

**Meeting Minutes**  
**NCERA-101 Controlled Environment Technology and Use**  
**Tuskegee University, Tuskegee, Alabama, USA**  
**April 14-17, 2007**

**Participants**

George Adamson (Ontario Scientific), Daniel Barta (NASA-Johnson Space Center), Mark Blonquist (Apogee Instruments), Conrad Bonsi (Tuskegee Univ), A.J. Both (Rutgers Univ), Melissa Brechner (Cornell Univ), Bruce Bugbee (Utah State Univ), Roger Cohn (EGC), David DeVilliers (Cornell Univ), Jonathan Frantz (USDA-ARS), Gary Gardner (Univ. Minnesota), Richard Gladon (Iowa State Univ), Alec Hay (Utah State Univ), Norman Hill (Duke Univ. Phytotron), Henry Imberti (Percival Scientific Inc), Ramesh Kanwar (Iowa State Univ), Meriam Karlsson (Univ. Alaska), Bruce Kettner (BioChambers Inc), Chieri Kubota (Univ. Arizona), Ron Lacey (Texas Agric. Exp. Station), Peter Ling (Ohio State Univ./OARDC), Gioia Massa (Purdue Univ), Tim Mies (Univ. Illinois), Cary Mitchell (Purdue Univ), Robert Morrow (Orbital Technologies), Desmond Mortley (Tuskegee Univ), Joey Norikane (Univ. Kentucky), Andrew Ogden (Univ. Georgia), Sonali Padhye (Michigan State Univ.), Robert Pollack (Southern Sun), Reg Quiring (Conviron), Sharon Reid (Conviron), Mark Romer (McGill Univ. Phytotron), A.O. Rule (EGC), Erik Runkle (Michigan State Univ), John Sager (NASA, Kennedy Space Center), Carole Saravitz (North Carolina State Univ), Timothy Shelford (Cornell Univ), Ryan Stewart (Univ. Illinois), Noriko Takahashi (Ohio State Univ./OARDC), Marc Theroux (BioChambers Inc), Ted Tibbitts (Univ. Wisconsin), Alex Turkewitsch (Greenhouse Engineering), Mark van Iersel (Univ. Georgia), Jeff Werner (Univ. Alaska), Ray Wheeler (NASA, Kennedy Space Center), Ann Widrig (USDA-ARS), Neil Yorio (Dynamac Corp. Kennedy Space Center).

**Executive Committee**

Desmond Mortley, Chair  
Erik Runkle, Vice Chair  
Gary Stutte, Secretary  
Dave Fleisher, Past Chair

**Opening**

The meeting was brought to order by the Chair at 8:11 am. Welcoming remarks were made by Dr. Walter Hill, Dean of the College of Agricultural, Environmental and Natural Sciences. Dean Hill thanked the participants for choosing Tuskegee University and extended congratulations to Desmond Mortley, Conrad Bonsi and the many organizers of the meeting. Desmond Mortley reported that 48 attendees were participating in the meeting and acknowledged the generous sponsorship of the industry members and Tuskegee University administration. The participants then introduced themselves.

**Announcements**

Ted Tibbitts (Univ. Wisconsin) requested that members consider submitting papers to the annual journal entitled "Environment Control in Biology". This journal, formerly known

as Biotronics, then the International Journal of Biotronics is an official English publication of the Japanese Society of Environment Control in Biology, the Japanese Society of High Technology in Agriculture, and the Biotron Institute, Kyushu University. The email for the editors is [ecb@agr.kyushu-u.ac.jp](mailto:ecb@agr.kyushu-u.ac.jp). The journal homepage is <http://133.5.207.201/j-seikan/index-g.html>.

