Most aspects of the JOVE program at Harding University were very successful. The number and quality of students interested in space science areas was increased due to the availability of support funds for JOVE scholars. Both physics faculty associated with the program have continued work in areas associated with the JOVE program. Several additional research grants for student research and scholarship support have been received from the Arkansas Space Grant Consortium since the termination of the JOVE program. The network connection established has been used extensively for educational and research purposes in connection with awarded grants and with science education at Harding University.

The major unsuccessful area was in obtaining external funding in the area of solar physics in which Harding’s JOVE program was working and in not more aggressively pursuing communication and cooperative effort with our JOVE mentor. This has resulted in all of the associated JOVE faculty no longer working in the solar physics area. The JOVE program has contributed significantly to the success of faculty programs in other areas that were fundable.
PHASE ONE

I. Research

Brief description of research results:

Because of the delay in receiving the computer workstation, most efforts were put into setup and organization of the system and development of the plans for the solar spectral, solar magnetic field, and maximum entropy image restoration programs.

A computer program SPECTRA is being developed to aid in the analysis of Skylab spectral data. The program, written in PV-Wave command language for a Sun computer, is menu driven for ease of use.

Projects currently underway are to improve the line fitting algorithm and correct for the "rubber cam" effect in Skylab's spectrometer.

An interface is being designed to run on Harding's Sun computer to allow the Maximum Entropy program MaxEnt, currently licensed on a computer at MSFC, to be accessed locally over the internet. A program to calculate and display the solar magnetic field above the solar surface using solar magnetogram data is also beginning.

Communication with NASA colleague

There was extensive communication with our NASA colleague via e-mail, personal visits, and telephone conversations.

Refereed Journal Articles Submitted:

None

Other Publications Published:

None

Oral and Poster Papers Presented:

A poster presentation on Harding's JOVE outreach was presented at the JOVE conference

Philip Joyner and Lambert Murray, ANALYZING SOLAR SPECTRA, Arkansas Academy of Sciences, April 1993

Philip Joyner and James Mackey, SOLAR SPECTRA, Arkansas Space Grant Consortium April 1993

Paul Finley and James Mackey, GRAPHICAL REPRESENTATION OF SOLAR MAGNETIC FIELDS, Arkansas Academy of Sciences April 1993

Paul Finley, THE SOLAR MAGNETIC FIELD ABOVE THE SOLAR SURFACE, Arkansas Space Grant Consortium, April 1993

Proposals Awarded:

1. Agency providing funding: Arkansas Department of Education $ Amount $27,900
   Title of project/PI: AEGIS: MISSION MARS -- Steve Baber, James Mackey, Lambert Murray
   Period of Performance: 1993

2. Agency providing funding: Arkansas Space Grant Consortium $ Amount 18,200
   Title of project/PI: Solar Energy Transfer Mechanism, James Mackey, Steve Baber, Lambert Murray
   Period of performance 1992/3

Proposals Submitted:

1. Agency Submitted to: Arkansas Department of education $ Amount $27,900
   Title/PI: AEGIS: MISSION MARS -- Steve Baber, James Mackey, Lambert Muttay
   Period of Performance: 1994

Are you utilizing the Internet or other network?

Yes, extensively for data transfer and information gathering.

Please identify the data sets, if any, used in your research

UV spectral data from the Harvard spectrophotomer on Skylab
II. Student Involvement
Indicate the impact that the JOVE program has had on student enrollment and/or recruitment?

The number of physics majors has increased from 1 to 2 per year to a value of 3 to 4 per year. The enrollment in the Astronomy & Space Science course has held steady at about 60 per semester.

Student Research Assistants:
N/A

III Curriculum Development
New Curricula:
None

New Courses:
A new course in Astronomy & Space Science, Physical Science 113, has been added to the general education program at Harding University. Current enrollment is typically 60 per semester.

Ammended Courses or Augmented Courses:
None

Reading or independent study courses:
Weekly noncredit colloquium on space science and solar physics for JOVE scholars.

IV. Outreach:
Students: high school and middle school

<table>
<thead>
<tr>
<th>Outreach Effort</th>
<th>Location</th>
<th>Estimated Number</th>
</tr>
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<tr>
<td>AEGIS - Two week workshop for gifted 8th &amp; 9th graders</td>
<td>Harding University</td>
<td>40</td>
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</table>

Teachers:
None

Public:
None

V. Summer Programs
For Students
AEGIS - MISSION MARS - Two week residential workshop in June for 40 eight and ninth grade students

For Teachers
Dr. Murray served as a science consultant for a math and science grant submitted to the Annenberg Foundation, designed to improve science and math instruction in rural area through telecomputing.

VI. Roadblocks to progress/suggestions
The initial roadblock was the delay in receiving the JOVE grant funds and the difficulty in obtaining the Sun workstation in a timely manner

VII. Other Activities
None

PHASE TWO

I. Research

Brief description of research results:
Work continued on the development and refinement of the computer program SPECTRA.
Extensive rewrites were conducted of many of the program interfaces while work continued on developing more accurate line fits and line profiles.
A locally run PC Maximum Entropy Restoration program was obtained and applied to astronomical images. Work was begun on using the program with solar images. Better calculation and display procedures for plotting solar magnetic fields were developed.
Communication with NASA colleague
There was continued communication with our NASA colleague via e-mail.

