

Partnering with ARS for Technology Commercialization Success

Richard J. Brenner, Ph.D.

Assistant Administrator of ARS for Technology Transfer

Renee Wagner, Ph.D.

Technology Transfer Coordinator, MWA

Tara Weaver-Missick, MSM

Marketing & Information Specialist

Office of Technology Transfer



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Peoria NCAUR



Our Current Environment...

Budget deficits (national, states), \$135 / barrel oil, global warming, food shortages, water issues, food safety housing meltdown, weak \$, unemployment rising, erosion of global competition, emerging plant diseases, natural disasters ---

When has there ever been a more urgent need for innovation and partnerships to transfer research outcomes to our customers and stakeholders?!



The Challenges of Today...



Bruce P. Mehlman
Former Assistant
Secretary of
Commerce for
Technology Policy;
“Partners on a
Mission: Federal
Laboratory
Practices
Contributing to
Economic
Development,”
Nov. 2003

“...American leadership is anything but assured in today’s global economy – in fact, it’s very much at stake. We face more significant challenges to our innovative capacity and long-term competitiveness than ever before. To succeed in the face of growing challenges we’re going to need extraordinary efforts from industry, educators, and policy makers.

And we’re going to need our federal labs to continue in their long tradition of rising to meet our toughest challenges.”





ARS: The Largest Agricultural Research Organization in the World

“ARS conducts research to develop and *transfer* solutions to agricultural problems of high national priority and provide information access and dissemination to:

- ensure high-quality, safe food, and other agricultural products
- assess the nutritional needs of Americans
- *sustain a competitive agricultural economy*
- enhance the natural resource base and the environment, and
- *provide economic opportunities for rural citizens, communities, and society as a whole.*”

- Over 2100 scientists at 100 locations, many co-located with Land Grant universities.
- 1100 projects in 22 National Programs

<http://www.ars.usda.gov/Research/Research.htm>



How Does Industry Partner with ARS for Commercialization?

Through the Office of Technology Transfer...

- ***Licensing*** current protected technologies (including plants) to private sector firms for commercial production.
- ***Cooperative Research and Development Agreements (CRADAs)*** establish research partnerships to solve industry problems.



Technology Transfer: *the adoption of research outcomes for public benefit*



Office of Technology Transfer

Centralized in policy and approvals, licensing, marketing;
decentralized in negotiation and implementation of CRADAs

Patenting

- 10 registered patent agents
- Located in Beltsville, MD; Peoria, IL; Albany, CA

Marketing

- Targeted marketing
- Web subscribe *Tech Alerts*
- Partnering opportunities

Licensing

- 4 senior licensing specialists
- HQ based

Tech Transfer Coordinators

- 7 specialists with life science / ag background
- Distributed across geographic Areas of ARS



ARS Goals of Technology Transfer

Public mission – a problem solving agency

- *Transfer* of technology is the primary objective --- not licensing income
- Protect intellectual property *principally* if it enhances technology transfer
- Facilitate development of cooperative research agreements with private sector firms for further R&D in agricultural industries.



ARS Decision-Making Principles

- ARS conducts research to develop and *transfer* solutions to agricultural problems of high national priority. ⇒ *Licensing policies are mission driven.*
- Research programs are designed with stakeholder input, and outcomes are measured by positive impacts. ⇒ *ARS has a “market pull” orientation.*
- A variety of tools are available for partnering and technology transfer. ⇒ *Use the right tool for the job.*



Types of Tools Used in Technology Transfer

- Confidentiality Agreement
- Material Transfer Agreement (MTA)
- Patent, PVPC
- License Agreement
- Trust Fund Cooperative Agreement
- Memorandum of Understanding (MOU)
- Non Funded Cooperative Agreement
- Cooperative Research and Development Agreement (CRADA)
- Partnership Intermediary Agreement

ARS Licensing Goals

- Use the patent system to facilitate technology transfer
- Provide an incentive for investments by the private sector
- Support small business enterprises and entrepreneurs
- Support investments by U.S. businesses in international markets



ARS Licensing Practices

- No licenses are required for research-only use of ARS inventions.
- Most commercial licenses are exclusive or partially exclusive.
- Exclusive commercial licenses for plant varieties reserve the right to make the licensed varieties available to others for research and breeding.



ARS Licensing Practices: Applying for a License

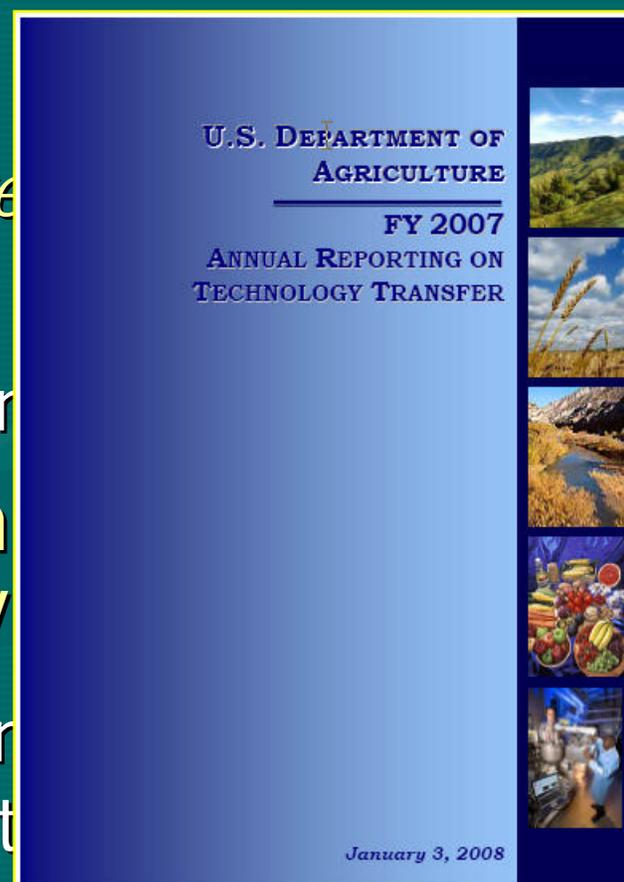
- Detailed instructions are available on the ARS Partnering webpage.
- *This is an interactive process.* Licensing Program staff are available to answer questions throughout the application process.
- This is NOT a bidding process. The first application received for an invention is evaluated on its merits.



