CALIFORNIA INSTITUTE OF TECHNOLOGY

Purchasing Services
M/C 103-6, Pasadena, CA 91125

DATE: March 22, 2001

TO: Brent Fultz

FROM: Bill Cooper, Director of Purchasing Services EXT.: 4573

SUBJECT: ***Summary of Proposed Procurement Services for Support of ARCS***

INTRODUCTION

On March 20, 2001, we met to discuss requisite procurement services in support of your grant proposal for the construction of "A High Resolution Chopper Spectrometer" (ARCS). The following summarizes Purchasing Services' commitment to facilitate the application of procurement processes that insure proper stewardship and accountability in the expenditure of public funds as foreseen by the Federal Acquisition Regulations (FARS).

ASSIGNMENT

William Rodriguez, Senior Contract Negotiator and Purchase Order Group Team Lead, is assigned as Contracting Officer in support of this project. Mr. Rodriguez, a former Senior Contract Negotiator with the Jet Propulsion Laboratory, is fully cognizant of and experienced with FAR purchasing mandates. Mr. Rodriguez will have at his disposal the Oracle Purchasing system, interfacing with Accounts Payable and Property Management modules as well as additional buyer support, as needed.

Mr. Rodriguez's vita is attached for your review.

FUNCTIONS

The following lists some of the major functions Procurement Services will perform as required by and under the guidance of the Principal Investigator (PI). This list is not

meant to be all inclusive and may be expanded as additional purchasing services are later identified and added at the request of the PI.

- Consult and advise on selection of appropriate contract type to insure most reasonable pricing and cost containment, e.g., firm fixed price versus cost-plus.
- Insure maximum competition for the acquisition of goods and services through implementation of the appropriate procurement mode, e.g., Request for Quotation (RFQ), Request for Proposals (RFP), Invitation for Bid (IFB).
- Where non-competitive procurement is warranted insure proper and written justifications are in place.
- Draft and issue appropriate solicitations.
- Conduct bid openings and assist in bid/proposal evaluations and contract negotiations.
- Issue contract award documentation and enter purchase orders into Oracle system insuring proper coding of capital equipment items to interface with property management system.
- Implementation of A-133 Certification Requirements and other appropriate measures if applicable for the safeguarding of Government Furnished Property (GFP).
- Monitor vendor performance and conduct required administration throughout the course of the contract to include issuance of administrative or negotiated change orders.

UNIQUE ASPECTS AND AREAS OF CONCERN

- Coordination with off-site Project Manager at Argonne National Lab, tentatively Doug Abernathy. Dr. Abernathy will be trained on, and provided direct access to, Caltech's Oracle on-line requisitioning system.
- Coordination with appropriate personnel at the receiving facility at the Spallation Neutron Source at Oak Ridge, Tennessee.
    - Where applicable, insure contracts include "Inspection and Acceptance" clauses requiring reasonable performance period before payment.
    - Implement detailed receiving process requiring presentation of stock receiver or certified invoice prior to Caltech payment.
    - Implement detailed property "tagging" procedure for incoming capital equipment and GFP.

- Insure strict compliance with specification and design parameters to guard against cost overruns.

TIMETABLE

Four to five year project term with initial funding beginning in late FY 2000-2001. However, the bulk of purchasing activity is anticipated to take place in years two and three.

Please contact me if you require any clarification or correction to the above or if we may be of further assistance at this time.

Enclosure

cc: Al Horvath, Controller
Tina Lowenthal, Manager, Purchasing Services
William Rodriguez, Senior Negotiator

Brent Fultz

Professor of Materials Science
California Institute of Technology

Address:

Work: mail 138-78
Rm 231 Keck Laboratory
California Institute of Technology
Pasadena, California 91125

office: 626 395 2170 fax: 626 795 6132
e-mail: btf@hyperfine.caltech.edu
http://www.caltech.edu/~matsci/btf/Fultz1.html

Home: 269 S. Berkeley Ave, Pasadena, California 91107

Education:

High school graduation, valedictorian, 1972

B.Sc.	Physics, Massachusetts Institute of Technology, 1975
M.Sc.	Engineering Science, University of California, Berkeley, 1978
Ph.D.	Engineering Science, University of California, Berkeley, 1982

Employment:

9/82-12/82	Postdoctoral Fellow, Materials and Molecular Research Division, Lawrence Berkeley Laboratory
12/82-10/85	Staff Scientist II, Materials and Molecular Research Division, Lawrence Berkeley Laboratory
10/85-12/90	Assistant Professor of Materials Science, California Institute of Technology
1/91 - 3/97	Associate Professor of Materials Science, California Institute of Technology
5/92-9/92	Contract Professor, Faculty of Engineering, Universitá degli Studi di Udine, Italy
3/97 -	Professor of Materials Science, California Institute of Technology

Consulting:

2/86 -	Materials Science and Engineering Consultant Everett Charles Technologies, 700 E. Harrison Avenue, Pomona, Calif. 91767
1/94 - 12/95	Defense Science Study Group, Institute for Defense Analyses 1801 N. Beauregard St, Alexandria, VA 22311-1772
3/96 - 10/96	Defense Science Board Task Force on Tactics and Technology for 21st Century Military Superiority, sponsored by the Chairman of the Joint Chiefs of Staff and the Under Secretary of Defense (Acquisition and Technology). T. Gold and D. Latham, co-chairs.
6/97 -	Los Alamos National Laboratory Inelastic neutron scattering studies of lanthanide and actinide metals
7/97 -	Los Alamos Neutron Science Center (LANSCE) Materials Program Advisory Committee (beamtime proposal evaluations for inelastic scattering experiments)
11/97 -	Intense Pulsed Neutron Source (IPNS) Program Advisory Committee (beamtime proposal evaluations for inelastic scattering experiments)

10/99	External Reviewer, DOE Chemical Sciences Review of Electrochemical Energy Storage and Conversion Programs, Argonne National Laboratory, Argonne, IL.
10/00	Workshop on Advanced Technologies and Urban Operations, Institute for Defense Analyses, Nov. 2000
11/00 –	Actium Materials, Inc. Houston, TX, Scientific Advisory Board Member

Security Clearance:

1994	DoD Secret
1999	DOE Q

Professional Societies and Service:

Membership:

The Minerals, Metals, and Materials Society (TMS)
American Physical Society (APS)
Materials Research Society (MRS)
The Electrochemical Society

Committees:

Metals Properties Council (sponsored by ASM, AWS, ASME, ASTM)
Task Group on Properties of Materials at Cryogenic Temperatures 1982-1984

The Minerals, Metals, and Materials Society (TMS)
Chemistry and Physics of Materials Committee 1987-
Vice-Chairman, 1995 – 96 *Chairman*, 1997 - 1998
Publications Coordinating Committee 1993 - 1996
Divisional Council of the Electronic, Magnetic, and Photonic Materials Division (EMPMD) 1994 - 1998

ASM International,
Atomic Transport Committee, 1989-
Vice-Chairman, 1992-94 *Chairman*, 1994 - 97
Divisional Council of the Materials Science Division (MSD) 1994 - 97

Synchrotron Radiation Instrumentation Collaborative Access Team
Advanced Photon Source, Mössbauer beamline, Argonne, Illinois 1994 -

Los Alamos Neutron Science Center (LANSCE) Users' Group (LUG)
Executive Committee, Neutron Scattering Repreesentative, 2001-2002

U.S. Representative (one of two) on the International Board for the Applications of the Mössbauer Effect 1999 – 2005.

