# National Agricultural Research, Extension, Education and Economics Advisory Board

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## A REPORT ON CONDUCTING COOPERATIVE RESEARCH AND TECHNOLOGY TRANSFER: MODELS FOR BRIDGING AGENCIES, UNIVERSITIES AND INDUSTRY

**February 13, 2012**

## EXECUTIVE SUMMARY

The National Agricultural Research, Extension, Education and Economics (NAREEE) Advisory Board has been tasked by Congress to provide advice to the Secretary, Congress, and Land Grant Institutions on long term and short term national policies and priorities, relating to agricultural research, extension, education, and economics. Since the inception of the Board a central feature of the advice it has provided has been the importance of funding of agricultural research and technology transfer. In keeping with this focus a working group of the Board organized a panel of experts to speak at the March 30, 2011 meeting of the Board regarding examples of structured research cooperatives or integrated organizations that set and implement research priorities and accomplish application of results together across agencies, departments, universities and industries. Panelists included representatives of the: National Science Foundation; North Carolina State University, United States Department of Agriculture (USDA) – Agricultural Research Service (ARS); and Department of Defense (DoD) in cooperation with Department of Energy (DoE) and Environmental Protection Agency (EPA). Through that meeting, subsequent deliberations, and the associated report the Board has developed five primary recommendations.

**NAREEE recommends that the USDA Research, Education and Economics Mission Area:**

1. **Study, compare and evaluate research cooperative models to ascertain elements of governance, leadership, organizational process, funding and partnership that would:**
   a. **foster integration across USDA departments and among USDA, universities and industry;**
   b. **involve stakeholders in research prioritization;**
   c. **focus resources on research priorities;**
   d. **achieve efficiency;**
   e. **foster the transfer of the research outcomes into commercial products or processes; and**
   f. **contribute to the advancement of agricultural and natural resource science and practice.**

2. **Dedicate adequate intramural and extramural resources to the funding of industry-university-agency cooperative research.**

3. **Pursue the use of industry-university-agency cooperative research to provide opportunities for graduate and post-graduate STEM education.**

4. **Recognize the ability of industry-university-agency cooperative research to build collaborative research leadership and management skill sets and human resource development, as well as the provision of best practice guidelines.**

5. **Recognize the ability of industry-university-agency cooperative research to integrate and advance private sector stakeholder participation.**

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## A REPORT ON CONDUCTING COOPERATIVE RESEARCH AND TECHNOLOGY TRANSFER: MODELS FOR BRIDGING AGENCIES, UNIVERSITIES AND INDUSTRY

**Developed from a Panel Presentation and Discussion at the Spring 2011 Meeting of the National Agricultural Research Education, Extension & Economic Advisory Board (NAREEE)**

**February 13, 2012**

### Situation Statement

There are many government agencies, universities and private industries with research and technology transfer missions that address challenges and opportunities in the broad realm of agriculture and natural resource management. Issues cover the range of concerns from food security to global productivity, human nutrition to sustainability, and bio-energy to climate change. As issues become more complex, information and data become more accessible, and funding for research is scarcer, it is imperative that agencies, universities and industries optimize their effectiveness and efficiency through formal and informal cooperation in the research enterprise. No one organization, institution or department has the fiscal, political or intellectual capacity to address a priority research agenda alone.

The USDA NAREEE Advisory Board can be a catalyst for cooperation in research on behalf of agriculture and our nation. NAREEE wanted to learn more about existing examples of cooperation that bridge and combine complementary research assets in the public and private sectors, in order to share successful models that might be further supported or mimicked at USDA and other federal agencies. The question at hand was; "how do we create an environment where parties cooperate in the identification of research priorities, combine their skills and assets in the conduct and application of research, and realize a synergy and mutual benefit in cooperation?"

**Panel Selection**

NAREEE assigned a committee to plan a panel presentation and discussion at the March 30 semi-annual Board meeting. The panel would feature examples of successful agency-university-industry cooperation in research and its application. Committee members included Dr. Dennis Heldman Heldman, Dr. Nancy Childs and Dr. Steve Daley-Laursen, chair. The committee established a goal of: *featuring a diverse suite of examples of structured research cooperatives or integrated organizations that set and implement research priorities and accomplish application of results together across agencies, departments and/or sectors.*

The committee searched for models of partnerships among federal agencies, universities and industries, seeking examples of existing, tested cooperatives that: a) bring industry, university and agency people together in the identification and implementation of research priorities, b) advance scientific discovery, and c) serve the needs of practitioners in industry and agencies by fostering the application of result in products and processes on the ground.

