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Quarterly Report
Third Quarter (September to November 2001)

University of Nevada, Las Vegas
Advanced Accelerator Applications
University Participation Program

December 31, 2001

Prepared by:

Anthony E. Hechanova

Director, UNLV AAA UPP

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ACRONYMS

AAA	Advanced Accelerator Applications
ADTF	Accelerator-Driven Test Facility
ADTTA	Accelerator-Driven Transmutation Technology and Applications Conference
AMUSE	Argonne Model for Universal Solvent Extraction
ANL	Argonne National Laboratory
ANRC	Amarillo National Research Center
ANS	American Nuclear Society
COE	UNLV College of Engineering
DOE	U.S. Department of Energy
DOE-ALB	DOE Albuquerque Operations Office
DOE-NE	DOE Office of Nuclear Energy, Science, and Technology
HRC	Harry Reid Center for Environmental Studies
IPPE	Institute of Physics and Power Engineering
ISTC	International Science and Technology Center
LANL	Los Alamos National Laboratory
LANSCE	Los Alamos Neutron Science Center
LBE	Lead Bismuth Eutectic
LBNL	Lawrence Berkeley National Laboratory
LEDA	Low Energy Demonstration Accelerator
MCNPX	Monte Carlo Neutron Photon with extremely high-energy libraries code
MOU	Memorandum of Understanding
SEM	Scanning Electron Microscope
SMC	Student Mini-Conference
SOW	Statement of Work
TBE	UNLV Thomas Beam Engineering building complex
TEM	Transmission Electron Microscope
UNLV	University of Nevada, Las Vegas
UPP	University Participation Program
VPR	Vice Provost for Research

1. INTRODUCTION

This Quarterly Report is a primary deliverable from the University of Nevada, Las Vegas (UNLV) Advanced Accelerator Applications (AAA) University Participation Program (UPP) Director to the U.S. Department of Energy (DOE) as described in the UNLV AAA proposal[1] and Statement of Work for the Third Quarter[2].

The UNLV AAA UPP Director implements the program's administration using staff from the Harry Reid Center for Environmental Studies (HRC) to ensure that work conducted under the UNLV AAA UPP meets program objectives. The UNLV AAA UPP consists of three components: Program Support, Research Infrastructure Augmentation, and Student Research. Further information about the activities and reports discussed in this document can be viewed on the UNLV AAA Program's website at <http://aaa.nevada.edu>.

1.1 Chronology of Events

Sept. 1, 2001	Task 4 First Quarter Report submitted to UNLV AAA Director
Sept. 3, 2001	Task 3 First Quarter Report submitted to UNLV AAA Director
Sept. 5-6, 2001	UNLV participation at AAA Quarterly Technical Review, Argonne, IL
Sept. 7, 2001	HRC Space Meeting: HRC-415 allocated for Materials Performance Lab
Sept. 19, 2001	14 UNLV AAA abstracts submitted to ANS Student Mini-Conference, Reno
Sept. 21, 2001	Inaugural LBE Loop Steering Committee Meeting: determined path forward
Sept. 24, 2001	UNLV International Programs Meeting: discuss exchange and collaboration
Sept. 26, 2001	AAA Seminar on Separations, James Laidler, ANL
Sept. 28, 2001	Candidate Presentation and Interview for Research Scientist A: Dr. Yang
Sept. 28, 2001	AAA Seminar at Chemistry Department Seminar Series, Gary Cerefice
Oct. 1, 2001	UNLV faculty visits ANL West, Profs. Chen and Clarksean
Oct. 2, 2001	AAA Seminar, Steel Corrosion in LBE, UNLV AAA Task 3
Oct. 5-7, 2001	AAA display at the Pahrump, NV, Harvest Festival
Oct. 8, 2001	AAA presentation to UNLV College of Engineering faculty
Oct. 9, 2001	Inaugural AAA DOE-NE/UNLV Program Conference Call
Oct. 9, 2001	AMUSE Code Training at UNLV, conducted by ANL staff
Oct. 12, 2001	Research Scientist A position offered to Dr. Longzhou Ma
Oct. 15, 2001	AAA DOE-NE/UNLV Program Conference Call
Oct. 15, 2001	AAA discussion with UNLV Dept. of Civil and Environmental Eng. faculty
Oct. 16, 2001	AAA Seminar, Melt Casting of Fuel Pins, UNLV AAA Task 1
Oct. 19, 2001	DOE Conference Call regarding NEPA and UNLV AAA UPP
Oct. 19, 2001	Draft Subcontract Agreement with KRI (Task 6) submitted to DOE-ALB
Oct. 22, 2001	AAA DOE-NE/UNLV Program Conference Call
Oct. 23, 2001	AAA presentation to UNLV Engineering Associate Dean for Research
Oct. 23, 2001	AAA Seminar, Niobium Cavities, UNLV AAA Task 2
Oct. 25, 2001	AAA lecture on reprocessing and transmutation to honors science class

Oct. 25, 2001	UNLV AAA UPP Second Quarter Report submitted to DOE
Oct. 28, 2001	Report on Criticality, Culbreth et al. [3], submitted
Oct. 29, 2001	AAA DOE-NE/UNLV Program Conference Call
Oct. 30, 2001	Engineering Space Meeting: allocation of TBE B-129 for AAA projects
Nov. 1, 2001	LBE Steering Committee submits Suggestions for Experimental Plan[4]
Nov. 5, 2001	Dr. Longzhou Ma accepts Research Scientist A position, to start Dec. 1, 2001
Nov. 5, 2001	AAA DOE-NE/UNLV Program Conference Call
Nov. 5, 2001	AAA presentation to UNLV Dept. of Physics Chair
Nov. 6, 2001	Executive Committee Meeting: FY02 budget reallocation approved
Nov. 6, 2001	LANL visit to UNLV: Tom Zaugg gave AAA Seminar and met with faculty
Nov. 7, 2001	AAA discussion with UNLV Dept. of Civil Eng. Construction Mgmt faculty
Nov. 9-15, 2001	UNLV AAA Conference Committee organizes participation for 24 UNLV students and 11 faculty members in ANS and ADTTA conferences in Reno
Nov. 9-11, 2001	AAA Embedded Sessions in ANS Student Mini-Conference, Reno, NV organized by UNLV AAA UPP[5-18]. 14 papers presented by UNLV AAA students covering all 12 Tasks. One Best Session Paper award received.
Nov. 10, 2001	ANS SMC Morning Session keynote speaker, Denis Beller
Nov. 11-15, 2001	ANS Accelerator Applications and ADTTA Conference, Reno, NV. Three papers[19-21] presented by UNLV AAA faculty.
Nov. 12, 2001	International Molten Metal Target Advisory Group meeting, Reno, NV: UNLV proposal for use of ISTC Target agreed upon, establishment of international advisory committee recommended.
Nov. 13, 2001	ANS Banquet: Former Nevada Governor Robert List speaker
Nov. 16, 2001	DOE-NE visit to UNLV: James Bresee and Tom Ward meet with faculty and students
Nov. 16, 2001	LANL visit to UNLV: Bill Hamilton, MCNPX training preliminary meeting
Nov. 16, 2001	Seminar and visit by Frank Avignone, University of South Carolina
Nov. 19-21, 2001	UNLV participation at ANL Fuels Development Workshop, Idaho Falls, ID
Nov. 20, 2001	UNLV article on Reno Conference distributed
Nov. 26, 2001	Task 4 Second Quarter Report submitted to UNLV AAA Director
Nov. 26, 2001	Task 10 First Quarter Report submitted to UNLV AAA Director
Nov. 26, 2001	AAA discussion with UNLV Department of Mathematics faculty
Nov. 27, 2001	AAA Seminar, Manufacturing Processes for Fuel, UNLV AAA Task 9
Nov. 27, 2001	Task 2 Second Quarter Report submitted to UNLV AAA Director
Nov. 28, 2001	DOE-ALB visit to UNLV: meeting between Contracting Offices
Nov. 28, 2001	Fourth Quarter Statement of Work[22] submitted to DOE
Nov. 29, 2001	AAA DOE-NE/UNLV Program Conference Call
Nov. 30, 2001	Call for Proposals distributed for FY02 proposals

1.2 Overall Program Schedule

The Third Quarter milestones and deliverables for the UNLV AAA University Participation Program are shown in Figures 1 to 3.

