FINAL REPORT
TO
OFFICE OF NAVAL RESEARCH

DoD Science and Engineering Apprenticeship Program for
High School Students

1996–'97 Activities
Contract No. N00014-96-1-1110

Principal Manager: Dr. Richard L. Pfeffer
Geophysical Fluid Dynamics Institute
The Florida State University
Tallahassee, FL 32306-3017
(904)-644-5594

May 1997
The Florida State University
Tallahassee, Florida
1. INTRODUCTION

The year 1996-'97 represented our fifteenth successful DoD Science and Engineering Apprenticeship Program for High School Students at Florida State University, sponsored by the Office of Naval Research. The program this year was again administered by the Geophysical Fluid Dynamics Institute (GFDI) under the direction of Dr. Richard L. Pfeffer. Student educational activities and work experiences were centered at GFDI.

In the spring of 1996, the guidance counselors of five local high schools were asked to recommend outstanding college-bound students who they thought would benefit most from our program. Ten students were selected to participate starting in the summer of 1996 and thirteen during the school year, 2 of whom were from the summer program, 6 of whom were from last year’s program, and 5 new students during the academic year. Our student group consisted of 9 seniors, 7 juniors and 5 exceptional sophomores. The departure from our past concentration on seniors was motivated by our desire to expose students to science and scientific methodology at an earlier age. Some background information concerning the students who were selected appears in the following section. Further information pertaining to each apprentice is attached at the end of the report.

Students spent a total of 30 hours per week with the program for 10 weeks in summer and 10–20 hours per week during the school year. They participated in the research program via data handling and data processing with the aid of computer operated equipment, and in enrichment activities during the summer; including lectures, laboratory demonstrations, scientific films, field trips and a formal course and a weekly discussion session on the history of science using the book Coming of Age in the Milky Way by Timothy Ferris. A summary of their activities and projects is included in Section 3.
<table>
<thead>
<tr>
<th>NAME</th>
<th>RACE</th>
<th>SEX</th>
<th>HIGH SCHOOL</th>
<th>ANTICIPATED COLLEGE</th>
<th>ANTICIPATED MAJOR</th>
<th>AWARDS/SCHOLARSHIPS</th>
<th>ACTIVITIES/HOBBIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lizza Bailey</td>
<td>White</td>
<td>Female</td>
<td>Leon High School</td>
<td>Undecided</td>
<td>Undecided</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Robert Sidney Cox, III</td>
<td>Other</td>
<td>Male</td>
<td>Leon High School</td>
<td>University of South Florida</td>
<td>Biology</td>
<td>Who's Who Among American High School Students, National Merit Scholar, Florida Academic Scholar, USF Excellence Award</td>
<td>Ultimate Frisbee</td>
</tr>
<tr>
<td>Ashish Desai</td>
<td>Asian</td>
<td>Male</td>
<td>Lincoln High School</td>
<td>University of Florida</td>
<td>Biochemistry</td>
<td>National History and Government, Who's Who Among High School Students, Best BIONR Student, NHS Scholarship, Florida Academic Scholarship, 1st place Latin Student, 1st Place History Fair</td>
<td>Sports (Baseball, Football, Soccer, Basketball), Disk Jockeying</td>
</tr>
<tr>
<td>Shannon Dunn</td>
<td>Other</td>
<td>Female</td>
<td>Godby High School</td>
<td>FSU</td>
<td>Undecided</td>
<td>National Honor Society, National French Honor Society, Awards for accounting, English, Drama, Science, Academic Merit; City of Lights</td>
<td></td>
</tr>
<tr>
<td>NAME</td>
<td>RACE</td>
<td>SEX</td>
<td>HIGH SCHOOL</td>
<td>ANTICIPATED COLLEGE</td>
<td>ANTICIPATED MAJOR</td>
<td>AWARDS/SCHOLARSHIPS</td>
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<tr>
<td>Allison Eagen</td>
<td>White</td>
<td>Female</td>
<td>Leon High School</td>
<td>Undecided</td>
<td>Accounting</td>
<td>2 Time All Big Bend in Cross-Country, All Big Bend in Track, Secretary of Exchangetts (Service Club), Treasurer of MAT (Math Club), 2nd and 3rd place at French Competition, Treasurer of Pierian (Honor Society)</td>
<td></td>
</tr>
<tr>
<td>David Henderson</td>
<td>White</td>
<td>Male</td>
<td>Jefferson County</td>
<td>Undecided</td>
<td>Undecided</td>
<td>Working on computers</td>
<td></td>
</tr>
<tr>
<td>Daanish Hoda</td>
<td>Asian</td>
<td>Male</td>
<td>Lincoln High School</td>
<td>FSU</td>
<td>Undecided</td>
<td>NHS, National Merit Finalist, Salutatorian, State and National Awards in Math and English Achievement</td>
<td></td>
</tr>
<tr>
<td>Adrianne Holmes</td>
<td>Black</td>
<td>Female</td>
<td>Lincoln High School</td>
<td>Undecided</td>
<td>Chemistry</td>
<td>National Honor Society, Mu Alpha Theta, Who’s Who Among High School Students, National History and Geography Award, First Place District History Fair (1995)</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>ACTIVITIES/HOBBIES:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Winter Festival Jr. Award for Piano, Outstanding Student Awards, Valedictorian of Griffin Middle School (1994), Who’s Who of Band and Academics</td>
</tr>
<tr>
<td>Playing Piano, Saxophone and Flute; Singing, Dancing and Acting in Community Theatre; Horseback Riding, Writing Poetry</td>
</tr>
<tr>
<td>Running, Music, Service Clubs</td>
</tr>
<tr>
<td>Ultimate Frisbee</td>
</tr>
<tr>
<td>Service Club, Youth Choir Member, SADD</td>
</tr>
</tbody>
</table>
NAME: Mitesh Jivan  
RACE: Asian  
SEX: Male  
HIGH SCHOOL: Godby High School  
ANTICIPATED COLLEGE: Undecided  
ANTICIPATED MAJOR: Undecided  
AWARDS/SCHOLARSHIPS:  
ACTIVITIES/HOBBIES:  

