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CASE Mission

CASE capitalizes on our cross-disciplinary strengths in science and engineering by

- educating undergraduate and graduate students to become future leaders capable of addressing significant scientific and technological issues that challenge our world

- conducting original research related to earth, energy, materials and the environment
CASE Vision

CASE will become an international leader in interdisciplinary research and education as it operates at the intersection of science and engineering.

From a recent MME PhD candidate:

"I believe the CASE initiative is a great idea; I have been consistently faced with challenges that require a multidisciplinary approach to problem solving since leaving Mines. It is increasingly important to prepare students for real world scenarios where cross functional ability and collaboration is required."
CASE Departments and Programs

Departments

- **Chemical and Biological Engineering**
  - BS, MS, PhD in Chemical Engineering
  - BS in Chemical and Biological Engineering

- **Chemistry and Geochemistry**
  - BS, MS, PhD in Chemistry
  - MS, PhD in Applied Chemistry
  - MS, PhD in Geochemistry

- **Metallurgical and Materials Engineering**
  - BS, MS, PhD in Metallurgical and Materials Engineering

- **Engineering Physics**
  - BS in Engineering Physics
  - Various joint BS/MS degree options
  - MS, PhD in Applied Physics

Programs

- **Materials Science (CBE, CH, ME, MME, PH)**
  - MS, PhD in Materials Science

- **Nuclear Science and Engineering Program (AMS, CEE, CH, ME, MME, PH)**
  - MS, PhD in Nuclear Science and Engineering
CASE: Who We Are

- Includes legacy and more modern science and engineering departments with emphasis on educational pedagogy and both fundamental and applied research.

- In FY14 CASE accounted for:
  - 26% of undergraduate majors (34% female)
  - 26% of the graduate students (42% of PhDs)
  - 26% of the credit hour delivery (excluding 700-level courses)
  - 32% of the faculty
  - 47% of the research awards (29% non-federal)
  - T/TT faculty growth from 79 to 90 in last 3 years
CASE Undergraduate Students Fall 2014
1108, 26% of Campus Total

Chemical and Biological Engineering, 634, 57%
Metallurgical and Materials Engineering, 154, 14%
Chemistry, 83, 8%
Physics, 237, 21%
CASE Graduate Students Fall 2014
339, 26% of Campus Total (42% of PhDs)
CASE Research Awards FY 14
$24,772,872, 47% of Campus Total

- Physics, 6,488,354, 26%
- Chemical and Biological Engineering, 7,079,637, 29%
- Metallurgical and Materials Engineering, 7,444,377, 30%
- Chemistry and Geochemistry, 3,760,504, 15%
CASE College Faculty FY 14
86.5, 32% of Campus Total

- Physics, 23.8, 27%
- Metallurgical and Materials Science, 20, 23%
- Chemical and Biological Engineering, 24.5, 28%
- Chemistry and Geochemistry, 20, 22%
CASE Credit Hour Delivery FY 14
37,332, 26% of Campus Total

- Physics, 13052, 35%
- Metallurgical and Materials Science, 3989, 11%
- Chemical and Biological Engineering, 8736, 23%
- Chemistry and Geochemistry, 11545, 31%
- CASE Admin., 11, 0%
Chemical and Biological Engineering

Existing Strengths/Programs of Distinction

- Recognized for research in hydrates, energy, soft materials, biomedical research, thin-film materials, simulation and modeling
- High research activity
- Excellence in instruction/advising/pedagogy

Emerging Strengths/Opportunity Areas

- Stronger research presence in the chem-bio area due to new T/TT hires

Weaknesses/Threats

- High undergraduate enrollment that must be managed effectively
- Need to improve undergraduate experience
- Need to improve graduate education experience
- Retention of high performing faculty

Critical Needs/Initiatives

- Tenure track lines to bring faculty/student ratios in line with our peers
- Technician support to maintain the CBE teaching laboratories
- Recent initiative to develop a new studio biology classroom
Chemistry and Geochemistry

