Grimshaw, T. Open Source Science Applied to CMNS Research: A Paradigm for Enhancing Cold Fusion Prospects and the Public Interest. in ICCF-14 International Conference on Condensed Matter Nuclear Science. 2008. Washington, DC.

Open Source Science Applied to CMNS Research: A Paradigm for Enhancing Cold Fusion Prospects and the Public Interest

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Abstract

Open Source Science (OSSc) is a collaborative, voluntary (uncompensated) and highly distributed method of research that emphasizes the power of new digital technologies, particularly the Internet. The OSSc paradigm grew out of the open source software movement of the last 20 years, which has resulted in wide availability of free software (such as the Linux operating system) as an alternative to proprietary software products. In many respects, OSSc represents a return to the concept that scientific research results are a public good rather than a proprietary product – an attitude clearly articulated in the 1940s by Robert Merton, the "father" of the sociology of science.

The public interest in the success of cold fusion has long been tacitly accepted because of the potential social welfare benefits related to its possibilities for very low cost energy and even transmutation of chemical elements. Cold fusion researchers, because of rejection of their field by mainstream science and continued highly marginalized research conditions, already employ many of the methods and tools of OSSc. For example, they not only use websites for posting research papers and but also utilize Internet discussion groups for introducing ideas and dialoguing online about the merits and deficiencies of those ideas.

The prospects of cold fusion success may be significantly enhanced by extending the current informal and implicit use of OSSc-type methods to more organized and explicit deployment under the sponsorship of a recognized professional organization such as ISCMNS. A formal, sponsored use of OSSc for support of cold fusion could not only enhance current methods (not replace them) by bringing them under a professional organization "umbrella", but also bring powerful OSSc methods into play that are not currently used. For example, research collaboration (especially by scientists in other fields) may be enhanced by establishing an open website dedicated to this purpose, including posting of research data (in addition to papers and interpreted information) by registered users. Another example would be a "wiki-like" website that would not only increase the availability and quality of cold fusion information, but also improve its accessibility to the public and policy makers, thus helping to "make the case" for badly needed public policy changes toward cold fusion. Fortunately, OSSc

methods have been applied in other fields (e.g., environmental datasets), so working examples are well established and readily available.

The collaborative and voluntary approach of OSSc may be somewhat less powerful for highly technical and specialized fields (like the nuclear physics underpinnings of cold fusion theory and research) than has been the case for open source software, where the population of contributors is vast. Nevertheless, the prospects for cold fusion success, and the associated public interest in that success, would be significantly enhanced by expanded and more disciplined application of OSSc methods by the CMNS community.

1. Introduction

Open Source Science (OSSc) is a recent development in the methodologies of scientific investigation that departs significantly from scientific practice as it has evolved in recent decades. OSSc is enabled by technologies of the digital revolution, particularly the Internet, and embraces a collaborative investigative approach rather than conventional individual or small-group research methods. OSSc grew out of Internet-supported collaborative development of software under a paradigm known as Open Source Software (OSS) or Free/Libre OSS (FOSS or FLOSS). Particularly successful examples of the OSS paradigm are the Linux operating system software, Apache server software, and Open Office word processor, spreadsheet, and presentation software.

Cold fusion (CF) is a potentially revolutionary scientific discovery in which nuclear fusion (basically of hydrogen to helium, as in the hydrogen bomb) is achieved at non-explosive rates and at ambient (near-earth-surface) temperatures. CF[1] was announced by two research chemists[2] in 1989 as a scientific breakthrough with promise of meeting most of the energy needs of society. However, for a variety of reasons (both technical and sociological), CF was rejected by the mainstream scientific community within a year of its announcement.

Despite this rejection, research into CF has continued under highly marginalized conditions by a relatively small group of capable and reputable scientists. This research appears to show clear evidence of the validity of CF phenomena. Given the potential benefit of CF for improving the human condition, and given the continued promising research results, it seems apparent that continued – and expanded – research is urgently needed. And with its current state of rejection and marginalization, CF appears to be an ideal candidate for research under the OSSc paradigm, not only because of the appeal of voluntary research contributions in the absence of funding from conventional resources, but also because of theoretical challenges whose resolution may benefit from the insights and perspectives of other fields besides nuclear physics.

CF and OSSc have emerged and developed in about the same timeframe – in the last 20 years or so. Each in its own way challenges the norms of scientific culture – the sociology of science. And each one also has the potential of revolutionizing our understanding not only of scientific

[1] CF researchers have sought to replace “cold fusion” with other more accurate terms, including “low energy nuclear reactions” (LENR), “chemically assisted nuclear reactions” (CANR), and “condensed matter nuclear science” (CMNS). Although the new terms are legitimate and helpful, “cold fusion” continues to be readily recognized and widely used.

[2] Martin Fleischmann and Stanley Pons, as described in Section 3.

phenomena but also in how scientific research is fundamentally conducted. Successful CF/OSSc research has the potential result not only of an important new energy source but also of improving the way that science is performed more generally.

