

## Collaboration It Is Much More Than the Technology

Toward the Goal of Moving Off the Planet

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### Abstract

A joint study conducted with the University of Central Florida and the National Aeronautics and Space Agency's (NASA) Kennedy Space Center (KSC) resulted in a new approach to the collaboration issues that had troubled the Agency. We believe in teams. We believe in the concept of collaboration. We never doubted Douglas Engelbart's thesis-- "Our very survival depends on our ability to work together, more effectively, to get collectively smarter. Computers—when used properly—can help us do that" (1). It was not lack of trying. Predictably, NASA engineers had worked as if better and better technology would resolve the matter. It had not. The study itself provided an insight, an "aha! moment that pointed us toward the problems of collaboration we had to solve. People quickly saw that we had to remove barriers and make it easier to share data, coordinate efficiently, work together to add value and create corporate memory. This paper describes what happened.

Key words: share, coordinate, collaborate, corporate memory, easy, virtual team

### 1. BACKGROUND

Research for a NASA collaborative tools data-base was turned on its head moving the focus from tool requirements to a study of how to augment and implement a

collaborative system that would really enable people on virtual teams to work successfully together.

The team (KSC and University of Central Florida) looked at the functions any team trying to work collaboratively has to address—the problems they must solve if any kind of collaboration is to work—no matter the mission. (2) Because NASA has teams working together in more than a dozen locations from coast to coast – collaboration is a necessity. We looked at the problems as if the team had no choice but to work virtually. This requires rigorous attention to mitigating problems that distance and different time zones impose. Although a virtual team can include human-computer and even computer-computer interaction --our focus has been and continues to be on the individuals or groups that interact with one another. The assumptions we make are that to achieve true collaboration involves tacit and explicit knowledge, synchronous and asynchronous time, print and digital media, and both face-to-face and virtual encounters within, between and among teams.

To aid the process, we determined that it is the intent of the electronic collaborative functions, methods and tools to establish and maintain a controlled environment, keep the story clearly in view and make its elements transparent, cost-effective, robust, timely, easy to use and accessible to the team. We look and work toward a system --someday in the future-- that meets Arthur C. Clarke's third law-- his

designation of mature technologies that are “indistinguishable from magic.” (3)

We further state that we design collaborative effort to

- Acquire something that is absent but desired
- Destroy, remove or contain something undesirable.

In some cases—especially in our work-- this may be to do something that is without precedent. In all cases such effort addresses an important mismatch between what exists and the outcome the group collaboratively seeks to achieve. The shared vision of what must be achieved is the driver in successful collaboration. This is true of a sporting victory, a successful opening night, a technology break-through or the grand adventure of space exploration

## 2. COLLABORATIVE FUNCTIONS

We defined collaborative functions as “actions, taken with others, to solve a problem that—if unaddressed — would impede success.” (4)

1. Access data –
2. Coordinate for efficiency
3. Work with others to add value—achieve results that satisfy team goals
4. Create corporate memory

The model implies an increasing level of complexity from data to coordination to achieving goals to capturing corporate memory.

## 3. METHODS:

We matched these collaborative functions with methods using a definition adapted from the Random House Dictionary. (4) “An orderly procedure or process; a regular manner of doing anything... as a way of reaching a given end by a series of acts that tends to secure it.”

We considered a number of methods for investigation and rolled them into 9. For each we used an active verb. They are

- (1) Build and Strengthen Team,
- (2) Provide Help or “Make

It Easier”

- (3) Exchange Information and Messages,
- (4) Research,
- (5) Schedule and Track,
- (6) Discuss,
- (7) Represent
- (8) Survey and Poll,
- (9) Archive Knowledge

In all cases, the implication is of an electronic environment controlled for access, input, sharing, release and distribution.

## 4. BUILD AND STRENGTHEN TEAM

To address the concept: “Build and Strengthen Team” demands actions that promote cohesion and tools that enable the team members to share the vision of what they are trying to achieve, It also requires attention to presence—knowing that the members are present for a virtual meeting or are elsewhere. It demands orientation of new team members and plans to consciously dissolve the team when the work is done. “Cohesion” can be as simple as a shared joke. It can be as complex as an on-line tutorial on the subject of distributed collaboration.

## 5. PROVIDE HELP

It is important for success that we make it easy. The idea is to enable people to generate effective performance in the moment of need and to give them help that is really helpful at the least cost in terms of time and money. As yet, collaborative tools are not so intuitive that we can just push the button and go. They are amazing, but not yet magic —that is, as easy to use as flipping on the television. It is important for success that we make it easy. Such tools range from providing simple checklists, Frequently Asked Questions (FAQ) or job aids to facilitating on-line tutorials.

