# Organization and Management of the ARCS Project

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**Abstract.** A large construction project, built at the SNS but managed through a university with personnel at national laboratories, is a managerial challenge. The plan for the ARCS project management, outlining the responsibilities and authorities of the project team members and project stakeholders, is presented here.

**Keywords:** ARCS, SNS, management, project organization, personnel, budget authority

## 1. Introduction

This document outlines the plan of the Principal Investigator for managing the ARCS project as of February, 2002. This plan originated with the plan in the ARCS proposal itself [1], but it has been updated and refined.

## 2. Personnel

Figure 1 shows the organizational structure of the ARCS project. DOE BES interacts directly with the P.I., Brent Fultz, who is responsible for executing the project and for timely reporting on progress. An Executive Committee will also inform DOE BES of significant developments, or report on issues and progress if requested. The person serving in the central position as Project Manager, Doug Abernathy, has been appointed as a Visiting Associate at Caltech. This flexible appointment is presently without a salary, but a Caltech salary is possible if this is desired later. The Visiting Associate appointment allows Doug Abernathy to interface with the purchasing and accounting systems at Caltech. Access to Caltech's Oracle account management database has now been set up for him, and this is possible remotely through a secure internet connection. Documentation of purchases will be centralized at Caltech, and reports on receivables at the SNS will be transmitted to Caltech.

Doug Abernathy will be located primarily at the Argonne National Laboratory where he can utilize the support staff and the design expertise in the neutron Instrument Systems group under Kent Crawford. Later in the project it is expected that Doug Abernathy will move to the Spallation Neutron Source in Oak Ridge and complete the transition to ARCS instrument scientist. For these interactions and for the grant management, an administrator is required at Caltech. Communication between Caltech and Argonne occurs on a daily basis, usually by e-mail and telephone.

Probably in 2004, Doug Abernathy will move to Oak Ridge to oversee the construction of the instrument, commission it, and become the ARCS instrument scientist. It is understood that DOE BES will support this instrument scientist position through the SNS operations budget. Technical support for the completed ARCS

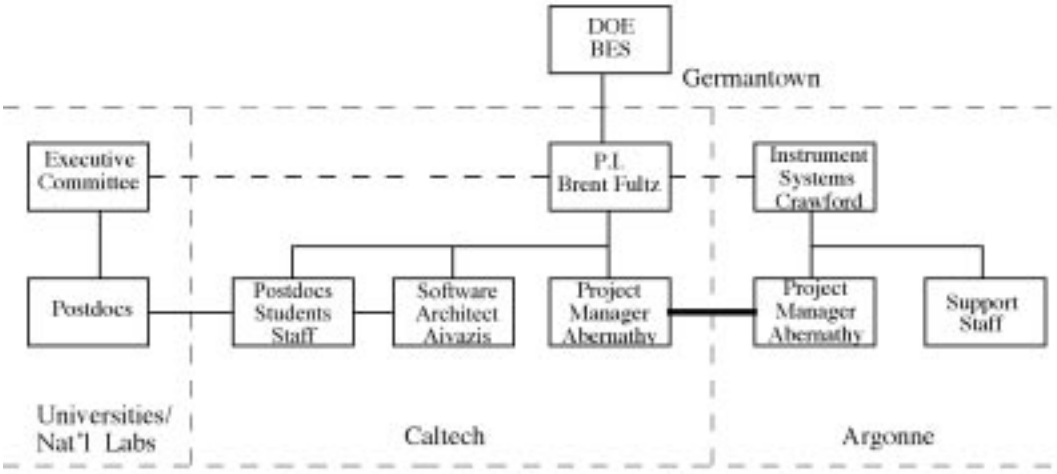


*Figure 1.* Organizational chart of the ARCS project management. Light dashed lines bound geographical locations.

instrument, befitting a world-class neutron spectrometer will be provided by the SNS operations budget. Brent Fultz intends to spend a sabbatical leave at Oak Ridge during the commissioning of the instrument. Some partial support for Fultz may be required from Oak Ridge or the SNS, if this is inappropriate for the ARCS project budget.