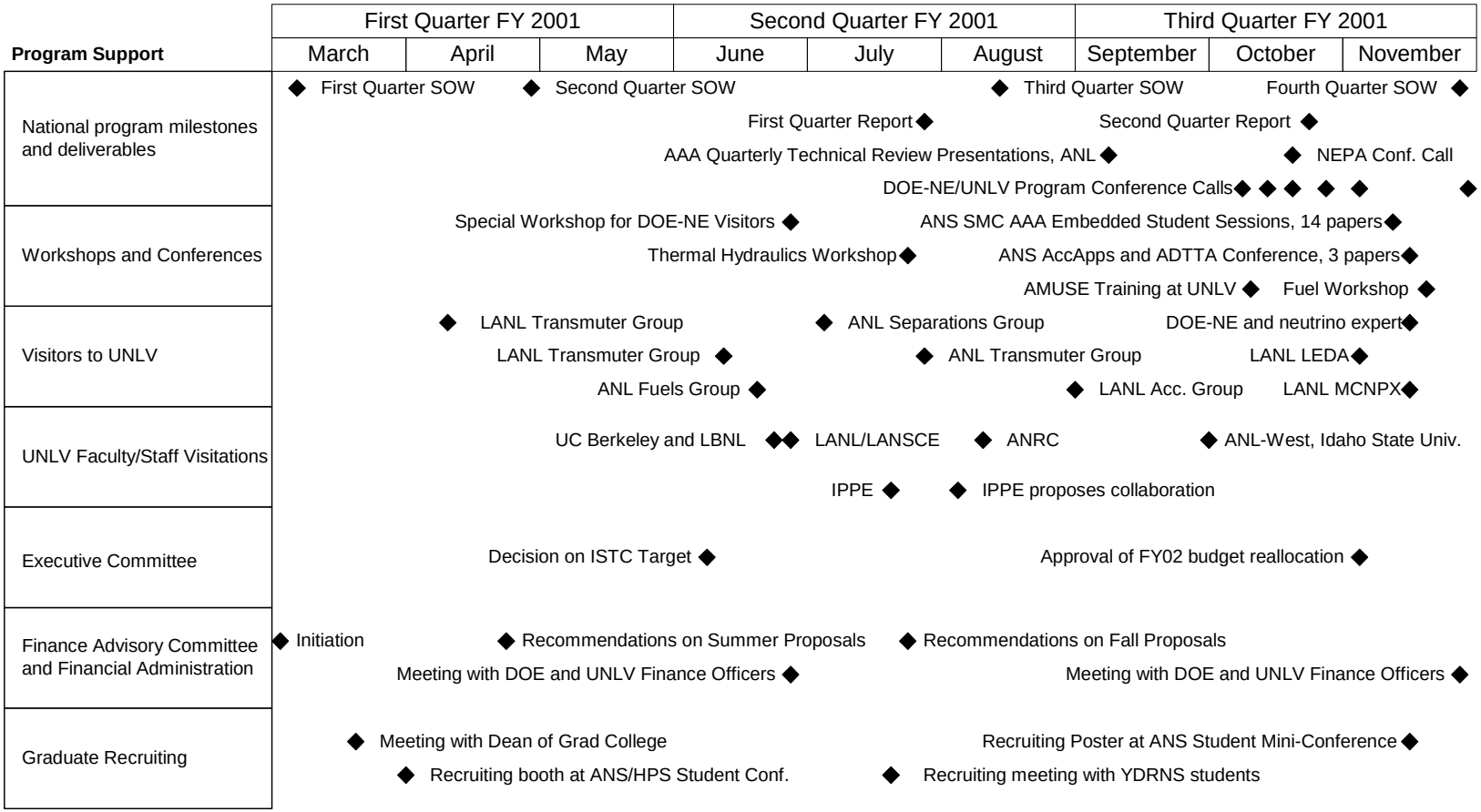

Figure 1. Milestones and Deliverables of Program Support for the UNLV AAA University Participation Program through the Third Quarter.

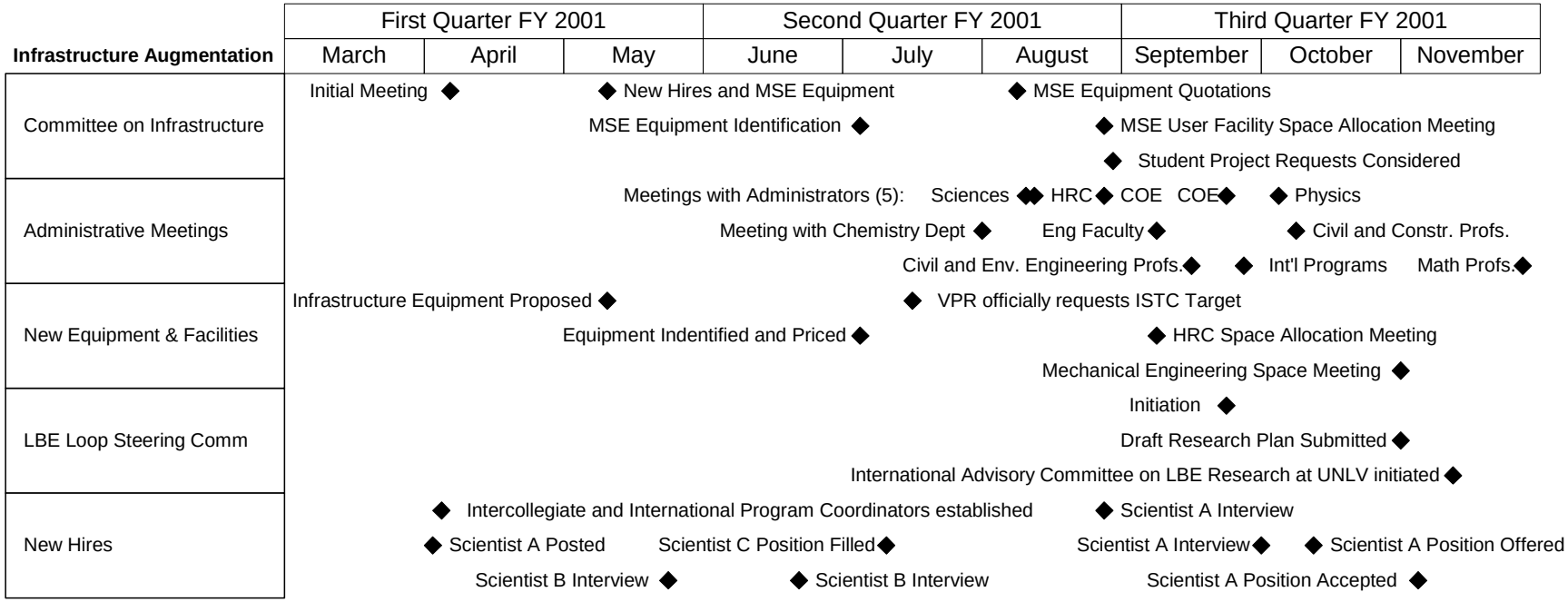

Figure 2. Milestones and Deliverables of Research Infrastructure Augmentation for the UNLV AAA University Participation Program through the Third Quarter.

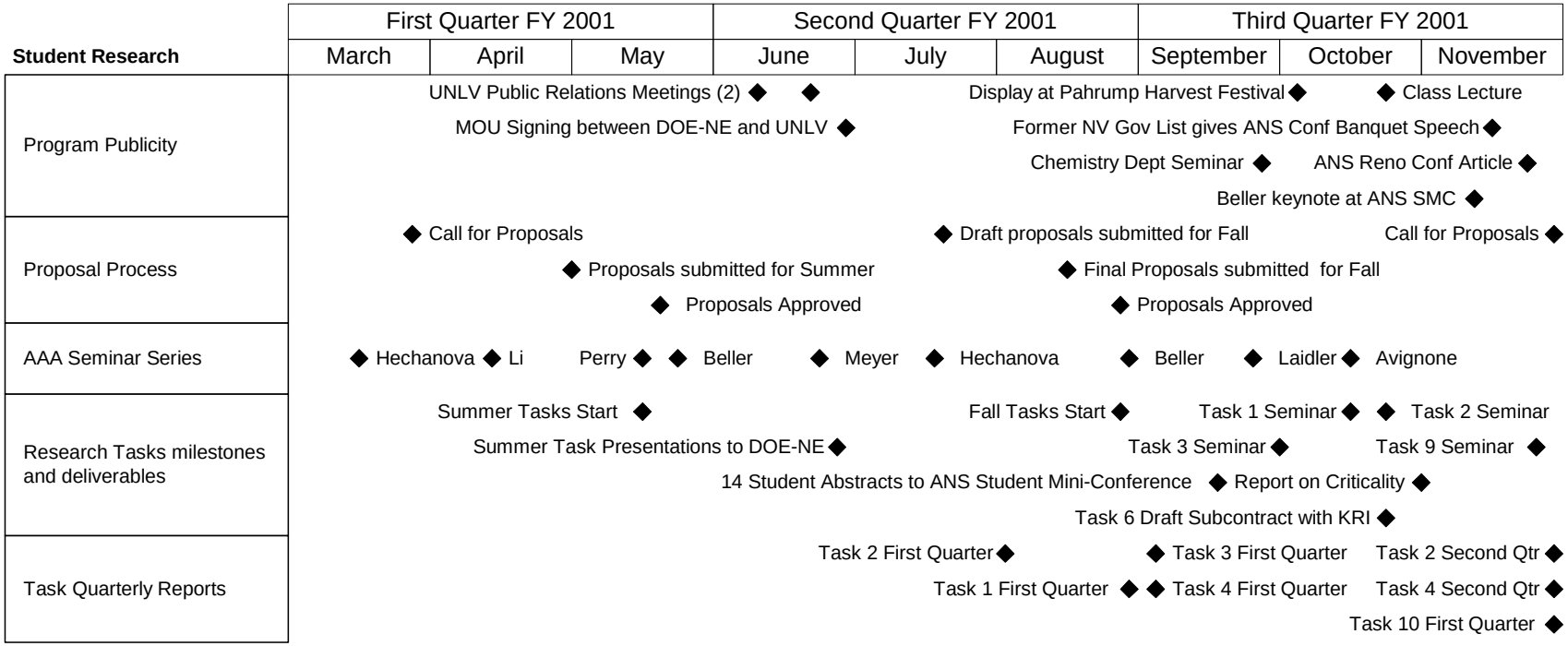

Figure 3. Milestones and Deliverables of Student Research Tasks for the UNLV AAA University Participation Program through the Third Quarter.

