigation, aiming at multiple distances, controlling inhabited or uninhabited vehicles, locating friend or foe), and in many cases to provide realism that is difficult to simulate or represent (e.g., non-Hookean dynamics of sand, mud, snow).

3. Shared situation awareness (SA) is the fundamental determinant of value, and this is not limited to outdoor demonstrations even if it is considerably easier to achieve outdoors for many tasks. Shared situation awareness, as opposed to identical situation awareness, is useful to the extent that relatively small differences in vantage point blend first-person and third-person perspectives. This, in turn, fosters insightful collaborative reflection.

4. Implicit in the value of shared SA is the opportunity for concurrent reciprocal influence among participants. The coupling between shared SA and reciprocal influence gives participants inescapable accountability for the influence they have on each other. They share

their engagement with the world. They co-exist. Sharing the experience of such connections, and the meaning it implies, enables a deeper understanding of team dynamics. Quick Looks enable communication from the second-person standpoint that otherwise is difficult without contemporaneous shared experience [6].

5. Spacious venues lend themselves to large-scale attendance and optional participation. They allow attendees to move rather easily between passive observation and active participation. Accordingly, they can be designed to foster initiative, improvisation, and serendipity [6]. This is relatively easy in outdoor venues but it doesn't require them. It doesn't even require physical co-location. There are needs and opportunities for innovation that generalizes these attributes to a broader range of forums such as web-based collaboration.

Military SME typically approach Quick Looks as rehearsals such as rock drills. In this approach to rehearsals, the SME periodically breaks the squad into teams to generate discussion about their roles and responsibilities, to allow for initiative, and to share the meaning of the task and how it is approached. Normally, in breakout discussions during the rock drills, teams discuss operational issues and context. Similarly, Quick Looks provide opportunities for scientists to introduce their perspectives on the activities and tasks at hand. In addition to collaborative reflection and extemporaneous discussion, Quick Looks include walk-throughs of events that normally occur very quickly (e.g., breach, clearing a room) in addition to conducting the event at normal speed. Moving vantage points of various members of a team can be captured using video cameras (Figure 6). Video and still photographs can be are taken from third-person perspectives.

Figure 6. Situated collaborative problem solving on the ground and, notionally, on the web.

An example of a topic that would be difficult to discuss in a diverse group is so-called *4d terrain*. Four-dimensional (4d) terrain considers apertures (e.g., windows, doors, partial enclosures), passageways (e.g., paths, hallways), obstacles (e.g., furniture, clutter, vegetation, outcroppings), and barriers (e.g., walls, fortifications) as constraints on traversability that alter the manner and speed with which a space can be traversed. 4d terrain brings time into the three cardinal dimensions of space but as an outcome rather than as a causal variable. The layout of a building interior, for example, has a significant impact on entering and clearing a room. In mountainous terrain, even with contour maps and satellite imagery, it may be difficult or impossible to

appreciate what one can see from a particular place on the map. In wooded terrain, it is difficult to appreciate what one can see through the clutter even with photographs from particular vantage points with the relevant seasonal foliage.

Inside the 4d terrain, motion parallax (e.g., head movements) and the three-dimensional spatial vision it enhances helps overcome the intentional or natural camouflage of color, size, and shape of optical texture in the surroundings. In all environments, the constraints of natural surfaces and clutter on locomotion are difficult or impossible to appreciate without actually experiencing them. Rehearsals in complex terrain foster thinking that is more topological than geometric, and that is more dynamical than kinematic. These are just a few examples of the operationally relevant considerations that can be addressed in considerable scientific and operational detail through shared experiences in Quick Looks.

The proven power of the Quick Look methodology can be taken to a much higher level by extending it to participants who are not physically present. This methodology has been realized with the use of recorded video after a Quick Look with a different or broader team. The video is effective in providing boundary objects for collaboration who tend to use different language in describing their experience and who have very different past experiences. The next innovation would be to allow some team members to participate live while remote from the site of the Quick Look (represented notionally in Figure 7). This innovation would provide remote participants with opportunities for influence on the events in stride, even potentially to the level of changing vantage points and point of regard. Assuming cell phone signal connectivity, this is not a difficult technological problem. The principal challenge would be coordination between remote users and the people on site with cameras.

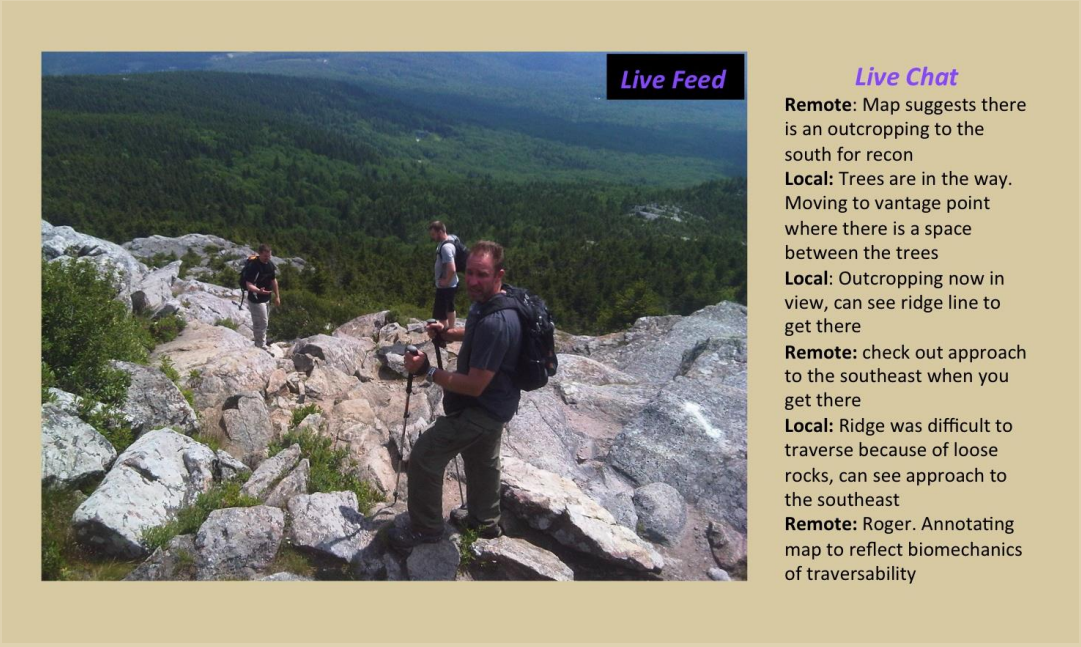

Figure 7. Notional remote engagement of distributed communities in Quick look events.

