UNIT REVIEW FOR CY 2014

Unit Name: Agricultural & Biosystems Engineering

Unit Head: Kitt Farrell-Poe

Date of review: March 23, 2015
A. Unit finance and business (10 min presentation + 10 min discussion)

1. Business personnel assessments
   Formal personnel assessments have not been conducted as the Business Center was just formed as a pilot project in August 2014.

2. Finance and budget – focus on overview of strengths and weaknesses of the unit financially
   **Strengths:** have better understanding of accounts; because new Business Center is more responsive and accurate, we should be better positioned for large grants; Operate the only CEA Teaching Lab in US supporting the highly valued [now being duplicated] CEA interdisciplinary engineering and science educational program which requires significant yearly operational costs [both a strength & weakness].
   **Weaknesses:** spending too much time on account management & not enough time on strategic planning; account deficits incurred by prior unit administration(s) has put serious constraints on our ability to support research efforts (lack of IDC funds to use for conference attendance, supplies, hiring, etc.)

3. New resource generation – specific opportunities you are exploring
   Increasing summer/winter courses; expanding outreach offerings (online minor); increase short course offerings that include venture companies investing in new urban agricultural food systems and connecting them with the growers who want to learn how to do it. UA-CEAC joins Hungry Planets, LLC, to partner with Arizona commercial/residential builders, economic development community, and educators statewide & regionally to develop programs to feed and employ the future by advancing controlled environment agriculture profitable production, technology, & education. [see notes]

4. How are business functions in your unit helping achieve the goal of being “the most effective, efficient, responsive, flexible, and financially sustainable college on campus”?
   We finally have an understanding of our accounts; our grants are more consistently submitted; there is a culture of trust that is being fostered between faculty/staff and the Business Center
B. Cooperative Extension (10 min presentation + 10 min discussion)
Total Extension FTE annually for the last 3 years (3 numbers): 2.50, 2.72, 3.09
Unit’s Extension outcomes and impact for stakeholders by individual program, in terms of economic impact (e.g. dollars and jobs), by individual program:

- Improving vegetable production through utilization of spike wheel liquid injection technology:
  - Applied nitrogen rates could be reduced 25% through use of point injection systems without negatively affecting crop yield.
  - Reducing sidedressed nitrogen rates by 25% would save lettuce growers approximately $30/ac, and if utilized on the roughly 50,000 acres of lettuce raised in Arizona, increase farm profits by approximately $1.5 million annually.
- Automated machines for thinning and intra-row weeding:
  - Program efforts helped get Aim/Shark (carfentrazone) labeled for use for automated thinning.
  - The product, which costs about $15/ac less to apply than other materials, was used to thin approximately 5,000 acres in 2014 saving growers approximately $75,000.
  - As compared to broadcast spraying, spot spraying reduces pesticide applications rates by over 90% and thereby, depending on the chemical applied, provides significant savings to growers (typically $23/ac). About 1,000 acres used this technique in 2014, saving growers $23,000.
- Onsite Wastewater Education:
  - 34 people in Cochise county had increased knowledge on how to manage their septic systems to prevent replacement
  - Conventional septic systems in Arizona typically cost around $5000. Knowing how to take care of your septic system can save the homeowner at least that much. 199 inspectors took classes that contributed to their eligibility to conduct Transfer of Ownership Inspections. A typical inspection costs between $250-$1000 depending on conditions at the site and tank. Another 19 out of 20 practitioners who took the Soil & Site Evaluation class became eligible to conduct soil & site evaluations. I do not know the cost of these evaluations, but 19 more jobs were created.
- Controlled Environment Agriculture: [see notes]
  - Since 2012 more than 20 acres of high technology greenhouses ($20M investment; 100 jobs created; Production = 0.6M lbs/acre/year tomatoes (or 300 ton/acre/year, 9x greater than in field)) were created in Arizona. Also, since 2012 indoor farms (a.k.a. Vertical Farms) using only artificial lighting have commercialized with one of the leading businesses producing lettuce and greens (1.7M heads/acre/year, more than 10x than in field)
B. Cooperative Extension (10 min presentation + 10 min discussion), cont’d

Describe the level of program integration (e.g. with county Extension programs, center programs, and stakeholders) of Extension programs in your unit:
Each program has medium-high levels of integration with their respective audiences.

Describe the level of integration between the research and Extension components of faculty programs in your unit:
Each program has medium-high levels of integration with their respective audiences.

