MBA
Knowledge Management

A Knowledge Management System Benefiting Postdoctoral Fellows at Los Alamos National Laboratory

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1. INTRODUCTION

This paper describes a knowledge management scheme for the Physical Chemistry and Applied Spectroscopy group within the Chemistry Division of Los Alamos National Laboratory (LANL) in the USA, where I worked as a postdoctoral fellow from 1997 to the year 2000.

Typically, a group such as the Physical Chemistry group consists of approximately 30 people, including senior scientists, postdoctoral fellows, and technicians. Within this group are subgroups, each headed by a senior scientist, that concentrate on a particular area of research (e.g. quantum dots, polymer photophysics, physical chemistry…).

The postdoctoral appointments are limited term appointments (normally 2 years), after which the person normally leaves the group to pursue their career objectives. The postdoctoral fellows typically perform the majority of the scientific research and as a result build up a valuable store of tacit and explicit knowledge during their tenure. For example, much of the research involves building, maintaining, optimizing, and operating complicated scientific equipment such as high-powered pulsed and continuous lasers, chemical dry boxes, laser and electron-beam ablation equipment, cryogenic equipment, nonlinear optical devices, etc. As a result, the person will develop a significant body of procedural and declarative knowledge relating to the technology with which they work. In addition, they will develop a network of personal relationships both internal and external to the group on which they rely to facilitate their work, be it in an administrative, technical, or scientific sense. At the end of their tenure they leave and, to the great detriment of the group, take all their knowledge with them.

Proposed herein is a scheme to mitigate this problem.

2. DESCRIPTION OF THE ORGANIZATION

Due to the presence of Los Alamos National Laboratory, the town of Los Alamos contains the highest number of Ph.D.'s per capita of any incorporated municipality in the United States. The laboratory employs over 10,000 people, working in a range of scientific and engineering endeavors spanning the fields of physics, chemistry, biology, computer science, and mathematics, to name a few. The work environment is dominated by the "technical staff members", who are senior scientists that serve as group leaders, much the same as professors at universities, with the caveat, of course, that the technical staff members do not teach courses. Working with the technical staff members are postdoctoral fellows, graduate and undergraduate students, and technicians. The laboratory also employs support-staff that perform the various administrative duties requisite of any large organization, such as human resources, procurement, facilities management, health and safety, etc.

The physical layout of the laboratory is interesting and has a strong influence on the work culture of its employees. The laboratory covers over 10 square miles of canyons and mesas on the flank of an ancient volcano in the vast expanses of the northern New Mexico wilderness. The laboratory is composed of "technical areas", each of which is secured to varying degrees by fences and other security arrangements. Each technical area is dedicated to a particular division and so specializes in a particular type of research (e.g. neutron scattering, materials science, high explosives…). The technical areas are therefore islands in a wilderness separated, often by several miles, from other technical areas. This layout has its origins in the years of the Manhattan Project when security was paramount. The effect of the layout currently is to hinder greatly interaction between different employees of different technical areas due simply to the physical separation between the technical areas.

3. DESCRIPTION OF THE PROBLEM

When a postdoctoral fellow is introduced into this environment, he or she is faced with a variety of obstacles that impede their effectiveness in conducting scientific research. These obstacles may be classified as follows:

1. Administrative
2. Technical
3. Technological
4. Scientific

3.1 ADMINISTRATIVE OBSTACLES

In the administrative domain, the majority of difficulties are linked to the integration of the new person into the administrative system of the laboratory. This may include obtaining an official laboratory identity badge, a library card, health insurance (including eye and dental coverage, which is dealt with apart from the normal health insurance), obtaining certification by the laboratory health and safety organization, obtaining keys for the various buildings and gates in the technical area, or obtaining a parking sticker for their car.

Normally the new postdoctoral fellow will seek guidance from their group leader (a technical staff member) to help them navigate through this administrative jungle. This proves an ineffective manner of tackling the problem for several reasons. First, the technical staff member has no reason to stay abreast of developments in this domain and typically is at a loss to provide effective help. Furthermore, this additional demand on the time of the technical staff member reduces their effectiveness in accomplishing their own scientific mission. The group leader, therefore, normally routes the new postdoctoral fellow to the first available administrative person in the technical area, which again may or may not prove to be the appropriate person. The process continues in an ad hoc fashion until finally a solution is found. The process is not only inefficient but demoralizing as well for the new postdoctoral fellow. Furthermore it is a drain on the temporal resources of all the people involved in finding a solution.

To reduce the difficulty in integrating a new arrival into the laboratory's administrative quilt, a system to collect and transmit the explicit procedural knowledge gained by previous postdoctoral fellows would be helpful.