Awards and Honors:

Associate Member, Society of Sigma Xi, 1975

Travel Fellowship for the 5th University Glass Conference,Rensselaer Polytechnic Institute, Aug., 1979

Scholastic Achievement Award, Golden Gate Chapter of the American Society for Metals, 1979

John E. Dorn Achievement Award, Golden Gate Chapter of the American Society for Metals, 1981

IBM Faculty Development Award, 1986, 1987

Xerox Foundation Grant, 1986

Jacob Wallenberg Foundation Scholarship, 1988

Presidential Young Investigator Award, 1988-93

TMS Student Paper Award (supervised Lawrence Anthony, awardee in both 1988 and 1989)

Patents:

B. Fultz, "Radiation Detector", U.S. Patent # 4,393,306.
Patent rights licensed to Ranger Scientific, Inc.

Ratnakumar V. Bugga, Gerald Halpert, Brent Fultz, Charles Witham, Robert C. Bowman, Jr. and Adrian Hightower
"Metal Hydrides as Electrode/Catalyst Materials for Oxygen Evolution/Reduction in Electrochemical Devices",
U.S. patent No. 5,656,388 issued Aug. 12, 1997.

Ratnakumar V. Bugga, Brent Fultz, Robert C. Bowman, Jr., Subbarao Surampudi, Charles Witham, and Adrian Hightower,
"$LaNi_5$-Based Metal Hydride Electrode in Ni-MH Rechargeable Cells"
U.S. Patent No. 5,888,665 issued March 30, 1999.

I. E. Anderson, T. W. Ellis, R. C. Bowman, Jr. C. Witham, B. Fultz, and B. V. Ratnakumar, "Ultrafine Hydrogen Storage Powders"
U.S. Patent No. 6,074,453 issued June 13, 2000.

R. Chave, C. Lindensmith, J. Dooley, B. Fultz, and M. Birsan
"Magnetostrictive Actuation", Application filed Oct. 29, 1998 claiming the benefit of U.S. Provisional Application No. 60/063,991, filed October 29, 1997.

Textbook:

1. Brent Fultz and James M. Howe, Transmission Electron Microscopy and Diffractometry of Materials, (Springer-Verlag, Heidelberg 2001). ISBN 3-540-67841-7. Drafts used as course text since 1991.
2. Brent Fultz and James M. Howe, Worked Solutions to Problems in Transmission Electron Microscopy and Diffractometry of Materials. Restricted access web site. As of Jan. 2, 2001 it contains 136 worked solutions to 111 problems out of the 151 in the text.

Books Edited:

3. M. M. Disko, C. C. Ahn, and B. Fultz, eds., Transmission Electron Energy Loss Spectrometry in Materials Science, TMS EMPMD Monograph Series Vol. 2 (TMS, Warrendale, 1992) ISBN Number 0-87339-180-2.
4. B. Fultz, R. W. Cahn, and D. Gupta, eds., Diffusion in Ordered Alloys, TMS EMPMD Monograph Series Vol. 3 (TMS, Warrendale, 1993) ISBN Number 0-87339-204-3.
5. L.Q. Chen, B. Fultz, J. W. Cahn, J. R.Manning, J. E. Morral and J. Simmons, eds., Mathematics of Microstructure Evolution, joint publication of (TMS, Warrendale, PA) TMS ISBN No. 0-87339-351-1 and (SIAM, Philidelphia, PA) SIAM ISBN No. 0-89871-386-2.
6. E. Ma, B. Fultz, R. Shull, J. Morral, and P Nash, eds., Chemistry and Physics of Nanocrystalline and Related Non-Equilibrium Materials, (TMS, Warrendale) (TMS, Warrendale, PA, 1997), ISBN No. 0-87339-358-8.
7. C. C. Ahn, M. M. Disko , and B. Fultz, eds., Transmission Electron Energy Loss Spectrometry in Materials Science and the EELS Atlas, book contract with John Wiley signed May, 1998.
8. B. Fultz, "Nuclear and Electron Resonance Spectroscopies in Materials Research (tentative)", Volume 9 in Methods in Materials Research: A Current Protocols Publication. Elton Kaufmann, et al., eds. John Wiley, submitted.
9. B. Fultz, "Electron Methods in Materials Research (tentative)", Volume 11 in Methods in Materials Research: A Current Protocols Publication. Elton Kaufmann, et al., eds. John Wiley, submitted.

Book Chapters (royalties)

10. Brent Fultz, "Chemical Systematics of Iron-57 Hyperfine Magnetic Field Distributions in Iron Alloys", Chapter 1 in Mössbauer Spectroscopy Applied to Magnetism and Materials Science Vol. I, G. J. Long and Fernande Grandjean, eds., (Plenum Press, New York, 1993) pp. 1-31.

11. Brent Fultz, "Vibrational Entropy and Local Structures of Solids", in Local Structure from Diffraction, S. J. L. Billinge and M. F. Thorpe, eds. (Fundamental Materials Research Series, Plenum Press, New York, 1998) 273-294.

12. Brent Fultz, "Mössbauer Spectrometry", in Methods in Materials Research: A Current Protocols Publication. Elton Kaufmann, et al., eds. John Wiley, Unit 9.c. submitted.

13. James M. Howe and Brent T. Fultz, "Transmission Electron Microscopy", in Methods in Materials Research: A Current Protocols Publication. Elton Kaufmann, et al., eds. John Wiley, Unit 12a.2. submitted.

Refereed Publications in Archival Journals (135 total, listing since 1997)

100. L. J. Nagel, B. Fultz, J. L. Robertson, and S. Spooner, "Vibrational entropy and microstructural effects on the thermodynamics of partially-disordered and ordered Ni_3V", Phys. Rev. B, 55 (1997) p. 2903-2911.

101. T. A. Stephens and B. Fultz, "Chemical environment selectivity in Mössbauer diffraction from $^{57}Fe_3Al$", Phys. Rev. Lett. 78 (1997) p. 366-369.

103. H. N. Frase, L. J. Nagel, J. L. Robertson, and B. Fultz, "Vibrational Density of States in Nanocrystalline Ni_3Fe", Philos. Mag. B 75 (1997) 335-347.

104. G. Le Caër, P. Delcroix, B. Malaman, R. Welter, B. Fultz and E. Ressouche, "Comparison of Disorder Induced Thermally and by Ball Milling in Ni_2MnSn, Materials Science Forum, 235 (1997) pp. 583-588.

105. M. Birsan, B. Fultz, and L. Anthony "Magnetic properties of bcc Fe-Pd extended solid solutions", Phys. Rev. B 55 (1997) p. 11502-11506.

106. A. Hightower, R. C. Bowman, Jr., and B. Fultz, "Mechanical Alloying of Fe and Mg", J. Alloys Compounds 252 (1997) p. 238-244.