2. The Open Source Science Paradigm

Open Source Science is a paradigm for conducting research that differs substantially from conventional science as it has evolved in the last few decades, particularly since World War II. This difference is not just one of methodology and reporting, but of much more significant characteristics of values, perspective, underlying motivations, and associated reward systems. In the OSSc perspective, research (and the resulting knowledge) is viewed as a public good – as belonging to the commons – and as freely accessible rather than protected by property rights. This perspective was initially brought forth in the context of collaborative development of computer software (OSS) and has extended into other areas, including publication of technical literature (Open Access, OA) and scientific investigation (OSSc). Open Source in general, and OSSc specifically, are promoted by the Creative Commons[3] organization and its subsidiary, The Science Commons[4].

Origins in the Open Source Software Movement

The OSS movement apparently began as a reaction to the high cost, and resulting unavailability to many, of proprietary software[5]. The basic idea behind OSS, initiated (or at least articulated) by Richard Stallman is that software belongs to the public at large; i.e., to the commons (Stallman 2007). Many projects and software products have been initiated under the OSS paradigm[6], but the Linux and Apache operating systems for individual computers and computer servers are examples that are most frequently referenced. The advantages of the open source approach over proprietary software development have been summarized by Raymond (1998). The history and impact of the OSS movement are described in several sources (see, for example, Bretthauer (2002), Fuggetta (2003), and von Krogh and von Hippel (2003)).

Two of the greatest surprises and accomplishments of the OSS movement have been the high level of participation and number of contributions without direct monetary compensation and the high quality of the software products, which compete very successfully with proprietary products. The high quality is believed to be the result of the concept[7] that "many heads are better than one" – a clear demonstration that collaboration can be highly successful in the area of software development.

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[3] http://creativecommons.org/

[4] http://sciencecommons.org/

[5] In the early days of computer and software development, nearly all software was custom-developed and freely shared among programmers. Later commercial interest led to the "enclosure" of software and its licensing for proprietary use and sale.

[6] Sourceforge (see http://sourceforge.net/) is the most commonly used website for registering and downloading projects. As of December 3, 2007, the number of registered projects was 163,783.

[7] "With many eyes all bugs are shallow." See Raymond, Eric. "The Cathedral and the Bazaar." *First Monday*, vol. 3, no. 3 (March, 1998). Online. Available: http://www.firstmonday.org/issues/issue3-3/raymond/. Accessed: November 2007.

Reinforcement of Traditional Science?

A primary precept of OSSc is that knowledge is owned by the public at large – it is part of the commons – in much the same way that software is viewed under the OSS movement. Although this viewpoint seems rather radical in the early 21st century, with the current emphasis on intellectual property protection through copyrights and patents, in actuality it represents a return to traditional perspectives of scientific research. Robert Merton, the "father" of the study of the sociology of science, advanced several precepts or norms regarding the conduct of science, which are summarized in the acronym CUDOS and are listed in Appendix A (Merton 1942, 1968):

- Communalism
- Universalism
- Disinterestedness
- Originality[8]
- Skepticism

These norms, which considerably pre-date the OSS movement, neatly sum up the primary precepts of OSSc[9]. Within academia, for example, faculty are paid salaries (often by the public) for teaching and guiding students (especially graduate students) and for conducting research and publishing the results, which then become part of the commons. Emergence of the OSSc paradigm thus represents a return to (or reinforcement of) traditional cultural attitudes toward scientific investigation.

OSSc not only reemphasizes a traditional viewpoint toward science and knowledge as part of the commons, but it also makes use of powerful tools, such as communication and electronic file management functions of the Internet, to further or enhance collaboration in scientific investigation. It also encourages, and provides the means for, the synergy of many people with different backgrounds and perspectives to attack a problem. Such collaborative effects provide the basis for cross-fertilization among different fields and disciplines, one of the most powerful methods of achieving new insights into a problem area[10]. The effectiveness of mass collaboration in many areas has been well summarized by several authors, including Tapscott and Williams (2006), von Hippel (2006), and Benkler (2007).

Open Access Reporting of Research Results

Extension of the OSS paradigm to the publication of research results (OA) apparently took place in response to the skyrocketing cost of journal subscriptions (which were growing at a rate three times the rate of inflation) and a growing concern of "enclosure" of knowledge through aggressive application of copyright law and passage of new laws, such as the Digital Millennium Copyright Act (DMCA) in the U.S. A major concern has been the economic gain being realized by publishers who were charging high prices for literature (research papers) that was funded at

[8] "Originality" was not in Merton's essay[12b] where the norms were introduced; it was added subsequently.

[9] *The thing that hath been, it is that which shall be; and that which is done is that which shall be done: and there is no new thing under the sun.* (Ecclesiastes 1:9-14).