NAME: Tammy Jones  
RACE: Black  
SEX: Female  
HIGH SCHOOL: Godby High School  
ANTICIPATED COLLEGE: Undecided  
ANTICIPATED MAJOR: Veterinarian Medicine  
AWARDS/SCHOLARSHIPS: Honor Roll, Who’s Who, Academic G  
ACTIVITIES/HOBBIES:  

NAME: Durga Kode  
RACE: Asian  
SEX: Female  
HIGH SCHOOL: Leon High School  
ANTICIPATED COLLEGE: Undecided  
ANTICIPATED MAJOR: Undecided  
AWARDS/SCHOLARSHIPS: Honor Roll  
ACTIVITIES/HOBBIES: Playing Basket ball  

NAME: Julie Matthews  
RACE: White  
SEX: Female  
HIGH SCHOOL: Leon High School  
ANTICIPATED COLLEGE: University of Florida  
ANTICIPATED MAJOR: Sports Medicine  
AWARDS/SCHOLARSHIPS: Honor Roll  
ACTIVITIES/HOBBIES: Weightlifting, Swimming  

NAME: Marcus Mills  
RACE: Black  
SEX: Male  
HIGH SCHOOL: Godby High School  
ANTICIPATED COLLEGE: Florida State University  
ANTICIPATED MAJOR: Undecided  
AWARDS/SCHOLARSHIPS: FSU Incentive Scholarship, Scholarship Award from Omega Psi Phi, Vocational Gold Seal Scholarship, Varsity Football Letter  
ACTIVITIES/HOBBIES: Music, Sports
<table>
<thead>
<tr>
<th>NAME</th>
<th>RACE</th>
<th>HIGH SCHOOL</th>
<th>ANTICIPATED COLLEGE</th>
<th>ANTICIPATED MAJOR</th>
<th>AWARDS/SCHOLARSHIPS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vishnu Pabbathi</td>
<td>Asian</td>
<td>Leon High School</td>
<td>Undecided</td>
<td>Undecided</td>
<td>Basketball, Running</td>
</tr>
<tr>
<td>Keysha Peterson</td>
<td>Black</td>
<td>Rickards High School</td>
<td>Undecided</td>
<td>Undecided</td>
<td>Basketball, Running</td>
</tr>
<tr>
<td>Terra Sherlock</td>
<td>White</td>
<td>Leon High School</td>
<td>Undecided</td>
<td>Physics</td>
<td>Golden Glove Award (soccer), Sheriff's Ride Along and Shooting Program Awards, 1st Place in 3rd Grade Science Fair, 1st Sergeant in the Sheriff's Explorers, Vice-President in Nice Science Club, Communications Officer of Phoenix Science Club, Junior Varsity and Varsity Soccer</td>
</tr>
<tr>
<td>Aruna Subramani</td>
<td>Asian</td>
<td>Lincoln High School</td>
<td>University of Florida</td>
<td>Science</td>
<td>Honor Roll, Special Recognition Award, Academic Awards in English, Social Studies, French; Principal Awards in 9th, 10th, and 11th Grades; Traveling</td>
</tr>
<tr>
<td>Benjamin Switzer</td>
<td>White</td>
<td>Godby High School</td>
<td>Undecided</td>
<td>Computer Science</td>
<td>Honor Roll; Martial Arts, Chess, Quotes Collector</td>
</tr>
</tbody>
</table>
Michelle Wallace
Black
Female
Lincoln High School
University of Miami
Biology
National Honor Society, 1995 1st place Leon County History Fair,
Biological Institute of ONR Math Award, Biological Institute of ONR Science Award
Piano

Jereme Wilson
Black
Male
Godby High School
Undecided
Undecided
1st place Public Speaking, 1st place Poetry Contest, Honor Roll, Certificates of Academics, Physical Education Awards, Essay Contest
Singing, Writing Poetry
3. STUDENT WORK PROJECTS AND INSTRUCTION

Twenty-one students participated in digitizing velocity vector data from photographs of flow fields obtained in laboratory experiments that simulate the influence of mountains on the atmospheric jet stream, and two assisted in data analysis using computer programs on PCs and the VAX. These activities were part of a larger project on studies of the interaction of bottom topography with overlying baroclinic waves investigated by Drs. R. L. Pfeffer and R. Kung. The students' work was supervised by Mr. Bala B. Kode.

The major project in which the students participated during the summer was the analysis of photographic velocity data from laboratory experiments on the interaction of topography with baroclinic waves. The experiments were conducted in a thermally driven rotating annulus of fluid.

Oceanography Prof. Ruby Krishnamurti (Fellow of the AMS and APS) demonstrates thermal oscillators to the high school student group.

The data from the experiments were obtained by means of a camera, mounted at the top of a rotating annulus of fluid, which recorded the movements of laser-illuminated particles suspended in the fluid. The camera produced a sequence of still photographs; in each photograph the movement of every particle appeared as a string of dots. By digitizing the positions of these dots and calculating the distance between...
dots and the orientation of each string of dots, one can determine the velocity field as a function of time. Fourier analyses and energetics calculations of such data provide valuable information about the behavior of baroclinic waves in the presence of bottom topography.

The students had the opportunity to gain experience in the use of digitizing equipment, personal computers, and video monitors which display the work graphically as it is being digitized. They were also able to see and discuss the results of a first-level analysis of the digitized data performed on the GFDI DEC VAX computer cluster. During the course of the summer, the students worked with photographs from several different experiments, which allowed them to see the effects of variations in experimental parameters such as the difference in temperature between the inner and outer walls of the bath, the speed of rotation, and the presence or absence of topographic barriers with different shapes.

The instruction and training given to the high school students concerning their work as apprentices went well beyond that needed to do the job. Efforts were made by the faculty and staff to make their work experience a learning process and an introduction to scientific methodology. Our goal was to ensure the students’ understanding of the relationships between theoretical models and observable phenomena, such as the jet stream and ocean currents, (e.g., the Gulf Stream and the Kuroshio Current) which affect the transfer of heat from the tropics to the arctic. This was accomplished by explaining in detail the goals of the program, the scientific methodology, the implications of the experimental and related theoretical results and the contributions of the students’ work to the overall project.

