NCR-101 Annual Meeting Minutes
Cornell University
Sunday 28th March, 1999

Welcome
Meeting opened by Mark Romer at 8:10am in Riley-Robb Hall (home of the Department of Agricultural and Biological Engineering), Cornell University
Mark Romer welcomed the 15 or so new members to the meeting.

Local Arrangements: Dr. Bob Langhans from Cornell described the audiovisual capabilities for the meeting. PowerPoint presentations and overheads etc. could be accommodated. A buffet style lunch would be provided outside the meeting room. Leslie Katzman was handling the registrations. Please ensure that registration fees are paid before you leave. Registration for the meeting is $65. Bob Langhans thanked EGC and Conviron for supporting the reception and buffet on Saturday evening. Sunday evening dinner was on your own, except for those people who would like to meet together at a local restaurant (about 30 members indicated that this was what they would like to do). Bob Langhans indicated that he would like to meet with Industry Reps during the first break.

Introduction of Participants:
The attending NCR101 members, and associated (about 11) graduate students, then introduced themselves around the room.

General Announcements / Events (Members)

- Donald Krizek had some USDA Pamphlets for distribution to the members
- Lou Albright announced an International Conference on Modeling and Control in Agriculture, Horticulture and Post-Harvest Processing, July 10-12, 2000. Wageningen, the Netherlands. For more information see http://www.aenf.wau.nl/conf2000
- Royal Heins &emdash; Andre Gosselin from Laval University, Quebec is planning to hold a Symposium of Supplemental Lighting in Fall, 2000.
- Mark Romer announced that Dr. Tibor Tischner (Hungarian Phytotron) passed away recently.

NCR-101 Business Meeting
Introduction: Mark Romer passed around the membership list / database for corrections and additions. In addition, website entries for the various stations were solicited. He asked members to please give one copy of the station reports to the Secretary for inclusion with the minutes. The station reports are typically distributed to the entire membership.

A. Administrative Advisors Report (Dr. Ramesh Kanwar)
Dr. Ramesh Kanwar distributed four handouts of particular importance for land-grant Institutions (see below). Dr. Kanwar thanked the group for organizing the venue. In the Year 2000, NCR101 will meet at Purdue University. In 2001, the group plans to meet in the UK, so these arrangements should be planned at this meeting. He indicated that this was not precedent-setting, so USDA approval should be relatively easy. Approval would be easier from the Board of Directors if this meeting could be associated with an international workshop or similar type arrangement.

Handout # 1 Summary: Educational Reform Act.

- All Agricultural Stations (1862, 1890 and 1994 institutions) must make these plans to get formula funds from the Federal Government by October 1, 1999. Responsibility falls on Experiment Station Heads and Heads of Department.
- Experiment Stations must develop plans of work (page 1) under the Hatch Act. Stakeholder input is required.
- NCR Committees are likely to disappear.
- Emphasis is on multidisciplinary research (page 2).
- Multi-State Extension Programs are now being required. At least 25% of AES funds must be spent on multi-state projects (page 3)
- Section 204. Integrated research and extension programs must be done in the future. Funding must be 25% or twice the AES 1997 percentage.
- Annual Reports are now required from AES station directors
- Act 201 (page 5). 1994 Institutions must develop programs with 1862 and 1890 Institutions.

Handout # 2: American Agriculture Statistics

- Percentages of Income Spent on Food
- Federal Funding for Agricultural Research
- Hatch Funding is likely to disappear in the next 10 years &emdash; programs will be competitive, so extension programs may disappear &emdash; the best programs will survive.
- Critical Issues to be addressed in FY2000 (page 4). Targeted Funding Lines

Handout # 3: FY2000 Presidents Budget Proposal:

- Highlights: Increase of 2.6% in agricultural funding. In addition, up to $152M in further funding. Some programs have disappeared altogether &emdash; e.g. no NRI funding for water quality research &emdash; integrated into other programs.

Handout # 4: NASULGC Budget Committee - Proposed Changes

Q: John Lea-Cox asked how technology issues are being included in the various programs?

A: Dr. Kanwar replied that USDA, NASA, and EPA forming closer partnerships and research proposals will be more successful if inclusive. In addition, DOD is a source of funding for developing technology.

B. Minutes, 1998 Meeting from College Park, Maryland (Dr. Raymond Wheeler)

- Raymond Wheeler summarized the minutes from the 1998 NCR-101 co-hosted UM/USDA Meeting at College Park, Maryland. No additions or corrections were suggested.
- Royal Heins made a motion to approve the minutes. Motion seconded by Donald Krizek and the group voted to accept the minutes.

