New Mexico NASA EPSCoR
Year 2 Progress Report
Contract NNX09AP69A

1. **Project Title**: New Mexico Exoplanet Spectroscopic Survey Instrument (NESSI)
2. **Grant number**: NNX09AP69A
3. **PI name & contact information**:

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5. **Award Institution**: New Mexico State University (NMSU)
6. **Award date**: 8/1/2009
7. **Date of report**: May 16, 2011

8. **Research accomplishments measured against the proposed goals and objectives**.

Instrumentation: Since May, 2010 (the previous update), the NESSI project has completed its design work and begun purchasing some of the components for the instrument. The design work was completed principally via in-person meetings of the core NESSI team at NMT: Dr. Michelle Creech-Eakman (science PI), Dr. Kamel Houari (1st postdoc), Dr. Michael Hrynevych (2nd postdoc), Mr. Luke Schmidt (PhD student), Ms. Heather Bloemhard (PhD student), Mr. Charlie Moore (undergraduate), Mr. Dan Rodeheffer (undergraduate), Ms. Genevieve Vaive (undergraduate) and unpaid engineers working on the project from the Magdalena Ridge Observatory: Dr. Colby Jurgenson (optical engineer), Dr. Fernando Santoro (mechanical engineer), Mr. Andreas Olivares (mechanical engineer) and the assistance of two junior mechanical engineers on their team: Mr. Chris Salcido and Mr. Stephen Jimenez. Occasional telecons to discuss design goals were held with the NASA-JPL collaborators, principally: Dr. Mark Swain and Dr. Gautam Vasisht. Contracts were let with: ISP Optics to build the warm optics (except for K-mirror and autoguider lenses) and Universal Cryogenics to build the cryostat for the spectrometer. Ongoing telecons and two face-to-face meetings with Universal Cryogenics have been conducted and we expect to start cutting metal for the dewar this month. Internal build (at NMT) of a handling cart and telescope interface plate to attach the NESSI instrument to the Magdalena Ridge Observatory (MRO) 2.4m telescope are currently underway.

Discussions with and quotes were obtained from several more companies/vendors for prices and delivery timelines for the cold optics, K-mirrors, dichroic beamsplitter, derotator assembly, computer hardware, mechanical assemblies and focal plane array (which included an in-person visit by the Science PI to the Teledyne offices in Los Angeles). Three students have been involved in the design work on the software for NESSI, and are currently prototyping the software on spare and related observatory equipment in the laboratory. Unfortunately, two main issues have significantly slowed us from our intended progress on the instrumentation work. First, Dr. Kamel Hourairi left voluntarily NMT in early May 2010. We held another search for a postdoc, receiving 12 applications and interviewing 3 candidates, and subsequently hired Dr. Michael Hrynevych, who started in Dec 2010; we incurred a 7 month loss of progress in design work that Dr. Hourairi would have participated in. Second, the pledged funding from NMT Research Vice-President and MRO PI Dr. Van Romero for the cost of the NESSI hardware (which is separate from the EPSCoR matching funds) was put on a spending freeze for the entire MRO observatory in Dec 2010 due to the status of the US FY2011 budget where the majority of MRO funding is derived. It is anticipated that this spending freeze will be lifted in Aug 2011, the team is moving forward to have a final design review with our external collaborators in July 2011 in anticipation of letting the remainder of our contracts as soon as the spending freeze is lifted. Two goals for year two have not yet been attempted because the NESSI instrument is not yet ready to take to the telescope are: 1) establishing collaborations with faculty at other universities in NM to prepare students to use NESSI, and 2) deploying NESSI on the MRO 2.4m telescope. Both of these will incur significant expenses from the original NASA EPSCoR proposal in the form of: 1) grants to the faculty members from other universities to visit NMT/MRO, and 2) the purchase of MRO 2.4m telescope access, and so we are presently underspent on the project and anticipating needing a one-year no-cost extension to meet our goals for the NESSI project.

