

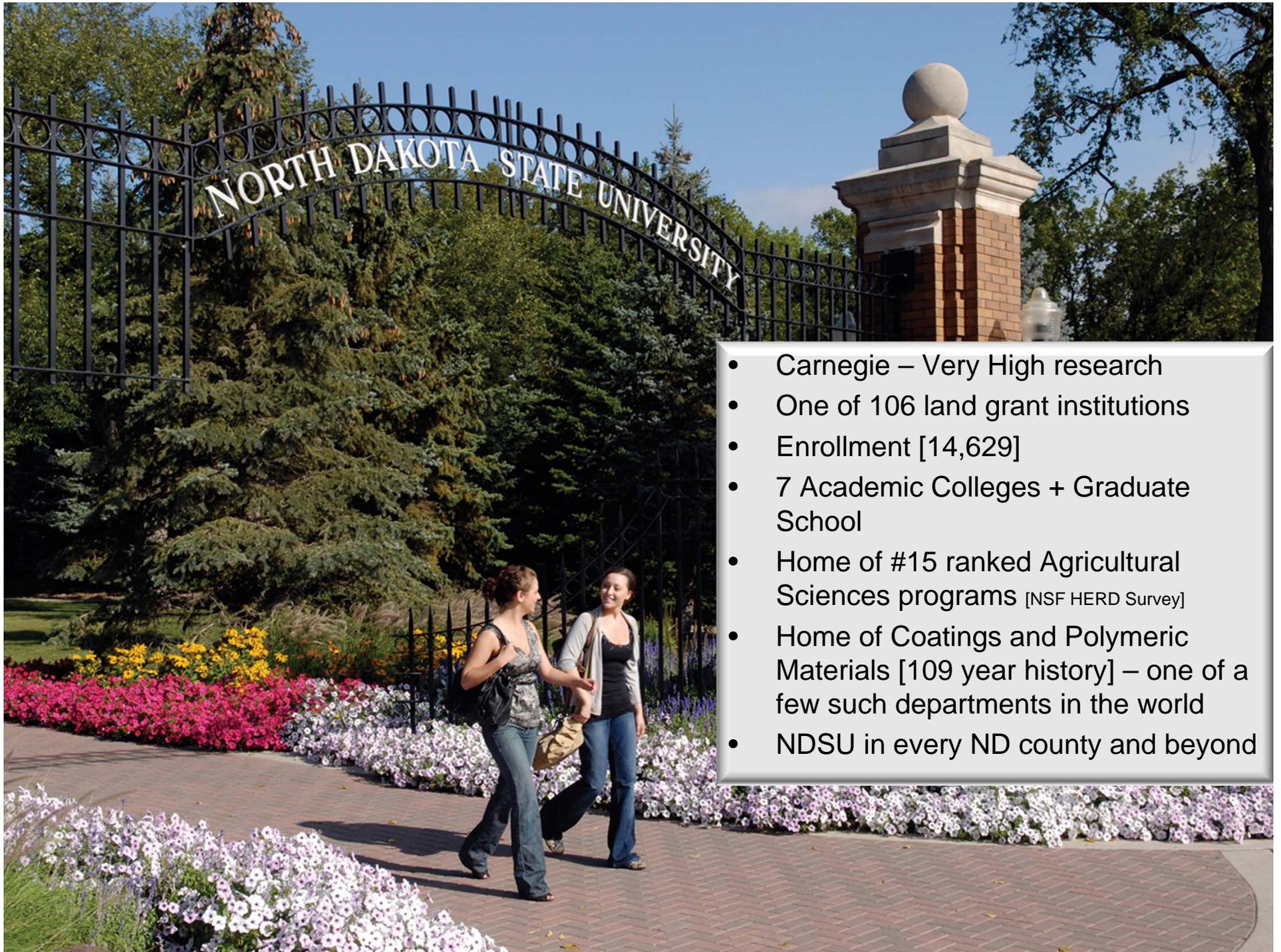
NDSU OFFICE OF
RESEARCH AND CREATIVE ACTIVITY