Refereed Journal Articles Submitted:
None

Other Publications Published:
None

Oral and Poster Papers Presented:
- Craig Copeland and Lambert Murray, SPECTRA: A Spectral Analysis Program, Arkansas Space Grant Symposium, April 1994
- Richard Anderson and Lambert Murray, SPECTRA: Line Calculations, Arkansas Space Grant Symposium, April 1994
- Brian Mitchell and James Mackey, Graphical Representation of Solar Magnetic Fields, Arkansas Space Grant Symposium, April 1994

Proposals Awarded:
1. Agency providing funding: Arkansas Department of Education $ Amount: $27,900
   Title of projects/PI: AEGIS MISSION MARS -- Steve Baber, James Mackey, Lambert Murray
   Period of Performance: 1994

2. Agency providing funding: Arkansas Space Grant Consortium $ Amount: $2,800
   Title of projects/PI: Solar Energy Transfer Mechanism, James Mackey, Steve Baber, Lambert Murray
   Period of Performance: 1994

Proposals Submitted:
1. Agency Submitted to: Arkansas Department of Education $ Amount: $27,900
   Title/PI: AEGIS MISSION MARS -- Steve Baber, James Mackey, Lambert Murray
   Period of Performance: 1994
   Primary Use of Funds: outreach

Are you utilizing the Internet or other network?
Yes

Please identify the data sets, if any, used in your research.
UV spectral data from the Harvard spectrophotometer on Skylab

II. Student Involvement:
Indicate the impact that the JOVE program has had on student enrollment and/or recruitment?
The number of physics majors has held fairly steady at 3 to 4 per year since JOVE began.

Student Research Assistants:
N/A

III Curriculum Development:
New Curricula:
None

New Courses:
None

Amended Courses or Augmented Courses:
None

Reading or independent study courses:
None

IV. Outreach:
Students: high school and middle school

Outreach Effort

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<td>Harding University</td>
<td>40</td>
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<tr>
<td>2</td>
<td>Dr. Murray made 2 slide presentations on space at area elementary schools</td>
<td>Searcy, AR</td>
<td>80</td>
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</table>
Teachers
None

Public:
None

V. Summer Programs
For Students
AEGIS - MISSION MARS - Two week residential workshop in June for 40 eighth and ninth grade students

For Teachers
None

VI. Roadblocks to progress/suggestions
A great difficulty lies in using undergraduates in a research program. As the student becomes knowledgeable about the research, he graduates.

VII. Other Activities
None

PHASE THREE

I. Research
Brief description of research results:
Work continued on the development and refinement of the computer program SPECTRA Input routines were rewritten to improve usability.
The PV Maximum Entropy routines were not useful on solar image data. Work also continued on the calculation and display procedures for plotting solar magnetic fields.

Communication with NASA colleague
Limited

Refereed Journal Articles Submitted
None

Other Publications Published
None

Oral and Poster Papers Presented:
Harry Garner and Lambert Murray, Calculating Line Ratios in Solar Spectral Data, Regional meeting of the AOK Section of AAPT, October 1995


James Mackey, Computer Imaging in Education, Arkansas Space Grant Consortium, Nov. 1995

Matt Lee and James Mackey, Using NIH Image, Arkansas Space Grant Consortium, Nov. 1995

Proposals Awarded
1. Agency providing funding: Arkansas Department of Education $ Amount $27,900
   Title of projects/PI: AEGIS: MISSION MARS -- Steve Baber, James Mackey, Lambert Murray
   Period of Performance: 1995

2. Agency providing funding: Arkansas Space Grant Consortium $ Amount 2,800
   Title of projects/PI: Utilization of the Maximum Entropy Restoration Algorithm for the Analysis of Solar Image Data - Dave Anderson and James Mackey
   Period of Performance: 1994

Proposals Submitted
1. Agency Submitted to: Arkansas Department of Education $ Amount $27,900
   Title/PI: AEGIS MISSION MARS -- Steve Baber, James Mackey, Lambert Muttay
   Period of Performance: 1995
   Primary Use of Funds: outreach
Are you utilizing the Internet or other network?
  yes

Please identify the data sets, if any, used in your research
  UV spectral data from the Harvard spectrophotometer on Skylab

II. Student Involvement:
Indicate the impact that the JOVE program has had on student enrollment and/or recruitment?
  The number of physics majors has held fairly steady at 3 to 4 per year since JOVE began.

Student Research Assistants:
  N/A

III Curriculum Development:
New Curricula:
  None

New Courses:
  None

Ammended Courses or Augmented Courses:
  None

Reading or independent study courses:
  None

IV. Outreach:
Students Outreach Effort

  1. AEGIS: Two week workshop
     for gifted 8th & 9th graders

Teachers:
  None

Public:
  None

V. Summer Programs
For Students
  AEGIS - MISSION MARS - Two week residential workshop in June for 40 eight and ninth grade students

For Teachers
  None

VI. Roadblocks to progress/suggestions
  No New ones.

VII. Other Activities
  None