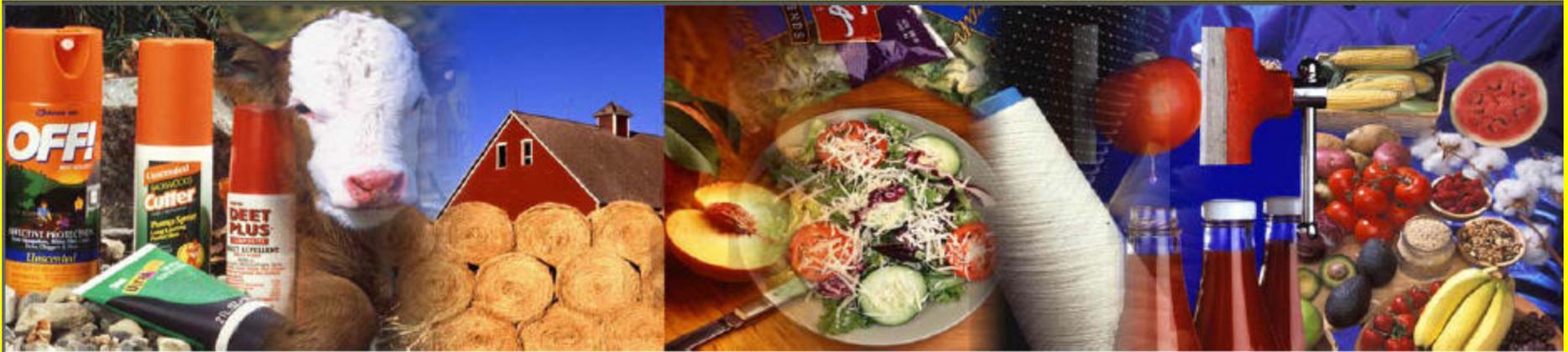
Annual Report to Congress on Technology Transfer --- FY 2007 License Metrics

<http://www.ars.usda.gov/Business/Business.htm>

- Licenses:
 - Active: *339 (130 with university co-owned)*
 - New in 2007: 25
 - Biological Materials: 22 (5 with university co-owned)
- Licenses with products on market:
 - from university co-owned*
 - 30 are plant materials (plant Variety Protection Certificates)



Marketing – “Technology Alert”



U.S. DEPARTMENT OF AGRICULTURE. AGRICULTURAL RESEARCH SERVICE



Animal Production (all animal-related technologies)

Aquaculture

Cattle

Poultry



Crop Production (all crop-related technologies)

Soybeans

Corn

Cotton

To sign-up, contact:

Tara Weaver-Missick, Marketing and Information Specialist

USDA, ARS Office of Technology Transfer

5601 Sunnyside Avenue, Room 4-1172

Beltsville, Maryland 20705-5131

Phone: 301-504-6965 Fax: 301-504-5060

E-mail: twm@ars.usda.gov



E

C



Natural Resources



Biobased Products/Bioenergy

Models for Developing and Transferring Technologies to the Private Sector

Background Invention
(developed in USDA)

Seek Private Sector Interest For Commercialization

The screenshot shows the USDA Agricultural Research Service website. The header includes the USDA logo and the text 'United States Department Of Agriculture Agricultural Research Service'. Below the header is a navigation bar with links for 'Home', 'About ARS', 'Help', 'Contact Us', and 'En Español'. A search bar is located on the left side of the page. The main content area is titled 'Partnering' and features a patent listing for 'New Method to Make an Industrial Lubrication Fluid'. The listing includes the patent title, docket number (7106), serial number (11717524), and a technology description. The description states that ARS scientists in Illinois have developed a way to make a vegetable oil based material using several natural compounds. This technology can be used in the formulation of biobased-industrial lubrication fluid, potentially replacing petroleum-based fluids. One of ARS's compounds can be poured at cold temperatures—a property required by the lubrication industry. The compounds also have structures which have the potential to be used to form a new type of surfactant. Many other commercial lubricants and surfactants are available; however, ARS's biodegradable compounds are more environmentally friendly. The technology has been shown to be usable on the small scale. Global lubricant demand is more than 30 million tons annually, and commercial surfactant use in the United States and Canada is more than 3 million tons per year. ARS is seeking a cooperative research and development partner to further evaluate the compounds in this invention, as well as conduct extensive lubricant testing. In addition, more research needs to be accomplished to develop the technology's use as a commercial surfactant. Companies that produce surfactants and are looking to