### **ASHS CEWG Meeting Highlights**

Jonathan Frantz (USDA-ARS), chair of the ASHS working group, reported that planning for the 2007 meeting in Phoenix, Arizona was well under way. The workshop “Light Emitting Diodes (LED’s) in Horticulture”, organized by Ray Wheeler (NASA-KSC), is scheduled for July 18, 2007. Speakers will include NCERA-101 members Bob Morrow (Orbital Technologies) and Gioia Massa (Purdue Univ). The workshop is designed to be more “hands-on” in nature with equipment demonstrations and displays. Jonathan Frantz also reported that the Crop Physiology Working Group was organizing a workshop on July 19<sup>th</sup> titled “Irrigation Sensors and Control” organized by Marc Van Iersel (Univ. Georgia). Marc van Iersel (Univ. Georgia) indicated that the workshop was hoping to stimulate discussion about the pros and cons of different sensor control technologies. Lastly, topics were discussed for a workshop or colloquium to be held at the 2008 annual meeting. Jonathan Frantz will work with interested participants to narrow down the list for workshop and colloquium proposals in the upcoming months prior to the ASHS annual meeting.

### **Administrative Advisor Report**

Ramesh Kanwar (Iowa State Univ) continues to serve as administrative advisor to this committee. Dr. Kanwar thanked the organizers and remarked that George Washington Carver had originally begun his studies in Iowa State. He indicated that the NCERA-101 (North Central Extension and Research Activity) committee is the oldest serving and best attended group in the entire North Central Region. It has had excellent partnerships with industry and is often highlighted at Directors meetings as a good example of national and international cooperation.

Dr Kanwar reminded the group that meeting minutes should be posted on the website within 60 days after the annual meeting. He emphasized the importance of reporting the group’s accomplishments (outcomes) and making meaningful impact statements. Impact statements should include quantifiable impacts or “contributions to society” as it were. Members are also encouraged to include information on the status of funding at their experiment station. Station reports should be submitted promptly each year to assist the secretary in completing the report.

Dr Kanwar discussed the state of funding indicating that the overall situation has been moving through a slow period of activity but some signs of improvement could be seen on the horizon. As an example, he mentioned that the State of Iowa was investing over \$100 million in bio-energy initiatives including \$32 million in the new bio-renewable lab building (\$28 million for the building and \$4 million for lab equipment). Industry partnerships were also contributing over \$23 million to the state programs so there is reason for optimism.

### **Approval of the 2006 Meeting Minutes**

The minutes had been previously distributed to members via email. Erik Runkle (Michigan State) asked for comments or proposed amendments. None were made. Marc Van Iersel motioned to approve the minutes, seconded by Bruce Bugbee (Utah State Univ.), and approved by all.

### **Station Reports Discussion**

A discussion ensued about the new format for the station reports. Erik Runkle re-emphasized to the group the importance of completing the station reports according to the new format guidelines – particularly the sections on accomplishments and impact statements (outcomes). He indicated that this would be of great assistance to the current and future executive secretary. Mark Romer (McGill University) mentioned that the reports served two distinct functions within the group - to fulfil the USDA mandate (as indicated by Erik Runkle and Dr. Kanwar) as well as a general source of information for sharing with other members (activities, equipment and unique problems or findings). Bruce Bugbee suggested that members include “little discoveries” made during the course of the year. These would not alone be significant to publish a paper, but are interesting and often useful findings. Bruce Bugbee indicated that the size restrictions for reports are no longer present and photos and data findings could be added. He suggested users prepare and format their reports so that they can easily be added by the webmaster. Erik Runkle supported this concept and indicated that the change from NCR to NCERA (North Central Extension Research Activity) increased the emphasis on extension and sharing of findings with the larger community.

### **E-mail Discussion Group**

Tim Mies and Ryan Stewart (Univ. Illinois) asked the group if there would be any interest in developing an e-mail discussion group for the exchange of ideas between members. Tim Mies mentioned he had investigated Google Groups and other similar moderated sites. Ryan Stewart mentioned this would be very useful for new faculty and staff working with controlled environments. Mark Romer (McGill Univ. Phytotron) mentioned that the International Controlled Environment Reporting Guidelines committee has been using the UK-based JISC server with good success (<http://www.jisc.ac.uk>). Alex Turkewitsch (Greenhouse Engineering) mentioned that the group may consider developing a site similar to that used by the AERGC (Association of Education and Research Greenhouse Curators <http://www.life.uiuc.edu/aergc/>). The list server is based at the University of Illinois and offers daily digests as well as archive searches. Participants are not required to be members of the association and the list has minimal spam and list-mining activity. Tim Mies indicated that he and Ryan would investigate possible sites and report back to the group.