Controlled Environment provides research in greenhouse design and operations, and crop production which are used in greenhouse business operations. For example, evaluation of greenhouse glazing (Kacira, Kubota); organic fertilization (Kacira, Jensen, Tollefson); tomato variety trials (Giacomelli, Jensen); Environmental control practices & systems design (Kacira, Giacomelli); New Crop production practices (Rorabaugh, Kacira, Kubota, Jensen, Giacomelli)
B. Cooperative Extension (10 min presentation + 10 min discussion), cont’d

Unit’s Extension **social outcomes and impact** by individual program:

- **Onsite Wastewater Education Program:**
  - 9 practitioners have increased knowledge about the issues and solutions for treating high-strength wastewater using onsite wastewater treatment systems.
  - 4 practitioners have increased knowledge on how to install, inspect, and provide O&M for onsite wastewater treatment systems that incorporate a mound soil treatment system.
  - 25 onsite practitioners have more knowledge about installing onsite wastewater treatment systems and are more knowledgeable about national standards for installing systems.
  - 19 practitioners have increased knowledge on designing onsite wastewater treatment and dispersal systems using Arizona regulations.
  - 21 people have a better understanding of their septic systems and the management needed to extend the life of their system. 20 participants rated it either Highly Valuable (19) or Valuable (1).

- **Controlled Environment Agriculture:**
  - 30 practitioners (5 in AZ) have increased knowledge about the issues and solutions for designing or operating greenhouse food production systems.
  - 40 practitioners (6 in AZ) have increased knowledge on how to transplant and grow within a non-recirculating top drip hydroponic tomato production system.
  - 35 people have a better understanding of their plant growth systems and the management of their system. 60% of participants rate the short course programs either Highly Valuable/Valuable.

- **Lunar Greenhouse-Outreach Teaching Module (LGH-OTM)** - from 2012 through 2014 the LGH-OTM has demonstrated controlled environment technology for Bioregenerative Life-Support. It is operated for Outreach/Extension and has been viewed (in display format or news media broadcast) by more than 2M people in San Diego, CA, Chicago, IL (at Museum & at Bio-Expo) and currently at Biosphere2 (100k people per year [See justification details in notes]

- **Earthlight Video** http://cals.arizona.edu/earthlight/ . The documentary produced by Cody Sheehy, featured interviews with NASA scientists, U of A researchers and students exploring the urgency of sustainable living and how projects like the lunar greenhouse are key to maintaining our planet. “Earthlight” premiered at the Loft Cinema in Tucson July 2014 (200 people) in honor of the 45th year anniversary of the Apollo landing. It was shown by AZ Public Media on Arizona Illustrated (4 times estimated 100,000 people). It currently headlines displays at Biosphere2 in AZ (100k visitors per year), and at Botanical Gardens of Padova, Italy (??k visitors per year). Its YouTube video has been viewed more than 14,000 times.

- **Short Courses.** Four short courses provided knowledge, experience and planning opportunities for 100 - 120 attendees each year. Provides direction and information to support decision-making on start-up operations, greenhouse technology design and operations. Advise 50 small business developers annually.
Unit’s Extension summary in one or two sentences:
The department is working on increasing our Extension visibility on our website and communications to the department. Each program is contributing to the strategic planning of 3 of our 4 emphasis areas (Controlled Environment Agriculture; Food, Bioproducts, & Renewable Energy; Water Resources) – see ABE strategic plan.

Provide copies of peer review reports and unit head reviews for each CE faculty (as attachments with review presentation)
List company, corporation or industry interactions with Cooperative Extension in your unit this past year including advisory boards, individual faculty/industry research projects, and classroom or curricular participation.

*Company, Corporation or industry interactions:* Kress Umweltschonende Landtechnik, Vaihingen, Germany (industry cooperator); Aztera LLC, Tucson, AZ (industry cooperator interested in licensing UA Automated Thinner Technology); Top Flavor Farms, Inc., Bard, CA (grower cooperator); Yuma Fresh Vegetable Association, Yuma, AZ; Lufa Farms, Rooftop greenhouse, Quebec City, Quebec, Canada; VFT Global, LLC, Vertical Farm Technologies, New York City, NY; Hungry Planets Sales & Services, Michael Munday, Tucson, AZ; Green Sense Farms, Robert Colangelo, Portage, IN; Green Planet Group, Jim Scheonberger, jschoenberger@greenplanetgroup.com, Ed Lonergan, founder and CEO; Inda-Gro, Darryl Cotton, Lighting Systems; Wholesum Harvest Farms, Theo Crisantes, Greenhouse Vegetables; [more listed in notes section]