Marketing Section

- Creates summary for web
- Targets industry

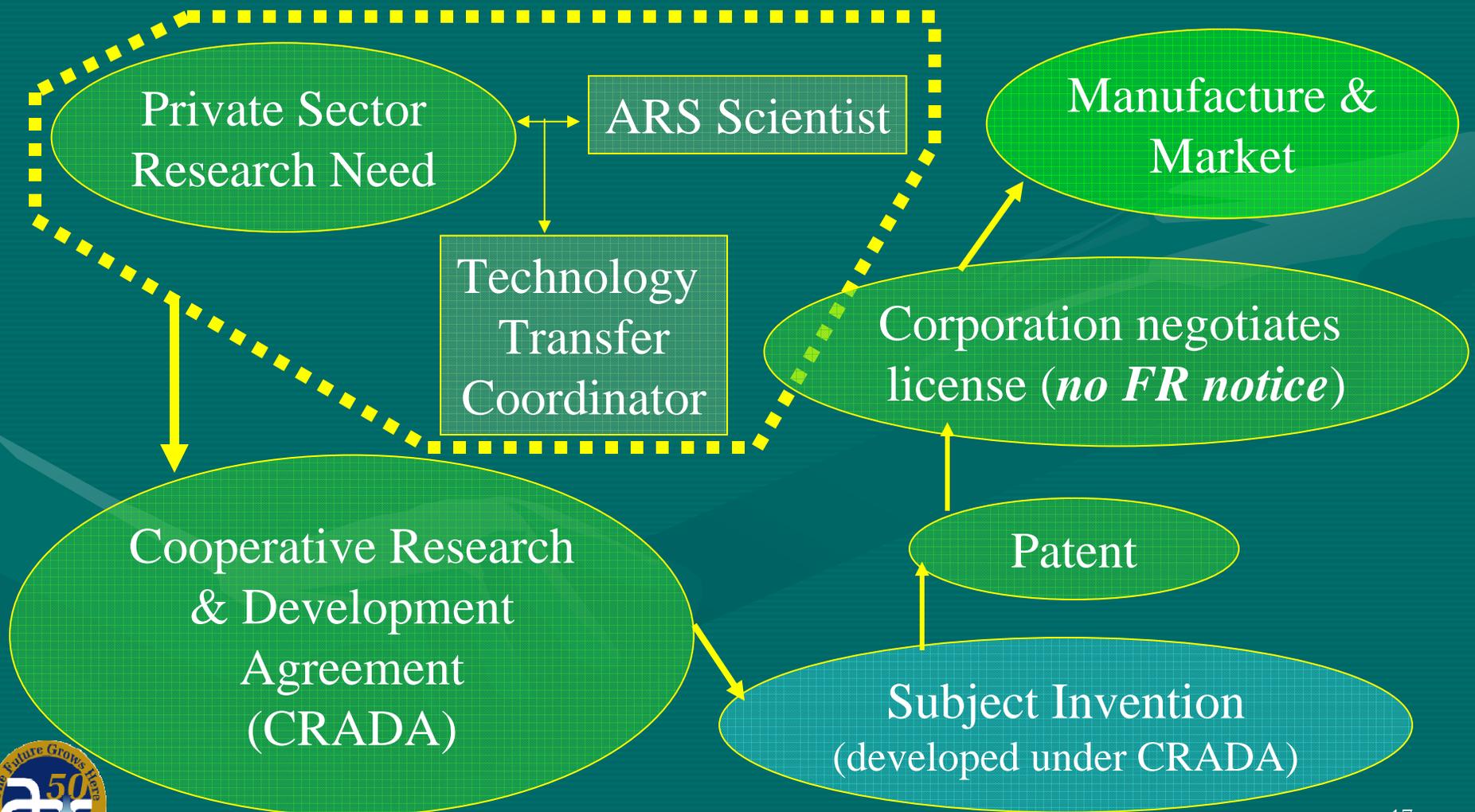
Federal Register Notice

Licensing Section

Corporate response



The CRADA Model for Developing and Transferring Technologies to the Private Sector



Cooperative Research and Development Agreement (CRADA)

Benefits to Firms:

- Access to ARS research capacity
- First right to negotiate Exclusive License for Subject Inventions without FR notice
- Confidentiality (competitive advantage)
- Opportunity to compete in global markets

Benefits to ARS:

- Results-Oriented Research/Impact
- Market information
- Identification of Licensee
- Resources (For the Project)



CRADA Partners

- May be an individual company, group of firms, association, university or combination of above
- May include cooperation with another Federal agency
- ARS actively seeks CRADAs with small and/or minority-owned businesses
- No need to “compete” for CRADAs, we are free to choose the best partner
- Approved through ARS line management & program management



CRADA Negotiations

Firms May Provide:

← Expertise

← Employees

← Materials

← Funds

← Equipment

← Facilities

*ARS May Provide Any of the Above
Except Funds*



Four regional research centers, provide the major portion of ARS's capability for research and development of technology to increase the use of agricultural products and thereby enhance the economic viability and competitiveness of U.S. agriculture.



NCAUR (NRRC) – Peoria, IL



SRRC – New Orleans, LA



ERRC – Wyndmoor, PA



WRRC – Albany, CA



Pilot Plants of the Regional Research Centers



Partnerships

The Center is eager to explore new partnerships that would expand the use of the SRRC Pilot-Plant facilities. Current areas of research interest include food processing, oilseed extraction, fiber processing and finishing, pyrolysis processes, bio-fuels development, and environmental testing, but most areas of value-added agricultural product and process development can be accommodated.

A number of industry-government interactions have been undertaken within the pilot -plants from short-term specific research projects, with SRRC personnel performing most of the work, to extended interactive collaborations, with external personnel located on-site over sustained periods.