People can learn skills and mastery through self-study and instruction including rehearsal with practice—simulation. The

need may be for guidelines, skill lessons, help desk, electronic performance support systems, coaching or training in situation analysis, decision-making or troubleshooting. Some people even learn by reading the directions—however, that might be 4-5 pages and should not a manual with over 100 pages.

## **6. EXCHANGE MESSAGES AND INFORMATION**

Telephone, email, instant messages, message boards and faxes are among the most common means for exchanging and sharing data and messages. It infers brevity, data and focus.

## **7. TRACK AND SCHEDULE**

Calendars, schedules, and other methods for tracking activities-- work-breakdown steps, milestones, deliverables, concerns, resources and budgets are vital to any project but especially for collaborative teams.

## **8. RESEARCH**

We defined research as “systematic investigation of facts and theories.” (4) It can include a variety of internet activities, reference materials, Web sites, lists and links, as well methods designed to search and organize study, discover facts, explore theory, use libraries as a common resource, examine computer data and databases and put other team members in touch with pertinent information. This collaborative need and the need to exchange messages and information as well as to track and schedule are the easiest problems for technology to address and many collaborative tools prove useful in this regard. Ease of use and interoperability remain issues

## **9. DISCUSS**

Because the story is at the heart of collaboration, discussion is the most common method that we use in problem

solving and decision-making. It is the one most problematic and the most challenging to capture and facilitate. To discuss is “to examine and confer about an idea through comment, argument, debate, inquiry or reason.” The team abstracted this definition for our purposes from the Random House Dictionary, Roget’s *Thesaurus* and online resources. (4) Although discussion can be written as well as spoken—oral usage is the more common, and written discussions are considered to be casual or “off the record” rather than of a formal or official nature.

As the verb “to discuss” dictionaries and the thesaurus also suggest, in part, to: advise, answer, argue, assess, brainstorm, canvass, challenge, compare notes, comment, compare, confer, consider, deal, debate, deliberate, dispute, envision, estimate, evaluate, examine, explain, imagine, inquire, inspect, interpret, interrogate, investigate, judge, mediate, mull over, negotiate, question, ponder, propose, quarrel, question, quibble, rebut, reason reflect, refute, refer, review, scrutinize, seek advice, squabble, speculate, talk over, theorize, think about, think through, toss around, thrash out, vent, weigh, wrangle.

“To discuss” comes from the Middle English meaning “to shake, strike or scatter.” This seems to imply change as a result of the exchange and that idea fits very into the concept of collaboration adding value through argument, reasoning and judgment.

## **10. REPRESENT**

Representation methods (including creation of concepts and artifacts)) control access, develop, share, edit, report, revise, rework, release and distribute materials supporting the team’s shared vision as well as activities to achieve group collaborative goals. The process implies intervention, discipline, control and formality. That implication is of a controlled environment for access, sharing, recording, releasing and distributing team products.

To represent entails human intervention-- a reworking of data and information creating knowledge of value to

the team. It can involve analysis, synthesis, innovation, craft and creativity.

The resulting products can include but not be limited to abstracts, accounts, analyses, announcements, articles, blueprints, briefings, broadcasts, charts, configuration and content management tools, decision plans, declarations, demonstrations, depictions, depositions, descriptions, directions, directives, documentations, drawings, experiment logs or reports, exhibits, graphs, intelligence analyses and syntheses, illustrations, interpretations, interviews, journals, lessons learned, logs, measurements, minutes, models, monographs, narratives, photographs, plans, plan analyses, posters, presentations, press releases, proposals, procedures, records, reports, requirements, research results, risk analyses, scenarios, scripts, sketches, simulations, situation analyses speeches, statements, statistics, studies, syntheses, theses, 3-D digital media, translations, treatises, treatments, digital and film documentation, virtual reality, visualizations, web casts or white papers.

Tools have varying strengths in this critical area with particular weakness in easy, accessible, interoperable, scalable interactive visual media. This is of special concern for NASA with its heavy emphasis, especially for Space Exploration SBA ground operations, on advanced visualization simulation for analysis and design.

#### **11. VOTE**

This methodology allows people to survey and express opinions, weigh options, select criteria, and make decisions. Used well, it can be an important means for building consensus. This, too, is an area that most collaborative tools do address. Ease and interoperability remain among the issues.

#### **12. ARCHIVE**

This activity involves the assemblage of legal, financial, intelligence and other documents that provide an

essential history of the project (including specifically *what, who, where, when, how* and *why*). It can also include but not be limited to affidavits, agreements, authorizations, contracts, certificates, credentials, deeds, licenses, management issuances, meeting transcripts, personnel and project records including validation and verification, permits, proposals, project or program evaluations, regulations, specifications, summons, subpoenas, transcripts, testimony and warrants.