## 3. Interface Between the ARCS Project and the SNS Project

A professional working relationship offers mutual benefits to both the ARCS project and the SNS Instrument Systems group. The ARCS project needs the results from, and the resources of, the SNS shared engineering design effort. ARCS will also benefit from SNS work on instrument components, simulations, contacts with vendors and contractors, consultations on standards for engineering and fabrication, and of course, safety. Shielding calculations must be performed by the SNS shielding group, for example, and shielding design for the primary flight path of the ARCS instrument must be evaluated by them.

Although ARCS is a small project in comparison to the SNS project, ARCS has the flexibility to make quick investments in engineering and components, such as providing funds to support SNS personnel for evaluating the performance of detectors and choppers. Doug Abernathy will coordinate with the SNS Instrument Group any testing and evaluation required by the ARCS project. In some cases, coordination will involve changes to the ARCS or SNS project schedules, sometimes without additional cost. When coordination does affect costs to either the SNS or ARCS projects, an equitable sharing of costs shall be found between Instrument Systems group and the ARCS project. For example, if coordination requires the purchase of engineering, labor and supplies that benefit all instruments at the SNS, some support should be provided by the shared engineering budget of the SNS. Alternatively, if ARCS requires engineering modifications of common components,

the ARCS project shall support this work at the SNS. Travel costs for meetings shall be borne by the party that initiates the meeting.

A major piece of the university component of the ARCS project includes the development of scientific software. The software architecture is being coordinated by a software engineer, Dr. Michael Aivazis, Member of the Professional Staff at the Center for Advanced Computing Research at Caltech. Dr. Rick Riedel of the SNS is informed and involved in all major decisions, such as data storage, data standards, software architecture, programming languages, and user interfaces. The software, like the hardware, will be maintained by SNS operations after the ARCS instrument is commissioned, so decisions now will have a long-term impact on the SNS facility, and will affect instruments other than than ARCS. Coordination of the software development activity with other instrument development teams is therefore important to establish early in the project.

## 4. Role of the Executive Committee

The Executive Committee will assess all major design issues and oversee the project execution so that the ARCS instrument will benefit a broad science program as quickly as possible. The Executive Committee is organized and selected to be small and engaged, with a membership listed in the Appendix. The Committee will approve the detailed instrument design and the work breakdown structure of the ARCS project. Members of the Committee, together with the P.I. and the Project Manager, will serve as the change control board to assess proposed changes to the scope of the ARCS project, both in hardware and software. It is expected that members of the Executive Committee will pursue the type of science that will done with the ARCS instrument. For activities that contribute directly to the ARCS project, the ARCS project may contribute to the support of this work.

The members of the Executive Committee will seek outside sources of funding for some aspects of the ARCS project. This could, for example, include the writing of a proposal to the NSF or a private foundation to fund a high-field magnet or a dilution refrigerator for the sample region of ARCS. The Executive Committee will also seek funding for scientific software development. [1] The sample environments for ARCS will be planned in consultation with the SNS sample environment activity and the IDTs for the CNCS and backscatter spectrometers. (The anticipated sharing of sample environment facilities was an important reason for selecting a horizontal geometry for the ARCS spectrometer.)

In the later stages of the project, it is expected that the Executive Committee will oversee the development of the user program for the ARCS spectrometer. Members of the Executive Committee will negotiate with DOE and SNS management for the fraction of instrument time allocated directly to the IDT, and the Committee will then allocate beamtime requests originating from within the IDT.

[1] Brent Fultz and Oscar Bruno participated in a nearly-successful proposal to the NSF in the area of the mathematics of materials that included a significant effort on scattering calculations. They are contemplating other shared proposals.