4. ENRICHMENT ACTIVITIES

Aside from the students’ activities as apprentices, they participated in a variety of other educational activities. These included a series of talks on research topics covering a broad spectrum of scientific disciplines. Talks were given by undergraduate and graduate students Mike Kirby and Scott Applequist, and by Drs. Furbish, Gruender, Kasha, Ruby Krishnamurti, Kung, Long, Loper, Magnan, Pfeffer and Ruscher on topics ranging from the modeling of the Earth’s Interior to Flavenoids. In addition, the students
participated in discussions with Dr. Long on Coming of Age in the Milky Way, an exciting book on the history and methodology of physical science by Timothy Ferris. A series of scientific films was also selected and shown by Dr. Kung. These covered topics such as astronomy, the strange new science of deterministic chaos, space exploration, atmospheric phenomena, volcanos and others. Drs. Kung and Ruby Krishnamurti also engaged the students in a series of scientific experiments in which different natural phenomena were simulated in the laboratory. A list of these activities is given in Table 1. Dr. Long also took students on field trips to the National Weather Service at the Airport, Channel 27 TV station, the FSU Planetarium, the National Magnet Laboratory and the FSU Nuclear Physics facility.

Ten students also took advantage of another opportunity offered by the program — namely, a course of their choice, with tuition and books paid for by the program. Seven of the students took a Psychology course, one a Nutritional Science class and two a Mathematics course. Eight of these courses were for college credit and two were audited.

5. CONCLUSION

Questionnaires completed at the end of the summer program of enrichment activities revealed that the students felt that, aside from the monetary rewards, they had benefited a great deal from both the hands-on work experience and the enrichment program. This was especially true of the younger students. They were grateful for the opportunity to work in a scientific environment and acquire new skills and experience. Faculty and staff mentors reported that the students were bright, attentive, well motivated and willing to work. Their contribution to the various projects was also significant. The digitizing work was done carefully and accurately and hence contributed substantially to a much needed data base for further analysis and study.
Philosophy Professor David Gruender discusses the life and scientific accomplishments of Galileo with the high school students.

In general, the students felt financially rewarded and scientifically enriched by their experience in the program. We feel that the students acquired a certain maturity and confidence which should be a great asset to them during their final years in high school, college and their chosen careers.
Chemistry Professor Kasha (Member of the National Academy of Sciences) discusses "Flavenoids Flower Color, Lasers and Health" with the high school students.

Distinguished Research Professor Loper explains earth interior processes to the high school students.

Geology Professor Furbish discusses the dynamics of river meanders with the high school students.
Dr. Long conducts a discussion with the high school students of a chapter of the book “Coming of Age in Milky Way” by Timothy Ferris.

Distinguished Research Professor Pfeffer conducts a session entitled “Name that Planet” using JPL photos extracted from the internet.

Mechanical Engineering Professor Buzyna explains apparatus used for laboratory studies of supersonic flow.
## 1996 ONR/GFDI Summer Enrichment Program Schedule

**Time:** 2:00 PM to 3:00 PM; **Place:** GFDI Reading Room or as indicated

<table>
<thead>
<tr>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
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<tbody>
<tr>
<td><strong>Films</strong></td>
<td><strong>Discussions</strong></td>
<td><strong>Talks</strong></td>
<td><strong>Lab. Demonstrations</strong></td>
</tr>
<tr>
<td>June 10 (V70492)</td>
<td>11 Dr. Christopher Long</td>
<td>12 Dr. David Gruender</td>
<td>13 Dr. Richard Pfeffer</td>
</tr>
<tr>
<td>The Shores of the Cosmic Ocean (COSMOS Episode 1)</td>
<td>The Dome of Heaven &amp; Raising the Roof</td>
<td>Galileo and How the World Turns</td>
<td>Welcome</td>
</tr>
<tr>
<td>17 (V70495)</td>
<td>18 Dr. Christopher Long</td>
<td>19 Dr. David Furbish</td>
<td>20 Dr. Robin Kung</td>
</tr>
<tr>
<td>Travels in Space and Time (COSMOS Episode 8)</td>
<td>The Discovery of the Earth</td>
<td>Dynamics of River Meanders</td>
<td>Laboratory Experiments at GFDI</td>
</tr>
<tr>
<td>24 (V70897)</td>
<td>25 Dr. Christopher Long</td>
<td>26 Dr. David Furbish</td>
<td>27 Dr. Ruby Krishnamurti</td>
</tr>
<tr>
<td>Searching for Black Holes (The Astronomers Part 2)</td>
<td>The Sun Worshippers</td>
<td>Bubble Dynamics and Volcanic Eruptions</td>
<td>Rayleigh-Benard Convection</td>
</tr>
<tr>
<td>July 1 (V70900)</td>
<td>2 Dr. Christopher Long</td>
<td>3 Dr. Paul Ruscher</td>
<td>4 <strong>Holiday</strong></td>
</tr>
<tr>
<td>Stardust (The Astronomers Part 5)</td>
<td>The World in Retrograde</td>
<td>Weather Forecasting</td>
<td></td>
</tr>
<tr>
<td>8 (Lab. Demo.)</td>
<td>9 Dr. Christopher Long</td>
<td>10 Dr. Dave Loper</td>
<td>11 Dr. Ruby Krishnamurti</td>
</tr>
<tr>
<td>Dr. George Buzyna</td>
<td>Newton's Reach</td>
<td>The Earth's Interior</td>
<td>Thermal Oscillators</td>
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<tr>
<td>(at M. E. Lab.)</td>
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<tr>
<td>Supersonic Flow</td>
<td></td>
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<tr>
<td>15 (F382490)</td>
<td>16 Dr. Christopher Long</td>
<td>17 Dr. Jerry Magnan</td>
<td>18 Dr. Robin Kung</td>
</tr>
<tr>
<td>Thunder in the Skies (Connection 6)</td>
<td>A Plumb Line to the Sun</td>
<td>Chaos in Plasmas and Water Drops</td>
<td>Annullus Experiments</td>
</tr>
<tr>
<td>22 (F382520)</td>
<td>23 Dr. Christopher Long</td>
<td>24 Dr. Mike Kashia</td>
<td>25 Dr. Ruby Krishnamurti</td>
</tr>
<tr>
<td>Countdown (Connection 9)</td>
<td>Deep Space</td>
<td>Flavenoids: Flower Color, Lasers and Health</td>
<td>Double-Diffusive Instability</td>
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<tr>
<td>29 (V70306)</td>
<td>30 Dr. Christopher Long</td>
<td>31 Dr. Richard Pfeffer</td>
<td>August 1 Dr. Robin Kung</td>
</tr>
<tr>
<td>Strange New Science of Chaos (NOVA)</td>
<td>Island Universes</td>
<td>Name That Planet</td>
<td>Rotating Fluid Flows</td>
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<tr>
<td>5 (GFDI Video)</td>
<td>6 Dr. Christopher Long</td>
<td>7 Mr. Mike Kirby</td>
<td>8 (F382450)</td>
</tr>
<tr>
<td>Hawai'i Born of Fire (NOVA)</td>
<td>Einstein's Sky</td>
<td>Math Modeling</td>
<td>(Film) Death in the Morning</td>
</tr>
<tr>
<td>12 (GFDI Video)</td>
<td>13 Dr. Christopher Long</td>
<td>14 Mr. Scott Applequist</td>
<td>(Connection 2)</td>
</tr>
<tr>
<td>Cyclone (National Geographic)</td>
<td>The Expansion of the Universe</td>
<td>Statistical Weather Prediction</td>
<td>Mixing and Unmixing</td>
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<tr>
<td>14 (F382450)</td>
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**Field Trips will be scheduled for the Fridays of the Summer Program.**