[10] Several websites have been set up specifically to offer rewards and provide a venue for creative people of different disciplines to seek solutions to problems that have proven to be intractable within the field in which they originated. See, for example, the *Innocentive* website at http://www.innocentive.com.

public expense and for the public good. One of the earliest movements toward OA took place as an effort to help investigators in developing countries, where scientific literature was fast becoming unavailable because of inability to pay high subscription costs. The OA movement, like the OSSc paradigm, fosters the concept of knowledge as commons and represents a verification and strengthening of the Mertonian view toward science and the reporting of scientific investigation.

Motivations for Open Source Creativity

Scientific discovery, it seems, occurs in two primary ways – through individual insight or inspiration and through collaborative sharing of ideas and perspectives in trying to solve a problem or meet an objective[11]. Creative people seem also to be motivated by two forces – private gain and community contribution (as well as the pleasure of artistic expression). Economists in general focus on the private interest motivations and appear to have been surprised by the success of the OSS movement without evidence of compensation by the contributors. A number of studies have been published on the seeming mystery of OSS motivating factors (see, for example, Lerner and Tirole (2005), von Hippel and von Krogh (2003), and Madey Free and Tynan (2005)). Other investigators appear to display a more balanced understanding of human motivation and emphasize the social structure and implicit rewards of uncompensated contributions (Crowston and Howison (2005), Edwards (2003), Osterloh and Rota (2007), Zeitlyn (2003)).

The motivation for OSSc participation comes less from economic drivers and personal gain motives and more from the intellectual satisfaction provided, the perceived gain in reputation, and the promise of improving the human condition. The rewards are therefore less tangible and remunerative and more intellectual and community driven in nature.

OSSc may therefore provide the opportunity to achieve a better balance not only between the private and public motivations of creative people but also between the two avenues of scientific progress by individuals and group collaboration.

Intellectual Property Issues

Not surprisingly, IP issues are closely related to the motivating forces of inventive people. Those who are more socially motivated will be attracted to OSSc contribution, whereas those with a private interest motivation will seek IP protection for their work under copyright or patent law. One of the salient developments of the OSS movement was the concept of using copyright law to protect the open access status of OSS. In this development, contributors establish a copyright (called “Copyleft”), which allows others to freely copy and modify software but with certain restrictions such as attribution to the software developer and “viral” properties – the provisions of the Copyleft apply to all software derived from the Copylefted software. The Copyleft concept and its application in the Gnu General Public License (GPL) are well described by Mustonen (2003) and on the Free Software Foundation website[12]. A similar or parallel effort to protect OSS under patent law has been initiated, at least for Linux, by the Linux Foundation[13]

[11] These represent “end points on a spectrum” and in reality best occur conjunctively or in some form of combined or alternating individual and group effort.

[12] http://www.fsf.org/licensing/essays/copyleft.html

[13] http://www.patent-commons.org/

and the Open Invention[14] initiative. The copyright and patent issues for OSSc apparently have not yet been addressed to the extent that they have been for OSS.

Challenges to Open Source Science Success

Although OSSc represents a constructive return to the traditional values and practices of science, and adds significantly to scientific practice through the power of the Internet, it is not a panacea. The issues around treating knowledge as a common good have been delineated by Hess and Ostrom (2007) in three categories – studying, protecting and building the knowledge commons. Specific issues addressed include the growth and preservation of the knowledge commons, intellectual property concerns and countering "enclosure" of information, and application of commons concepts to published papers (OA), science (OSSc), collective action, and economics. An urgent concern for OSSc and science in general is the recent trend to privatization of public knowledge (Bollier 2002). For OSSc specifically, Schweik (2007) identifies four areas needing urgent attention:

How to license digital material besides software. Perhaps broaden the Copyleft concept to apply to other forms of intellectual property.

How to achieve success in the context of current incentive structures. Modify incentives and develop a "next-generation" e-journal.

How to govern collaboration under the OSSc paradigm and develop and implement an effective "commons governance structure".

How to finance projects under the OSSc paradigm. Rely on voluntarism and develop alternate financing schemes for paper publishing.

This author also points out that the main difference between scientific and software OSSc projects is the larger variety of participants in science projects. The central question for successful application of the OSS paradigm to science (OSSc) is the provision of adequate incentives for the broad spectrum of potential participants.

3. Cold Fusion Background

If it proves to be real, CF will be good news for the welfare of humanity because it holds the promise of providing abundant supplies of energy from nuclear sources at temperatures close to the surface of the earth and with little or no associated harmful radiation.

Cold fusion apparently achieves nuclear fusion at ambient temperatures by somehow overcoming the natural repulsion of protons (the Coulomb barrier) in the nuclei of hydrogen atoms so that they fuse, with the production of helium and release of energy.

For a variety of reasons, CF was not fully enough substantiated to be accepted by mainstream science during the year after its announcement. Not only was it not accepted, but it was also held up as a premier example of how science should not be done. It became the subject of a number of books and papers as "bad science," "voodoo science", and even fraudulent science.

Despite this negative outcome, a number of capable and reputable researchers continued their investigations – and continued to achieve positive results – in the years after 1990. For example,

[14] http://www.openinventionnetwork.com/index.php

a recent CF publication (Storms 7007) tabulated some 184 confirmations of excess heat (indicating nuclear fusion) from 1989 to 2004.