C. Instrument Package Report (Dr. Bruce Bugbee)

1. Annual Report

- Bruce Bugbee reported on the Instrument Package Account. University of Wisconsin overpaid Utah State by $7,354 which was repaid to Univ. Wisconsin after Dr. Ted Tibbitts sorted it out.
- Four New Li-COR sensors were purchased in the past year ($1,204). Several of the Instrument Package sensors were sent back to the manufacturers and recalibrated, some for the first time in a decade. Most of the sensors were still accurate (within a few percent). Bruce will comment on this further in the report. Balance in the Account as of March 23rd was $6,862.
- A new instrument package has been put together for the calibration of PAR sensors. Bruce Bugbee noted that plants integrate radiation far better than we can measure it (compared to other environmental variables). The package includes a variable Quantum Integrator (eight input channels) with a calibrated plate that can test five unknown and three known sensors.
- Bruce presented a cost-benefit analysis of using Li-COR 'Factory' vs. NCR-101 Quantum Sensor Calibration:
    - **Li-COR Accuracy** (± 4%) Cost $60 per sensor &endash; calibrated at Li-COR once a year.
    - **NCR-101 Accuracy** (± 2%) Cost $300 flat fee &endash; calibrated under NIST Reference Incandescent Lamp (one month turnaround time).

2. Report on Long-term drift of Li-COR Quantum Sensors

- Bruce presented variability data of 10 Li-COR sensors in a calibration block . Steve Klaussen optimized the signal:noise ratio of the sensors, all mounted in a single block. Sensors ranged from 4% high to 4% low (steady drift in 6 months). Three sensors were chaotic (15% high / low) over a 60 day period. These sensors were then sent back to Li-COR for recalibration. Li-COR found no drift in the sensors, or error in the assembly. There appears to be a humidity factor with some Li-COR sensors. Li-COR indicated that this was of real concern to them and they intend to pursue the matter.

  Q: What is a quick way of telling whether a sensor is erratic?
  A: Redundancy &emdash; have two sensors together
  C: Dr. Lynton Incoll suggested a stable point source (reference source). Bruce agreed that you need a steady point source

  Sidenote &endash; Bruce indicated that they did not seem to have a problem with Apogee sensors that were cavity filled.

  Q: Was the decrease in sensor performance related to rain events?
  A: Bruce thinks that it is more related to humidity and the glass/filters that Li-COR uses in their sensors.

  Q: What is the difference in construction?
  A: Underwater cable is not completely water proof, but if it were the cable going into the sensor, all sensors should show it. Not clear how the water is getting in, but temperature changes may cause negative pressure changes in the sensor that may draw water in.

  Q: What is the error of the sensors compared to the error in placement of the sensor within the plant canopy / location?
  A: Probably as much, but it is important to understand the mechanism for calibrating the instrument package.

3. Addition of a UV/visible spectrometer to Instrument Package

- Bruce proposed to the committee to add a UV/visible spectrometer to the Instrument Package (Model EPP 2000C with UV upgrade) that would cost $3,550. In addition, a Li-COR 1800-02 optical calibrator ($3,570) plus integrating sphere ($700) would include a National Institute of Standard Technology standard incandescent tungsten filament lamp.

  Q: How would these instruments be used by the group?
  A: Most of the instruments in the package are probably used for measurements, rather than calibration (apart from PAR sensors).
  C: Donald Krizek commented that the calibration lamp might not have enough UV to be an effective calibrating instrument.

- A motion was made by Roy Young to authorize Bruce Bugbee to purchase the Spectrometer, subject to no major flaws and acceptable performance being apparent within 30 days (Dr. Gerry Deitzer and Donald Krizek to field test the instrument at University of Maryland and USDA &emdash; BARC in this time).
- Motion was seconded by Don Krizek. Unanimous vote.

D. NCR-101 Communications Issues:

1. Internet Homepage (Dr. David Tremmel) http://www.ncr101.duke.edu

Overview of the Site:

1. David Tremmel gave an overview of the site, starting with the history of the NCR101 group by Robert Langhans and Ted Tibbitts (thanks to Donald Krizek).
2. Activities of the group are listed together with information exchange, Publications, Officers, and Members, including links to government agencies, Controlled Environment Facilities, CE Working Groups and Industry links.
3. Other Links on the page take people to other controlled environment (International) Groups and facilities (e.g. in Australia and New Zealand)

Feedback on the Site:

1. Mark indicated that all information would reside in the member database, incorporating one web-site link to each institution. Members would then be responsible for updating their institution information twice a year.
2. Donald Krizek offered formal thanks from the group to David Tremmel for all the hard work that he has done on the website in the past year.
3. Mark Romer passed on a suggestion from Ted Tibbitts that the Measurement and Reporting Guidelines should be reported on the Website. The group indicated that various publishers would be receptive to this, but John Lea-Cox noted that copyright release has to be negotiated with the individual publishers if the publication is placed on the Website.