**Chapter by chapter discussion of "Coming of Age in the Milky Way" by Timothy Ferris, Anchor Books, 1988.**
INFORMATION FOR EACH APPRENTICE

1. Name: Bailey Lizza

2. School Address, 1996-97, if applicable:

3. Expected Major/University Enrolled in: Undecided

4. Last Grade Completed: 10

5. Type of School: (x)Public ( )Private

6. Race/Ethnicity: (Voluntary) ( )Black (x)White ( )Hispanic ( )Asian ( )Other

7. Sex: ( )Male ( )Female

8. Installation: Geophysical Fluid Dynamics Institute, Florida State University

9. Mentor(s):

10. Principal Discipline of Research: Atmospheric Science

11. Major Tasks Performed: Digitizing of velocity vectors from photographs of flow fields obtained in laboratory experiments.

12. Honors, Awards and Scholarships:

13. Activities/Hobbies:
INFORMATION FOR EACH APPRENTICE

1. Name: Claborn__Phillip
   last first

2. School Address, 1995-96, if applicable: Auscilla Christian

3. Monticello, FL
   name phone

4. Expected Major/University Enrolled in:

5. Last Grade Completed Type of School: ( )Public ( )Private

6. Race/Ethnicity: (Voluntary) ( )Black ( )White ( )Hispanic ( )Asian ( )Other

7. Sex: ( )Male ( )Female
   WGPA:

8. Installation: Geophysical Fluid Dynamics Institute, Florida State University
   name
   Dr. Robin J. Kung, Associate Scholar/Scientist

9. Mentor(s): Dr. Richard L. Pfeffer, Professor of Meteorology and GFDI Associate
   name title

10. Principal Discipline of Research: Atmospheric Sciences

11. Major Tasks Performed: Digitizing of velocity vectors from photographs of flow fields obtained in laboratory experiments.

12. Honors, Awards and Scholarships: 3rd place Regional Science Fair, A Honor Roll.

INFORMATION FOR EACH APPRENTICE

1. Name: Cox III Robert Sidney

2. [Redacted]

3. School Address, 19'95-'96, if applicable Leon High name (904)488-1971 phone
550 W. Tennessee St., Tallahassee, FL

4. Expected Major/University Enrolled in: Biology/New College of USF

5. Last Grade Completed Type of School: (x)Public ( )Private

6. Race/Ethnicity: (Voluntary) ( )Black ( )White ( )Hispanic ( )Asian ( )Other

7. Sex: (x)Male ( )Female W GPA: __________

8. Installation Geophysical Fluid Dynamics Institute, Florida State University name
   Dr. Robin J. Kung, Associate Scholar/Scientist

9. Mentor(s): Dr. Richard L. Pfeffer, Professor of Meteorology and GFDI Associate title

10. Principal Discipline of Research: Atmospheric Sciences

11. Major Tasks Performed: Digitizing of velocity vectors from photographs of flow fields obtained in laboratory experiments.


13. Activities/Hobbies: Ultimate Frisbee
INFORMATION FOR EACH APPRENTICE

1. Name: Desai Ashish
   last
   first

2. School Address, 1995-96, if applicable: Lincoln High
   name
   phone
   3838 Trojan Trail, Tallahassee, FL

3. Expected Major/University Enrolled in: Biochemistry/University of Florida

4. Last Grade Completed: 12
   Type of School: (X) Public
   ( ) Private

5. Race/Ethnicity: (Voluntary) ( ) Black
   ( ) White
   ( ) Hispanic
   (X) Asian
   ( ) Other

6. Sex: (X) Male
   ( ) Female

7. WGPA: 4.67

8. Installation: Geophysical Fluid Dynamics Institute, Florida State University
   name
   Dr. Robin J. Rung, Associate Scholar/Scientist
   Dr. Richard L. Pfeffer, Professor of Meteorology and GFDI Associate
   title

9. Mentor(s):

10. Principal Discipline of Research: Atmospheric Sciences

11. Major Tasks Performed: Digitizing of velocity vectors from photographs of flow fields obtained in laboratory experiments.


13. Activities/Hobbies: Playing sports (baseball, football, soccer, basketball), talking to people & helping them with problems, listening to music and disc jockey.
INFORMATION FOR EACH APPRENTICE

1. Name: Dunn Shannon
   last first

2. [Redacted]

3. School Address, 1995-'96, if applicable: Godby High
   name phone
   1717 W. Tharpe St., Tallahassee, FL

4. Expected Major/University Enrolled in: Undecided/FSU

5. Last Grade Completed: 10
   Type of School: ( )Public ( )Private

6. Race/Ethnicity: (Voluntary) ( )Black ( )White ( )Hispanic ( )Asian ( )Other

7. Sex: ( )Male ( )Female
   WGPA: ___.33

8. Installation: Geophysical Fluid Dynamics Institute, Florida State University
   name
   Dr. Robin J. Kung, Associate Scholar/Scientist

9. Mentor(s): Dr. Richard L. Pfeffer, Professor of Meteorology and GFDI Associate
   title

10. Principal Discipline of Research: Atmospheric Science

11. Major Tasks Performed: Digitizing of velocity vectors from photographs of
    flow fields obtained in laboratory experiments.