Integrating Teams and Methodologies for System-of-Systems R&D

An interesting methodological realization in our prior work on a Joint Lightweight Tactical Vehicle (JLTV) was that vehicle designs could not be assessed without considering the mission specific kit that a team of Soldiers would have to carry with them [26]. Vehicles and Soldier equipment are the responsibilities of different organizations in the acquisitions sector, the S&T sector, and the user representatives sector. The methodological innovations that helped us bridge the gaps among these organizations involved aggregation of field-based walk-throughs by a multi-faceted team with field-based measurement techniques and associate modeling and simulation from the commercial sector (e.g., accident reconstruction). The models based on the field exercises facilitated dialogue and collaborative problem solving among people with different kinds of experience, expertise, and associated terminology. The models enabled the team to collaborate on combinations of vehicle design attributes and Soldier kit that were far more varied than what the team could experience in the field exercise with available prototypes and mockups. The next step we envision is to enable situated collaborative problem solving in a geographically distributed team as if the participants were co-located together on site with the systems they are assessing (Figure 8).

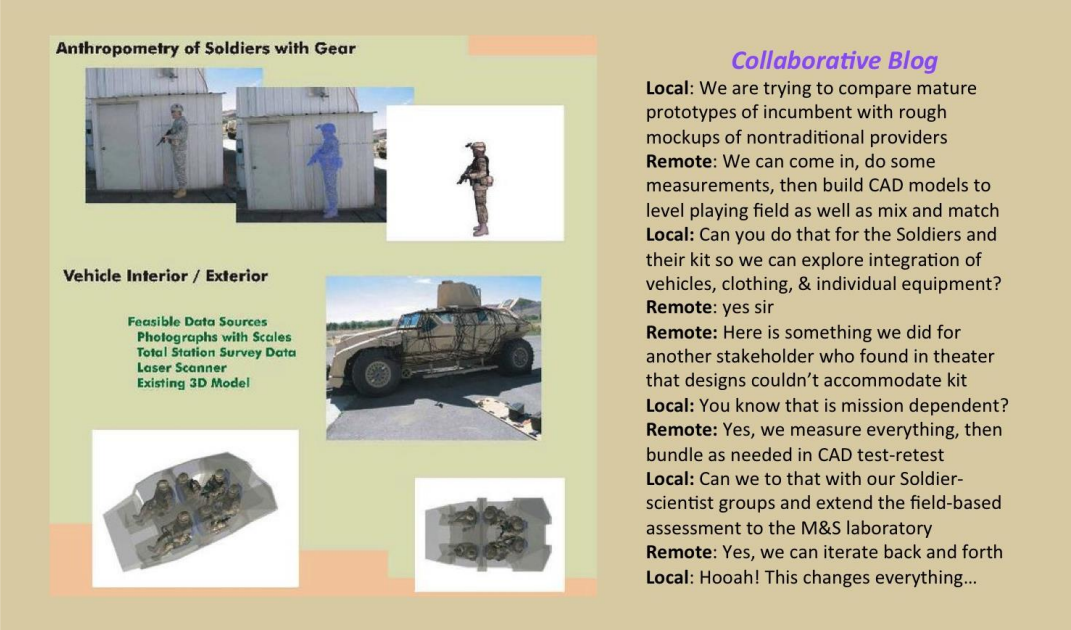

Figure 8. Extend field-based assessment by integrating it with M&S with notional blog.

Integrated documentation and visualization would be quite helpful given that different groups of people typically are involved in the various stages of a program of R&D and given that collaboration moves back and forth that between the field and the laboratory. Previous efforts utilized an agile form of systems engineering to preserve insights and sustain progress across discrete events. In the work on the JLTV, we conceptualized R&D as an extended series of collaborative events that, while distributed geographically and across different groups of participants over time, was a unified process (Figure 9). A formal process of coordination between groups and across activities was necessary to maintain coherence of the program and to ensure systematic progress. This was as much a manifestation of the culture created in our expeditionary community as it was about systems engineering contrivances. Our systems engineering was a manifestation of our community culture and, as such, agile implementation of

the processes was straightforward. We continually refined our understanding of what was necessary and sufficient in our documentation based on what the community found to be valuable.

We planned for concurrent continuous improvement on all the major aspects of scientific methodology in our program of R&D. We tracked systematic improvement in methods (participants, settings, procedures), generation of evidence (collaborative observation and analysis), interpretation of results (externalities, shortcomings, gaps), and translation to practice (capabilities integration, 2nd and 3rd order effects, next steps). The lesson to be learned from this work is that scientifically-inspired methods for TDA and associated development of capabilities need not be ponderous. The extensive and unparalleled foundation of inquiry provided by the scientific community can help the leaders of expeditionary communities make exceedingly well-informed decisions about how to structure and streamline processes for expeditionary TDA.

Another lesson to be learned from previous efforts is that communication must reflect collaboration, that is, it must be in the form of dialogue. It must be as much about listening and sharing as about telling and informing. Documentation need not be in the form of the latter although it almost always is. Instead, it should strive for the second person standpoint (Darwall, 2006). The opportunities for innovation in this regard are addressed briefly in the following subsections.