4. Donald Krizek raised the issue of publicity of the Handbook. Mark Romer suggested that the Website form should note that it was printed off the web, and Iowa State Press could provide data on this. Individual members can ask professional societies to link to the site.
5. The Metatag structure should also reflect the most important keywords for search engines. John Lea-Cox volunteered to approach the National Agricultural Library and AgNIC databases to list the site.
6. Bernie Grodzinski suggested that money could be generated from the website for supporting the instrument package and other group costs. Mark Romer suggested that we look into this matter as a separate discussion. Ramesh Kanwar suggested that the money generating activity should be kept within the ASHS committee for the moment (until he can clarify matters from the USDA side). Mark Romer said that the group would not do anything without approval.
7. Donald Krizek would also like peer-reviewed information on instruments, calibration and data collection techniques associated with those instruments. Mark Romer concurred and Gary Stutte suggested that the ASHS workshop proceedings should be included in this area.
8. From the attendance at the 1998 ASHS controlled environment workshop, this information was obviously wanted by a much larger audience.
9. Donald Krizek brought up the issue of standardizing to SI units. The guidelines are in SI units, so the group should encourage manufacturers to include these units in their literature.
10. Lynton Incoll suggested mini-reviews in appropriate journals to focus on these issues and target specific audiences. Donald Krizek noted that you have to work with the editors of these journals to suggest the appropriate use of SI units in publications. John Lea-Cox noted that you have to educate people as to the worth of keeping environmental data during the course of their experiments. Lynton Incoll noted that you need enforcement by the editors of journals for those experiments that use controlled environments. Mark Romer noted that the webpage would be an appropriate place to put these guidelines for editors to refer to as a resource.

Controlled Environment Reference Database:

1. John Lea-Cox asked the membership for feedback on a reference database to include in the website. He indicated that there were a number of issues involved with this, including developing a Boolean search engine and what kind of references the membership would like cited. For example, what were the most appropriate journal articles that should be included in the database?

2. Gerry Deitzer voiced concern about whether many of these citations can be found, particularly some of the NASA Technical Memoranda. John Lea-Cox suggested that the National Agricultural Library should be a repository for these documents.
3. Gary Stutte commented that the ASHS CE working group had been through a similar debate for the ASHS webpage. Trying to decide what were the most pertinent articles was too contentious for any individual. He suggested that articles should be restricted to NCR101 produced publications.
4. Mark Romer commented that Ted Tibbitts had suggested drafting a committee to decide what should be included in the list. Bernie Grodzinski suggested that perhaps individuals interested in providing their own relevant publications could use the NCR101 website as a template, and they could provide that information on their own website.
5. Gary Stutte said that there needs to be some concern over what references from outside sources are entirely relevant to the site.
6. Dave Tremmel suggested that the relevant publications included in the site could be organized using keywords, to make searching easier.
7. The consensus of the membership appeared to be to list a limited number of references on the site, organized by key words / subject areas, and that a search engine would not be required at present to facilitate this.

Membership Information

1. Mark Romer asked the membership for feedback on contact information for inclusion on the NCR101 Homepage &emdash; Name, Address, Phone, Fax, email, website. Dave Tremmel suggested that the individual from each institution should make this decision. No adverse comments were noted by the participants.

2. John Lea-Cox suggested that we publish the minutes on the webpage, and suggested that the date of the annual meeting would be the cut-off date for submitting station reports to the secretary. Hardcopies of these reports and the minutes of the annual meeting would be then forwarded to Dr. Kanwar for distribution to the Agricultural Experiment Station Directors.
3. Don Krizek made the motion to make the station reports and minutes available on the Web. Motion seconded by Alex Turkewitsch. Unanimous vote.

2. Membership List Update:

- Mark Romer mentioned that the database was now three years old and that the membership increased by 28 members this year, with three deletions (net gain of 25 members).
- The membership is composed of 118 representatives from 66 institutions. The institutions fall into 4 broad categories: Academic, Government, CE facilities and Industry.
- The Membership List now includes Director, Institution and member information

D. Other Business:

- Donald Krizek has been approached to revise a Chapter "Environmental control for animals and plants" for inclusion in the ASHRAE 2001 Fundamentals Handbook. Art Spomer agreed to help Donald Krizek with this task.