2. PROGRAM SUPPORT

The primary deliverables for the Program Support component are quarterly and annual reports. These reports will detail the progress on each administrative task and the milestones and deliverables generated during the appropriate period. Other than this report, the only other documents provided to DOE this quarter are the following:

- Draft Subcontract Agreement with the Khlopin Radium Institute, St. Petersburg, Russia, to design, fabricate, and deliver a neutron multiplicity detector system for UNLV AAA Task 6, October 19, 2001.
- UNLV AAA University Participation Program Second Quarter Report, October 25, 2001.
- UNLV AAA University Participation Program Statement of Work for the Fourth Quarter, November 28, 2001.

The following are the individuals involved in the day-to-day administration of the UNLV AAA UPP during the Third Quarter.

UNLV AAA UPP Executive Committee:

Anthony Hechanova	Director
Gary Cerefice	Deputy Director (Harry Reid Center for Environmental Studies)
Malcolm Nicol	Deputy Director (College of Sciences)
William Culbreth	Deputy Director (College of Engineering)

UNLV Student Support Staff:

Christina Crossan	Undergraduate, Health Physics Department
Demian Gitnacht	Undergraduate, Health Physics Department
Cheryl Gustafson	Undergraduate, Kinesiology Department
Ingrid James	Undergraduate, School of Social Work
John Knoten	Undergraduate, Civil and Environmental Engineering
Jeff Stutz	Graduate Student, Health Physics Department
Richard Turner	Undergraduate, Health Physics Department

UNLV AAA UPP Affiliates:

Pattie Baldwin (HRC)	Director of Finance
Denis Beller (LANL)	AAA UPP Intercollegiate Programs Coordinator
Ning Li (LANL)	AAA UPP International Programs Coordinator
Thomas Ward (DOE)	Senior Science Adviser

2.1 UNLV AAA UPP Meetings and Committees

This section describes the motions of committees that were active during the Third Quarter.

Executive Committee:

Dr. Anthony Hechanova, Chair
Dr. Gary Cerefice (Harry Reid Center)
Prof. Malcolm Nicol (College of Sciences)
Prof. William Culbreth (College of Engineering)

The Executive Committee met on November 6 to discuss the FY02 budget reallocation to trim the $6 million proposed budget to accommodate $4.5 million in actual funding. The Committee also discussed the LBE User Facility, the MSE equipment procurements, updates on LEDA and ADTF, and student recruitment and proposal solicitation.

LBE Loop Steering Committee:

Dr. Anthony Hechanova, Chair
Vice Provost for Research Stephen Rice (UNLV Administration)
Dean Frederick Bachhuber (College of Sciences)
Associate Dean Kenneth Fridley (College of Engineering)
Dr. Gary Cerefice (Harry Reid Center)
Prof. Malcolm Nicol (College of Sciences)
Prof. William Culbreth (College of Engineering)
Prof. Samir Moujaes (Department of Mechanical Engineering)
Courtney Kerr (Office of Environmental Health & Safety)

The Committee met for the first time on September 21, 2001, to discuss the details of the ISTC Target and its history, to determine the purpose and mission of the LBE Loop User Facility, to hear proposals for placement of the facility (Engineering Complex, Geosciences Building, and Harry Reid Center were the candidate sites), and to determine the policy and path forward for the establishment of an LBE Loop User Facility. The committee endorsed the concept of having a near-term temporary facility set up in the Thomas Beam Engineering Complex for immediate research availability while a new and more equipped permanent facility could be developed at the Harry Reid Center.

The Committee also appointed a Subcommittee to develop a conceptual research plan consisting of Dr. Gary Cerefice (HRC), Prof. Samir Moujaes (Engineering), and Prof. John Farley (Sciences). The Subcommittee submitted a draft research on November 1, 2001 as preparation for the International Molten Metal Target Advisory Group meeting held during the ANS Conference in Reno, NV, on November 12, 2001. At the Advisory Group meeting, Philip Finck (ANL) presented

the UNLV proposal and his opinions for why the proposal should be supported. The Advisory Group agreed with the concepts in the proposal. They also requested that an International Advisory Committee be formed with a member from each international group associated with the ISTC Target. This recommendation was agreed upon by Dr. Anthony Hechanova and Prof. Samir Moujaes who were representing UNLV at the Advisory Group meeting.

Other Committees:

Conference Committee: Anthony Hechanova (Chair) and Kathy Lauckner (Co-Chair) organized the three AAA embedded sessions of the ANS Student Mini-Conference held the weekend before the national winter conference in Reno, NV. 24 papers were presented including 14 from UNLV undergraduates and graduate students. All 12 of the UNLV AAA Tasks were represented. A total of 25 UNLV students and 11 faculty members attended the ANS student and professional conferences in Reno, NV, Nov. 9 to 15, 2001. Their travel and conference expenses were covered by the UNLV AAA Program Support portion of the program.

At the ANS Accelerator Applications Division Technical Program Committee meeting, it was decided that the next embedded AAA meeting will be at the ANS summer meeting in San Diego CA, in 2003. Denis Beller was appointed the Technical Program Chair. Anthony Hechanova committed to organizing another student conference or workshop in conjunction with the AAA embedded topical meeting in San Diego, CA.

Finance Oversight: HRC Finance Director Patricia Baldwin, HRC Grants and Contract Expert Leisa Rodriguez, and Anthony Hechanova met on November 28, 2001 with DOE Albuquerque Office contract officers Sam Espinosa, Melissa Thomas, and Clay Ramsey to discuss matters related to new paperwork requirements for all DOE grants.

Information Management Committee: Anthony Hechanova (Chair), Gary Cerefice, and John Knoten. Weekly meetings were held to maintain and update the UNLV AAA UPP website at <http://aaa.nevada.edu> and the AAA library.

Search Committees:

- Research Scientist A, Harry Reid Center (Anthony Hechanova, Chair) – A second candidate was interviewed on September 28. On October 12, the Search Committee concurred on the selection of Dr. Longzhou Ma and a formal offer was made. Dr. Ma formally accepted the position on November 5 and he will begin his duties December 1, 2001.

- Research Scientist B, College of Sciences (Dean Frederick Bachhuber, Point of Contact) – A formal offer has been made to the top candidate that includes equipment and facilities made available by the UNLV AAA Program.

- Research Scientist D, Department of Geosciences (Rod Metcalf, Dept. Chair, Point of

Contact) – The UNLV AAA Program by recommendation of the Executive Committee and Infrastructure Committee will co-sponsor a new hire in the open position of SEM Technician. The paperwork to accommodate the new funding mechanism has been approved and the search is underway.

2.2 Workshops, Conferences, and Collaboration Meetings

AAA Quarterly Technical Review, September 5-6, Argonne, Illinois – The purpose of the meeting was to bring research coordinators from across the national program to a central location and provide progress reports to DOE-NE and national project directors. Anthony Hechanova, Gary Cerefice, and Denis Beller represented the UNLV AAA Program.

AMUSE Code Training Workshop, October 9, UNLV – The purpose of the workshop was for ANL experts to train UNLV students and staff who are using the AMUSE code in their research (UNLV AAA Tasks 8 and 11) or who have a general interest in learning the code.

ANS Student Mini-Conference embedded AAA sessions, November 9-11, Reno, Nevada – The purpose of the conference was to bring together students from around the country who are working on AAA-sponsored research. 24 UNLV students and 8 faculty members attended the ANS SMC.

ANS Winter Meeting Accelerator Applications Division embedded topical meeting and ADTTA, November 11-15, Reno, Nevada – The purpose of the conference was to bring together accelerator-driven transmutation experts from around the world to discuss their research. 10 UNLV students and 7 faculty members attended these meetings. Two members of the UNLV LBE Loop Steering Committee attended the ADTTA Molten Metal Target Advisory Group meeting on November 12.

Transmuter Fuel Development Workshop, November 19-21, Idaho Falls, Idaho – The purpose of the workshop was for international experts to meet and discuss their candidate fuels and research programs. Representing UNLV were Anthony Hechanova, Malcolm Nicol, Yitung Chen, and Randy Clarksean.

Research collaboration meetings are encouraged and arranged to help enhance communication networking and develop collaborative graduate student research projects. Research collaboration meetings were held between UNLV faculty and the following groups:

- Argonne National Laboratory Separations Group, September 26, visit to UNLV by James Laidler
- Argonne National Laboratory – West, October 1, visit to Idaho Falls by Profs. Yitung Chen and Randy Clarksean
- DOE-NE and UNLV Directors' Conference Calls, October 9, 15, 22, and 29; and November 5 and 29, telephone conferencing between John Herczeg, Thomas Ward, and Anthony Hechanova
- NEPA Conference Call, October 19, discussion of implications on UNLV AAA Program

- Los Alamos National Laboratory LEDA Group: November 6 and 7, visit to UNLV by Tom Zaugg
- DOE-NE, November 16, visit to UNLV by James Bresee and Thomas Ward
- LANL MCNPX Group, November 16, visit to UNLV by Bill Hamilton
- Neutrino/basic nuclear sciences, November 16, visit to UNLV by Frank Avignone, University of South Carolina

2.3 UNLV AAA UPP Website, Information Management, and Seminars

The UNLV AAA UPP website <http://aaa.nevada.edu> was maintained in the Third Quarter by UNLV student webmaster John Knoten. This website contains relevant information for internal UNLV communications, networking with outside groups, and for general public access. A library housed at the HRC was maintained that contains materials supplied by the national laboratories and other sources related to the AAA.