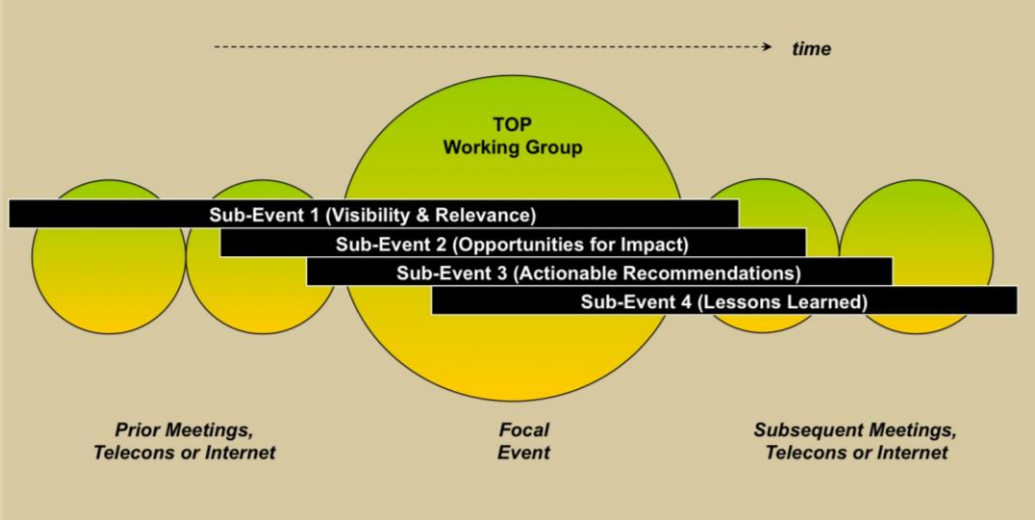

Figure 9. Scientifically-inspired agile systems engineering.

Systematic documentation is critical to maintaining coherence over an expedition in a community with changing constellations of participants. It also is provides visibility to ostensibly non-essential individuals and opportunities for their legitimate peripheral participation. This, in turn, suggests a powerful overlap in intent with contemporary strategic communications in the commercial sector that emphasizes consumer engagement. Strategic communications can shape both expectations and memory of participants in a collaborative event in addition to the more conventional purpose of disseminating information to people who aren't participants in collaboration and co-creation. We have adopted this perspective in our utilization of quick looks for disintermediation with stakeholders and for a coherent diversity within our project teams (Appendix A).

Shaping expectations of participants maximizes efficiency of their utilization in Quick Looks. It ensures that the time of participants is not wasted. As in good project management, it also minimizes the chance that details will be overlooked. It fosters initiative of nonessential personnel. It educates the attention of all participants to the most critical observables and considerations in key events. It sharpens the focus of observation and in-stride analyses.

The value of shaping the memories of participants is less obvious. Human remembering is not like the memory of physical devices. It is an act not a thing. It is a continual re-collection of past experiences and meanings made of them from the new perspective of a person at a subsequent point in time. If the context of past experiences is not continually refreshed, future contexts will conflate those experiences with other experiences that may or may not be related. If the future contexts are related, they can enrich the meaning made of past experiences. If not, they can distort the remembering of those experiences. There is no neutral. Memories will change whether the community takes control of them or not. This is not to say that "group think" can or should be allowed to influence the remembered experiences of participants. The point is that collaboration in an event and experience of an event should not end when the event ends.

Dialogical Blogging and Multi-Local Collaboration

We have emphasized the importance of dialogue and reciprocal influence among community participants throughout our work. Documentation of dialogue is a way of tracking progress, with a minimum of effort, over various deliberations in a community of practice. As suggested above, lessons can be learned from strategic communications in the commercial sector. Something like a blog can be used to document such dialogue but it would transcend common use of blogs in the commercial sector. We refer to our employment of this concept as a *diaβlogue*. Essentially it is a digest of situated collaborative problem solving that is logged on the web. The term diaβlogue is a combination of the familiar weblog with the concept of continuous beta in improvement of a product or service. It is a collaborative journal about the pursuit of a common objective (Figure 12). The new term emphasizes the departure from blogs that, for the most part, are merely a widely distributed web-based log of one's own private thoughts and opinions.

In one early trial of the diaβlogue, we had frequent discussions (a couple times a week on average) among a small group of people involved in instruction in the Army whenever it was convenient and with whomever it was convenient. We generally kept the discussion to 30 minutes or less and only when there was something important about a personal real-world activity to talk about (consistent with the concept of a "hot wash" in the Army). Over a 90-day period, most of the discussions were less than a half-hour and the shortest one was ten minutes. Importantly, discussion always referred to actions on the ground that they both reflected and could influence. They were grounded in verifiable reality. In this instance, most of the discussions included one participant who was working in field-based training and one who was working in classroom-based education. By design, the diaβlogue was multi-local.

The intent was to provide the two teams with *visibility* into events on the ground in each locality and *opportunities for influence* upon those events. These have been the two key principles of community organization and collaboration since the work of the Wolfpack Enterprise. The innovation beyond the Wolfpack is to bring these two principles into multi-local collaborative problem solving, to situate collaboration in more than one place, and to extend the presence of individuals and teams.

