FOSTERING THE RECENT HISTORY OF SCIENCE AND TECHNOLOGY IN NEW MEDIA: A REPORT ON PAST PRACTICES AND FUTURE DIRECTIONS

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Introduction

This report is a summary of the first phase of our project (now called ECHO: Exploring & Collecting History Online—Science & Technology), as outlined in our original proposal to the Alfred P. Sloan Foundation. The goal of this initial phase was to critically assess the state of the practice of collecting and presenting the history of science and technology on line. We spoke with the directors of other Sloan-funded projects, reviewed a broad array of history Web sites with similar objectives, and convened a roundtable to examine the problems and issues raised by all of these sites, as well as our own project, in the greatest possible depth. Together these efforts have produced a number of valuable insights, leading us to modify some elements of our project while clarifying our vision of where online research in the recent history of science and technology is, and where it should go. The report itself will be used, in edited form, as part of the "Practical Guide" to doing history online that we are developing as one element of the project. Portions of this report will also form the basis of presentations at scholarly meetings and articles in journals and newsletters. We have already made one presentation that draws on this work at an oral history conference in Annapolis and we are on the program for the Society for the History of Technology meeting in the fall.

As historians we are acutely aware of the importance of learning from the past so as not to repeat it. As we suggested in our proposal to the Sloan Foundation, we have placed a high priority on thoroughly understanding current and prior attempts to collect and present the history of science and technology on the Internet. Only by closely examining and comparing other efforts, including the work of prior Foundation

grantees as well as other Internet projects that capture the past, could we hope to generate a list of best practices and formulate new ideas and methods for recording the history of science and technology using this promising new medium. It would serve neither the Foundation nor the Center for History and New Media to head off blindly in pursuit of this end without building on what has worked—and avoiding what has not. In short, we have endeavored to proceed in a smarter, more efficient, and more effective manner to accomplish the goals of this project and to further the overarching and clearly significant effort of the Sloan Foundation to save the recent history of science and technology before it is lost to the ages.

Our commitment to communicating with and learning from others is already starting to pay dividends. Important patterns have emerged from our investigations. Reasons for the failure of some projects have become clearer; elements of success have become more apparent. In this process of discovery we found the candid assessments, second thoughts, and novel ideas of the other Sloan grantees invaluable. These individuals and organizations form a great storehouse of information and experience, and despite the disappointment that some of them feel with respect to their efforts on the Web, we sense that in retrospect it will be clear that they were part of a necessary, if occasionally frustrating, learning process. If their results have been uneven, it is obvious from speaking with them that together they have produced a record with great implications for future efforts to gather the history of science and technology on line. *We summarize what we have learned from that record in Section 1 of this report.*

In addition, we recognized early on that the collection of oral histories and artifacts from scientists, engineers, and other participants in the history of science and technology is not so different from certain other historical efforts on the Internet. For example, some sites on the history of World War II have produced tremendous

databases of personal stories and images. What can we learn from these immensely successful projects that can be applied to the history of science and technology? How can we reproduce that impressive level of response? Pursuing the answers to these crucial questions provided complementary lessons to those gained in our survey of the existing Sloan projects. *We discuss these lessons in Section 2.*

Having already gained a significant amount of insight through our extensive survey of Sloan and non-Sloan Web sites, we concluded the initial assessment phase of our project by convening a roundtable of experts on March 17th and 18th, 2001. Bringing with them detailed knowledge of different elements relating to the collection, storage, and presentation of history on the Internet, the roundtable participants intelligently addressed our proposed agenda and helped us to further understand common pitfalls and effective tactics when working on line. *In Section 3 of this report we outline their thoughtful response to the various elements of our project and to the broader effort underway to collect historical accounts and artifacts digitally. We also include their critiques of the existing Sloan sites in the Appendix.* Members of the roundtable raised several issues to which we had given little thought, and aided our effort at assessing the strengths and weaknesses of existing Web sites.

With a far clearer sense of the state of the art and the problems encountered by others who have built sites on the history of science and technology, we are now in a position to move forward with certain hard-won lessons in mind. *We explain how these lessons have led us to revise some elements of our original plan in Section 4 of this report.* The conclusions we have drawn from interviewing other Sloan project directors, from our survey of non-Sloan sites, and from the input of our roundtable consultants are an important first step toward achieving greater clarity about the effective online construction and acquisition of the history of science and technology. But they also

expose the need for further, wide-ranging experiments to see what works and what does not. The true key to reaching our goals and the goals of the Sloan Foundation will be to continue to learn from failure, from success, and from each other.

Section 1: Lessons from the Existing Sloan Sites

By our count, there are now two dozen sites on the history of recent science and technology that have been built with the assistance of the Alfred P. Sloan Foundation. Our first undertaking was to examine these sites thoroughly, and to ask for the thoughts and advice of their directors. We spoke to many by phone and corresponded with most of the rest via email. As already noted, we were tremendously gratified by how open the Sloan grantees were to our inquiries and how helpful their responses were. Many of the project directors told us that they were excited by the fact that we were surveying the group to gain an overarching understanding of collecting and presenting the history of science and technology on line. Alone they were just a single data point; clearly, it would be useful to everyone involved to look at the full array of sites to find meaningful patterns. Indeed, as we discuss in the conclusion of this report, there is still a great need for a wide variety of additional experiments in order to discern these patterns.

Regarding their own efforts, the general feeling of the project directors was one of disappointment. Almost all viewed the Internet as a promising new way of reaching historical participants and expanding our knowledge of the recent history of science and technology, yet it turned out to be far more difficult than they had expected to collect significant first-hand accounts. With the notable exceptions of the *Electric Vehicle* site, the *MouseSite*, and the *Blackout* site, most of the Web sites failed to attract more than a handful of comments. Even including the directors of the three projects with numerous contributions, all of the Sloan grantees now realize that their expectations for

this seemingly instantaneous medium were too high. Nevertheless, many of them still believe that the Internet can provide a novel role in the collection and preservation of historical memories and artifacts—if we can better understand the roots of their overall disappointment and the reasons behind the successful gathering of historical recollections on the three sites mentioned above as well as at certain times on the rest of the sites.

Certainly a great deal of discouragement began with the difficulty so many of the project directors had in getting their sites up and running properly. Despite the rapid advances that have been made in the relatively young field of Web software, there are still considerable problems with stability, compatibility and user-friendliness. Some project directors tried Lotus Notes and other expensive commercial packages for discussion forums and the input of comments; others tried software tied to a specific platform, such as the Macintosh or (more frequently) Windows NT. These experiments worked far from flawlessly, leading to a spate of bugs, perplexed contributors, and headaches for the directors. Moreover, much of this software continues to evolve seemingly by the month, leading to the inevitable glitches associated with upgrade cycles. As we summarize in the last section of this report, such experiences have led us to conclude that the best way to proceed in the future is with open source, rather than commercial, software. Like HTML, the underlying code behind Web pages, open source database software like MySQL and scripting languages like PHP are platform independent and can be easily shared with other webmasters. Just as it is possible to copy sections of HTML code from any Web page to reproduce a similar layout on another page, it is possible to copy pieces of MySQL and PHP code to create similar Internet databases. In addition, by using such open source software one can seek help from a rapidly expanding and surprisingly charitable global user group. Best of all, like

the software itself this help is free and easily accessed, and while there are often radical differences between versions of commercial software such as Windows or Word, open source software is remarkably backward compatible. The latest version of the open source operating system Linux, for instance, retains virtually all of the commands and structure—as well as the stability—of decades-old UNIX.

The software problems experienced by the majority of the Sloan directors have also led us to believe that it is important to match the complexity of the technology to the stage of the project. Many of the directors fell back on email, perhaps the simplest means of communicating on the Internet, as their last resort for garnering contributions when complex software proved too frustrating. Perhaps this application of technology should have happened in reverse. In the early stages of a project a method like email may be a perfectly acceptable, simple way of gathering contributions. As soon as project directors have enough contributions and content to build robust sites, then they can move to more demanding forms of interactivity and the more elaborate software that goes along with it. We should note, however, that the *Blackout* site and the *Electric Vehicle* site used Web-based surveys from the start, and the *MouseSite* used relatively complicated forum software. Nevertheless, it still seems sensible to be flexible on the method of inputting contributions and to suggest to historians of recent science and technology that they need not use the fanciest technologies at the beginning of their projects. Again, continued experimentation on this issue would be useful.

In spite of ubiquitous software problems, it is important to emphasize that human elements were just as significant as technical ones—if not more so—in the project directors' minds. The directors were extremely reluctant to praise or blame technology for the success or failure of their sites. For them, reluctance among scientists to contribute, for instance, was a matter beyond technology. In our lengthy

conversations, we focused on four non-technical elements of each site: the topic, including how it was conceived and described to its potential audience; the content and design of the site; the nature of the audience for the site and its attitude toward the Internet and historical recollection; and lastly, efforts to publicize the site. Throughout, our greatest concern was the way in which each element helped or hindered the collection of history on the site. For example, in our discussions about the content of the site, we asked the project directors if they had a sense of which material drew people to the site, and, if they could start afresh, what they would have put up on the site before publicizing it.

The analysis of these four non-technical components of the existing Sloan projects was complicated, however, by the difficulty of separating these elements to discern which one or ones had an impact on rates of contribution. Perhaps the content was excellent but visitors had a difficult time figuring out how to add their accounts to the site; maybe the publicity was poor but the topic had a natural constituency that gravitated to the site by word of mouth. Indeed, this complexity reinforced the need to compare as many projects as possible—and ultimately led to our survey of non-Sloan sites for additional understanding of the highly involved process of building a site that is successful at garnering contributions.

Topics

The topics for the Web sites constructed by the Sloan grantees represent an impressive and fascinating range of interests and subject matter. However, many of the project directors now say that they wished that they had spent a little more time conceiving and developing the topics to achieve the highest possible level of

participation. Often the topics were chosen—and perhaps more importantly, framed—with little thought given to their audience or appeal. For example, at least five of the sites had a direct link to the issue of global warming (*Greenland Ice Drilling*, *Solar Variability and Climate Change*, *The GARP Atlantic Tropical Experiment*, *The Clean Air Act*, and *The History of General Circulation Models*), yet the project directors were not very aggressive in connecting their sites to this critical and well-known issue. This is not to say that all sites must aspire to reach the widest possible audience—indeed, for many topics the audience is by nature fairly small. Nevertheless, in retrospect some of the directors realized that their topics were unnecessarily circumscribed. This lowered the number of visitors to their sites, restricted the field of possible contributors, and made key historical participants less interested in contributing because it seemed fairly unimportant.

For sites with an inherently small audience, expectations were probably unrealistic. Professional associations understand that a good response rate to one of their direct mailings is 5 percent; this statistical reality held true for many of the Web sites as well. For example, although the *Greenland Ice Drilling* site asked for contributions from a wide variety of people who might have had a role in facilitating these experiments, including government officials, machine operators, and information technology personnel, the most likely contributors were those most invested in the research: the actual climatologists and geologists who set up and ran the experiments. Although there have been a number of ice drilling projects, this is still a relatively small group of scientists, and with a low response rate the site failed to acquire many first-hand accounts. Therefore, unless it is possible to change the attitudes and habits of scientists (a possibility discussed below), a site with a small natural audience is unlikely to garner more than a handful of responses.

On the other hand, a large potential audience does not guarantee success either. Some topics, like the *Digital Audio Recording* project, targeted populous but highly diffuse communities of researchers, in a number of disparate fields. This perhaps created a different problem than the one encountered by more circumscribed projects: no specific scientific community felt that the Web site was "theirs," again leading to few contributions. Looking at the sites that were successful at collecting historical recollections, it is apparent that they either had a committed, almost cult-like user base, such as the *MouseSite* or the *Electric Vehicle* site, or an extremely large potential pool of contributors, like the *Blackout* site. Leaving aside that latter site, which is perhaps unique in its orientation toward a popular as well as a scientific and technological audience, our conclusion is that the most promising topics are those that are built around discernable, reachable cohorts of a relatively decent size, and which are given the broadest implication possible while still appealing to the targeted community of scientists or engineers.