### **Website report**

Mark Romer (McGill Univ. Phytotron) presented the website report in the place of Tracy Dougher (Montana State U.) who was absent. Mark Romer indicated that parts of the website (<http://ncr101.montana.edu/>) are in need of updating, particularly the sections pertaining to the history of the group and current activities. The original text is now

almost 10 years old and does not reflect the group's activities of the past decade – for example the publications (CE Reporting Guidelines) and International meetings in 2001 and 2004. Ted Tibbitts offered to work with Mark and Tracy on revising the existing pages. Mark Romer asked for feedback about possible updates to the website and welcomed members to send their suggestions to him. Mark Romer also mentioned that each member organization has a distinct webpage which can display a wide variety of information including: contact info, station reports, operating guides, descriptive text, related links etc. Each member would be responsible for updating the information posted on their individual site (verifying links etc). Ray Wheeler (NASA-KSC) asked whether the page could list all the members at a specific site – for example, NASA-KSC has 4 NCERA-101 members. Mark Romer indicated that this was possible and that the personal space was essentially without restriction (although overall file size may be limited – this would have to be verified by the Webmaster). Ted Tibbitts mentioned that 2 useful resources were now posted on the website: The Growth Chamber Handbook and the Proceedings of the Lighting Conference held in Madison in 1994. Ted Tibbitts wondered how much use was made of these sites. Several members indicated that they often supply the URL to interested students and researchers for reference.

### **Membership Report**

Mark Romer gave a brief membership report. This group is in its 32<sup>st</sup> year, and currently there are 139 members from 102 institutions, with a healthy balance among phytotrons, universities, governmental institutions, and industries. (See Appendix A for the membership summary). Mark Romer indicated that approximately 75% of the members attend meetings regularly and he wondered whether further action should be taken to encourage “dormant” members to participate. There were no specific suggestions offered by the group. A.J. Both (Rutgers Univ) asked if the group is actively pursuing other members that we would like to add to the membership. A discussion ensued and it was suggested that individual members should contact colleagues working in controlled environments and make them aware of the group's activities. Mark Romer also indicated he would distribute a list of states which did not currently have active representation in the group.

### **Awards to Attendees**

Since 2005, additional funding available from sponsorships and registration fees have been used to subsidize the registration cost for graduate students. In addition, a Graduate Student Poster Competition has been held to defray some of the travel costs associated with meeting attendance. This year's winners were Lashelle McCoy (Tuskegee Univ.) and Melissa Brechner (Cornell Univ). At the Awards banquet on Monday evening, a well deserved NCERA-101 “Significant Contributor Award” was presented to Mark Romer.

### **Guidelines for Measuring and Reporting Environmental Parameters**

A.J. Both (Rutgers Univ) spoke to the group about the progress of the International committee preparing guidelines for measuring and reporting environmental parameters in tissue culture. A.J. Both reviewed the history of the guidelines committee which began in 2001. The first set of guidelines (*Minimum Guidelines for Measuring and Reporting Environmental Parameters for Experiments on Plants in Growth Rooms and Chambers*)

was published and presented at the 2004 International meeting in Brisbane, Australia. The guidelines are available as a PDF document (bi-fold flier) as well as two poster sizes: a smaller size for posting in Controlled Environment facilities and a larger size for presenting at poster sessions of scientific meetings. These documents can be found on the NCERA-101 website (<http://ncr101.montana.edu/>). In 2004, a second committee was formed to develop guidelines for tissue culture experimenters. A draft of the guidelines has now been developed and was circulated among the NCERA-101 membership several days before the meeting. A.J. Both requested that members review the document and send feedback within the next couple of months. He indicated that the committee was hoping to have a final published document for launching at the International meeting planned for Florida in 2008. Some discussions ensued about specific items in the guidelines with members contributing ideas. Interest was displayed by the growth chamber manufacturers concerning the issue of financially supporting the printing and distribution of the new guidelines. It was also suggested that the committee investigate whether culture media suppliers would be willing to contribute and perhaps distribute the guidelines to their customers. There was strong support among the group to develop a brochure and small Tissue Culture guidelines poster, but less interest for the large poster. Many members indicated that they found the 2004 guidelines very useful and made efforts to distribute it to colleagues and students. Some members also displayed interest in having additional printed copies of the Minimum Guidelines Brochures. A rough count indicated 2000 copies would be desirable. Ted Tibbitts commented that this publication was a major activity of the committee and that efforts should be made to promote and distribute it into the future.

