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 and Judiciary Committees

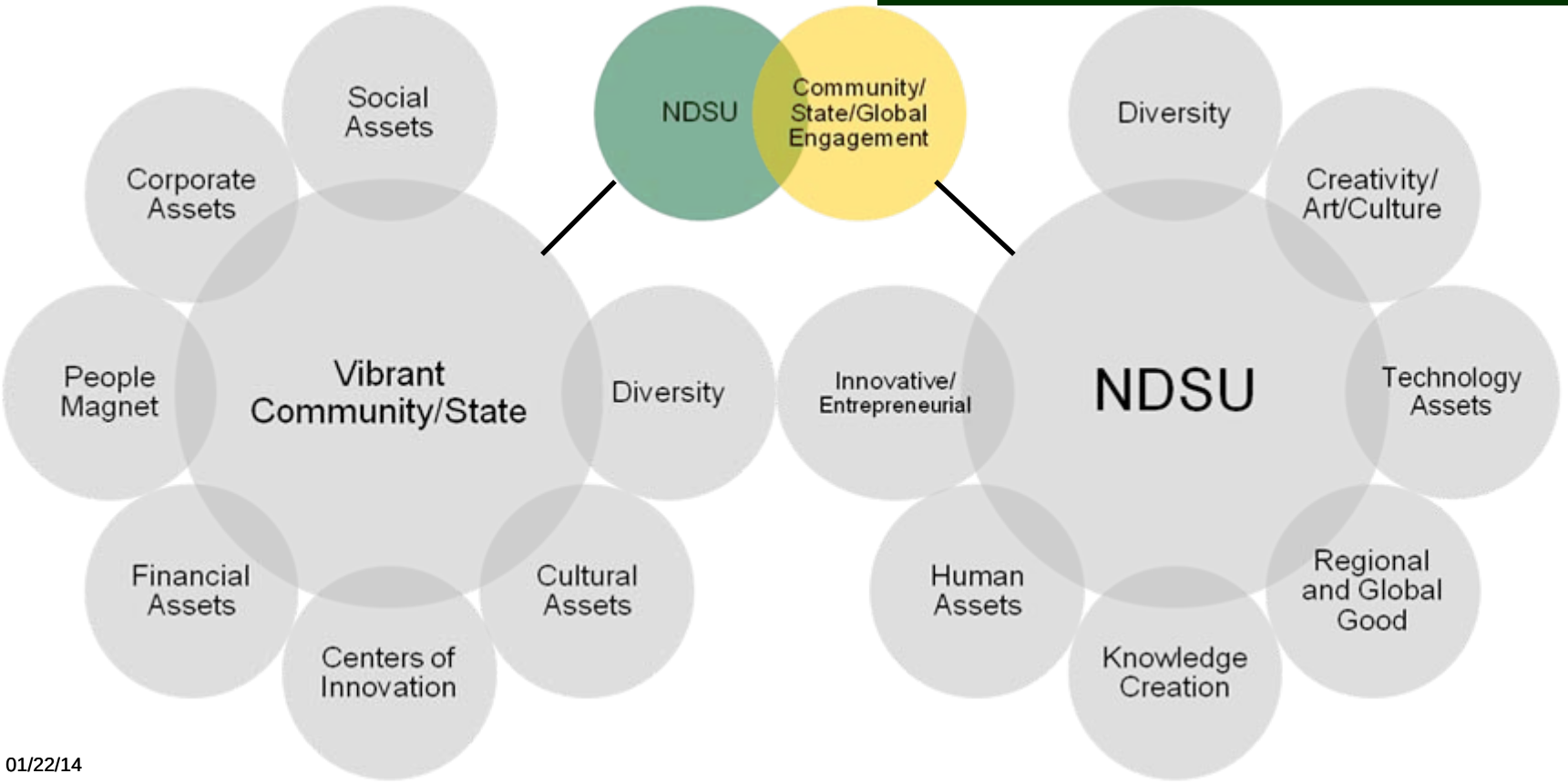
01/22/14

- 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

NDSU is a Metropolitan, Land-grant, Research University

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

NDSU research success is a result of an engaged ecosystem internal and external to the university



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

World Renowned Agricultural Sciences

"For the Land and Its People"

