Appendix E
The SRI Atmosphere—The Roles of Research Staff and Managers

In spite of the many varied experiences people find in their work environments, such places have a definable culture or atmosphere. SRI has such an atmosphere and virtually every researcher I have known here, as well as many who support them, is aware of it. On balance, that feeling is invariably a positive one and I believe it stems from some combination of the independence they feel and the general level of proficiency they find. I also believe that the SRI atmosphere is immensely important to its staff, perhaps the Institute's most telling attribute, transcending the inevitable difficulties with people and situations that visit us all. Beyond the feelings of freedom and competence, SRI's atmosphere is also one of innovation and an enticing but illusive potential for interdisciplinary collaboration. The SRI atmosphere is carried dominantly by its people and the roles they have filled over its history. It is with some trepidation that I engage these subjects and it must be, almost by definition, a personal perspective.

Nurturing Innovation

Two extremely important attributes of an applied research organization are competency and innovation.[1] These say everything about the type of person who would be hired or would feel comfortable at SRI. In contract research both orientations must almost be taken for granted since no research client wants to pay for old solutions expensively rediscovered. But how are the right people found? With some risk, competency can be discovered or even measured at the time of employment. After employment, new areas of research can be learned, formally or informally. But the more difficult question concerns innovation.

Because evidence of innovation may be revealed by their prior work, SRI staff often come from research universities or other laboratories. The ponderous question, though, is whether innovation can be taught, enhanced, encouraged, or forced, or is simply an innate characteristic of some people. Good researchers are motivated to exploit their natural creativity simply by being among the first to originate a new concept, abetted, perhaps through competition with their peers. If a researcher is surrounded by peers who are each breaking new ground or setting the state of their art, it is very difficult not to do likewise. To make such an atmosphere possible at SRI, two provisions are necessary: finding the funds to support the innovative activity and making sure that the working environment does not become too administratively distracting. If reasonable encouragement within such an environment doesn't work, my 40 years of experience tells me that not much else will. In starting a new group, building that kind of atmosphere early is critical.

To illustrate how much innovation is intrinsic to the researcher, here are a couple of instances of how innovation sprang from nothing more conducive than a coffee break. Pure serendipity or the right people in the right atmosphere? The setting for one instance began with a rather protracted project with a West-coast paint company that was developing a new latex-based paint. A problem the company was having was the formation of bubbles in the paint that wouldn't dissipate before the paint began to dry. This caused a roughness in the surface that made it unusable. In spite of trying a large number of mixtures, nothing was working well enough. Meanwhile, another SRI laboratory had an ongoing project with a large Western firm that involved the processing of coconut meat it was importing from Africa. The company was extracting oil from the meat to sell to the soap industry, but the company also wanted to know what other uses there were for coconut oil and, just as important, what could be done with the coconut residue? From the

[1] Innovation, as used here, simply means introducing something new and different based on a creative insight or act. It could be an invention or just a new way of portraying a problem or its solution.

former, SRI chemists proceeded to develop a useful substance they called a "plasticizer" that helped plastics shape and hold their form. But, though they racked their brains, they couldn't find uses for the residual meat. Now the coffee break.

The paint researchers were complaining that while they had found a chemical that would smooth the bubbles out, they needed an oil base to go with it. A chemist on the coconut project bolted to his feet and pulled a notebook from his pocket. One of these three coconut oil fats, he said, has some peculiar molecular properties that you might what to look at. Out of a hunch came a double-barreled solution. Tests revealed that one of the coconut residues also fit the paint defoaming need, and it came into use in the other client's paint as well as that of several other paint companies.

A second instance came from a coffee break in the Engineering part of SRI and another cross-discipline question. Could a laser be built to replace the radio frequency sources used in weather radar? The result was the building at SRI of the first weather lidar, or laser-based radar, for probing the atmosphere. That story is unfolded in Chapter 9. While the common denominator here was a coffee break, needless to say it was the caliber and orientation of the people who attended them that made the difference.

One of the best evidences of a prolonged history of innovation at SRI was the creation in the 1960s and 1970s of the rudiments of personal computing. The rough vision existed, but the means to deliver the desired functionality had to be invented and then refined as it came into use. The development lasted almost two decades. But though retrospectively it was revolutionary, the magnitude and value of the innovation were not at the time evident to everyone. With no similar developments to look at, this work was almost totally SRI innovation. Unfortunately, innovation doesn't always take hold and this work ultimately ended at SRI in the failure of outside sponsorship.