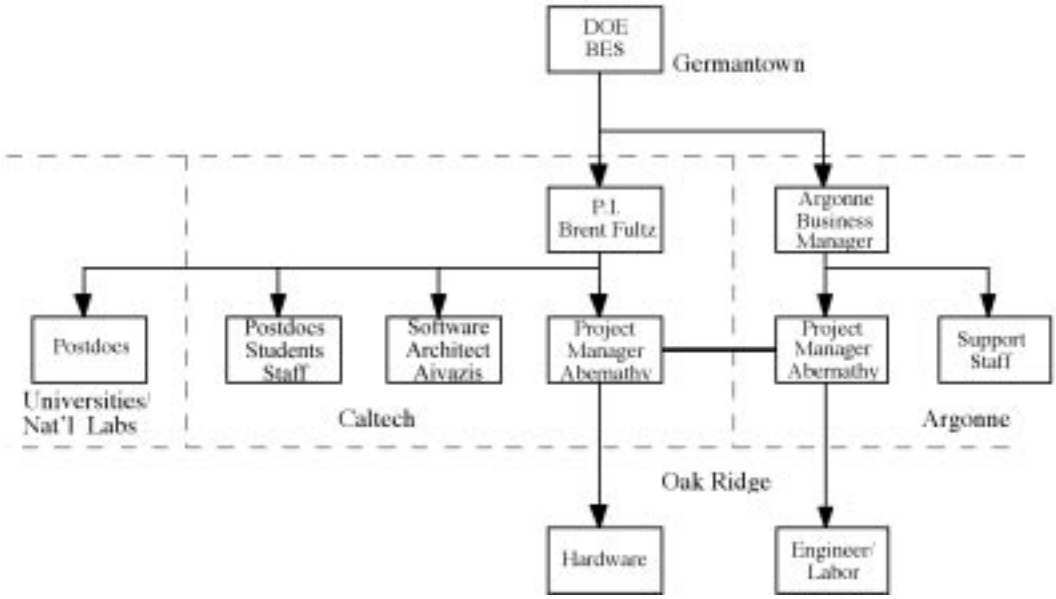


*Figure 2.* Funding channels for the ARCS project.

## 5. Financial Management

Figure 2 shows the financial flow of the ARCS project. The P.I., Brent Fultz, is responsible for directing all funding in the ARCS project, and for reporting all costs and financial status to DOE. This includes coordination with Dr. Helen Kerch of DOE BES to direct the funds into DOE field work proposals to Argonne and perhaps Oak Ridge. These direct funds from DOE to Argonne are needed for support of engineering services and assembly, for example. (It is more difficult to arrange this support as a subcontract from Caltech to Argonne.) The sum of the budgets to Caltech, Argonne, and perhaps Oak Ridge will equal the total budget authorized by DOE BES for each budget period, but it is expected that the distribution of funds between Caltech and Argonne will vary as the project requires different amounts of services from these different organizations.

As mentioned previously, Doug Abernathy is authorized to access and review the ARCS financial records in the Oracle database maintained by Caltech Finance. Changes to these financial records will be approved by Brent Fultz and implemented by Caltech staff. Vendor invoices will be sent to Caltech, and paper records of purchases and reconciliations will be maintained at Caltech. All purchases and contracts for ARCS hardware will occur through the Business Services Office of Caltech. Bill Cooper, Caltech's Director of Purchasing Services, has proposed how his office will interact with the Project Manager (see his memo in an appendix of the ARCS proposal). The Project Manager will have day-to-day contact with this Caltech office, although it is not necessary for the Project Manager to present in person at Caltech, except for a few days near the beginning of the project. There is zero overhead for equipment purchases through Caltech, and subcontracts issued through Caltech are charged Caltech overhead (presently 60 %) on the first 25 k$ of each multi-year subcontract. At present, title to the ARCS spectrometer will be

vested in Caltech. There seems to be no financial benefit to ownership, nor any effect on the cost of the project. This could change if there were changes in either the assessment of the Tennessee use tax, or the Caltech overhead rate. Title to the spectrometer could be changed in the future to minimize the cost to the project, for example.