107. R. C. Bowman, Jr., C. K. Witham, B. Fultz, B. V. Ratnakumar, T. W. Ellis, and I. Anderson "Hydriding Behavior of Gas-Atomized AB_5 Alloys", J. Alloys Compounds, 253-254 (1997) pp. 613-616.

108. C. Witham, R. C. Bowman, Jr., and B. Fultz, "Gas-phase H_2 absorption and microstructural properties of $LaNi_{5-x}Ge_x$ Alloys", J. Alloys Compounds, 253-254 (1997) pp. 574-578

109. T. A. Stephens and B. Fultz, "Interference in Mössbauer diffraction from polycrystalline ^{57}Fe and $^{57}Fe_3Al$", Phys. Rev. B, submitted.

110. L. J. Nagel, B. Fultz, and J. L. Robertson, "Phase Equilibria of Co_3V", J. Phase Equilibria, 18 (1997) p. 21-23.

111. R. Ravelo, J. Aguilar, M. Baskes, J. E. Angelo, B. Fultz, and B. L. Holian, "Free energy and vibrational entropy difference between ordered and disordered Ni_3Al", Physical Review B 57 (1998) p. 862-869.

112. L. J. Nagel, B. Fultz, and J. L. Robertson, "Vibrational Entropies of Phases of Co_3V Measured by Inelastic Neutron Scattering and Cryogenic Calorimetry", Philos. Mag. B 75 (1997) p. 681-699.

113. L. B. Hong and B. Fultz, "Two-Phase Coexistence in Fe-Cu Alloys Synthesized by Ball Milling at Two Intensities", Acta Materialia 46 (1998) p. 2937-2946.

114. C. K. Witham, A. Hightower, R. C.Bowman, Jr., B. V. Ratnakumar, and B. Fultz, "Electrochemical Properties of $LaNi_{5-x}Ge_x$ Alloys in Ni-MH Batteries" J. Electrochem. Soc. 144 (1997) p. 3758-3764..

115. B. Fultz, C. C. Ahn, E. E. Alp, W. Sturhahn, T. S. Toellner, "Phonons in nanocrystalline ^{57}Fe", Phys. Rev. Lett. 79 (1997) p. 937-940.

116. J. L. Robertson, H. N. Frase, P. D. Bogdanoff, M. E. Manley, B. Fultz and R. McQueeney "Phonon densities of states of γ-Ce and δ-Ce measured by inelastic neutron scattering", Philos. Mag. Lett. 79 (1999) 297-304.

117. B. Fultz, T. A. Stephens, W. Sturhahn, T. S. Toellner, and E. E. Alp, “Local Chemical Environments and the Phonon Partial Densities of states of ^{57}Fe in $^{57}Fe_3Al$”, Phys. Rev. Lett. 80 (1998) p. 3304-3307.

118. B. Fultz and T. A. Stephens, “Mössbauer Diffraction and Interference Studies of Polycrystalline Metals and Alloys”, Hyperfine Interactions 113 (1998) p. 199-217.

119. H. Frase, B. Fultz and J. L. Robertson, “Phonons in nanocrystalline Ni_3Fe”, Phys. Rev. B 57 (1998) p. 898-905.

120. L. J. Nagel, L. Anthony, J. K. Okamoto, and B. Fultz, “An Experimental Study of the Difference in Vibrational Entropy between Ordered and Disordered Fe_3Al”, Journal of Phase Equilibria 18 (1997) p. 551-555.

121. P. D. Bogdanoff and B. Fultz, “Vibrational Entropies of Alloying and Compound Formation – Experimental Trends”, Philos. Mag. B 79 (1999) 753-765.

122. G. Vandegrift and B. Fultz, “The Mössbauer Effect Explained”, American J. Physics 66 (1998) p. 593-596.

123. C. C. Ahn, Y. Ye., B. V. Ratnakumar, C. K. Witham, R. C. Bowman, Jr., and B. Fultz, “Hydrogen Desorption and Adsorption Measurements on Graphite Nanofibers”, Appl. Phys. Lett. 73 (1998) p. 3378-3380.

124. J. A. Dooley, C. A. Lindensmith, R. G. Chave, N. Good, J. Graetz, and B. Fultz “Magnetostriction of single crystal and polycrystalline $Tb_{0.60}Dy_{0.40}$ at cryogenic temperatures”, J. Appl. Phys. 85 (1999) 6256-6258.

125. H. N. Frase, B. Fultz, S. Spooner, and J. L. Robertson, “A Small Angle Neutron Scattering and Mössbauer Spectrometry Study of Magnetic Structures in Nanocrystalline Ni_3Fe”, J. Appl. Phys. 85 (1999) 7097-7104.

126. H. N. Frase, R. D. Shull, L.-B. Hong, T. A. Stephens, Z.-Q. Gao, and B. Fultz, “Soft Magnetic Properties of Nanocrystalline Ni_3Fe and $Fe_{75}Al_{12.5}Ge_{12.5}$”, NanoStructured Materials 11 (1999) 987-993.

127. Y. Ye, C. C. Ahn, C. K. Witham, B. Fultz, J. Liu, A. Rinzler, D. Colbert, K. Smith and R. Smalley, “Hydrogen Adsorption by Single-Walled Carbon Nanotubes and their Cohesive Energy”, Appl. Phys. Lett., 74 (1999) p. 2307-2309.

128. P. D. Bogdanoff, B. Fultz, and S. Rosenkranz, “Vibrational Entropy of $L1_2$ Cu_3Au Measured by Inelastic Neutron Scattering”, Phys. Rev. B 60 (1999) p. 3976-3981.

129. A. Hightower, P. Delcroix, G. Le Caër, C-K. Huang, B. V. Ratnakumar,C. C. Ahn, and B. Fultz, “A ^{119}Sn Mössbauer Spectrometry Study of Li-SnO Anode Materials for Li-ion Cells”, J. Electrochem. Soc. 147 (2000) p. 1-8.

130. M. C. Smart, B. V. Ratnakumar, S. Surampudi, Y. Wang, X. Zhang, S. G. Greenbaum, A. Hightower, C. C. Ahn and B. Fultz, “Irreversible Capacities of Graphite in Low Temperature Electrolytes for Lithium-Ion Batteries”, J. Electrochem. Soc., 146 (1999) 3963-3969.

131. J. L. Robertson, B. Fultz and H. N. Frase, "Phonon Contributions to the Entropies of hP24 and fcc Co_3V", Phys. Rev. B 60 (1999) 9329-9334.

132. B. Fultz, T. A. Stephens, E. E. Alp, M. Y. Hu, J. P Sutter, T. S. Toellner, and W. Sturhahn, "Atom clusters and vibrational excitations in chemically-disordered $Pt_3{}^{57}Fe$", Phys. Rev. B 61 (2000) 14517-14522.

133. R. J. McQueeney, M. E. Manley, B. Fultz, G. Kwei, R. Osborn, and P. D. Bogdanoff, "The dynamic magnetic susceptibility in γ-cerium, β-cerium, and low-density cerium alloys", Philos. Mag. B, in press.

134. M. E. Manley, B. Fultz, and L. J Nagel, "Heat capacity and microstructure of ordered and disordered Pd_3V", Philos. Mag. B 80 (2000) 1167-1178.