Audience

Related to the nature of the topics were questions about the character of the intended audience, and particularly the members of that audience who took an active role in the history of the science or technology under discussion. Surprisingly, most of the project directors believed that they had underestimated computer use among older scientists and retirees. Many directors had approached their topics worrying that the historical participants of greatest importance were less computer savvy than the current generation and thus would have trouble entering their recollections on the Web site. This worry was unfounded, however, as most project directors concluded that senior

scientists and engineers had access to computers and could have used them to respond if they had wanted to. Larry Kruger of the Neuroscience Society, an emeritus professor at UCLA, had canvassed his colleagues on this potential hurdle, and found little to be concerned about.

A far greater problem turned out to be the broad resistance of scientists and engineers to the project of collecting history. Sloan directors said that they encountered deeply ingrained feelings among researchers that prevented them from responding to the call for contributions. Some felt that they were not responsible for creating the historical record, others that the historical record was already out there. Some researchers expressed a strong desire for privacy, while others worried about the effect of their contributions on their current employment or on their reputation among colleagues. Most researchers felt that if they were going to engage in historical recollection, it would be for associates in their community rather than for outside historians. That last sentiment was especially telling: it is clear that scientists and engineers often *do* practice history—just not in a manner that is familiar or open to the academic historian. Some of the ways scientists and engineers engage history are the practice of the *festschrift*, commemorations, and the celebration of anniversaries. Understanding such modes of history, which seem natural to scientists and engineers, is critical to the success of future Sloan projects. In short, while the general public may contribute to a Web site because it lends authority and importance to their experiences, scientists and engineers gain prestige from their place within their professions, and participating in public reminiscences may be unattractive to them for a variety of reasons.

Unfortunately, the apathy of many researchers toward history was exacerbated rather than mitigated by the overall tone of many of the Web sites, which made them

appear to be directed more toward the concerns of historians than scientists and engineers. Our roundtable panelists noted that questions on the sites were often abstract, or even confusing. Worse, they frequently sounded like one historian speaking to another historian about the grander issues behind a science or technology. For instance, the *GARP Atlantic Tropical Experiment* site raises important historiographical questions about the Cold War, but these questions may not have seemed immediately relevant to potential contributors who participated in this meteorological test. It may be necessary to discover the answers to these more profound questions as a byproduct of discussions that hew closer to the hearts and minds of the scientists who were there.

Content & Design

Almost without exception the project directors expressed regret that they had failed to post a significant amount of content—particularly content unavailable anywhere else on the Web—before they advertised their sites. Server statistics, Keith Seitter of the American Meteorological Society told us, show that numerous visitors came to their sites only once, leading to the conclusion that these one-time visitors were disappointed with what they found. (As our roundtable participants also remarked, it was often difficult to find the most impressive content on each site. Oftentimes this content was buried three or four layers deep, requiring extensive searching to find it.) If they had a chance to start from scratch, many project directors would have spent considerably more time assembling and digitizing artifacts that would have intrigued their target audience, as, for instance, the *MouseSite* did. Tom Perry of the American Society of Mechanical Engineers, for one, said that he would have liked to have had

fifty percent of the total content up before allowing visitors to access the site. It is absolutely necessary, most of the directors also decided, to post content that was compelling and rich enough for visitors to want to return to the site—and for new visitors to seek out the site because of its unique content.

However, it also became clear that the content that was most effective at prodding historical participants to visit a site repeatedly was the ongoing contributions of other participants. On the positive side, this means that once a site has reached a "critical mass" of contributions, further contributions often come in without the prompting of the site staff. This phenomenon is clear in the continually expanding database of contributions on the *Electric Vehicle* site, the *MouseSite*, and the *Blackout* site. The latter site, in particular, is now garnering additional recollections each week from new, unprompted visitors who apparently feel comfortable adding their memories to those of scores of other respondents. Perhaps forty percent of the contributions to the site have come *after* active recruiting stopped. On the other hand, the "critical mass" phenomenon also means that it is extremely difficult to get the first set of responses, and to build a base of contributions that will, by itself, act as a magnet for other responses. The case of the *Boston Central Artery/Tunnel* site is instructive in this regard. For a variety of reasons—political, social, legal—many key figures in this massive engineering project were reluctant to add their recollections to the site. With few comments posted on the site, other potential contributors failed to respond, even after repeated prompting. Sara Wermiel of MIT told us that many correspondents felt that posting to the site seemed of little import, a difficult feeling to dispel when there are so few contributions already there.

Publicity

This dilemma obviously makes publicity exceedingly important, yet for the existing Sloan sites publicity was generally scattershot and ineffective. Project directors discovered to their dismay that advertisements in professional journals and other broad publications were almost entirely worthless. Gene Bierly of the American Geophysical Union remarked that they published two articles in the AGU bulletin, which reaches 38,000 members, yet they received almost no response on their *Solar Variability and Climate Change* site. The use of well-known scientists to promote a site and urge colleagues to contribute also failed. Keith Seitter enlisted some of the biggest names in climate research to work on outreach, but was surprised by the feeble responses of their associates. There were some successful attempts to generate publicity and contributions through promotions at professional conferences, but participation often failed to last more than a few days. For example, the American Meteorological Society's project on the history of the GARP Atlantic Tropical Experiment used a conference near the 25th anniversary of the experiment to promote the site. There was a flurry of online discussion that week—which then abruptly ended with the conclusion of the conference. The *MouseSite* also benefited immensely from a conference, making it clear that real-world productions can have a significant impact on site activity; the question now becomes how to sustain the high energy level produced by such live events.

Direct, and often offline, contact became a necessary outreach method in many of the Sloan projects. For example, after a tremendously frustrating period using Lotus Notes and purely Internet-based methods of publicity, Sondra Schlesinger, director of the *Structural Virology* site, turned to calling potential contributors on the telephone. She even flew out to California to meet with several of them in person. Sara Wermiel

sent out detailed mailers and questionnaires to prospective contributors for the site on the Boston central artery/tunnel project; Tom Perry mailed hundreds of postcards to historical participants. Such efforts probably could have been expanded significantly. In a common lament, Perry candidly related that he would have reversed his budget priorities if given a second chance, spending 40 percent on aggressive outreach rather than on the hardware and software to receive and organize contributions.

It is essential to note, however, that most project directors thought that the key to successful outreach was not necessarily going offline, but to be "proactive," as Perry put it. In other words, be sure that those in the target audience receive—repeatedly—information about the site and its special qualities. Aside from his efforts to reach out to the Electric Vehicle community through online bulletin boards and newsgroups, David Kirsch attended a number of EV conferences as well as local meetings of enthusiasts. Over many months numerous EV engineers and users got to know him and heard his steady drumbeat of publicity; this constant activity eventually produced a greater willingness within the EV community to contribute to Kirsch's site. The Blackout project also used a wide variety of online and real-world outreach methods to heighten awareness of the site, from bulletin boards to fliers to local networking. Jenny Nathans, librarian of the American Meteorological Society, thought that another way to produce the repetitious publicity that breeds familiarity and a high contribution rate would be to send out a monthly or quarterly email newsletter to historical participants about the most recent additions to a site.

The Future

To summarize, some of the most important lessons gleaned from our conversations with prior Sloan grantees, as well as our review of their sites and our own nascent efforts at collecting history, are:

• The "front end" is more important than the "back end." Many projects spend a great deal of time, manpower, and resources on the "back end"—the servers and software that enable a Web site to operate and do complex things. Experience has shown, however, that often it is the sites that work harder on the "front end"—the content, interface (often quite simple) and outreach—that succeed in collecting contributions from historical participants. Indeed, overly complex back ends often render a site unusable when software is upgraded or the technical staff moves on.

• Historians have no training in publicity, yet publicity is absolutely critical to getting responses. Unlike the Field of Dreams, if you build a Web site, they won't necessarily of come. Scientists and engineers have to hear about a site—often repeatedly—before they become interested in contributing. This publicity need not be fancy, however; a direct, personalized email to a historical participant or a regular email newsletter about a site may be more effective than a colorful ad in a journal, magazine, or newspaper.

• Projects must be planned around discernable, reachable cohorts of scientists. Before launching a site, a project director should be able list the names and contact information of most or all of those in the cohort. It is preferable that this group considers itself a community; if not, the historian must work extremely hard to build a sense of community.

• Think like your subjects, not like a historian. Scientists and engineers engage history differently than historians do, and we have to understand their perspective in order to create sites that welcome contributions in the manner they are used to.

• Let historical participants know that their contribution matters. Many people consider the Web an ephemeral medium, so it is absolutely imperative to broadcast the real-world connections projects have. There should always be a contact person for a project, with a telephone number and email address; there should be a clear sense of where contributions will be deposited—preferably a museum, library, or other institution that reinforces the lasting import of recollections and artifacts.

• Contributions may be the best magnet for attracting other contributions. This creates a chicken-and-egg problem, however, which can only be overcome by thinking carefully about how to collect the first slate of contributions. Successful methods for doing so include planning a project around an anniversary, commemoration, or conference. Methods that rely on scientists and engineers visiting the site, such as online dialogues with famous historical participants, may not work.

• While the Internet functions at light speed, the collection of history doesn't. Persistence pays off. Some of the most successful sites have taken years to build a critical mass of participation. Plan for the long run.

Our conversations with the Sloan project directors often ended on this final, worrying note: the fate of their sites in the long run. Many of the directors we talked to found it hard to secure long-term support and maintenance for their sites. Professional associations and academic institutions seemed to be of little help in this regard. Indeed,

these somewhat nebulous organizations often had trouble building and ensuring their sites were functional during the period of Sloan funding, much less committing resources to their functionality and preservation over many years. Time and again we heard project directors ask if we could serve as a future, more stable home for their projects. Their desire was for a place with a dedicated technical and historical staff unhindered by the shifting composition of their institution's hierarchy, committees, and part-time information technology workers. One project director at a major professional organization told us how his hours at headquarters never quite matched the hours of others involved with the project, including technical staff. In addition, he found that certain rules of the organization—for example, the directive that everything on the Web site be approved by a committee—greatly hindered the potential of the site.

Perhaps more vitally, many project directors could not ensure that contributions garnered by their sites would be properly saved for posterity, or even that their sites would remain on their institution's Web server over the years. As we discuss in the last section of this report, this crucial need for long-term archiving of sites has led us to considering an expansion of our strategic plan, including strengthening our ties to George Mason University's library or another archive for reliable storage of the material gathered through the projects under our umbrella, and offering archival services to other historians of science and technology, including prior Sloan grantees, who are interested. If we can find adequate funds, it is clear that we should consider working on sustaining existing sites and archiving their content.

Section 2: The Emerging Practice of Collecting History On Line

To further our understanding of the issues encountered by the prior Sloan Foundation grantees, we searched the Web for successful models of online historical collection outside of the realm of the history of science and technology. Seventeen sites stood out as exemplars, having gathered valuable historical recollections from thousands of participants.[1] Their ability to engage online visitors in the past, and their broader ability to establish a strong community among their members, provide some valuable lessons to historical practitioners seeking to use the Web as a research medium.

The sites we reviewed fell into a few basic categories: sites devoted to real-world places; interactive art installations centered around personal histories; "talkback" sites established in conjunction with an educational broadcast program; virtual communities of veterans and seniors; and projects devoted to collecting historical memories and artifacts. Most of the seventeen sites collected a considerably greater number of contributions than even the most successful of the twenty-four Sloan-funded sites; all but one of them collected at least a hundred more than the best of the Foundation's first and second wave sites. Significantly, nearly all relied on some type of "real world" event or social network to attract and sustain involvement on line.

The single clearest determinant of success for these Web sites is their ability to tap or create a strong sense of community among participants. "Real-world" sites like the one devoted to Brainerd, Kansas, or the Rowville-Lysterfield community center in

[1] These sites are listed at http://chnm.gmu.edu/sloan/roundtable/collecting.html

Australia, craft online spaces whose evocation of already established meaningful places, family connections, and community history resonate with the local people who contribute family histories, reminiscences, folklore, and personal artifacts such as photos and scanned documents. Art installations draw patrons together into the temporary community of a shared experience. One such installation, the *Collected Visions* project at NYU, solicits photographs—both on line and during inaugural exhibits—which are annotated by the contributors with explanatory excerpts from their family history. Another, the powerful *Atomic Memories* virtual exhibit at San Francisco's Exploratorium, also began as an installation tied to a Web forum, juxtaposing personal memories of how visitors first learned about the bombing of Hiroshima and Nagasaki and reflections on the meaning of nuclear warfare. "Talkback" sites like PBS's POV site, *Re: Vietnam*, feature highlighted "survivor stories," and some enjoy very active newsgroup-style discussion areas whose numerous messages are posted mostly by an engaged cohort, such as Vietnam veterans. Such a cohort finds the arcana of their shared past to be endlessly fascinating—a sentiment sure to be shared by the social historians of the future.

