

# Management & Environmental Technologies, Inc.

## PennState Nanofabrication Chip Camp

### Summary Report, Summer 2002



*Philadelphia students learn about nanofabrication manufacturing technology*

From: Kenneth J. Dunkley, Technology Manager  
To: Dr. Brenda K. Mitchell, President/CEO  
Date: January 9, 2002

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# PennState Nanofabrication Chip Camp

## Summary Report, Summer 2002

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This document contains lists of the students who participated in the Penn State Nanofabrication Chip Camp Program conducted in the summer of 2002. The lists, broken down by home cities, provide the student's name, grade, and the results of "TalkBack" questionnaires associated with each group.



*Students learn about nanofabrication manufacturing technology*

TalkBack results for three of the four groups are provided and total results for the three groups are summarized in charts titled:

- "Survey of Student Responses to the PennState Nano-Camp TRUE vs. FALSE Questions" and
- Total Score of the PennState Nanofabrication TalkBack Questionnaire: The Most Liked Events Arranged in Order of Preference

Also, anecdotal information is contained in the individual student's responses in the comment sections. Taken as a whole, the results of the questionnaire suggest that students with higher grade levels may be more receptive to and may be able benefit more from the chip camp experience.



For instance, from the second chart notice how the event "*Thinking that one day I could actually attend Penn State or some other university or college*" was rated #2 in preference by 9.8 grade level students (i.e., the Boys & Girls Club of Philadelphia) but rated only # 5 in preference by students of grade level 8.8 (Mercer County Housing Authority/Falbo-Pennrose & Farrell Area School, Farrell, PA). Of course, our small sample size thwarts any firm conclusion and relegates most of our comments to speculation. However, during the sessions there was unanimous agreement among

attending MET chaperone staff that the program materials would be better suited to the needs of 10<sup>th</sup> and 11<sup>th</sup> graders.

The most recommended suggestion was to include more hands-on "nano" activities, although they are difficult to come by.

The participating organizations, their locations, and trip times are as follows:

### **CHIP CAMP PROGRAM SCHEDULE - SUMMER 2002**

- *Mercer County Housing Authority, Farrell, PA* 6/19/02 to 6/21/02
- *NAACP of Harrisburg, PA* 6/24/02 to 6/26/02
- *Boy & Girls Clubs of Philadelphia, PA* 7/15/02 to 7/17/02
- *Mayer Sulzberger & Henry C. Lea Middle Schools, Phila., PA* 6/26/02 to 6/28/02

Lists containing the names and information on the participating students are attached. Appropriate statistical averages are provided when available.

A photographic record of the experience is included on the CD-ROM associated with this report. The report contains four photographic portfolios that document the chip camp experience.

# **PENNSTATE NANOFABRICATION TECHNOLOGY CHIP CAMP**

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## **FACT SHEET**

### **WHO WILL ATTEND?**

Groups of middle school youth in the 8<sup>th</sup> through 10<sup>th</sup> grades. Maximum youth group size is twenty (20) participants. One adult chaperone for every four youth and inclusion of parents as chaperones is encouraged.

### **PROGRAM SCHEDULE - SUMMER 2002**

- *Mercer County Housing Authority, Farrell, PA* 6/19/02 to 6/21/02
- *NAACP of Harrisburg, PA* 6/24/02 to 6/26/02
- *Boy & Girls Clubs of Philadelphia, PA* 7/15/02 to 7/17/02
- *Mayer Sulzberger & Henry C. Lea Middle Schools, Phila., PA* 6/26/02 to 6/28/02

Program duration: Three days – see attached sample three (3) day agenda

### **ELIGIBILITY**

- Students interested in math, science & technology
- Middle school student referred by school official or community youth program staff
- Students to provide a 50 word narrative on why they'd like to attend
- Students willing and able to follow directions without behavioral problems

### **CO-SPONSOR/PARTICIPANT RESPONSIBILITY**

Some organizations require a \$10 deposit from students to ensure their participation once accepted. The \$10 is returned on the day of the trip.