The committee explored and studied consumer cooperatives, informal cooperatives between research institutions, and formal industry-university-agency cooperatives managed by federal agencies. Funding sources included donations, membership assessments, dedicated agency budgets and competitive grants. The committee selected the following set of four examples to feature in the March 30 panel presentation and discussion:

- Industry-University Cooperative Research Centers Program. National Science Foundation. Federal Agency and Land Grant University-Based Examples and Perspectives

  Speaker: Dr. Rathindra (Babu) DasGupta, Program Director, National Science Foundation National Program, Arlington VA

  Speaker: Dr. Barry Goldfarb, Director, Center for Advanced Forestry Systems of Industry-University Cooperative Research Centers/ Professor and Head, Department of Forestry and Environmental Resources, North Carolina State University

- Floriculture and Nursery Research Initiative and the Cooperative Research and Development Agreement

  Speaker: Dr. Judith B. St. John, Associate Administrator, U.S. Department of Agriculture - Agricultural Research Service - Office of National Programs, Beltsville MD

- Strategic Environmental Research and Development Program and Environmental Security Technology Certification Program , Department of Defense in cooperation with Department of Energy and Environmental Protection Agency

  Speaker: Dr. Anne Andrews, Deputy Director Strategic Environmental Research and Development Program and Environmental Security Technology Certification Program, US Department of Defense.

The panel members provided 30 minute presentations about the structure, framework, content and key factors in success for their respective cooperatives. Presentations were followed by 90 minutes of discussion among panel members and NAREEE Board members.

**Key Messages from Presentations and Discussion**
***USDA Perspective***

USDA Under Secretary for Research, Education, and Economics (REE), Dr. Cathie Woteki, addressed the NAREEE Board before the panel discussion commenced. Her comments were relevant to the topic of the panel discussion. She said, "The USDA's Action Plan asks, how we can manage USDA REE Agencies as a portfolio, as an integrated agency, to most effectively bring science and education together, across disciplines to address societal issues? To achieve this vision we must transform USDA into a high profile research organization, and we must become a whole department, with a cohesive, collective mission, garnering resources and partnership to achieve maximum impact on issues."

***National Science Foundation (NSF) Industry/University Cooperative Research Centers (I/UCRC)***

The primary objective of the I/UCRCs is to move science results to commercial products and intellectual property. NSF encourages the centers to develop a shared portfolio of pre-competitive technologies, defined by industrial members of the center. In a sense, faculty members are carrying out the priority research agenda of an industry.

This cooperative program has been in existence for 30 years. It is the most highly leveraged program in NSF. There are 58 active I/UCRCs in existence. There are common operating procedures and governance processes across all the centers, but also flexibility to allow each center to perform optimally. The Centers are named to reflect the integration of disciplines within them.

The early versions of these centers were located at a single university, but now centers include multiple universities. For example, the Wood Based Composites Center is based at Virginia Polytechnic Institute and State University with partner sites at Oregon State University and the University of Maine. University partners are all within the United States, but private/corporate partners can be US or international. There are currently 723 members with the proportion of private partners increasing steadily.

USDA scientists are involved in several I/UCRC centers.

A small amount of NSF funding is provided up front as seed money to start a center. There are incentives for center faculty members to leverage other sources of funding. State funding is common. NSF creates the center, helps establish the industrial advisory board, and then backs off and lets the university partner lead. NSF funding starts out small and gets even smaller as the Center develops and evolves. NSF does provide supplemental funding to encourage

collaborations and connections between I/UCRCs, to support international collaborations and to foster connections with Small Business Innovation Research (SBIR) companies.

I/UCRCs have a maximum overhead (indirect cost) rate of 10%.

I/UCRC Centers are renewed annually. An evaluator, funded by NSF, constantly studies the interaction between faculty and industry members and reports annually to NSF. NSF uses this input to support its decision making on whether a Center should continue to exist. NSF's goal is that the centers will operate in the long term; accomplishing a "*happy marriage"* status.

Companies must sign an agreement on intellectual property. Industry has rights to all intellectual property developed. Each industry member has one voting representative.

I/UCRCs are different from NSF Engineering Research Centers (ERCs). ERCs have a large amount of direct NSF funding, operate under a Center strategic plan, are located at a single university, and focus on a single subject matter area.