The situation with CF – continued affirmative results without general acceptance by the scientific community – has been characterized as "undead science" (Simon 2002). The cycle typically experienced by radical new discoveries has been well characterized by Kuhn (1986) and consists of initial rejection, followed by marginalization and derision, and then by eventual acceptance, with major advance in the body of scientific knowledge. If it proves to be "real" CF may be poised for vindication and resurgence as a legitimate field of science (see, for example, Beaudette (2002), Krivit and Winocur (2004), and Storms (2007)).

Current Research Conditions

Cold fusion researchers, in spite of (or perhaps because of) the rejection and marginalization of the field, have formed a relatively close-knit (although often fractious) community that has its own methods of conduct, communication, critique and reporting of research results,. The Internet, which emerged to national prominence and widespread usage in about the same timeframe as marginalized CF research has continued, has played a key role in the success achieved in that research. Continued and expanded use of the Internet will be a major ingredient of support of CF research in the future.

The ways that CF research is conducted are greatly influenced, naturally, by the initial fate of CF and its continued rejection and marginalization. Although a few CF investigators hold prestigious academic or research positions at well-established organizations, much research is conducted at home laboratories and similar small facilities that are dedicated solely to CF research. In the absence of reasonable levels of funding, many of the phenomena that are known to need systematic and thorough investigation with costly lab equipment go unattended. Development of adequate explanations (theories) for observed phenomena is hindered by insufficient experimental data. Without adequate data to "bound" theoretical explanation, theories proliferate, and it is difficult to determine which ones are possible or likely and which are extremely unlikely or impossible.

Communication and Reporting: Existing Open Source Methods

The CF research community has developed its own methods and tools for maintaining professional relationships and sharing results. Many of these methods closely resemble or mimic the conventions of mainstream science. They entail extensive use of the Internet, so the community is well positioned to take increased advantage of digital technologies and tools. The salient communication and reporting methods currently used are described below.

Professional Organization. The International Society for Condensed Matter Nuclear Science (ISCMNS) is the accepted CF-dedicated professional organization. According to its website[15], the ISCMNS mission is "to promote the understanding, development and application of Condensed Matter Nuclear Science for the benefit of the public". It achieves this mission "by organizing scientific meetings, facilitating communication and collaboration between scientists, [and] publishing and distributing results". The organization was registered in England in 2006 as a not-for-profit company. It is governed by a constitution and executive committee, and it maintains a code of conduct for its members.

[15] http://www.iscmns.org/

Conferences. The CF research community presents papers on theory and experimental results in mainstream science conferences where such opportunities can be found – for example, a "Condensed Matter" session at the American Physical Society (APS) annual meeting in March. Because of its marginalization, CF has also been the topic of dedicated conferences (International Conferences on Cold Fusion, ICCF) since 1991, with meetings held in various countries where CF research is conducted about every 18 months. The 12th and 13th conferences were held in Yokohama, Japan[16] in late 2005 and in Dagomys, Russia in the summer of 2007[17], respectively. ICCF-14 is scheduled for August 2008 in Washington, D.C.[18]. The ICCF conferences, as noted, are held under the auspices of the ISCMNS.

Peer-Reviewed Journal. As in the case of conferences, CF researchers publish peer-reviewed papers in mainstream scientific journals – where their papers are not rejected outright because of the topic. In response to a strong need for additional publication outlet, ISCMNS has recently initiated a CF-dedicated peer-reviewed journal, the Journal of Condensed Matter Nuclear Science[19] (JCMNS). This journal is copyrighted as an open-access publication that requires no special permission for downloading for non-commercial use or for teaching purposes. The first issue, which came out in April 2007, had 12 research articles.

Publications Repository. A website entitled LENR-CANR[20] provides an online library with a bibliography of more than 3500 journal papers, books and news articles related to CF. Included in the library are more than 500 scientific papers in PDF (Acrobat) format. The website also includes links to two important electronic books (described in the next section) that can be downloaded without charge. LENR-CANR is maintained by Jed Rothwell and is not currently sanctioned by ISCMNS or other professional society, although the ISCMNS website does provide a link to LENR-CANR.

Electronic Books. Three e-books are available on LENR-CANR for free downloading, as noted above. Jed Rothwell's "Cold Fusion and the Future" (2007) is intended to "show that with cold fusion we can accomplish marvelous things (p. 1). The fourth edition, published in April 2007, has 188 pages. It has an introduction, a description of CF, an outline of how CF will change society, and a review of specific technologies that will be changed by CF. Edmund Storms' "A Student's Guide to Cold Fusion" (2003) is more technically oriented, including eight chapters that provide an overview, describe the production of anomalous energy and nuclear products, delineate the "nuclear active environment" and the behavior of palladium, and explain the Pons-Fleischmann effect and a possible theory for the nuclear reactions. Beaudette's "Excess Heat – Why Cold Fusion Prevailed (2nd Ed.)[21]" is one of the most important reference works in the cold fusion and is also now available online on LENR-CANR.