    Society, Awards for Accounting, English, Drama, Science, Academic Merit, etc.,
    City of Lights Winter Festival Jr. Award for Piano, outstanding student Awards,
    Valedictorian of Griffin Middle School ('94), Listed in Who's Who of Bandt Academics

13. Activities/Hobbies: Playing Piano, Saxophone, and flute; singing, dancing and
    acting in community theatre plays; horseback riding; reading; writing poetry;
    cleaning, listening to music, going to concerts; working; socializing;
    doing homework.
## INFORMATION FOR EACH APPRENTICE

1. **Name:** Eagen Allison
   - last
   - first

2. **School Address, 1995 if applicable:**
   - Leon High (904) 488-1971
   - 500 W. Tennessee Street, Tallahassee, FL

3. **Expected Major/University Enrolled in:** Accounting/undecided

4. **Last Grade Completed:** 11
   - Type of School: (x) Public ( ) Private

5. **Race/Ethnicity:** (Voluntary)
   - ( ) Black (x) White ( ) Hispanic ( ) Asian ( ) Other

6. **Sex:** ( ) Male ( ) Female
   - WGPA: 4.53

7. **Installation:** Geophysical Fluid Dynamics Institute, Florida State University
   - Dr. Robin J. Kung, Associate Scholar/Scientist

8. **Mentor(s):** Dr. Richard L. Pfeffer, Professor of Meteorology and GFDI Associate

9. **Principal Discipline of Research:** Atmospheric Science

10. **Major Tasks Performed:** Digitizing of velocity vectors from photographs of flow fields obtained in laboratory experiments.

11. **Honors, Awards and Scholarships:**
   - 2nd time All Big Bend in cross country, All Big Bend in Track, Sec. of Exchangettes (service club), Treasurer MAT (Math Club), 2nd & 3rd place at French competition, Treasurer of Pierian (Honor Society).

12. **Activities/Hobbies:** Running, Music, Service clubs.
INFORMATION FOR EACH APPRENTICE

1. Name: Henderson David

2. [Redacted]

3. School Address, 1996-'97, if applicable: Jefferson County

4. Expected Major/University Enrolled in: Undecided

5. Last Grade Completed: 11

6. Race/Ethnicity: (Voluntary) Black White Hispanic Asian Other

7. Sex: (X) Male

8. Installation: Geophysical Fluid Dynamics Institute, Florida State University

9. Mentor(s): Dr. Robin J. Kung, Associate Scholar/Scientist

10. Principal Discipline of Research: Atmospheric Science

11. Major Tasks Performed: Computer upgrades and repairs, etc.

12. Honors, Awards and Scholarships: National Beta Club Member

INFORMATION FOR EACH APPRENTICE

1. Name: Hoda Daanish

2. School Address, 1995-96, if applicable
   Lincoln High
   3838 Trojan Trail, Tallahassee, FL

3. Expected Major/University Enrolled in: Undecided/Florida State University

4. Last Grade Completed: 12th
   Type of School: (x) Public   ( ) Private

5. Race/Ethnicity: (Voluntary)   ( ) Black   ( ) White   ( ) Hispanic   (x) Asian   ( ) Other

6. Sex: (x) Male   ( ) Female
   WGPA: 4.73

7. Installation
   Geophysical Fluid Dynamics Institute, Florida State University
   Dr. Robin J. Kung, Associate Scholar/Scientist

8. Mentor(s):
   Dr. Richard L. Pfeffer, Professor of Meteorology and GFDI Associate
   title

9. Principal Discipline of Research: Atmospheric Sciences

10. Major Tasks Performed:
    Digitizing of velocity vectors from photographs of flow fields obtained in laboratory experiments.

11. Honors, Awards and Scholarships:
    NHS, National Merit Finalist, Salutatorian,
    Various State and National Awards in Math, English Achievement.

12. Activities/Hobbies:
    Pick-up games around neighborhood, ultimate Frisbee.
INFORMATION FOR EACH APPRENTICE

1. Name: Holmes Adrianne
   Last first

2. School Address, 1996, if applicable: Lincoln High (904) 487-2110
   3838 Trojan Trail, Tallahassee, FL

3. Expected Major/University Enrolled in: Biology/University of Florida

4. Last Grade Completed: 12th Type of School: (x) Public ( ) Private

5. Race/Ethnicity: (Voluntary) (x) Black ( ) White ( ) Hispanic ( ) Asian ( ) Other

6. Sex: ( ) Male (x) Female
   GPA: 3.91

7. Installation: Geophysical Fluid Dynamics Institute, Florida State University
   Name: Dr. Robin J. Kung, Associate Scholar/Scientist

8. Mentor(s): Dr. Richard L. Pfeffer, Professor of Meteorology and GFDI Associate
   Name: title

9. Principal Discipline of Research: Atmospheric Science

10. Major Tasks Performed: Digitizing velocity vectors from photographs of
    flow fields obtained in laboratory experiments.

11. Honors, Awards and Scholarships: National Honor Society, University of Florida
    Minority Scholarship, Clark Atlanta University Tuition Scholarship, Who's
    Who Among American High School Students.

12. Activities/Hobbies: Service Club, Youth Choir Member, SADD.
**INFORMATION FOR EACH APPRENTICE**

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<tbody>
<tr>
<td>1.</td>
<td>Name: Jivan Mitesh</td>
</tr>
<tr>
<td>2.</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>School Address, 1996-97, if applicable: Godby High School (904) 488-1325</td>
</tr>
<tr>
<td>4.</td>
<td>Expected Major/University Enrolled in: Undecided</td>
</tr>
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<td>5.</td>
<td>Last Grade Completed: 11</td>
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<tr>
<td>6.</td>
<td>Race/Ethnicity: (Voluntary)</td>
</tr>
<tr>
<td>7.</td>
<td>Sex: (M)Male (F)Female</td>
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<tr>
<td>8.</td>
<td>Installation: Geophysical Fluid Dynamics Institute, Florida State University</td>
</tr>
<tr>
<td>9.</td>
<td>Mentor(s): Dr. Richard L. Pfeffer, Professor of Meteorology and GFDI Associate</td>
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<td>10.</td>
<td>Principal Discipline of Research: Atmospheric Science</td>
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<td>11.</td>
<td>Major Tasks Performed: Digitizing of velocity vectors from photographs of flow fields obtained in laboratory experiments.</td>
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<td>12.</td>
<td>Honors, Awards and Scholarships:</td>
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<tr>
<td>13.</td>
<td>Activities/Hobbies:</td>
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</table>
INFORMATION FOR EACH APPRENTICE