3.2 TECHNICAL OBSTACLES

Under the heading of technical obstacles fall items that require the help of technicians such as electricians, plumbers or machinists. Examples range from gaining access to the machine shop, to obtaining the appropriate facilities management personnel to address issues such as a need for high-voltage, three-phase electrical power outlets, or a malfunctioning air conditioner, or yet again obtaining help from the computer staff in order, for example, to back up data, get an email address, manage one's web space, or obtain permission to use laboratory-purchased software. Again the typical approach to these problems involves days of trial and error to locate and contact the appropriate personnel, at which point the hard work starts of establishing a working relationship with the technician.[a]

The problem, therefore, is not so much one of a lack of procedural knowledge, but a lack of a personal working relationship that, ideally, is based on trust and respect. In this respect the problem falls under the interpretive heading of knowledge management, because the knowledge required is built up through multiple interactions (of a social nature) with a technician. Through these interactions the postdoctoral fellow learns such things as the hours during which the technician is likely to be most receptive, the tools and techniques which he or she uses, the limits to the technical knowledge of the technician, the extent to which the technician is bound to follow laboratory policy (i.e. whether the technician can "cut corners" in certain situations), or the standards with which he or she can work (e.g. metric or imperial).

A system to accumulate this knowledge and transmit it from one postdoctoral fellow to the next is needed.

3.3 TECHNOLOGICAL OBSTACLES

Technological problems constitute the most important source of difficulties for postdoctoral fellows. In this category are grouped all difficulties related to the high-technology equipment that the fellows work with every day. A typical example of such a problem is the tuning of a high-powered pulsed laser. Becoming proficient at this requires a lot of experience. Not only must one be familiar with the optical theory behind the operation of these lasers, but he or she must be aware of a myriad of interrelated factors that will affect the laser's performance and stability. For example, one must take into account the weather when tuning these lasers, as well as the time of day. On humid days, certain optical coatings will absorb humidity and dilate, reducing their reflective properties, making it easier to damage the optic. Ambient temperature is also important, so one need not bother tuning the laser in the morning on a cold winter day, since the temperature of the laboratory[b] will rise significantly due to the heat of the lasers over the day. For this reason it is advisable not to turn the lasers off at night on certain occasions. The laser cavities are also extremely sensitive to dust, so hepa filters provide a constant flow of clean air over the lasers. The postdoctoral fellow is therefore well advised to maintain proper hygiene, especially as regards dandruff since, as one Russian postdoctoral fellow discovered, laser cavities are extremely sensitive to dandruff. The list of "astuces" is endless; your author recalls commenting one day to a technical staff member that not a day went by without the discovery of another factor to take into account when tuning these complex laser systems. Of course, these technological difficulties are not limited to lasers. Many other systems also require such knowledge to obtain maximum performance. Cryogenic systems, chemical dry-boxes, electronic systems (eliminating cross-talk is real art) are a few other systems where knowledge gained from experience is extremely valuable.

Technological difficulties are not limited to the variety that may be solved by the application of an insightful low-tech remedy. Many problems require the intervention of the manufacturer, or the replacement of parts. However, often it is experience that teaches one that the replacement of a crucial part will resolve a problem. In addition, dealing with manufacturers and their representatives is not always a simple matter. Here, too, it is valuable to have knowledge about the effectiveness of certain manufacturers in reparations, whether on-site visits are useful or whether an item should be sent back to the factory for repair, etc.

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[a] Technicians are usually highly experienced personnel significantly older than the postdoctoral fellows. Tact and diplomacy, therefore, are vital allies for the postdoctoral fellow when requesting work from a technician.

[b] The laboratory in which I worked was nothing more than a large warehouse with metallic walls and suffered from poor thermal insulation and regulation. It has since been replaced by a more modern facility.

Thus in the technological arena a system needs to be implemented that can store and retrieve all the declarative and procedural knowledge that is generated by the postdoctoral fellows.

3.4 SCIENTIFIC OBSTACLES

The nature of scientific research obliges participants to become familiar with a range of scientific subjects that goes beyond the training received in graduate school. For example, as a physicist studying conjugated polymers, one must have working knowledge of chemistry, electrical engineering, and materials science. Hence one is forced to continually learn new concepts from different fields but often, unfortunately, without the support of a university setting. The result is that it is often difficult to gain the knowledge necessary to understand a new concept without expending a disproportionate amount of time and energy. For example, your author needed to comprehend the concept of excimers in order to understand a journal article on conjugated polymers. There being nobody on hand with which to discuss, a trip to the library (a 6 mile drive from our technical area) was called for, resulting in the discovery of several textbooks on the subject. These were perused and numerous equations and formulas were found describing excimers. However, these textbooks were too advance – what was needed was an introductory text. Finally, a web search revealed that excimers were nothing more than “excited dimers”, which was exactly the information needed since I understood dimers well. The point of this digression is that the postdoctoral fellow often needs to acquire new knowledge, but does not have the time or motivation to follow an in-depth course – all they need is a specific piece of information that will provide the final 10% or so of knowledge necessary to complete an understanding of a given topic.

