THE UNIVERSITY OF TENNESSEE
BOARD OF TRUSTEES

MINUTES OF THE
RESEARCH, OUTREACH, AND ECONOMIC DEVELOPMENT COMMITTEE

October 8, 2015

Knoxville, Tennessee

The Research, Outreach, and Economic Development Committee of the Board of Trustees of The University of Tennessee met at 2:45 p.m. EDT, Wednesday, October 8, 2015 in the Hollingsworth Auditorium of Ellington Plant Sciences Building on the UT Institute of Agriculture campus in Knoxville, Tennessee.

I. CALL TO ORDER

Chair Bill Evans called the meeting to order.

II. ROLL CALL

Dr. Evans asked Dr. David Millhorn, UT Executive Vice President, to call the roll. The following members of the Research, Outreach, and Economic Development Committee were present:

William E. Evans, Chair
George E. Cates
Tim L. Cross
Russ Deaton
Joseph A. DiPietro
Brian W. Donavant
Jalen K. Blue
David A. Golden
Julius Johnson
Raja J. Jubran
Candice McQueen (joined the meeting after roll call)
Rhedona Rose
Miranda N. Rutan
John D. Tickle

Margaret A. Norris and David M. Stern were not present at the meeting.

Dr. Millhorn announced the presence of a quorum of the Committee. Other Trustees, members of the administrative staff, public, and representatives of the media were also present.

Chair Evans welcomed Mr. John Tickle, newly appointed to the UT Board by Gov. Haslam, to the ROED Committee as well as to the UT Board of Trustees and a round of applause was extended to Mr. Tickle.

III. MINUTES OF THE LAST MEETING

Chair Bill Evans asked for any corrections to the minutes of the June 24, 2015, meeting of the Committee. Hearing none, the Chair called for a motion to approve the minutes as written. The motion was made by Trustee Jubran, seconded, and carried unanimously.

IV. RESEARCH HIGHLIGHTS AND UPDATES

Dr. Millhorn presented a power-point presentation (Exhibit 1) providing research highlights and updates for the University. Dr. Millhorn noted education, research and public service are the pillars our University. Dr. Millhorn presented graphs depicting 2015 UT revenue sources ($2.141B total, with tuition, state-federal-local appropriations, and sponsored research projects comprising the three largest sources) and described areas of grants and contracts supporting at least part or 34.7 percent of FTE system-wide faculty salaries and 21.5 percent FTE of system-wide staff salaries. UT faculty and staff worked diligently to compete in a difficult funding climate, Dr. Millhorn said, to bring in nearly $380M in revenues in 2015. Dr. Millhorn provided graphs to illustrate funding history (2001-2014) and levels for two major sources of UT proposal awards: the National Science Foundation (NSF) and the National Institutes of Health (NIH). NIH is the largest sponsor of university-based research in the country, with a current annual budget of $32B, Dr. Millhorn noted (NSF's annual budget is at approximately $8B). Data indicate a substantial increase in the number of proposals competing for a relatively stagnant level of funding for both NSF and NIH; both institutions are funding at approximately 20 percent of the number of proposals received, Dr. Millhorn stated. UT is experiencing a steady increase in research expenditures with about 28.5 percent growth base since FY07, Dr. Millhorn noted, while many universities are experiencing downfalls. This level of success, he stated, demonstrates the quality of UT's research programs.

Other research success components discussed by Dr. Millhorn included the important impact of the Governor's Chair program, the continuing strong partnership in UT-Battelle management of the Oak Ridge National Laboratory, and the increase of UT-ORNL joint faculty appointment growth from 40 several years ago to currently almost 200. Dr. Millhorn highlighted the Tennessee Manufacturing Innovation Program RevV, a joint UT-ORNL initiative funded by the Tennessee Department of Economic & Community

Development to create incentives to research-oriented companies to come to Tennessee or to promote growth in companies already in the state. Dr. Millhorn noted Cirrus Aircraft is an example of a company recently recruited to Tennessee within this program. Of the $2.5M received last year, Dr. Millhorn said, $1.7M has been appropriated for 14 approved projects ($1.3M) and recruitment incentives ($400,000).

Dr. Millhorn concluded his presentation by introducing the next four presentation topics. He noted the unique appointment nature of Governor's Chair hire Philip Enquist and the impact upon the AMIE project, which Dr. Millhorn said, UTK Architecture Dean Scott Poole had just informed him was named by the Department of Defense (DOD) as among the top 14 DOD projects in the nation.