### **Instrument Package Report**

Bruce Bugbee (Utah State Univ.) reported that the instrument packages were rented 3 times from March 2006 to March 2007. The current balance of the instrumentation package is \$962. A discussion ensued about the purpose of the package and ways to increase the utilization and availability at research stations. Bruce mentioned that the goal of the package was to allow users to characterize specific controlled environments, to calibrate their own individual sensors and simply test new sensors before purchase. Ted Tibbitts mentioned that originally, experiment station directors agreed to pay for the rental of the package and members could approach their directors for these funds. In the past, committee members brought the sensors back to their facilities and invited colleagues to bring their own equipment for calibration. Dr. Kanwar offered to distribute a note to the experiment station directors outlining the existence and research benefits of the package and encouraging them to support it. He also suggested that department Chairs could be approached for funding. Bruce offered to draft a letter which would explain the benefits of the package for distribution to various sources.

Bruce Bugbee described the various instrument package options and indicating that the Radiation Package was still the most popular. Bruce Bugbee reported that a new instrument had been added following comments at last years meeting. The Humidity-Temperature Calibration Package includes 2 reference Vaisala HMP45 humidity sensors and 4 reference thermistors connected to a dedicated micrologger. The package includes a shielded, aspirated column with empty holes for inserting the user's sensors. He noted that the range of accuracy for the Vaisala probes was +/-2% between 30-90% and +/-3 to

4% above or below those values and that it is very important to control the temperature during measurement as small changes in temperature can produce 3-4% changes in relative humidity (at the same absolute humidity).

A new Net Radiometer Package is available which includes a Kipp & Zonen CNR2 radiometer and dedicated Apogee micrologger. The CNR2, a four-way radiometer that separately measures net shortwave (280-2,600 nm) and net longwave radiation (4.5-42  $\mu\text{m}$ ), has been made available to NCERA members by the Utah State Crop Physiology laboratory. Bruce Bugbee indicated that this unit is excellent for characterizing the thermal loads of growth chambers, particularly those equipped with HID lamps. More information on the instrumentation package is available at the NCR-101 website (activities section). Interested members should contact Alec Hay (Alec.Hay@usu.edu) for information and bookings.

Bruce Bugbee then introduced new psychrometric chart software that had been written which was available from the Internet <http://badger.uvm.edu/dspace/handle/2051/2983>. A tutorial could also be found at <http://badger.uvm.edu/dspace/handle/2051/2985>. Chieri Kubota (Arizona State Univ) noted that users should be aware that the wet bulb temperature calculation is not correct under different altitudes (other than sea level) or different atmospheric pressures (other than 101.3 KPa).

### **Measurement Instruments List**

John Sager (NASA-KSC) spoke to the group concerning a motion from the 2006 meeting concerning the development of a list of appropriate instrumentation for environmental variables commonly measured in controlled environments. The proposed list was to include companies, contact information, caveats (how to measure particular environmental parameters) but not to include explicit recommendations. John displayed a list of sensors for the members to review then asked for clarification from the membership about this motion – were the members simply interested in a list of available products for further investigation or were they in fact more interested in specific information about the usefulness and performance of these instruments (i.e. buy/don't buy, known problems, limitations etc.). An engaging debate ensued concerning the question and problems associated with this type of list. Several members indicating that this type of list would be a good starting point for persons interested in purchasing new instruments. John Sager offered to make the list of radiation, temperature, atmospheric moisture, CO<sub>2</sub>, air velocity, pH, electrical conductivity, dissolved oxygen, and water potential sensors available on the NCERA-101 website ( <http://ncr101.montana.edu/>).

The spreadsheet is included as separate attachment with the minutes. Members should provide comments on the sensors and inputs directly to John Sager ([john.c.sager@nasa.gov](mailto:john.c.sager@nasa.gov)) with a CC to Bruce Bugbee (bruce.bugbee@usu.edu).