NDSU RESEARCH IMPACTING THE STATE AND NATION

**Kelly A. Rusch
Vice President**

Joint Meeting of the Interim Higher Education Funding and Judiciary Committees

01/22/14



- Carnegie – Very High research
- One of 106 land grant institutions
- Enrollment [14,629]
- 7 Academic Colleges + Graduate School
- Home of #15 ranked Agricultural Sciences programs [NSF HERD Survey]
- Home of Coatings and Polymeric Materials [109 year history] – one of a few such departments in the world
- NDSU in every ND county and beyond



- **Historic Research Strengths**
 - Agriculture
 - Transportation
 - Coating and Polymeric Materials
 - Pharmaceutical Sciences/Nursing

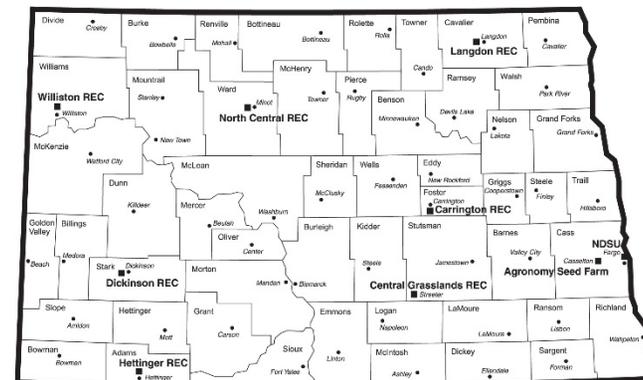
World Renowned Agricultural Sciences



“For the Land and Its People”

Strengths

- Plant genetics/pathology/seed stock
- Animal Science/livestock productivity
- Agribusiness/Applied Economics/Global markets
- Environmental [water/soil/air]
- Diagnostic Labs
- Bio-energy/bio-composites
- Precision Agriculture
- North Dakota Agricultural Weather Network
- The reach of the Research Extension Centers
- The reach of the Extension Service



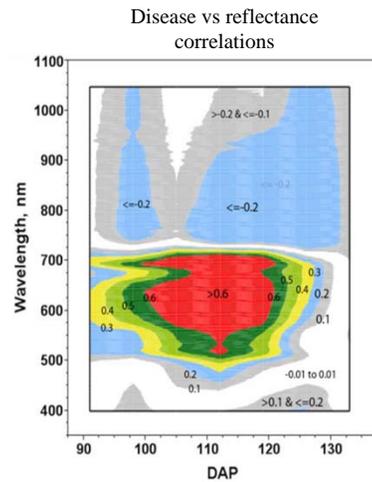
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Sreekala Bajwa
 Professor & Chair, Department of
 Agricultural & Biosystems
 Engineering
 College of Agriculture, Food
 Systems & Natural Resources



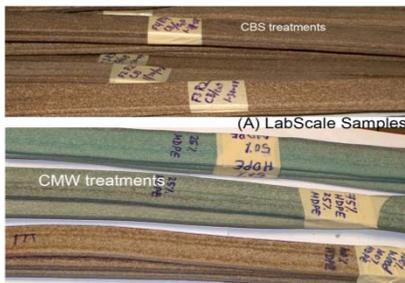
Elias Elias
 University Distinguished
 Professor, Department of Plant
 Sciences
 College of Agriculture, Food
 Systems & Natural Resources



Precision Ag: Soybean
 Disease monitoring



Durum wheat breeding



Bio-composites: natural
 fiber reinforced
 thermoplastics from value-
 added ag. waste



Disease resistance:
 Fusarium head blight

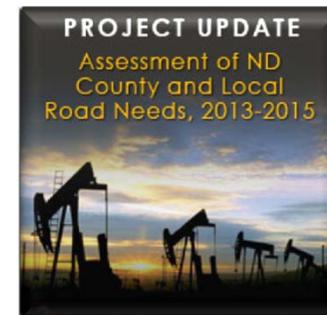
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Transportation

[focuses on highway, transit, rail, air and waterway issues]