D. Selection of 1999-2000 Officers (Nominating Committee: Dr. Richard McAvoy, Dr. Judith Thomas and Dr. Mark Romer)

- Mark Romer reported that the committee recommended. Ray Wheeler as Chair, Dr. John Lea-Cox (Vice-Chair) and Dr. Arend-Jan Both as secretary.
- Motion offered by Roy Young and Seconded by Don Krizek. (Unanimous vote)

E. Agenda Item: **Future Meetings; Year 2000**

- The next meeting will be held at Purdue University, West Lafayette, Indiana from 11-13th March, 2000. Cary Mitchell reported that a block of 40 rooms is currently reserved for NCR101 group at Purdue Memorial Union Hotel on Campus. The format will be traditional, Saturday afternoon reserved for the ASHS Controlled Environment Working Group meeting, Sunday Business Meeting and Information Exchange, concluded on Monday morning with a tour of the new Purdue Greenhouses on Monday afternoon. Tours will be held on Tuesday, 14th March, which will end up near the Indianapolis airport.
- Bruce Bugbee asked that graduate students should be encouraged to produce relevant posters and that Cary Mitchell should be asked to provide poster space for the 2000 meetings

Proposal for 2001 Meeting in Norwich, UK

1. Synopsis

- Mark Romer provided a synopsis of the developments that had occurred to date for the UK2001 meeting.
- The idea had been suggested at the 1998 NCR101 meeting, with strong support from Dr. Kanwar. Royal Heins and John Lea-Cox followed up at ISHS in Brussels and got in touch with Dr. Lynton Incoll at Leeds University. Following the UK Controlled Environment group meeting in September, where the proposal was put to the UK members, a meeting outline was put together for consideration at this meeting. The committee decided to conduct an email poll of the membership to invite Dr. Incoll to the 1999 meeting at Cornell, which Mark Romer arranged. The results of that ballot were 35 votes for: 3 against.

2. Presentation &emdash; Dr. Lynton Incoll, Convener, UK CEUG

- Dr. Incoll introduced himself and expressed his thanks to the group for supporting his trip. He is based at Leeds University, and is involved in CE through the management of about 25 growth chambers at Leeds.
- *Membership:* Active membership of the UK Society is currently about 130 people, from Government, Universities and Commercial groups. Membership has been affected greatly by government closing institutions down in the 1980's and 1990's. Commercial organizations now comprise a number of people from Industry . Total number of institutions involved is now approximately 25 (about 10 universities). Potentially about 43 Universities could be represented.
- *Communications:* Membership is on an Access database, kept by Dr. Incoll. Many members are not on email. There is an non-moderated group mailing list on majordomo. It has been rarely used to date. Their Webpage has been revamped in the past few weeks.
- *UK Meeting Structure:* Twenty-four hour meeting (Noon to Noon).
    - First Day: Two scientific sessions after lunch, sometimes around a theme. Evening meal is followed by the Business meeting. Business meeting follows a standard format including minutes for the last meeting, New and Old Business, Maintenance issues, sensor etc. and any issues that may be of relevance and where information can be exchanged. Very similar to the NCR-101 Meeting.
    - Second Day: Trade Display and Tour of Facilities of hosting institution. Meeting ends with Buffet Lunch. Trade show can be any business that impacts controlled environments.

3. Proposal for Joint Meeting in 2001:

- *When:* Early September proposed since early March is Easter in UK &emdash; competition for accommodation, air flights expensive. September may be a problem for US participants.
- *Where:* Suggested John Innes Institute, Norwich. Good meeting facilities, next to University of East Anglia. Large CE facilities, about 750 employees and they have agreed to host the meeting. Includes the Sainsbury Laboratory. Has extensive ranges of glasshouses and CE facilities. It has a range of containment glasshouse and six sets of various CE facilities.
- *Program:*
    - Day 0: Buffet Supper and Registration; Welcome reception
    - Day 1: Scientific Program &emdash; 4 sessions of papers through the day. Evening Meal, followed by Individual Groups Business Meetings. The scientific program could include updates of seminal presentations from the previous few years. e.g. on refrigerants, research on the effects of low-pressure on plant growth, lighting etc.
    - Day 2: Four sessions of Information Exchange, followed by Conference Dinner

- Day 3: Tour of Facilities: Rooms, CE rooms, Cabinets, Seed Store for genetic conservation, Rare Botanical Book Library, Laboratories (various styles and types). Trade Display: CE Rooms, cabinets, glasshouses, sensors, control systems, components and supplies, Integrated pest management.
- Day 4+: Tour of Other Installations: See attached file of various suggested tours and costs

- Dr. Incoll then regaled the members with a slide show of various facilities and institutions throughout the UK, to provide some background for the various tour options.