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[16] http://newenergytimes.com/Conf/ICCF12/ICCF12-Abstracts.pdf

[17] http://newenergytimes.com/Conf/ICCF13/ICCF13-Abstracts.pdf

[18] http://www.iscmns.org/iccf14/index.htm

[19] http://www.iscmns.org/CMNS/publications.htm

[20] http://www.lenr-canr.org/

[21] Beaudette, Charles G. Excess Heat: *Why Cold Fusion Research Prevailed*. 2nd ed. South Bristol, Maine: Oak Grove Press, 2002.

Newsletters. The best-known and most complete CF newsletter is "New Energy Times" (Krivit 2007), which is produced bimonthly by the New Energy Institute, with Steven Krivit as editor and publisher. It is not yet sanctioned by ISCMNS or other professional society, but is widely recognized in the CF research community as an authoritative and reliable information source. The website[22] where the newsletter can be downloaded has a highly protagonistic slant and contains many other references and links in addition to the newsletter. The New Energy Times website and newsletter are particularly valuable for an introduction to the field for newcomers, both interested researchers and the general public.

E-mail Thread in CMNS Google Group. An e-mail thread for CF researchers has been established in Google Groups by Haiko Leitz[23]. Participation is by invitation – new members must be recommended by a current member before being added to the list by Leitz. The CMNS list is quite active, typically with 12 to 20 postings daily. The subjects are quite varied and range from highly theoretical exchanges to detailed experimental results to the problems of marginalization and public perception. Many of the e-mails provide links to websites of interest or to support a point being made or a position being taken.

Video Clips. Several video CF-related clips are available in services such as Google Video and YouTube. Topics addressed include promotional pieces to further the "CF cause" and excerpts from meetings and conferences. For example, a video of the March 23, 1989 press conference where CF was dramatically announced is available[24]. Another video[25] covers a presentation by Glenn Seaborg – "Cold Fusion Presidential Briefing [1989]" – in which it is admitted that the negative CF findings of a U.S. DOE Energy Research Advisory Board in 1989 were fore-ordained.

Researcher Personal Websites. A number of active CF researchers and other interested parties maintain personal websites that are designed to provide valuable information and promote the CF case. Examples are the websites of Edmund Storms[26], Melvin Miles[27], Ludwik Kowalski[28], and Brian Josephson[29].

Periodic Special-Purpose Websites. CF researchers periodically create websites or webpages to support particular experiments or other initiatives. An example is an online laboratory notebook[30] that is maintained by EarthTech International, Inc. for experiments performed in their highly sophisticated calorimeter (humorously termed MOAC – Mother of All Calorimeters). This webpage contains a daily chronology when experiments are underway and screenshot images from LabView, the software used to record data from the calorimeter.

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[22] http://www.newenergytimes.com

[23] cmns@googlegroups.com

[24] http://video.google.com/videoplay?docid=-5820042344911746802

[25] http://video.google.com/videoplay?docid=-6144236233611516224&hl=en

[26] http://pw1.netcom.com/~storms2/

[27] http://coldfusion-miles.com/.

[28] http://pages.csam.montclair.edu/~kowalski/cf/

[29] http://www.tcm.phy.cam.ac.uk/~bdj10/

[30] http://216.201.168.140:8081/logbook.htm

4. Cold Fusion Research under the Open Source Science Paradigm

Cold fusion research as it is conducted, critiqued, and reported under its current marginalized state may benefit from the perspectives, methods and tools of the OSSc paradigm. OSSc offers potential advantages to the CF research effort in four main areas:

Enhanced research through increased collaboration

More options and better clarity on intellectual property topics

Improved communications and reporting of research through expanded use of the Internet

Increased accessibility of CF information for those new to the field and to improve prospects for acceptance into mainstream science

Cold fusion research as it is conducted today already has many of the characteristics of research under the OSS paradigm, such as performance of low-budget research by many investigators and at many locations. To the extent that the OSSc paradigm may be applied to CF research, it must be from a standpoint of "incremental value" to the current practices of the CF investigator community. Since ISCMNS has been established as the primary CF-focused professional organization, it would be the natural sponsor of OSSc-based enhancements.

Enhanced Collaboration

One of the primary contributions that OSSc can make to the CF research effort is to provide the means for increased collaboration, particularly by those having expertise in other fields. Because of the marginalized state of CF, there appears to be a highly-developed sense of community among the active researchers, and there seems to be a strong ethic of collaboration. Although the cooperation appears to be more pervasive than in "normal" scientific investigation, current methods do not specifically emphasize sharing of ideas and cross-fertilization from other scientific fields.

Two aspects of CF research may somewhat limit the degree of cross-disciplinary collaboration– the highly advanced understanding of nuclear physics required for formulating reasonable theories, and the sophisticated laboratory skills required to achieve successful experiments. Nevertheless, a more collaborative approach may have excellent potential for new insights emerging from the perspectives of other fields. Under the OSSc approach, a mechanism and associated guidelines will be provided to state the CF research and theoretical issues clearly, make them widely available and easy to respond to, and receive, evaluate and incorporate the input received.