Chair Evans thanked Dr. Millhorn for his presentation and gave kudos for growing UT's research funding by 28.5 percent in a difficult funding climate. Dr. Evans noted that for every federal grant additional funds are received for overhead (space, utilities and the like). Dr. Millhorn noted diversifying programs and collaboration with both federal and private sectors with good partners, such as ORNL, are also key growth factors.

Trustee Jubran asked if the $435M UT research expenditures in 2015 was the total amount in grants including the overhead and he was told it was. (Note was made by President DiPietro that grant overhead percentage varied depending on the funding agency.)

V. BRIEFING ON FEDERAL AND STATE RESEARCH FUNDING

Chair Evans recognized Anthony Haynes, UT Vice President for Government Relations and Advocacy, to give a report on federal and state research funding (Exhibit 2). Mr. Haynes discussed the correlation of downward federal-sponsored research program funding to decreased federal budget levels and described a predicted debt-ceiling "showdown" in the next few weeks and the political activity these situations will generate. The 2011 Budget Control Act alleviated sequestration impact for some time, Mr. Haynes said, and now shrinking domestic agency budgets are also negatively affecting the national budget situation.

Mr. Haynes showed graphs indicating trends in federal spending since FY2010, noting total R&D federal spending is down just over 15 percent and nondefense R&D is down roughly 5 percent. He noted that decreasing funding levels filter through to agencies such as the NSF, DOE Science, NIH and NASA (the latter two institutions down significantly--over 10 percent each). Other agency budgets of interest to UT, such as NIST (National Institutes of Standards and Technology), DOE applied programs, USDA and USGS (US Geological Survey), as well as DOD Science & Technology, Mr. Haynes stated, are down and this downward trend is expected to continue.

Mr. Hayes discussed limits on discretionary spending since FY2010. The current federal budget is approximately $4T, but the federal government is in disagreement over a "delta" of $50-75B between the President's proposed FY2016 budget and the sequester baseline. Mr. Haynes discussed external political factors affecting higher education budgets as well as the FY2016 Office of Science budgets and consequent impacts on national security, computing and other important issues. The FY2016 energy program budgets, particularly in electricity delivery and nuclear energy, Mr. Haynes said, have a better outlook for growth.

Mr. Haynes noted the federal Agriculture budget has been significantly down over the last few years and forest fire-suppression costs are escalating at an alarming rate and eventually could impact any available discretionary funding. Mr. Haynes noted the NIH budget is likely to receive the best increase in funding than experienced in the last 30 years with an approximate $1B increase (3.3 percent) for research in Alzheimer's, Big Data, the BRAIN initiative, antibiotic resistance, and Precision Medicine.

Mr. Hayes discussed targeted increases within the Department of Commerce in cybersecurity, disaster resiliency, and other areas and noted funding for the Manufacturing Extension Partnership (MEP) likely would remain flat at $130M. In discussing the FY2016 Defense (DOD) S&T budget, Mr. Hayes noted Dr. John Schmisseur at UTSI is one of the nation's top six hypersonics experts in the Air Force. This bodes well for Dr. Schmisseur's wind tunnel work and other research initiatives in the areas of applied and advanced technology development to receive DOD funding.

In conclusion, Mr. Haynes noted areas he and other UT government relations personnel are watching closely for UT priorities within the federal budget climate.

Dr. Evans thanked Mr. Haynes for his thorough presentation.

VI. CHEROKEE FARM UPDATE

Dr. Millhorn recognized Mr. Cliff Hawks (President and CEO, Cherokee Farm Development Corporation, CFDC) to give an update on Cherokee Farm. Mr. Hawks thanked members for inviting him to participate in the meeting and thanked Hitachi Consulting representatives Todd Price and Coleman Adams for also participating and providing additional perspectives on the Cherokee Farm Innovation Campus project. Mr. Hawks noted he had updated members last June with a written report on the status of the first anchor tenant at Cherokee Farm and he was pleased to report today that negotiations between the anchor tenant and a private developer with whom CFDC is working closely

has produced an agreement with the expectation that a lease as well as leases with three other smaller tenants for the next building will soon be executed.

Mr. Hawks presented a power-point presentation (Exhibit 3) and noted plans for the next building at Cherokee Farm are progressing and a marketing firm has been engaged to plan and implement a Cherokee Farm marketing and branding campaign. Mr. Hawks said he believes the timing is now right to move forward with a marketing effort which incorporates the new building with available space to lease in order to introduce Cherokee Farm and its assets to key decision-makers and to activate a brand-messaging campaign that will continue to educate and spotlight the resources and opportunities at Cherokee Farm Innovation Campus. Mr. Hawks discussed the primary and target audiences for the campaign.

