

**MATCHING THE CAPABILITIES OF HIGHER EDUCATION
INSTITUTIONS WITH THE TECHNOLOGY NEEDS
OF THE Y-12 NATIONAL SECURITY COMPLEX**

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MATCHING THE CAPABILITIES OF HIGHER EDUCATION INSTITUTIONS WITH THE TECHNOLOGY NEEDS OF THE Y-12 NATIONAL SECURITY COMPLEX

Cathy S. Fore¹

Abstract — In support of the U.S. Department of Energy, National Nuclear Security Administration, the Oak Ridge Minority Educational Institutions (MEI) Technology Partnerships Program was established with a mission to cultivate long-term, mutually beneficial strategic partnerships with MEIs [Native American Institutions and Tribal Colleges, Historically Black Colleges and Universities (HBCUs), and Hispanic-Serving Institutions] that result in cooperative research, education, and economic ventures. Long-term partnerships with MEIs that are technology based can directly support the challenges faced by both government and Corporate America. The institutions gain from the partnership by learning how to provide the types of services required by federal agencies and industry, and the work/study programs are more tiered to the engineering, scientific, and computing needs of the 21st Century. The program provides an opportunity for government, industry, and MEIs to partner to apply their technological talents and create new business opportunities. This partnering is being made possible by the development of a Technology Matrix that matches the capabilities of selected minority and majority institutions with the technology needs and interests of the Y-12 National Security Complex, with a focus on manufacturing-related technologies.

Index Terms — manufacturing, minority institutions, national security, technology partnerships

BWXT Y-12, L.L.C. (BWXT Y-12) manages and operates the Y-12 National Security Complex under contract with the National Nuclear Security Administration, Y-12 Site Office. One of Y-12's national security missions is to be the technology leader for secondary components of nuclear weapon systems. This mission covers the science and engineering of special materials, manufacturing applications, production, and life-cycle management. To accomplish this important mission, Y-12 requires specialized skills in manufacturing, engineering, science, and technology.

New avenues and partnerships are being established between Y-12 and higher education institutions to enhance opportunities for collaborative research, development, and application. These new initiatives will provide a special opportunity for colleges and universities to advance and restructure their engineering undergraduate and graduate programs to better serve the national security needs of the nation. The Oak Ridge Minority Educational Institutions (MEI) Technology Partnerships Program was established to engage these technology-focused partnerships. The mission of the MEI Program is to make use of the unique scientific, manufacturing, and technology resources of the Oak Ridge Complex to initiate, advance, and sustain partnerships with MEIs and majority institutions. The program has been successful in leading these partnerships toward cooperative and mutually beneficial business development alliances.

The MEI Program has developed a unique web-based system that matches the capabilities of selected institutions of higher education with the technology needs and interests of the Y-12 Complex. The goals of this web-based tool are to:

- address the needs of Y-12's modernization and technology research and development (R&D) staff,
- create an effective pipeline for meeting Y-12's critical skills needs,
- serve as a resource for supporting strategic objectives of the universities, and
- enhance the potential for collaborative R&D and business development.

Based on the results of an extensive evaluation of the key technology areas required to support the mission of the Y-12 Complex, seven technology focus areas were identified and used as a foundation for matching the universities' capabilities:

- **Manufacturing**
 - Metals processing
 - Chemical processing and high equity materials recovery
 - Machining
- **Testing, Inspection, and Validation**
 - Dimensional inspection/metrology

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- Material characterization and aging effects
- **Materials Science and Engineering**
 - Metals
 - Polymers
 - Characterization
- **Engineering Design and Analysis**
 - Chemical and nuclear process design
 - Manufacturing equipment, facilities, and systems
 - Thermal, structural, and natural phenomena analysis
- **Process Control and Automation**
 - Sensors to integrated control and measurement systems
 - Wireless technologies
 - Containment systems for processing of hazardous materials
 - Robotics
 - Process automation
- **Computational Science and Modeling**
 - Process modeling and simulation
 - Model-based manufacturing
 - Information management
- **Nuclear Safety**
 - Facility safety
 - Criticality safety
 - Ceramics

The capability information collected and incorporated into the system's database represents the results of an extensive effort to research each university's web site with regard to:

- Awards and Patents,
- Centers of Expertise,
- R&D, and
- Facilities and Equipment.

The higher education institutions selected for the first phase of the web-based system are shown in Table I.