Intellectual Property Considerations

A strong Mertonian ethic has prevailed to date within the CF research community. As CF emerges from its rejected state, the uneasy balance between openness and enclosure, between sharing knowledge as property of the commons and seeking personal gain through intellectual property measures, may be significantly disturbed. Given the potential importance of CF as a universal energy source, it may be in the public interest to keep as much knowledge of the phenomenon as possible readily available as open source. At the same time, the interests of investigators must be protected not only to maintain incentives for CF research, but also to maintain the integrity of information as it is developed and published.

Under the CF/OSSc paradigm, both the public interest and the private interests of CF investigators need to be addressed. The options available for copyright of published papers, including the use of Copyleft and the GNU General Public License[31], will be described, and links to websites that provide more information and tools will be included. Similarly for patent alternatives, CF-specific information will be provided so that investigators can make informed decisions.

Research Communication and Reporting

Although the methods currently used by the CF research community have many open access features, additional measures are available under the OSSc paradigm to enhance development, communication and reporting of research results. The best approach to optimizing methods for communication using Internet tools and technologies is to examine what's currently being done, infer the requirements that are being met, and recommend improved methods. Examples of Internet tools that are available to enhance communication and reporting are shown in Table 1.

Public Access to Information

Owing to its rejected and marginalized status, CF has a unique challenge of communication to potentially interested researchers and the public as a whole. Much information on the history, current status and new developments is available from a variety of sources, especially websites. But considerable effort is required to locate these sources, evaluate them for particular strengths, and classify them for their utility to the CF field and in what topical area.

Under the CF/OSSc paradigm, emphasis will be placed on developing a clear statement of the "CF case" in a mildly promotional tone and making it easily accessible. The various sources of information – books, websites, papers, repositories, etc. – will be identified and categorized to facilitate the task of newcomers to the field in "coming up the learning curve." The needs of both the general public – for general information for making an informed decision about CF – and potentially interested sophisticated researchers, who need a more in-depth introduction to the field, will be addressed.

[31] http://www.fsf.org/

Table 1. Internet Tools for Communication and Reporting[32]

Information Type	Online Tools	Method of Distribution
News	Blogs Podcasts Moblogging	RSS Automated e-mail newsletter User checking Web site
Events	Calendars	Open standard event formats (.ics, iCal, vCal, etc.) RSS E-mail alerts User checking Web site
Participatory Dialog/Interactivity	Forums Blog entry comments Polls Real-time text chat Video chat Webinars	RSS E-mail subscriptions to comments or forums Online polls/surveys User interacting with Web site Chat programs Webinar services
Documents/Images	File manager Searchable image gallery	FTP RSS E-mail notification Dashboard
Contacts/Members/ Groups	Membership database	Searchable database, links in forums/blogs
Shared applications/ documents	Google Docs Zimbra.com Basecamp.com	Online access to shared application
Summary, quick glance, monitoring change	Digital dashboard	Web page Desktop application (*e.g.*, Visio) Mobile phone application

Summary of Current and Proposed Solutions

Table 2 provides a summary of the inferred CF research and communication requirements along with a listing of current and proposed CF/OSSc methods of meeting the requirements. This summary provides the basis for a specific implementation plan, which is presented in preliminary form in Section 5.

[32] Adapted from "Models of Collaboration Tools" by Professor Gary Chapman, LBJ School of Public Affairs, The University of Texas at Austin. Online. Available: http://www.21stcenturyproject.org/collaboration_tools.htm.

Table 2. Current Methods and Proposed OSSc Approaches for CF Research and Communication

Function/Requirement	Current Method or Tool	OSSc Approach[33]
Knowledge Development: Real-Time Professional Exchanges	-E-mail list on GoogleGroups, managed by Heiko Leitz	-As currently; periodically post e-mail threads on ISCMNS website -ISCMNS assume responsibility for GoogleGroups if/when necessary -RSS feed feature on ISCMNS website; webinar services; blogs & podcasts
Knowledge Development: Collaborative Publication	-E-mail list on GoogleGroups, managed by Heiko Leitz	-Post draft papers and other documents for download and addition through collaborative research
Knowledge Development: Intellectual Property	-None?	-Webpage describing copyright and patent options -Hyperlinks to websites with Open Source explanations and options
Cross-Fertilization Promotion	-None?	-Formulate unresolved theoretical and experimental problems and post on ISCMNS website -Provide management for responses from researchers from other fields
Shared Software & Other Tools (e.g., Experimental Design)	-Informal exchanges among individual researchers	-OSSc enhancement: Identify and post most important software and tools (e.g., experimental software) on ISCMNS website for online access
News	-"New Energy Times" newsletter (primarily) by Steven Krivit	-Mirror "New Energy Times" newsletter on ISCMNS website (or at least provide hyperlink) -Provide Internet functions , such as blogs, podcasts, RSS feeds
Scheduled Events	-"Events" on ISCMNS and New Energy Times websites	-As currently. Implement online calendar on ISCMNS website to supplement Events on existing sites