## 6. Summary (as of February 2002)

Brent Fultz will direct the funds to the various tasks of the ARCS project, but will to delegate a large part of financial management to Doug Abernathy, who will maintain the resource-loaded work breakdown structure of the project. Doug Abernathy has a Visiting Associate appointment at Caltech, giving him the same access privileges as a Caltech staff member when using the Caltech purchasing and accounting systems. Although Argonne and Caltech are both involved in the development of the project plan, Abernathy is putting a greater effort towards the hardware plan, and Fultz and Aivazis are emphasizing the software. Both the hardware and software plans will be approved by the ARCS IDT, in consultation with the SNS and probably in with the advice of outside reviewers.

## 7. Acknowledgements

The work at Caltech was supported by the U. S. DOE under contract DE-FGO3-01ER45950.

## References

1. B. Fultz, ARCS – A High-Resolution Direct Geometery Chopper Spectrometer at the SNS, submitted to the U.S. DOE on June 3, 2001.

## 8. Appendix: IDT Membership

### 8.1. Executive Committee Membership

*Brent Fultz (California Institute of Technology) [Principal Investigator]:*

Area of Expertise: Long-term interest in thermodynamics of solids.

Relevant Experience: Ph.D. 1982 from U.C. Berkeley, faculty at Caltech since 1985. Fultz's group showed that vibrational entropy is important for the thermodynamics of alloy phase stability. In the last few years they have been measuring phonon spectra of materials by inelastic neutron scattering with the relevant inelastic spectrometers in the U.S., identifying reasons for differences in vibrational entropy between alloy phases. Recent measurements on cerium, vanadium, and uranium have shown that thermal electronic excitations have significant effects on phase stability. Investigations are being planned to test the thermodynamic significance of phonon-phonon and electron-phonon interactions.

*Doug Abernathy (Oak Ridge National Laboratory, Spallation Neutron Source) [Project Manager]:*

Area of Expertise: Scattering instrument design, construction and operation. Surface scattering and x-ray photon correlation spectroscopy.

Relevant Experience: Senior Technical Associate at AT&T Bell Laboratories (1985-1987), working with Dr. G. Aeppli. Designed operational equipment and controls for an eV resolution backscattering monochromator and analyzer for the HFBR. Ph.D. (1993) Massachusetts Institute of Technology, studying the structure and phase behavior of the Si(113) surface using a specially constructed x-ray surface diffraction UHV chamber. Joined the European Synchrotron Radiation Facility (1993-1998) as an instrument scientist for the Troika beamline, studying surface diffraction and the production and use of coherent x-rays. Currently working for the Instrument Systems of the Spallation Neutron Source at ANL (1998- ), recently to develop concepts for neutron spectrometers.

*Ward Beyermann (University of California, Riverside):*

Area of Expertise: Correlated-electron physics and biomaterials, thermodynamic and transport properties, neutron scattering, measurements at low temperatures and in high magnetic fields.

Relevant Experience: Ph.D. (1988) from the University of California, Los Angeles. Faculty at University of California, Riverside since 1990. Beyermann's group has investigated the thermodynamics, transport, magnetic excitations, and structure of actinide and lanthanide intermetallic materials. Many of these measurements are conducted at low temperatures and in high magnetic fields up to 60 T. They have also conducted inelastic and elastic neutron scattering experiments at NCNR, IPNS, and the Lujan Center. Some of the phenomena of interest include: quantum critical fluctuations and disorder in systems that exhibit non-Fermi liquid properties, many-body quadrupolar interactions in intermetallics, the influence of large magnetic fields on correlated-electron behavior, and vibrational excitations in Fullerenes, nanotubes, and biomaterials.

*Robert J. McQueeney (Los Alamos National Laboratory):*

Area of Expertise: Condensed matter physics, correlated electronic systems, lattice and spin excitations, neutron and x-ray scattering, pulsed neutron scattering instrumentation.