One key factor in the success of the centers is effective leadership by the faculty director. Successful centers have a faculty leader who fulfills two roles with skill – performing as an active, respected scientist, and facilitating communications and process among the diverse array of players. The faculty leader must have sensitivity to industry, agency and university cultures. The Center director can be located at the host university or any other location deemed appropriate by NSF and the partner organizations.

***Center for Advanced Forestry Systems (CAFS)***

CAFS is one example of an NSF I/UCRC that pulled together dozens of existing university-industry-agency research cooperatives from across the nation. Nearly 70 independent forestry research cooperatives were established in land grant forestry colleges throughout the nation in the 1950's. These cooperatives were focused on many aspects of forest management; tree genetics and genomics, stand productivity, pest management and nutritional ecology/fertilization. Forest industry and federal and state agencies were active partners in setting common research goals and conducting research to advance forest science and the goals of forest industry.

These cooperatives operated independently of one another, focused on regional issues and species. Several years ago, NSF became a belt around these cooperatives, establishing an I/UCRC for advanced forestry systems. Members of existing cooperatives decided they wanted to be part of the NSF infrastructure because it fostered and aided collaboration across regions, research areas and tree species. CAFS now has roughly 25 cooperatives with 99 members including 23 large industries, nine federal agencies and several non-profits.

The decision to coalesce the forestry research cooperatives in a common system has been positively reinforced as scientists and industry land managers attempt to adapt to the forces of climate change. The combined cooperatives provide access to regional and national sets of field trials and data on the effects of climate on tree species distribution, stand productivity and pests. Also, by combining the cooperatives working on all aspects of forest management, researchers

are able to examine effects on a full array of ecosystem services based in the forest environment. CAFS members recently landed a grant in the USDA AFRI competition to study climate effects on southern conifer forest systems.

Cooperative members share in priority setting, pay dues and sponsor research on their own lands. Members choose either full or associate member status and these categories have different levels of dues and different rights to intellectual property.

Graduate education is a key component of all CAFS cooperatives. Members share a genuine interest in training the next generation of forest scientists and natural resource decision makers. Many cooperative graduate students complete their degrees and go to work for industry and agency members.

NSF funding in CAFS cooperatives is highly leverage with state and university funding, McIntire-Stennis funding from USDA, and numerous competitive grants programs.

CAFS research cooperatives help to maintain and protect a valuable resource; critical long term intellectual resources, long term field study sites, and legacy data.

CAFS members inherently value technology transfer and graduate education. Members believe in cooperation and collaboration as a way to add value to research efforts, but they also bring territorial and parochial interests that must be sorted out and managed by the leadership. There is a considerable cost for leadership. The cooperative leader is constantly working with individual members to understand their specific interests and to lead the formulation of common goals and priorities.

***Nursery and Floriculture Industry Cooperatives***

The USDA Agricultural Research Service (ARS) fosters research partnership between floriculture and nursery industries and university and agency researchers. Two examples provided in the panel discussion are the *Floriculture and Nursery Research Initiative* and *Cooperative Research and Development Agreements.*

**The Floriculture and Nursery Research Initiative (FNRI)** is a partnership of government, industry, and universities to obtain and guide Federal research dollars targeted at the industry's needs. Funding is appropriated by Congress ($2.89 million in short term research in FY10) and matched by a similar amount in ARS base funds. This is a managed research program administered by the ARS.

Permanent base funding to ARS supports permanent ARS employees, operations, and infrastructure. Short Term (3-5 year) funding is available for university, ARS, and Botanical Gardens research teams and also supports temporary employees (post-docs, graduate students), and operations.

Funding allocations can be stipulated by Congress with input from industry on research needs. Final funding decisions are made by the ARS Office of National Programs. Industry & ARS

identify top researchers in ARS and universities to address high priority needs. The program array selected achieves a balance between floriculture and nursery interests. Complementarity with related research projects, teamwork across disciplines, and leveraged funding are all strongly encouraged and figure in the project selection process. Diseases, breeding, pest management, production systems, water and nutrient management and climate change and carbon sequestration projects were among the 45 new projects funded in FY10.

**Cooperative Research and Development Agreements (CRADA)** are used for joint research and development efforts with at least one non-Federal, U.S. partner where an outcome has the possibility of developing into a viable commercial product, in a cooperative partnership with potential to result in intellectual property, or to address an ARS objective to achieve technology transfer and commercialization, but not income.

The primary outcomes of CRADA efforts are new processes, commercial products and intellectual property. The goal is never to generate income for the ARS.