1. Name: Jones
   last
   first

2. [Redacted]

3. School Address, 1995-'96, if applicable
   Godby High
   name
   (904) 488-1325
   phone
   1717 W. Tharpe Street, Tallahassee, FL

4. Expected Major/University Enrolled in: Veterinarian Medicine

5. Last Grade Completed: 11
   Type of School: (x) Public ( ) Private

6. Race/Ethnicity: (Voluntary) (x) Black ( ) White ( ) Hispanic ( ) Asian ( ) Other

7. Sex: ( ) Male (x) Female
   WGPA: 3.96

8. Installation
   Geophysical Fluid Dynamics Institute, Florida State University
   name
   Dr. Robin J. Kung, Associate Scholar/Scientist

9. Mentor(s): Dr. Richard L. Pfeffer, Professor of Meteorology and GFDI Associate
   name

10. Principal Discipline of Research: Atmospheric Science

11. Major Tasks Performed: Digitizing velocity vectors from photographs of flow fields obtained in laboratory experiments.


13. Activities/Hobbies: Shopping, skating talking on phone reading, etc.
### INFORMATION FOR EACH APPRENTICE

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<tr>
<td><strong>1.</strong></td>
<td>Name:</td>
<td>Kode Durga</td>
</tr>
<tr>
<td></td>
<td></td>
<td>last first</td>
</tr>
<tr>
<td><strong>2.</strong></td>
<td>School Address, 1996-'97, if applicable</td>
<td>Leon High (904)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>name phone</td>
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<tr>
<td><strong>3.</strong></td>
<td>Expected Major/University Enrolled in:</td>
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<td><strong>4.</strong></td>
<td>Last Grade Completed:</td>
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<td><strong>5.</strong></td>
<td>Race/Ethnicity: (Voluntary)</td>
<td>( ) Black ( ) White (x) Hispanic ( ) Asian ( ) Other</td>
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<td><strong>6.</strong></td>
<td>Sex:</td>
<td>( ) Male (x) Female</td>
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<td><strong>7.</strong></td>
<td>WGPA:</td>
<td></td>
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<tr>
<td><strong>8.</strong></td>
<td>Installation:</td>
<td>Geophysical Fluid Dynamics Institute, Florida State University</td>
</tr>
<tr>
<td></td>
<td>name</td>
<td>Dr. Robin J. Kung, Associate Scholar/Scientist</td>
</tr>
<tr>
<td><strong>9.</strong></td>
<td>Mentor(s):</td>
<td>Dr. Richard L. Pfeffer, Professor of Meteorology and GFDI Associate</td>
</tr>
<tr>
<td><strong>10.</strong></td>
<td>Principal Discipline of Research:</td>
<td>Atmospheric Science</td>
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<td><strong>11.</strong></td>
<td>Major Tasks Performed:</td>
<td>Digitizing of velocity vectors from photographs of flow fields obtained in laboratory experiments.</td>
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<td><strong>12.</strong></td>
<td>Honors, Awards and Scholarships:</td>
<td></td>
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<tr>
<td><strong>13.</strong></td>
<td>Activities/Hobbies:</td>
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</tbody>
</table>
**INFORMATION FOR EACH APPRENTICE**

1. **Name:** Matthews Julie

2. **School Address, 1996, if applicable:** Leon High (904) 488-1971

   500 W. Tennessee Street, Tallahassee, FL

3. **Expected Major/University Enrolled in:** Sports Medicine/University of Florida

4. **Last Grade Completed:** 12

5. **Type of School:** (x) Public ( ) Private

6. **Race/Ethnicity:** (Voluntary) ( ) Black (x) White ( ) Hispanic ( ) Asian ( ) Other

7. **Sex:** ( ) Male (x) Female

8. **Installation:** Geophysical Fluid Dynamics Institute, Florida State University

   **Mentor(s):**

   - Dr. Richard L. Pfeffer, Professor of Meteorology and GFDI Associate

9. **Principal Discipline of Research:** Atmospheric Science

10. **Major Tasks Performed:** Digitizing of velocity vectors from photographs of flow fields obtained in laboratory experiments.

11. **Honors, Awards and Scholarships:** Honor roll

12. **Activities/Hobbies:** Weightlifting, Swimming.
INFORMATION FOR EACH APPRENTICE

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<tr>
<td>1.</td>
<td>Name: Mills Marcus</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>School Address, 1996, if applicable Godby High (904) 488-1325</td>
<td></td>
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<tr>
<td>3.</td>
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<tr>
<td>4.</td>
<td>Expected Major/University Enrolled in: Undecided/Florida State University</td>
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<td>5.</td>
<td>Last Grade Completed Type of School: (X) Public ( ) Private</td>
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<td>Race/Ethnicity: (Voluntary) (X) Black ( ) White ( ) Hispanic ( ) Asian ( ) Other</td>
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<tr>
<td>7.</td>
<td>Sex: (X) Male ( ) Female</td>
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<td>8.</td>
<td>Installation Geophysical Fluid Dynamics Institute, Florida State University</td>
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<td>9.</td>
<td>Mentor(s): Dr. Robin J. Kung, Associate Scholar/Scientist</td>
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<td>10.</td>
<td>Principal Discipline of Research: Atmospheric Science</td>
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<td>11.</td>
<td>Major Tasks Performed: Digitizing of velocity vectors from photographs of flow fields obtained in laboratory experiments.</td>
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<tr>
<td>12.</td>
<td>Honors, Awards and Scholarships: FSU Incentive Scholarship, Scholarship Award from Omega Psi Phi, Vocational Gold Seal Scholarship, Varsity Football letter.</td>
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<tr>
<td>13.</td>
<td>Activities/Hobbies: Music, reading, sports</td>
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</table>
INFORMATION FOR EACH APPRENTICE