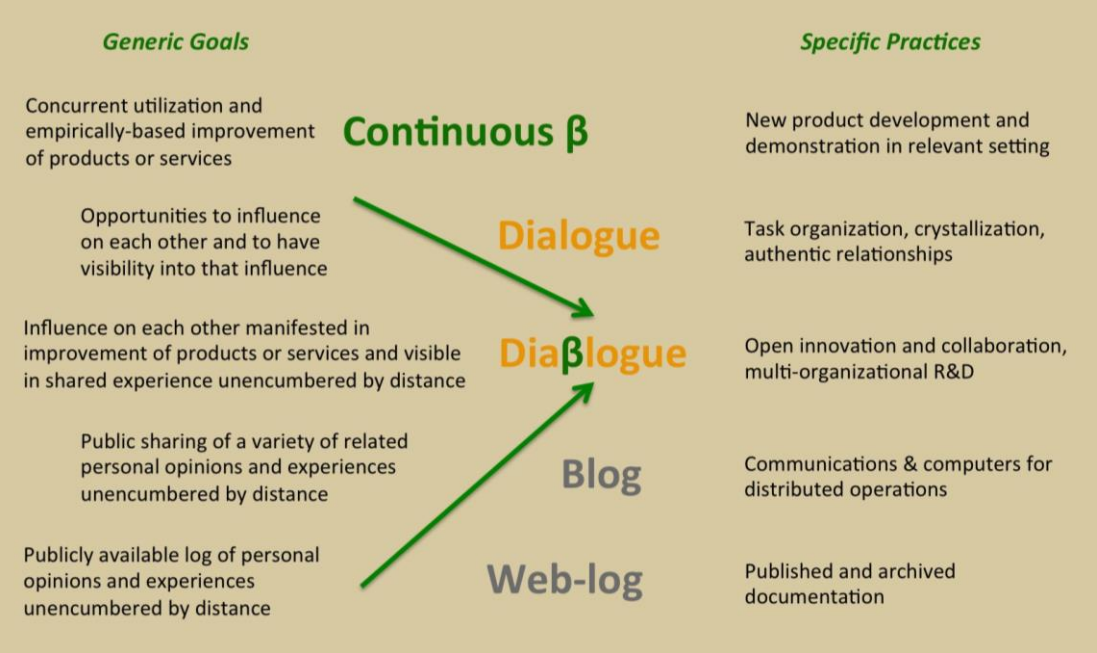

Figure 10. Web-based documentation of multi-local collaboration Diaβlogue

A more specific objective of the diaβlogue is for one's observations and opinions to become grounded in the reality of someone else. The interpersonal influence that occurs in such grounded dialogue has consequences beyond the dialogue. More importantly, in the context of a habitual relationship, these consequences are visible to all participants in the ongoing dialogue. Thus they are accountable to each other and their respective influence. This is accountability to be enjoyed, not to be dreaded, because it strengthens a relationship and guides initiative in the context of it. It brings the second-person standpoint to peer-to-peer interactions among people who are embedded in different situations. It thus blurs the distinction between presence and remoteness as well as between first-hand and second-hand experience. This profoundly changes the nature of professional interaction from the climate of a brainstorming session to one in which initiative in a conversation is balanced by accountability. This is true dialogue in which the participants can learn from each other. It is authentic dialogue to the extent that observations and conjectures are verifiable in the concurrent activities in which at least some of the participants are involved.

In the early diaβlogue trial, audio recordings of the conversations were summarized, in text of fewer than 750 words, consistent with best practices for blogging in 2010. Building on the developments in our work on the JLTV, a framework was used to identify and track systematic developments in the conversation. The framework was possible because of the level of abstraction developed in the OBTE monograph that revealed connections between ostensibly different kinds of events in field-based training and classroom education.

We tried to blog about a multi-local conversation within 24 hours of its occurrence, often immediately afterwards and on the basis of notes taken during these conversations. Consistent with best practices in blogging at the time, the intent was to keep the posts under 750 words and to strive to make them actionable (i.e., referring to something one should do differently or perhaps sustain in one's own instructional activities). Most of the posts were under 500 words, and the minimum was only 170 words.

It is important to make sure that the consequences of the actionable posts are visible to the participants over time. So, for example, we would reflect on what was actually done in an attempt to address an issue raised in a prior post. Each discussion, thus, was not a unique event. The discussions were linked and critically interdependent with respect to some intended outcome. This is the only way to ensure accountability for one's participation. This vastly enhances the quality of participation and the motivation to participate.

The posts, and thus the discussion they represented, were not distributed widely in this trial. The concern was to minimize anything that would discourage openness and experimental thinking. Certain themes and action items from the discussions (traceable to discussions through the blog posts) were distributed more widely. In six words or fewer, we expressed take away points with respect to several interrelated categories from a framework with developed in extensive prior work [6]. This also helped us trace progress with respect to particular practices addressed in the sequence of blog posts over time.

Finally, in this trial, it was valuable to do the peer review with two instructors who had similar teaching philosophies but who were working in very different environments (one with classroom-based learning events and one with field-based learning events). However one achieves it, diversity of perspectives is exceedingly valuable in expeditionary communities. The idea is not to reach simple consensus or triangulate on a single way to view a capability but rather to come to a more complete understanding of the various facets of a capability with respect to shared values.

An infographic in Appendix B provides a summary of the 90-day trial. The point is not the details in this graphic or the particular issues addressed. It is that there are ways one can track multiple streams of conversation over time about shared or sharable experiences. This motivates change proposals that can be verified and validated. This kind of micro-journaling doesn't take a lot of time, and it probably saves wasted time. There are a lot of things to measure or count in such documented dialogue even when they are based on subjective assessments.

There is enormous potential for extending the diaβlogue methodology into original digital audio or video content on the web. We believe it can be a valuable complement to situated collaborative problem solving in Tech Search events and Quick Look events. It can extend situated collaborative problem solving at minimal cost. A diaβlogue also can be a source of valuable data that, while initially unstructured, can be lead to quantitative as well as qualitative assessments to the extent that an a priori framework is used to extract themes and capture micro-experiences. It has the potential to become a more powerful scientific tool because of the opportunities for influence (i.e., interventions) and visibility that in encourages into consequences of the dialogue.

Our methodology of situated collaborative problem solving has developed naturally from our work in selectively open innovation in expeditionary communities. We believe there is vast potential for further development of this methodology that leverage emerging uses of social media and web-based collaboration tools in commercial markets. The commercial trends fueling these innovations can be leveraged to create expeditionary communities in and around various U.S. Government organizations. The most significant trends are associated with the convergence of social, mobile, analytics, and cloud (SMAC) as well as the Internet of Things (IoT) and online games. The resulting services, platforms, and infrastructure provide a foundation for web-based manifestations of community processes that can transform high-impact programs ranging from technology development to live, virtual, and constructive (LVC) training. The key will be to harness these technological innovations with the social structures and sensibilities of the scientific community. Figure 11 suggests the art of the possible that we currently are pursuing.