135. H. N. Frase, B. Fultz, J. L. Robertson and S. Spooner, "Structural Relaxation within the Grain Boundaries of Nanocrystalline Ni_3Fe", Philos. Mag. B 80 (2000) 1545-1554.

136. B. Fultz and H. N. Frase, "Grain Boundaries of Nanocrystalline Materials — their Widths, Compositions, and Internal Structures", Hyperfine Interactions, in press.

137. J. Graetz, N. Good, B. Fultz, J. Dooley and R. Chave, "Magneto-Mechanical Effects in Polycrystalline $Tb_{76}Dy_{24}$", J. Appl. Phys. 87 (2000) 5795-5797.

138. A. Hightower, C. C. Ahn, B. Fultz, and P. Rez, "Electron Energy Loss Spectrometry on Lithiated Graphite", Applied Phys. Lett. 77 (2000) 238-240.

139. Y. Ye, C. C. Ahn, and B. Fultz, J. J. Vajo and J. Zinck, "Hydrogen Adsorption and Phase Transformations in Fullerite", Applied Phys. Lett., 77 (2000) p. 2171-2173.

140. M. E. Manley, R. J. McQueeney, J. L. Robertson, B. Fultz, and D. A. Neuman, "Phonon densities of states of γ-cerium and δ-cerium measured by TOF inelastic neutron scattering", Philos. Mag. Lett. 80 (2000) 591-596.

141. U. Kriplani, M. W. Regehr, and B. Fultz, "A Mössbauer Effect Powder Diffractometer", submitted to Hyperfine Interact.

142. P. Bogdanoff and B. Fultz, "The role of phonons in the thermodynamics of the martensitic transformation in NiTi", Philos. Mag. B 81 (2001) p. 299-311.

143. L. Pasquini, A. Rempel, R. Würschum, K. Reimann, M. A. Müller, B. Fultz, and H.-E. Schaefer, "Thermal vacancy formation and D0$_3$-ordering in nanocrystalline intermetallic (Fe$_3$Si)$_{95}$Nb$_5$", Phys. Rev. B 63 (2001) 134114.

144. M. E. Manley, B. Fultz, R. J. McQueeney, C. Brown, W. L. Hults, J. L. Smith, D. J. Thoma, R. Osborn, and J. L. Robertson, "Large harmonic softening of the phonon density of states of uranium", Phys. Rev. Lett. 86 (2001) p. 3076-3079.

145. M. E. Manley, R. J. McQueeney, B. Fultz, G. Kwei, R. Osborn, and P. Bogdanoff, "Vibrational and electronic entropies of γ-cerium and β-cerium measured by inelastic neutron scattering" Philos. Mag., submitted.

146. A. F. Yue, B. Fultz, R. Dimeo and D. A. Neumann, "Low-energy phonons in nanocrystalline Ni$_3$Fe", submitted to Phys. Rev. Lett.

147. B. Chen, D. Penwell, M. B. Kruger, A. F. Yue and B. Fultz "Nanocrystalline Iron at High Pressure", J. Appl. Phys. 89 (2001) p. 4794-4796.

148. B. Fultz, C. K. Witham, and T. J. Udovic, "The Distribution of Hydrogen in LaNi$_5$ and LaNi$_{4.75}$Sn$_{0.25}$", in preparation.

149. U. Kriplani, J. Y. Y. Lin, M. Regehr, and B. Fultz, "Intensities of Mössbauer powder diffractions from ^{57}Fe", submitted to Phys. Rev. B.

Refereed Chapters in Society Books / Refereed Conference Proceedings
(53 total, listing since 1997)

188. B.V. Ratnakumar, S. Surampudi, B. Fultz, C. Witham, R.C. Bowman, Jr., and A. Hightower, "LaNi$_{5-x}$Sn$_x$ Electrodes for Ni/MH Electrochemical Cells," *NASA Tech Briefs* August 1998, p. 60-61.

189. B.V. Ratnakumar, C. Witham, B. Fultz, , S. Surampudi, R.C. Bowman, Jr., and A. Hightower, "LaNi$_{5-x}$Ge$_x$ Electrodes for Ni/MH Electrochemical Cells," *NASA Tech Briefs* August 1998, p. 61-63.

190. H. N. Frase, L. J. Nagel, J. L. Robertson, and B. Fultz, "Vibrational Density of States in Nanocrystalline Ni$_3$Al, Fe and Ni$_3$Fe", in E. Ma, B. Fultz, R. Shull, J. Morral, and P Nash, eds., Chemistry and Physics of Nanostructures and Related Non-Equilibrium Materials, (TMS, Warrendale, PA, 1997), ISBN No. 0-87339-358-8. pp. 125-134.

191. B. V. Ratnakumar, A. Hightower, C. Witham, R. C. Bowman, and B. Fultz, "Kinetics of Hydrogen Diffusion in LaNi$_{5-x}$Sn$_x$ Alloys", in Electrochemical Society Proceedings Vol. 96-17, P. D. Bennett and S. Gross, eds. (The Electrochemical Society, Pennington, NJ, 1997) p. 197 - 208.

192. J. A. Dooley, C. A. Lindensmith, R. G. Chave, B. Fultz, and J. Graetz, "Cryogenic Magnetostrictive Actuators: Materials and Applications" Proceedings of ACTUATOR 98, 6th International Conference on New Actuators, Bremen, FRG, 1998.

193. J. Ting, V. K. Pecharsky, I. E. Anderson, C. Witham, R. C. Bowman, Jr., and B. Fultz, "Gas Atomization Processing of LaNi$_{5-x}$M$_x$ Modified with Silicon and Tin", Hydrogen in Semiconductors and Metals, MRS Symposium Proceedings 513, N. H. Nickel, W. B. Jackson, R. C. Bowman, Jr., and R. Leisure, eds. (Materials Research Society, 1998) 305-310.

194. J. Dooley, N. Good, J. Graetz, T. Chave and B. Fultz, "Magnetostriction of Polycrystalline Tb-Dy at Cryogenic Temperatures", Adv. Cryogenic Eng. (Materials), in press.

195. B. Fultz and H. N. Frase, "Grain Boundaries of Nanocrystalline Materials", in Ultrafine Grained Materials, R. S. Mishra, S. L. Semiatin, C. Suryanarayana N. N. Thadhani, and T. C. Lowe, eds., (TMS, Warrendale PA, 2000) p. 3-12.

196. B. Fultz, W. Sturhahn, T. S. Toellner, and E. E. Alp, "An Inelastic Nuclear Resonant Scattering Study of Partial Entropies of Ordered and Disordered Fe_3Al", MRS Symposium Proceedings XX, S. Mini, eds. (Materials Research Society, 2000), in press.

197. R. Chave, C. Lindensmith, J. Dooley, B. Fultz, and M. Birsan, "Polycrystalline Tb/Dy Alloy for Magnetostrictive Actuators", NASA Tech Briefs 23 (8) (1999) p. 44.

198. R. Chave, J. Dooley, B. Fultz, and M. Birsan, "Extruding Tb/Dy for Magnetostrictive Actuators", NASA Tech Briefs 23 (8) (1999) p. 44.