The following seminars were presented during the Third Quarter:

"An Overview of the Chemical Separations Process for the Advanced Accelerator Applications Program," James Laidler, Argonne National Laboratory, September 26, 2001.

"Alchemy: An Alternative to the Yucca Mountain Strategy? An Introduction to the AAA Program" Gary Cerefice, UNLV, Chemistry Departmental Seminar, September 28, 2001.

"Experimental Investigation of Steel Corrosion in Lead Bismuth Eutectic (LBE): Characterization, Species Identification, and Chemical Reactions," John Farley and Dan Koury, UNLV AAA Task 3, October 2, 2001.

"Design and Analysis for Melt Casting Metallic Fuel Pins Incorporating Volatile Actinides," Yitung Chen and Frank Wu, UNLV AAA Task 1, October 16, 2001.

"Modeling, Fabrication, and Optimization of Niobium Cavities," Myong Holl, Sathish Subramanian, and Qin Xue, UNLV AAA Task 2, October 23, 2001.

Frank Avignone, University of South Carolina, UNLV Physics Departmental Seminar, November 16, 2001.

"Design and Evaluation of Processes for Fuel Fabrication," Georg Mauer and Jae-Kyu Lee, UNLV AAA Task 9, November 27, 2001.

3. RESEARCH INFRASTRUCTURE AUGMENTATION

The goal of the Research Infrastructure Augmentation component of the UNLV AAA UPP is to augment the research staff and facilities at UNLV to increase the ability of the university to perform AAA research. The following sections describe progress made in infrastructure augmentation.

3.1 New Hires

Research Scientist A, Harry Reid Center — Fourteen applications were submitted for this position. Four candidates made the short list. Two candidates on that list were available for an interview. The position was offered to one of these candidates on October 12 and he officially accepted the offer on November 5. Dr. Longzhou Ma begins his position on December 1, 2001.

Research Scientist B, College of Sciences — The search committee has completed their process and their top candidate was offered a faculty position. Negotiations over the conditions of the hire between the college and the candidate were conducted in the Third Quarter and include an obligation from the UNLV AAA Program for availability of equipment and facilities. The position was not yet filled by the end of the Third Quarter.

Research Scientist C, College of Engineering — The College of Engineering completed their search and hired Dr. Ajit Roy in a newly created Associated Research Professor position on July 1. Half of Dr. Roy's time will be devoted to AAA and he will be a principal involved in developing an AAA Materials Performance User Facility.

Research Scientist D, Department of Geosciences and Harry Reid Center — The UNLV Department of Geosciences lost their SEM technician and the funding to support the SEM machine. The UNLV AAA Program upon the recommendation of the Infrastructure Committee has taken over the service license on the device and has agreed to support half of the time of a new SEM technician. The responsibility of this position will also include the support of other UNLV AAA equipment and research needs.

3.2 New Equipment and Facilities

Four new user facilities are under development in the Third Quarter.

Materials Performance User Facility: This facility is to be built in existing space in the College of Engineering complex and utilize auxiliary laboratory space at the Harry Reid Center until completion of the Engineering facility. About $230,000 in equipment went through the UNLV purchasing process and equipment and supplies have begun to arrive in the Third Quarter.

Transmission Electron Microscopy (TEM) User Facility: This facility is to be built in existing space at the Harry Reid Center. The first step in the development of the facility was to hire a TEM expert

(Research Scientist A, see Section 3.1) aid in the selection of a TEM, and the design, development, and operation of the new TEM User Facility. This position will begin at the start of the Fourth Quarter.

Lead Bismuth Eutectic Loop User Facility: A LBE Loop Steering Committee was established in the Third Quarter and candidate locations for the loop have been discussed. The current path forward is to set up the ISTC Target as an experimental loop in the College of Engineering Complex while a permanent and tailor-made facility is designed and developed as part of the Harry Reid Center. In addition, an International Advisory Committee (as recommended by the ADTTA Molten Metal Target Advisory Group) will help determine the type of research that should be conducted and help review and prioritize all proposals for LBE research.

Materials Characterization Facility: The UNLV AAA Program at the recommendation of the Infrastructure Committee will financially assist in the maintenance of an already existing facility within the College of Sciences that contains optical microscopes and a Scanning Electron Microscopy (SEM) through taking over the payment of service contracts. In addition, the UNLV AAA Program's fourth new hire (referred to as Research Scientist D in the UNLV AAA UPP proposal[1]) will be cost-shared with the Geosciences Department and will include responsibilities as a technician for the SEM and TEM facilities.

4. RESEARCH PROJECTS

The Student Research component is the core of the UNLV AAA UPP with steadily increasing funds as the program evolves and capability expands.

4.1 Student Research Tasks

Table 1 lists the 12 tasks that comprise the student research component of the UNLV AAA University Participation Program. 4 tasks began in the summer term and 8 tasks began in the fall term. The First Quarter progress reports from the 4 tasks that started in the summer are included as an appendix. All research groups appear to be presenting adequate progress as evidenced by a healthy representation at the ANS Student Mini-Conference, presentations at seminars, and good communication with program coordinators and national project partners.

Table 1. The 12 Student Research Tasks funded in Year 1 of the UNLV AAA UPP

Task	Title	UNLV Department National Collaborator Cost (No. of Grad Students)	Tech Area
1	Design and Analysis for Melt Casting Metallic Fuel Pins Incorporating Volatile Actinides	Mechanical Engineering Dept Argonne National Laboratory $141k (2 Grads)	Fuels
2	Modeling, Fabrication, and Optimization of Niobium Cavities	Electrical & Comp Eng Dept Los Alamos National Lab $161k (3 Grads)	Accelerator
3	Experimental Investigation of Steel Corrosion in LBE: Characterization, Species Identification, and Chemical Reactions	Physics Department Los Alamos National Lab $190k (2 Grads)	Transmuter
4	Hydrogen-Induced Embrittlement of Candidate Target Materials for Applications in Spallation-Neutron-Target Systems	Mechanical Engineering Dept Los Alamos National Lab $146k (2 Grads)	Target
5	Modeling Corrosion in Oxygen Controlled LBE Systems with Coupling of Chemical Kinetics and Hydrodynamics	Mechanical Engineering Dept Los Alamos National Lab $109k (2 Grads)	Transmuter
6	Neutron Multiplicity Measurements for AAA Target/Blanket Materials	Harry Reid Center Los Alamos National Lab $140k (1 Grad)	Transmuter
7	Develop Dose Conversion Coefficients for Radionuclides Produced in Spallation Neutron Sources	Health Physics Department Los Alamos National Lab $160k (2 Grads)	System Integration
8	Development of a Systems Engineering Model of the Chemical Separations Process	Mechanical Engineering Dept Argonne National Laboratory $150k (2 Grads)	Separations
9	Design and Evaluation of Processes for Fuel Fabrication	Mechanical Engineering Dept Argonne National Laboratory $87k (1 Grad)	Fuels
10	Development of a Mechanistic Understanding of High-Temperature Deformation of Alloy EP-823 for Transmutation Applications	Mechanical Engineering Dept Los Alamos National Lab $99k (1 Grad)	Target
11	Nuclear Criticality Analyses of Separations Processes for the Transmutation Fuel Cycle	Physics and Mech Eng Dept Argonne National Laboratory $110k (2 Grads)	Separations
12	Radiation Transport Modeling of Beam-Target Experiments for the AAA Project	Mechanical Engineering Dept Argonne National Laboratory $110k (2 Grads)	Transmuter

4.2 Student Recruitment

Graduate student recruitment efforts were initiated early in the UNLV AAA program to fulfill the mission to attract topnotch students in science and engineering. The UNLV AAA program is now an integral component of UNLV's recruiting efforts.

In the Third Quarter, a promotional poster was displayed at the American Nuclear Society Student Mini-Conference, November 9-11, 2001 in Reno, NV, that promoted both the university and the AAA program. In addition, the UNLV AAA UPP Intercollegiate Programs Coordinator has also distributed UNLV graduate student recruitment information at Idaho State University and met with their dean of engineering and others.

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6. Lee, J.-K., "Transmuter Fuel Fabrication Processes," UNLV Department of Mechanical Engineering, ANS Student Mini-Conference, Reno, NV, November 10, 2001.
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8. Shanahan, J., Y. Song, P. Patton, and M. Rudin, "Development of Dose Conversion Coefficients for Radionuclides Produced in Spallation Neutron Sources," UNLV Department of Health Physics, ANS Student Mini-Conference, Reno, NV, November 10, 2001.
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Modernization of AMUSE Code for the Chemical Separations Process," UNLV Department of Mechanical Engineering, ANS Student Mini-Conference, Reno, NV, November 10, 2001.