Within the bounds of propriety, the SRI researcher is given wide latitude in areas of exploration. That latitude is part of the SRI atmosphere. While a few SRI research managers have constrained their people to pursue subjects in the mainstream of R&D, most are more adventurous. Thus, topics like psychographic segmentation of the consumer population for marketing, or the use of computers to augment human intellect, or even questionable topics such as remote viewing and cold fusion have been given a good airing at SRI. On the other hand, SRI has always had an ethical atmosphere, and many opportunities that would not reflect well on the Institute, independent of outcome or remuneration, have not been approved. As one example, though perfectly legal, projects directly related to Nevada gambling to my knowledge have never been approved. As a practical matter, however, most discretion about whether to undertake a project comes from skepticism about whether enough support can be found to do a subject justice.

A Successful Contract Researcher

In my opinion, the people who make successful contract researchers at SRI have five necessary characteristics. They are *creative*, they understand at least one *discipline* well, like all good leaders they are *motivational*, and they have an ethic for *integrity* and *hard work*. A *creative* orientation naturally takes one beyond the expected or predictable to a broader range of solutions to a given problem or opportunity. It questions not just the invited answer but also the premise itself. On the other hand, creative thought must also be accompanied by enough knowledge to become a good point of departure for not only what changes should occur, but also whether they can be realized. In a contract research organization it is important that imagination exist at all levels of abstraction concerning a problem; that is, from the high-level statement of the problem or overarching goal, down to the details about how the solution might be implemented. This is a lot to ask of one person, so often a team of people is needed to span the levels of perception that many solutions require.

Regarding *disciplines*, it is difficult to make an innovative contribution unless one is steeped in at least one relevant discipline. *Applying* a particular discipline requires enough of an understanding to be efficient and productive in its use. Similarly, advancing the state of that discipline or art demands an even greater appreciation of it. SRI has always had people with such grasps across a set of important disciplines; not to have such a background obviously forecloses research in the

areas to which such disciplines apply. SRI's strength has always been in the rich number of disciplines among its staff.

Having said all that, there are a very few, exceptional researchers who have the innate power to look at an opportunity, and quickly position themselves at the very frontier of the relevant field. Though it may take a year or two, they emerge with a totally new approach that makes a world of difference in the utility or accuracy of the selected field or even in the field's underlying science. Such people are wonderfully appropriate in a contract research environment.

Motivation is necessary in two critical dimensions: one, is the ability to lead a group of project people toward a responsive goal; and second, and perhaps more important, is the ability to sell a potential sponsor that SRI has the understanding, the insight, and the approach to bring new and competent solutions to bear on the sponsor's problem.

Because SRI is a contract research institute, it is obviously successful only when it has an adequate backlog of research contracts.[2] Those individual researchers who can consistently deliver such backlog effectively wear chain mail; that is, they enjoy an enormous protection against whatever internal buffeting occurs. Those who gain long-term sponsorship and do quality work are probably the most revered people at SRI.

The last researcher attribute is best evidenced by how truthfully and consistently one represents him or herself. For most of SRI's existence, that quality has given SRI a reputation for *integrity* and *objectivity* with clients. Some of this stems from the scientific ethic and some from the very direct relationship that exists between the project leader and the client. Personal integrity, of course, builds organizational integrity. SRI's Tom Boyce puts it this way: "When I came to SRI in 1983 and had to call on potential clients to market or explore new work, I was amazed at how accessible people were when you told them you were from SRI. One of the first places I went was the Philippines. I would pick up the phone and call someone cold and, assuming they were in, I could get an appointment that same day or at the latest, the next. That was very gratifying and, you know what? It made me want to leave that contact in as good or better shape for the next SRI person who might call. It was a bond of responsibility I felt in continuing our excellent reputation."