The materials should be not only those required by law, but also those providing enough information to restart or build upon the project without having to reinvent it. This is of critical importance to the Agency. Reports and studies we are doing now may contain information that a team will need in 2055. In the case of the current planning for SBA ground operations, the expectation is that the teams will continue to operate over a similar period with constant turnover of members and need for orientation and avoidance of duplication,

Most collaborative tools simply collect everything. At some point it will become important to develop scenarios from lessons learned and other tools that help the teams find what they need to know when they need to know it.

#### **13. IMPLICATIONS OF THE INITIAL STAGE OF THE PROJECT (PHASE 1)**

The experience affirms that virtual teams matter. They provide an opportunity to bring talented people together to work flexibly and collaboratively on innovative projects.

Survival, much less success, is a challenge. Teamwork is always a challenge but virtual teams—distributed across short or vast spaces and time zones—require special discipline and care. Experience further reaffirms the importance of paying attention to management, scheduling, communication and technical infrastructure needs that must be approached in a proactive manner and differently from traditional management.

Collaborative teams require a controlled environment—the more so because it is invisible. There must be security so information goes to those who need it and are authorized to receive it and nowhere else. This security extends to managing intellectual property and other materials. There needs to be clear communication—managed and frequent. Accuracy of sources requires our attention, and it, too, has no easy answer.

Among the challenges, members of a virtual team need explicit project status. If they do not know what people are doing they will assume they are not doing much. Different teams and projects will have different needs—being able to customize the environment is clearly a factor.

Above all, we affirm—loudly and clearly-- that tools must be people-centric or they will not be used. We see the need for an environment that keeps the story clearly in view and make its elements secure, transparent, cost-effective, robust, timely and, especially, easy to use.

To use a popular NASA expression, we “violently agree” that trust is the main event when it comes to a virtual organization. The essential role of the environment is to provide the team members with a virtual place that encourages such trust, promotes cohesion, critical reflection and knowledge construction though interaction with other members of the team.

The study produced an important scaffold upon which to build. It proves easy for others to grasp and understand. Present work, based on scenarios of fictional teams explores actions that make it more probable that we can actually share data, coordinate efficiently, add value through working with others and create a corporate memory (4).

We remind ourselves of the well-known management cry, ‘Keep It Simple, Stupid.’ Our ultimate focus is—in the words of the old song -- to recognize that “ nice and easy does it every time.” (6)

But there is no easy answer, no right or best approach. It is difficult to make something easy. We know that. But, it can get better. “We are a pragmatic people often

believing that what works is what is true. We are also dreamers, often dangerous open-eyed dreamers, tinkering, looking for something better dreamers.” (7). True virtual collaboration is an idea that has not yet worked for us. Some might say it is a lost cause. We think otherwise. Turning this idea into action is worth the price. We are hopeful that the approach we have taken and the work we are doing to develop an augmented collaborative environment system will help us in taking the lead to move off the planet.

#### ENDNOTES

(1) Engelbart, D. 1962, *Augmenting Human Intellect: A Conceptual Framework*, Palo Alto, SRI

(2). An important, but ephemeral resource was an article by David Coleman, *Choosing Collaborative Tools* that pointed the team to collaborative problems rather than groupware or other tools as the solution. This led us to redefine the issue and develop the framework focusing on (1) share data, (2) coordinate efficiently, (3) work together to add value and (4) create corporate memory. Unfortunately, the website no longer exists and a search of the Internet did not locate the article. This underscores a persistent problem with Internet research.

(3) Clarke, A.C. 1961, *Profiles of the Future*

(4) Random House Dictionary of the English Language (unabridged) 1966, New York. In addition, the team added ideas from Dictionary.com and similar web sites as well as other dictionaries and Roget's *Thesaurus*.

(5) Elfrey, P, R, Conroy, M.P, 2004, *Toward Collaboration*, NASA White Paper 2004,

(6) Spence L, Bergman A, Keith M, 1960, “Nice’N’Easy”, Northern Arts, Los Angeles

(7) Elfrey, P, 1982, *The Hidden Agenda*, Recognizing What Really Matters at Work, John Wiley and Sons, New York.

#### AUTHORS

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Michael Conroy has been with NASA throughout his career, beginning in 1983 as a co-op student working in the Expendable Launch Vehicle Program. His recent effort involved being chief of the Computational Sciences Branch at NASA's Kennedy Space Center, leading the KSC efforts related to Advanced Engineering Environments as well as the deployment of advanced tools and capabilities for use at KSC. A graduate of the University of Central Florida, his career spans many NASA programs and projects including:

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- Computational analysis
- Design and system simulation
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