Equipment/operations supported within the facilities:

- Milling equipment (knife, hammer, attrition, pin mills, etc.)
- Reactors (glass and stainless steel jacketed reactors)
- Fiber carding, drawing, spinning, knitting and weaving operations
- Non-woven fiber processing
- Fabric wet processing, dyeing and chemical treatments
- Solvent extraction and processing
- Extrusion (single and twin barrel screw extruders)
- Ultrafiltration
- Ultrasonic treatment
- Evaporation
- Pelleting



the PILOT PLANTS of the



Southern Regional Research Center

RESOURCES:

Specifically defined areas are available for safe and confidential processing of agricultural crops and marine units leading to edible food products and non-food bio-based products and fuels. The space is flexible allow of modular equipment as well as the assembly of coordinated process sequences. The pilot labs are equipped with process equipment representing most important unit operations needed for foods and crop conversion component separation.

PARTNERSHIPS:

We are eager to explore new partnerships that would make use of the WRRRC Pilot Plants in such areas as development of new bio-based products, biofuels and bioenergy from agricultural products/byproducts; new techniques for utilizing fruits, vegetables, and cereal grains; and water and energy-efficient new methods for drying and preservation. Partnerships may take the form of Cooperative Research and Development Agreements, Trusts, and Reimbursables.

FUTURE:

In order to improve the R&D Facility to meet present and future needs, a multiphase modernization by ARS in 1997. Phases 1 and 2, which addressed major parts of the area used primarily for food and biofuel research, were completed in 2005. Phase 3a modernization, which will include additional research capability as well as upgrades to the Food Processing laboratory and its extrusion facility, is to be completed in 2008. The modernized facility will be home to research involving 70 or more research Service scientists and scientific support staff, as well as industry Cooperative Research Agreement partners and University collaborators, many of whom are already using the facility proceeds.

James N. Seiber, Center Director,
510-559-0600
jseiber@pw.usda.gov
David Nicholson, Technology Transfer Coordinator,
510-559-2841
David.Nicholson@ars.usda.gov



Process Equipment Supported Capabilities for Food and Industrial Application:

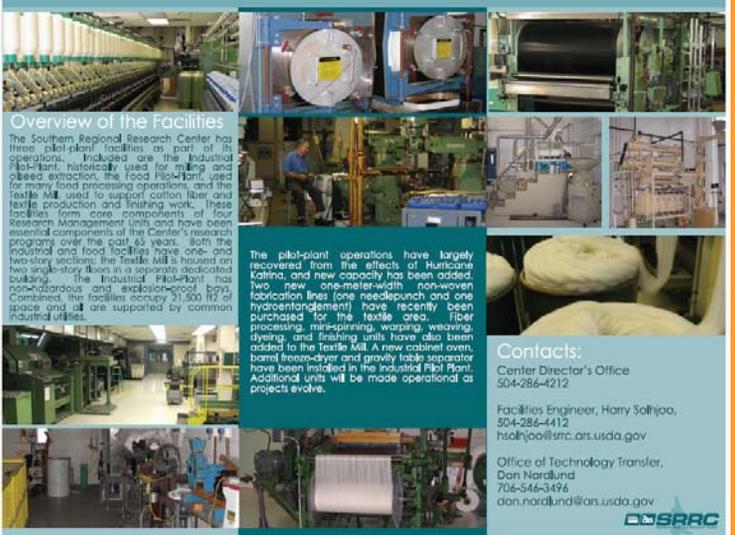
Ambient and Heated Mixing	Filtration: (physical, ultratration, reverse osmosis)	Size Reduction
Atmospheric and Vacuum Canning	Freeze Drying	Solvent Extraction
Batch and Continuous Centrifugation	Freezing	Solvent Processes
Bleaching	Heat Transfer: nonconcentric / Emulsification	Spray Drying
Coating	Milling	Spray Drying
Comminuting	Pasteurizing	Ultra Filtration
Compression molding	Peeling	Ultrasonic Treatment
Culinary Steam	Puffing	Vacuum Evaporator
Cutting	Reverse Osmosis	Solvent Processes
Emulsifying	Screen Separation	Full Range of Material Instrumentation
Extrusion (single and double screw)		
Fermentation		
Fiber Spinning		

Working space physical overhead varies from one to four stories. Research bays may be compartmentalized for confidentiality. An area (45,000 sq ft) of total floor space.

Overview of the Facilities

The Southern Regional Research Center has three pilot-plant facilities as part of its operations. Included are the Industrial Pilot-Plant, historically used for milling and oilseed extraction, the Food Pilot-Plant, used for many food processing operations, and the Textile Mill used to support cotton fiber and textile production and finishing work. These facilities form core components of four research, Management Units and have been essential components of the Center's research programs over the past 45 years. Both the industrial and food facilities have one- and two-story sections; the Textile Mill is housed on two single-story floors in a separate dedicated building. The Industrial Pilot-Plant has non-hazardous and enclosed-floor bays. Combined, the facilities occupy 21,500 sq ft of space and all are supported by common industrial utilities.

The pilot-plant operations have largely recovered from the effects of Hurricane Katrina, and new capacity has been added. Two new one-meter-width non-woven fabrication lines (one needlepunch and one hydroentanglement) have recently been purchased for the textile area. Fiber processing, mini-spinning, wrapping, wetting, drying, and finishing units have also been added to the Textile Mill. A new cabinet oven, barrel break-dryer and gravity table separator have been included in the redesigned Pilot Plant. Additional units will be made operational as projects evolve.