Perhaps the most dramatic success story in the talkback category is HistoryChannel.com's *Veterans' Forum*, an online community devoted to veterans that often enjoys promotional tie-ins with documentaries and other featured programming on the History Channel. Its Vietnam message board alone has nearly 20,000 postings, some of which are irrelevant or posted by non-veterans, but the vast majority of which reflect a serious—indeed, quite intense—connection with the past. The *Veterans' Forum* is a special case, since it has evolved into more of a virtual community than a talkback site tied into a particular broadcast. Indeed, its eleven active message boards are very similar to the twenty-five message boards in SeniorNet's *World War II Living Memorial*—

each devoted to a different aspect of "the Good War"—which together contain over 6,000 postings. Such virtual communities are able to transcend considerable obstacles to online access related to class, education, and age, because they allow their members to reinforce some of the most significant social networks in their lives.

Projects that rather self-consciously attempt to gather historical memories and artifacts on line, and promote historical "engagement," have encountered greater obstacles than the online communities of veterans and seniors. One example of this is *My History is America's History*, an online resource funded by the National Endowment for the Humanities that is devoted to promoting personal history among a popular audience. Despite the considerable national publicity this site has enjoyed in the eighteen months it has been running, it has only gathered several hundred personal histories, a relatively disappointing number. Certainly a poor interface has not helped, but perhaps more problematic is the fact that unlike the message boards on the senior and veteran sites, which contain missives of varying length and depth, *My History is America's History* asks visitors to write longer and more profound pieces of autobiography. This is surely a task that seems daunting to many people; on the other hand, when people do submit recollections to the site, they tend to be of a far higher quality than on other sites, and they are probably more useful for future historians.

In terms of sheer numbers of contributions, however, it is clear that the most successful sites engage participants on a personal level, encouraging them to relate the details of their lives and interests to the topics they feature. Indeed, the most active sites, such as the *World War II Living Memorial* or the *Veterans' Forum*, exist solely to serve the need for personal connection among their membership. "Real-world" sites appeal to pride of place and provincial sentiment, to the novel feeling of seeing one's life broadcast (and mildly glamorized) on the Internet. To the extent that they are

successful, sites devoted to capturing the past, such as *My History is America's History*, appeal to the powerful resonance of the personal connection to remembrance of the past. The same observation could be made of the *MouseSite*, the *Blackout* site, and *EV Online*: the most active sections of all three sites tapped the experiences of historical subjects for whom the Englebart group, the blackouts, and the electric vehicle community had personal significance.

Where "natural" communities such as seniors or veterans cannot be located, "artificial" audiences may be created with some ingenuity. The key to such projects, most of which are experimental, is personalization. Interactive art installations engage visitors, and prompt them to respond to the art, by finding novel ways to connect personal history to the site's subject, for example by asking visitors to talk about how *they* remember learning about the atomic bomb, or by having patrons donate family photographs and then annotate them, placing them within a larger narrative tapestry about formative experiences and artistic vision. Once community is established through a vivid and compelling personal connection or experience on line, less immediately personal discussions may be sustained.

In all of the Web sites we examined, active audiences had "sharp boundaries"—to borrow David Kirsch's phrase—that made it easier for project staff to target them, and, perhaps more importantly, helped potential contributors realize that they "belonged" there. A site devoted to Rowville-Lysterfield in Australia plays to the pride and personal interest of that town's residents, but it also identifies a discrete and manageable universe of people whose ties to each other are clear. The Sixties-L email list features over 3,000 postings from people who vividly remember that turbulent decade and continue to work through those memories with considerable reflection and passion on line. Despite the apparent broadness of its topic, the site in fact engages a

cohort of respondents who share an unusual degree of real-world experience, and thus draw on the sensibilities that flow from a shared formative moment.

Interestingly, at all but the most personally oriented sites content is still important to draw and hold interest among participants. In part, this reflects the effectiveness of a well-chosen topic. If a site offers anything new on a subject that captures the interest of a well-defined audience, its URL is bound to make its way into the bookmark files and email exchanges of that social network. What matters in choosing content, however, is not so much its exhaustiveness or refinement of presentation, but rather its distinctiveness. A small collection of compelling or provocative materials, carefully annotated or explicated in some fashion that appeals to the curiosity of a targeted audience, is far more effective than a vast but conceptually murky collection of materials. An example of this is the *Atomic Veterans* site, devoted to the community of veterans who participated in nuclear testing during the Cold War. This site is modest, but it provides its community with the information that it desires (e.g., an up-to-date collection of declassified documents) and it presents that information in a fashion that reflects the veterans' experiences (e.g., as it pertains to specific operations and outfits). In the most effective sites, the topic and the content merge with the contributions, spinning off a dialogue that becomes the main attraction of the site. Keeping the site current and fresh is also important for maintaining its vitality among participants. Perhaps the most appropriate metaphor for sites aiming to engage online communities of historical participants is that of cultivating a small but well-tended digital garden, of recognizably human proportions, in which a community may grow.

Organizational clarity and simplicity, conveyed by the site's design, is particularly helpful to maintaining energetic interactivity. Because of the basically

social impulse that seems to drive online reminiscence, uncomplicated design and intuitive interfaces worked best for the sites reviewed. Some of the most effective sites gathered most of their historical contributions using the most rudimentary collaborative platform, the online bulletin board, including the *World War II Living Memorial*, the *Veterans' Forum*, and PBS's *Re: Vietnam*. Even more impressively, while these sites used highlighted excerpts and small features to draw participants into the discussions, *Sixties-L* relied exclusively on an email listserv. It seems clear that well-defined audiences are just looking for simple outlets to express their sensibilities and articulate their social ties to others who share them. The less complex the interface, the easier it is for such audiences to get to what interests them: the conversation.

The "less is more" approach also applies to publicity and recruitment efforts. To discover the secret of these sites' success, we contacted two of the most active sites—SeniorNet's *World War II Living Memorial* and HistoryChannel.com's *Veterans' Forum*. The people in charge of the interactivity on both sites reported that their online communities practically ran themselves, and thus required little promotion or outreach. This impressionistic report was misleading, however. It would be more accurate to say that these sites had so effectively tapped into the social networks constituting their audiences that outreach *seemed* to require no effort. Indeed, the active members of the message boards on these two sites mostly rejected more traditional approaches to publicity. For example, the SeniorNet staff report having proposed a wide range of high-profile events to their volunteer moderators who oversee discussion on the *World War II Living Memorial* message boards, only to have them summarily rejected time and again. When traditional forms of publicity do drive participation, it is because they reinforce the existing interests of the members. Thus, the *World War II Living Memorial* eventually had to create five separate threads to contain the more than 4,500 postings

that flooded in after Tom Brokaw hosted a discussion of his book, *The Greatest Generation*. SeniorNet members were already accustomed to participating in online book clubs, and the content of Brokaw's book had the effect of preaching to the choir of WWII-identified seniors.

For sites that lack a natural sense of community, traditional forms of publicity are especially suspect. A conversation with the director of *My History is America's History* revealed the relative success of a "guerilla marketing" approach, in which organizations and communities are contacted through grassroots networking strategies, and a "public relations approach" emphasizing expensive media promotions. At a critical point in their outreach effort, NEH's public affairs department took over the recruitment effort for the site. Despite very high volumes of traffic generated by the department, which peaked during high-profile campaigns in conventional media, visitors continued to show relatively little interest in taking the time and making the substantial effort necessary to contribute their family histories to the site. On the other hand, the site's biggest success in garnering contributions occurred when a class of students was given an assignment to construct their family histories. This generated over 30 contributions, just under a tenth of the total number currently on the site. The director reports that she is moving back to a more grassroots strategy that is likely to elicit more local efforts such as this one.[2]

The lessons that emerge from this review of popular historical sites may not transfer entirely to the realm of the history of science and technology. However, they

[2] The targeted groups include the American Association of Museums, local libraries, the National Park Service, people who work with the public in cultural institutions, genealogy groups, the Mormon Church, the African American Historical and Genealogical Association, teachers participating in National History Day, the American Association of Retired Persons, and the National Council on Aging. The site has also begun a monthly feature aimed at well-defined communities—e.g., in connection with African American History Month—which should help increase contributions.

do reinforce much of what we learned in our canvass of the Sloan project directors, and the general principles we recorded at the end of Section 1. Clearly it will be useful to continue keeping one eye on sites which do not cover science and technology, but which succeed in gathering important historical recollections on line. Among other things, we will be featuring annotated links to such sites as part of the Practical Guide.

Section 3: Roundtable on Collecting the History of Science and Technology On Line

Our effort to achieve the clearest possible vision of effective methods for collecting and presenting history on line concluded with our convening of a roundtable of experts on March 17th and 18th, 2001. Participants in the roundtable were chosen for their significant experience with new media and history and for their complimentary areas of expertise. From outside of George Mason University we brought in Greg Crane of Tufts University, one of the nation's leading experts on online archival practice and the editor-in-chief of the Perseus Digital Library, one of the most important Internet archives; Linda Shopes of the Pennsylvania Historical and Museum Commission, past president of the Oral History Association; Stuart "Bill" Leslie of Johns Hopkins University, a distinguished scholar of the history of science and technology and secretary of the Society for the History of Technology; David Kirsch of UCLA, one of the original Sloan Foundation STIM grantees and director of the *Electric Vehicle Online* site; and Steve Brier, a leading figure in humanities computing, associate provost for technology at the Graduate School and University Center, CUNY, and president of the American Social History Project. From within George Mason University we asked Mike O'Malley, associate professor of history, creative director of the Center for History and New Media, and a historian of technology; John Cheng, assistant professor of history and a specialist in the history of science and twentieth-century American history; and Alison Landsberg, assistant professor of history and a scholar of cultural memory, to join us.

As we had hoped, the roundtable helped to strengthen our sense of how to execute our charge from the Sloan Foundation. From the very beginning of the roundtable we pressed the participants to help us clarify the issues and problems we face in the years ahead and to assist us in surmounting the obstacles faced by the other Sloan grantees. Our discussion was marked by an optimistic, yet pragmatic, tone, and numerous useful suggestions came out of the sessions. Informed by the lessons drawn from the previous critique of existing sites, participants presented a striking consensus on most of the larger programmatic issues raised by our plans. Their concrete suggestions reflected this clear vision, and provided us with some excellent points of departure for the upcoming phase of our project.

The discussion revolved around the three proposed sections of our Web site: the Memory Bank, where scientists and engineers will enter their recollections; the Practical Guide, where we will provide advice and solutions for other historians who wish to employ the Internet as a tool for their research; and the Virtual Center, which will contain a directory of Web sites on the history of science and technology as well as other features that will draw historians, scientists, and the general public to our site. Throughout the discussion, many of the roundtable participants expanded upon on comments made in their reviews of the Sloan sites, which are included in the Appendix.

The Memory Bank & Dialogues

As we have already noted, our growing feeling from the examination of the existing Sloan sites as well as other sites that collect first-hand accounts was that this concept has not been fully developed and remains in need of a great deal more refinement, which can be achieved through further careful experimentation. The

roundtable affirmed this sentiment. They believed that it would be extremely helpful for the Memory Bank section of our site to serve as a test bed for effective methods in online research, while at the same time contributing to the store of primary materials through a variety of projects. In order for ECHO to foster the practice of collecting and presenting the history of science and technology on line, it needs to develop a database of best practices in the field.

Moreover, most roundtable participants felt that trying many different forms of online projects, as well as our increasingly nuanced understanding of the issues involved in gathering the recollections of historical participants over the Internet, precluded the strict divisions we had originally proposed for the Memory Bank: "My Life in Science and Technology," an autobiographical section aimed at scientists and engineers; "Great Moments in Science and Technology," focused on participants in major developments and breakthroughs; and "Everyday Encounters in Science and Technology," devoted to the popular experience of science and technology "at the grassroots." Instead of pigeonholing our projects in these rigid categories, the roundtable concluded, perhaps it would be better to allow each project's scope and tenor conform to the needs and desires of its intended audience, and to enhance the potential for the successful accumulation of memories. Some projects may simply be called "memorials," like the site recollecting the life and impact of the computer pioneer Claude Shannon (discussed in the final section of this report), while others may garner responses from both an outreach effort to a specific scientific cohort and an association with an anniversary widely publicized in popular media.