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13. Koury, D., D. Perry, and J. Farley, "Investigation of Corrosion of Steel by Lead Bismuth Eutectic," UNLV Department of Physics, ANS Student Mini-Conference, Reno, NV, November 11, 2001.
14. Wu, C., K. Dasika, Y. Chen, and S. Moujaes, "Modeling Corrosion in Oxygen Controlled LBE Systems with Coupling of Chemical Kinetics and Hydrodynamics," UNLV Department of Mechanical Engineering, ANS Student Mini-Conference, Reno, NV, November 11, 2001.
15. Lewis, M.M., "High Temperature Deformation Characteristics of Alloy EP-823," UNLV Department of Mechanical Engineering, ANS Student Mini-Conference, Reno, NV, November 11, 2001.
16. Kozak, R., "Hydrogen-Induced Embrittlement of Candidate Target Materials for Applications in Spallation-Neutron-Target Systems," UNLV Department of Mechanical Engineering, ANS Student Mini-Conference, Reno, NV, November 11, 2001.
17. Bakker, L., "Radiation Transport Simulations in Support of Accelerator-Based Transmutation," UNLV Department of Mechanical Engineering, ANS Student Mini-Conference, Reno, NV, November 11, 2001.
18. Curtis, S.J., and C.D. Hull, "Neutron Multiplicity Measurements of AAA Target/Blanket Materials", UNLV Department of Health Physics and the Harry Reid Center for Environmental Studies, ANS Student Mini-Conference, Reno, NV, November 11, 2001.
19. Ward, T., A. Rimski-Korsakov, M. Todosow, G. Greene, M. Divadeenam, C.L. Snead, Jr., A. Hanson, E. Pitcher, D. Beller, C. Hull, W. Culbreth, A. Hechanova, and G. Cerefice, "Note on the Benchmark and Validation of the LAHET Code System," U.S. Department of Energy, Washington, D.C., ANS Conference, Reno, NV, November 11-15, 2001.
20. Hechanova, A.E., and G.S. Cerefice, "Establishment of an Advanced Accelerator Applications University Participation Program at the University of Nevada, Las Vegas," Harry Reid Center for Environmental Studies, UNLV, Las Vegas, NV, ANS Conference, Reno, NV, November 11-15, 2001.
21. Farley, J., D. Koury, and D. Perry, "Investigation of Corrosion of Steel by Lead Bismuth Eutectic," UNLV Department of Physics, Las Vegas, NV, ANS Conference, Reno, NV, November 11-15, 2001.
22. Hechanova, A.E., "UNLV AAA University Participation Program Statement of Work for the Fourth Quarter," November 28, 2001.

APPENDIX

Task 1. First Quarter Report

Quarterly Report
5/15/01-8/15/01

Phase I: Design and Analysis for Melt Casting Metallic Fuel Pins Incorporating Volatile Actinides

Submitted to

Advanced Accelerator Applications Program
Technical Focus Area
Fuel Development Research
ATTN: Dr. Anthony Hechanova
Harry Reid Center
University of Nevada Las Vegas

Submitted by

Dr. Yitung Chen, Principal Investigator, uuchen@nye.nscee.edu
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August 30, 2001

Management Issues:

Mr. Xialong (Frank) Wu, who is a master program student of the Mechanical Engineering Department, has been working on this project since June 1, 2001. He has been paid $1,500 per month from 6/1/01 to 8/31/01. Dr. Randy Clarksean, who is an adjunct professor of the Mechanical Engineering Department, has also been working on this project since June 1, 2001. He will receive his paycheck in the end of August since his contract document wasn't able to go through the campus administration system in time. Dr. Darrell W. Pepper, who is a professor and chairman of the Mechanical Engineering Department, has also provide many technical suggestions in this project. A regular group research meeting is held very Monday afternoon to discuss the technical issues.

The project kick-off meeting was held at HRC in the UNLV campus from June 21 to 22, 2001. Dr. Mitchell K. Meyer, who is the project leader of fabrication development group in the ANL-West, has attended the kick-off meeting at UNLV. Many technical issues and information have been discussed and exchanged during the meeting. Mr. Xialong Wu, Dr. Clarksean, and I will go to Idaho Fall from September 30 to October 1, 2001 to discuss our six conceptual of casting furnace designs with Dr. Meyer and his staff at ANL-West. Mr. Wu has also presented his research project to Dr. Magwood and his staff from DOE on June 29, 2001. He will also be encouraged to participate and present a paper in the American Nuclear Society Winter Meeting, November 10-12, 2001, in Reno, Nevada. Dr. Clarksean and I will also attend the Argonne Workshop on Fuel Development for Actinide Transmutation Systems at Idaho Fall, November 19-21, 2001.

The proposed timeline for research tasks has been followed. A few actinide chemists from ANL or LANL are needed to help us to track down and document the volatile actinide transport properties. Dr. Denis Bellow has been consulted to provide a list of contact people in LANL. The academic annual license of using commercial software FIDAP at UNLV will be purchased in September. One Pentium IV Gateway personal computer will also be purchased in the end of August.

Technical Issues:

Six candidate casting furnace concepts have been identified. These concepts were developed in conjunction with ANL-West researchers at a kick-off meeting. The six concepts include:

- Inductively heated pressurized chamber vacuum cast
- Inductively heated pressurized chamber
- Inductively heated – continuous casting.
- DC Arc melting and casting.
- Induction skull melting and casting.
- Semi-levitation melting and casting.

Each of the different concepts is being evaluated for their advantages and disadvantages. The items under consideration include how pressure or other approaches can impact the transport of volatile

actinides from the melt. An extensive literature review is in process to assist in the evaluation of each of the proposed concepts.

(1) DC Furnace:

A: DC Graphite ARC furnace and diagnostic system for soils

- Members: MIT plasma fusion center, Electro-Pyrolysis Inc, Pacific northwest lab
- Advantages: (a) single electrode eliminating the consumption of electrodes due to surface oxidation (50%); (b) ease of power control; (c) high energy transfer efficiency; (d) lower carbon consumption; (e) melts easily processed

B: DOE-1999

- Advantages: (a) a single, high temperature thermal process for melting and fuel fabrication (melting temperature is 1500°C); (b) can deal with a wide range of materials (debris, trash, metals, soil, etc)
- Disadvantages: high temperatures may lead to volatilization of Americium

C: ABB DC arc furnace: past, present, future

- Advantages: (a) reduction of graphite electrode consumption; saves on electric power (5%); (b) long arc operating with foaming slag to shield the arc and to improve heat transfer to the charge; (c) easier to control of the melting process (electromagnetic force);
- Disadvantages: the graphite-containing bottom materials are more expensive

D: Analysis of velocity and temperature fields of molten metal in DC electric arc furnace

- Summary: (a) the circulating patterns and the patterns of increasing the temperature of the melt is significantly affected by the change in bottom electrode diameter; (b) the effect of natural convection on the circulation is negligible.
- Advantages: (a) comparing to AC furnace, DC can deliver heat directly to the melt; (b) reduction of the electrode-tip erosion rate (about 40%);
- Introduction: electrically induced flow (EIF) plays an important role, the actual flow within the molten metal is caused by following driving forces: (a) electromagnetic force generated by arc; (b) natural convection due to temperature gradient; (c) the interaction between the arc plasma and the bath.
- This model consider simultaneously the magnetohydrodynamic and thermodynamic effects

E: DC furnace at Florida Steel Corp. in Tampa/USA

- Advantages: (a) one single electrode (700mm) minimizes the consumption of electrodes, low wear rate and the use of standard MgO ramming materials save refractory costs; (b) comparing to AC furnace, DC will result in a saving of 5.10\$/t_{liquid} ;
- Notes: The design always focuses on the design and the economy of the anode. Now they have a 60 t DC arc furnace.

F: Improving efficiency of DC arc furnace using oxyfuel cum lances and auxiliary electrodes

- Use of auxiliary and/or oxyfuel burners

(2) Induction Skull Melting:

A: Duriron Co. Dayton, OH and USBM (the United States Patent: 4738713 describe the same model)

- Advantages: alloy uniformity due to the intense stirring action of induction field;
  Greater melting efficiencies by splitting the crucible into more segments;
  Also the increased number of crucible segments may render the crucible discontinuous enough to levitate the melt sufficiently to prevent excessive arcing and resulting crucible damage; copper crucible avoiding reaction and contamination; flexibility in charge stock; the induction field and constant stirring of metal maintain a high level of superheat throughout the melt.
- Disadvantages: the process is limited to about 85 lb of molten metal per heat;
  Electrical efficiency is only about 30% (much of power is attenuated by the crucible).
- One promising area for ISM is the casting of clean (very low inclusion content) metals, particularly nickel-bass superalloys used for aerospace applications.
- Notes: the original and former design of ISM use calcium fluoride or any other slag materials preventing crucible damage

B: Analysis of Induction Skull Melting Furnace by Edge Finite Method Excited from Voltage Source

- Using the 3D edge-based finite element method (short computation time and low memory requirement) to analyze the magnetic flux density an eddy current and electromagnetic force distribution, we can optimize the production of the high-efficiency induction skull-melting furnace.
- The efficiency of the furnace depends to a great degree on the number of and the position of the copper rods and the size of the air gaps between them.

(3) Vacuum Casting:

A: Casting technology for manufacturing metal rods from simulated metallic spent fuels (Uranium metal rod)

- Advantages: (a) vacuum-induction furnace (10^{-3} Torr: prevent reaction to oxygen); (b) induction heating to provide self-stirring and homogeneity and fluidity; (c) directional-solidification equipment to prevent the formation of pores and shrinkage defects (we need to control the axial temperature gradient); (d) from the temperature gradient, we can predict solidification rate and lead the pores to the top of the rod.
- Notes: most nuclear power plants want to decrease the unit cost of electric power generation. Water-cooled.