1. Name: Pabbathi Vishnu
   last name
   first name

2. Address: Redacted

3. School Address, 1996, if applicable: Leon High School
   name
   phone (904) 488-1971

500 W. Tennessee Street, Tallahassee, Florida

4. Expected Major/University Enrolled in: Undecided

5. Last Grade Completed: 10
   Type of School: (x) Public ( ) Private

6. Race/Ethnicity: (Voluntary) ( ) Black ( ) White ( ) Hispanic (x) Asian ( ) Other

7. Sex: (x) Male ( ) Female
   WGPA: 3.71

8. Installation: Geophysical Fluid Dynamics Institute, Florida State University
   name
   Dr. Robin J. Kung, Associate Scholar/scientist

9. Mentor(s): Dr. Richard L. Pfeffer, Professor of Meteorology and GFDI Associate
   title

10. Principal Discipline of Research: Atmospheric Science

11. Major Tasks Performed: Working on the computer and printing out plots of
    the laboratory experiments

12. Honors, Awards and Scholarships:

INFORMATION FOR EACH APPRENTICE

1. Name: Peterson Keysha
   last first

2. School Address, 1996-97, if applicable: Richards (904) 488-1783
   name phone
   3013 Jim Lee Rd., Tallahassee, FL

3. Expected Major/University Enrolled in: Undecided

4. Last Grade Completed: 11
   Type of School: ( )Public ( )Private

5. Race/Ethnicity: (Voluntary) ( )Black ( )White ( )Hispanic ( )Asian ( )Other

6. Sex: ( )Male ( )Female
   WGPA: 

7. Installation: Geophysical Fluid Dynamics Institute, Florida State University
   name
   Dr. Robin J. Kung, Associate Scholar/Scientist
   Dr. Richard L. Pfeffer, Professor of Meteorology and GFDI Associate
   title

8. Mentor(s): 
   name

9. Principal Discipline of Research: Atmospheric Science

10. Major Tasks Performed: Digitizing of velocity vectors from photographs of
    flow fields obtained in laboratory experiments.

11. Honors, Awards and Scholarships:

12. Activities/Hobbies:

13. }
**INFORMATION FOR EACH APPRENTICE**

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<tr>
<td>1.</td>
<td><strong>Name:</strong> Sherlock Terra</td>
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<tr>
<td>2.</td>
<td><strong>School Address, if applicable:</strong> Leon High (904) 488-1971</td>
</tr>
<tr>
<td>3.</td>
<td><strong>Expected Major/University Enrolled in:</strong> Physics</td>
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<td>4.</td>
<td><strong>Last Grade Completed:</strong> 12</td>
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<td><strong>Type of School:</strong> (x)Public ( )Private</td>
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<td><strong>Race/Ethnicity:</strong> (Voluntary) ( )Black (x)White ( )Hispanic ( )Asian ( )Other</td>
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<tr>
<td>7.</td>
<td><strong>Sex:</strong> ( )Male (x)Female</td>
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<td>8.</td>
<td><strong>Installment:</strong> Geophysical Fluid Dynamics Institute, Florida State University</td>
</tr>
<tr>
<td>9.</td>
<td><strong>Mentor(s):</strong> Dr. Robin J. Kung, Associate Scholar/Scientist</td>
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<tr>
<td>10.</td>
<td><strong>Principal Discipline of Research:</strong> Atmospheric Science</td>
</tr>
<tr>
<td>11.</td>
<td><strong>Major Tasks Performed:</strong> Digitizing of velocity vectors from photographs of flow fields obtained in laboratory experiments.</td>
</tr>
<tr>
<td>12.</td>
<td><strong>Honors, Awards and Scholarships:</strong> Golden Glove Award (Soccer), Sheriff's Ride-Along and Shooting Program Awards, 1st Place in 3rd grade Science Fair.</td>
</tr>
<tr>
<td>13.</td>
<td><strong>Activities/Hobbies:</strong> 1st Sergeant in the Sheriff's Explorers, Vice-President in Nice Science Club, Communication Officer of Phoenix Science Club, Junior Varsity and Varsity Soccer.</td>
</tr>
</tbody>
</table>
INFORMATION FOR EACH APPRENTICE

1. Name: Subramani Aruna
   last first

2. [PII Redacted]

3. School Address, 19 96, if applicable: Lincoln High (904) 487-2110
   name phone
   3838 Trojan Trail, Tallahassee, FL

4. Expected Major/University Enrolled in: Science at University of Florida

5. Last Grade Completed: 11
   Type of School: (x) Public ( ) Private

6. Race/Ethnicity: (Voluntary) ( ) Black ( ) White ( ) Hispanic (x) Asian ( ) Other

7. Sex: ( ) Male (x) Female
   WGPA: 4.57

8. Installation: Geophysical Fluid Dynamics Institute, Florida State University
   name
   Dr. Robin J. Kung, Associate Scholar/Scientist

9. Mentor(s): Dr. Richard L. Pfeffer, Professor of Meteorology and GFDI Associate
   name title

10. Principal Discipline of Research: Atmospheric Science

11. Major Tasks Performed: Digitizing of velocity vectors from photographs of
    flow fields obtained in laboratory experiments.

12. Honors, Awards and Scholarships: Honor Roll, Special Recognition Award,
    Academic Awards- English, Social Studies, French, etc. Principal Awards-
    9th, 10th, 11th grade.

13. Activities/Hobbies: Like to travel
INFORMATION FOR EACH APPRENTICE

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<tr>
<td>1.</td>
<td>Name: Switzer Benjamin</td>
</tr>
<tr>
<td>2.</td>
<td></td>
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<tr>
<td>3.</td>
<td>School Address, 1996, if applicable: Godby High (904) 488-1325 1717 W. Tharpe St., Tallahassee, FL</td>
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<td>4.</td>
<td>Expected Major/University Enrolled in: Undecided</td>
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<td>5.</td>
<td>Last Grade Completed: 12 Type of School: (x) Public ( )Private</td>
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<td>Race/Ethnicity: (Voluntary) ( ) Black (x) White ( ) Hispanic ( ) Asian ( ) Other</td>
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<td>7.</td>
<td>Sex: (x) Male ( ) Female WGPA: 3.7</td>
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<td>8.</td>
<td>Installation: Geophysical Fluid Dynamics Institute, Florida State University</td>
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<tr>
<td>9.</td>
<td>Mentor(s): Dr. Robin J. Kung, Associate Scholar/Scientist Dr. Richard L. Pfeffer, Professor of Meteorology and GFDI Associate</td>
</tr>
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<td>10.</td>
<td>Principal Discipline of Research: Atmospheric Science</td>
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<td>11.</td>
<td>Major Tasks Performed: Computer Maintenance</td>
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<td>12.</td>
<td>Honors, Awards and Scholarships: Honor Roll</td>
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### INFORMATION FOR EACH APPRENTICE