Strengths

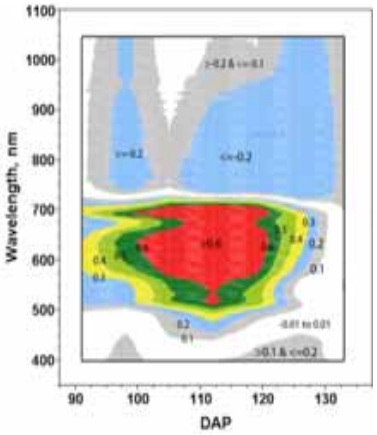
- Plant genetics/pathology/seed stock
- Animal Science/livestock productivity
- Agribusiness/Applied Economics/Global markets
- Environmental [water/soil/air]
- Diagnostic Labs
- Bio-energy/bio-composites
- Precision Agriculture
- North Dakota Agricultural Weather Network
- The reach of the Research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

NDSU

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

Disease vs reflectance correlations



Precision Ag: Soybean Disease monitoring

Durum wheat breeding

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

Disease resistance: Fusarium head blight

Transportation

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

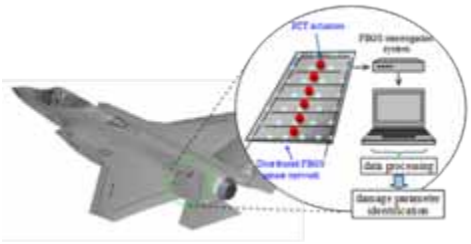
- Storied history of providing results for the State
- UGPTI is in charge of or part of 4 University Transportation Centers grants
  - Transit center grant with South Florida as lead. Only two selected in the country to focus on transit
  - Rural and Small Urban Livability Center [Montana State is lead]
  - 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

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

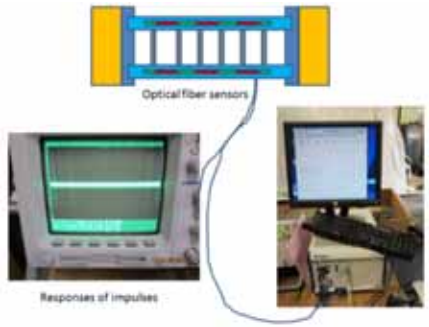
Mijia Yang
Assistant Professor,
Department of Civil and Environmental Engineering,
College of Engineering

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 Mallik
Professor, Department of Pharmaceutical Sciences

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

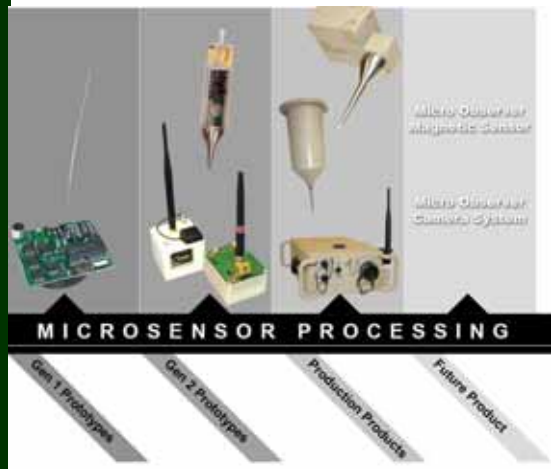
Research Expertise

•Health Disparities Research
•Community-based collaborative action research
•Emic Collaborative Research with Native American Elders

- **Recent Research Strengths**
  - Nanoscale science and engineering
  - High Performance Computing
  - STEM Education Research

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

ND Centers of Excellence

COE/CORE

COE/CORE #: 15

COE/CORE $: $34,417,500

Industry #: 73

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

COEs/COREs

- 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

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

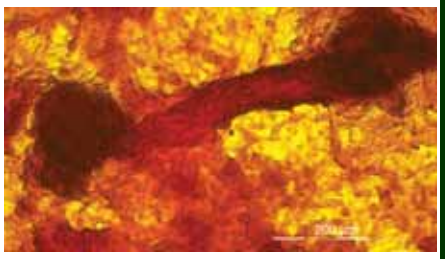
Faculty Start-up: Co-founder of Elinor Specialty Coatings