199. R. Chave, C. Lindensmith, J. Dooley, B. Fultz, and M. Birsan, "Push/Pull Magnetostrictive Linear Actuator", NASA Tech Briefs 23 (8) (1999) p. 47.

200. R. Chave, C. Lindensmith, B. Fultz, and M. Birsan, "Magnetostrictive Heat Switch for Cryogenic Use", NASA Tech Briefs 23 (8) (1999) p. 48-49.

201. B.V. Ratnakumar, R. C. Bowman, A. Hightower, C. Witham, and B. Fultz, "$LaNi_{5-x}M_x$ Alloys for Ni/Metal Hydride Electrochemical Cells," *NASA Tech Briefs* May 1999, p. 48.

202. J. Dooley, B. Fultz, J. Voccio, R. Change, and N. R. Good, "Magnetoelastic Vibration Dampers", NASA Tech Briefs, in press.

203. A. Hightower, C. C. Ahn and B. Fultz "Electron Energy Loss Spectrometry on Lithiated Graphite" Microbeam Analysis 2000; Institute of Physics Conference Series **165** (2000) pp. 225-226.

Non-Refereed Papers and Reports (20 total, listing since 1997):

218. C. K. Witham, A. Hightower, R. C. Bowman, Jr., B. V. Ratnakumar, and B. Fultz, "$LaNi_{5-x}M_x$ Metal Hydride Alloys for Alkaline Rechargeable Cells", in Proc. 12th Annual Battery Conference on Applications and Devices, Long Beach, CA, January, 1997 (Inst. Electrical Electronic Engs., Piscataway, NJ, 1997 catalog number 97TH8226), pp. 323-325.

219. A. Hightower, C. K. Witham, R. C. Bowman, Jr., B. V. Ratnakumar, B. Fultz, B. Czajkowski, L. Zhang, D. Singh, M. Klein and L. Huston "Performance of $LaNi_{4.7}Sn_{0.3}$ Metal Hydride Electrodes in Sealed Cells", in Proc. 13th Annual Battery Conference on Applications and Devices, Long Beach, CA, January, 1998 H. Frank and E. Sao, eds. (Inst. Electrical Electronic Engs., Piscataway, NJ, 1998 catalog number 98TH8299) p. 399-404.

220. T.E. Mason, C. Broholm, B. Fultz, R. Osborn, R.A. Robinson, G. Aeppli, H.A. Mook, S.E. Nagler, B. Keimer and S. Kern, "HELIOS: A High Intensity Chopper Spectrometer at LANSCE", ICANES '98 Conference Proceedings.

221. C. C. Ahn, Y. Ye, B. V. Ratnakumar, C. Witham, R. C. Bowman, Jr., and B. Fultz, "Carbon as a High Capacity Solid State Storage Medium for Hydrogen", Proc. 14th Annual Battery Conference on Applications and Devices, Long Beach, CA, January, 1999, H. A. Frank and E. T. Seo, eds., (Inst. Electrical Electronic Engs., Piscataway, NJ) IEEE 99TH8371, p. 67-71.

222. C. K. Witham, A. Hightower, B. V. Ratnakumar, R. C. Bowman, Jr., and B. Fultz , "$LaNi_{5-x}M_x$ Alloys in Rechargeable Batteries: Factors affecting Cycle Lifetimes", Proc. 14th Annual Battery Conference on Applications and Devices, Long Beach, CA, January, 1999, H. A. Frank and E. T. Seo, eds., (Inst. Electrical Electronic Engs., Piscataway, NJ) IEEE 99TH8371, p. 61-65.

223. A. Hightower, J. Graetz, C. C. Ahn, B. Fultz and P. Rez, "The Valence of Li in Graphite", submitted to the Proceedings of the Electrochemical Society Annual Meeting, Phoenix, 2000.

224. C. C. Ahn, Y. Ye, B. Fultz, J. J. Vajo, and J. J. Zinck, "Hydrogen Storage in Single Walled Carbon Nanotubes", Proceedings of the 10th Canadian Hydrogen Conference, T. K. Bose and P. Bernard, Eds., (Canadian Hydrogen Association, Quebec, 2000) ISBN 0-9696869-5-1, pp. 392-399.

Student Papers Supervised (8 total, listing since 1997):

231. Michael Manley, "Low Temperature Inelastic Neutron Scattering Study of Phases of Cerium", First Prize Student Poster Competition, Los Alamos Neutron Science Center (LANSCE) Users' Group Meeting, August 1998.

232. Peter Bogdanoff, "Vibrational Entropies of Cu-Au Alloys", First Prize Student Poster Competition, Los Alamos Neutron Science Center (LANSCE) Users' Group Meeting, January, 2000.

233. Michael Manley, "Vibrational Softening in α-Uranium", Los Alamos Science, Nov. 26, 2000 (LA-UR-00-4100) p. 202-207.

Conferences and Symposia Organized (since 1997):

B. Fultz, R. Shull, E. Ma, J. Morral, and P. Nash, “Chemistry and Physics of Nanostructures and Related Non-Equilibrium Materials”, TMS Annual Meeting, Orlando, FL Feb. 9-13, 1997.

International Advisory Committee, The International Symposium on the Industrial Applications of the Mössbauer Effect, ISIAME 2000, Virginia Beach, Virginia, August 13-18, 2000.

Program Committee of the International Conference on the Applications of the Mössbauer Effect, 2001, Oxford, England (ICAME'01).

Invited Technical Presentations (since 1997):

B. Fultz, “Vibrational Entropy of Materials”, Condensed Matter Physics Colloquium, Los Alamos National Laboratory, March 6, 1997.

B. Fultz, “Two New Methods for Materials Characterization Based on the Mössbauer Effect”, Physics Dept. Colloquium, Univ. Texas, El Paso, Mar 26, 1997.

B. Fultz, “Phonon Partial Densities of States of ^{57}Fe in Alloy Phases”, Workshop on Inelastic Nuclear Resonant Scattering”, Argonne National Laboratory, April 21 - 22, 1997.

B. Fultz, “Vibrational Entropy of Metals and Alloys”, Workshop on Local Structure from Diffraction, Traverse City, Michigan Aug. 10-14, 1997.

B. Fultz, “Mössbauer Diffraction from Polycrystalline Alloys”, International Conference on the Applications of the Mössbauer Effect, Rio de Janeiro, Brazil, September 14-20, 1997.

B. Fultz and L. J. Nagel, “Anharmonic Effects on the Vibrational Entropy of Alloy Phases”, TMS Fall Meeting, Indianapolis, IN, Sept. 14-18, 1997.

B. Bultz, “Vibrational Entropy and Phonon Densities of States of Materials”, U. C. San Diego Condensed Matter Physics Colloquium, Oct. 8, 1997.

B. Fultz, “Improved Alloys for Ni-MH Batteries”, Materials Research Society Spring 1998 Symposium on Hydrogen in Semiconductors and Metals, San Francisco, April, 1998.

M. E. Manley, L. J. Nagel, and B. Fultz, "Vibrational Entropy Difference between Ordered and Disordered Pd_3V", Hume-Rothery Symposium for R. Kikuchi, TMS Annual Meeting, San Antonio, Feb. 16, 1998.