In addition, the "My Life in Science and Technology" section gave most roundtable participants pause. They agreed that scientists and engineers, like the general public targeted by the NEH's *My History is America's History*, would be

somewhat hesitant to contribute lengthy autobiographical pieces to this section of the ECHO site. Of course, by allowing respondents to choose autobiography along with other formats in all of our projects, we can track the relative success of each and decide for ourselves. Over time, we can expand the list of testable practices as we learn which problems are the thorniest.

Regarding the critical question of effective recruitment of historical participants, the roundtable agreed that outreach should inform the framing of a topic, rather than the reverse. If we are to proceed by opportunistically seizing upon existing communities of historical subjects who are predisposed to participate in such a study, then we must have a clear sense of who they might be, and how we can reach them. To this end, the roundtable identified four basic strategies that we might employ: targeting tight-knit cohorts, such as alumni of influential labs or companies; drawing visitors to the site by featuring topics which enjoy significant publicity from other sources; deploying small, mobile studies which lure traffic from an existing resource, such as a highly trafficked site; and enlisting a broad effort by partnering with like-minded practitioners, such as museum curators or high school teachers.

The idea of targeting cohorts drew the most support from the roundtable. The most numerous examples which came up in discussion were the laboratories which produced some of the most influential discoveries and technologies of the twentieth century, such as FermiLab, Brookhaven, Draper, and Bell, as well as groups of researchers within such labs who had worked on discrete projects, such as the cyclotron at Berkeley in the 1930s, or more recently superconductivity at MIT. Generational cohorts may also prove responsive—e.g., scientists within a given specialty who finished graduate school in the same period. Such cohorts are likely to have alumni associations or less formal but still strong social networks that would make recruitment

more effective and less biased than would be the case if we had to work through university and corporate public relations offices. Another way to reach lab cohorts might be to take notice of events such as anniversaries or commemorations, an approach that has yielded some modest success in our database memorial to Claude Shannon.

The other three strategies for developing projects also hold considerable promise, especially if implemented in combination with a focus on a well-defined, reachable cohort of scientists or engineers. Highly publicized events or developments may draw attention in any number of ways: due to controversy, as in the genetic engineering of crops; as a result of a disaster or a failure of great public interest, such as the Three Mile Island incident, the failed Challenger launch, or the demise of the Mir space station; as a byproduct of discontent and alarm regarding widespread technologies and practices, such as the proliferation of class-action suits over defective products, or the mounting "bandwidth rage" produced by the growing use of DSL. Such publicity can clearly draw visitors and even contributors to a project.

However, as we have seen with the *Boston Central Artery/Tunnel* site, some topics are too hot to handle without alienating important historical subjects and amplifying the voices of certain publicity-seeking malcontents. Accordingly, we must look to identify topics whose productive controversy and public attention is not hampered by overriding antagonisms. The same caution applies to any efforts we might make to draw traffic from existing high-profile sites. For example, a widely discussed, profanely titled Web site devoted to leaking anonymous, inside information on the impending failure of dot-com companies may produce historically valuable insights, but it also runs the risk of placing a spotlight on a very biased group of contributors.

Finally, it should be noted that the overall recommendations for the Memory Bank also apply to the Dialogues, which were originally proposed as a way to draw traffic to the site by featuring interviews and events with prominent scientists, engineers, and other visible figures. In line with our developing notions of what works and what does not, the roundtable agreed that we should pursue and feature prominent figures only to the extent that they advance outreach and contributions for particular projects. To "get the word out" for a Memory Bank project, we should look to partner with institutions that are already in the business of publicizing science and technology, such as museums, PBS (Nova) and the Discovery Channel.

Other ideas for publicity for the Memory Bank included developing assignments for teachers that tie into ECHO events; hosting a meeting for a particularly energized user group or cohort, as occurred with the Englebart Symposium, held at Stanford University to attract participation in the *MouseSite*; and setting up a kiosk, or even a laptop, in a museum where it can be used to directly solicit contributions from among the visiting patrons. Direct mail or email targeted at groups of clearly identified respondents, such as enthusiasts who read Sky *and Telescope Magazine*, or even the more varied readership of *Red Herring*, continues to hold promise, although it may also be prohibitively expensive.

The Practical Guide & Professional Outreach

As we recounted at the beginning of Section 1, it quickly became clear to us that numerous complications continue to hinder the ability of historians to use the Internet as a tool for the collection and presentation of history. With so many elements to master—a panoply of acronymed computer languages, design principles, and copyright

concerns, to name just a few—the roundtable lauded our effort to bring together how-tos and solutions in one central location. Indeed, they believed that the Practical Guide, while incorporating some information found elsewhere on the Web, would be in its totality unique and immensely useful.

There was a general consensus that the main categories of materials that we plan to feature in the Practical Guide are appropriate, although two categories might be added: funding and institutional support, and a beginner's section devoted to trouble-shooting unanticipated challenges.[3] The key question most seemed to agree, is how these resources are framed so as to be useful to the diverse audiences of practitioners whom we choose to target. Aside from making "recruitment" a high priority, it was not clear how we might profitably address all the concerns of our diverse client base in a single guide. If there is one thing we can count on, it is that graduate students, museum curators, archivists, school teachers, professional societies, and other groups of practitioners will need to know very different things as they plan for projects which gather historical materials on line.

The roundtable was divided on how to address this problem. One group felt that we should provide separate entry pages to the Practical Guide that would organize materials according to the needs of each group. In this scenario, the entry point for scholars would place more emphasis on topics such as intellectual property and privacy for human subjects, while the entry point for enthusiasts and collectors would lean more toward design, text preparation, and basic historiography. In effect, we would be writing separate tutorials and FAQs for each group of practitioners, although at the

[3] The categories for the Practical Guide originally specified in our proposal to Sloan were: Historiography, Design, Recruitment, Publicity, Copyright & Intellectual Property, Privacy & Ethics, Archival Management, Text Preparation, and Technical Issues.

deepest level of specificity these would converge on shared resources, such as white papers on digitization standards or guides to XML. Others felt that if we produced an effective overall narrative for the Practical Guide home page, visitors would find it easy to identify the sections of the Guide that were relevant to their interests. It seems that we will have to query our client base, and experiment with both approaches, to determine which works best. Like the Memory Bank, the specific materials we feature in the Practical Guide should reflect the needs that emerge from our outreach to projects we support.

Indeed, we can increase the effectiveness of the materials we organize into the Practical Guide by culling them from our work in the Memory Bank. As we prepare materials for these projects, we can keep an eye out for items that can be excerpted, abstracted, linked, or featured as a case study in the Practical Guide. Real-world examples can be instructive, especially if care is taken to frame them with narrative that explains to readers the ways in which they might apply the experience to their own interests. For very basic topics, it may even help to use illustrations, cartoons, and animation, if these can be produced cheaply. For more advanced topics, case studies and sample code may be framed within a larger workbook or project guide.

The roundtable was also enthusiastic about our plans for spreading this practice around a variety of constituents. Indeed, they argued for making this even more central to the project. The roundtable participants believed that it would be tremendously useful to bring together a network of historical practitioners whose ability to preserve the past has been measurably improved by the implementation of online research techniques. They thought this could be accomplished in at least three ways: by forming partnerships with relevant organizations; by providing critical support services to projects in need of such assistance; and by acting as a super-consultant that connects

allied projects and helps identify networks of partners who might assist each other. We have already begun to develop a list of existing projects that we might approach in this vein.

Identifying new or unorganized practitioners is a more difficult matter, not least because there are many groups that may not be aware of their need to learn more about online techniques in historical research. The roundtable was most helpful in suggesting strategies by which we might identify such candidates for outreach. These might be labeled "associational" strategies, as they seek to take advantage of the various social networks in which historical practitioners move. Since most historical practitioners already assume active roles in their own organizations, we should seek to influence the way they do business "on their own turf." By the same token, it seems unlikely that we will be able to persuade practitioners to become part of a new "expertise exchange" established by ECHO for online historical projects, as our proposal indicated. A far more modest and realistic effort by SHOT to have its members register themselves as "experts" in their areas of specialty—largely to facilitate media requests for authoritative commentary—apparently failed to enlist many participants.

Roundtable discussion centered mostly around strategies for outreach to graduate students, teachers, and other individuals who have identified themselves as committed to preserving or exploring the past. Nearly every aspect of ECHO can be profitably tailored to the interests of budding scholars and teachers. This is because graduate students in the history of science and technology and related fields are generally young, willing to innovate, and looking for ways to reach historical subjects for their dissertation research. Furthermore, graduate students represent the future of scholarly historical practice. Schoolteachers make good recruits for similar reasons. Middle- and high-school teachers are generally interested in discovering new ways to

promote "active learning," and have indirect access to historical subjects through their students, whom they can assign projects which take advantage of online techniques. Other categories of practitioners that the roundtable felt should be targeted included: local historical societies, government historians, science museums, collectors, amateurs, and enthusiasts. The roundtable cautioned, however, that reaching and working with some of these groups, such as smaller historical societies and museums, as well as enthusiasts, may prove challenging.

The Virtual Center

The Virtual Center was the one aspect of our proposed site that met with some resistance from the roundtable. Greg Crane warned about the nature of building such a portal from scratch, describing it as a "treadmill" that would drain away much of our time, energy, and resources. Established portals, like Yahoo, could assemble and maintain a more exhaustive list of links on the history of science and technology more effectively than we could, other roundtable participants argued. As discussion of this concern continued, we tried to find a golden mean in which our efforts to produce a directory of sites on the history of science and technology would be, like the other elements of our project, highly attractive to our audience while not blindly overreaching given our limited resources. We explored the possibility of highlighting and annotating just the best sites, or sites which appear sufficiently robust and important, or some combination of the two.

Although some skepticism lingered, the roundtable eventually warmed to our idea of retaining the directory in a more modest, but perhaps more useful form. They suggested two especially promising routes: embracing and extending an already

existing portal on the history of science and technology, and establishing a peer review network for history of science and technology Web sites. Regarding the latter, the roundtable participants underlined that the vital practice of devoting critical, informed, scholarly attention to Web-based projects has been widely neglected, and that the Virtual Center could make up for this oversight. Bill Leslie ironically noted that the Society for the History of Technology's journal *Technology and Culture* lacked an editor of Web reviews, an omission that resulted in little if any attention to scholarship being done on the Web. It seems that the History of Science Society's *Isis* suffers from the same oversight. This suggests a potentially important role for the Virtual Center of the ECHO Web site. In addition, it dovetails nicely with the goals of the Practical Guide. An email newsletter to historical practitioners featuring the most recent reviews of history of science and technology sites and/or featured reviews in a professional journal would enhance both our project and the practice of the history of science and technology in general.

Moreover, a smarter alternative to building our own expansive portal is to take over stewardship of an existing directory of Web sites on the history of science and technology. We had already begun to explore this option, and the roundtable thought it was a shrewd tactic. They encouraged us to continue to explore alliances with existing portals to try to guide their efforts in ways that would serve our larger mission. For example, they suggested that we might be able to oversee the history of science and technology section of the open directory project called DMOZ, or establish some link to Yahoo regarding categories relevant to our project. As we describe in the final section of this report, we have recently been successful in our search for such a stewardship. In the near future we hope to control of one of the most prominent and comprehensive directories of the history of science and technology on the Internet. Along with

professional reviews of important Web sites, building on this well-known, existing directory should help the Virtual Center better achieve its original objectives.

Section 4: Next Steps for the ECHO Project

The suggestions and advice we have received from the roundtable participants, the existing Sloan project directors, and the directors of other sites that collect history via the Internet, as well as our own investigation of dozens of sites and online methods, are just part of our effort to discover and disseminate best practices. Since we began implementing this project in January 2001, we have constantly striven to be as well-informed as possible and plan to sustain this productive awareness over the project's remaining thirty-two months. With a growing set of principles in hand, we will be better able to execute each element of our original proposal to the Alfred P. Sloan Foundation. Surely these principles, such as the ones listed at the end of Section 1, are not the final word on collecting and presenting the history of science and technology on line. We do feel confident, however, that they provide an outline for more effective Web projects. Indeed, we have already begun to practice what we preach, moving forward with these principles in mind as we construct the ECHO site.