As with any organization, SRI has its leaders, both formally and informally designated. Over most of its existence, technical leaders have been perhaps the most venerated by the staff, either because they are innovative or because they repeatedly bring in significant research contracts by offering prospective clients innovative and timely ideas and solutions. The Institute has several ways in which it honors such people. Each year awards are given for lifetime accomplishments: two Institute Fellows for technical achievement, one person who has contributed substantially to mentoring others to greater achievement, and one for life contributions to society in general. Added to these regular awards is a post-retirement SRI Hall of Fame whose members are elected by the SRI Alumni Association. Appendix J lists all these awardees to date.

Interdisciplinary Research

It stands to reason that in an applied research world, so often driven by the problems at hand, work bridging distinctly different disciplines would be commonplace. But when an institution is defined by the presence of traditionally separated disciplines, interdisciplinary talents are not easily developed. Over my 40 years at SRI, there have been numerous times, both formal and informal, when the subject of building this kind of interdisciplinary capability has been brought up by management in general terms, as it tried to educate the staff on its virtues and how it could be achieved. If any of those top-down efforts resulted in any concrete interdisciplinary achievements, I am not aware of them. In spite of the legitimate view that there are often rich rewards for exploring the boundaries of two or more disciplines, our educational, research, and even reward systems, not all of which are internal, discourage leaving one's chosen field. Furthermore, because by nature interdisciplinary wedges are not easily foreseen, speaking in general terms about them accomplishes almost nothing.

Yet in a heterogeneous place like SRI, there should be countless opportunities for

[2] Success has more than a financial dimension at SRI. The quality of work, the stature of its staff in their field, and the degree to which its clients benefit are other valid measures of success.

interdisciplinary work. Even if not induced by management, these could come from the informal interaction of different researchers or from the awareness of a need that does not yield well to a unidisciplinary approach. The question is how to encourage its happening?

The best and perhaps only way such endeavors have been successful at SRI is when they arise within some individual who has both the capacity and interest to bridge multiple fields. It is not enough just to identify an interdisciplinary bridge; someone must actually build it locally. That takes a person who is proficient in at least one field and willing to develop a working knowledge of the other. These "bridge people" are a necessary but not sufficient condition for interdisciplinary work.

Beyond having the bridge person, a team is usually needed, and perhaps the most difficult aspect of interdisciplinary work is getting other experts who are steeped in or advancing the art in one field to divert their attention to another. There is clearly some security in remaining within one's own field and, since most research laboratories are organized by discipline, researchers may be reluctant to leaving their organizational home for something that by nature has more risk. If the new effort is difficult enough to require several years of dedicated investigation, that looms as almost a career change to the discipline-centered specialist.

But bridge people do exist at SRI and, if one's notion of interdisciplinary work is more modest (i.e., it can be spanned with a small bridge, so to speak, either in the art or time), a substantial amount of that work occurs. Examples such as the marriages developing between chemistry and material sciences or biology or the blending of chemistry and biology to define toxicology are now commonplace. Business and economics are also easily overlaid on virtually any engineering or scientific pursuit. Lacking at least one bridge person, however, even small bridges can sometimes be difficult to erect.

As a division director, I sponsored for over a year weekly lunches between computer scientists, linguists, automatic speech recognition people, and electrical engineers to discuss the advancement of human-computer interaction. Though the advantage of that goal was fairly clear, it was still difficult to draw people out of their familiar haunts to tackle what most people would think of as inevitable. SRI had invented the world's choice for hand-screen coupling, the mouse, had as good an automatic speech recognition capability as anyone, had invented a handwriting recognition system in 1970s, and was steeped in natural language understanding and other artificial intelligence-based fields; thus, the initiative seemed very natural. Some success came in the formation of a Computer Dialogue Laboratory, a physical but not organizational facility where interaction research could go on and, eventually, it did inspire a very few people into melding automatic speech recognition with natural language understanding to improve on the accuracy of machine-recognized speech. But while that set the state of the art in terms of recognition accuracy, the most recent advancements in automatic speech recognition drew on other approaches and sheer machine power for their success. In the end, gaining a new plateau in human-computer interaction lacked the bridge person and, given no clearly identifiable sponsor with that interest, little came of it. There were no new technologies developed and no commercial successes. Agents, semi-autonomous acting pieces of network-mobile software, were advanced in these deliberations, but they didn't materialize at SRI until a bright young Artificial Intelligence Center (AIC) computer scientist later developed them. That approach did, coincidentally, return to enhance the functionality of human-computer interaction (see Chapter 4, a description of AIC work).