One of the best sources of knowledge in this area is other postdoctoral fellows. As there are normally a good half-dozen postdoctoral fellows working within each subgroup, and over 40 working in the Physical Chemistry and Applied Spectroscopy group (this covers essentially the entire technical area within which I worked), the resources exist for satisfying the demand. The problem is essentially one of identification and communication; one must be able to identify an expert on the topic in question (e.g. excimers), and then communicate with that person in order to acquire the requisite knowledge.

4. KNOWLEDGE MANAGEMENT SYSTEM

Described herein is a knowledge management system that would address the problems discussed in the previous section.

4.1 OBJECTIVE OF THE SYSTEM

The stated objective of the system is to prevent the loss, once they finish their tenure, of the explicit and tacit knowledge built up by a postdoctoral fellow during his or her tenure at LANL. Although this is not possible in the strict sense, striving towards this objective should yield numerous benefits, which are listed below:

1. The time required for new postdoctoral fellows to become integrated administratively should be reduced.
2. The time required for a new postdoctoral fellow to identify and become acquainted with the technical personnel, and to request and receive work from them should be reduced.

3. The time required for a new postdoctoral fellow to gain the competence necessary to operate the scientific equipment (lasers, cryogenics, electronics, etc.) without supervision and at a level sufficient for obtaining publishable results should be reduced.
4. All postdoctoral fellows should be able to identify, within a matter of minutes, other postdoctoral fellows or technical staff members that are liable to have expertise in a given scientific domain. In addition, consulting their work (i.e. seminars, publications) on given topics or contacting them directly should be made a trivial matter.

4.1.1 Metrics

Although designing metrics for evaluating the knowledge management system is not, strictly speaking, the subject of this paper, it is worthwhile to touch on the topic to ensure that we remain grounded in reality. For this reason I will briefly identify below a few candidates for metrics.

If we consider these expected benefits to be the goals of the knowledge management system, we can devise metrics to evaluate how well the system is performing. By observing these metrics we will get feedback on the performance of the system, its weak points, and its strong points. This will allow us to fine- or coarse- tune the system once it is implemented. Observing the metrics will also allow us to judge the value of the knowledge management system to determine if it is worth continuing at the same level, expanding, or, if the results are negative, dismantling.

In general, any metric should not be a burden to any postdoctoral fellow nor any technical staff member. It is the role of the administrative staff to maintain metrics.

To measure the amount of time it takes for a new postdoctoral fellow to become integrated into the administration system, one can have the health and safety administration notify the group secretary when a member of their group becomes certified. Likewise, when a security badge, or health insurance is issued, the group secretary should be notified. The secretary will store this data in the relevant file, and it can be used in an obvious manner to create a metric indicating the amount of time it takes for a new postdoctoral fellow to become integrated administratively.

To measure the time it takes to become familiar with the system for obtaining technical help in the laboratory may be accomplished, for example, by sending a weekly email to all technicians inquiring if they have interacted with any new postdoctoral fellow. The email may include the names and photos of the fellows in question, and the degree of interaction may range from a simple discussion with no follow-up action required to an interaction involving the placement of a work order. This data may then be used to create an appropriate metric to evaluate the effectiveness of the knowledge management system in reducing the time needed for postdoctoral fellows to master the subtleties of obtaining technical assistance.

Devising a metric to evaluate the knowledge management system's effectiveness regarding the third goal listed above is not simple, especially since it must be done without interfering in any way with the missions of the postdoctoral fellows or the technical staff members. A possible way to address this issue is to collect data remotely using information technology each time someone uses the information system that will be part of the knowledge management system.[c] In this way one or several metrics may be constructed that allow the monitoring and evaluation of this part of the knowledge management system. A similar approach may be applied for creating one or several metrics for the forth goal listed above.

[c] The information system referred to here is described below in §4.2.1.

4.2 COMPONENTS OF THE SYSTEM

4.2.1 Functionalist Component

The functionalist component of the knowledge management system will be used primarily to store and transmit the explicit, procedural knowledge, and may be seen as the "reifying" aspect of the system. The essence of this component will be an information system that will capture, store and transmit explicit procedural knowledge. The specificities of the information system will not be addressed here since that is outside the scope of this paper, and they depend on the users and developers of the system.