Sleeping bags or pillow and sheets

Snacks for bus trips, evening treats & cameras

### **TRANSPORTATION**

Local sponsors are responsible for transportation to and from PENNSTATE

PENNSTATE will contribute up to \$350 toward transportation costs, if needed

### **SCHOLARSHIPS**

PENNSTATE provides scholarships which pay for the following items:

Room and board on site in the college dormitories, breakfast, lunch & dinner meals, technology instructors, laboratory equipment & lab experiences, tour schedule for after class activity

### **WHERE**

Pennsylvania State University Nanofabrication Facility at State College, PA

### **WHY?**

- Education & cultural exposure
- Education & career mobility orientation
- Develop, expand & strengthen career support systems
- Cutting edge technology experience
- Mentoring, coaching & tutoring access
- Have fun!

# THE PENN STATE NANOFABRICATION FACILITY CHIP CAMP CURRICULUM

## Summer 2002

### Approx Times\*

### Day One

- 1:00 Welcome and Overview of Chip Camp Rules
- 1:15 Introduction to Nanotechnology
- 2:00 Snack Break
- 2:15 Rotating Activities  
2:20-3:00; 3:05-3:45; 3:50-4:30
- Cleanroom tour
  - Microelectronics videos
  - Biomedical “chips” and technology
- 4:40 Wrap-up
- 5:00 Adjourn

### Day Two

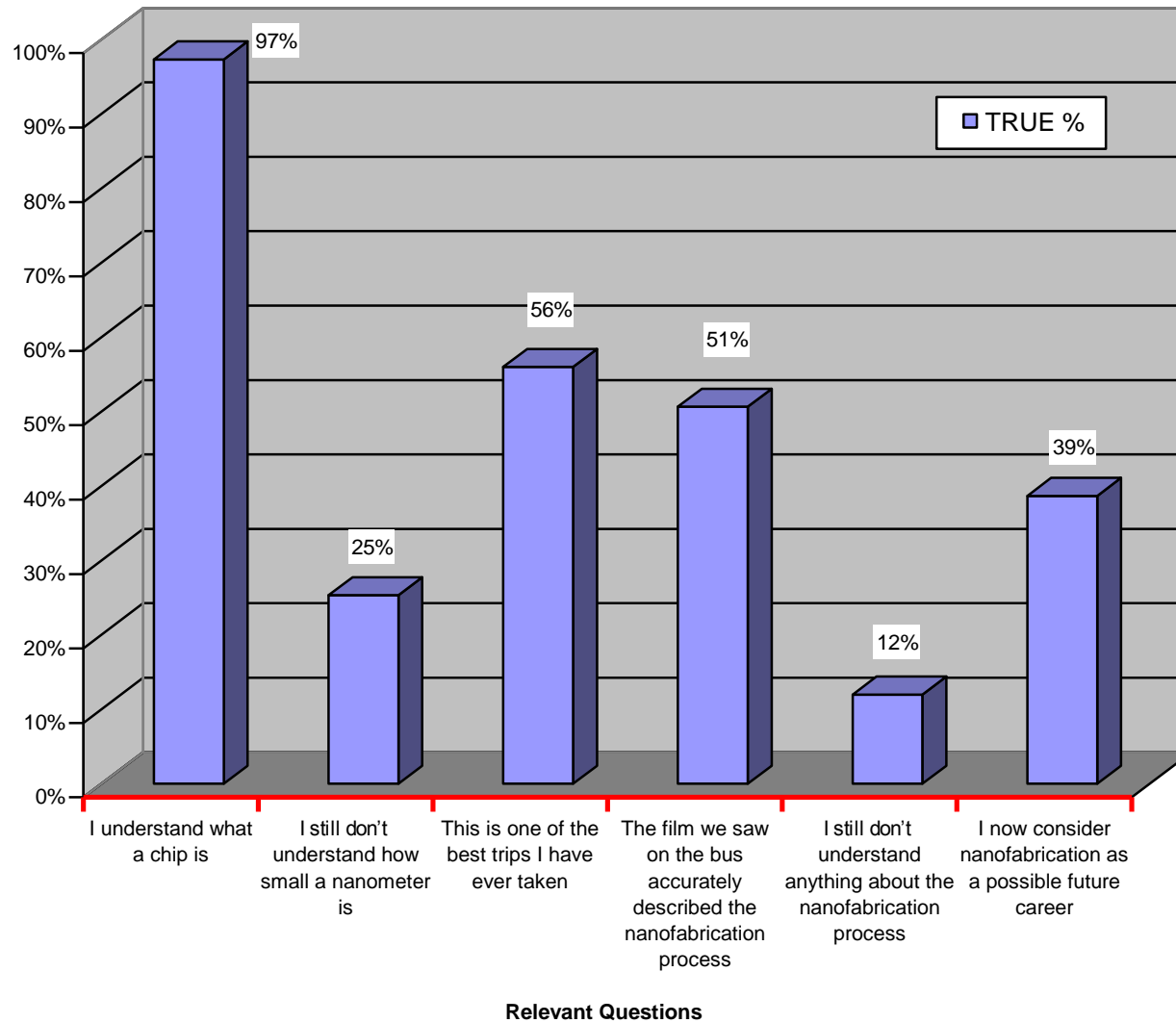
- 9:30 From Sand to Silicon to Circuit City: Basic Steps in Making a Chip I
- 10:30 Snack Break
- 10:45 Rotating Activities  
10:45 to 11:00 gowning  
11:00-11:40; 11:45-12:25; 12:30-1:10
- Physical Vapor Deposition: Putting Metal on Silicon
  - Patterning: Lithography
  - Etching: Using Plasmas to remove material
- 1:15 Lunch with Staff Engineers and Technicians
- 2:15 Pathways to Nanotechnology Careers
- 2:45 Colleges/Universities and the NMT Partnership Programs
- 3:30 Bryce Jordan Center Tour
- 4:30 Adjourn