Existing Strengths/Programs of Distinction
- Recognized for research in biofuels, soft and nanomaterials
- Campus locus for molecular bioscience
- High research activity, tripling in past 5 years
- Leader in diversity (~50% UG & 35% faculty female)

Emerging Strengths/Opportunity Areas
- Strong growth in UG biochem track / pre-health majors
- PhD program doubled in past 5 years
- Strong ties to NREL; 2 faculty joint appointments
- Excellent radiochemistry faculty hires

Weaknesses/Threats
- Space pressure & fragmentation (in 4, soon to be 5 buildings)
- Retention of high performing faculty
- Need to improve graduate recruiting / experience

Critical Needs/Initiatives
- Support demand growth & strategic opportunity in bio
- Recent initiative to restructure Freshman Chemistry for content (Materials Chemistry flavor) and pedagogy (active learning/studio)
Metallurgical and Materials Engineering

Existing Strengths/Programs of Distinction
- Strong research activity
- Strong industrial support
- Highly sought at both UG and Grad levels
- Few materials departments in the US have maintained strengths in traditional areas – referred to as “national treasure” by VC

Emerging Strengths/Opportunity Areas
- Part of several recent large national initiatives
  - Critical materials institute (CMI)
  - Lightweight Innovation for Tomorrow (LIFT)

Weaknesses/Threats
- Loss of faculty to retirements, tenure, etc. (loss of core competencies)
- Minimal polymers, electrical properties, biomaterials and computational modeling currently in MME – how to maintain strengths in core (legacy) areas while also hiring into new areas needed to serve our students

Critical Needs/Initiatives
- Faculty hire in the chemical metallurgy area to support CMI, CR³, etc. – especially critical given recent faculty loss and pending retirements (aP search ongoing)
- Strategic hire in the computational materials area
- Develop more effective partnerships across campus
Physics

Existing Strengths/Programs of Distinction

- Condensed matter science (emphasizing renewable energy and nanotechnology)
- Applied optics (directed toward femtosecond laser phenomena and imaging)
- Applied subatomic physics (organized around studies of unstable nuclei and cosmic rays)
- Nationally-recognized undergraduate program including Studio Physics which handles a large number of students

Emerging Strengths/Opportunity Areas

- Nationally-recognized graduate program
- Best teaching practices in both UG and grad program
- Enhancing expertise and topics in our three focus areas

Weaknesses/Threats

- Little diversity (no female T/TT faculty)
- Loss of Experimental Condensed Matter faculty (retirements, reassignments, etc.) threatens core teaching and research

Critical Needs/Initiatives

- Faculty hire in Experimental Condensed Matter (most critical)
- Funding for an electronic technician and a machinist
- Funding to support best teaching practices - upper level
- Expanded student hourly Learning Assistant budget
- Support for graduate students and recruitment efforts
Materials Science

Existing Strengths/Programs of Distinction
- Interdisciplinary program (CH, MME, PH, CBE, ME, etc.)
- Substantial fraction of grad enrollment and degree production
- Strong ties to NREL and NIST
- Courses taught by faculty from multiple departments
- Attracts high quality grad students

Emerging Strengths/Opportunity Areas
- Part of several large national initiatives
  - Materials Innovation Platform (NSF-MIP proposal)
  - Partial impetus for funding of CoorsTek Interdisciplinary Center

Weaknesses/Threats
- Challenges with no home department
  - Teaching assignments from different departments
  - Different requirements for students
  - Confusion between degrees in Materials Science and MME

Critical Needs/Initiatives
- Pursuing Materials Innovation Platform (NSF-MIP proposal)
- Developing International Center for Materials Characterization with NREL as part of effort to establish Joint Energy Research Institute (JERI)
- Need larger annual budget and long-term strategic plan
- Need TA/Fellowship support
Nuclear Science and Engineering

Existing Strengths/Programs of Distinction

- Interdisciplinary program (AMS, CH, ME, MME, PH) with unique and focused emphasis
- Very strong ties to National Labs (Idaho, Argonne, Los Alamos) and USGS
- Unique facilities on and off campus (Radiochemistry Labs, USGS Reactor, Nuclear Materials Labs)