B. Fultz, H. Frase, C. C. Ahn, J. L. Robertson, S. Spooner, E. E. Alp, W. Sturhahn, T. S. Toellner, R. McQueeney, "Vibrations of Nanocrystals", TMS Annual Meeting, San Antonio, Feb. 16, 1998.

B. Fultz, H. Frase, C. C. Ahn, J. L. Robertson, S. Spooner, E. E. Alp, W. Sturhahn, T. S. Toellner, R. McQueeney, "Vibrations of Nanocrystals", TMS Annual Meeting, San Antonio, Feb. 16, 1998.

B. Fultz, H. Frase, C. C. Ahn, J. L. Robertson, S. Spooner, E. E. Alp, W. Sturhahn, T. S. Toellner, R. McQueeney, "Vibrations of Nanocrystals", TMS Annual Meeting, San Antonio, Feb. 16, 1998.

B. Fultz, “Vibrational Entropy of Alloy Phases”, Oak Ridge National Laboratory, Sept. 1, 1998.

B. Fultz, “Vibrational Entropy of Alloy Phases”, Sandia National Laboratory, Livermore, Nov. 24, 1998.

B. Fultz, “Inelastic Nuclear Resonant Scattering and Mössbauer Diffractometry of Polycrystals”, Physics Colloquium at Old Dominion University, Norfolk, VA, Feb. 11, 1999.

B. Fultz, H. Frase, J. L. Robertson, “Heat Capacity, Phonons, and Vibrational Entropy of Nanocrystals”, TMS Annual Meeting, San Diego, CA, February 1999.

B. Fultz, "Vibrational Entropy of Alloy Phases", Solid State Sciences Seminar, California Institute of Technology, Pasadena, CA, March 9, 1999.

B. Fultz, “Vibrational Entropy of Alloy Phases”, MRS Spring Meeting, April 7, 1999.

B. Fultz, C. C. Ahn, R. C. Bowman, Jr., B. V. Ratnakumar, Y. Ye, and C. K. Witham, "Hydrogen in Metals and on Carbons", HRL Laboratories, Malibu, CA, May 25, 1999.

B. Fultz, "Vibrational Entropies of Alloy Phases", Workshop on Thermodynamic and Structural Properties of Alloy Materials, June 20 - 25, 1999 Oranjestad, Aruba.

B. Fultz, "Vibrational Entropy and Inelastic Nuclear Scattering", Condensed Matter Seminar, Purdue University, Sept. 17, 1999.

B. Fultz, "How Studies of Vibrational Entropy Bring Us to 3-ID", DOE Program Evaluation Board for Synchrotron Radiation Instrumentation Beamlines (SRI-CAT) at the Advanced Photon Source, Oct. 7, 1999.

B. Fultz, “Entropies of Ordered Alloys”, Intermetallics for the Third Millenium (ASM symposium in honor of R. W. Cahn, Nov. 1999).

B. Fultz, "Inelastic Nuclear Resonant Scattering Studies of Phonons in Alloys", MRS Fall Meeting, Boston, Nov. 2, 1999.

B. Fultz, "Inelastic Neutron Scattering Studies of Vibrational Entropy", LANSCE User's Group Meeting, Santa Fe, NM, Jan. 25, 2000.

B. Fultz and H. N. Frase, "Grain Boundaries of Nanocrystalline Materials, TMS Annual Meeting, Nashville, TN Mar. 13, 2000.

B. Fultz, "Vibrational Entropy of Alloy Phases", Materials Colloquium, Johns Hopkins University, Mar. 29, 2000.

B. Fultz, "Vibrational Entropy of Materials", Materials Science and Mineral Engineering Colloquium, Univ. of Calif. Berkeley Aug. 31, 2000.

B. Fultz, "The VERTEX Spectrometer", DOE review of the Short Pulse Spallation Source Enhancement Project, Los Alamos National Laboratory, Dec. 5, 2000.

B. Fultz, "Mossbauer Diffraction of Materials", 12th International Conferrence on Hyperfine Interactions, Park City, Utah, Aug. 12-17, 2001.

B. Fultz, "Structure and Dynamics of Nanocrystalline Materials," ASM Roundtable Meeting, The Boeing Company, Canoga Park, CA April 26, 2001.

B. Fultz, "The ARCS Spectrometer", SNSWorksop on the Cold Neutron Chopper Spectrometer, NIST Center for Neutron Research, Gaithersburg, MD, May 21, 2001.

B. Fultz, "Mossbauer Diffraction of Materials", Materials Research Lecture, California Institute of Technology, May 30, 2001.

Present GraduateStudents Supervised

Peter Bogdanoff, Materials Science, Ph.D. expected: 2000

Nathan Good, Applied Physics, Ph.D. expected: 2001

Jason Graetz, Materials Science, Ph.D. expected: 2002

Alan Yue, Materials Science, Ph.D. expected: 2002

Jian Liu, Materials Science, Ph.D. expected: 2004

Alexander Papandrew, Materials Science, Ph.D. expected: 2005

Tabitha Swan-Wood, Materials Science, Ph.D. expected: 2005

Olivier Delaire, Materials Science, Ph.D. expected: 2005

Former Ph.D. Students Supervised

Douglas Harvey Pearson, “Measurements of White Lines in Transition Metals and Alloys Using Electron Energy Loss Spectrometry”, Ph.D. in Applied Physics, California Institute of Technology, September 30, 1991.

presently: Staff Research Physicist, Naval Research Laboratory, Washington, D.C.

Hao Ouyang, “Grain Boundaries of Nanophase Materials”, Ph.D. in Materials Science, California Institute of Technology, October 12, 1992.

presently: Associate Professor of Materials Science, National Chung Hsing University, Taiwan

James Kozo Okamoto, “Temperature-Dependent Extended Electron Energy Loss Fine Structure Measurements from K, L_{23}, and M_{45} Edges in Metals, Intermetallic Alloys, and Nanocrystalline Materials”, Ph.D. in Applied Physics, California Institute of Technology, May 6, 1993.

presently: law student, Stanford Univ.

Lawrence Anthony, “Kinetics of Disorder→Order Transformations in Highly Nonequilibrium Materials”, Ph.D. in Materials Science, California Institute of Technology, May 24, 1993.

presently: Assistant Prof. of Physics, Toledo Univ.