The information system should be placed under the responsibility of a permanent member of the administrative staff. A team for developing the system should be headed by this person, and include (at a minimum) a competent person from LANL's IT support staff as well as a person from the facilities management domain. The development of the system, and particularly its interface, should be carried out using input and feedback from the users, meaning primarily the current postdoctoral fellows but also the technical staff members.

The specifications of the information system are as follows.

1. It must provide a centralized entity that is accessible remotely and that contains a database of procedures of all sorts.

The team that develops the information system will initially populate the database. Examples of procedures and information that need to be included are how to obtain and renew a security badge, how to contact facilities management, how to access the machine shop, the name, organizational position, and expertise of all people in the technical area, to name a few. The information in the database should be cross-referenced so that, for example, if one is searching for information on installing high-voltage power supplies, and one finds a person that is also knowledgeable about electronic filtering, one can quickly find all information about electronic filtering. Links to employee web pages should also available.

To make the database accessible remotely the most obvious solution is a system involving current computer networking technology. Thus users would be able to access the database from any computer connected to the technical area intranet (e.g. all laboratory and desktop computers).

2. Its existence must be extremely easy to discover so that ignorance of its existence by any employee in the technical area would be extremely unlikely.

There are numerous ways to make the existence of the information system obvious to all. Examples include posting signs in the corridors, including a description of it in the new employee handbook (although few employees actually consult all material in this handbook), sending a brochure describing the system to all new employees in their mail,[d] announcing it at the beginning of all group meetings, etc.

3. Searching the database must be extremely easy. It should not require any training.

A keyword search such as is used for Internet search engines is a possible solution. A list of the most common advanced search options should be visible on the interface.

[d] note: *snail* mail, not email

4. The interface to the database must provide a mechanism for contributing additional procedures, subject to verification of the contribution by the information system administrator.

This is a crucial part of the information system because it will allow the system to grow and to constantly acquire information that is relevant to the users. For example, if a postdoctoral fellow discovers a new way to collimate a laser beam, he or she could contribute the procedure to the database by filling out a form. This information would thus become available to all the employees of the technical area. Schemes for encouraging such contributions will be discussed in the following section.

5. Access to the database from the technical area must be unrestricted, since establishing an administrative hurdle to access it would defeat its purpose. There must be no passwords and no clearance required (it must therefore contain no sensitive material).

If we assume that a solution involving computer technology is chosen for this information system, then the database must be freely accessible from any computer connected to the technical area intranet. To access the database from outside the technical area, a username and password may be required. The procedure for obtaining the required username and password should be clearly posted on the interface of the database.

4.2.1.1 Implementation example

Although the development of the information system interface must be left to the users, a simple example of a possible implementation is outlined here. The system envisioned can be implemented using current database and networking technology.[e] The system consists of a central database that can be accessed remotely using standard Internet protocols. Figures 1, 2, and 3 below show screenshots of possible interfaces for the home page (which allows a simple keyword search),[f] the advanced search page, and the page for adding additional information to the database, respectively.

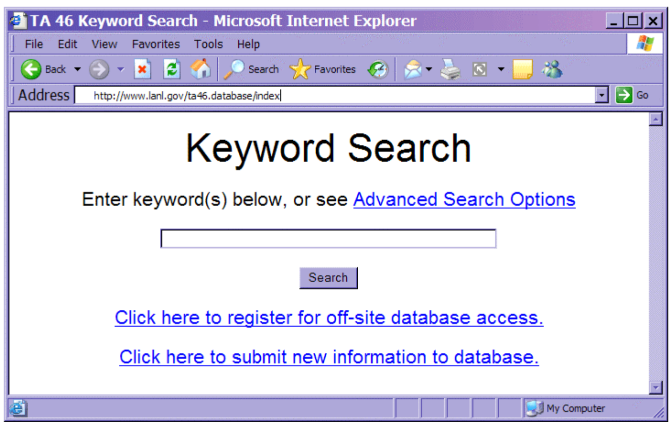


FIGURE 1 A PROPOSED INTERFACE FOR THE DATABASE. NOTE THAT THE USER CAN REGISTER FOR OFF-SITE ACCESS, ACCESS AN ADVANCED SEARCH PAGE, AND SUBMIT NEW INFORMATION TO THE DATABASE.

[e] Sun Microsystems proposes a technology suite based on Java (e.g. Java Database Connectivity (JDBC), Java Server Pages (JSP), Java Scripts (no acronym!), Java Enterprise Beans, etc) that enables the implementation of a remotely accessible database. The technology may be downloaded free of charge from the Sun Microsystems website (www.sun.com).

[f] This interface is inspired by Google.