Emerging Strengths/Opportunity Areas

- New Radiochemistry Focus
- Safeguards and Nuclear Forensics
- Nuclear System Design and Operation

Weaknesses/Threats

- Challenges with no home department
  - Balancing teaching needs of program with those of the home departments
  - Balancing cultures, expectations, and requirements of constituent departments
- Need to increase enrollment
  - RA's supported by research/fellowships
  - Non-thesis programs can increase enrollment

Critical Needs/Initiatives

- Avenue to replace retired expertise in nuclear materials
- Maximize opportunities for faculty research cooperation
- Harness interdisciplinary nature of program to increase enrollment while growing research portfolio
- Maintain access to reactor support funds/fuel
CASE Strengths and Opportunities

- **Strong research productivity**
  - $>400K per T/TT faculty (small fraction from research faculty)
  - Considerable growth in graduate student population

- **Interdisciplinary combination of departments**
  - Unique college structure that can be capitalized on

- **Part of several national initiatives**
  - CMI, LIFT, Institute for Advanced Composites Manufacturing Innovation

- **Existing strengths/programs of distinction**
  - MME considered a “national treasure” by visiting committee
  - Various centers of renown
    - Steel Center, Hydrate Center, REMRSEC, CIEMACS, NUSEC
    - Solid UG education – studio bio, studio physics, etc.

- **Emerging strengths/opportunity areas**
  - Computational materials (materials genome)
  - Biosciences and bioengineering
  - Advanced manufacturing initiatives
  - CoorsTek – ICMC and interdisciplinary laboratories

- **Recent success with endowed chairs**
  - Grandey chair in Chemistry
  - ABS chair in MME
CASE Weaknesses and Threats

- **Non-uniformity in contact hours, course assignments, etc. across and within departments**
  - Efforts underway to examine and address issues – desire to facilitate research productivity and continue to improve the undergraduate experience

- **Lack of institutional strategic planning in certain areas**
  - Computational Materials (Genome)
  - Bioscience and Bioengineering
  - Materials Science
  - Nuclear Science and Engineering
  _Note: In several of these areas, we’ve hired some excellent faculty but it is unclear that the institution has a plan for what we want to look like in 10 years_

- **Limited technical and support staff**
  - Compared to our peers – less support for research-active faculty – pending changes in overhead return policies may allow us to address?

- **Challenges with unique structure of CASE**
  - Will our unique structure be considered a strength or a weakness?
CASE Initiatives

- **Lead the creation of the Joint Energy Research Institute with NREL**
  - Incentivize center by providing/developing prestigious graduate student and post-doctoral fellowships in order to attract the very best to the institute *(Mines deans and VPRTT beginning discussion and will involve NREL shortly, hope to have a plan in place in 6-12 months)*

- **Lead Materials Genome (MG) efforts across CASE and beyond - determine strengths and weaknesses and what is needed for Mines to capitalize on MG opportunities**
  - Build on recent successes in the Advanced Manufacturing Initiatives – Matlock (ASPPRC) in the Lightweight Innovations for Tomorrow and Dorgan in Institute for Advanced Composites Manufacturing *(Initiated discussions among computational faculty, strategy for education and research in 6-12 months)*

- **Build reputation based on interdisciplinary uniqueness**
  - Only place in the country where Physics, Chemistry, Chemical and Biological Engineering and Metallurgical and Materials Engineering are all in one college
  - Capitalize on unique interdisciplinary nature of CASE – use for recruiting top undergraduate, graduate students and faculty *(Initiated discussion among DH’s; will engage new information specialist to move forward; hope to use new CoorsTek center as central focus/impetus)*

- **Develop institutional infrastructure for large user facilities**
  - Assess how Mines can position itself to better capitalize on the federal opportunities that currently exist in the advanced manufacturing arena?
    - Short-term: Institutional investment in technical staff to support the ICMC (International Center for Multiscale Characterization) which will become a showcase facility in the new CoorsTek building *(this budget cycle?)*
    - Long-term: Develop a strategy for using cost recovery to cover salaries and benefits of these staff *(will develop appropriate proposals)*
CASE Initiatives - 2