*Advisory boards:* ABE Industrial Advisory Board, AZ Dept of Environmental Quality Onsite Wastewater Advisory Committee, AZ Departments of Environmental Health Services Assn Onsite Technical Advisory Group

*Classroom or curricular participation:* ABE 696a Graduate Seminar, PLS 300 Guest Lecture, ENVY 105 Guest Lecture; Susannah Dickinson, RA, School of Architecture; Austin Smith, internship; Raphael Gruener, Designated Campus Colleague; Erica Hernandez, NASA Space Grant Intern; Myles Lewis, Verdant Earth Technology; Katherine Leyton, Lucuma Film, Graduate Education Recruitment video; Aquaponics Group, CALS students, weekly meeting, CEAC; Chris Bennett, Technology and Issues Editor, Farm Journal Media; [continued in notes section]
C. Research. Units fill in bold only, CALS central Admin will provide you with the other data. (slides 5-8; 15 min presentation + 15 min discussion)

1. Total State-Funded Research FTE annually for the last 5 years (5 numbers): 8.94, 7.68, 9.05, 6.86, 7.32 (includes 0.26 for Ed Martin)

2. Unit Research Expenditures CY14: $463,321

3. Unit's share of CALS research input (research FTE, start-up and any other investment) for the last 5 years (5 percentages): FY12: 5.1%; FY13: 5.78%; FY14: 5.5%; FY15: 5.76% (only 4 years of data available)

4. Number of extramural proposals submitted by the unit divided by faculty FTE annually for the last 5 years (5 numbers): 4.92, 6.51, 4.64, 6.41, 3.05 (CALS dashboard) OR 3.85 (UAVitae)

5. Number of peer-reviewed publications divided by faculty FTE annually for the last 5 years (5 numbers): 4.47, 5.73, 6.19; 8.45; 1.78 (Web of Science) OR 12.16 (UAVitae)

6. List of successful proposals, sponsors, direct funding amount, total amount and match amount on separate Excel spreadsheet for CY14.
**Intellectual property data for FY14 (ABE/CALS)**

- Disclosures: 3/18
- Provisional Patents: 4/14
- Patents: 1/2
- Licenses: 3/7
- Companies spun out: 1/1
D. Academic Programs (slides 9-13; 15 min presentation + 15 min discussion)  

PLEASE PROVIDE COMPLETED SLIDES 9-13 AND THE ACADEMIC GRID TO JOY WINZERLING ONE WEEK IN ADVANCE OF YOUR REVIEW

1. Describe all anticipated changes, deletions or additions in your majors, minors and/or certificates.
   
   1. **ABE 450/550** Effective Communications in Engineering and Science – approved for fall 2015
   
   2. **ABE 481A/581A** Engineering of Biological Processes – will no longer be taught by an ABE Faculty member.

   3. **ABE 482/582** Integrated Engineered Solutions in the Food-Water-Energy Nexus- Possible new course offering, approval is currently pending the CALS Curriculum committee.

   4. **ABE 487/587** Metagenomics: From Genes to Ecosystems- Possible new course offering, approval is currently pending the CALS Curriculum committee.

   5. **ABE 492** Directed Research- approved new Engineering Tech elective

   6. **ABE 516** Statistical Bioinformatics and Genomic Analysis “home department” was moved from STATS department to the ABE Department.

   7. **ABE 613** Applied Statistics – home department was moved from Natural Resources to ABE

   8. Online minor for Yuma SIE program.


2. List current distance certificate programs, study abroad, executive and continuing education.

   • The ABE curriculum committee is reviewing course offerings to determine what ABE courses are best suited for on-line Outreach offerings.

   • The Undergraduate Committee is working on developing an on-line minor, that would partner with the Systems Engineering On-line Degree program and the UA Yuma Program.

   • Dr. Hurwitz and Dr. Farrell-Poe are exploring the possibility of offering a certificate program in Biosystems Informatics.

3. List new courses planned and/or course changes or closures for courses offered in winter or summer sessions.

   • **ABE 428/528** Control of Erosion Process, will be offered in the Pre-session of 2015. The 428/528 was last offered in the spring of 2011.
4. Describe any anticipated changes in instruction faculty that will either streamline your operation or disrupt your course instruction.