In building each section of the site—the Memory Bank, Practical Guide, and Virtual Center—our goal has been to emulate successful tactics, avoid duplicating mistakes, and provide an overall framework for the productivity of all historians of science and technology who wish to use the Internet to further their research and expand the store of primary materials. As the roundtable participants noted, this implies somewhat restricting the topical scope of the ECHO site to focus mainly on subjects that reinforce our efforts to instruct and support our client base. Doing this will allow us to concentrate our energies on our main objective: to serve as a central

resource, clearinghouse, and standard-bearer for diverse projects that might be able to profit from the new historical practice of online research.

Indeed, we must continue to be single-minded about addressing the concerns of the historical practitioners whom we seek to help. In programmatic terms, this means abandoning any effort to develop a "definitive" list of topics to guide the Memory Bank, Practical Guide, or Virtual Center so that we can concentrate on the needs and interests of specific groups such as historians of science and technology, museum curators, archivists, and amateur and enthusiast groups. In concrete terms, this means building more narrative "mediation" into our site, aimed at our various audiences; likewise, we must tailor our outreach to reflect more precisely the specific needs of the most promising groups of practitioners, such as graduate students. Rather than trying to guess what historical practitioners might need to know to collect history on line, we will use aggressive outreach to carefully targeted constituencies as a leading indicator of what content and services we should provide. Finally, this focus has pushed us to seek to influence or even form partnerships with existing projects and professional groups.

The Memory Bank

As we detailed in the prior section, in consultation with the roundtable we now envision the Memory Bank as a laboratory for identifying, enhancing , and institutioanlizing the most effective online practices, and as a result we have to modify slightly our original plan for this aspect of the project. Despite the already substantial experience of the prior Sloan grantees, the relative efficacy of different Web techniques is still somewhat unclear. We still do not know the answer to basic questions which online researchers must confront, ranging from the mundane to the more complex. For

example, is email more effective than an online form as a way to conduct a survey? Do email listservs provide a better balance between the passive gathering of historical recollections and the active voice of the historian than is the case for Web site bulletin boards? How much follow-up is needed to raise participation rates from, say, five percent to ten percent? The Memory Bank will serve as a test bed for such critical questions. If we make a point of trying out and comparing different techniques, we will be able to generate valuable data on which practices work best in different scenarios.

Nevertheless, we still maintain our commitment to collecting a significant amount of primary materials from the recent history of science and technology, as well as our commitment to the overall benchmarks for the Memory Bank. However, rather than attempting to organize the projects that collect these materials within the three originally proposed sections ("My Life," "Great Moments," and "Everyday Encounters"), and on a set number of predetermined topics, we will test various online practices through an opportunistic, broader array of projects. In addition, we will test the successful application of certain practices to projects with which we consult. In short, we will develop projects which will do at least one of two things, as part of the goal of collecting first-hand accounts and artifacts: 1) test and evaluate specific techniques for which historical practitioners have a clear need, or 2) directly support the efforts of historical practitioners whom we have enlisted. We can begin identifying the first class of projects based on our own assessment of the state of historical practices on the Web, starting with the twenty-four projects funded by the Foundation.

In our original proposal we had projected the need for ten dialogues with important figures in the history of science and technology, which we assumed would be a useful part of our attempt to gather historical recollections. As this report makes clear, we no longer believe that the time, energy, and funds committed to producing

these dialogues would be well spent. In consultation with the roundtable, we now conceive of a more productive use of such resources. Rather than attempting to secure dialogues with figures in ten major areas, as originally proposed, we will select figures according to their ability to draw traffic to projects we have chosen to support. Some may indeed be prominent, while others will be chosen according to other criteria of effectiveness, such as "cult" status or "man on the street" qualities. Other dialogue-like content may include previously published materials, such as interviews or articles, which we might choose to republish on the ECHO site if it promises to draw the interest of potential contributors.

One of our own initial projects, on the computer pioneer Claude Shannon, provides an illustration of our plan for the Memory Bank. The accumulated wisdom that went into its design and execution gives us hope for what historians of science and technology can accomplish through this part of the ECHO site. Looking at the lessons we have compiled over the last three months, we formulated a test project that would capitalize on as many of them as possible. Shannon, the father of modern information theory and the scientist behind many digital and communications technologies, passed away on February 24, 2001, at the age of 84. We knew that Shannon had a tremendous following among computer scientists, and that recollections of the man and his influence could form an appropriate starting point for a historical Web site on twentieth-century communications technology and the Internet. Using the relatively uncomplicated open source software to which we are committed after hearing of the technical problems of other Sloan project directors, we were able to build a Web site in one week that could accept contributions on Shannon and his impact.

Using the basic outreach method of email, we then sent out roughly 250 personalized notes to computer scientists whose email addresses we had compiled from

online directories. The email asked these historical participants to join their colleagues in remembering an important figure in their field's history; rather than burdening these computer scientists with historiographical jargon, in other words, the email appealed to their sense of community, continuity, and internal history. We also asked the computer scientists to talk about how their own work branched off of the pioneering theories of Shannon, in effect placing them in a genealogical tree of their scientific family from the 1940s to the present. Simply put, our email gently prodded its recipients to place themselves in the storied history of an important field of modern science and technology.

With no further prompting, we achieved close to a ten percent response rate from our targeted audience. Some of the respondents told us (unsurprisingly) that they did not know Shannon personally or were not influenced by him although they had heard of the name. Another set of respondents wrote to say that although they were busy they would make the effort to visit our site to make a contribution in the near future. Thirteen scientists made contributions within ten days, for an initial response rate of just over five percent. Some chose to email us their recollections (an option we explicitly gave them), while most contributed via the Web site. Perhaps most significantly the responses were expansive—far longer than most of the contributions on the existing Sloan sites. A few went on for several pages and included valuable biographical insights about Shannon. Overall, the submissions exhibited Shannon's influence on everything from electrical engineering, Internet protocols, and DSL to more surprising fields such as quantum physics. The length and breadth of many of the responses showed us that we had clearly struck a nerve with at least a segment of a scientific community. Indeed, many of the contributors thanked us for setting up a mechanism for remembering an important figure in their past and allowing them to

express how he changed the face of modern computing. Moreover, these respondents came to our site from across the United States, as well as Great Britain, Hungary, Norway, and even Siberia, exhibiting the unique power of the Internet to reach out to historical participants wherever they may be.

The Practical Guide & Outreach

The roundtable unanimously affirmed our goals for the Practical Guide, and our modifications to this part of our original proposal are relatively minor. Although it is by no means in its final form or contains all of the information we would like, we have already posted a sizable list of links to relevant resources on the Practical Guide section of the ECHO Web site. Some of the existing Sloan projects have already used these resources. For example, we referred Larry Kruger to the subsection on copyright regulations after he told us of his concern about using materials on his neuroscience Web site from professional journals. We will continue to expand this set of useful materials while beginning to add our own editorial passages. In addition, we have begun to work on the effective presentation of this information to the Practical Guide's varied constituents.

We are also moving swiftly ahead with our plan to offer consulting services to historical practitioners. For instance, after our conversations at the roundtable we built a site for Bill Leslie to gather recollections of the history of photonics from Xerox employees, to whom he lectured recently. David Kirsch appears interested in exploring a second project with us, on failed dot-com companies, although we have yet to formalize a consulting arrangement with him. We have also investigated helping David Roberts, a historian of mathematics education, to construct a site to record the memories

of retired math teachers. In addition, our location in the Washington metro region will permit us to consult with important professional science and technology organizations such as the American Institute of Physics and the American Geophysical Union. Both Spencer Weart of the AIP and Gene Bierly of the AGU are looking forward to meeting with us in the near future and working with us on their online projects. We have also held discussions with two graduate students, one interested in the history of biotechnology and the other working on the impact of the GI Bill on the training of scientists and engineers.

These graduate students may participate in the first of our two planned workshops, which were part of our original proposal to the Foundation. The roundtable thought that the most appropriate historical practitioners for the first workshop were academic historians such as graduate students and professors. In addition, they had a promising suggestion for reaching these historians: a competitive program that solicits proposals for review. We could announce this competition in places where practitioners ordinarily look for funding, such as newsletters and listservs, while also making direct phone calls and sending out emails to gatekeepers like graduate advisors. The winners of the competition would receive a stipend and they would be required to attend a workshop on the nuts and bolts of running an online historical project. If necessary, we might increase the average stipend amount and decrease the number of recipients to attract the best possible talent. The roundtable thought that if additional funds were available we could make this offer of support even more attractive to graduate students, who may be among the most energetic, successful directors of these projects.

To publicize our support for historians of science and technology who wish to use the Internet to gather primary materials, we have already placed an announcement

about ECHO in the Society for the History of Technology newsletter. This was done with the encouragement and assistance of Bill Leslie, who also reserved a special slot for us to present ECHO at the next SHOT meeting in San Jose this fall. Other potential partners whom we will approach in search of historical practitioners include: the Smithsonian postdoctoral program and its program for small museums; ASTEC, the organization of science and technology museums; the Library of Congress; the History of Science Society; the Organization of American Historians; and H-NET. We would also be happy to provide the same training to projects previously funded by the Foundation, if that would be productive. It seems that many of these projects, especially those supported by the professional societies, still have considerable potential to attract contributions from their sizable membership bases if they can rework their sites with an eye to the lessons outlined in this report. All of these efforts are aimed at our larger goals of fostering best practices and institutionalizing the practice of collecting and presenting the history of science and technology on line.

The Virtual Center

As our original proposal to the Foundation noted, we thought it was critically important to bring a significant volume of traffic to our site to enhance the prospect for collecting valuable historical recollections and to make the largest possible segment of the historical community aware of our services. The Virtual Center, a portal for the history of science and technology on line, was to be our most significant tool in this respect, but in speaking with our constituents we became concerned about the effectiveness of this tactic since those interested in the history of science and technology already have their favorite portals or search engines. Early on we thus explored the

possibility of forming an alliance with a well-known, existing portal, and this idea was backed by the roundtable.

Fortunately, our previous offer to the editor of the WWW Virtual Library for the History of Science, Technology, and Medicine—one of the most widely referenced portals in our field, with over 1900 links to it from other sites and a high volume of traffic—yielded just the opportunity we needed to act on this possibility. The editor, Tim Sherratt of the Australian National University, contacted us recently and indicated his willingness to hand over the reins of the directory to ECHO. If our stewardship of this portal comes to fruition, it will certainly draw a large volume of extremely relevant traffic to the ECHO site without requiring that we expend tremendous amounts of energy establishing a definitive collection of links. Our effort to embrace and extend the WWW Virtual Library portal is yet another example of the way in which we can build upon established institutions and practices. As David Kirsch pointed out, in particular this is an example of placing oneself at the top of a existing network, a highly efficient way of generating publicity and familiarity. Naturally, taking over the WWW Virtual Library for the History of Science, Technology, and Medicine will require substantial work and resources, but it will be worthwhile since it gives us a prominent location on the Web. Indeed, searches on the history of science and technology often return this site near the top of the results page.

If the adoption of the WWW Virtual Library appears too unwieldy upon closer examination, however, we would bring to the foreground of the Virtual Center other, homegrown elements. First of all, we would accelerate our annotating of the best or most important sites on the history of science and technology. In line with our original proposal to the Foundation, we have already annotated approximately eighty sites and catalogued over 300. Secondly, we would immediately proceed with our plan to write

reviews of Web sites, possibly in conjunction with a scholarly journal. Once our outreach begins in earnest, we will have access to a network of informed critics who will provide an excellent reviewing base for the scholarly community, and these reviews will help to legitimize the practice of online history as well as foster best practices through peer review. We plan to contact the editors of *Technology and Culture* and *Isis*, two of the premier journals in the history of science and technology, to explore the possibility of a Web site review alliance. We also plan to do an additional number of select reviews, chosen according to their relevance for Memory Bank projects and outreach, which we will distribute to our growing network of partners, fellows, and contacts in the form of a quarterly electronic newsletter.