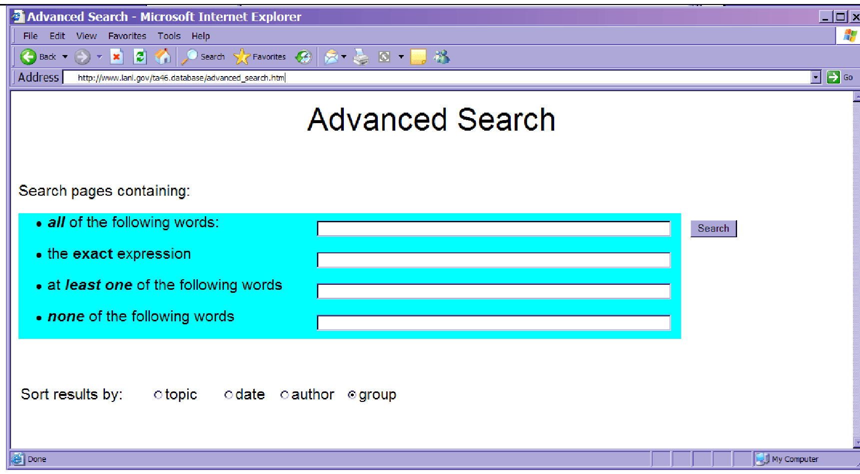


FIGURE 2 THE PROPOSED ADVANCED SEARCH INTERFACE FOR THE DATABASE.

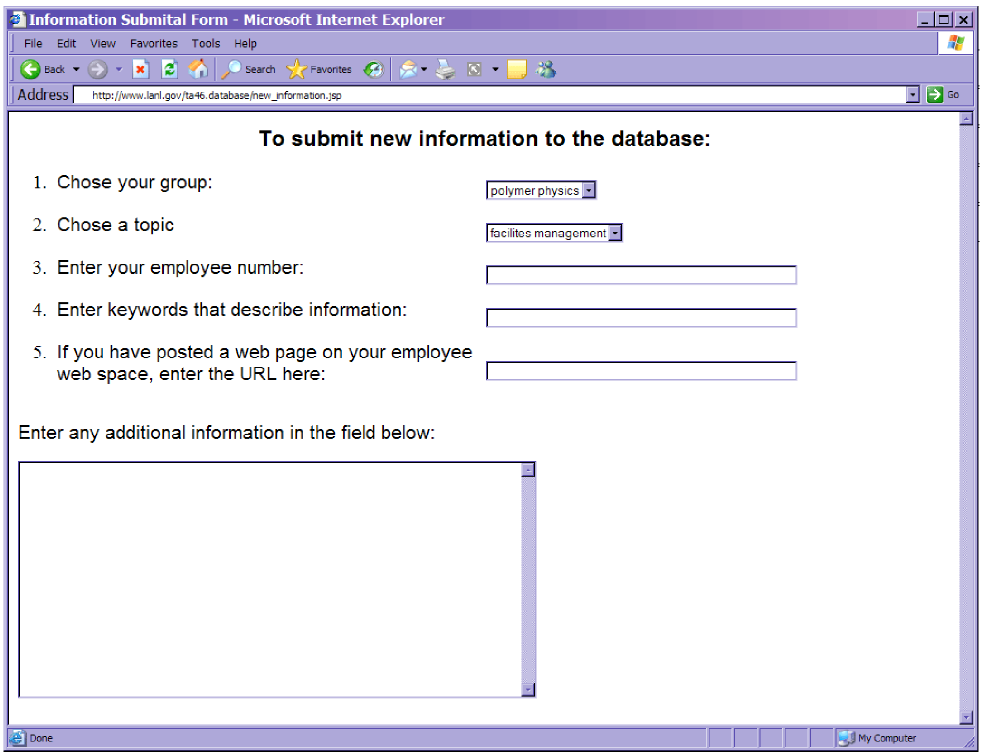
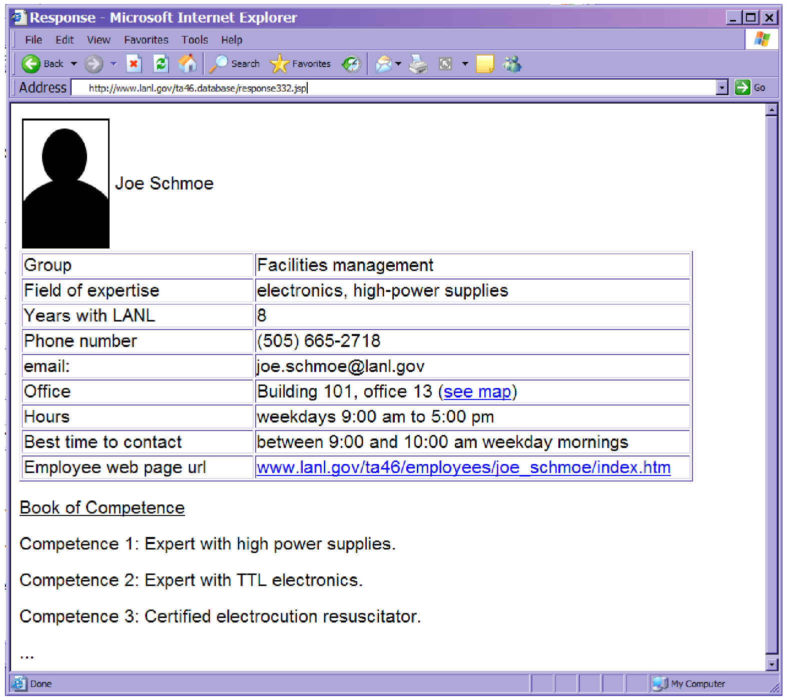