- Storied history of providing results for the State
- UGPTI is in charge of or part of 4 University Transportation Centers grants
 - Transit center grant with South Florida as lead. Only two selected in the country to focus on transit
 - Rural and Small Urban Livability Center [Montana State is lead]
 - Mountain-Plains Consortium focused on multimodal transportation, energy, and sustainable development
 - Mountain-Plains Consortium focused on State of Good Repair



Small Urban and Rural Transit Center



Estimation of Railroad Capacity Using Parametric Methods



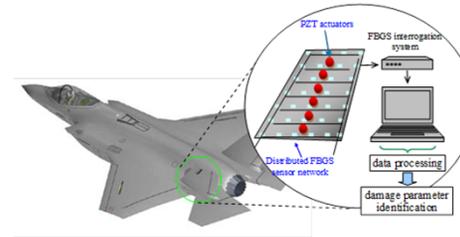


Yong Bai
 Chair and Professor,
 Department of Construction
 Management & Engineering,
 College of Engineering

Mijia Yang
 Assistant Professor,
 Department of Civil and
 Environmental Engineering,
 College of Engineering



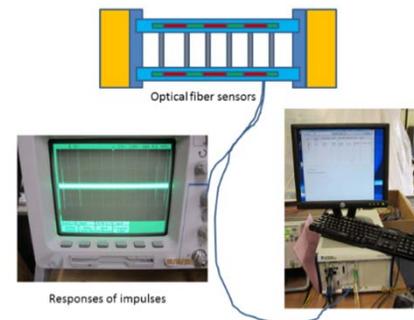
Highway work zone safety



Health monitoring over an aircraft through optic sensors



Infrastructure construction and maintenance



Suggested health monitoring system for bridges

Coatings and Polymeric Materials

From paint regulation
[1905] to polymeric
organic coatings as
surface protectants

Uniqueness

- The only formal program in the United States
- The only academic research focused on polymer organic coatings in the United States
- The oldest of three programs in the world
- Focus on polymeric coatings dates to 1905
- Department is a graduate program
- Undergraduates can receive a minor
- Example of close tie to industry

Coatings is a \$50-100 billion industry

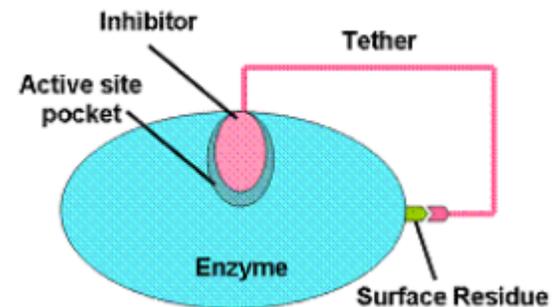
Pharmaceutical Sciences/Nursing

- Pharmacy was established in 1902
- New Master of Public Health – joint with UND – potential for collaborative research



Sanku Malik
Professor, Department of
Pharmaceutical Sciences

Less/non-toxic nanotechnology method for detection and inhibition of cancer; co-inventor with Dr. Srivastava - Biochemistry



Research Expertise

- Health Disparities Research – 2013 named a Hampton Faculty Fellow through Spirit of EAGLES
- Community-based collaborative action research
- Emic Collaborative Research with Native American Elders



Donna M. Grandbois, RN, Ph.D.
Assistant Professor
Department of Nursing





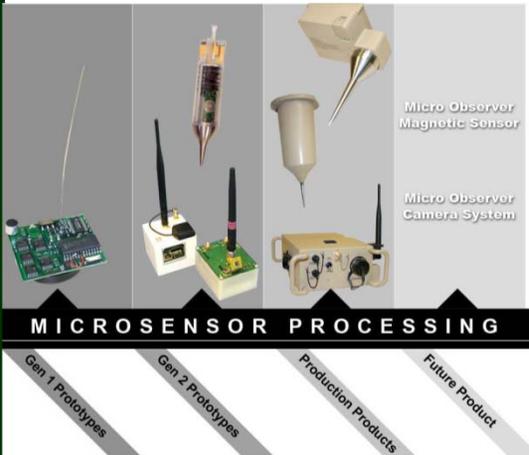
- **Recent Research Strengths**

- Nanoscale science and engineering
- High Performance Computing
- STEM Education Research
- EPSCoR/IDEA areas of emergence