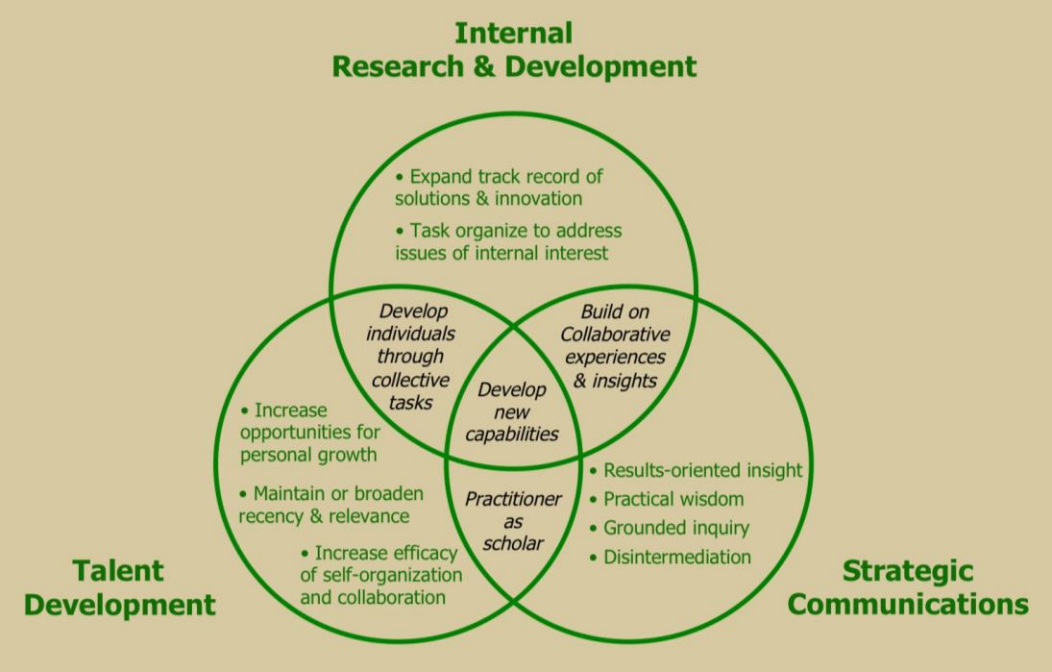

Figure 11. Inevitable integration of highly compartmentalized organizational functions.

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Appendix A. Quick Event Planning and Strategic Communication

WBS1	WBS2	WBS3	WBS4
1. Beginning: Prior to Quick Look Event			
	1.1 Planning		
		1.1.1 Identify diversity of stakeholders	
			Across projects
			Across government programs
			Across market sectors
			Across value network
		1.1.2 Identify venue options	
			Outdoor military facility?
			Indoor military facility?
			Outdoor non-military facility?
			Indoor non-military facility?
		1.1.3 Time and motion plan	
			Duration and times of day
			Clothing and equipment required
			Food, water, rest rooms
			Getting to, from, and access
		1.1.4 Event characteristics and details	
			Story board with intent, milestones, conceptual waypoints
			Props, manipulanda, environmental constraints
			Rules of engagement, left-right limits on improvisation
			Observer-controller
		1.1.5 Live and Remote Attendees	
			Who can attend in person
			Who can attend but only remotely
			Who is interested but cannot attend
		1.1.6 Capture shared or sharable experiences	
			Audio-video equipment
			Cameras
			Text generation and capture
			Independent observation and interview
		1.1.7 Contingencies and backups	
			Identify critical path dependencies and minimize risk
			Branches, sequels, and limited engagement

WBS1	WBS2	WBS3	WBS4
	1.2 Preparation		
		1.2.1 Connect with Stakeholders	
			First-hand interactions are required, preferably one on one
			Share conjectures about convergence of interests/capabilities
		1.2.3 Motivate collaboration	
			Persuade, cajole, entice, explore convergence of project outsiders
			Stimulate open innovation by generating threads of dialogue
			Establish and sustain synchronous or asynchronous dialogue
		1.2.4 Shape expectations for a situated collaborative problem-solving event	
			Share prior experience (stratcom packages may be necessary)
			Extract and prioritize interests from dialogue or prior knowledge
			Distribute initial conjectures, issues, and knowledge gaps
			Share time and motion plan
			Share event characteristics and details
		1.2.5 Acquire equipment and other materiel	
			Personal
			Organizational
			Outside organization
		1.2.6 Remote attendance	
			Cell phone
			Smart phone
			Computer
		1.2.7 WARNO and FRAGOs	
			Directions and accommodations
			Contact information and coordination plan
			Emergency management plan

WBS1	WBS2	WBS3	WBS4
2. Middle: Quick Look Event			
	2.1 Staging		
		2.1.1 Props and Other Materiel	
			Check functionality
			Check availability to participants
		2.1.2 Communication and Coordination	
			Check participant status
			Instructions to active participants and observers
	2.2 Event Direction and Management		
		2.2.1 Awareness of conditions	
			Critical path violations
			Contingency plans if necessary
		2.2.2 Awareness of time	
			Adaptability and in-stride adjustments for maximum value
			Promulgate awareness (vis milestones) among participants
		2.2.3 Situated Collaborative Experiences	
			Using props (e.g., COTS/GOTS prototypes or mockups)
			Enable a diverse group (led by Tech & Ops SME) to collaboratively envision
			collaboratively envision a new use or modification of the prop
			New/improved capability (technical, operational, and programmatic)
			Emphasis on insight, surprise, edification, and community
		2.2.4 Capture shared or sharable experiences	
			Audio-video
			Photographs
			Text
	2.3 Cleanup & Disposal		

WBS1	WBS2	WBS3	WBS4
3. End: Strategic Communications			
	3.1 Recognition of Participants and Participation		
		3.1.1 Distribution List for Post-Event Communication	
			Individuals who partipated in or observed event
			Stakeholders who had live remote visibility
			Stakeholders who could not make event
		3.1.2 Intent of Post-Event Communication	
			Emphasize people and issues on which impact greatest
			Emphasize people and issues with the greatest impact
			Consider implications for follow-though with particular people
	3.2 Influence Constructive Remembering of Shared Experiences		
		3.2.1 Distribution List for Post-Event Communication	
			Individuals who partipated in or observed event
			Stakeholders who had live remote visibility
		3.2.2 Intent of Post-Event Communication	
			Feed back records of each's and other's experiences
			Shape the meaning that is made of everyone's experiences
			Continue the open innovation in a decentralized manner
		3.2.3 Content of Post-Event Communication	
			Edited individual and interpersonal behavior
			Edited oral comments and dialogue about experience
			Edited text-based comments and dialogue about experience
		3.2.4 Format of Post-Event Communication	
			Audio
			Video
			Text
		3.2.5 Medium for Distribution of Post-Event Communication	
			Interactive blogging
			Email and chat
			Tweets and Social bulletin boards
			Noninteractive website
	3.3 Culminating Presentation or Demonstration		
		3.3.1 Distribution List for Post-Event Communication	
			Individuals who partipated in or observed event
			Stakeholders who had live remote visibility
			Stakeholders who could not make event
		3.3.2 Intent of Post-Event Communication	
			Aggregate distributed collaboration before, during, and after event
			Emphasize trajectory of learning and capabilities development
			Edify about the span and relevance of community expertise
		3.3.3 Format and Content of Post-Event Communication	
			Consistent with practices for branding and stratcom
			Broaden practices for branding and stratcom