### **Project Goals Committee**

Desmond Motley reminded the group that a committee had been struck in 2006 to examine possible project goals for the group. Marc Van Iersel indicated that no progress had been made in this area. Dr Kanwar mentioned that the NCERA was designated as an information sharing group and did not require specific “projects” to fulfill its mandate. He then indicated that if the group were interested in developing a specific project to “add value to the group”, they could apply for national funding to meet this need.

Desmond Motley suggested that given the comments, the committee could be disbanded until a clearer mandate presented itself.

### **Selection of 2007-2008 Officers**

Erik Rankle reported that the Executive Committee had investigated several active members and had selected Alex Turkewitsch for nomination as Incoming Secretary. Erik mentioned that the group was appreciative of the participation and support of industry members in the group. Dick Gladden (Iowa State Univ) motioned to accept the nomination, seconded by Bruce Bugbee (Utah State Univ). Bruce further moved that the group affirm the nomination by voice vote. Seconded by Ron Lacey (Texas Ag. Exp. Station). Members voted vocally and unanimously in favour of the nomination.

### **2008 International Meeting Report - Florida**

Neil Yorio (Dynamac Corp./KSC) outlined the state of planning for the 2008 meeting. The dates for the meeting are March 8-12, 2008 and the venue (Holiday Inn Resort - Cocoa Beach) has been booked. Rooms will be available for \$105 USD/night and will be available at that rate for 3 days prior & 3 days following the meeting. The Holiday Inn is a full service resort with numerous pools, restaurants, bars and amenities directly on its beachfront property and members are encouraged to bring their families for a holiday! The conference registration will be \$275 USD for participating members, \$125 for students and \$100 for accompanying guests (spouses, children) who wish to participate in the tours, reception & dinners. The tentative Conference schedule is as follows:

- Sat - March 8 – Reception
- Sun/Mon March 9-10 – Sessions & posters
- Tue/Wed March 11-12 – Tours of KSC facilities & local area CE facilities

The conference program is currently being developed with an international organizing committee. The tentative session topics which have been proposed are:

- New Approaches for Control and Monitoring Environmental Conditions
- New Responses/research results from experiments in CEA
- Reliability and quality control for CEA facilities
- Novel instrumentation, sensors, and /or analysis approaches.
- Non-traditional applications in CEA
- Design and Development of new facilities.

Details will be posted on KSC website (<http://www.lssc.nasa.gov/als/ncere101.php>) and are expected to be linked from the NCERA-101 website (<http://ncr101.montana.edu/>) in June. An announcement of the meeting will be distributed by email. The website will be set up to accommodate online registrations and hotel bookings.

### **2009 Meeting Proposals**

Two proposals were brought forth for discussion by the group. Mark Romer informed the group about an offer by Dr. Andre Gosselin (Dept. Phytologie, Univ. Laval, Quebec) to meet jointly at the International Symposium on High Technology for Greenhouse Systems “Greensys 2009” to be held June 14-19 in Quebec City, Canada. The estimated costs of the meeting were to be \$700USD registration fee (including all conference activities and ISHS Acta Horticulturae publication); \$ 150USD /night x 5 night’s hotel.

Mark further volunteered that he would be prepared to organize a day in Montreal ahead of the meeting to tour the McGill Phytotron, conduct the NCERA-101 business meeting and participate in some local cultural activities (haute cuisine & French lessons at the bistro etc). Members would then be expected to fly into Montreal and out of Quebec City.