Center for Nanoscale Science and Engineering



Electronics
miniaturization



MicroObserver
sensor systems



RFID tags in
cattle for an
animal health
project

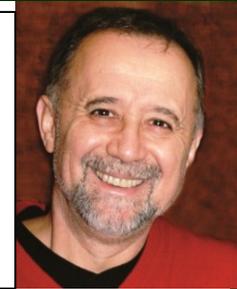
Areas of Expertise

- Wireless electronics and sensor design and fabrication
- Wireless electronics and sensor applications emphasis on packaging and miniaturization and RFID
- Laser enabled advanced packaging [LEAP]
- High-throughput experimentation for materials discovery, formulation and applications
- Protective coatings [anti-fouling, anti-microbial, anti-corrosion, anti-wear]
- Micro cold spray painting
- Flexible/printed electronics
- MicroObserver sensor systems





Dante Battocchi
 Associate Director, Center for
 Surface Protection; RCA and
 Adjunct Professor, Coatings
 and Polymeric Materials



Val R. Marinov
 Assoc. Professor, Ind. &
 Manufacturing Engineering
 Faculty Assoc., Center for
 Nanoscale Science & Eng.



Anti-ice coatings for wind
 turbines and UAS

Faculty Start-up: Co-
 founder of Elinor
 Specialty Coatings



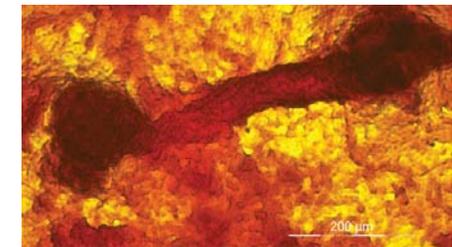
World's first RFID
 "banknotes": a chip-in-paper
 concept realized using LEAP.
 The image at the bottom is a
 backlit photo clearly showing
 the embedded RFID antenna
 and chip.

Faculty Start-up: Uniqarta

Co-inventor of Mg-rich
 primers for corrosion
 protection – licensed to
 Akzonobel Aerospace



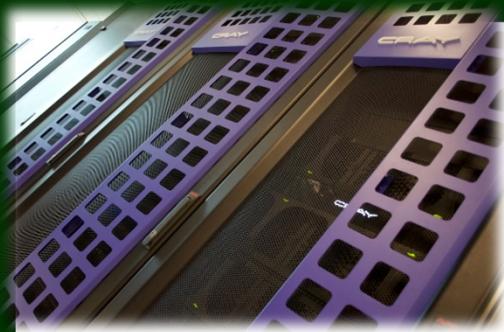
Formation of large bone
 nodule on a nanoclay
 scaffold – using clay to
 make human bones



Gordon Bierwagen
 Professor, Department of
 Coatings and Polymeric
 Materials, Director, Center for
 Surface Protection

Kalpana Katti
 University Distinguished
 Professor, Department of Civil
 and Environmental
 Engineering

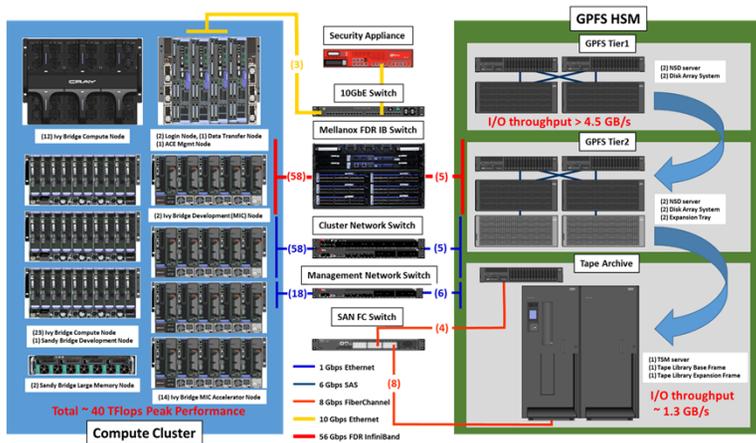




Center for Computationally Assisted Science and Technology (CCAST)