All of the techniques, except the continuous casting approach, require the use of "molds" to form a fuel rod. The rods will have large length to diameter aspect ratios. A general finite element model is being developed to analyze the flow, heat transfer, and solidification of molten metal as it flows into

the mold. The model will eventually consider

- Flow into the mold,
- Heat transfer to the mold,
- Phase change within the metal,
- Heat transfer from the mold to its surroundings,
- Heat transfer within the mold,
- Potential external heater control schemes to cast full length rods, and
- Transport of volatile actinides within the rod – if applicable.

The model presently considers the flow of a fluid into a long rod. The other physics will be added as the modeling work progresses. Preliminary modeling results are shown in Figure 1. A "volume of fluid" (VOF) method is used with the general-purpose code FIDAP to model the system. A mesh is developed for the complete domain and the molten material (fluid) flows into the geometry. A symmetry section is assumed for this problem, with the bottom of each section being the centerline of the "rod."

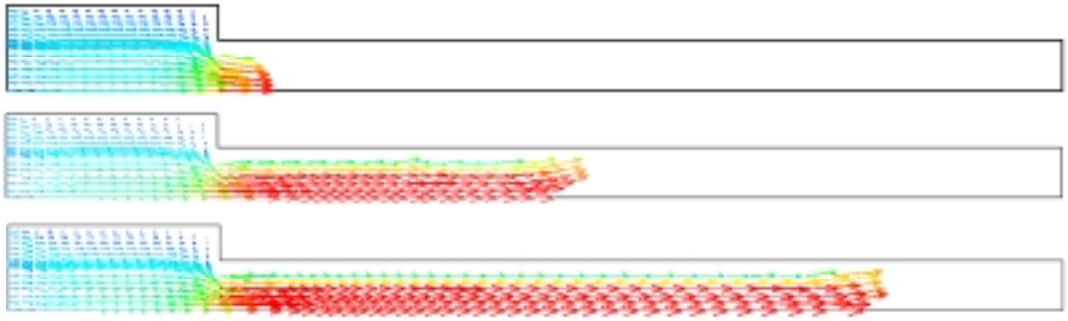


Figure 1 - Preliminary modeling results for the flow of a fluid into a cylindrical rod. Results obtained with the general purpose finite element code FIDAP. Bottom of each section represents the centerline (r=0).

Task 2. First Quarter Report

Modeling, Fabrication, and Optimization of Niobium Cavities – Phase I

Quarterly Progress Report
5/15/01 - 8/15/01

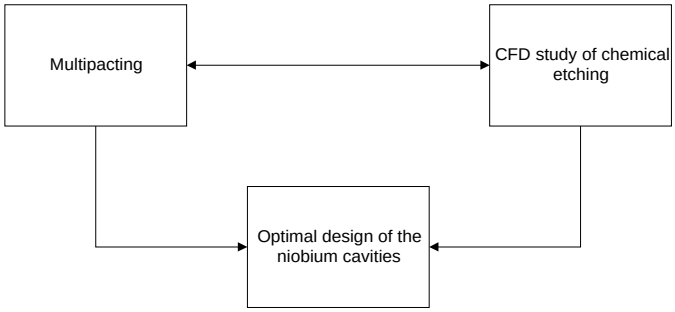
UNLV-AAA University Participation
Program

Robert A. Schill, Jr. and Mohamed B. Trabia
Principle Investigators

Purpose and Problem Statement

Multipacting is one of the major loss mechanisms in rf superconductivity cavities for accelerators. This loss mechanism limits the maximum amount of energy/power supported by the cavities. Optimal designs have been identified in others' studies. In practice, these designs are not easily manufactured. Chemical etching processes used to polish the cavity walls result in a nonuniform surface etch compromising the optimal geometrical design. Past multipacting studies have not examined the impact of wall perturbations.

It is the purpose of this study to examine the chemical etching process in the design of niobium cavities so to maximize the surface quality of the cavity walls while minimizing the multipacting losses. Single and multiple cavity cell geometries are to be investigated. Optimization techniques will be applied in search of the chemical etching processes, which will lead to cavity walls with near ideal properties. Figure 1 depicts a block diagram of the optimization procedure, which is intended to be fully automated among a variety of existing codes.



Personnel

Principal Investigators:

- Dr. Robert A. Schill, Jr. (Electrical Engineering)
- Dr. Mohamed B. Trabia (Mechanical Engineering)

Research Investigator:

- Dr. Yi-Tung Chen (Mechanical Engineering)

Students (Summer 2001):

1. Ms. Myong Holl, Undergraduate Student, (Mechanical Engineering)
2. Mr. Greg Lull, Undergraduate Student, (Electrical Engineering)
3. Ms. Qin Xue, M.S. Graduate Student, (Mechanical Engineering).

National Laboratory Contact:

- Dr. Dominic Chan, Project Leader for Superconducting RF Engineering Development and Demonstration AAA Technology Project Office at Los Alamos National Laboratory

Notes:

1. Mr. Sathishkumar Subramanian, Graduate Student in Mechanical Engineering, has just joined our group.
2. Mr. Greg Lull will be leaving the project at the end of August of 2001. A student is currently being sought to replace Mr. Greg Lull.

Management Progress

Budget Issues:

- Purchase of software codes (Field Precision, MATLAB, and FEMLAB).
- Purchase of two complete computer systems (Gateway. A third computer system has been ordered.

Notes:

1. Most of the major equipment budget has been spent.
2. Salary expenditures are on target.

Management Problems

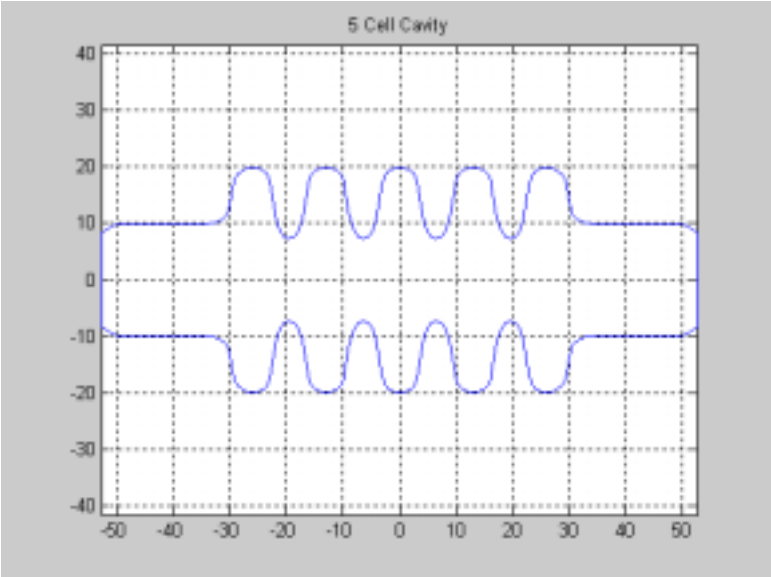
Several software difficulties have been identified and are currently being addressed as can be seen in the remainder of this report. Some of these issues has taken longer than expected and has slowed the progress of the current research in some areas.

We intend to overcome some of the software difficulties. A purchase of a chemical engineering toolbox will aid in the study of azimuthally symmetric geometries is anticipated in the second quarter. If the electromagnetic codes are shown to be incompatible with the TRAK_RF code, a different particle tracking code written by Dr. H. Padamsee will be sought.

Technical Progress

Parametric Design of the Niobium Cavity

A model for single-cell as well as multi-cell niobium cavity was created in MATLAB. All dimensions are considered as parameters that can be varied later by the optimization programs.



Multipacting Study

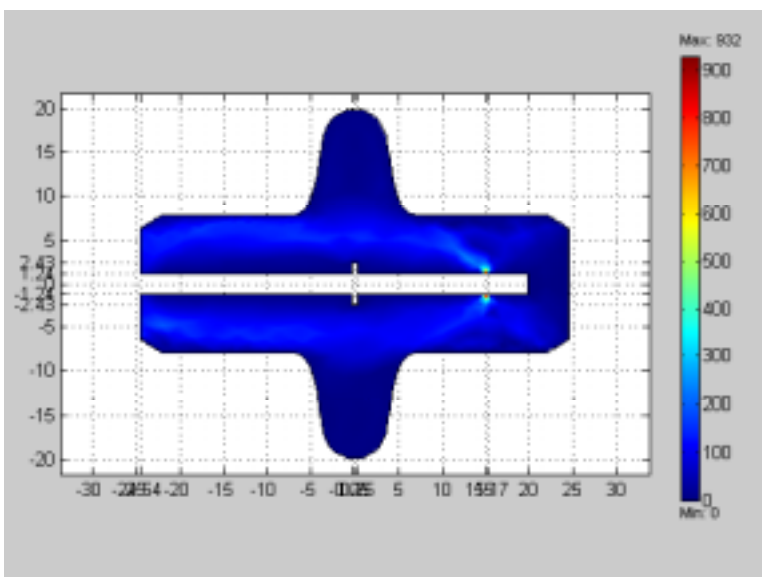
A set of codes has been in part purchased from Field Precision Inc. to investigate multipacting in a niobium cavity. TRAK_RF, a two-dimensional research particle tracking code, has been provided to us at no cost. A significant amount of time has been spent in learning these codes and examining the accuracy and consistency of the codes. Some versions of the purchased codes have not been compatible with TRAK_RF resulting in inconsistent results. Further investigations are underway to either correct or work around the inconsistency.