Appendix B. Multi-Local Collaborative Problem Solving with a Diaβlogue

Infographic on the following pages

Quality requires a theoretically substantial framework to track progress across multiple streams of thought

Quality requires dialogue that is grounded in (traceable to) contemporaneous events that they can influence, in principle

Integration of different platforms for dialogue

Visibility and opportunities for influence are the point of the dialogue with remote colleagues

Diversity of perspectives fosters insightful dialogue that also is practical because of grounding... "end user is an integral part of the system" to innovate services

Quality requires cross-referencing and traceability of claims & evidence

Theoretical framework helps identify relatedness among concurrent discussion threads.

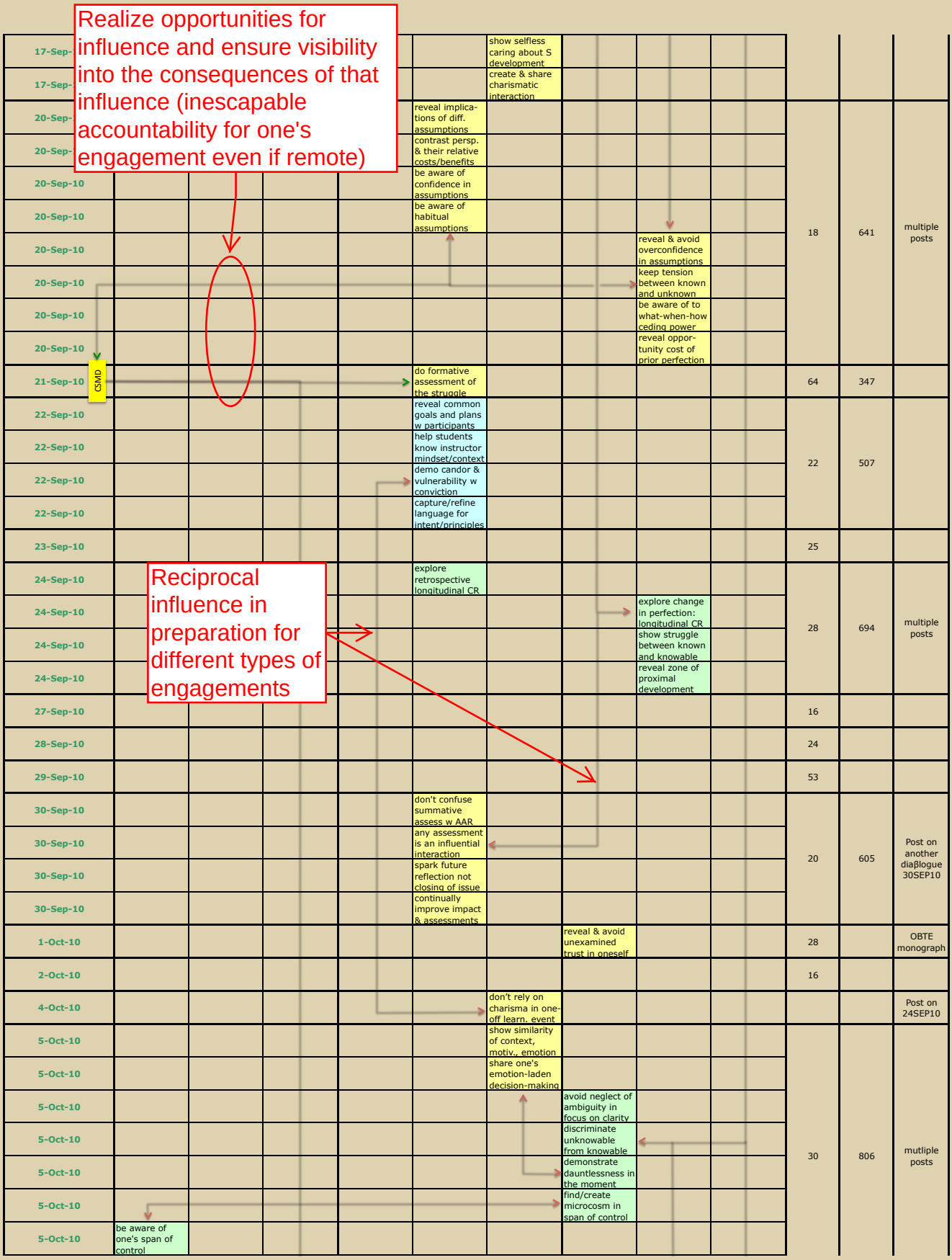
Teleconferences ("hot wash") that are brief by design before the formal workday starts