Contacts:

Center Director's Office
504-286-4212
Facilities Engineer, Harry Solhjoo,
504-286-4412
hsolhjoo@srrc.ars.usda.gov
Office of Technology Transfer,
Don Nardlund
706-546-3496
don.nardlund@ars.usda.gov



Pilot Plants of the Regional Research Centers



USDA • ARS

NATIONAL CENTER FOR AGRICULTURAL UTILIZATION RESEARCH PILOT PLANT

From its beginning, NCAUR has worked directly with industry to achieve results of global significance, first and most notably to develop the method for the mass production of penicillin. The commitment to commercializing new technology continues today.

To facilitate technology transfer, NCAUR offers pilot plant scale-up for industrial products, bio-based products / biofuels and food processing, along with the on-site expertise of more than 100 Ph.D. researchers from nearly a dozen different scientific disciplines. The result is product development and production capacity with the additional benefit of business incubator functionality.

These assets are combined with legislative authority allowing materials produced in the pilot plant to be sold by the collaborator in order to prove market concept. The result is a unique and powerful capacity for partnership and success at NCAUR.

The Power of Partnering

Agreements between NCAUR and its industry, university, and agency partners lead to successful development of commercial production and formulation technologies.

Examples include:

- A new metalworking fluid derived from soybean oil rather than petroleum, providing performance benefits and lower cost
- Conductive polymers made from plant polysaccharides, such as starch and cellulose, that work as well as the petroleum based materials in the developmental pipeline
- Microbial agents that control a variety of pests, including Formosan subterranean termites; the aquatic weed hydrilla; Fusarium head blight of wheat and potato dry rot, late blight and spotting
- New types of skin care additives attached to soybean oil and other natural oil molecules with anticipated uses in skin-, hair- and related personal-care products for health-conscious consumers
- A series of oat- and barley-based fat substitutes that are good for the heart, the most recent providing a "double-whammy" of reducing fat calories while at the same time working to reduce cholesterol



Food Processing Resources

Food processing research focuses on enhancing the performance of agricultural materials in existing applications and on developing new products to promote health using crops such as corn, soybeans, oats, barley and wheat. Equipment includes:

- Jet cooking lab featuring excess steam jet cookers capable of producing 30 gallons of liquid per batch of one gallon per minute
- Electric boiler producing clean steam generated from distilled water with no additives
- Vertical cutter mixer capable of blending liquids in batches up to 4 gallons each
- Steam-heated drum dryers capable of drying suitable materials at approximately 5 liter per minute
- Fully equipped test kitchen including a convection oven with capacity for 30 dozen cookies per batch or 12 1.5 lb. loaves of bread per batch or 4 20-lb. turkeys
- Sensory evaluation lab and test kitchen with odor and light-controlled booths for members of trained sensory panels

Chemical Processing Resources

Chemical processing research focuses on modifying the chemical and physical properties of soybean and other vegetable oils to develop improved quality and functionality, and on modifying bio-based materials such as polysaccharides and proteins from corn. Equipment includes:

- Werner & Pfleiderer ZSK-30 and Leistritz 18 mm co-rotating twin screw extruders with multi-pport injection, heating or venting capability; Brabender single screw extruder capable of producing pellets and 1/4" ribbons; Randcastle co-extrusion system for extruding 3 or 5 layer films
- Brabender and Haake torque rheometers
- Cincinnati Milacron injection molding machine with 78 ton clamping force
- Ultrafiltration device capable of accepting any suitably sized cartridge membrane
- 5 and 50-gallon reactors, filtering apparatus, reverse osmosis concentrators, chiller, membrane separation apparatus, deaerating screens and more
- Myers-15 distillation apparatus, high vacuum distillations and high pressure reactors
- Supercritical fluid extraction pilot plant
- Technomic 600 lb/day pilot scale oil refiner R8D
- Small production scale equipment for de-hulling, cleaning, screening, aspirating, grading and milling seeds, including Rototek cleaner, seed conditioner and 400 lb/hr. French press

Biological Processing Resources

Biological processing research focuses on metabolic engineering technologies to convert agricultural commodities such as corn & crop residues into biofuels and chemicals, enzymes and polymers and to develop natural biological pest control agents. Equipment includes:

- Benchtop and pilot plant fermenters (1-100 L scale fermenters)
- Ancillary equipment for recovering and drying microbial products such as batch and continuous centrifuges, fluidized bed, spray, tray and vacuum freeze dryers and a rotary drum vacuum filter
- Controlled environment and plant growth chambers
- Turkey integrated robotic workcell laboratory automation for high throughput molecular screening

For more information about partnering opportunities at NCAUR contact:

KATHERINE O'HARA, Communications Officer

Ph: 309-681-6448 Email: kate.ohara@ars.usda.gov

RENEE WAGNER, MVA Technology Transfer Coordinator

Ph: 309-681-6565 Email: renee.wagner@ars.usda.gov



www.ncaur.usda.gov



Where people and facilities are in place to conduct research programs of national importance. We welcome opportunities to collaborate with sister agencies, academics, and industrial partners.

Shu-I Tu, Acting Center Director, 215-233-6595, shui.tu@ars.usda.gov
Vic Chavez, Technology Transfer Coordinator, 215-233-6610, vic.chavez@ars.usda.gov
USDA, ARS, ERRC, 600 East Mermaid Lane, Wyndmoor, PA 19038

ERRC Pilot Plants and Facilities



More than 20,000 sq. ft. of space with utilities and equipment for research at pilot and near commercial scales.