The Roles of Research Management

The position of management in a research institution is somewhat precarious, but not unimportant. Though a research organization's figure of merit is defined dominantly by the creative talents of its research staff, managers do have important roles. Just how important is quite honestly a function of your perspective, but there usually exists within a research management hierarchy a transition from close identification with the research staff and their culture to more remote but necessary preoccupations such as policy and profitability. While the manager rising in this hierarchy probably doesn't feel a creeping estrangement, nonetheless it occurs. Profitability, allocation of resources, and resolving interorganizational conflicts are some of management's duties, and

they are all viewed as distractions by the myopic and impassioned researcher. It is probably the case that good managers in any setting maintain some interaction with the working level but in contract research, where the first two levels are responsible for most of the organization's success, it is crucial. These are the levels that provide virtually all revenue and client satisfaction.

An involved, walk-around manager is a benefit to any organization including those involved in contract research. Here, where the working levels are so critical to income production, it is important that managers identify with those levels and how they can be motivated and helped. You can easily see attempts by some research managers as they try to avoid any cultural transition as they move into management. One example is "dressing down." The "wearing of a tie" is often subordinated to the need for implied acceptance by the stereotyped, open-collared, sometimes disheveled researcher. Many hardcore male researchers I have known will go to almost any length to avoid neckties, wearing them only for the outside world, such as clients. Even then the strange combinations of shirt, tie, and jacket seem chosen to convey their discomfort. Male managers that don't wear ties consistently are likely to be paying some deference to the research culture and giving a little tip-off about their own self-perceptions.

Managing in a contract research organization is certainly more difficult if not more important than in one whose money flows in from the top and is allocated according to someone's preferences. In a contract research setting like SRI, the researcher is expected to decide on the area of work, win the sponsorship to carry it out, and convey to the client the relevancy, adequacy, and competency of the results. That is a great training ground, and in the eyes of a typical researcher, it doesn't leave a huge role for a manager above the laboratory level. There is a prepositional invective used at SRI that goes a long way in typifying its culture. A researcher may sometimes claim, "I don't work *for* SRI, I work *at* SRI!" Strangely, as distancing as it may sound, that statement is often spoken with fondness about how it feels to work at SRI. Accordingly, as a manager at SRI, it was very difficult for me to assert that someone worked *for* me as opposed to *with* me![3]

So, what should a manager's role be at a place like SRI? As you might expect, the answer varies depending on the level of management, and there is probably room for a few different styles. For much of SRI's history, there were five levels of management. Now, there are, preferably, but four, albeit SRI is now much smaller. The first two management levels, those that direct a collection of projects called a program and the laboratory or center director, are still permeated by the research culture…what projects should be sought, what is the expected quality of the work, and who should be doing it. Except for financial aspects, management above that level is often discretionary, but just which discretions get exercised becomes critical. The starting or stopping of research areas, or programs, is an important middle-management activity perhaps not exercised frequently enough at SRI. At the highest management levels, that tendency to become disconnected from the producing levels must also be avoided or become simply an overhead load in the eyes of the research staff.

There are several important things that contract research managers at any level must do:

- Support a culture where creativity and innovation can flourish. Managers and not just researchers must be "keepers of the flame" at SRI; that is, they must be oriented toward preserving an atmosphere of innovation.
- Assure that the quality of work doesn't suffer under client or internal pressures.
- Administer the budget process and its allocations of required levels of performance. It is this process that should be used to reinforce positive outcomes and limit or terminate poor ones. Nonprofit institutes still require fiscal discipline.
- Resolve and correct interorganizational conflicts. Like everyone else, researchers can covet the same roles, clients, and projects as their fellow researchers. While internal

[3] Here I might usefully quote from a memo to my Division staff when I retired in the spring of 1998. It relates my true feelings about being a manager at SRI: "….Finally, I would like you to remember that whatever unfolds, you are the Institute. You don't just work *for* SRI, you don't just work *at* SRI, *you are SRI* and everything you do here has some impact on others, so let it be your best. SRI will succeed only if you do and it will fail only if you fail to meet your potential…."

competition can sometimes be beneficial, SRI is one place it must be controlled. A former head of Bell Labs mentioned to me that even Nobel Laureates engage in jealous wrangles.