Mr. Hawks provided an outline of the Cherokee Farm media proposal providing key target categories such as agriculture, data and analytics, biomedical, energy, material science, research and supercomputing and the corresponding publications to convey Cherokee Farm assets to target audiences. In addition, a focus will be placed on real-estate, site-consultant driven publications; to this end, Cherokee Farm will be featured in the November *Site Consultants* publication with a full-page ad and editorial comments in the publication as well, Mr. Hawks stated. A power-point slide of the Cherokee Farm campaign calendar was shown, beginning with the November 2015 kickoff and going through August 2016, by which time approximately 1.3M impressions will have been given out to its target audiences. Mr. Hawks also discussed a feature opportunity in six issues of *Fortune* magazine to promote Cherokee Farm.

Mr. Hawks presented a preview of a marketing video, an effective tool, he said, produced to create a strong visual reflecting the great city of Knoxville, University of Tennessee, the Oak Ridge National Laboratory (ORNL), and the Governor's Chairs and other impressive talent in promotion of the Cherokee Farm Innovation Campus.

As efforts continue to launch the marketing campaign and finalize plans for the next building, Mr. Hawks noted he is excited about the opportunity that lies ahead for Cherokee Farm and the University of Tennessee as close collaborations continue with Hitachi Consulting and several stakeholders including the Tennessee Valley Authority, Knoxville Utilities Board and ORNL to implement a microgrid and microgrid research platform at Cherokee Farm. This feature, in particular, he said, differentiates Cherokee Farm Innovation Campus from other university-related research parks, with sustainable energy solutions as a primary focus throughout the development of the park. It provides, as well, the opportunity to co-market Cherokee Farm with Hitachi to energy-solution and micro-grid technology companies seeking opportunities to test their product on the Cherokee Farm microgrid. Mr. Hawks noted Hitachi has made several visits to UT and ORNL and it has been a pleasure working with the Hitachi team over the last two years.

Mr. Hawks introduced Mr. Todd Price (Senior Vice President, Microgrid Solutions, of Hitachi Social Innovation Business-Americas, with over 25 years of client consulting, alliance, execution and leadership experience working directly with companies such as Frito Lay, Dell, Coors Brewing, Neiman-Marcus, Royal Caribbean, and Raytheon, among others, and co-founding the BIPM firm Navigator Systems, nationally-recognized for revenue growth and an outstanding company culture) to give a power-point presentation (Exhibit 3b) of its developing relationship with Cherokee Farm. Mr. Price noted he has been at Hitachi for 10 years and his focus for the next five years will be to build a microgrid industry which is around $1M in annual revenue today to $500M in annual revenue in 2020. To accomplish this goal, he said, Hitachi recognizes the importance of partnering with a university to build a new form of electricity delivery, adding resiliency and cybersecurity, among other assets, to the grid. UT's relationship with ORNL, Mr. Price said, is extremely attractive to what Hitachi is looking for in a microgrid-controller development.

Hitachi's dialogue with Cherokee Farm has been developing for two years, as Mr. Hawks had noted, he said, and Hitachi is now ready to begin developing a microgrid at Cherokee Farm. Mr. Price defined "microgrid" as basically a localized, distributed generation of power production delivered to a building or buildings typically working in parallel with a primary grid but with the ability to move into "island mode" to continue to provide power (usually at or below grid prices) to facilities being served if an incident (storm-related, cybersecurity issues, aging breakdown, etc.) occurs to cause the primary power grid to shut down. One of the best examples of microgrid deployment in the US, Mr. Price noted, was when hurricane Sandy knocked out electrical power in all lower Manhattan but microgrids at New York University kept its facilities functioning. Mr. Price described the importance of microgrid research and the well-aligned Hitachi microgrid visionary plans, he believes, with Cherokee Farm's vision for its campus. Cherokee Farm will offer an excellent microgrid testing ground in a real-world environment, Mr. Price stated.