### Day Three

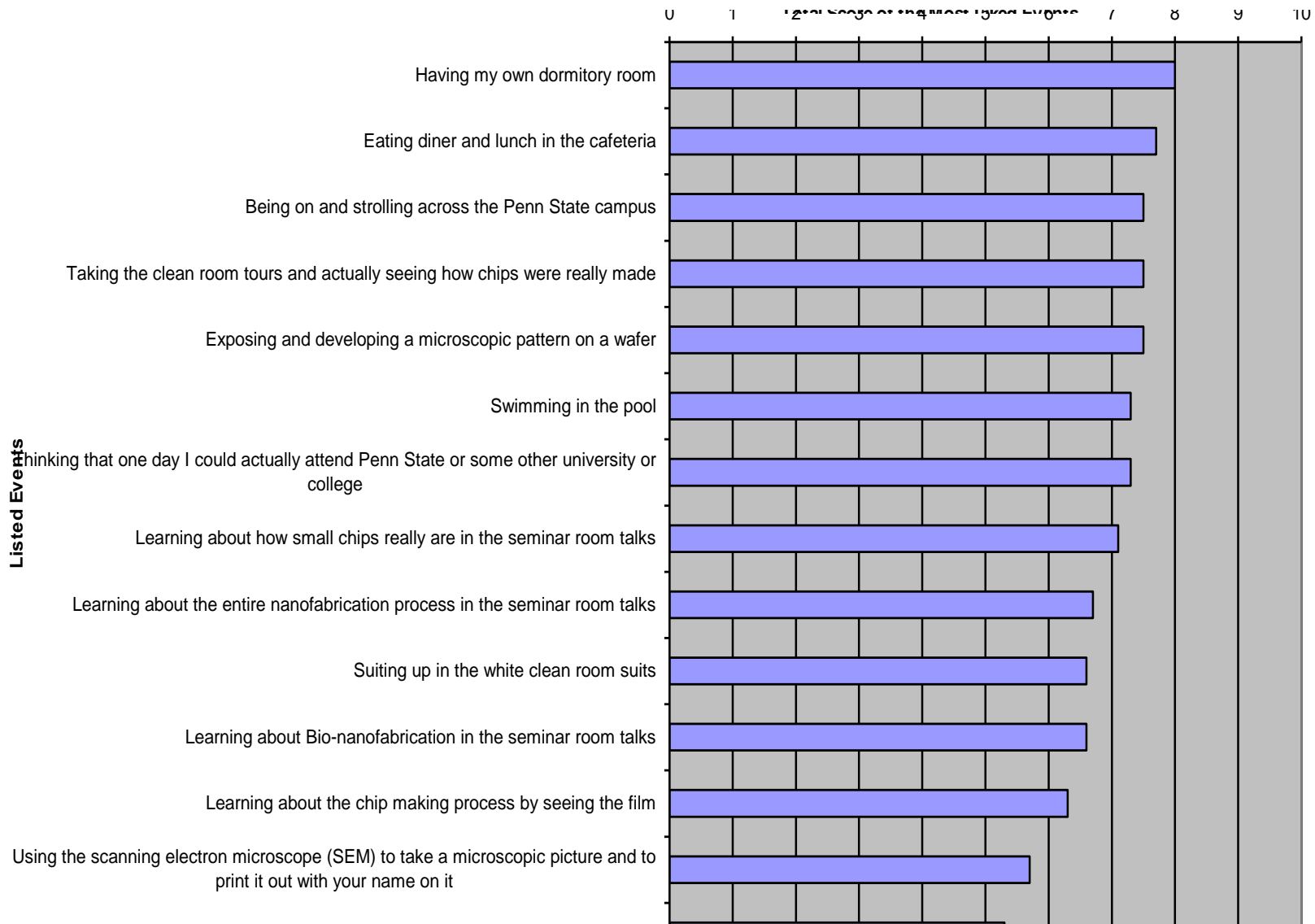
- 9:00 From Sand to Silicon to Circuit City: Basic Steps in Making a Chip II
- 10:00 Rotation Activities  
10:00 to 10:15 gowning, 10:15-10:55; 11:00-11:40; 11:45-12:25
- Thermal Modification: 4-stack furnace and/or RTA
  - Chemical Vapor Deposition: LPCVD and ECR PECVD
  - Characterization: Scanning Electron Microscope
- 12:30 Wrap-up and evaluation