Three script codes (makemesh.m, callwsim.m, and run_rtf.m) have been developed to automate the calling and running of the Field Precision software in a MATLAB environment. The resonant frequency of neighboring modes is determined. The file findmaxfield.m has been written to find the maximum normalized primary field in the cavity structure. A correction factor is determined and used to renormalize the computed fields so to treat all geometry perturbations on an equal footing. The normalization constant is based on the fields supported by a cylindrical cavity whose wall geometry is best fits the cavity geometry under test. The file partplot.m has been written to provide a visual plot of the trajectory of a charged particle. Two other batch files have been written to aid in the study of the codes.

CFD Study of Chemical Etching

Surface finish of the niobium cavity plays an important role of achieving the best performance. Perturbation of the geometry of the cavity inner surface can seriously affect its performance due to rf heating or electron field emission. Therefore, fabrication of the cavity is followed by a surface finish treatment using chemical etching. A baffle is inserted inside the cavity and an etching fluid is circulated to improve surface finish. The following steps were taken toward understanding and modeling of this problem:

1. Attempting to understand the particular of the chemical etching process as it is now through intensive discussions with Dr. D. Chan, LANL.
2. Started developing a finite element model for the process using FEMLAB software. FEMLAB was used since is an integrated part of MATLAB, which makes it easier to create parametric designs. The following figure shows the results of a preliminary simulation of the etching fluid flow within a single-cell niobium cavity. We are still in the process of tuning this model.



3. We are in the process of extending the analysis of the previous step to a five-cell niobium cavity.
4. We plan to purchase a FEMLAB Chemical Engineering Module that will be helpful in producing more accurate model of the problem.

Optimization Study

Due to the elliptical geometry of the cavity, current etching techniques do not produce a uniform surface finish. The project starts with modeling a single-cell cavity. Results will be verified using data from LANL. The project will be extended to multiple-cell cavities. Results will be also verified using data from LANL. Our immediate objectives are

- Producing accurate models of multipacting and chemical etching.
- Verify modeling results using experimental data of LANL.
- Integrate modeling tools with optimization techniques.

We are having ongoing discussions with LANL personnel regarding these issues.

Task 3. First Quarter Report

Quarterly Report May 15-August 15, 2001

Analysis of Corrosion of Steel by Lead Bismuth Eutectic

John W. Farley, UNLV Physics
Dale L. Perry, LBNL

The goal is to achieve a basic understanding of the corrosion of stainless steel by Lead Bismuth Eutectic (LBE), which has been proposed for use in the transmuter as both a coolant and as a sputtering target.

Management Issues

Since this was the first quarter of funding, the first task was to assemble the team. Physics graduate student Dan Koury was hired. A second physics graduate student, Brian Hosterman, arrived on campus just at the very end of the quarter. We spoke with an undergraduate chemistry student, Denise Parsons, who wants to join the research group, for a few hours a week, because of her full schedule. We are seeking another undergraduate student as well. UNLV chemistry professor Allen Johnson became a collaborating scientist. Prof. Johnson is a welcome addition because he brings a great deal of relevant expertise to the team, particularly on the new XPS facility, which Johnson is helping to install (the XPS is discussed below).

We are collaborating well with DOE laboratory scientists. Dr. Ning Li, head of the LBE effort at Los Alamos, visited UNLV on May 16 and August 6th, and we had productive meetings with him.

In addition, we attended a AAA seminar on fuel development on June 21, and a meeting on Separation Science with Drs. George Vandegrift and James Laidler on July 2nd.

A major management issue was getting a signed subcontract with LBNL for Dale Perry. That was a big problem. It was not solved during the quarter. However, it was solved shortly afterwards: about Aug 21. One issue was overhead. LBNL received the full overhead for Dale Perry's time. For the first year only, and as a special case, this additional expense was met by rebudgetting funds from the UNLV infrastructure account. It is unclear what will happen in the 2nd and 3rd year of the project. This is one area where we could use some help.

Technical Issues

Dr. Li provided samples of steel that has been exposed to LBE and which have been analyzed by the Russians.

Graduate student Dan Koury became familiar with the instruments that are used to analyze samples:

the Scanning Electron Microscope (SEM) and X-ray Photoelectron Spectrometer (XPS). Prof. Allen Johnson was a great help on the XPS. We took the first data using the SEM and XPS, examining the samples that had been previously analyzed by the Russians.
Koury examined corroded and uncorroded samples of steel, and found important differences, particularly with regard to oxygen and chromium. He made a June 29 presentation to a delegation from DOE headquarters, including Bill Magwood.

Our first task is to verify the Russian sample analysis.

We plan to do experiments taking advantage of synchrotron radiation at the Advanced Light Source (ALS). In late May and early June, John Farley travelled to the ALS to become familiar with facilities there, and met with Dale Perry.

Overall things are going well

Plans for the next quarter (Aug 15-Nov 15).

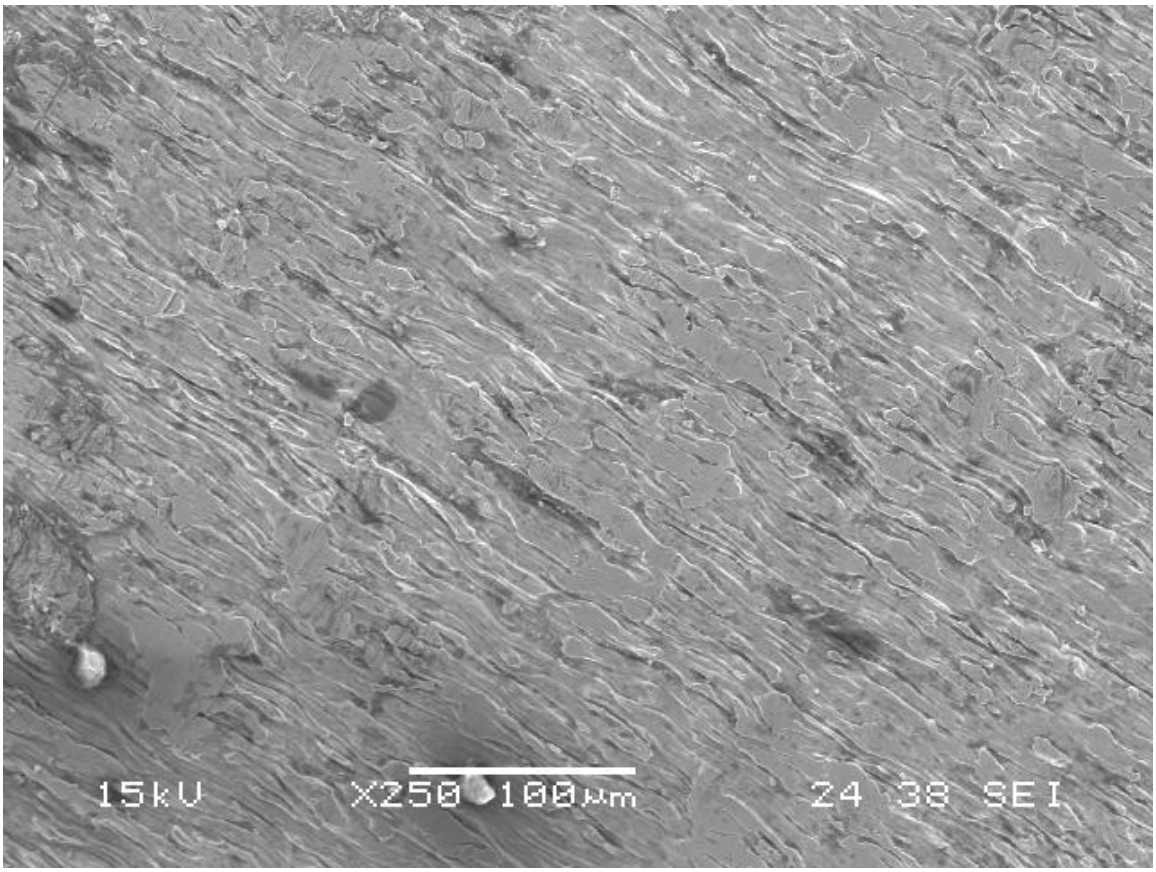
Management issues: we expect to have newly arrived graduate student Brian Hosterman fully integrated into the project. In addition, we will seek additional undergraduate student help.

Spending: the major item is the LBNL overhead issue mentioned above in connection with the LBNL subcontract. That was solved for the first year, but remains unsolved for years 2 and 3.