- Develop CASE/Mines strategy for pursuing large interdisciplinary funding
  - Work with VPRTT office to identify and/or create funding opportunities (ongoing)
  - Reward faculty for pursuing and garnering high visibility funding by
    - providing them with lower teaching loads (as appropriate)
    - supporting appropriate travel and other expenses (as appropriate)
    - providing appropriate administrative and budget support (possibly via new overhead return – 1-2 years)

- Develop CASE/Mines strategic plan for bioscience and bioengineering
  - Start with an assessment of where we’re at – faculty, areas of focus, etc. and where we want to be (vision) and determine, based on this assessment, how to achieve this vision (6 months for vision and strategy for 5-10 year plan)

- Develop a CASE/Mines strategic plan for nuclear science and engineering
  - Start with an assessment of where we’re at – faculty, areas of focus, etc. and where we want to be (vision) and determine, based on this assessment, how to achieve this vision (6 months for vision and strategy for 5-10 year plan)

- Extend educational pedagogy across CASE and Mines
  - Incentivize faculty to enhance their teaching efforts (ongoing)
CASE Immediate Needs (AY16)

- **Graduate Student Support**
  - Increased TA support
  - Increased fellowship support – need to make them competitive/elite in order attract the best and brightest

- **Departmental and Cross-Departmental Technician and Staff Support**
  - 1-2 technical people for characterization facility (ICMC)
  - 1 technician for mechanical testing – possibility of creating an “Innovative Materials Manufacturing Technology Test Bed”
  - Machinists and Electronic Technicians
  - Laboratory Technicians

- **Faculty Lines**
  - Existing searches: CBE – Coors Chair; MME – ABS Chair and aP, PH – aP, CASE – diversity hire
  - Off-cycle: PH/MME – Vladan Stevanovic (5)% NREL support)
  - AY16: As a minimum, replacements for retirements (3), resignations, failures in P&T (1) – need to update numbers.

- **Undergraduate Student Support**
  - Continued support for Research Fellowships
  - REU support – strong correlation of REU students applying to CSM for graduate school in both Physics (25%) and MME (15%)
  - Learning Assistant support

- **Space**
  - Co-location of departmental faculty in Physics and Chemistry
CASE Longer Term Resource Needs

- **Joint Energy Research Institute with NREL**
  - Seed funding for prestigious fellowships (grad and post-doc)
  - Faculty line (50% Mines – 50% NREL)
  - Administrative support (use REMRSEC infrastructure)

- **Computational Materials (Genome)**
  - Perform critical assessment of faculty expertise on campus (grass roots effort underway)
  - Use future hires to strengthen if institutional priority or significant funding success
    - B. Gorman leading $17M Materials Innovation Platform proposal that spans CASE and CECS faculty
    - T. Lowe leading initiative to develop unique “Innovative Materials Manufacturing Test Bed” (large equipment donation from Carpenter Technology)

- **Interdisciplinary Uniqueness**
  - Strategically assess how best to capitalize on
    - Materials science bridges the different departments – what gaps do we need to fill to truly capitalize on?
    - Bioscience/Bioengineering – less developed but it is in our future and institution needs to be strategic – resources will be required.
CASE Longer Term Resource Needs

- Institutional Infrastructure for Large User Facilities
  - Invest short-term in infrastructure for ICMC, Manuf. Test Bed, etc. with the longer term plan that they will become self-sustaining in 3 years.

- Pursuit of Large Interdisciplinary Funding
  - Recent successes are indications that CASE/Mines is well poised for such initiatives (REMRSEC, LIFT, CMI, etc.) – resources needed to support/enhance these efforts

- Strategic Planning for Bio, Computational Materials, Nuclear, etc.
  - Potential resources may be needed once strategic plans are developed keeping in mind that more faculty lines in one area will likely come at the expense of other areas

- Extend educational pedagogy across CASE and Mines
  - Limited incentives for faculty may be required/desirable
Thanks!!