[33] Most OSSc enhancements are taken from "Models of Online Collaboration" by Professor Gary Chapman, LBJ School of Public Affairs, The University of Texas at Austin. See the following website: http://www.21stcenturyproject.org/collaboration_tools.htm

Table 2. Current Methods and Proposed OSSc Approaches for CF Research and Communication (continued)

Function/Requirement	Current Method or Tool	OSSc Approach
Professional Meetings & Proceedings	-ICCF Conferences sponsored by ISCMNS -Mainstream science conferences (e.g., APS March meeting) -Conference proceedings posted on LENR-CANR	-As currently. Post proceedings on ISCMNS website as mirror to LENR-CANR - OSSc enhancement: Provide webinar services?
Publication of Peer-Reviewed Papers	-Submit and publish papers in mainstream scientific journals (where available) -Publish in newly-established CMNS Journal	-As currently. Maintain posting of CMNS Journal on ISCMNS
Publications Repository	- LENR-CANR, operated by Jed Rothwell	-Mirror LENR-CANR repository on ISCMNS website -ISCMNS assume responsibility for repository if or when necessary
Professional Contacts & Group Members	-ISCMNS membership database	-Searchable database on ISCMNS website, with links in forums and blogs
Professional Acknowledgements	-Preparata Award, granted at ICCF Conferences and posted on ISCMNS website	-As currently. Improve presentation of awards under public information portion of ISCMNS website
Quick Glance, Monitoring Changes	-Visits to many websites, without guideline on what exists or how linked	-Digital dashboard on ISCMNS website
Public Awareness & Cold Fusion Promotion	-"New Energy Times" website (primarily), with newsletter - LENR-CANR website, with three downloadable books by Beaudette, Rothwell and Storms	-As currently. Add links from ISCMNS website -Webinar services, FAQs, wiki, RSS feed service for ISCMNS website

5. Enhanced Application of Open Source Science to Cold Fusion Research

Implementation of OSSc enhancements to the current CF research paradigm will make full use of the functions of the Internet. The website of ISCMNS, the accepted CF professional organization, will be the assumed platform for supporting the CF/OSSc implementation.

Website Organization and Structure

The ISCMNS website, as modified to support CF/OSSc research, will (like most websites) consist of a homepage and a number of topical webpages. The website will be set up to meet the CF/OSSc requirements as set forth in Table 4-2, using the best features of the ORS example.

The homepage will be designed for the general public but will also fully support the sophisticated needs of the CF research community. It will provide high-level information about CF in general and about ISCMNS specifically. A clean, uncluttered appearance will help ensure public interest. Hyperlinks to the topical webpages and other CF websites will be used extensively to avoid "information overload" on the homepage.

The individual webpages will be developed by CF topical area as described in Table 4-2 and will range from descriptive and promotional pages for the general public and researchers new to the field to highly technical forums and download facilities to help researchers to collaborate on such topics as theoretical underpinnings of CF and experimental designs and results. The following webpages are expected to be needed (at a minimum) for the revised ISCMNS website:

Basic Non-Technical CF Descriptions. For the general public; mildly protagonistic in tone. Includes CF professional acknowledgements and links to the many existing CF websites.

News and Scheduled Events. For both the public and CF researchers, especially ISCMNS members. Includes a calendar and links to other important newsletter websites as well as schedules and agendas of upcoming professional meetings.

Professional Contacts and Group Members. For ISCMNS members and other CF researchers. Purpose is to enhance networking among CF interested parties and contributors.

Professional Real-Time Exchanges. For the CF research community. Provides information on current GougleGroup e-mail exchanges, including conditions for participation.

Collaborative Publication. Contains drafts of technical papers, white papers, and other manuscripts for collaborative development and authorship. Designed to be a close parallel to collaborative software development under OSS paradigm. Would facilitate contributions from researchers in other fields.

Intellectual Property Information. Provides an overview of copyright and patent alternatives. Focuses on choices that support the OSSc paradigm, such as Copyleft and open patents.

Shared Software and Other Tools. Set up for posting of researchers' work products that may have utility for other members of the CF community. Designed to enhance collaboration in the research effort and increase efficiency (avoid "re-inventing the wheel"). May also include reference to webpage on intellectual property.

Publication of Peer-Reviewed Papers. Currently the Journal of Condensed Matter Nuclear Science, which is posted on the ISCMNS website. Provides a means for more formal peer review of individual papers than the Collaborative Publication webpage described above (although works from that webpage could "graduate" to peer-reviewed status by the collaborative authors.)

Publications Repository. Provides a link to (and possibly mirrors) the existing LENR-CANR website. Also contains relevant mainstream science publications to CF research that are not directly CF-related (the focus of the LENR-CANR website.) ISCMNS should be prepared to adopt the repository if or when necessary.

Monitoring Changes and Quick Glance. Designed to keep CF researchers up to date on current developments in an automated fashion. Upon individual request or consent, may include RSS feed functionality for revisions to the ISCMNS website.