Zheng-Qiang Gao, “The Kinetics of Ordering, Grain Growth, and Chemical Segregation in Nonequilibrium Fe_3X Alloys (X = Al, Si, and Ge)”, Ph.D. in Materials Science, California Institute of Technology, May 18, 1994.

presently: Assistant to President on Engineering, Intex Corp., Long Beach

Liubo Hong, “Structures and Stabilities of Nanocrystalline Materials Synthesized by Mechanical Alloying and Modeled as Driven Alloys”, Ph.D. in Materials Science, California Institute of Technology, Sept. 25, 1995.

presently: Applied Materials, PVD Technology, San Jose, CA

Tab Allen Stephens, “Chemical Environment Selectivity in Mössbauer Diffraction”, Ph.D. in Materials Science, California Institute of Technology, May 14, 1996.

presently: Motorola Research, Austin, TX

Laura Jeanne Nagel, “Vibrational Entropy Differences in Materials”, Ph.D. in Materials Science, California Institute of Technology, June 18, 1996.

presently: Assistant Professor of Engineering Technology, West Texas A&M Univ., Amarillo, TX

Heather Nicole Frase, “Vibrational and Magnetic Properties of Mechanically Attrited Ni_3Fe Nanocrystals”, Ph.D. in Materials Science, California Institute of Technology, April 9, 1998.

presently: member of technical staff, Institute for Defense Analyses, Alexandria, VA

Charles K. Witham, "The Effects of Alloy Chemistry on the Electrochemical and Hydriding Properties of Ni-Substitutted $LaNi_5$", Ph.D. in Materials Science, California Institute of Technology, June 4, 1999.

presently: postdoctoral fellow, JPL

Ushma Kriplani, "Kinematical Mössbauer Diffraction from Polycrystalline ^{57}Fe", Ph.D. in Physics, California Institute of Technology, April 18, 2000.

Adrian Hightower, "Lithium Electronic Environments in Rechargeable Battery Electrodes", Ph.D. in Materials Science, California Institute of Technology, July 14, 2000.

presently: member of technical staff, Nanostream, Inc., Pasadena, CA

Yun Ye, "Interaction of Hydrogen with Novel Carbon Materials", Ph.D. in Materials Science, California Institute of Technology, August 8, 2000.

Michael E. Manley, "From Elementary Excitations to Microstructure: the thermodynamics of metals and alloys across length scales," Ph.D. in Materials Science, California Institute of Technology, April 25, 2001.

presently: Director's Postdoctoral Fellow, Los Alamos National Laboratory, NM

Current and Pending Federal Research Support of Dr. Brent Fultz

A. Current Support

1. U. S. Department of Energy

Project Title: "Anode Materials for Rechargeable Li-Ion Batteries"

Principal Investigator: B. Fultz

Coinvestigator: Peter Rez, Arizona State University

Person-Months: 0.2

Total request: $ 528,000

First year request: $ 175,000

Period of Support: 1/1/00 - 12/31/02 (3 yrs)

2. U. S. Department of Energy

Project Title: "Experimental Studies on the Vibrational Entropies of Alloy Phases"

Principal Investigator: Brent Fultz

Person-Months: 0.5

Period of Support: July 15, 2000 to July 14, 2003 (3 yrs.)

Total Award Request: $ 308,122

First year award: $ 99,716

3. National Science Foundation

Project Title: "The Structure and Entropy of Alloys Studied by Mössbauer Diffractometry and Nuclear Resonant Scattering"

Principal Investigator: B. Fultz

Person-Months: 0.5

Total Award: $337,219

Period of Support: 1/1/99 - 12/30/01 (3 yrs)

B. Pending Support

1. This proposal.

Five-Year Cost Profile of ARCS Spectrometer Project

The graph below shows the ARCS project cost profile, including subcontracts and hardware expenditures. The "year" axis is not "fiscal year," but rather the expected costs for each year of the project. The total height of each bar is the total annual cost, and the regions are coded as:

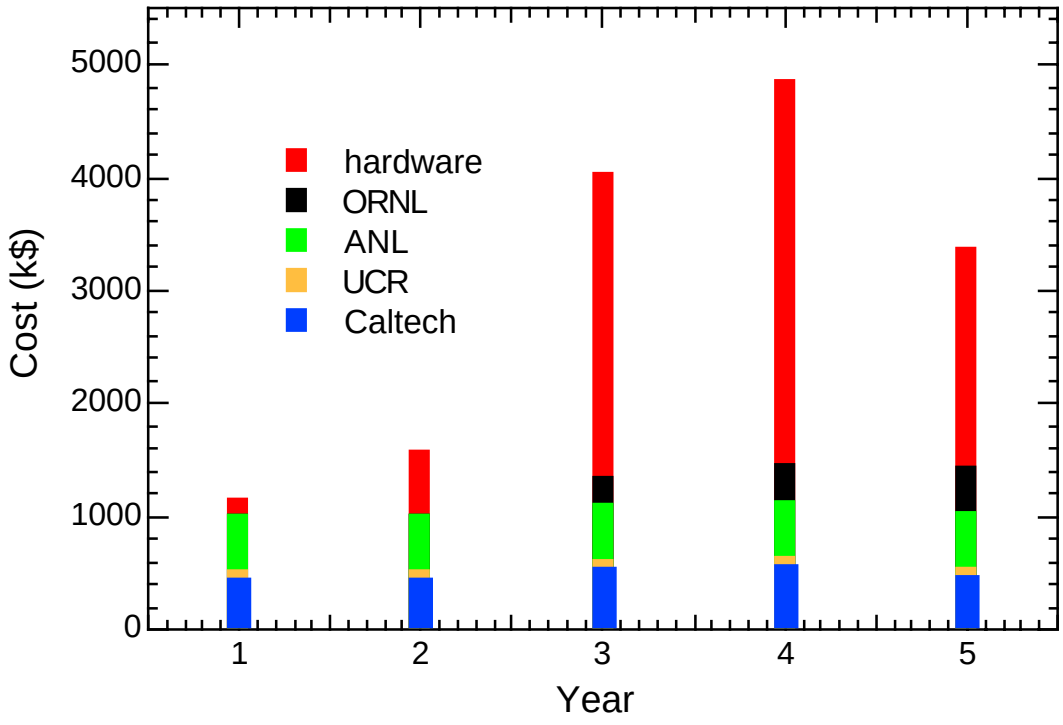
Caltech – labor for software engineer, postdoctoral fellows and graduate student for software and science effort, administrative support, computer hardware and software, plus all project travel, project supplies, publications, and miscellaneous expenses.

UCR – Univ. of Calif. Riverside subcontract for support of a postdoctoral fellow

ANL – Argonne contract for professional engineering and administrative support

ORNL – subcontract for installation of the hardware at the SNS

hardware – components of the spectrometer (details of the hardware expenditures are presented in the table on the following page)



Spending Profile - Procurements

ITEM	FY01 Cost (k$)	FY02 Cost (k$)	FY03 Cost (k$)	FY04 Cost (k$)	FY05 Cost (k$)	Total Cost (k$)
Detectors and Data Acquisition	**120**	**0**	**738**	**2191**	**1463**	**4512**
Low-angle LPSDs	80			930	929	1939
High-angle LPSDs			480	480		960
LPSD Electronics	40		258	721	474	1493
Beamline Controls/DAQ				60	60	120
Primary flightpath	**0**	**529**	**100**	**301**	**0**	**930**
Core vessel insert		50				50
Shutter insert		50				50
T0 Horizontal Axis Chopper				150		150
Disk Chopper			100			100
E0 Fermi Chopper		300				300
Variable Aperatures				120		120
Beamline Roughing Pump				16		16
Neutron Guide		114				114
Guide casing and fixed apertures		15				15
Beam Monitors				15		15
Secondary Spectrometer	**0**	**0**	**1282**	**120**	**20**	**1422**
Sample Vessel			38			38
Low-angle Vessel			770			770
High-angle Vessel			306			306
Goniometer/Thimble				80		80
Radial Collimator				40		40
Safety Interlocks					20	20
Vacuum Roughing Pump			24			24
Vacuum Cryopump/Turbopump			144			144
Shielding	**0**	**0**	**542**	**542**	**388**	**1472**
Incident Beamline/Shielding			198	198		396
Beam Stop					90	90
Vessel Internal Shielding			45	45		90
Vessel Shielding - Wax Cans			299	299	298	896
Sample Environment	**0**	**32**	**0**	**72**	**34**	**138**
Cryofurnace		27.5				28
Displex					34.1	34
Furnace				71.7		72
Temperature Controller		4.5				5
Miscellaneous	**0**	**0**	**20**	**160**	**5**	**185**
Mezzanine				100		100
Control cabin and furniture				40		40
Tool Box & Tools			5			5
Miscellaneous Supports/Hardware			15	5	5	25
Instrument Services				15		15
MAT'L TOTAL	**120**	**561**	**2682**	**3386**	**1910**	**8659**