Food and bio-based processing pilot plant (10,000 sq. ft.); Dairy processing pilot plant Center of Excellence in Extrusion and Polymer Rheology (CEEPR); Grains pilot plant (2,000 sq. ft.); BSL-2 containment pilot plant (2,000 sq. ft.); BSL-2 challenge facility (2,000 sq. ft.); Bio-Fuels pilot plant (1,000 sq. ft.); Tannery

ERRC Pilot Plant Equipment

Bio-Based Products

Size reduction and mixing devices
Batch and continuous chemical reactors, 1 to 1000 L
Evaporators
Dryers: shell, freeze, tray, drum, and belt types
Die and wax melting systems
Oil extraction and purification

Bio-Fuels

70L Continuous Dry Grain Ethanol Processing Facility
60 L and 300 L Fermentation Systems
3" Pilot Scale Fermentation and Gasification Reactor
Pilot Scale Ethanol Centrifuge and DROFF Press
Nomenclature Pilot Scale Mill for Evolvable Reduction and Fractionation
Ethanol/Ca-Product Extraction and Purification Systems

Dairy Processing Technologies

Fluid milk and food processing
HEER-CHT pasteurizer
Microfiltration systems
Universal pilot plant system for milk processing
Microfiltration
Spray dryer
Ultra-high-pressure (UHP) system (UHP-6.2.1 model)
Fat vents for super critical CO₂ extraction and reaction
Cheese plant
Raw milk
Extraction and milling (CEEPR)
Tara raw material (ARV-RTF-60, WSP 226-30)
Intrinsic milk (Dusq)
Media laboratory film center

Food Safety Technologies

Produce safety
BSL-2 containment pilot plant
Design milk hot water water pasteurizer
Produce washers: brush, rotator, and vibration type
Juice and beverage safety
Integrated process and packaging line, 200 L/h
Pilot scale field system
Radio frequency electric field system
Dose-phase carbon dioxide system
Soybean leg filler
Most @ ready-to-eat product safety
Vacuum steam reaction tank pasteurizer
UV lab-based

Tannery

Tanning drums
10 10-L (Dumatec 4-to-1 and 6-to-1)
4 pilot-scale drums (max capacity 210 4-sided)
Sed production equipment for flaking, wetting, splitting, drying, mixing, and milling
Mixer, roller, dryer (single gate, Curjelux vacuum)
Flouring spray booth
Constant temperature storage tunnel
Mechanical property testing equipment



Our *Newest* Tool for Partnerships

ARS signed its first formal **Partnership Intermediary Agreement (PIA)** with the Maryland Technology Development Corporation (TEDCO) to promote joint public/private research & technology-based economic development with businesses in Maryland (September 28, 2007)

ARS History with TEDCO:

A “trial” MOU was established in May 2000

- 4 Technology Showcase events at Beltsville Agricultural Research Center
- 8 partnerships with small / start-up companies
 - 7 projects established with three different TEDCO funding programs

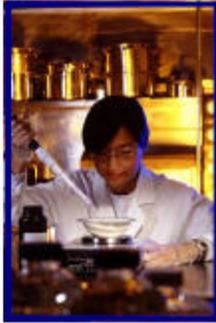
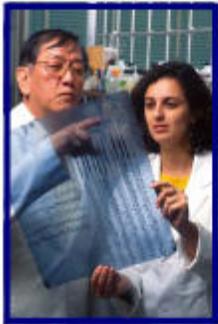


Our Newest Tool for Partnerships



United States Department of Agriculture
Agricultural Research Service

Partnership Intermediary Agreements (PIA) and Technology Transfer



What is a Partnership Intermediary Agreement (PIA)?

PIAs allow federal research agencies to enter into an agreement with a non-profit organization (partnership intermediary) to assist the federal agency with its technology transfer efforts.

The partnership intermediary's services complement those of the federal laboratory and increase the likelihood of success in conducting cooperative or joint activities between the federal agency and a partnering organization (businesses, universities, or other federal agencies).

These agreements can help strengthen state and national economic development and help U.S. businesses compete globally in the marketplace.

The ARS Office of Technology Transfer (OTT) facilitates and manages PIA agreements for USDA.

What's in it for the Partnering Organization?

PIAs give the partnering organization access to more than 2,000 ARS researchers located at more than 100 research facilities nationwide—including four state-of-the-art pilot plants located in California, Illinois, Louisiana, and Pennsylvania. The partnering organization becomes part of our Agricultural Technology Innovation Partnership (ATIP). Any business that enters into an agreement with ARS resulting from a PIA partnership becomes an ATIP affiliate. ATIP is a forum created and managed by ARS-OTT that fosters interactions between businesses, universities, and ARS professionals nationwide.

What's in it for Businesses?

Through the partnering organization, businesses gain:

- marketing assessments and business plan development assistance,
- identification of funding source (state funds, angel investments, venture capital, and SBIR and other federal grants),
- early notification of "ARS Technology Showcase" events,
- access to facilities, equipment and research expertise through formal agreements, and
- assistance in matching USDA technologies with business needs.



What's in it for ARS?

The partnering organization offers many benefits to ARS researchers, including:

- identifying potential research partners and licensees,
- increasing access to a variety of businesses,
- providing industry perspective on ARS technologies,
- increasing the likelihood of impact from research outcomes,
- identifying potential funding sources for research scientists, and
- expanding customer and stakeholder interactions with the private sector and other federal agencies, e.g., food safety and environmental agencies.