\*See the document “On Campus Bus Scheduling” for correct times

**Survey of Student\* Responses to the PennState Nano-Camp TRUE vs FALSE Question**  
*[\*73 students + 3 chaperones]*



## Total\* Score of the PennState Nanofabrication TalkBack Questionnaire: The Most Liked Events Arranged in Order of Preference [\*73 students + 3 chaperones]



## RESULTS\* of Penn State Nanofabrication Trip: *TALK BACK!*

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Boys & Girls Club of Philadelphia/Simon Gratz H. S., 7/15/02 –7/17/02

[\* Includes feedback from 17 youngsters and 0 chaperones. Minimum age: 12 yrs,  
Maximum age: 18 yrs. Average age: **14.3** yrs. Average grade level: **9.8**]

**Score the events you liked the most by awarding it a number from 1 to 10**  
(Where 10 represents the best)

	<b>Scored Events presented in favored order</b>	<b>Total Average Score</b>
1.	Having my own dormitory room	8.9
2.	Thinking that one day I could actually attend Penn State or some other university or college	8.5
3.	Taking the clean room tours and actually seeing how chips were really made	8.3
4.	Learning about how small chips really are in the seminar room talks	8.2
5.	Learning about the entire nanofabrication process in the seminar room talks	7.6
6.	Exposing and developing a microscopic pattern on a wafer	7.6
7.	Eating diner and lunch in the cafeteria	7.6
8.	Swimming in the pool	7.4
9.	Being on and strolling across the Penn State campus	7.4
10.	Learning about Bio-nanofabrication in the seminar room talks	7.2
11.	Suiting up in the white clean room suits	7.1
12.	Learning about the chip making process by seeing the film	6.9
13.	Using the scanning electron microscope (SEM) to take a microscopic picture and to print it out with your name on it	5.8
14.	Seeing a current on campus event (insert a current campus event)	3.6

(The Total # of respondents was 17. This included 0 chaperones)

### Results of TRUE or FALSE Questions

	<b>Questions</b>	<b>Total Count TRUE</b>	<b>Total Count FALSE</b>
	I understand what a chip is	17	0
	I still don't understand how small a nanometer is	4	13
	This is one of the best trips I have ever taken	7	10
	The film we saw on the bus accurately described the nanofabrication process	10	7
	I still don't understand anything about the nanofabrication process	1	16
	I now consider nanofabrication as a possible future career	7	10