FIGURE 3 THE PROPOSED DATABASE INFORMATION SUBMITTAL FORM.

Figure 4 below shows an example of what a response to a database query may look like using keywords “high power supplies”. The page contains a wealth of information, particularly for a new postdoctoral fellow. The employee’s name and picture are given (a valuable piece of knowledge that may help to avoid embarrassing errors). Also included is the best time to contact the individual, which may save significant time. A link to a map showing the way to the employee’s office is present, as well as a link to the his or her employee web page where more information should be available. Note that the information provided includes a book of competence and other information that should serve to promote the building of relationships.



Joe Schmoe

Group	Facilities management
Field of expertise	electronics, high-power supplies
Years with LANL	8
Phone number	(505) 665-2718
email:	joe.schmoe@lanl.gov
Office	Building 101, office 13 (see map)
Hours	weekdays 9:00 am to 5:00 pm
Best time to contact	between 9:00 and 10:00 am weekday mornings
Employee web page url	www.lanl.gov/ta46/employees/joe_schmoe/index.htm

Book of Competence

Competence 1: Expert with high power supplies.

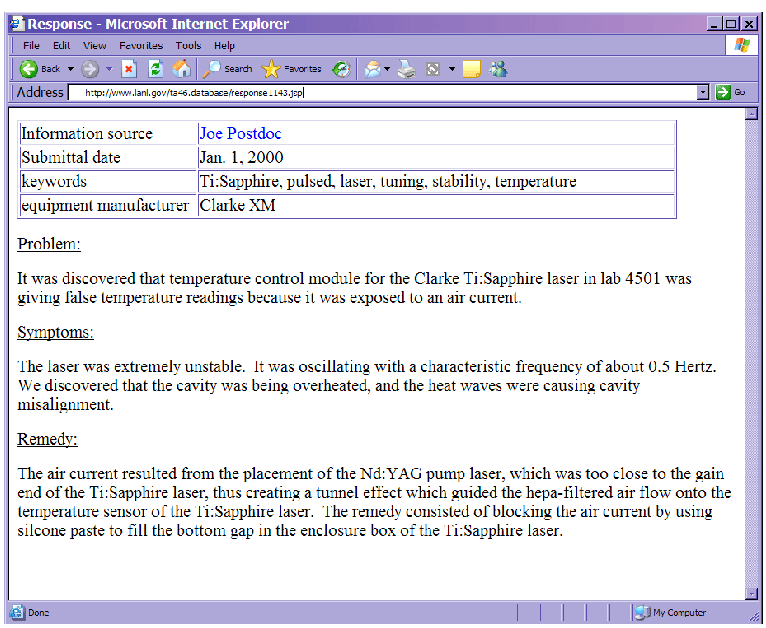
Competence 2: Expert with TTL electronics.

Competence 3: Certified electrocution resuscitator.

...

FIGURE 4 AN EXAMPLE OF A RESPONSE TO A DATABASE QUERY. NOTE THAT THE RESPONSE CONTAINS A BOOK OF COMPETENCE, AS WELL AS INFORMATION THAT PROMOTSE RELASIONSHIP BUILDING.

Another example of response to a query is shown in Figure 5. In this example the query is assumed to be concerned with the topic of laser stability. The example is meant to demonstrate the type of valuable procedural and declarative knowledge that may be stored, communicated, and transmitted by the system. Without the information system, this sort of knowledge is not communicated nor transmitted, and is lost when the person who created the knowledge leaves the organization.



Information source	Joe Postdoc
Submittal date	Jan. 1, 2000
keywords	Ti:Sapphire, pulsed, laser, tuning, stability, temperature
equipment manufacturer	Clarke XM

Problem:

It was discovered that temperature control module for the Clarke Ti:Sapphire laser in lab 4501 was giving false temperature readings because it was exposed to an air current.