Goals for Partnership Intermediaries

Provide complementary assets to ARS Office of Technology Transfer

- Guide local / regional business with research needs to the appropriate ARS scientist (CRADA opportunities)
- Triage business plans of private sector to seek “winners” as candidates for research partnerships with ARS researchers
- Acquire marketing assessments on ARS technologies from 3rd party sources (business schools, entrepreneur programs, angel investors, etc.)
- Coordinate “Technology Showcase” events to facilitate partnerships with private sector companies



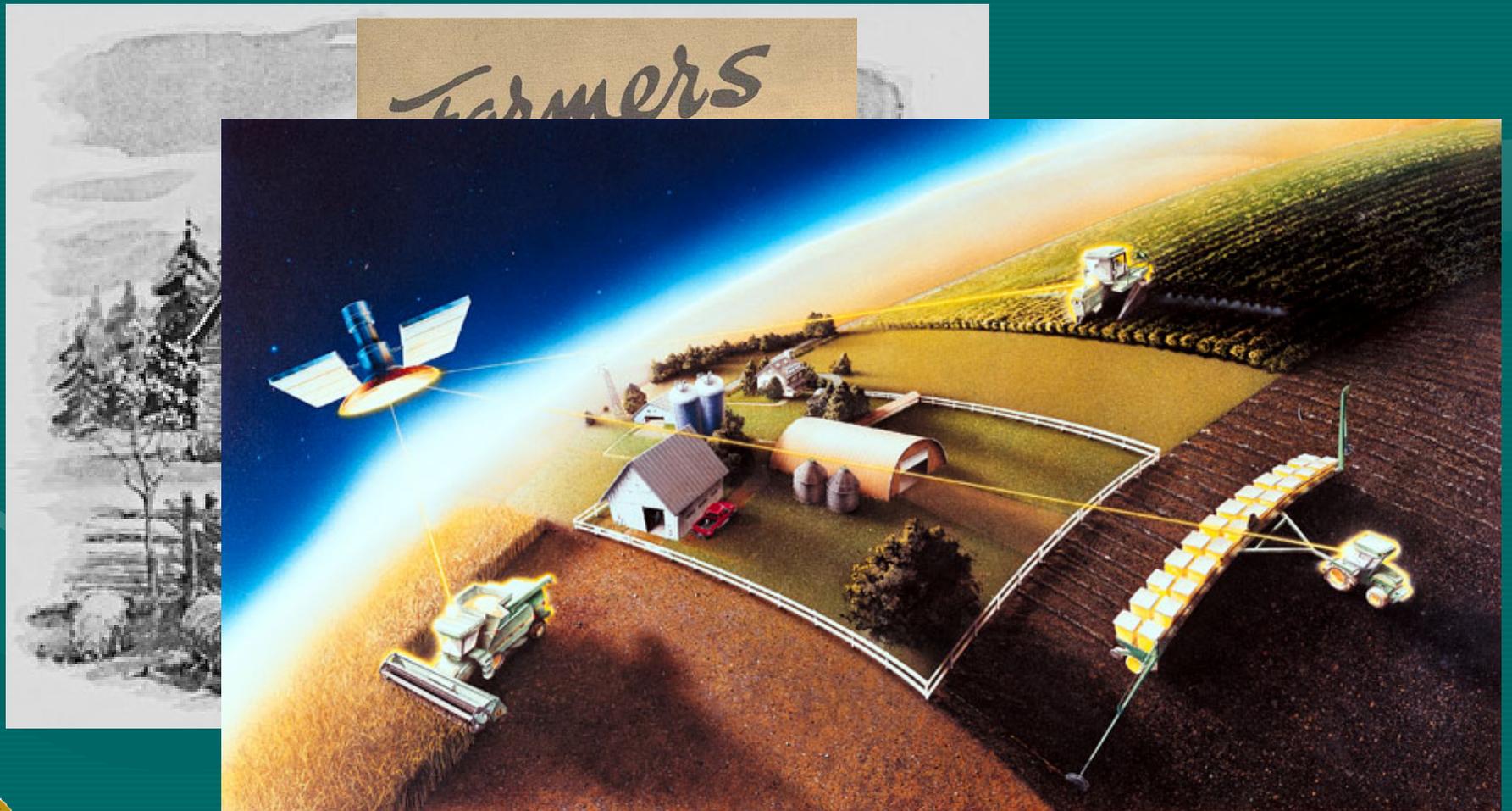
Goals for Partnership Intermediaries

Provide complementary assets needed by private sector to succeed in commercializing federal inventions

- Assist in accessing public / private funds
 - SBIR proposals
 - Angel investors
 - State funds
- Manage their own seed/venture funds to support CRADA and license partners of ARS
- Assist private sector in preparing license applications