Aim for best practice of post that is fewer than 750 words

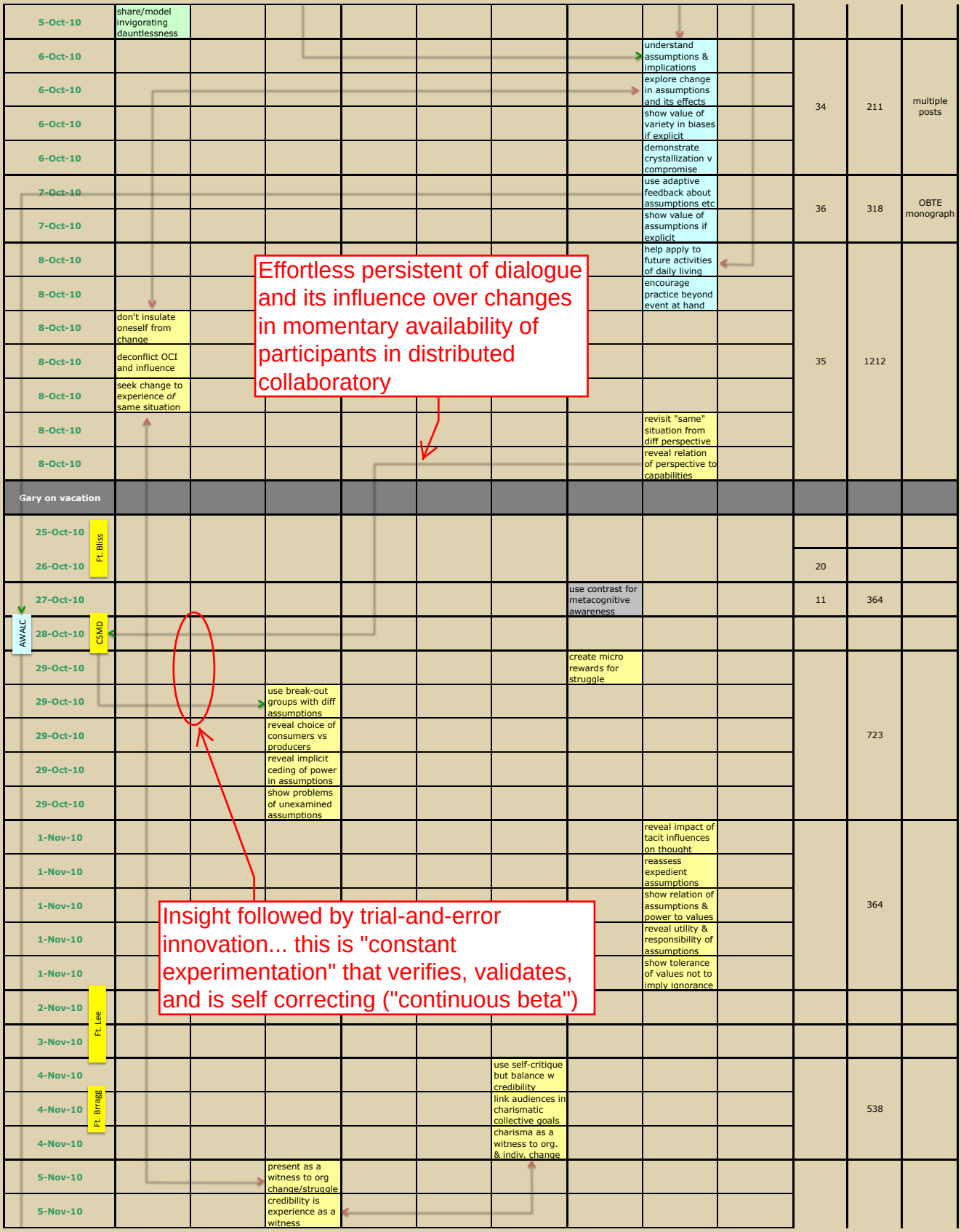
Data from 90-Trial with Diaβlogue in the Context of Outcomes-Based Training & Education

Yellow cells represent dialogue with Morgan about classroom-based instructor-leader education
Blue cells represent dialogue with Scott about field-based instructor-leader education (e.g., train the trainer)
Green cells represent dialogue with Morgan and Scott about leader education (including Staff & Faculty Development) in general
Gray cells indicate influential interactions that occurred outside of discussions with Morgan or Scott (e.g., TRADOC ATED, Capacity Building)
Red arrows represent cross-references that were explicitly specified in the diaβlogue
Green arrows show influences on and influences of events that ground the dialogue
Leftmost column shows classroom-based events with yellow boxes and field-based events with blue boxes

Conditions for OBTE (means to the ends) / Event and Diaβlogue Date	Thread 1	Thread 2	Thread 3	Thread 4	Thread 5	Thread 6	Thread 7	Thread 8	Thread 9	Diaβlogue Data		
	Potency of Micro-Experiences	*Inter-Temporal Reasoning*	*Centrality of Choice & Responsibility*	*Reason Informed by Passion*	*Necessity of Collaborative Reflection*	*Authenticity and Charisma*	*Necessity of Personal Struggle*	*Continually Improving Perfection*	*Temporally Extended Self*	*Statistics By Day*		
	Interplay Between Tangible and Intangible			Situation Awareness & Informed Engagement			Facilitated Self-Development			Telephone (minutes)	Post (words)	Reference
USMA DMI												
82nd												
1-Sep-10												
7-Sep-10							let students figure things out			37	828	
8-Sep-10							give autonomy in what matters & is authentic			81	354	
9-Sep-10 Ft. Polk												
12-Sep-10							reflect on the struggle implicit in past-present				170	
								show perfection as yesterday's illusion				
								stress progress over conclusive achievement				
13-Sep-10					don't keep (all) journals private							
13-Sep-10					reveal hidden assumptions in inner work life							
13-Sep-10					AAR shouldn't reinforce old habits/approach							
13-Sep-10					explain why task intended to be vague							
13-Sep-10					don't neglect AAR, correct expectations					41	544	OBTE monograph and multiple prior posts
13-Sep-10									journal on remembered experience			
13-Sep-10									juxtapose current & past experience			
13-Sep-10									be humble given unknown future knowing			
13-Sep-10									stress mastery on the precipice of the unknown			
14-Sep-10			avoid dichotomy of individual vs collective/team							10	201	OBTE monograph
14-Sep-10					show teachers are students, and vice versa							
15-Sep-10					allow collateral sharing of best practices/COE							
15-Sep-10				confront don't deny emotions as information						27	177	OBTE monograph and prior Post on 14SEP10
15-Sep-10 Ft. Benning				consider what emotions reveal about motives								
16-Sep-10					address what others cannot observe easily							
16-Sep-10					share journals to reveal others' tendencies					29	622	
16-Sep-10					become aware of one's own thought process							
16-Sep-10					work w others' thought frags and influences							
17-Sep-10					explore value of inner work life to others/team							
17-Sep-10				consider regret and mourning after insight								
17-Sep-10				consider what emotions reveal about change						35	387	OBTE monograph