Mr. Price discussed benefits of microgrids with groups such as UT, Cherokee Farm, DOE/ORNL, KUB and TVA. This is a new field, he noted, with currently about 90 microgrids in use in the US, but by the end of this year it is projected the US will have about 300. By 2020 there will be thousands in use (New York State alone is projected to deploy several thousand by 2020). Mr. Price gave a vision of what Cherokee Farm will look like in 10 years, including a "Center of Excellence" with universities, industry, utilities, regulators and national laboratories learning from the microgrid research platform's captured methodology, published best practices, generated case studies and benchmarks for other microgrids. The University of Tennessee provides a great destination, Mr. Price said, for educational opportunities, critical research, and as a rich recruiting resource.

Mr. Price concluded his remarks by noting that recently Mitsubishi announced a significant investment with the University of New Mexico on a microgrid deployment

and research platform. After close review of this undertaking, Mr. Price said he believes there is an opportunity for Hitachi and the University of Tennessee to deliver a research platform with a better business case and a much better return over time for the University, ORNL, and the city of Knoxville; while microgrid is a young market, he said, it is moving and Hitachi is pleased to be moving to the University of Tennessee and Cherokee Farm.

Dr. Evans thanked Mr. Price for his presentation. Trustee Jubran asked about the timeframe for the Hitachi agreement with Cherokee Farm. Mr. Price responded that Stage One (definition of the business case for both the microgrid and research platform) is almost finalized. Student Trustee Jalen Blue noted he is excited about the Hitachi microgrid development at Cherokee Farm and looks forward to hearing more on this topic.

VII. ADDITIVE MANUFACTURING INTEGRATED ENERGY PROJECT

Dr. Millhorn recognized UTK Dean of the College of Architecture and Design Scott Poole to give a power-point presentation (Exhibit 4) on the Additive Manufacturing Integrated Energy (AMIE) project. Dean Poole stated he and colleagues are most excited about this new project with Oak Ridge National Laboratory (ORNL). Dean Poole noted it was about three years ago when he approached Dr. Millhorn with the idea of hiring a team of some of the best architecture and design experts in the world instead of hiring an academic appointee for a UT-ORNL Governor's Chair position. Both Dr. Millhorn and Dr. Stacey Patterson (UT Associate Vice President for Research) gave him the confidence, Dean Poole stated, to pursue this out-of-the-box concept involving unusual legal constraints and other challenges in affiliating with the private firm of Skidmore, Owings, and Merrill (SOM) to accomplish this unique appointment of a Governor's Chair in April 2014 (Philip Enquist, Governor's Chair in Energy and Urbanism; partner in SOM). Dean Poole noted Skidmore, Owings, and Merrill is one of the most highly-respected architectural firms in the world, with offices in London, Hong Kong, Chicago, New York, and San Francisco, and it has over 10,000 completed projects in more than 50 countries. Dean Poole noted that in 1943 SOM laid out the master plan for the Oak Ridge National Laboratory. SOM has designed some of the most iconic buildings in the world, Dean Poole said, including the world's tallest building, the Burj Khalifa in Dubai; he noted that Bill Baker, structural engineer of the Burj Khalifa building, recently gave a private seminar to about 40 of UT's students, an example of one of the many benefits of the UT-SOM relationship. Mr. Enquist and the SOM team, Dean Poole said, is connecting UT with the best architecture and design experts in the world as opportunities arise—and the first opportunity was, in fact, the AMIE 1.0 project.

Dean Poole noted the AMIE 1.0 project is a singular project completed from its conception in casual coffee-house discussions to a completed building in a nine-month timeframe. Dean Poole highlighted AMIE touch-points (including a prototype in which its integrated solar array works in conjunction with a paired hybrid automobile to provide

all necessary power; a public showcase of clean-economy future construction; a collaboration of industry, government and academia; and a prototype of high-efficiency lifestyle) and noted Clayton Homes has also been an important partner in the project. The UTK College of Architecture and Design, and UT in general, Dean Poole stated, will depend increasingly upon private partners and the AMIE 1.0 project is a good example of this kind of key collaboration.

The project is exciting popular imagination, a key charge of the Architecture College mission, Dean Poole said; in addition, students are working with experts at ORNL at the Manufacturing Demonstration Facility (MDF), where the 3D-printed car was made that President Obama saw in January when he visited Oak Ridge, to develop building concepts that leverage emerging additive manufacturing capabilities. With SOM architects present in the studio, Dean Poole stated, UT graduate student research paralleled and influenced the design of the AMIE prototype in creating a 3D-printed "envelope" for a next-generation technology: Modified Atmospheric Insulation (MAI) panels. Dean Poole showed slides illustrating the AMIE construction.