- On-ramp to leadership-class national facilities: XSEDE (NSF), INCITE (DOE), and OSG (NSF/DOE)
- 114 active users
- Currently 11 million scheduable CPU hours/year
- 8.3 million hours used in 2013



Next-generation Data-intensive Cyberinfrastructure for Research and Education (DICRE)

DICRE Architecture:

- “Oversized” tiered parallel file systems (~750 Terabytes) and active-archive (near-line) tape storage (~4 Petabytes)
- ~1,500 compute cores (processors)
- ~40 Teraflops and ~18 million scheduable CPU hours/year



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STEM Education

Bradley Bowen, Ph.D.
Assistant Professor, School of
Education
College of Human Development
and Education

Research Expertise

- Engineering Education
- Project-Based Learning
- K-12 Teacher Professional Development
- Simulation Modeling



STRUCTURES_{2.0}

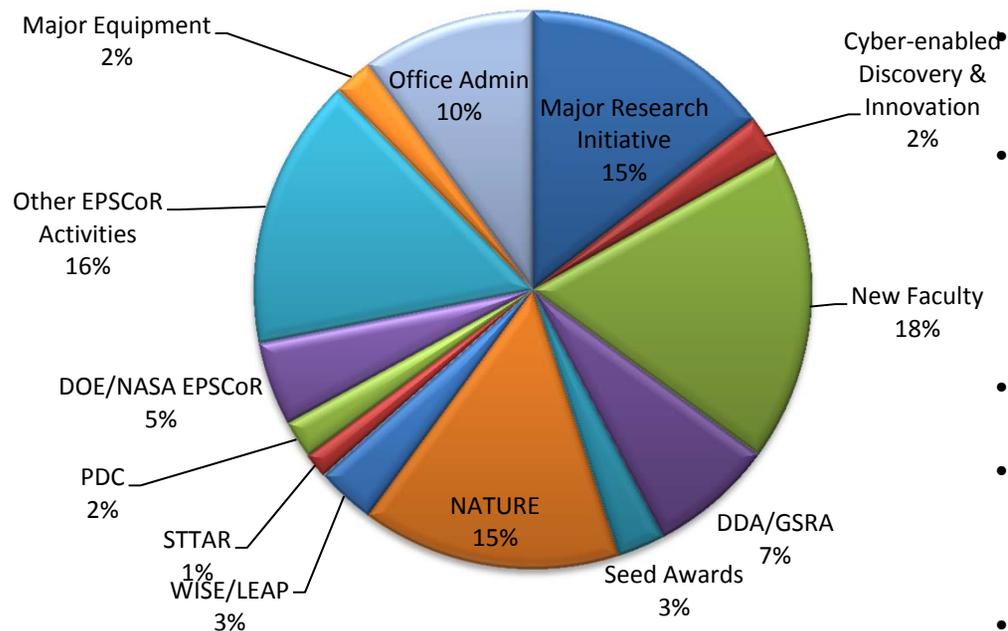


Engineers know their science – that's for sure. But they also have great tools to help them visualize their design in 3D. In this section, you'll build 3D models on screen and quickly choose between various truss types, materials, and sizes.

EPSCoR/IDEA

Critical to Building the State's Capacity

NDSU EPSCoR Funding by Program 9/1/08-Current



- 44 New Faculty have been supported through the New Faculty Startup Program
- 31 Doctoral Dissertation Assistantships awarded
- 17 Graduate Student Research Assistantships awarded
 - For students from ND's 4-yr institutions and Tribal Colleges pursuing graduate degrees
- 13 Seed Awards
- 28 LEAP/WISE Awards (relationship with NDSU ADVANCE FORWARD program) – for seed or bridge research funding and lab renovations
- 25 NASA/DOE EPSCoR Awards
- Supported deployment of 10 Gbps connections to buildings and desktops and single mode fiber optic cable to 30 NDSU buildings