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</table>
| 1. | **Name:** Wallace Michelle  
|    | last  
|    | first  |
| 2. | PII Redacted  |
| 3. | **School Address, 19\(^6\), if applicable**  
|    | Lincoln High  
|    | (904) 487-2110  
|    | 3838 Trojan Trail, Tallahassee, FL  |
| 4. | **Expected Major/University Enrolled in:** Biology, University of Miami, FL  |
| 5. | **Last Grade Completed** 12  
|    | **Type of School:** (✓)Public ( )Private  |
| 6. | **Race/Ethnicity:** (Voluntary) (✓)Black ( )White ( )Hispanic ( )Asian ( )Other  |
| 7. | **Sex:** ( )Male (✓)Female  
|    | **WGPA:** 4.46  |
| 8. | **Installation** Geophysical Fluid Dynamics Institute, Florida State University  
|    | name  
|    | Dr. Robin J. Kung, Associate Scholar/Scientist  |
| 9. | **Mentor(s):** Dr. Richard L. Pfeffer, Professor of Meteorology and GFDI Associate  
|    | name  
|    | title  |
| 10. | **Principal Discipline of Research:** Atmospheric Science  |
| 11. | **Major Tasks Performed:** Digitizing of velocity vectors from photographs of flow fields obtained in laboratory experiments.  |
| 12. | **Honors, Awards and Scholarships:** National Honor Society  
|    | 1995 1st Place Leon County History Fair, Biological Institute of ONR Math Award, Biological Institute of ONR Science Award.  |
| 13. | **Activities/Hobbies:** Piano, Reading.  |
INFORMATION FOR EACH APPRENTICE

1. Name: Wilson Jereme

2. School Address, 1996, if applicable: Godby High, (904) 488-1325

3. Expected Major/University Enrolled in: Undecided

4. Last Grade Completed: 11

5. Type of School: ( )Public ( )Private

6. Race/Ethnicity: (Voluntary) ( )Black ( )White ( )Hispanic ( )Asian ( )Other

7. Sex: ( )Male ( )Female

8. Geophysical Fluid Dynamics Institute, Florida State University

9. Mentor(s): Dr. Richard L. Pfeffer, Professor of Meteorology and GFDI Associate

10. Principal Discipline of Research: Atmospheric Science

11. Major Tasks Performed: Digitizing of velocity vectors from photographs of flow fields obtained in laboratory experiments.


INFORMATION FOR EACH MENTOR

1. Name: Kung Robin
   last first

2. Installation: Florida State University, Geophysical Fluid Dynamics Institute
   (904) 644-5594
   phone

3. [Redacted]

4. Sex ( ) Female (X) Male

5. Race/Ethnicity: (Voluntary) ( ) Black ( ) White ( ) Hispanic (X) Asian ( ) Other

6. Highest Degree Earned: Ph.D.

7. Principal Field of Research: Geophysical Fluid Dynamics

8. Number of Years of Mentorship: 12

9. Number of Apprentices Supervised this Year, 1996: 10
INFORMATION FOR EACH MENTOR

1. Name: Long Christopher
   last first

2. Installation: Florida State University, Geophysical Fluid Dynamics Institute
   name
   (904) 644-5594
   phone

3. [Redacted]

4. Sex ( ) Female  (X) Male

5. Race/Ethnicity: (Voluntary) ( )Black (X)White ( )Hispanic ( )Asian ( )Other

6. Highest Degree Earned: Ph.D.

7. Principal Field of Research: Atmospheric Science

8. Number of Years of Mentorship: 3

9. Number of Apprentices Supervised this Year, 1996: 10
INFORMATION FOR EACH MENTOR

1. Name: Pfeffer Richard L.  
   last  first

2. Installation: Florida State University, Geophysical Fluid Dynamics Institute  
   (904) 644-5594  
   phone

3. [Redacted]

4. Sex  ( ) Female  (X) Male

5. Race/Ethnicity: (Voluntary) ( )Black (X)White ( )Hispanic ( )Asian ( )Other

6. Highest Degree Earned: Ph.D.

7. Principal Field of Research: Meteorology and Geophysical Fluid Dynamics

8. Number of Years of Mentorship: 14

9. Number of Apprentices Supervised this Year, 1996: 12
INFORMATION FOR EACH MENTOR

1. Name: Kode Bala
   last
   first

2. Installation: Geophysical Fluid Dynamics Institute
   name
   644-5594
   phone

3. [P11 Redacted]

4. Sex
   ( ) Female (x) Male

5. Race/Ethnicity: (Voluntary) ( ) Black ( ) White ( ) Hispanic (x) Asian ( ) Other

6. Highest Degree Earned: Undergraduate Student

7. Principal Field of Research: Atmospheric Science

8. Number of Years of Mentorship: 1

9. Number of Apprentices Supervised this Year, 1996-’97: 21
In the spring of 1996, the guidance counselors of five local high schools were asked to recommend outstanding college-bound students who they thought would benefit most from our program. Ten students were selected to participate starting in the summer of 1996 and thirteen during the school year, 2 of whom were from the summer program, 6 of whom were from last year’s program, and 5 new students during the academic year. Our student group consisted of 9 seniors, 7 juniors and 5 exceptional sophomores. The departure from our past concentration on seniors was motivated by our desire to expose students to science and scientific methodology at an earlier age. Some background information concerning the students who were selected appears in the following section. Further information pertaining to each apprentice is attached at the end of the report.

Students spent a total of 30 hours per week with the program for 10 weeks in summer and 10–20 hours per week during the school year. They participated in the research program via data handling and data processing with the aid of computer operated equipment, and in enrichment activities during the summer; including lectures, laboratory demonstrations, scientific films, field trips and a formal course and a weekly discussion session on the history of science using the book *Coming of Age in the Milky Way* by Timothy Ferris. A summary of their activities and projects is included in Section 3.