There have been dynamic interactions with SOM architects and UT students during the first year of the Governor's Chair relationship, Dean Poole noted. AMIE has the capacity to help with future projects involving, among other things, disaster relief and emergency assistance, defense applications, and modular housing (a collaboration project is currently underway with TVA, Dean Poole noted).

(A video featuring AIME 1.0 was unable to be shown due to technical problems; however, the video was shown to the full Board the following morning.)

Dr. Evans thanked Dean Poole for his informative presentation.

VIII. UPDATE ON THE INSTITUTE OF ADVANCED COMPOSITES MANUFACTURING INNOVATION (IACMI)

Dr. Taylor Eighmy, UTK Vice Chancellor for Research and Engagement, presented a power-point presentation (Exhibit 5) providing an update of the Institute of Advanced Composites Manufacturing Innovation (IACMI). Dr. Eighmy noted the structure pictured in Dean Poole's AMIE slides was connected to a vehicle and solar panels and the natural gas fuel supply and generators deployed make the building and vehicle a completely autonomous mini-microgrid, giving further elegance to the concepts described in the previous AMIE and Hitachi presentations.

IACMI is in the process of being rebranded "The Composites Institute," Dr. Eighmy stated, and he is co-chair of the board of the 501c3 now legally renamed the "Collaborative Composite Solutions (CCS) Corp." Dr. Craig Blue of ORNL is the CCS

CEO.

Dr. Eighmy showed slides of the President's visit last January in Clinton when the IACMI award was announced and of the official signing and launch ceremony in June when Dr. David Danielson, Assistant Department of Energy (DOE) Secretary, Office of Energy Efficiency and Renewable Energy, came to Knoxville to represent DOE (Dr. Millhorn signed the MOU at the ceremony on behalf of the University of Tennessee, Dr. Eighmy noted), as it is Dr. Daniel's office which is providing the funding of the National Network for Manufacturing Innovation (NNMI) $259M award (over five years).

From discussions at prior presentations to the UT Board, Dr. Eighmy reminded members that IACMI is comprised of five components: vehicles (Michigan); wind turbines (Colorado); compressed gas storage (Ohio); innovative design, predictive modeling and simulation (Indiana); and composite materials and process technology (Tennessee).

Dr. Eighmy discussed the IACMI budget, managed within terms and conditions of the cooperative agreement with DOE, and the composition of the NNMI team. Slides were shown of the CCS Senior Leadership team, including Dr. Stacey Patterson and Dr. Uday Vaidya (UT Governor's Chair), headed by Dr. Blue, and the CCS Board of Directors (including Dr. Eighmy and Doug Parks of Dow, Co-Chairs, and Dr. Stacey Patterson and Dr. Martin Keller, ORNL, Ex-Officio members); there are three Federal Advisory Board members from DOD and DOE. There is also representation on the Board from all charter industry members putting in more than $5M in new funding: Volkswagen, Dassault Systemes, Ford, Lockheed-Martin and DowAksa. The charter states are also contributing at least $10-15M each in new dollars and there is approximately $100M of other forms of new cash is to match the $70M from DOE, Dr. Eighmy stated.

Dr. Eighmy discussed three projects underway and future plans for industry "roadmaps" concerning R&D with its 123 corporate partners, as well as issuing a Request for Proposal (RFP) for Enterprise and Technical Collaboration.

Dr. Eighmy showed slides taken in Oak Ridge during the August visit of Secretary of Commerce Pritzker and of Vice President Biden at the September co-location announcement of the Michigan Center in concert with one of the other NNMIs in Detroit, illustrating the high-level spotlight on the initiative.

Dr. Eighmy concluded his presentation in noting the expected IACMI impact to UT, including development of critical relationships with its charter members, and some of the next steps anticipated for the initiative. Dr. Eighmy noted, to regard to research expenditure discussions earlier in the ROED meeting, UTK will be able to capture the expenditures from IACMI for the next five years of approximately $50M annually to the NSF and $15M annually for federal research expenditures, increasing UT's total research

expenditures substantially.

Dr. Eighmy noted he hopes to provide continued updates to members about IACMI and its impact on East Tennessee's economy.

Chair Evans thanked Dr. Eighmy for his presentation on a most exciting program and said the Committee looks forward to future updates on the initiative.

IX. OTHER BUSINESS

None.

X. ADJOURNMENT

There being no other business, Dr. Evans adjourned the meeting at 4:20 p.m.

Respectfully submitted,

David E. Millhorn, Ph.D.