4. Discussion on the Meeting Proposal.

- Don Krizek and Royal Heins strongly recommended the joint meeting with the UK and European groups.
- Ramesh Kanwar indicated that the experiment station directors would support one official from each station for the meeting.
- Bruce Bugbee commented that it was more expensive for him to come to Cornell than it was for Dr. Incoll to come from England.
- Ramesh Kanwar asked if industry could support graduate student involvement.
- Royal Heins made a motion to organizing a meeting in the UK in 2001. Don Krizek seconded the motion. The motion passed unanimously.
- Royal Heins then asked for a show of hands as a straw poll from people who thought they might attend. Approximately 25 people present indicated that they would go. Mark indicated that other members not present had expressed a strong interest in going.
- Gerry Deitzer asked if late May could be an alternative period for the conference.
- Lynton Incoll stated that September would be the best period to arrange tours from an accommodation perspective at the Universities. The Easter period in Spring would be low-cost airfare period from USA, but the end of the year would be better climatically for plant people. The NTV meeting in Holland is usually held in the Fall. Lynton will investigate times around Easter.
- John Lea-Cox suggested that a committee member should be charged with investigating funding sources to support the 2001 meeting. Lynton said that some of his committee members are also charged to investigate funding sources e.g. NATO, but there are restrictions associated with these grants.
- Mark Romer asked what the scope of the meeting should be, and whether the meeting should be opened up as a conference. David Tremmel suggested extending invitations for representatives from other institutions (e.g. Australian, New Zealand, Japanese groups etc). Lynton asked for help in getting in contact with various European representatives, who he has had trouble in getting in touch with. International Speakers / representatives would also elevate the workshop to the level that Dr. Kanwar suggested.
- Mark Romer asked if the committee should think about a theme for the Workshop, and produce a proceedings to justify a pitch for support funding. Gerry Deitzer suggested that CE was a narrow topic in and of itself. Lynton suggested that "Controlled Environment in the Third Millennium" might be sufficient. Ramesh Kanwar seemed to think it would help his cause if there were some other event or title that could be added to the meeting.

5. Election of 2001 Conference Organizing Committee

- The following members were appointed as the US committee to help Lynton Incoll and the UK committee to organize the 2001 Meeting at John Innes Institute, University of East Anglia, Norwich:
    - John Lea-Cox (Chair) &emdash; NRSL Dept., University of Maryland, College Park

- Ray Wheeler &emdash; NASA, Kennedy Space Center, FL
- Arend-Jan Both, Agricultural Engineering Department, Cornell University
- Mark Romer &emdash; McGill University
- Donald Krizek &emdash; USDA, Beltsville Agricultural Research Center, MD

Information Exchange

The following attendees participated in station reports:

Sunday, March 28th , 1999 (4:30 &emdash; 5:15pm)
Gene Giacomelli - Cook College Rutgers University

Monday, March 29th , 1999 (8:00 &emdash; 12 noon)
Royal Heins - Michigan State University
Mike Dixon - Guelph University
Roy Young - Penn State University
Edie Sears - Penn State University
Gioia Massa - Penn State University
Cary Mitchell - Purdue University
Chuck Leibert - Iders Inc.
Alex McIlraith - Iders Inc.
Rick Cordes - Environmental Growth Chambers
Peter Ling - Ohio State University
Dan Barta - NASA Johnson Space Center
In-Bok Lee - Ohio State University
John Lea-Cox - University of Maryland
Gerry Deitzer and Tim Mies - University of Maryland
David Tremmel - Duke University Phytotron
Don Krizek - USDA-ARS Climate Stress Laboratory, Beltsville
Reg Quiring - Conviron
Eric Runkle - Michigan State University
Bruce Bugbee - Utah State University
Chieri Kubota - Chiba University, Japan
Wade Berry, UCLA
Ray Wheeler - NASA Kennedy Space Center
Mark Romer - McGill University Phytotron
Bob Langhans - Cornell University
A. J. Both - Cornell University
Lou Albright - Cornell University
Dan Ciolkosz - Cornell University
Mauricio Salamanca - Cornell University
Gunes Ilaslan - Cornell University

The Station Reports were followed by afternoon tours of the Controlled Environment Hydroponic Lettuce greenhouses, the Floriculture greenhouses and the hydroponic test bed facilities at Cornell University.