In all cases, industry sets priorities for research to address their major production issues, and ARS identifies university and government researchers to conduct research that addresses these issues.

CRADAs benefit industry by providing access to ARS research capacity, allowing first right to negotiate Exclusive License for Subject Inventions without Federal Register notice, confidentiality (competitive advantage), and opportunity to compete in global markets.

CRADAs benefit ARS by promoting results-oriented, mission-driven research efforts and providing market information and fiscal resources.

In CRADA negotiations, private firms may provide expertise, staff, fiscal resources, materials, facilities and equipment. ARS may provide all of these expect fiscal resources.

To date, CRADAs have resulted in over 320 licenses and 125 commercial products in the marketplace. Sixty two percent of CRADAs have been with small businesses.

This is a managed program, not a competitive program. Funding is provided in the ARS budget. Industries have endowments to support additional research through competitive grants programs. CRADA and industry funded programs are commonly integrated and interactive.

***Department of Defense (DoD) Strategic Environmental Research and Development Program (SERDP) and Environmental Security Technology Certification Program (ESTCP)***

The DoD sees the technology development process having five major steps; service requirements, basic and applied research, advanced development, demonstration and validation and implementation. SERDP fosters basic and applied research and advanced development and ESTCP fosters demonstration and validation and implementation.

Both SERDP and ESTCP are part of a "requirements driven" process mandated by federal environmental laws and regulations on DoD lands. Research and technology transfer efforts reduce the current and future liabilities of the department. The primary focus is on contamination from past practices and pollution prevention to control product life cycle costs.

SERDP was established by Congress in 1991 as a partnership among the DoD, Department of Energy and Environmental Protection Agency. SERDP does basic and applied research focused on environmental issues facing the DoD. All funding and staffing for SERDP is located in the DoD.

SERDP is heavily focused on development of new products and processes for use by the DoD that also spin into the commercial realm. They do advanced technology development to address near term needs and fundamental research to impact real world environmental management.

Two examples of SERDP research areas are: a) cost-effective management of contaminated sediments on munitions grounds, and b) the role of invasive species and fire on threatened and endangered species located on military land in the southwestern US.

A Council, stipulated in the authorizing statute, approves SERDP's annual program. Technical Committees made up of technical and end user experts identify research priorities and advise on project selection. The committees also facilitate technology transfer.

SERDP workshops translate DoD requirements into research topics. Focused, two day events include academics, industry, regulatory and DoD end users who prepare a report that guides a new research strategy and identifies opportunities for near term technology demonstrations. Broad solicitations for competitive research are sent simultaneously to universities and federal science agencies. Project plans submitted are peer reviewed. Once launched, projects are subject to rigorous annual review.

ESTCP is a demonstration and validation program featuring and advancing cost efficient environmental technologies by testing products in the field to ensure that managers can use them. ESTCP demonstrates innovative and cost-effective environmental technologies that capitalize on past investments and bring technology out of the lab and into commercial practice. The program facilitates regulatory and end user acceptance of new technology.

ESTCP labels their format as an "Investment Approach". They conduct broad competitive solicitations to federal agencies, universities and industry; create new research partnerships by bringing developers, regulators, researchers and end users together for product testing at DoD labs; validate operational cost and performance using independent testing and evaluation; and identify DoD market opportunities – all resulting in effective technology transfer.

The ESTCP governance process is modeled after SERDPs process. Technical Committees assist with defining of technical objectives and processes of technology transfer.

**Recommendation from NAREEE Board to USDA Leadership**

The NAREEE Advisory Board sees the value of partnerships and collaborations between agencies, industry and universities for the prioritization and conduct of research, development of tools and applications, and transfer of research findings to agricultural and natural resource practice. This panel has provided the NAREEE Board with insights into several models of research cooperatives that are beneficial to agricultural and natural resource management and the advancement of science. The chosen partnership presentations emphasized, across a range of institutional structure and focus, intellectual property development, capacity building, technology transfer, human resource development and education, and leverage of federal research funds, formulary funded staff, and private investment. All of the cooperative center examples are well established with an impressive history of successful operation. Their larger legacy is the contribution towards furthering technology transfer, aiding new business development, advancing graduate science, technology, engineering, and mathematics (STEM) education, and expanding knowledge based employment.

**NAREEE recommends that the USDA REE Mission Area:**

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## Report Developed by the NAREEE Advisory Board – Spring 2011 Meeting Working Group

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