Presentations/Publications: Dr. Creech-Eakman has given presentations on NESSI to the following venues: Dr. Mario Perez, NASA Contract Monitor on EPSCoR project, Socorro and Magdalena Ridge, NM, July 2010; Los Alamos National Laboratory (LANL) scientists, Los Alamos, NM (with Dr. Penny Boston) Dec, 2010; discussions with various faculty during an invited colloquium visit to University of New Mexico Astronomy Department, Sept 2010; Enchanted Skies Star Party, invited speaker, Socorro, NM, Oct 2010; engineers at Teledyne Imaging Systems, Dec 2010; private group of professional astronomers visiting MRO facility, Socorro, NM, March 2011; Socorro Rotary Club, invited speaker, Socorro, NM, April 2011. Dr. Colby Jurgenson has given a presentation and was first author on a paper on NESSI's optical design at the SPIE Meeting in San Diego, CA, July 2010. Dr. Fernando Santoro has submitted and had accepted an abstract in anticipation of a paper and presentation he is giving on NESSI's mechanical design at the ASME Meeting in Denver, CO, Nov 2011. Ms. Heather Bloemhard is presenting a poster on NASA IRTF-Spex exoplanet data she has taken and NESSI design progress at the AAS Meeting in Boston, MA, May, 2011. Associated with a 4-day interferometry workshop at NM Tech in March 2011, eighty national and international scientists were given a tour of the MRO facilities, including the MRO 2.4m telescope.

Proposals: Dr. Creech-Eakman has submitted a supplementary outreach proposal to NASA in Feb 2010 to produce five "StarDate" radio programs on NESSI and MRO with Sandra Preston at the McDonald Observatory. Dr. Creech-Eakman and Dr. Boston have spoken with and

submitted a proposal to Dr. Salman Habib and Dr. Steve Buelow at Los Alamos National Labs to help support a Sept 2011 workshop on NESSI data interpretation (NT^2 Workshop Number One) in anticipation of NESSI first light in 2012. This workshop will include about 30 scientists from several universities and NASA Centers, and includes pledges of funding to support middle/high school teachers (from Mr. Chris Carberry at ExploreMars, Inc.) and some graduate students (from Dr. Dave Beaty, JPL) to be present for the three-days of discussions.

9. **Systemic change as evidenced by**:

a) improvements in jurisdiction research and development infrastructure;

These improvements include:
1. development of a competent design team of engineers, postdocs and students for the NESSI instrument at MRO/NM Tech
2. outreach to other scientists in NM (LANL and UNM)
3. outreach to the community of non-scientists in NM
4. discussions with and planning for NT^2 workshop with scientists at other NASA Centers

b) increased financial commitment from the jurisdiction, industry, and participating institutions;

In particular NM Tech MRO Management and NM Tech Administration is strongly behind the development of NESSI and has released professional engineers for several months of initially unanticipated design assistance on the project of approximately 14 months of FTE over the past year from principally 3 professional engineers. Pledged money is anticipated from initial conversations with LANL and in support of teachers and students to attend the NT^2 workshop. The institutions include: NASA Langley, NASA Ames, UC, Irvine, Penn State University, SETI Institute, LANL, JPL and ExploreMars Inc.

c) response of activities to NASA and jurisdiction priorities

In particular the present proposal for NASA Outreach funding to disseminate information about the instrument and facility via the "StarDate" radio program and an anticipated NASA Origins proposal to support NESSI activities to be submitted at the end of May 2011.

10. **Examples of successful technology transfer to the private sector.**

The principal technology transfer at this time is in the design of NESSI instrument as evidenced via conference papers and discussions with our vendors. Technology transfer has been slowed due to the lack of ability to spend MRO funds on the instrument itself.

11. **Extent to which collaborations with jurisdiction agencies, industry, research and academic institutions, and NASA have evolved.**

The principal evolution in relationships associated with NESSI are with: 1) industry partners to whom contracts for the NESSI instrumentation will be released (e.g. Universal Cryogenics,

Infrared Laboratories, JW Machining, ISP Optics, ICOS, Teledyne Imaging, SORL, Newport) and 2) community persons, university researchers, and national lab and NASA center individuals interested in the NT^2 meeting. These relationships have been developed via ongoing telephone discussions, requests for information and quotes (from the vendors), presentations, and discussions about the upcoming NT^2 meeting.

12. **Discussion of interaction between and cooperation with the jurisdiction's Space Grant Consortium.**

The NM Space Grant Consortium helps identify colleagues at institutions within the district that have similar research goals to those of the project. They hold a yearly meeting at which EPSCoR groups report project results and seek additional contacts. They also provide technical support on the expenditure of project funds. Finally, they provide administrative support on the submission of project reports. Graduate students on the NESSI project at NMT (Mr. Luke Schmidt and Ms. Heather Bloemhard) have submitted to NM SGC calls for supplementary funding to support the research they are undertaking as part their work on the NESSI and related astronomical projects. To date these proposals have not been funded.

13. **Research success of individual investigators as measured by**: See attached Spreadsheet

14. **Demographic (ethnicity/race and gender through self identification) information on participants:** See attached Spreadsheet