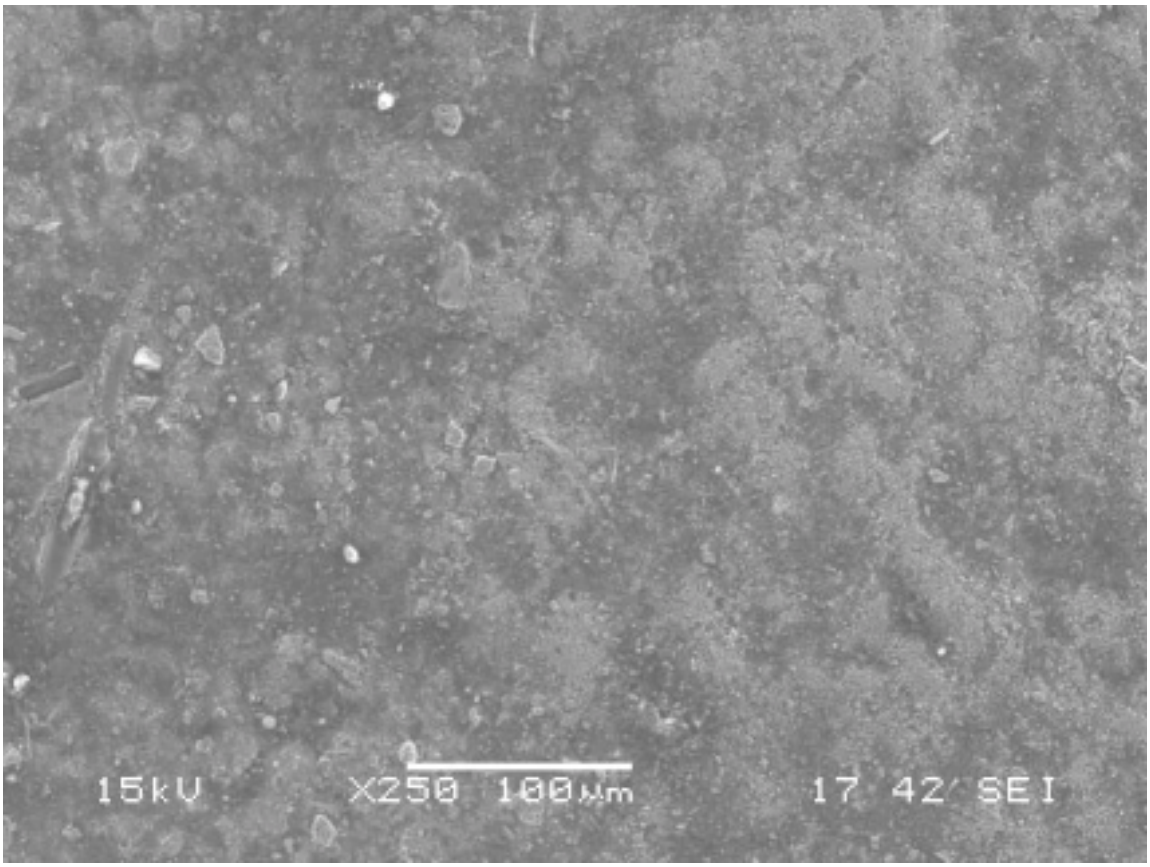
We are under budget on the graduate students, since the two will have TAs, hence are funded in part by the State of Nevada. We are over budget on time on the Scanning Electron Microscope, which is a recharge center. Funds for the SEM were not included in the original budget. Overall, we are about on budget so far. Undoubtedly there are some items that were forgotten.

Technical issues: we plan to submit a manuscript for the winter 2001 meeting of the ANS in Reno (Nov 11-15), and to attend the conference. This will be the first publication (refereed conference proceeding) from this project, and the proceedings will be published in Nuclear Materials about Feb. 2002.

Now that we have the first data from the steel, we need to start finding the chemical species present in the corrosion process. Studies of the steel using ablation of the surface will help.



This is a SEM image of the surface of 316 steel before exposure to LBE.



In contrast, this is an SEM image of 316 steel that is corroded from being exposed to LBE.

Task 4. First Quarter Report

MEMORANDUM

To: Drs. Anthony Hechanova and Gary Cerefice, HRC
From: Drs. Ajit Roy and Brendan O'Toole, MEG
Date: September 01, 2001
Subject: AAA Task-4 Quarterly (6/1 – 8/31, 2001) Report

Introduction

The subject task entitled "Hydrogen-Induced Embrittlement of Candidate Target Materials for Applications in Spallation-Neutron-Target Systems" had commenced during the quarter ending on August 31, 2001. A research account has been established, contracts for both faculty and students have been prepared, and efforts are well underway to embark on the related research activities, as proposed.

As the title of this project implies, the primary objective of this task is to evaluate the effect of hydrogen on environment-assisted cracking of candidate materials for applications in spallation-neutron-target (SNT) systems such as accelerator production of tritium (APT) and accelerator transmutation of waste (ATW). The materials selected for evaluation and characterization are martensitic stainless steels including HT-9, EP 823 and 422. The susceptibility to stress corrosion cracking (SCC) and hydrogen embrittlement (HE) of these alloys will be evaluated in environments of interest using tensile specimens under constant load and slow-strain-rate (SSR) conditions. The extent and morphology of cracking of these alloys will further be evaluated by optical microscopy and scanning electron microscopy (SEM). The concentration of hydrogen resulting from cathodic charging will be analyzed by secondary ion mass spectrometry (SIMS).

Highlights of Accomplishment

- Dr. Ajit Roy has joined the Department of Mechanical Engineering (MEG) in July 2001 as an Associate Research Professor on a full-time basis, concentrating on both Yucca Mountain (YM)/AAA-funded research projects and teaching activity (MEG). Dr. Roy's salary is being paid 50:50 from AAA program and YM Cooperative project fund. The current project participants are listed below.

Principal Investigators: Dr. Ajit K. Roy
Dr. Brendan J. O'Toole
Department of Mechanical Engineering, UNLV
Roy: Phone: (702) 895-1463 email: aroy@unlv.edu
O'Toole: Phone: (702) 895-3885 email: bj@me.unlv.edu

Investigators (UNLV): Dr. Zhiyong (John) Wang, Department of Mechanical Engineering
Dr. David Hatchet, Department of Chemistry
Mr. Raymond Kozak, Department of Mechanical Engineering
Mr. Mark Jones, Department of Mechanical Engineering
Wang: Phone: (702) 895-3442 email: zwang@nscee.edu
Hatchet: Phone: (702) 895-1777 email: dhatchet@ccmail.nevada.edu
Kozak: Phone: (702) 249-4201 email: ray.kozak@lvvwd.com
Jones: Phone: (702) 384-3756 email: kamproducts@earthlink.com

Collaborator (DOE): Dr. Ning Li, Los Alamos National Laboratory, New Mexico
Phone: (505) 665-6677 email: ningli@lanl.gov

- The test specimen design has been completed.

- Three experimental heats of Alloys HT-9, EP 823 and 422 have been melted. These ingots are currently being processed by hot working to convert them into bars at the vendor's facility, and will subsequently be shipped to UNLV for thermal treatments and specimen machining.

- A plan to establish a materials performance user facility has been developed and presented to the appropriate authorities for approval. This facility will have capabilities to conduct thermal treatments, metallographic evaluation, sample preparation, mechanical testing, along with corrosion studies (SCC/HE/Electrochemical Polarization etc.) involving numerous aqueous environments of interest both at elevated and ambient temperatures. This facility will house some recently procured equipment using YM funding, some existing equipment, and future equipment to be purchased from AAA funding. A list of future AAA-funded equipment, their descriptions, and rationale have already been presented to Dr. Hechanova and Cerefice in August this year.

- Equipment procured using the YM funding are the following.

- Constant-Extension-Rate-Test (CERT) systems (3) including high-temperature (up to 120^0C) test vessels. Vendor: Cortest Inc. Purchase Price: $77,435
- Proof Ring test assemblies (4) including high-temperature test vessels. Vendor: Cortest Inc. Purchase Price: $17,311
- Potentiostat (2), Corrosion Cell (2), and other accessories. Vendor: PerkinElmer. Purchase Price: $35,511
- Computers (3) for data acquisition and monitoring. Vendor: Gateway. Purchase Price: $6,000

- An undergraduate student is being selected to assist in experimental work commencing during the following quarter.

- The estimated first quarter expenditures are given in the following table.

Problems

No problems are anticipated. The final location of the AAA user facility within the College of Engineering is yet to be decided. In the interim, experimental program is being initiated in a laboratory located at the Harry Reid Center (HRC).

Status of Funds

Expenditures incurred during this first quarter are within the target amount allocated.

Plans for Next Quarter

- Prepare Implementing Procedures (IPs) on equipment and experimental techniques.
- Heat treat test materials, machine and prepare test specimens.
- Se up the interim laboratory at HRC using the YM-funded equipment.
- Process purchase requisitions for the remainder of equipment to be funded by both YM and AAA programs.

Task 4 First Quarter Expenditures	
A. Senior Personnel	
Brendan O'Toole - summer support	$ 4,354
David Hatchet - summer support	$ 3,500
John Wang - summer support	$ 3,491
TOTAL SENIOR PERSONNEL	***$ 11,345***
B. Other Personnel	
Raymond Kozak, 3 months	$ 4,500
Mark Jones, 3 months	$ 4,500
Undergraduate Assistant	$ -
TOTAL STUDENT SALARIES	***$ 9,000***
C. Fringe Benefits	
Faculty (3.31 %)	$ 376
Graduate students (1.75%)	$ 158
TOTAL FRINGE BENEFITS	***$ 533***
D. Operations	
Purchase Test Materials	$ 9,000
Machine Test Materials	$ -
Lab Supplies	$ -
Office Expenses	$ -
TOTAL OPERATIONS	***$ 9,000***
E. Travel	
Conference Travel	$ -
Travel to Los Alamos	$ -
TOTAL TRAVEL	***$ -***
F. Other	
15 credits per graduate student per year	$ 1,500
Equipment	
SEM fees at UNLV	$ -
TOTAL OTHER	***$ 1,500***
G. Total Direct Costs	***$ 31,378***
H. MTDC (G - Equipment & Tuition)	$ 29,878
I. F&A 50% of MTDC	**$ 14,939**
J. Total Project Cost	**$ 46,317**