NIH IDEA – NDSU has 2 Centers of Biomedical Research Excellence:
 Center for Visual and Cognitive Neuroscience [\$21.6M]
 Center for Protease Research [\$24M]

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ND Centers of Excellence

COEs/COREs

COE/CORE

COE/CORE #: 15

COE/CORE \$: \$34,417,500

Industry #: 73

Matching/leveraged funds \$: \$60,725,772

- Center for Surface Protection
- Center for Advanced Electronics Design & Manufacturing
- Center for Biopharmaceutical Research and Development
- Center for Life Sciences and Applications
- Center for Advanced Technology Development & Commercialization
- Center for Integrated Electronic Systems
- Oilseed Development Center of Excellence
- Center for Sensors, Communications and Control
- Center for Technologically Innovative Products and Processes
- Technology Incubator
- Beef Systems center of Excellence
- Center for Bio-based Materials Science and Technology
- Limited Deployment Cooperative Airspace Project
- Materials and Nanotechnology Center
- R1A

R&D Corporate Partners

Local to Global Companies

- American Crystal Sugar
- Appareo
- BASF
- Bobcat/Doosan Infracore
- Caterpillar RDL
- Datacom International, Inc.
- Killdeer Mountain Mfg,
- Monsanto
- Pedigree Technologies, Inc.
- Phoenix International
- Space Age Synthetics, Inc.
- Sanford Health
- Technology Appl. Group
- Triton Systems, Inc.
- Valspar
- 3M
- Akzo Nobel
- Arkema
- Bayer
- Cargill
- CertainTeed
- Dow Chemicals
- DuPont
- Hercules/Ashland
- Hempel
- Honeywell
- INVISTA
- Nissan Chemical
- Peregrine Semiconductor
- Pfizer
- Pioneer
- PPG Industries
- Sherwin Williams
- Starkey Labs
- Syngenta
- Symyx
- Tessera
- Textron Defense