We have recently added Dr. Bonnie Hurwitz, Assistant Professor, to our teaching and research faculty. Dr. Hurwitz proposed a new course offering, ABE 487/587 Metagenomics: From Genes to Ecosystems, which is currently under review by the by the CALS Curriculum committee. If we receive approval, Dr. Hurwitz will start teaching the course this fall. The Metagenomics course is a cross disciplinary course that focuses on the science of metagenomics. Environmental genomics is revolutionizing our understanding of microbes from the environment to human health, towards a holistic view of ecosystems or “One-Health.”

5. Describe your most compelling academic program need. [more details in notes section]

Graduate Program
Funding for Graduate Assistantships; Funding for recruitment; Onsite visits;
Ads in professional venues/and international publications and venues; Support travel to target
National & International meetings to build relationships with Universities; Funding to create
“Certificate” programs in Water resources, Irrigation Engineering, Remote Sensing, and
Bioinformatics.

Undergraduate Program
Funding for recruiting majors and minors; Off site visits (Yuma 4 times per year, Maricopa 2 times a
year, Wilcox/Safford 2times per year); Support travel to target National & International meetings to
build relationships with Universities;
Funding to create stand alone online major; Funding (Grant or College) needed to prepare stand
alone lecture and lab modules; Versatile teaching lab space, with secure storage, that is dedicated to
teaching; Potential disruption of Controlled Environment Agriculture’s curriculum delivery: A planned
retirement for June 2016—employee teaches critical plant science courses in controlled environment
hydroponic crop production required for all students studying controlled environments, sustainable
plant systems, ABE, and others with CEA emphasis.
6. **Complete** Course Grid Attached

7. **Describe** your marketing/recruitment plans to increase the following ABOR metrics:

   - Number of Bachelor's Degrees Awarded
   - Undergraduate Enrollment (Official 21st Day)
   - Number of Graduate Degrees

   Find ways to increase funding support Graduate Students by:
   - Faculty applying for Grants and funding
   - Assisting students with finding scholarships and grants
   - Collaborate with other Departments to find GAT/GARships for our students
   - Market the Accelerated Master’s Program
   - Develop online Master’s Program
   - Improve the look of our website
   - Recruit returning Peace Corps students
   - Attend recruitment fairs (i.e. UA Graduate School Day, Bio 5 networking event February)

   Find ways to increase Bachelor’s Degrees awarded by:
   - Improve the look of our website
   - Visits to Community Colleges, across the state
   - Hold in-house recruiting events with non-declared Engineering majors and non-declared CALS majors
     - Participate in Summer Engineering Academy
     - Promote the Department and our activities
     - Attend on campus meet your major fairs (spring and fall)
     - Attend marketing events on and off campus
     - Hold Engineering workshops and tours
     - Invite potential majors to department picnics, club events and fun activities.
   - Encourage non-declared majors to declare the major before their Junior year:
     - Invite non declared engineering majors (one on one) meetings with the Academic Program Coordinator, and Faculty to talk about the major and minor.
8. **Number of undergraduate students in the unit involved in**

i. Research experiences **20**

ii. Extension experiences **0**

iii. Internships **14**

iv. Experiential learning **5**
9. List the top 5 employers of your graduates:

Undergraduates and M.S. Graduates:
1. International Engineering firms (CH2M-Hill, M3, Malcome Pernie)
2. Agricultural Equipment Companies (Caterpillar, John Deere, CASE, CAT)
3. Consulting firms (George Cairo Engineering, Westland Engineering)

Ph.D. Graduates:
1. Government Agencies (Arizona State and Local, USDA-ARS, USPHS, USFS)
2. Universities (Domestic and Foreign)
3. International Engineering Firms (CH2M-Hill, M3)
4. Consulting Firms (Bosque Engineering)

10. Describe company, corporation or industry interactions with your unit this past year including advisory boards, individual faculty/industry research projects, and classroom or curricular participation. 
(see attached)
E. List faculty awards/recognition (1 min presentation + 1 min discussion):

1. Lingling An
   i. Top 5 downloaded paper in BMC Bioinformatics
   ii. Superior Paper Award from ASABE (co-authored with M. Kacira)
2. Murat Kacira
   i. Superior Paper Award from ASABE (co-authored with L. An)
   ii. Europe Ag Engineering Outstanding Paper Award Nomination from Biosystems Engineering Journal
3. Mark Siemens
   i. Certificate of Appreciation, ASABE, for contributions for revising ASABE standard, ASAE S477.1
4. Donald Slack
   i. Excellence in Global Education Award from UA, Office of Global Initiatives & Center for English as a Second Language
5. Muluneh Yitayew
   i. Western Agricultural Experiment Station Directors Award
6. Jeong-Yeol Yoon
   i. Superior Paper Award from ASABE