**All responses to the question: “What should Penn State do to improve the chip camp experience?”**

Generally these comments fell into a single group centered on *programming*

1. I only thing the PennState should do is continue to have chip camp so others can have an advantage like I did.	2. Let us try out some of the stuff in the clean[room] and {talk?} about it
3. More interactive and hands on project.	4. Penn State should let us stay longer so we can get to work in the lab longer
5. They should have lighter suits and let us sit down in the rooms that we go in.	6. Make it longer so the children can take in more information
7. Everything was nice except for the presentation on PowerPoint	8. Just do more events on the stuff we talk about and go over the stuff so people can understand it more
9. football stakium as well as they had a tour on the basketball stadium	10. Make it longer
11. Less lectures, less standing, less time	12. They should not make people standup while in the cleaning room
13. Have more hands on activities than Non Stop Boring Lectures	
14. Have more entertainment in the dorm rooms. Also let the students have a tour at the football stakium as well as they had a tour on the basketball stadium	15. More tour places
16. I really don't know what they should do.	

# RESULTS\* of Penn State Nanofabrication Trip: *TALK BACK!*

Mayer Sulzberger & Henry C. Lea Middle Schools, Philadelphia, PA  
6/26/02 – 6/28/02

[\* Includes feedback from 19 youngsters. Minimum age: 12 yrs, Maximum age: 14 yrs.  
Average age: **12.9** yrs. Average grade level: **8.4**]

**Score the events you liked the most by awarding it a number from 1 to 10**  
(Where 10 represents the best)

	<i>Scored Events</i> <b>presented in favored order</b>	Total Average Score
1.	Eating diner and lunch in the cafeteria	9.6
2.	Having my own dormitory room	8.4
3.	Swimming in the pool	8.1
4.	Being on and strolling across the Penn State campus	8.1
5.	Exposing and developing a microscopic pattern on a wafer	7.9
6.	Thinking that one day I could actually attend Penn State or some other university or college	7.4
7.	Taking the clean room tours and actually seeing how chips were really made	7.2
8.	Learning about <i>how small chips really are</i> in the seminar room talks	6.7
9.	Suiting up in the white clean room suits	6.5
10.	Learning about the <i>entire</i> nanofabrication process in the seminar room talks	6.5
11.	Seeing a current on campus event (insert a current campus event)	6.3
12.	Learning about <i>Bio</i> -nanofabrication in the seminar room talks	6.1
13.	Learning about the chip making process by seeing the film	5.9
14.	Using the scanning electron microscope (SEM) to take a microscopic picture and to print it out with your name on it	5.0

### Results of TRUE or FALSE Questions

	Questions	Total Count TRUE	Total Count FALSE
15.	I understand what a chip is	19	0
16.	I still don't understand how small a <b>nanometer</b> is	5	14
17.	This is one of the best trips I have ever taken	12	7
18.	The film we saw on the bus accurately described the nanofabrication process	3	12
19.	I still don't understand anything about the nanofabrication process	0	18
20.	I now consider nanofabrication as a possible future career	6	11

**All responses to the question: “What should Penn State do to improve the chip camp experience?”**

Generally these comments fell into two groups, *programming* and *accommodations*.

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|--|---|
| 17. They should let the children work in the factory and stand right in front of the machines and look at them make the chips. | 18. Stay for at least a week because it was to short and though us kids may not shown it but this was cool. Also boys and girls shouldn't be separated. |
| 19. Nothing they are perfect except they need not put on those little footee.  | 20. Penn State should make the camp days longer and the hour shorter. They should have bigger beds and TV's. We should have air contidioner in our dorm |
| 21. Penn State should make the time longer   | 22. Penn State should decrease the labs time  |
| 23. Be more interesting  | 24. Stop talking so much. We came to have fun not sit in a cold room and listen to some one talk  |
| 25. Play more games and don't talk so much   | 26. I didn't like it  |