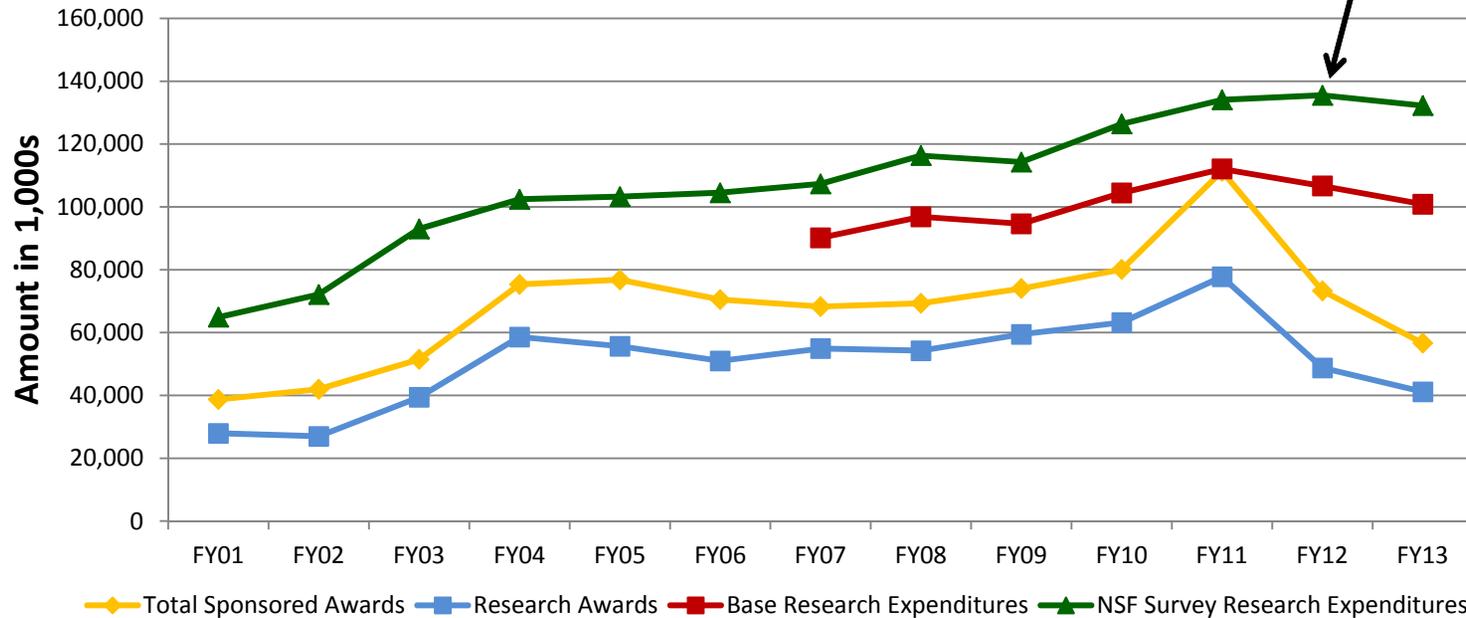
This is not an
exhaustive list

Funding and Expenditures

[A look back]

NDSU Sponsored Awards & Research Expenditures
FY 2001- FY 2013

FY2012 Rank:
#128 – total \$
#94 – non-medical school \$
#48 – no medical school



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NDSU.....The Future

A globally-renowned, land-grant instilled, innovative, creative and scholarly human enterprise that solves the grand challenges of today, anticipates those of tomorrow and impacts the social and economic well-being of the State, Region, Nation and World.

We are Aligned with the State's Vision

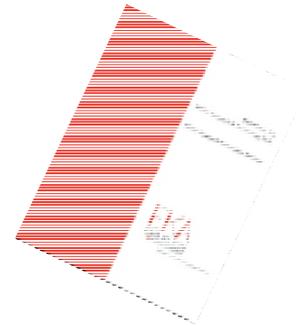


- Advanced manufacturing
- Technology-based business
- Value-added agriculture
- Energy
- Health
- Arts/culture
- Transportation
- Workforce development

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We are Strengthening our Partnerships

- Building upon existing partnerships
 - Research and Technology Park
 - Research Foundation
 - Fargo-Moorhead Economic Development Corporation
 - Valley Prosperity Partnership
 - State Department of Commerce [Centers of Excellence and Research ND Programs]
 - Corporate partners to expand translational research opportunities
 - Moving EPSCoR forward with stronger research ties to TCU and PUI entities



We are Positioning the University to Respond to Grand Challenges and Emerging Areas of Opportunity

- Building on existing strengths
- Growing Interdisciplinary programs [not exhaustive]
 - Emergency management
 - Transportation & logistics
 - Materials and nanotechnology
 - Environment and conservation sciences
 - Biomedical engineering
 - Sustainable materials
 - STEM education and research
 - Public health

Potential Grand Challenge Areas

- Food systems and security
- Healthcare and wellness
- Energy/environment/social trifecta

Emerging Areas of Opportunity

- UAV
- Informatics
- Digital mobile health

We are Positioning the University to Respond to Grand Challenges and Emerging Areas of Opportunity

- Identifying areas of emerging strength
- Developing a foundation to attract federally funded centers
- Cultivating a long-term value proposition with companies
- Cultivating a long-term value proposition with State entities

Potential Grand Challenge Areas

- Food systems and security
- Healthcare and wellness
- Energy/environment/social trifecta

Emerging Areas of Opportunity

- UAV
- Big Data/Informatics
- Digital mobile health

NDSU UAS-related R&D Activities and Commercial Applications in NP UAS TS:

- **Precision agriculture**

- Crops – management, harvest, etc.
- Livestock -- management, etc.



- **Technologies to improve UAS performance & safety**

- New protective & functional coatings & other materials for UAS & civil aircraft, e.g., anti-icing coatings, anti-corrosion coatings, etc.
- Avionics for UAS & civil aircraft, e.g., “sense and avoid” microelectronics

- **“BIG DATA” → UAS-based commercial applications**

- Analytical algorithms, informatics (“data mining”), etc.