Financial Support. Provides explanation of the CF/OSSc model and how it is funded, as well as instructions on how to make contributions.

Financial Support

The issues around financial support of OSSc initiatives were well articulated by Schweik (2007), apparently based in part on experience with the ORS project described above. The main points of this review are summarized as follows:

Financial support must be carefully addressed for OSSc projects to be successful.

Support must be considered in two areas – the time and effort involved in contributing to the OSSc project, and the required administrative and collaborative infrastructure.

Project financing in the past has come from seven types of revenue – government subsidies, philanthropy, corporate consortia, corporate investment, venture capital and investment banking, user or participant donations, and a hybrid or mix of the first six sources.

The costs for the time and effort for contributions may be covered by sources that are implicit in the OSSc paradigm and Mertonian science in general – donations from contributors who gain their livelihood by other means.

Administrative and infrastructure costs may be recovered in a similar manner to that used for OA publication costs, including compensation for ancillary support services, subscription models, and author-pays-to-publish models.

For the CF/OSSc project, the ISCMNS organization could establish a subsidiary foundation to control risk to the organization and to receive and manage funds.

Management and Approval Process

Decisions on the overall content and structure of the website will be subject to the approval of the ISCMNS Executive Committee. In addition, the Committee will be responsible for approving the methods of managing the website and the process for approval of specific content at a level lower than the Committee. More than likely a website manager will need to be designated on a voluntary (perhaps rotating) basis or, preferably, on a compensated basis, at least part time.

6. Summary

Cold fusion is a radical new development in physics that may benefit humankind substantially, if it proves to be true, as a new source of low-cost energy. Despite being rejected and marginalized early in its history, CF continues to be actively researched and still holds promise for eventual success. Open source software is a radical new developmental method that is already having a beneficial effect on the creation of new software through voluntary, collaborative effort. The OSS revolution is made possible by the powerful new tools and functions of the Internet that support dispersed collaborative software creation.

Extension of the OSS paradigm to scientific research (OSSc) is in many ways a reinforcement of open traditions of science as expressed in Merton's scientific norms (CUDOS). But OSSc also represents a major advance in collaborative scientific research through the power of the Internet, as is the case for OSS. The OSSc paradigm has already been applied successfully to "real-world" scientific projects and appears to be readily applicable to CF research efforts.

CF research may benefit in many ways from the systematic collaborative approach of the OSSc paradigm. Successful application of the OSSc paradigm to CF research would result not only in a further demonstration of the flexibility and power of the paradigm, but would also enhance CF prospects – so that this potential energy-producing phenomenon could be validated and developed for practical uses. Humanity as a whole would be the primary beneficiary of both the success of the OSSc paradigm and of development of CF as a major new source of inexpensive energy.

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Appendix A

The following amplification of Merton's CUDOS has been posted on the Internet by Mercer University.

> Communalism – The findings of academic science are public knowledge rather than private knowledge. Secrecy is prohibited in the sense that it cannot carry weight or be given credit in scientific discourse. Dishonesty is not tolerated and mutual, personal trust is the norm. Findings are accepted as primary literature in the public record only as a result of peer review.
>
> Universalism in science has two faces. Contributions to science can not be excluded because of race, nationality, religion, social status, gender, sexual preference, or other irrelevant criteria (i.e., science is multicultural); science strives to be a meritocracy; the scientific community attempts to be democratic and fair to its citizens. Empirical 'facts' have to be consensible and the scientific 'theories' that interpret them have to be consensual; the categories of "fact" (representation of experience), "taxonomy" (classification of facts), and "theory" (explanation of the classification) have to be shared among the scientists.

Disinterestedness – Objectivity is an attempt to separate the political, religious, economic personal vested interests of scientists of from their findings. All reference to economic, political, religious or other social interests is routinely and systematically excluded. Scientists are motivated by the same things that motivate non-scientists, but their work must reflect their disinterestedness in any particular outcome. They must be open to conclusions that are most consistent with their results.

Originality – Scientists are self-reliant, independent thinkers who are trained to be original; whether choosing a research question, deciding on an approach to address it, or finding a way to convince others of their findings, scientists must display novelty in order to gain maximum credit; when they publish, something about the research has to be new; thus, freedom or independence is a necessity in science (in the academy we call it "academic freedom"); also, the right to dissent (see below) is absolutely critical; this need for originality explains the emphasis on research rather than, say, scholarship and the drive towards specialization; research areas (requiring projects and proposals) have to be formulated and in some sense discovered.

Skepticism is an attitude of questioning and doubt, that defers judgment until supporting evidence is available. It is sometimes confused with cynicism. Scrutiny of research claims is a hallmark of good science. The scientific culture is an institutionalized context for argumentation. Peer review allows the most important moment for skepticism to be exercised and is the key institution of the scientific culture; this allows scientists to be held accountable to a community, rather than a superior authority.

(See website at: http://sci.mercer.edu/handouts/mertonian_norms.htm)