MAJORITY-MINORITY UNIVERSITY PARTNERSHIP

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Abstract---In this paper we will share our experiences with two majority universities, Penn State University and California Institute of Technology. We will h ighlight the impact of these partnerships on a) research in the College of engineering, technology and computer science, b) education at both undergraduate and graduate level, c) faculty development, d) student development opportunities such as summer internships, graduate studies and participation in research projects and e) leverage partnership to get additional grants and provide a greater visibility to both majority and minority institutions.

Index Terms ---- Majority, Minority, Partnerships, Leverage

I. INTRODUCTION

Over the past ten years there has been a greater emphasis from NSF and other federal agencies for collaborative projects. Collaboration among various departments/ colleges in the same university, collaborations among various universities, collaborations between academia and industry and collaborations between academia, industry and federal agencies. Recently NSF and some federal agencies have proposed collaboration between majority and minority universities. We shall address the last collaboration in this paper.

Historically Black Universities, Hispanic Institutions and Tribal Colleges and Universities are classified as Minority Institutions. Tennessee State University is a Historically Black University located in Nashville, Tennessee (USA). We shall share our partnership experiences with Penn State University and California Institute of Technology.

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The Engineering Research Institute at the University is engaged in conducting research in cutting edge technologies and has obtained funding from DoD, DOE, NASA, industries and other federal agencies. We will highlight the impact of these partnerships on a) research in the College of engineering, technology and computer science, b) education at both undergraduate and graduate level, c) faculty development, and d) student development opportunities such as summer internships, graduate studies and participation in research projects. The main purpose of majority – minority partnership is for minority institutions to make use of resources of majority universities to enrich their research base to compete for grants/ projects in open competition. The partnership also gives an opportunity to majority institution to make use of unique strength of minority institution and submit joint proposals to NSF/DoD and other agencies.

We shall also show how the partnerships can be leveraged to get additional research grants, provide opportunities for additional industrial and universities collaborations and how such collaborations provide a greater visibility to both majority and minority universities.

II. BACKROUND

In 1992 Tennessee State University (TSU) received a grant from the Office of Naval Research (ONR) to establish a Center for Neural Engineering (CNE) to enhance the research in Neural Engineering and transition this technology to real engineering applications [1]. TSU leveraged these funds to secure additional grants from NASA, DOE, and DoD. In 1995 ONR introduced TSU to Caltech as an outreach HBCU institution to Caltech's NSF Center for Neuromorphic Engineering to provide undergraduate students summer internships. In 1996 ONR also introduced TSU to Applied Research laboratory of Penn State University (ARL/PSU) to conduct research in artificial intelligence technologies in the field of condition based maintenance. Both of these partnerships

have been mutually beneficial and have resulted in conducting joint research projects that have benefited all the institutions. In next seven sections we will describe specific partnership outcomes, its impact on research, education, faculty development, and student development. We will also discuss leveraging this partnership to seek additional partnerships and funding.

III. PARTNERSHIP WITH CALTECH

Through the efforts of ONR, TSU joined Caltech's Engineering Research Center as an outreach HBCU institution. Initially it started with summer internship experiences for TSU undergraduate students, later on faculty exchange took place in the form of participation by Caltech's faculty in annual review of Center for Neural Engineering at TSU and participation by TSU faculty in annual review of NSF-Engineering Research Center at Caltech. Caltech faculty also presented seminars at TSU. This collaboration led to a joint research project funded by NSF for $1M in Robotics titled "Towards Consumer Telepresence" for the period 1998-2003 [2]. This project has exc ited many students at TSU and students from Caltech also visited TSU to share their computer software and port TSU developed software on their robot. Currently we both are able to navigate each other's robot through internet.

IV. PARTNERSHIP WITH PENN STATE UNIVERSITY

The Applied Research Laboratory/Penn State University collaboration started in 1996 when the Director of ARL/PSU visited TSU in November 1996. Fifteen days later TSU researchers visited ARL/PSU and that resulted in TSU getting two (2) subcontracts from ARL/PSU in 1997 in Condition Based Maintenance. ARL/PSU since then has awarded 3 more subcontracts to TSU. The interaction with ARL/PSU has led to writing joint proposals to various government agencies. In 1999 both TSU and ARL/PSU received funding jointly from DoD under Defense University Research Instrumentation Program (DURIP) to develop a fully functional testbed in condition based maintenance at TSU. This tested will diagnose the failure of critical components of rotating machinery such as bearing and gearbox using on-line real time signal processing techniques and AI tools. Many undergraduate students have completed their senior capstone design projects,

and a few graduate students have also written Masters theses in condition based maintenance. Many undergraduate students have also interned at ARL/PSU during summer months and a few are in the graduate program at Penn State University. Research faculty visits to each other's campus have been frequent. The five projects funded by ARL/PSU are:

1. Fuzzy Logic and Neural Network Controllers for Integrated Predictive diagnosis (IPD)
2. Data Acquisition and Analysis for Condition Based Maintenance of Ball Bearing
3. Physics Based Modeling of Ball Rearing
4. Measure of Effectiveness and Performance for Artificial Intelligence Based Monitoring Systems
5. Design Uncertainty Module

V. IMPACT ON RESEARCH

The impact on research through this majority-minority collaboration between TSU-Caltech and TSU-ARL/PSU has been phenomenal. TSU students have accomplished the following:

1. Completed 14 Masters Theses in CBM
2. Completed 10 Masters Theses in Robotics
3. Completed 10 undergraduate capstone design projects in CBM and Robotics

In addition faculty and students have presented 25 papers in CBM and Robotics at technical conferences.

VI. IMPACT ON EDUCATION

The collaboration impact on education at TSU has been in the areas of curriculum development, offering additional concentration at graduate level and receiving an approval to offer new Ph.D. degree program as described below:

1. TSU now offers graduate courses in
      Neural engineering
      Image Processing
      Predictive and Preventive Maintenance
2. Manufacturing- A new concentration in Master of Engineering degree program
3. Ph.D. in Computer and Information Systems Engineering (CISE) with concentrations in
      Controls and Signal Processing
      Robotics and Computer Integrated Manufacturing
      Computer and Communication Networks

Ph.D. in CISE combines the strengths of computer engineering, computer science, electrical engineering, mechanical engineering, manufacturing engineering and industrial engineering, and information science.

VII. IMPACT ON FACULTY DEVELOPMENT

As a result of collaborations with Caltech and Penn State University there has been a strong interaction among researchers. The researchers from Caltech and PSU/ARL have offered many seminars at TSU to TSU faculty and students. TSU faculty has made frequent presentations of their research findings to Caltech and ARL/PSU researchers. We have also written joint proposals to NSF, DoD and various other agencies. There has been awareness of TSU's capabilities to other faculty at Caltech and PSU and this has resulted many inquires from their faculty to collaborate on other proposals. TSU has also leveraged these partnerships to collaborate with other majority institutions such as Georgia Tech, University of Illinois and University of Michigan.

VIII. IMPACT ON STUDENT DEVELOPM-ENT

The collaborations with Caltech and Penn State University have provided many opportunities for undergraduate students. They have an opportunity to participate in collaborative research projects and work on cutting edge technologies such as condition-based maintenance and robotics using state-of-the- art tools. Some students are offered summer internships and a few have gone to pursue graduate studies at Penn State University. Almost all undergraduates on summer internship have been motivated to pursue graduate studies at many other universities.

Penn State University also offered in Fall 1998 and in Fall 1999 semesters a modified course in design to Architectural Engineering students through videoconference. The students from TSU and PSU participated in joint design project and communicated with each other through e-mail, faxes and teleconferences. These team projects were well received by the students and provided an active interaction among students and faculty members. The students also visited each other's campus once in a semester.

IX. LEVERAGE COLLABORATIONS

TSU has been very successful in leveraging partnerships with Caltech and Penn State University to form additional partnerships and attract additional research projects from industries, DoD and other agencies. Some of the most noteworthy partnerships are listed below:

1. Industrial Partnerships
    Concurrent Technology Corporation-NAVY Omnibus 2000 project
    SAIC-Army Omnibus 2000 project
    Sigmatech, Inc.-Army Omnibus 2000 project
    Emergent Technologies-C4I
2. Academic Partnerships
    Georgia Tech Research Institute
    University of Illinois
    University of Michigan
3. Projects funded as a result of collaborations
    NASA Ames—Robotics Project
    Army Tank and Armament Command (TACOM)----Robotics Project
    Defense Information Systems Agency (DISA)—Global Communication and Control Systems Project (GCCS)

X. SUMMARY

Overall partnership benefits both type institutions. It is essential for the survival of quality research. It provides opportunities for faculty development, student development, and access to resources that may not be available at minority institutions. Collaborations also increase the visibility of minority institutions and it lends itself to opportunities for additional mutually beneficial partnerships with academia, industry and federal laboratories. Thus majority-minority collaboration is a win-win story.

[1] M. J. Malkani, D. B. Rogers, S. S. Devgan, M. Bodruzzaman, J. L. Davis, et al, "Academia, National Laboratory and Industry: A Unique Partnership", ASEE Annual Conference Proceedings, Edmonton, Canada, June 1994.
[2] M.J. Malkani, D. B. Rogers, S. S. Devgan, S. Zein-Sabatto, J. L. Davis, et al, "Research In a Small Engineering College of a medium Size University", Annual Meeting and Conference of the American Society for Engineering Education, Pacific Southwest Section, 1999.