- **Transportation infrastructure and logistics**

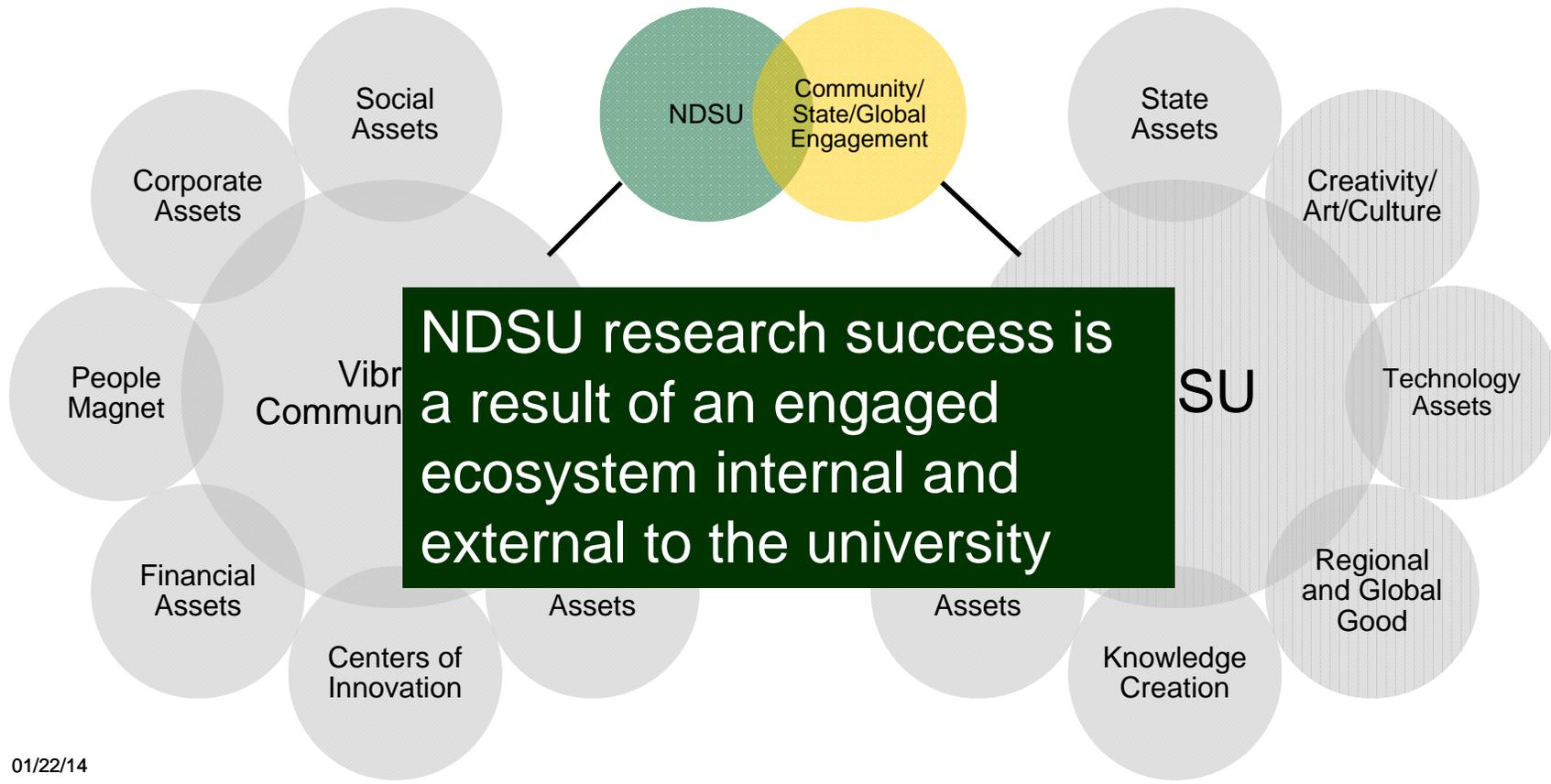
- Oil/gas drilling, pipelines, etc.
- Highways
- Railways



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NDSU is a Metropolitan, Land-grant, Research University

- Technology creation and transfer
- Knowledge creation and transfer
- Cultural creation and transfer



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