Title to the ARCS equipment will be vested in DOE. It will reside at the Spallation Neutron Source in Oak Ridge, Tennessee.

Government Subcontracts for the ARCS Project *

Argonne National Laboratory

Engineering and Design

Instrument Scientist	1.0 FTE	130/yr	5 yrs	650 k$
Project Engineer	1.0 FTE	175	5 yrs	875
Designer	1.0 FTE	115	5 yrs	575
ANL project support	0.4 FTE	60	5 yrs	300
	3.4 FTE	480	5 yrs	2,400 k$

Oak Ridge National Laboratory

Assembly, testing, installation

Engineer, technicians, construction		2 yrs	1,000 k$

Total Government Subcontracts **3,772 k$**

*Government subcontracts are paid directly to the National Labs.

Subcontract for the ARCS *

U. C. Riverside

Software Development (perhaps handled through Caltech)

Postdoctoral Fellow	1.0 FTE	70 (yr 1)	5 yrs	372 k$

* This subcontract is paid to Caltech and is included in the budget as a line item.

Budget Explanation Pages

Supplies:

Research Grade Metals, bottled gasses, quartz and ceramic components, testing fixtures, computer software & supplies. Unit costs are derived from internal charge documents and purchase orders.

We use cylinders of argon, ~$27 delivered, for much of our work. Another bottled gas used is oxygen (for glass-blowing), ~$7 delivered. Other gasses might be helium, ~$30 delivered. Liquid helium with delivery is about ~ $5/liter, with quantities typically on the order of 60 liters.

Research grade metals include high purity metals, oxide crystals, semiconductors and superconductors. They are purchased in relatively small amounts, but in varied forms, which may be wires, lumps, flakes, or single crystals. Prices vary based on availability, purity required, and type of item. Basis for pricing is purchase orders and catalog pricing.

Computer supplies include items such as storage media and hardware repairs and upgrades, and some computer hardware itself. Much of the software and its upgrades are also considered computer supplies, such as LaTEX, MatLab, C++ compilers, and operating systems.

Quartz rods are used for glassblowing. Tubes vary in diameter, and prices of ~$2 - 8/ft. are fairly typical. Most of what we purchase runs ~$2.25/ft.

Publication Costs:

Page charges for publication in such journals as Physical Review, Journal of Applied Physics, Journal of Metals, etc. Typical Journals are:

Journal of Applied Physics ($50 per page plus $20 per article)

Physical Review Letters ($50/page, $50 for abstract)

Applied Physics Letters ($95/page, $20/article)

Journal of Materials Research ($95/page)

Pergamon Press ($35/page, minimum additional charge of 2 pages for papers over 6 pages in length)

Papers ordinarily range in length from 5 - 10 pages, so page charges are usually $400-500 per article with figures.

Travel:

The travel program for each of the five years is similar. Airfare estimates are based on quotes, per diem rates, and past experience.

Round trips for domestic and international meetings and trips to experimental facilities:

1–2 annual meetings of the IDT (travel for 4 people 2 days)	7,000
4 domestic trips to IPNS (1 week, 3 people)	18,000
2 international trips to ISIS (1 week, 4 people) (England)	16,000
2 trips to domestic conferences or international ICANS meeting on neutron scattering	4,000

Costs for conferences are based on prior travel reports and quotations from our travel agency:

Meetings of the IDT are planned to minimize travel of the team members, and are likely to be held at Argonne, Caltech, Oak Ridge, or at domestic conferences such as the American Physical Society March meeting. Experiments are typically performed in teams of 2 to 4 members who travel together and work different shifts during the 24 hour day. Occasional travel to scientific conferences is also expected to be in the best interest of the ARCS project, especially if these are workshops on inelastic neutron scattering.

Airfare for domestic round trips are usually $375 - 500. International round trips are typically $1,200. US per diem is ~$35/day, lodging is $80-110/night. Car rentals for experimental work are typically $250, shared by all members of the team. Registration for conferences is ~$350. Typical conferences are 5 days but 3 day stays are typical.

Salary Information

Graduate Student represents 100% effort by a full-time student.

Technical Staff support represents 50% effort for a Member of the Professional Staff to serve as a software engineer.

Postdoctoral Salaries represents 3 full time effort Postdocs at 100%.

The special needs of my research activities require the participation of Project Assistant. These services are required to prepare and process reports and documents required by the project, and to coordinate activities and travel related to the project. In addition, the project requires special attention to manage the storage and exchange of data and project results. 50% of an administrative person's effort will be spent on this project.

Fringe Benefit

The Fringe Benefit rate of 22.5% is assessed on salaries excluding Graduate and Undergraduate salaries.

GRA Benefit

Institute Policy is to provide each graduate student employee who meets a required average work week with full tuition and fees. A portion of this cost is requested as a benefit (exempt from indirect costs) equivalent to 60% of the graduate research assistant salary effective August 31, 2000.

Indirect Cost Rate Justification

The Indirect Cost Rate of 58% is assessed to the direct costs excluding the GRA Benefit, Equipment, Participant Support Costs, and Subawards over $25,000.

Equipment Information

Equipment based at Caltech for the program is described below:

Computer Hardware and Software (Year one) $20,000

This is an estimate for the workstation hardware and software required for the software development work. These workstations and their software are not presently available to the ARCS team at Caltech. It is possible that the specific workstations will run the Linux operating system, perhaps with some arrangement for parallel processing. Details of the hardware and software (perhaps C++ compilers plus IDL or MatLab package(s)) will be determined once the software roadmap is complete.

Video Conferencing Equipment (Year one) $7,000

This price is an estimate based on the assumption that video processing hardware will be required to obtain good quality internet video capability. This will be used for communication between the Principal Investigator and the Project Manager on a daily basis.

Computer Hardware and Software (Year five) $25,000

It is expected that significant improvements in hardware and software over a 4 year time period will require the acquisition of new hardware and software before the ARCS instrument is commissioned. At least some, perhaps most, of this computer hardware and software purchase will be transferred to Oak Ridge, TN to reside with the ARCS hardware.

Equipment items of ARCS hardware

See proposal for details. Title to the ARCS equipment will be vested in DOE. ARCS equipment will reside at the Spallation Neutron Source in Oak Ridge, Tennessee.