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

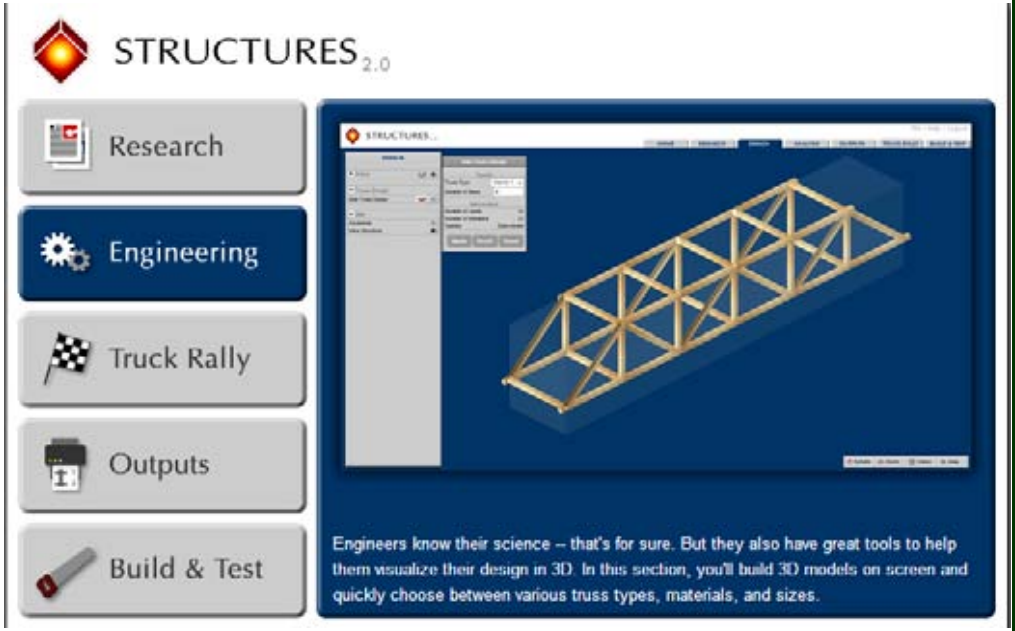
NDSU

STEM Education

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

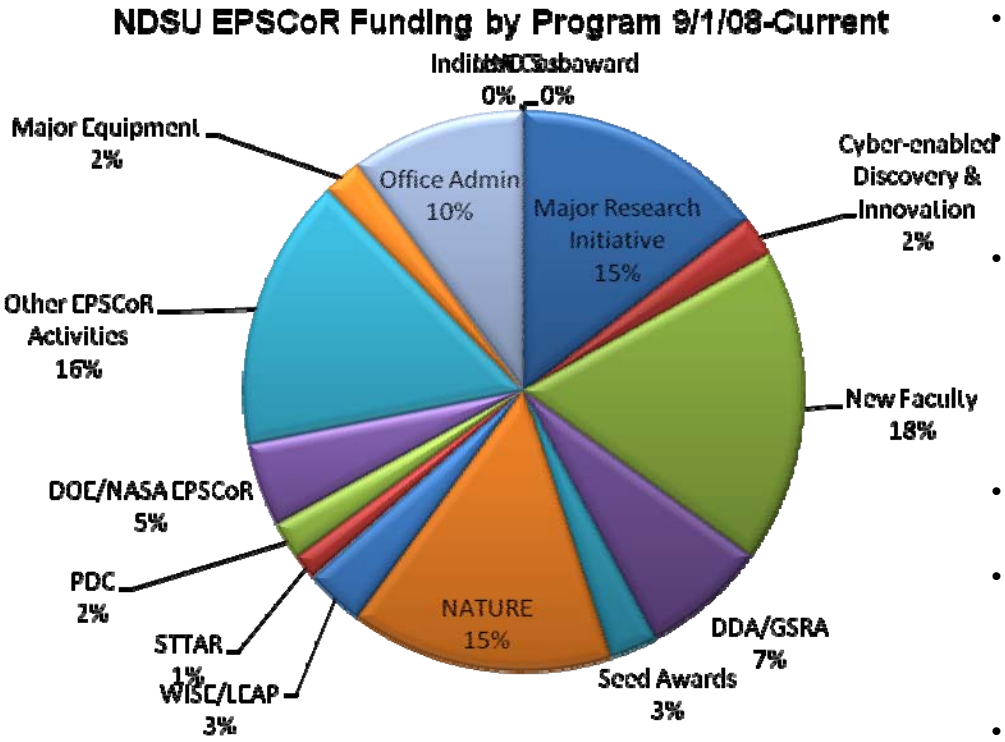
Research Expertise

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