Symptoms:

The laser was extremely unstable. It was oscillating with a characteristic frequency of about 0.5 Hertz. We discovered that the cavity was being overheated, and the heat waves were causing cavity misalignment.

Remedy:

The air current resulted from the placement of the Nd:YAG pump laser, which was too close to the gain end of the Ti:Sapphire laser, thus creating a tunnel effect which guided the hepa-filtered air flow onto the temperature sensor of the Ti:Sapphire laser. The remedy consisted of blocking the air current by using silcone paste to fill the bottom gap in the enclosure box of the Ti:Sapphire laser.

FIGURE 5 AN EXAMPLE OF A RESPONSE TO A DATABASE QUERY. THE RESPONSE DESCRIBES AN INCIDENT WHERE TACIT KNOWLEDGE WAS CREATED.

Obviously, the system can address many instances of the obstacles outlined in section 3 (Description of the Problem). The two example responses shown above address a technical problem (Figure 4) and a technological problem (Figure 5). A scientific or administrative problem may just as easily be solved using the system, for example by allowing a postdoctoral fellow to find a technical staff member with expertise in a given area (e.g. excimers), or an administrator for help dealing with some administrative issue.

4.2.2 Social Component

The functionalist component to our knowledge management system can fill many of the knowledge gaps of the new postdoctoral fellow (as well as new technical staff members or new staff). However, the strength of this component is in the storage, communicating, and transmitting of knowledge (mostly explicit, procedural knowledge). Another component is needed to facilitate the creation and identification of knowledge (some of which may then be stored, communicated, and transmitted using the functionalist component). This is the role of the social component of our knowledge management system.

The social component is the part of the knowledge management system that uses the relational approach. Its overarching goal is to promote communication between the *all* people of the group. The word "all" is italicized because, while it may be relatively easy to promote communications between the scientific members of the group (technical staff members and postdoctoral fellows), it is much harder to instill a culture of communication between the scientific members and the administrative staff and technicians. This is due to the vertical hierarchy that exists between these services. Thus the social component must soften this traditional hierarchy and enable a networking approach to problem solving to take hold.

The social component of the knowledge management system consists of four parts: the first two, communities of practice and story time, target the technical staff members and postdoctoral fellows; the last two, lunchtime and playtime, target all the employees of the technical area.

4.2.2.1 Communities of practice

Most of the research done in the Physical Chemistry and Applied Spectroscopy group involves the use of lasers of some type. These range from simple turnkey He-Ne lasers to extremely complex laser systems such as an amplified femtosecond pulsed laser. Some of the lasers are state-of-the-art, but many are relatively old (over 5 years). Operating and maintaining these laser systems is a very complex proposition and would benefit enormously from the establishment of a community of practice for laser users.

Initially the community of practice would need a semi-formal structure within which it may grow until it reaches the critical mass necessary to live on its own. This formal structure could be nothing more than a weekly or bi-weekly meeting[g] under the auspices of a technical staff member. All interested parties would be welcome at these meetings, and the agenda of the meeting could involve, for example, a short presentation by a researcher on a particular aspect of their laser system (the person giving the presentation should have great latitude in choosing their topic). Following this would be an open discussion on issues related to lasers. The members of the community of practice should be encouraged to submit any knowledge they consider useful to the information system described above (section 4.2.1).

[g] Since the Physical Chemistry and Applied Spectroscopy group is housed in one technical area, the logistics for such a meeting would be trivial.

The advantages of such an arrangement for new postdoctoral fellows are obvious. They will benefit not only from a forum that can provide immediate expertise of the highest caliber, but also of a structure that facilitates the building of relationships within their new working environment.

4.2.2.2 Story time

Story time refers to a technique I first saw while at graduate school studying physics. Professor Fred Wudl was a chemistry professor who oversaw a large group of graduate students and postdoctoral fellows (approximately 20 all included). At the end of each day, Fred's group would gather in a meeting room and Fred would go around the table, asking each person to explain briefly what he or she had done that day. The graduate students and postdoctoral fellows ruefully called these meetings "story time", since at times their accounting of the day's events were not entirely truthful.

I attended several of these meetings and found them quite useful for several reasons. For example, they provided a glue that prevented people engaged in different research activities from becoming completely disassociated from others in their group. In addition, each researcher knew a little about what equipment and techniques the others were using; knowledge that could prove extremely useful for one's own research. For those who were facing obstacles preventing progress in their research, the group brought moral as well as scientific support. Every time I attended story time I was amazed at the flood of helpful information and knowledge that washed over the room. An issue that may have started as a parenthetical comment by one person was liable to be picked up by another who would link it to another topic, and this process could repeat itself many times, until a thorough understanding of the issue was obtained. By the end of the meeting, which normally lasted less than 30 minutes, the group was energized and morale was high.