17-Sep-						show selfless caring about S development							
17-Sep-						create & share charismatic interaction							
20-Sep-					reveal implica-tions of diff. assumptions								
20-Sep-					contrast persp. & their relative costs/benefits								
20-Sep-10					be aware of confidence in assumptions								
20-Sep-10					be aware of habitual assumptions						18	641	multiple posts
20-Sep-10								reveal & avoid overconfidence in assumptions					
20-Sep-10								keep tension between known and unknown					
20-Sep-10								be aware of to what-when-how ceding power					
20-Sep-10								reveal oppor-tunity cost of prior perfection					
21-Sep-10	CSMD				do formative assessment of the struggle						64	347	
22-Sep-10					reveal common goals and plans w participants								
22-Sep-10					help students know instructor mindset/context						22	507	
22-Sep-10					demo candor & vulnerability w conviction								
22-Sep-10					capture/refine language for intent/principles								
23-Sep-10											25		
24-Sep-10					explore retrospective longitudinal CR								
24-Sep-10								explore change in perfection: longitudinal CR			28	694	multiple posts
24-Sep-10								show struggle between known and knowable					
24-Sep-10								reveal zone of proximal development					
27-Sep-10											16		
28-Sep-10											24		
29-Sep-10											53		
30-Sep-10					don't confuse summative assess w AAR								
30-Sep-10					any assessment is an influential interaction						20	605	Post on another diaβlogue 30SEP10
30-Sep-10					spark future reflection not closing of issue								
30-Sep-10					continually improve impact & assessments								
1-Oct-10							reveal & avoid unexamined trust in oneself				28		OBTE monograph
2-Oct-10											16		
4-Oct-10						don't rely on charisma in one-off learn. event							Post on 24SEP10
5-Oct-10						show similarity of context, motiv., emotion							
5-Oct-10						share one's emotion-laden decision-making							
5-Oct-10							avoid neglect of ambiguity in focus on clarity						
5-Oct-10							discriminate unknowable from knowable				30	806	mutliple posts
5-Oct-10							demonstrate dauntlessness in the moment						
5-Oct-10							find/create microcosm in span of control						
5-Oct-10	be aware of one's span of control												


5-Oct-10
share/model invigorating dauntlessness
6-Oct-10
understand assumptions & implications
6-Oct-10
explore change in assumptions and its effects
6-Oct-10
show value of variety in biases if explicit
6-Oct-10
demonstrate crystallization v compromise
34
211
multiple posts
7-Oct-10
use adaptive feedback about assumptions etc
7-Oct-10
show value of assumptions if explicit
36
318
OBTE monograph
8-Oct-10
help apply to future activities of daily living
8-Oct-10
encourage practice beyond event at hand
8-Oct-10
don't insulate oneself from change
8-Oct-10
deconflict OCI and influence
8-Oct-10
seek change to experience of same situation
35
1212
8-Oct-10
revisit "same" situation from diff perspective
8-Oct-10
reveal relation of perspective to capabilities
Effortless persistent of dialogue and its influence over changes in momentary availability of participants in distributed collaboratory
Gary on vacation
25-Oct-10
Ft. Bliss
26-Oct-10
20
27-Oct-10
use contrast for metacognitive awareness
11
364
AWALC
28-Oct-10
CSMD
29-Oct-10
create micro rewards for struggle
29-Oct-10
use break-out groups with diff assumptions
29-Oct-10
reveal choice of consumers vs producers
723
29-Oct-10
reveal implicit ceding of power in assumptions
29-Oct-10
show problems of unexamined assumptions
1-Nov-10
reveal impact of tacit influences on thought
1-Nov-10
reassess expedient assumptions
1-Nov-10
show relation of assumptions & power to values
364
1-Nov-10
reveal utility & responsibility of assumptions
1-Nov-10
show tolerance of values not to imply ignorance
Insight followed by trial-and-error innovation... this is "constant experimentation" that verifies, validates, and is self correcting ("continuous beta")
2-Nov-10
Ft. Lee
3-Nov-10
4-Nov-10
use self-critique but balance w credibility
4-Nov-10
Ft. Bragg
link audiences in charismatic collective goals
538
4-Nov-10
charisma as a witness to org. & indiv. change
5-Nov-10
present as a witness to org change/struggle
5-Nov-10
credibility is experience as a witness

Longer more in-depth dialogue by mutual agreement

5-Nov-10			promulgate latent collective knowledge							94	516	Post 04NOV10
5-Nov-10			provide lessons about (prior) lessons-impact									
5-Nov-10			focus struggle on "urgency-of-choice"									
8-Nov-10							give opportunity to adopt others' assumptions					
8-Nov-10 Ft. Lewis		avoid repetition of adaptation w/o mastery									793	Post 08OCT10
8-Nov-10		avoid equating adaptation with change itself										
8-Nov-10		build on life skills from new perspective										
10-Nov-10 Ft. Bragg												
12-Nov-10		avoid repetition of adaptation w/o mastery								152		
Morgan on Vacation												
2-Dec-10 TRADOCATED			don't create an all encompasing regulation		adopt more wiki-like instruction development	instructor-student as focus is essential		QAO can help if focus is on innovation				
3-Dec-10	note what instructors actually do	"test" on outcomes that matter		be patient about period of mourning	use consistent and coherent framework		don't allow change simply to be an out		stimulate reconstructive remembering		813	
6-Dec-10									discuss impact beyond learning event		294	
7-Dec-10 CSMD		Understand why learning event sought out					Set the right expectations about learning					
8-Dec-10										69	296	
10-Dec-10										26		
11-Dec-10 AWALC												

Median	28.5	512
Mean	38.6	513
Total	963	12,143
Standard Deviation	30.2	255
N (number of cases)	28	26
Mininum	10	170
1st Quartile	21.5	325
3rd Quartile	38.5	681
Maximum (including outliers)	152	1,212
Penultimate Max	94	828
Antepenultimate Max	69	813
Correlation (with order)	0.24	0.16
Median for 1st 45 days	28.5	507
N for 1st 45 days	22	17
Median for 2nd 45 days	47.5	516
N for 2nd 45 days	6	9

The "freemium" model, in this case, manifested in evidence-based clarifications and recommendations in serendipitous dialogue with stakeholders (a salient and credible differentiator)

diaβlogue is a viable practice even for the busiest participants

Easily digestible "blogs" that build to something substantial, traceable, replicable, and trustworthy

In this case (not of necessity) there was an in-stride adjustment to longer less-frequent teleconferences for more in-depth dialogue about cumulative lessons learned and more nuanced understanding of one's current and potential impact

"Turn organizations into laboratories capable of quickly testing and learning on a small scale"