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- |   |  |
|---|--|
| 27. To have the camp longer than as well to let the boys and girls room up together. To tour us around the building more. Stay up later | 28. They should let us share a room or let the college students take us on a tour. Have tv's and a bathroom in every room. |
| 29. Lower the price for losing a key. Letting the boys come see the girls. Letting us stay up late.                                     | 30. Put TV's in the room and let us play basketball inside of the Bryce Jordan Center                                      |
| 31. They should do a lot of more stuff because the tour is kind of corny  | 32. You should have more interesting tapes. Your own dorm rooms TV included  |
| 33. They should improve the room were we stay.  | 34. Cooler rooms and not have any boring lectures  |

**Comments from volunteer chaperones**

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|---|--|
| 35. Extend the camp for a longer period. Show slides of students who have attended previous camps | 36. I would gear this program more towards rising freshmen or older                                    |
| 37. Air conditioning (just kidding)   | 38. Kids could have had more planned activities in the evening other tan that I think it was excellent |

## Memorandum

Date: June 19, 2002  
 To: Debbie Boyle, PSU  
 From: Ken Dunkley, MET, Inc.  
 Re: Participant names & gender for the Chip Camp scheduled: 6/19/02 – 6/21/02

Participating Group: **Falbo-Pennrose Joint Venture HOPE VI and Farrell Area School**  
 Date of Chip Camp: 6/19/02 – 6/21/02.  
 Group Origin: Farrell, Pennsylvania

The total number of participants = 16 students + 5 chaperones + 2 MET, Inc. chaperones + 1 bus driver = 24 participants.

<i>Farrell High School / Mercer County Housing Authority,</i>		Gender
Contact: Joann Newell, (724) 342 4047 Hope VI CSS Coordinator (Mr. L Dewitt Boosel, Executive Director MCHA)		
<b><i>Student List</i></b>		
1	Cody Ringer	M
2	JaRel Clay	M
3	Erika Pollock	F
4	Heather O'Connell	F
5	Shellie Walker	F
6	Kerri Roupe	F
7	Ashlyn Sparrow	F
8	Leah Hubbard	F
9	Melissa Purich	F
10	Ike Williams (Manning)	M
11	Alicia Hopson	F
12	Blair Legg	M
13	Dominique Rosemond	F
14	Christea Pasley	F
15	Brandon Taylor	M
16	Jessie Taylor	M
<b>Chaperones</b>		
1.	Diane Woods	M
2.	Tony Sparrow	F
3.	Clerance Clay	M
4.	Kirsten Allen	F
5.	JoAnn Newell	F
<b>MET, Inc Chaperones</b>		
6.	Dr. Brenda Mitchell	F
7.	Ken Dunkley	M
<b>Bus Driver</b>		
8.	na	

**GREATER HARRISBURG NAACP  
CHIP CAMP PARTICIPANTS, 2002**

	<b>Name</b>	<b>Gender</b>	<b>School</b>	<b>Telephone</b>
1.	Asha Banks	F	C.D. East Jr.	(717) 561-1592
2.	Royce Bivens	M	" "	(717) 526-4967
3.	Jason Frye	M	" "	(717) 671-7008
4.	Octavia Hammond	F	" "	(717) 657-2511
5.	Autumn Johnson	F	" "	(717) 651-1453
6.	Mark Kaloka	M	" "	(717) 652-9442
7.	Paul Miller	M	" "	(717) 652-2786
8.	Jazsmine Silas	F	" "	(717) 671-4793
9.	Grady Smith	M	" "	(717) 561-0280
10.	Smith Walker	M	" "	(717) 5641004
11.	Joyce Waters	F	" "	(717) 652-1364
12.	Kara Stanton	F	Linglestown Jr.	
13.	Randi Patterson	F	Harrisburg High	(717) 233-4541
14.	Louisa Nkrumah	F	Swatara Jr.	(717) 558-9868
15.	Teerah Goodrum	F	" "	(717) 939-2345
16.	Teara O'Neal	F	Harrisburg High	(717) 232-7434
17.	Stephen Dixon	M	Milton Hershey	(717) 939-8697
18.	Marquia Boulaware	F	C.D. East Jr.	(717) 671-7008
19.	Avery Haywood	M	" "	(717) 232-5701
20.	Chibuikem Okoro	F	" "	(717) 651-1465

**CHAPERONS**

1.	Sharon Dixon	Mother of Stephen Dixon
2.	Judy Banks	Mother of Asha Banks
3.	Shelley Kaloko	Mother of Mark Kaloko
4.	Mrs. Nkrumah	Mother of Louisa Nkrumah

## Memorandum

Date: June 13, 2002  
 To: Debbie Boyle, PSU  
 From: Ken Dunkley, MET, Inc.  
 Re: **Revised** Participant names & gender for the Chip Camp scheduled: 6/26/02 – 6/28/02

Participating Group: **Mayer Sulzberger & Henry C. Lea Middle Schools**  
 Date of Chip Camp: 6/26/02 – 6/28/02.