Relevant Experience: Ph.D. (1996) from the University of Pennsylvania. Visiting Scientist at Caltech (1998). Joined staff at Los Alamos National Laboratory, Manuel Lujan Jr. Neutron Scattering Center (1998). Instrument scientist for the PHAROS chopper spectrometer. Principal investigator for the VERTEX chopper spectrometer project. Significant user of many neutron and x-ray facilities: Lujan Center, IPNS, HFIR, HFBR, ISIS, NSLS, and APS. Software programming experience for analysis and reduction of neutron scattering data and calculation of relevant correlation functions.

*Steve Nagler (Oak Ridge National Laboratory):*

Area of Expertise: condensed matter physics, low-dimensional and quantum magnetism, phase transitions.

Relevant Experience: Ph.D. (1982) from the University of Toronto with neutron scattering experiments at Chalk River. Visiting Scientist at IBM Research (Yorktown Heights) 1982-84. Professor of Physics at University of Florida (1984-1996). Joined ORNL in 1995 as a senior research scientist. At UF, Nagler built an x-ray lab based on a rotating anode and a large Huber 4 circle (same as used at most synchrotron scattering beamlines), and was a founding member of the MRCAT consortium to build beamlines at the Advanced Photon Source. Extensive use of major scattering facilities, including x-ray synchrotron sources (SSRL and NSLS), continuous neutron sources (ILL, HFBR, and HFIR) and the pulsed neutron source ISIS, particularly the chopper spectrometers MARI and HET.

*Ray Osborn (Argonne National Laboratory):*

Area of Expertise: Condensed matter physics, neutron scattering studies of strongly-correlated systems, rare earth and actinide magnetism, transition metal oxides. Running pulsed neutron spectrometers and user program.

Relevant Experience: Ph.D. (1989) University of Southampton UK. Scientist at ISIS pulsed neutron facility, UK, (1985-1992), responsible for the HET chopper spectrometer and user program. Scientist in Materials Science Division of Argonne National Laboratory (1992-) running a scientific program in strongly correlated electron systems (spin dynamics and crystal fields in heavy fermion compounds, quantum critical scattering in non-Fermi liquid compounds), and CMR compounds (magnetic correlations in manganites). Responsible for LRMECS spectrometer at IPNS and user program. Osborn has extensive experience of using a wide range of inelastic neutron spectrometers at different sources, including triple-axis spectrometers, reactor and pulsed time-of-flight spectrometers (direct- and indirect-geometry), polarized neutrons, on both single crystal and polycrystalline materials.

## 8.2. Instrument Development Team Members

The membership of the IDT does not include all scientists who have expressed interest in using the ARCS instrument. Such a membership list would be nearly double the length of the list below. The persons listed below as IDT members are those most willing to attend a national workshop and contribute to the discussion

on the instrument and its science program. Most have contributed to Sect. 1 of the ARCS proposal [1], and many were at the April 30, 2001 meeting at Caltech, the Sept. 24, 2001 meeting at Argonne, and a minor meeting at Caltech in Dec. 2001. This group and others has been receiving regular communications about the ARCS concepts and the preparation of this proposal, for example.

- D. Abernathy, Argonne National Laboratory
- W. Beyermann, University of California, Riverside
- C. Broholm, Johns Hopkins University
- O. Bruno, California Institute of Technology
- T. Egami, University of Pennsylvania
- B. Fultz, California Institute of Technology
- B. Gaulin, McMaster University
- B. Hudson, Syracuse University
- C-K. Loong, Argonne National Laboratory
- M. Manley, Los Alamos National Laboratory
- R. McQueeney, Los Alamos National Laboratory
- H. Nakotte, University of New Mexico, Las Cruces
- F. Mezei, Los Alamos National Laboratory
- S. Nagler, Oak Ridge National Laboratory
- R. Osborn, Argonne National Laboratory
- J. L. Robertson, Oak Ridge National Laboratory
- P. Sokol, Pennsylvania State University
- J. Tranquada, Brookhaven National Laboratory