EPSCoR/IDEA

Critical to Building the State's Capacity



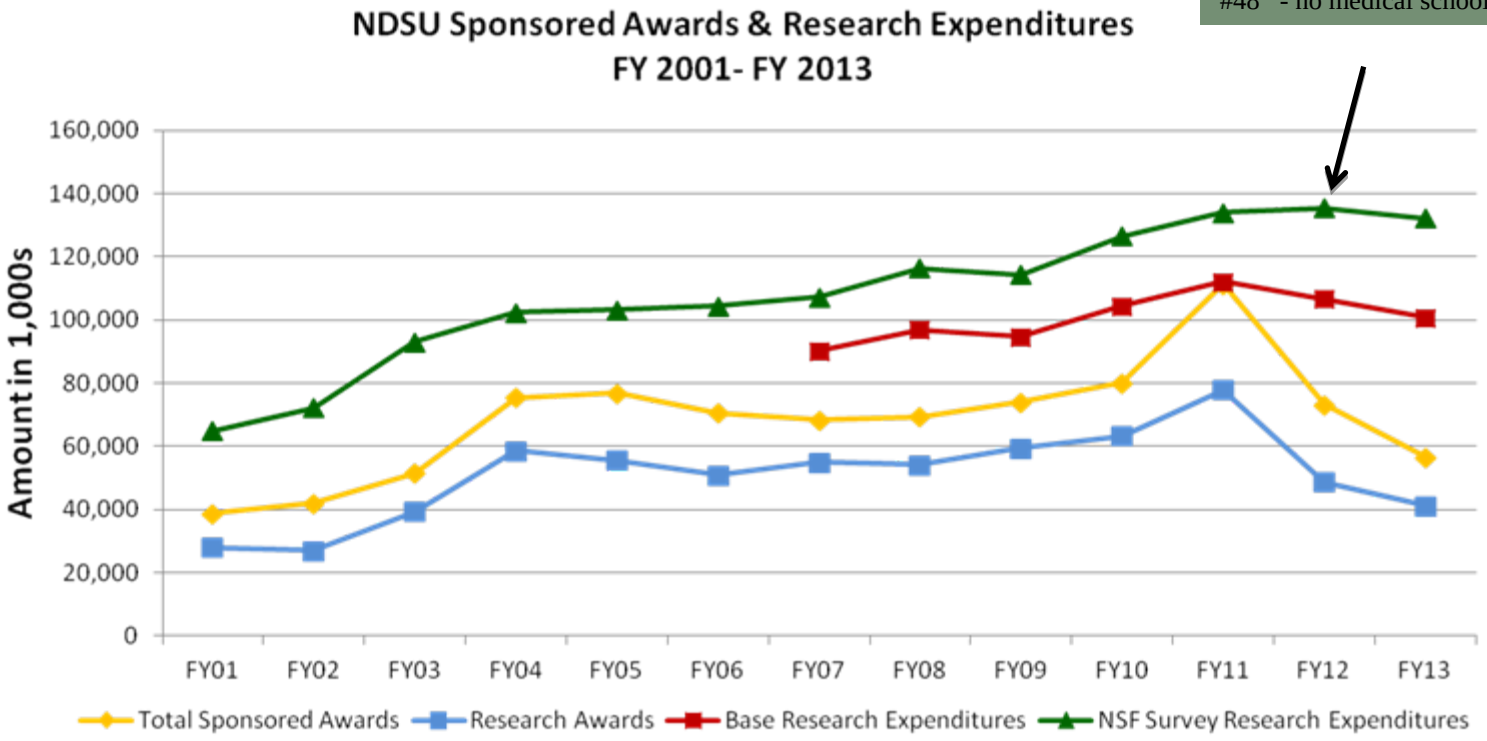
NIH IDEA – NDSU has 2 Centers of Biomedical Research Excellence:
Center for Visual and Cognitive Neuroscience [$21.6M]
Center for Protease Research [$24M]