The total number of participants = 20 students + 4 chaperones + 2 MET, Inc. chaperones + 1 bus driver = 27 participants.

HENRY C. LEA SCHOOL Southwest Academic Area Michael Silverman Principal 47th & Locust Streets Philadelphia, PA 19139 msilverm@phila.k12.pa.us Contact: Alan Snyder, 215 471-2915		Gender
<b>LEA Student List</b>		
17	Ian Garnett	M
18	Floyd Payne	M
19	Ashley Gallam	F
20	Rhodia Ramseur	F
21	Odelia McFadden	F
22	Whitney Johnson	F
23	Chantary Chhoeung	F
24	Aleysa Banks	F
25	Simone Carter	F
26	Michael Parker	M
<b>Lea Chaperones</b>		
1.	Tonya Green	F
2.	Alan Snyder	M
<b>MET, Inc Chaperones</b>		
8	Dr. Brenda Mitchell	F
9	Ken Dunkley	M

SULZBERGER MIDDLE SCHOOL 48 <sup>th</sup> and Fairmount Avenue Philadelphia, PA 1939 Contact: Daisy Century, 215 581-5510		Gender
<b>Sulzberger Student List</b>		
11.	Alicia L. N. Barringer	F
12.	Alesha R. Davis	F
13.	Nefertiti Downing	F
14.	Anne M. Frazier	F
15.	Dawn R. Frazier	F
16.	Jerome Haughton	M
17.	Derrick Page	M
18.	Michael A. Owen Jr.	M
19.	William Obiesie	M
20.	Ashley Singleton	F
<b>Sulzberger Chaperones</b>		
3.	Daisy Century	F
4.	David Miller	M
<b>Bus Driver</b>		
10		M

## Memorandum

Date: January 8, 2003

To: File

From: Ken Dunkley, MET, Inc.

Re: Updated Student & Chaperone List for the July 15-17, 2002 Nanofabrication chip camp

### Boys & Girls Clubs of Philadelphia

	<b>Name</b>	<b>Gender</b>	<b>Entering grade</b>	<b>Age</b>
1.	Namunisha Johnson	F	8	13
2.	Courtney Law	F	8	12
3.	Marguerite Sutton	F	8	13
4.	Preston A. Lockwood	M	9	13
5.	Nam Van Tran Jr.	M	9	15
6.	Khay-Yon Wilkins	M	12	16
7.	Jelissa Price	F	9	14
8.	Brian Hurst, Jr.	M	8	12
9.	Kelly Waiters	F	8	13
10.	Takeeia Wilkins	F	11	15
11.	Courtney Waiters	M	7	12
12.	Jessica Johnson	F	11	13
<b>AVERAGE</b>			<b>9.0</b>	<b>13.4</b>

### Boys & Girls Clubs of Philadelphia (in association with Simon Gratz H. S.)

	<b>Name</b>	<b>Gender</b>	<b>Entering grade</b>	<b>Age</b>
13.	Ebony Anderson	F	12	18
14.	Sasha Anderson	F	11	15
15.	Sheena Flippen	F	12	17
16.	Tyaira N. Perry	F	11	15
17.	Erica Walker	F	12	16
<b>AVERAGE</b>			<b>11.6</b>	<b>16.2</b>

### Chaperones

18.	Diane Datcher	F
19.	Charles Mosley	M
20.	Earle Hackett	M
21.	Sharon Washington	F

### MET, Inc.

22.	Ken Dunkley	M
23.	Corrie Mitchell	M

### Bus Driver

24.	Pam Jackson	F	Will not require a dorm room
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