In the final analysis, the ECHO project ultimately comes down to building, supporting, and institutionalizing this network of historical practitioners and allowing them to gather important recollections and artifacts on line. The Memory Bank, the Practical Guide and the Virtual Center are our front-line efforts to accomplish this critical goal; behind the scenes we have already worked and will continue to work to assist other historians with the often complicated, yet potentially rewarding, task of building Internet projects that acquire primary materials from scientists, engineers, and others who have been a part of the recent history of science and technology.

APPENDIX: REVIEWS OF SLOAN-FUNDED SITES BY ROUNDTABLE PARTICIPANTS

Below are reviews of Sloan-funded sites written by participants in our Roundtable. A few of the participants delivered their responses orally; we can provide their remarks from the conference transcript if that is useful. But they mostly echo the same themes.

REVIEWS BY LINDA SHOPES

Review of "Clean Air" site:

According to its introductory page, the "Clean Air" web site aims to "provide background information on clean air legislation and related efforts to enforce a reduction of pollutants in our atmosphere. It also serves as an introduction to a threaded discussion group on this subject that is being conducted by the American Meteorological Society" (AMS). For someone who is generally ignorant about the topic of clean air, the site does seem to be quite content rich, including an overview of relevant issues; technical documents; conference proceedings; a list of major clean air policy makers; a timeline of major environmental events; discussion of relevant legislation' photographs and maps of environmental disasters; and links to other very full sites (e.g. EPA, AMS). The site is also organized quite logically, with a left hand menu bar, making access to information and cross-referencing quite easy. There are disappointments, though, in some of the content presented: it takes too long to locate the text of clean air legislation and a potentially interesting "glimpse" into the archives of Senator Edmund Muskie, whose role in promoting clean air is not really explained, provides very brief summaries of selected correspondence related to environmental issues - why not link to the actual correspondence? And some site links are broken or otherwise nonfunctional - always an annoyance.

The site really falls down, however, in efforts to solicit archival documents for the site and especially in the development of its purported "threaded discussion group" on the subject of clean air. Site users click onto "Submit a Contribution," where they are invited "to contribute as many items as you have to help round out this collection" and directed to fill out a form describing "items to be loaned to us for scanning." There is no sense of what sorts of things the site is looking for, what sorts of documents might "round" out the collection; nor is there any way to find out what others have contributed or who contributors might have been - e.g. did some of the documents available elsewhere on the site come from this web solicitation? Clicking on to "Discussion Forum," the user is "welcome[d] to the Clean Air Act Discussion - where you can communicate and share with other participants in the collection of historical moments and experiences." Except there are apparently no conferences to participate in - no "current discussions" are posted and, even though I logged in as a discussion participant, I could not find archives of previous messages. Indeed, it seems as if only 6 people had ever participated in discussions, including me; and only 5 messages (which I could not locate) ever posted, the last in December 1999. What

happened? Did the AMS simply abandon the site? Did site sponsors ever publicize or promote the site to intended audiences or did they simply expect people to find it? If the former, did they let people know what sorts of information/discussions they were looking for? If the latter, with no conferences to participate in, there's no way for people to interact with the site. Very frustrating.[4]

Interestingly, by clicking onto "History Main Page" (one of the menu items on the site) the user is connected to the broader project in which "Clean Air" is nested, the AMS History of Earth Sciences on the World Wide Web project, which also includes GATE (GARP Atlantic Tropical Experiment). The introductory matter on this "umbrella" site is much more explicit about its intent and purpose; and a bit more directive in soliciting documents and commentary - but the Clean Air site user may or may not come upon it. Also, the GATE site seems somewhat more successful in
encouraging discussion - I followed one rather interesting thread on the politics of selecting the site of the tropical experiment but do note that it's not clear how the discussion is managed, how questions are posed; also the discussion itself consists largely of short, focused comments, not extended commentary. But I wasn't assigned the GATE site to review, so, I'll stop here. --LS

Review of "Lighting the Way" site

This is a straightforward, easy to navigate site developed by the Smithsonian Institution to "use the Internet to gather - as well as present - history . . . to explore changes in the science and technology of electric lighting over the past 30 years, especially the effects of energy issues on lighting." It's organized along two axes. The vertical axis has four layers: an introduction that outlines the purpose and organization of the site; three short, well written essays that discuss "changes in residential commercial, and industrial lighting over the last few decades and help show what we are after; three separate sets of questions directed specifically to conveyers, that is those who distribute lamps and lighting devices; producers; and consumers; and an edited presentation of the responses from these three separate group. It seems as if the reader can move especially easily between the fourth and third layers, making it easy to go from reader to respondent, presumably of value if one person's comment triggers a response in the reader {"it seems" because I could not navigate between these two layers and indeed had trouble making the connections - the message "Can't Find Web Site" kept coming up as connections timed out}. There is also a bibliography of materials in the files of the Electricity collections, NMAH and other items. The

[4]There's one clue that the site never was fully developed. At the bottom of the home page, there's a number of links, including "Contribute to the Project" and "Clean Air Forum." Clicking on to each of them results in the following message: "This page and respective links are being developed. Please check back for further posting to this area."

horizontal axis has three layers implied in the above: essays on commercial, industrial, and residential lighting; questions posed to conveyors, producers, and consumers; and the edited responses of these three groups. Very neat.

I make the following observations about the level and quality of participation. First, it is not at all clear how respondents were solicited. Did the SI do any specific outreach (to lighting engineers, designers, wholesales and retailers, consumer advocates, etc., for example, through their organized professional groups)? It seems unlikely, given the number of respondents, especially in the producer (2 respondents) and conveyor (13 respondents) groups; on the other hand, 35 consumers responded. In fact, what number of respondents would site organizers reckon as constituting "success"? (I understand that the site presents "selected" responses; I suspect, however, given that responses from 35 consumers were posted, more producer and conveyor responses would also have been posted, if they had been available.) How to account for the higher number of consumer respondents? - simply because they constitute a bigger universe of potential respondents? And what might motivate an individual to respond to a web survey? I would think that producers and conveyors especially could be appealed to as professionals, to share their expertise/opinions with the Smithsonian. Also, the site could make it easier to go from the essays to the questionnaires, inviting people right at the end of the essay to respond *and* linking them directly to the questions. And perhaps some very specific boxed or bracketed directions, "How To Use This Site," might give potential respondents greater confidence.

As for the quality of participation. Respondents are allowed a couple of levels of participation: "history to go" for short general comments and a more extensive questionnaire. Respondents are also able to note if they have material - artifacts and documents - to contribute. The questionnaire allows for the most extensive participation. Its questions are specific, focused queries that seem appropriate to each group of respondents and to a web-based questionnaire. For example, among the twelve questions conveyors are asked is, "Explain how the emphasis on lighting efficiency has changed the nature of your job during the past 30 years." Among the twelve consumers are asked, is "Give specific examples of instances in which you were satisfied or dissatisfied with energy-efficient lighting technology and explain why. Did the technology meet your expectations?" Responses are similarly short and focused, but not without value. Taken together, the consumer responses especially struck me as affording insight into the impact of the environmental movement on the general public (understanding too that these respondents represent a self-selected group). Yet the responses are nowhere near the extensive, expansive, and directed recall cultivated in oral history interviews as that practice is commonly understood. The questions here follow in lockstep order; no attempt is made - or can be made - to follow the logic of the respondent, or to follow up on specific responses. So, for example, when in response to a question about "the designers, marketers, or other conveyors you believe have been especially important in promoting energy-efficient lighting," one person answered "Believe it or not, OPEC," no effort was made to ask "why OPEC?" Similarly, the questions themselves often don't encourage extensive recall or ask for assessments, judgments, evaluations,

the way oral history interviewing does. A consumer is asked: "Have you purchased energy-efficient lighting devices for your home? Do you use them at work? Please give us specific examples if possible." But s/he is not asked why or why not s/he has purchased/used them. Respondents are asked to describe changes, but not offer their explanations of them. There is no room for them to "go on" either by the questions posed or the small boxes in which responses are to be typed.

So, I'm left wondering if a survey of this sort needs to be accepted for what it is - an informal, unscientific survey that cumulatively can provide some useful information if enough people respond to it. Might it also be used as a way of screening people for a more interactive oral history interview, either on line (one interviewer working with one respondent in either real time or over several days), on the telephone, or in person? I don't think, as presently structured it can encourage extensive, thoughtful recall from a broad public who simply happen upon the site. If lengthy responses are desired from specific individuals or groups of people, it would seem to me that they would need to be approached directly and, instead of being asked to respond to a group of specific questions, perhaps they should be provided with an outline and asked to write a memoir of sorts. Some might find this more of a project than they are willing to participate in - so fewer, in-depth accounts rather than more, survey-type responses may be the result. Which is preferable would depend on the project goals and, in the end, is a judgment call. Maybe too "electric light" is not a sufficiently interesting or significant topic to excite large numbers of people to "interact" with. Or maybe the historical significance needs to be articulated more fully for people to understand the value of their participation. It's hard to get people to see their own experience as history, to see themselves as history-makers - and this would seem to me to be especially true for scientific topics, where most people have simply capitulated to the experts. The web is certainly a tool for helping people articulate their historical experience, but it will take a lot more than the web to break down people's alienation from themselves as historical actors. --LS

Review of "Blackout" site:

It is fortuitous that of the three sites I have been asked to comment on, I chose to view this site last. Of the three, it is clearly has the most sophisticated design and organization; it also has the greatest intellectual depth and edge - viewing the other two sites first thus gave me some context for assessing this one. It also gave me a greater understanding of the limits of the other two site: "Clean Air" is deadly earnest and really not for the average citizen; "Lighting the Way" is more straightforward and welcoming to the general user but it lacks pizzazz, or much excitement. However, the graphic/technical/intellectual complexity of the "Blackout" site also took some time to get used to - it was a challenge to keep all the sections straight, the relationships among them clear (even though the "help" section does articulate this quite well). It takes some work to appreciate the site's depth - which may, on the one hand, encourage a more thoughtful interaction and, on the other, frustrate the more casual potential participant (or us relentlessly linear types). This is not to say that the site is poorly designed or illogical - just complicated.

The "Blackout" site, as everyone is probably aware, "uses the web as a research tool to reconstruct two memorable power failures that struck New York City and its surroundings" - the Great Northeast Blackout of 1965 and the New York Blackout of 1977. Like other sites, it includes general orientation material; a timeline; a bibliography (or archives), including donated materials; and background materials (here called perspectives). Helpfully, for the nonspecialist the bibliography includes considerable material on the blackouts from the popular press - it's not only technical material. And a well-organized "highlights" section allows the browser to get a feel for what the site includes and move into it according to his own inclinations. Most notable, however, the site raises genuinely interesting historical questions - about the different social responses to the 1965 and 1977 blackouts in NYC, about the perceived causes of the blackouts - and also does a nice job explaining why participation in the on-line forum matters. You feel like the site sponsors really want your participation - the flashing yellow light bulb on every page, by a request for comments, was quite inviting, I thought. There's not much of a connection made between the "content" and the "interaction" - might a specific path through some orientation materials (like the Lighting the Way site) help cultivate more considered responses?

So, what about the level and quality of interactivity? Respondents can participate on four levels, requiring a progressively greater investment of time/thought: by offering a short, simple comment; by participating in one of several discussions; by completing an on-line survey; and by volunteering for an interview. Each deserves a bit of commentary. The "comments" section - seemingly inviting and nonthreatening in its simplicity, is organized around five topics that really aren't very helpful or directive: "other," "factual," "question," "specifics," and "general observations" - how does one know which topic to choose? Clearly, most respondents weren't sure, selecting "other" most often (21 of the total of 38 responses I noted). The "discussion" section presents five separate discussion questions to each of three audiences: members of the electric utility industry, people who lived in the New York metropolitan area during the 1960s and 1970s, and survivors of the 1965 and 1977 New York blackouts. The questions are serious thought questions; most people didn't answer them. Especially disappointing is that no one answered any of the five questions directed to New York residents of the 1960s and 1970s - perhaps the questions seemed too much like a "test" and the average citizen felt he had no specific knowledge from which to answer them (e.g. "Was cheap and reliable electricity a 'basic right' that everyone was assumed to deserve as an extension of the American standard of living?"). The couple of exceptions here are perhaps instructive: Eight members of the electric utility industry, who presumably have specialized knowledge and can answer questions with some expertise, did address a couple of the questions, and nine people responded to the request for "reminiscences" of the 1977 and 1965 blackouts. Perhaps if questions to nonexperts were framed more personally, you'd get a greater response (e.g. "Did you assume that cheap and reliable electricity was simply a part of everyday life, part of the general standard of living?).