- 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

Funding and Expenditures

[A look back]

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



NDSU

NDSU……The Future

A globally-renowned, land-grant, 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
- Tourism
- Energy

- UAS
- Workforce development

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

- 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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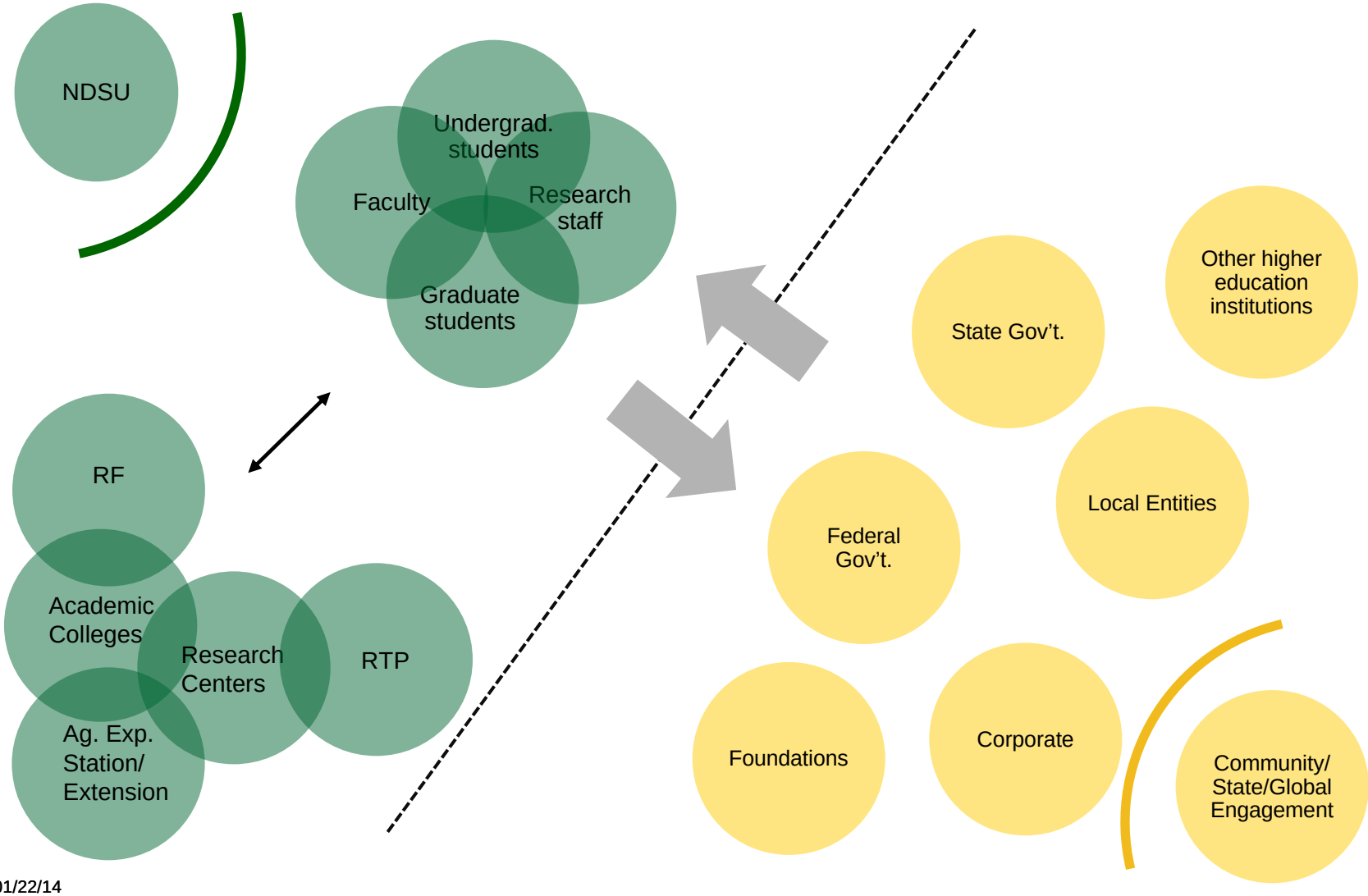
Collaborations Lead to Success



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