- Help clear the roadblocks to interdisciplinary work, especially where the required working level participants have already embraced the venture.
- Set the parameters that enable attracting the necessary talent.
- See oneself as both motivating new and good research, but also as serving and enabling project winners and leaders. Micromanaging is even more deadly here than elsewhere and, in deference to overhead burden that is so important to initiative and success at the project leader level, managers should be lean in their supporting staff.

As with any organization, there are also some things that any manager must *not* do, particularly from higher levels of management:

- Become so detached that you appear to be arbitrary and believe you are free to act without clear regard for the staff that is producing the revenue.
- Assume you can or should direct research content from the top down.
- Be assigned inordinate privileges in convenience, comfort, or financial reward. The exorbitantly paid and pampered CEOs of industry are a terrible model for a research institute.
- Fail to support and defend a researcher who has done good and relevant work objectively, even when the preferences of the client or others would have chosen some other outcome.

I will cite one of two incidents I had in the vein of this last point. We had a project with the FCC to quiet a car electrically so that forthcoming transistor circuits would perform reliably. In an unusual arrangement, our final contract payment depended on our success on an actual car. We knew the spark plugs and the distributor would be the culprits and devised inexpensive ways to modify them. But the automobile manufacturers, who didn't want to raise the cost of a car even one dollar, repeatedly rebuffed our efforts. We mentioned that reluctance in the final report to the FCC and suffered the wrath of the automobile industry association. Because the head of that organization knew the SRI president, we researchers were called on the carpet and asked to delete that observation in the report. Our resolve to report what happened held, the report wasn't changed and, interestingly, we later received two contracts from that same association in the ongoing assessment of automobile ignition noise![4]

Next there is the question of upper management selecting, or more precisely preselecting, future research areas in which the Institute is to engage. Though several SRI presidents, sometimes in the framework of strategic planning, have tried this, it never has worked well. If such a new field is apparent to someone not intimately engaged, it is probably already too late in the competitive research marketplace. Those best equipped to make the determination are those who have both current knowledge of an art *and* are pounding the street looking for opportunities day in and day out; that is, the research professionals or at best their first- and second-level managers. Managers at the second or third levels can sometime help when they form and maintain higher level contacts in client organizations where they can spot early the emergence of new research initiatives. Aided by such awareness, prompted by their own discovered opportunities, and faced with carrying out whatever they propose, it is the fertile minds of those engaged in the research where new research ideas best originate.

Finally, there is the matter of incentive systems. Over the past 20 years or so, SRI has experimented with different plans and one is in place at the moment that rewards good financial performance with limited bonuses. Its tailoring over the years has brought it to a general point of acceptance by the staff. In such an egalitarian research atmosphere, the danger arises when a bonus system becomes too large and concentrated in too few people. Lucrative bonuses, of course, can also play on the unfortunate temptation to distort actual performance in order to collect them. As mentioned above, highly differentiated privilege of any form for upper management is very unpopular in a contract research organization. To present a stark example of the damage a strong incentive system can bring to SRI, consider what happened in the late 1990s to SRI's Business Group. From its founding the Business Group had, like the rest of SRI, been an

[4] The SRI project leader, James Gaddie, personal communication, January 8, 2004.

organization of researchers, analysts, and principal investigators, each making their own way. In 1995 SRI's president changed that model to one typified by large management-consulting firms with very well paid, profit-sharing-oriented managers aided by replaceable minions who would do most of the work. I remember being asked to interview a number of these "rain-makers" and I did not find one that I thought belonged at SRI. The cultural clash was horrific and it was an important factor in the demise of the Group. Even if it would have worked financially, it could no longer, perhaps by design, be a place with any research content. Certainly, research ideas cannot flow down from detached managers as tasks to workers not steeped in the required disciplines. The conversion was fatal to that Group and financially painful for the residual part of SRI.

Finally, there is the general question of management-employee relationships, one evidence of which is the presence of or efforts toward forming a union. To my knowledge this subject surfaced at SRI only once among the non-exempt (from overtime) staff in the latter part of 1976. The initiative lasted a few months and was then abandoned for lack of interest.