Chieri Kubota spoke to the group about another ISHS event, the VI International Symposium on Artificial Lighting in Horticulture, which was being organized in Tsukuba, Japan for October 19-23, 2009. Chieri Kubota has spoken with the organizers (Dr. Sadanori Sase et al.) and they are positively considering a potential joint meeting with NCERA-101. If our members were interested, there would be the possibility of organizing a NCERA-101 session/workshop during the symposium. The estimated costs of the meeting were to be \$500USD registration fee (including all conference activities and ISHS Acta Horticulturae publication); \$ 100USD /night x 6 nights hotel; Airfares: \$1,000 - \$1,200. There would be the possibility to apply for funding from the NSF (International Research and Education). Funds up to \$60,000 per proposal are available. Chieri Kubota proposed a motion that the NCERA-101 group offer to be a supporting group to the symposium in Japan. Ray Wheeler seconded. Erik Runkle suggested that more information was needed outlining the responsibilities of such an involvement. A lengthy discussion ensued and the motion was not voted upon. Dr. Kanwar indicated that any International meeting would need a 2-year notice for USDA administration. The primary concern about both proposed meetings was the considerable expense involved and the fact that many members and graduate students would not be able to attend. A request was made for volunteers to consider holding a US-based meeting in 2009. Bruce Bugbee indicated that the group had last met in Utah in 1990 and that he would consider hosting again at some point. Erik Runkle also volunteered to offer Michigan as a fallback location should the international options not work. At this point the group decided to drop the discussion in favor of a later vote. Mark and Chieri agreed to prepare summary statements and conduct an e-mail vote of the entire membership within 2 months.

### **Result of E-mail vote on 2009 meeting**

An email ballot with background information on the International meetings was sent to the membership on 8 May, 2007 asking them to vote on two questions

QUESTION 1: Do you prefer to attend a [A] Domestic US-based meeting or an [B] International meeting in 2009.

QUESTION 2: If the consensus is to hold an international meeting, please choose between the 2 following options: [C] Quebec City – Greensys 2009 (June) or [D] Japan – International Lighting Conference (October)

Approximately 45% of the membership responded (53 ballots). The membership voted to have a domestic meeting in 2009 (24 votes domestic/22 votes international/5 no preference). If the vote had been for an International meeting, the membership strongly favored the Greensys 2009 venue (27 votes Quebec City/ 10 votes Japan).

### **Future Meetings**

Dick Gladon proposed that the group consider meeting in Iowa State University in 2010 or 2011. Dick mentioned that the group last visited Iowa in 1992 and that many of the



facilities had changed. New greenhouse facilities were being built in the Horticulture department. Dick Gladon indicated he had spoken to Henry Imberti about the possibility of co-hosting the meeting as well as including a possible tour of the production floor of Percival Scientific.

### **Adjournment**

At 2:15 pm, a motion to adjourn the meeting was made by Marc van Iersel. Seconded by Bruce Bugbee and approved by all.

Subsequent activities of the group at the Tuskegee meeting included:

- Presentation of Station Reports by members on Sunday & Monday
- Group tours: Young's Plant Farm, Auburn, AL; Callaway Gardens, Pine Mountain, GA and the Rhizotron & Greenhouses at the University of Georgia's Griffin campus.
- Special Awards Banquet – Monday April 16, 2007-04-27. At a special banquet organized by the Tuskegee University CFESH (*Center for Food and Environmental Systems for Human Exploration of Space*), The NASA/CFESH Award of Excellence was presented to NASA collaborators who had participated in the sweet potato program since 1986. Awards were given to Dan Barta, Albert Behrend , Bruce Bugbee, Tom Dreschel , Guy Fogelman, Yvonne Freeman, Bill Knot, Shannon Potter, Ralph Prince, John Sager, Ted Tibbitts & Ray Wheeler.

*Minutes prepared by Mark Romer. Revised and submitted by Gary Stutte, Secretary  
June 15, 2007*

## APPENDIX A

### NCERA-101 (NCR-101) Membership Summary ..... April 2007 Mark Romer, *List Curator*

<u>Membership Number</u> .....	April 2006.....	135
	2007.....	139
• Additions.....		6
• Deletions .....		2
• Net Gain(Loss).....		4

#### Membership Composition

#### Institutions

##### Members

• Phytotrons & Controlled Environment Facilities.....	15 .....	18
• University Departments, Agr. Exp. Stations .....	50 .....	69
• Government Organizations & Contractors .....	15 .....	18
• Industry Representatives .....	22 .....	31
• Independent .....		3
Total Number of Institutions .....		102
Total Number of Members .....		139

#### **New Institutions**

##### Canada

- University of Guelph - Controlled Environment Systems Research Facility

##### United Kingdom

- Rothamsted Research

##### USA

- University of Maryland - Wye Research and Education Center
- California Polytechnic State University – Bioresource & Agr. Eng. Dept