The survey section seems to be the most successful - it certainly offered the most substantive commentary and was the most fun to read. Two separate surveys were offered, one to members of the electric utility industry and one to blackout survivors. The survivor surveys numbered 135 most focusing on 1977. Again, the personal anecdotes, the insights survey results provided into the mood of those experiencing the blackouts, the tenor of the times they revealed, the folklore embedded in several accounts (several people initially thought that some action of theirs actually caused the blackout) - all are of some research value. And here too, respondents tended to avoid the more generalizing questions (e.g. "Did the blackout have any larger meaning in your mind?") The interview section included ten short interviews - not a lot of response, but a source of some good stories, good insights. Most responses in all of the four formats clustered in specific periods of 1998 and 1999, suggesting a few rounds of outreach, leading to a flurry of responses. Site visitors were also asked about materials they might have to contribute to the site, and apparently some substantive contributions were made.

A couple of general observations: experts can be invited to contribute expert knowledge. Participants in an event focus on their personal stories, mores than their assessment of the causes/meaning of these events (regrettably, I suppose). This may be especially true for matters scientific, where most ordinary citizens do seem to leave it to the experts, don't have much informed knowledge beyond their own experience and -at least in this case - seem to know it.
Similarly, the ordinary person seems not much interested in searching for the larger meaning of an event like the Blackout - perhaps it simply didn't have deep impact on people's lives. Perhaps as a historical event it does need more contextualizing for people to make the connections (the excerpt from Joshua Freeman's book makes a good effort here; also much of the material on the bibliography, but how many site visitors make their way through this material). Science is a difficult topic to engage lay audiences with, I think. And the Blackout doesn't have a dedicated corps of buffs, it seems.

REVIEWS BY DAVID KIRSCH

Here are my reactions to the selected websites in advance of our meeting this weekend. Might I suggest that you not distribute my comments until you've received everyone's so as not to prejudice the opinions of the other participants.

Returning to these issues after spending the last 18 months working on other topics, my over-riding feeling is one of profound frustration, particularly in the areas of recruitment and interactivity. The exceptions are strikingly few and far between and happily include the Blackout and Mouse sites.

The Blackout site has obviously become a much more robust and evolving resource. Although I still find the structure of the site somewhat difficult to navigate, the wealth of resources that have now been collected clearly demonstrate the opportunity that this mode of research holds for the future. The quality and depth of some of the personal reactions are wonderful and, to my eye, seem less "tainted" by the participant-observer bias that characterizes much traditional oral history. My only remaining question, to hearken back to a comment at one of the earlier workshops: Can you publish an article on the basis of the materials?

Similarly, the Mouse site, in addition to its excellent archival integration with the resources of the Stanford library, has emerged as the clear best-in-class in the area of recruitment and interactivity. The site now contains numerous interesting discussion threads of exactly the sort that I believe the Foundation intended to stimulate, intermixed of course with random inquiries and late night pleas for help from frenzied high school students. It's actually interesting that these seekers find the site, but don't realize the depth of information that can be accessed through the archival links. Also, I think it's very nice to see how the "people" section has expanded as the site has grown. The original list of participants must have at least doubled by my count, and many of the biographies are starting to be filled in. Again, I believe this phenomenon – along with the sharing of names, phone numbers, and other general contact info – is exactly what the Foundation hoped for.

So much for the successes; now for my comments about the frustrations.

The AMS / GATE experiment.

I loved this project when the AMS initially presented it at the first GMU workshop in 1999. Unfortunately, the execution has failed to engage the relevant audience.

Observations:

Interesting choice of topic; visual presentation is nice; the site is relatively easy to navigate. Bulletin board uses "web board" application, which shows how many

times a particular message, has been viewed, a nice feature. The discussion board is relatively easy to use, but *not* if you have a small screen. Usability also suffers as a result of the uneven text wrapping within discussion posts, making the longer posts especially difficult to follow.

The most interesting and developed debate concerns the decision to relocate GATE to the eastern Atlantic from the western Pacific. A 13 post thread– the deepest I have seen on any of the sites – contains lively exchanges between participants, handicapped somewhat by the presentation problems noted above and below. Specifically, it appears that participants were using text figures, which the software converted, to a proportional-spaced font, thereby rendering them even more difficult to understand. Also, the "live" thread is buried under several "dead" ones, making it hard to discover the richness of the debate.

Unfortunately, this thread seems to be the only one that attracted even modest interest, and almost every posting appeared on Jan 8, 1999. Why that date? Because that weekend, all of the participants were attending a special retrospective session on the history of GATE at a conference in Dallas. I have made some offline inquiries of some of the participants to see if Sloan also sponsored the conference session, but have not yet received any replies. If so, it was money well spent because it generated the only discernible interactivity on the site.

One further observation about the "live" thread: an excerpted version of the debate appears in an online newsletter that is reachable from the AMS/GATE site. The newsletter version of events, though somewhat sanitized, also does a better job of conveying the issues at stake. Should we be surprised? Does that mean that we site operators should routinely plan to write "clean ups" after threads have been completed?

Also, I had to infer the existence of the special conference session and search for it on google; it was not listed anywhere in the site; see http://www.confex.com/ams/99annual/hurricanes.htm. This site lists papers with links to abstracts from the conference, but it is not well kept up. The AMS/GATE sponsors should have helped collect and preserve these historically relevant materials.

Smithsonian / Lighting the Way.

Topic appears too diffuse; it's not at all clear why the site exists, i.e., research and collection or outreach and dissemination? A politically conservative critic might reasonably argue that the site simply asks for people to confirm a certain set of environmental and energy dogmas concerning the growing importance of more efficient lighting systems.

I would also suggest that the Smithsonian has chosen a topic about which they already know *too much*. Nowhere do we read what the organizers really need to know; general questions lead to general answers. I noted with amusement that all the artifacts that were offered to the curators were rejected because samples of same were already in SI collections.

While the site appears to have stimulated a number of contributions, it's not clear how they are organized, vetted, dated, or presented. The original authorial content seems particularly weak. It's not clear when a would-be contribution would make it onto the site (perhaps because SI doesn't want to get in political hot water for what's on its websites). Also, there is no clear authorial voice; project staff are identified only under copyright and credits; there's no way to email an *individual* –project manager or team member.

On a broader note, perhaps this is a characteristic weakness of institutional or scientific-society sponsored projects. Based on my quick review, none of these sites have achieved much by way of interaction and contributions (see Greenland ice cores too).

And finally, turning to the litmus test of publication, I cannot imagine how one would produce an organized contribution to our knowledge of the history of technology on the basis of this site's content.

IEEE / Going Digital Sites on Digital Audio and Speech Synthesis.

No sign of any interactivity present. Sites appear to be reasonably designed and presented, but no signs of life; are we sure these aren't beta sites that haven't actually launched yet?

Authorial voice only appears once, where site coordinator apparently wants a picture of a particular piece of technology. Again, not clear why such would be historically important other than because he doesn't have one.

Again, to the general issue: does it make sense to have the scientific and engineering societies sponsor these historical sites? Corporate ownership makes responsibility harder to establish; I'm not just thinking about accountability, but also about issues of authorial voice, whom to contact, whose name to search in the Web of Science database, etc.

I look forward to the comments of the other reviewers and hope to be pleasantly surprised.

REVIEWS BY ALISON LANDSBERG

Review of GARP Atlantic Tropical Experiment (GATE)

This website explores and documents the GATE project, an international effort in the 1970s to improve technologies for long-term weather forecasting. Towards this end, the site elicits contributions or accounts from individuals who were directly involved in the project. At first glance, the site offers two possibilities for such contributions: "GATE discussion" and "Personal Contributions", both of which are listed on the menu frame which remains in place as you move through the site. I imagine that "GATE discussion" was intended as an informal space for thoughts and questions, as opposed to the more formal contributions that appear under "Personal Contributions", but I can only guess, as clicking on "GATE Discussion" brings up the message "Document Not Found". Under "Personal Contributions" there are links to 3 contributions, which vary widely in form and content. The first is the first person narrative of an individual involved in securing oil for the mission (he had to contact an Iranian General who went to the Shah, etc.). The second contribution came from Michio Yanai, a scientist who turns out to have been a major player in the project (which I only learned by reading the third contribution which begins with an acknowledgment of Yanai). Yanai's contribution is a timeline detailing the evolution of the project, describing who met with whom, in what contexts and so forth. Unlike the lay language of the homepage (or the first contribution), Yanai's piece is aimed at specialists, people who know, for example, what "cumulus mass flux" is. The third and final contribution is a slide show that was presented at a conference on Hurricanes and Meteorology in 1999. The problem with this slide show is that it appears without the talk it originally accompanied. The slides, for example, have lists such as "What We Set Out to Do", "What We Did" and so forth, but no explanation of any of the things done. Graphs appear on some slides, which might be useful to specialists.

Because these contributions were so different from one another I clicked on the link to "Submit a Contribution" to see how contributions were solicited. The link calls up a form, which, in addition to personal information, gives you the choice of entering "a description of items to be loaned to us for scanning" or "any questions or comments you would like to forward to the project leader." The potential contributor is directed to be as specific as possible about his or her contribution, and that he or she will receive email instructions. In other words, potential contributors receive virtually no initial coaching on how to compose or frame their piece. The three contributions appear as a list (not grouped) nor are they introduced beyond author and title; it is not until one clicks on the link that one discovers the format of the contribution (timeline vs. slideshow).

By systematically reading through the website, I discovered that voices of the participants appear in another place as well. Under a link on the main menu entitled "Who's Who in GATE" there are short bios of participants, as well as information gleaned from interviews with a select group of them. The interviews, conducted by a student at Penn State University, aim to uncover "their experiences in GATE, what they personally got out of the experience, and how GATE has helped them in their careers." The material she uncovers, both

about the project and about the political climate and culture of the 1970s is interesting. For example, one participant remembers that when she was working with the Soviets they were using slide rules and were envious of her HP 35. However, the format the interviewer has chosen is less effective than it could be; first of all, for each question she gives the answers from all participants instead of moving serially from one person to another. Furthermore, it would be more effective, I think, to include the interviews verbatim, in Q&A format, rather than summarizing and quoting as she does. In several places she inserts a quote that includes highly specialized information or language without providing adequate contextualization.

After some reflection, I remain uncertain about the intended audience for this website. The homepage offers a lucid, but brief, description of the project. In that overview there is little if any specialized language and the emphasis is more on the nature of the enterprise (an international team of scientists, etc.) than on the specific inquiries undertaken. The contributions, on the other hand, are far too technical to be accessible to a lay person, and would be of interest only to someone with some background in meteorology. Nowhere on the website are terms explained. I think the website would benefit from a longer more sustained introduction that introduces the scientific component of the project in a meaningful and accessible way (a glossary of terms would also be useful). Such an introduction might prepare the reader for the contributions that come later. I would have liked some kind of editorial voice on the contributor's page as well, a voice that might frame the individual pieces.

On the whole, the site is easy to navigate. There is a permanent menu frame on the left, a design I found very useful. I would have liked to have known, however, that "Who's Who" also had interviews with participants, a point not obvious from the menu. I was also surprised that links to other sites about GATE were somewhat buried. Near the bottom of the menu there is a link to "GATE Research Resources". Here one has access to other academic sites on GATE, some of which have on-line data sets. There is also a link to the Tropical Meteorology Newsletter, a document reproduced in whole, which details the history of the GATE project. This link would be useful in the introduction. These other links, in other words, might better serve the user if they were also embedded in other places on the site.

In my opinion, while this is a site with great potential, it would benefit greatly from more mediation.