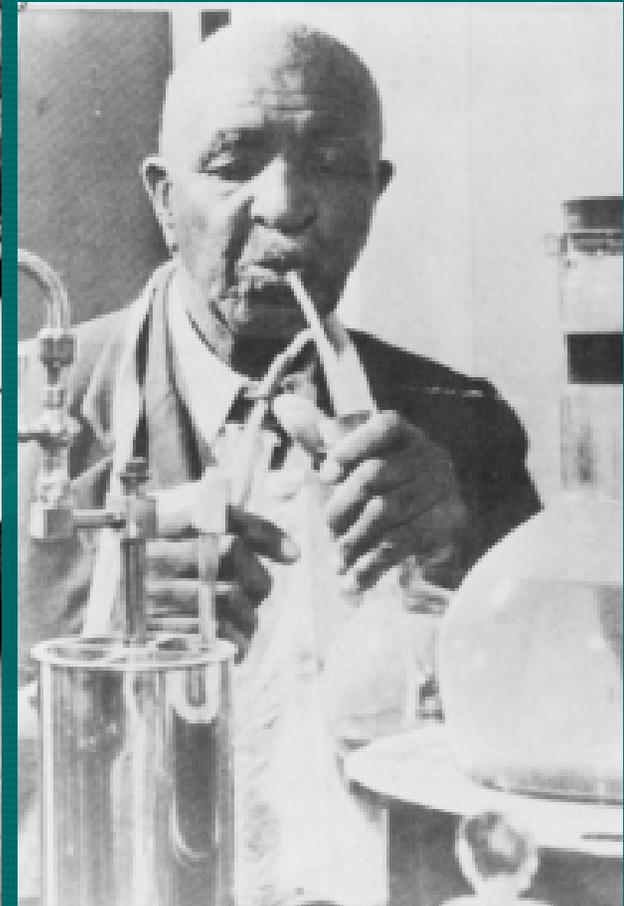


The Changing Landscape of Technology ... and Technology Transfer



The future ...

The future is written in the past...



The future ...

The future is written in the past...



From the Collections of Henry Ford
Museum & Greenfield Village



The future ...

The future is written in the past...



The future ...biobased products & biofuels

Switchgrass
& biofuels



Component
separation

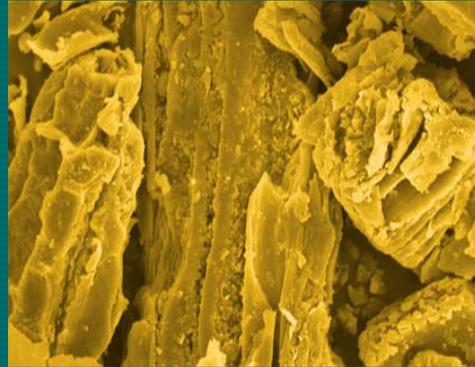
New foods & biobased products

Solutions From Concept to Commercialization...

Biomass to Energy & Co-Product Research *Feedstock Development, Production, Conversion*



Better crops for ethanol



Advanced processes for freeing fibers & sugars



Newly discovered fungi for better enzymes



Co-Product development & recovery



Scale up fermentation bioprocesses



The Office of Technology Transfer is at your service....

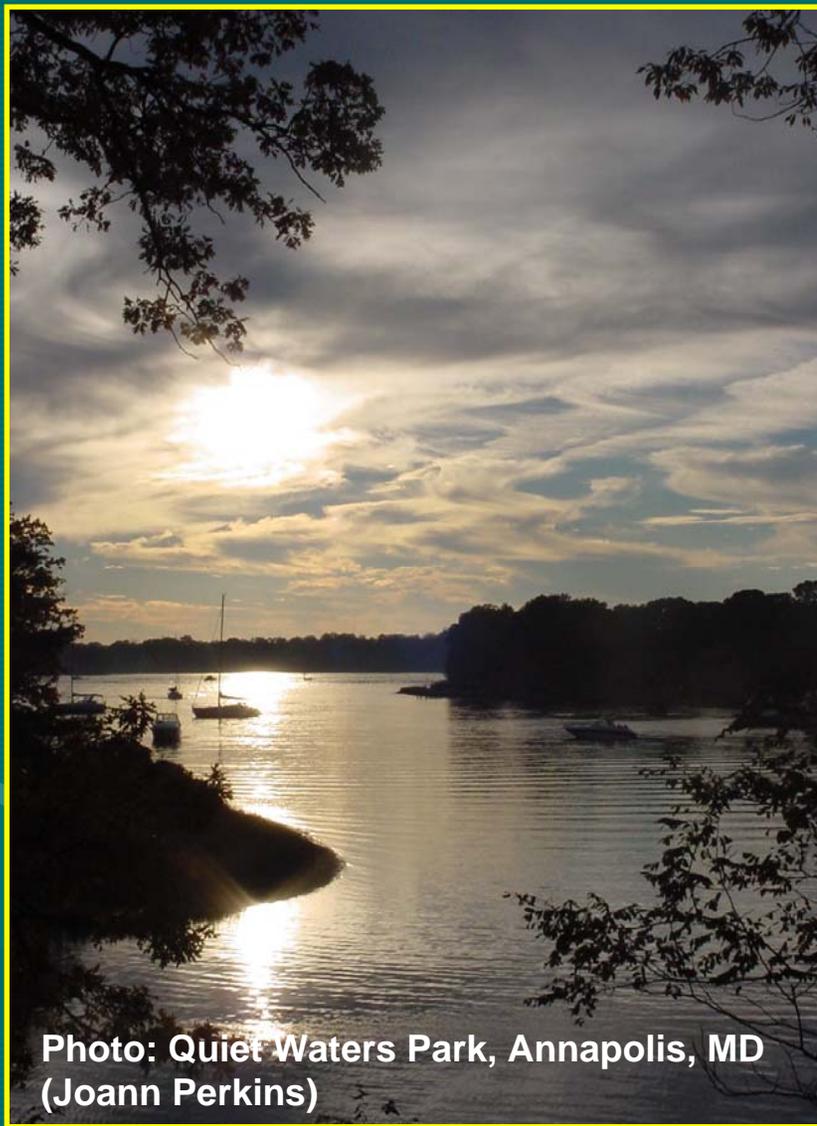


Photo: Quiet Waters Park, Annapolis, MD
(Joann Perkins)



Richard J. Brenner, Ph.D.
Assistant Administrator

Office of Technology Transfer
5601 Sunnyside Ave
Beltsville, MD 20705
(301) 504-6905



<http://www.ars.usda.gov/Business/Business.htm>