TABLE I.
SELECTED HIGHER EDUCATION INSTITUTIONS

Educational Institution	Minority Educational Institution
Alabama A&M University	Yes
Carnegie Mellon University	
Fisk University	Yes
Florida A&M University	Yes
Florida International University	Yes
Georgia Institute of Technology	
Howard University	Yes
North Carolina A&T State University	Yes
Northwestern University	
Ohio State University	
Pennsylvania State University	
Southern University and A&M College	Yes
Tennessee State University	Yes
Tennessee Technological University	
Tuskegee University	Yes
University of Tennessee	

These sixteen universities (nine minority and seven majority) were selected based on some specific criteria, noted as follows:

- Engineering (ABET) accredited universities
- Capabilities and experience base to support Y-12's needs
- Reasonable travel distance to the Oak Ridge facilities

Although the emphasis was placed on identifying minority educational institutions, the scope was expanded to include majority institutions for the purpose of promoting collaborations between MEIs and majority institutions, which would provide a more integrated capabilities resource to support R&D and critical skills needs.

TECHNOLOGY MATRIX

The web-based system provides users with a variety of methods to search and view the capability information. The primary feature of the system is a Technology Matrix, which provides a quick and easy method to identify and view a specific institution's capabilities to support Y-12's technology needs. The Technology Matrix is illustrated in Figures 1 and 2.



FIGURE 1.
TECHNOLOGY MATRIX.



FIGURE 2.
TECHNOLOGY MATRIX CONTINUED.

It is often assumed that minority and majority universities do not have comparable capabilities to support our nation's technology needs (i.e., national security). The following table (Table II) was compiled from the system's database to provide a summary of how the sixteen universities' Centers of Expertise compare with the seven technology areas of interest to the Y-12 Complex.

TABLE II
COMPARISON OF UNIVERSITY CENTERS OF EXPERTISE

Expertise	Minority	Majority
Manufacturing - eight universities	5	5
Testing, Inspection and Validation - eight universities	6	8
Materials Science and Engineering - eleven universities	11	19
Engineering Design and Analysis - fifteen universities	20	22
Process Control and Automation - ten universities	10	11
Computational Science and Modeling - twelve universities	15	16
Nuclear Safety - four universities	5	4

TARGETED APPLICATIONS

This web-based system was designed to address two specific objectives of the *Y-12 National Security Complex Strategic Plan*: (1) identify, develop, and deploy comprehensive, requirements-based technology; and (2) revitalize the workforce. Both of these objectives serve to directly support the Y-12 modernization initiatives. Therefore, implementation of the system is being targeted toward establishing a virtual network that focuses on technology R&D and critical skills needs. As illustrated in Figure 3, for seven of the sixteen universities, these virtual networks span a diversity of technologies and capabilities.



FIGURE 3.
TECHNOLOGY R&D AND CRITICAL SKILLS NETWORK.

A diverse set of users will find this web site to be valuable. The targeted users include business and technical staff at the Y-12 National Security Complex and at the universities. Specifically, the targeted applications of the system by organizational units currently include the following:

- Technology Development and Application: Identify universities who would be effective partners for collaborative R&D projects
- Procurement: Increase and enhance subcontracting goals to academia
- Human Resources: Improve recruiting strategies for critical skills by selecting universities whose capabilities best match a company's resource planning needs
- Business/Program Development: Create strategic, mutually beneficial partnerships that will support growth of new business development opportunities through improved teaming arrangements
- Universities: Increased awareness of the technology needs and interests of Y-12, which will support an improved position for winning new contracts

Some focused issues that the web site could address include the following:

- Identification of equipment, i.e., high-speed machines, at universities that could be used to enhance collaborative R&D opportunities
- Determination of a university's experience and knowledge base with contracts vs. grants in support of federal government and private industry solicitations
- Review of a university's research expertise compared to the critical/essential skills needs of a company
- Assessment of a university's capabilities to become an effective partner in responding to federal solicitations

SUMMARY

The Oak Ridge Minority Educational Institutions Technology Partnerships Program has made significant strides in establishing a framework for creating technology-focused partnerships with MEIs. Our nation's MEIs offer a broad range of capabilities spanning business, engineering, science, and technology. The Technology Matrix serves as only one example of how these capabilities can be matched with the needs and interests of government and the private sector, with a goal of enhancing cooperative research, educational, and economic ventures.