By implementing story time at the sub-group level (each technical staff member would meet with their students and postdoctoral fellows) these same benefits could be accrued. The technical staff members would set the frequency of the meetings (weekly, daily, bi-weekly…).

4.2.2.3 Lunchtime

Lunchtime is a nothing new, but it is a very powerful stimulant that enhances communication and the building of relationships.

Let me again draw from my personal experience to illustrate my point. Before working at LANL, I worked for two years in France at the Laboratoire d'Optique Appliquée (LOA). At this organization, lunch is a sacred tradition. At noon every day, virtually all employees of the lab stop working and spend at least one hour together sharing a delicious meal. One would never know exactly with whom one would share lunch; one day you could be at the table with the laboratory director, the next day with a group of machinists, the next with some scientists from another research group, etc. On first view, I thought this tradition was a monumental waste of time, nothing more than an excuse to shirk from work (and there is an element of that in the practice). However, I soon realized that this hour proved, on average, to be one of the most effective hours of the day. The conversation that flowed around the table, even if banal, served to lubricate relationships that proved extremely valuable for my work. One day you may learn about the procedures of the machine shop and their worries about new safety standards, the next day you might well learn about the strategy of the director in courting Japanese researchers, and the next you learn the challenges the high-energy laser group faces in compressing Joule-level pulses to sub-picosecond durations. In addition to this, the social interaction of the lunch hour served to stimulate and motivate everyone, leading to a more dynamic and energized workforce.

The contrast with what I found at Los Alamos National Laboratory could not be more striking. At LANL, there was no tradition of lunch, unless you consider that eating a cold sandwich alone at your desk fits the description. But it does not, and the result is that LANL and its people do not benefit from the advantages that I described above. For example, as a direct consequence of lunchtime, I found it much easier to open channels of communication between new postdoctoral fellows and administrative or technical staff at LOA than it was at the LANL. Without lunchtime, the morale of the employees suffers as well, which leads to a reduction in communication. This is especially true for new postdoctoral fellows who may feel overwhelmed by the size and diversity of LANL. In this case the daily nonstructured discussion with more experienced employees that comes with lunchtime would be extremely valuable in opening communications, and making connections between seemingly disparate sections of the organization and its people

To implement lunchtime at LANL, one has to take into account its geography. That the technical areas are islands in the wilderness without eating facilities and separated from the official LANL cafeteria by anywhere from 1 to 10 miles makes organizing a lunchtime system difficult, to say the least. Another obstacle to overcome is cultural – lunchtime in the USA is seen more as a necessary evil than an opportunity to create relationships, communicate and network. To avoid antagonizing people and/or losing the respect of many employees, a lunchtime system would have to be on-site (i.e. people should not be obliged to travel the 6 miles to the main cafeteria). In addition, lunchtime should be an option, not a requirement, for all employees.

One manner of implementing lunchtime at LANL that takes these constraints into account would be simply to dedicate a room (with some tables, chairs, and perhaps a microwave oven) to lunch. Since the vast majority of LANL employees bring bag lunches with them to work, this would allow them to eat these bag lunches in the company of other employees. The availability of this room must be communicated to all employees.

4.2.2.4 Playtime

Playtime constitutes the final piece of the social component of our knowledge management system. The establishment of a flexible and simple structure that allows employees to partake in collective activities outside of the work environment is envisioned for this component. Such collective activities include dancing, parlor games, sports, group tourism, etc. For instance, if a number of employees enjoy salsa dancing, organizing outings to salsa clubs in the region would be beneficial. For those who are more sportive in nature, football teams, tennis ladders, or ski outings could be organized.

Participation in any of the activities should remain voluntary, but could be encouraged by the system. The system should be simple enough so that less than one-half day per week would be required for an administrative staff member to keep the system running.

To implement such a system, the database discussed in §4.2.1.1 could be exploited to find common interests among the employees of the technical area, following which a proposition for a suitable activity would be circulated among all employees. In this way, no employee would feel under any obligation to partake in the activity in question. The activities themselves should be constructed so that the participants take ownership and become responsible for further installments of the activity.

The goal of playtime, then, is to boost morale, which in turn improves communication, cooperation, and the building of relationships; factors that are important for the collective creation and communication of knowledge.

5. CONCLUSION

A knowledge management system is described herein for improving the creation, communication, and transfer of tacit and explicit knowledge at Los Alamos National Laboratory. While the system is geared towards addressing the difficulties arising from the frequent turnover of postdoctoral fellows, all employees could benefit from the system.

The system is composed of two parts: The first is an updatable database that can be remotely accessed and that stores and retrieves information relevant to the organization. The second part is more socially oriented and consists of encouraging the development of communities of practice and other arrangements that encourage communication and the building of relationships.