History of the Clean Air Act

Like the GATE website, this one seeks to elicit contributions from those involved in the Clean Air movement. However, this site, at present, does not have any personal contributions on-line. Nevertheless, on the main menu there is a link entitled "Submit a Contribution" which pulls up a straightforward form (the same one as on the GATE website--see my review for details). Furthermore, as was the case with the GATE website, the link which promises "Discussion" doesn't work ("Document Not Found"). While there are, as yet, no personal contributions, one is able to consult bios of those involved (including some

Muskie archives). Seeking to reach a broad audience, the homepage describes the history of the Clean Air Act in an accessible manner and is embedded with useful hypertext links. There is also a link to a lucid history of the legislation, which includes links to the acts themselves.

REVIEWS BY MIKE O'MALLEY

Review of "Making PCR"
http://sunsite.berkeley.edu/pcr/index.html
3/16/01

This website is produced partly by Paul Rabinow, the well-known anthropologist and Foucault acolyte, and Soren Gorman, another Berkeley anthropologist. The first page has a surrealistic illustration of a whale floating past the Golden gate Bridge: I am still trying to figure out the connection to PCR. The website seeks to collect debate and commentary about PCR as well as give examples of PCR's application in research and commerce. It seems to be aimed at professionals, people working within the biotech field. I would rate it "very poor," a failure. It has generated very few responses and submissions since it first appeared in 1999, and this seems to be partly due to its bad design.

"PCR" stands for "polymerase chain reaction." As far as I can tell, this is a process whereby polymerase, a large molecule, is induced to generate copies of a strand of genetic material. The introduction by Rabinow hails PCR as a great innovation, but as a lay person I cannot see what the nature of the greatness is--it seems akin to a process for copying bricks, and in that sense to be more a triumph of manufacturing than a conceptual breakthrough. Rabinow's account is hyperbolic, not enlightening. But again, the site is not aimed at people like me (I don't think).

You cannot tell, from the first page, what the site is supposed to do. There is no explanation of what the site is "about" and no directions for its use. It begins with a link to "what is PCR," suggesting that it is a site for lay persons. But the linked page, written by Rabinow, fails to excite this layman's imagination. The opening page also includes a link to "Current Presentations on PCR," and then something called "PCR-Assisted Genetic Profiling for Patient Stratification: Improved Cost-Effective Healthcare:" this link, horribly, turns out to be a power point slide set. The presentation might be useful to people who work with PCR, but it makes the site highly confusing--is this an intro to PCR, or a forum for sharing examples of its use? Below this is a link for "comments," but the link takes you to a page set up for commenting on a different paper. No comments have yet appeared.

To the left on the first page are a series of links, as follows. Phrases in bold below are not link but headings: I have added descriptions, in italics, of where each link takes you

PCR HOME:

HOME--*returns to index page*
CURRENT RESEARCH--*takes user to another hideous PowerPoint presentation with a "comments" link*

PCR FORUM: *There is no explanation of the "forum:" users simply click one of the three links below*

FUTURE--*contains a quotation form the "inventor" of PCR and invites comments on future uses of PCR. There have been six comments since 12/98, none of which have much substance, and some of which are comical--see below*
PAST--*solicits comments on the invention of PCR. There are four comments, only one of which is substantive, but this one is written in very poor English*
ARCHIVE--*directs users to two previous questions posted for comment--here again, the results are extremely poor--the bulk of the comments are unanswered technical questions*
REVIEWS--takes user to a page with a few reviews of the site when it first appeared and, surprise surprise, reviews of Rabinow's book

PCR HISTORY:
FOUNDATIONAL PAPERS--*An archive of technical descriptions of PCR and how it works*
ORAL HISTORY OF ARTHUR KORNBERG M.D.--*links users to a framed site produced by a woman who interviewed Kornberg. Why we should care is not explained*
RELATED MATERIAL--*one link to an New York Times article*

PCR PROJECT:
PROJECT TEAM--*describes Rabinow and the other guy*
STIM HOME

These links, I should note, are not consistent from page to page--on each sub page the links on the left hand side are slightly different. Things vanish and reappear for no apparent reason.

The page has not inspired any extended commentary or submissions in much depth. The forum feature is especially disappointing. The forum pages use an html form to get users name, institution, email, and subject line. They then list comments below the form boxes. Comments include "Respected colleagues! Say please, as long can be saved molecule DNA in the environmental?" and "I would like to receive more information about PCR." One respondent entered a comment with the inexplicable subject line "Native American Pottery" but no actual comment. Some of the subjects appear to have been introduced Gormen, who has posted a "welcome" message and then apparently retired to one of Berkeley's many excellent cafes. There are perhaps two comments of any substance in the entire archive

I believe this page's failure can be laid partly on its very poor design, especially its failure to explain itself at the beginning. For example, beginning with a link called "what is PCR" tells the experienced scientist that this is a site for laymen--exactly what the project team wants to avoid. Even a modest attempt to explain what the forums are supposed to do would help focus their content--for example, simply establishing a separate space for technical questions would focus discussion on the topic at hand.

The topic questions are drawn from Kary Mullis' book on his invention of PCR. Mullis is a Nobel laureate, and the book is full of the kind of lofty, "reflections of a great man" language nobel laureates get to use--not the language of ordinary people or the language of science. That is, he is writing in the mode of "explaining to laymen," which discourages comment by people in science. He's also a very big wheel, with many students, colleagues, allies, and etc., and inviting other scientists to criticize his words in a public forum would seem to be like inviting them to shoot themselves in the foot. The "archive" questions were based on statements by John Watson--here again, the same criticism applies. A better strategy would have been to use an editorial in some public forum, like a newspaper, to start the discussion. A discussion based, for example, on insider/outside communication problems might have produced something more useful, especially if the project team had made some interventions in the discussion.

This is a poorly framed site with little explanation of its intentions. It sends a very confusing set of signals about who its audience is. It asks questions that seem guaranteed to alienate its core users.

Review of POP!—Changes in Beverage Containers
http://www.historiesofengineering.org/project/projectdisplay_aiche.asp?PID=1

This is a *far* better designed site, put together by the American society of chemical engineers. It gives a reasonably clear and simple statement of what it is about and what kind of information it is soliciting, right in the first line. It has minimal graphics and a consistent interface. Users get clear explanations of how to add material. In addition, the site makes it possible for contributors to attach documents--images, text files--and have them download on the user's click. So contributors don't have to convert existing documents into a new format, and they can easily add photos or other graphics.

The forum interface, however, is cumbersome and confusing--it is very hard to tell what is an initial topic and what is a response. I got syntax errors when I tried to click on the threads in some cases. The explanation of how to use the forum sheds murk, not light--as in this example:

This is the dark grey rectangle within the larger blue-bordered "message" rectangle and indicates how many messages are at the same level of the message tree as the message being currently viewed. There are also "next" and "previous" buttons at the right edge of the rectangle that allow you to easily view all the other messages at this level of the message tree.

The first subject is the career of Nathaniel Wyeth, Andrew's brother and inventor of the PET plastic bottle. There are seven messages at this writing, but sadly, four of the seven are from the moderator attempting to churn the waters. The project seeks recollections from people who knew or worked with Wyeth,

who died in 1990 but lives forever as a member of the "plastics hall of fame." The site is not reaching the audience it wants to reach, but it's worth noting that the earliest posts are from November 2000, so it hasn't been running that long. One discussion of beverage containers mentions nine responses, but I had a very hard time finding these responses--they seem to have all been part of a timeline sent in by a single user in pieces. There are the usual questions from desperate undergrads seeking last minute term paper information--this would seem to be a chronic problem. The site is failing in its objectives

Partly I think this may be due to the forum software. There would seem to be little need to reinvent the wheel in terms of discussion/submission software--there are a dozen successful version on the web already. I believe that the interface for submissions is deterring people to some extent.

The second project concerns the development of process simulation software. There are six "trees" since 1998, all started by the moderator. None has more than three responses, and of the one with three responses, one is a test and the other says "Witch is the most suitable model for batch fermentors simulation (in pseudoplastic fluids)?" But some of the threads have received substantial responses that are continued in word documents. So in this sense the site is moderately successful.

My conclusion about both of these is that they are on the right track but A: are not reaching a critical mass of potential contributors, and B, are using software interfaces that deter contributors.

REVIEWS BY JOHN CHENG

The two web sites I reviewed are better seen as one site, the "**Eyewitness Project" that uses two different technologies/subjects, Finite Element Analysis ("FEM") and the Artificial Heart,** in parallel attempts to collect "eyewitness" anecdotes, accounts, and information relating to the history of those technologies/subjects. In their words:

"You have been an eyewitness to technological developments that have become part of your career, your profession and your way of life. Through this new website and your contribution of text, images and documents, ASME would like you to help tell the story of the course of development and impact of significant mechanical engineering products and processes.

The Eyewitness Project is an on-line catalyst to capture your stories and reminiscences and to help identify issues and turning points -- the breakthroughs and the breakdowns -- inherent in the process of bringing ideas to the marketplace -- help locate and contribute significant records, reports, and accounts which demonstrate the evolution of specific areas of technology."

The URLs are:

(1) Finite Element Analysis, by the American Society of Mechanical Engineers http://www.asme.org/eyewitness/fem/femintro.html

(2) Artificial Heart, also by the American Society of Mechanical Engineers http://www.asme.org/eyewitness/heart/heartintro.html

The site is simple in its design. A main page (part of the ASME main site) describes the "Eyewitness Project" and has links to the rest of the ASME site, to an acknowledgments/contact page, and to the two content sub-sections: FEM and Artificial Heart. Each subsection has a main page with links to 1) a downloadable (PDF format) bibliography; 2) back the "Eyewitness" project main page; 3) to the "Eyewitness" acknowledgments/contact page; and 4) an timeline page for its respective subject.

The JavaScript-driven timeline pages are the main feature of the site and projects. Each subsection has identical features with only its subject content differing. A navigable timeline of years runs horizontally across a frame at the top of the page with colored dots indicating years with notable events and gray dots years without. The timeline frame also has buttons for the site home, for help/info ("?"), and for "contribute."

Selecting "?" opens an ancillary browser window with an explanation of the timeline and its annotations as well as instructions about adding comments to events (see below). This feature is redundant because the window opens when the timeline window is opened, but it probably exists for viewers who close the window and want to refer to it again.

Selecting "contribute" opens a new browser window with an event entry/modification form page, although it isn't clear what this page does because there are no instructions and it appears incomplete or unfinished.

Selecting a year or defined ranges of years on the timeline displays the list of events for the year(s) in a separate frame beneath. Colored/gray dots on the left indicate events with and without additional "assets" -- further descriptions, graphics, and/or web links. To the right of each event's brief description is a comment button -- color-filled for those events with comments, empty for those without. Comments and/or assets are displayed in separate browser windows that open when the appropriate colored dot or button is selected; comment pages allow viewers to add comments both to the original event and any comments viewers have added.

The kindest word for the site overall is inadequate; boring, poorly designed and thought-out, and frankly, not worth the time to review is still being nice. *Most* of my students' web projects are more sophisticated and complicated in design, analysis, and content than this site. It fails in almost every regard.

Aside from the absence of the most basic engagement with history and historical relationships and issues -- failing, for instance, to distinguish between history and chronology -- the site contains little actual content to speak of. The FEM timeline spans approximately 60 years from the 1940s to the present, roughly half of which have no listed events. Of the actual listed events, only those after 1997 have any additional assets of any sort, and most of these are links to other web sites, not any material collected for or by the project. The Artificial Heart timeline spans approximately 40 years, again with roughly half not having any listed events, and only five of the listed events have additional assets: one web link, two illustrations, a ?, and an asset that is clearly a mistake.

The two timelines have collected a total of three comments between them -- one by the FEM timeline and two by the Artificial Heart -- none of them substantive or longer than a sentence. These results are not surprising since there are no questions, explanations, or instructions beyond those in the help window, which simply ask visitors to add comments. No additional information or context is given for any of the events listed in the timeline other than its brief one-line description. Indeed, little is said or explained about the "Eyewitness Project" or either of the subjects it seeks to explore. "Finite Element Method" or "FEM" itself is not explained or defined anywhere in its timeline or introductory page. Basically, the only interactivity in the site lies in the operation of the timeline, not in the ways that visitors might actually engage or interact with the site's content and goal of content-collection.

Finally, from the standpoint of broad technological access, the site is designed with the assumption that visitors have later version browsers and high-speed internet connections since the timelines are JavaScript-driven and the bibliographies, while in cross-platform PDF format, are too large to download over a modem.