

# **Green Bank-WVU Link White Paper**

The following summary outlines the motivation, justification, and expected research and educational impact of providing High Speed network access within the state of West Virginia between the two premier research institutions of West Virginia University, and the Green Bank Radio Observatory.

## **Research Benefits from a Broadband Network**

### **Introduction**

The National Radio Astronomy Observatory (NRAO) is a National Science Foundation funded organization which owns and operates eight large radio telescopes in Pocahontas County, West Virginia. These include the 300' diameter Robert C. Byrd Green Bank Telescope (GBT), the largest fully steerable telescope in the world. The facilities of the NRAO in Green Bank, WV, also include cutting edge research facilities for astronomy, digital, software, and microwave engineering, as well as a world class science education program. The observatory provides many excellent opportunities for students, teachers, and other professionals to work with the staff on a wide variety of research and development projects, and it has a long history of aiding excellent scientists and engineers throughout their career. In summary, the Green Bank facilities of the National Radio Astronomy Observatory are a valuable resource to the state and the country, providing a unique opportunity for research and education in science and technology. A broadband link into the Green Bank site will greatly increase the research and education opportunities for a wide variety of students and researchers within West Virginia, the United States, and the World. Below we enumerate just a few of the additional opportunities broadband network access would provide.

#### ***a. Increased access for students and researchers to real time observations and data reduction***

The telescopes on the Green Bank site include not only the GBT but seven other telescopes ranging in diameter from 45' through 140'. A broadband network into the Green Bank site would allow for increased access to the telescopes and their data to the variety of students and other investigators currently engaged in both astronomical and engineering research at Green Bank. As the Green Bank site is fairly remote, providing access for researchers to both use the telescopes from their home location and readily access the telescope data would open the opportunities of telescope use considerably, insuring the best possible science is achieved with the Green Bank telescopes. Additionally, the existence of a broadband network would open the way for the Green Bank telescopes to be used to aid other research programs, such as providing a downlink for NASA spacecraft data to be received and redistributed across the country.

#### ***b. Real time correlation of data from telescope around the world***

The GBT often engages in simultaneous observations from using telescopes across the world through a variety of different telescope networks. Currently the lack of broadband access to Green Bank results in the GBT data being physically packed up and the data media is mailed to a centralized location where it is processed. A broadband network link in Green Bank would allow for real time correlation of the data, using a system that is already in place with many parts of Europe and Japan.

### ***c. Ready access to existing data archives***

Under the current network limitations, the GBT is forced to store its scientific data and have it physically delivered (mailed) to all parts of the country and the world. This method is slow and risky in terms of data integrity. The large servers required for on-site storage of data also creates sizable radio frequency interference, the radio astronomy equivalent of light pollution, which directly affects the sensitivity of the GBT. The higher bandwidth capacity would allow GBT to transfer the raw data faster to West Virginia University and take advantage of the computing infrastructure already there without the additional cost of creating and maintaining computing infrastructure on site for storage.

### ***d. Green Bank Link to West Virginia University for the Pulsar Search Collaboratory***

Astronomers at West Virginia University (WVU) are involved in the Pulsar Search Collaboratory (PSC), a project which provides high-school students across the state access to data from the Robert C. Byrd Green Bank Telescope (GBT) in a search for new pulsars (rapidly spinning neutron stars). These data are stored in a database at WVU. Currently there is no rapid means for the data to be transferred to WVU. A high-speed link would allow follow-up observations of new pulsars, and new search data, to be accessed by the students only a short time after data collection, thereby enhancing their exposure of Science, Technology, Engineering and Math (STEM) related study. The high-speed access would also allow for the GBT to be remotely controlled by students and teachers participating in the PSC program. Allowing for these controls through an internet-based interface would provide more access to the GBT across the state and throughout the US. Additionally, the interface would allow for additional video conferencing potential, where high school students and teachers from across the state and world could communicate with one another while conducting research and mentoring activities.

### ***What's missing now***

Researchers are still carrying data up to WVU and mailing disks and tapes around the world, a method with numerous inherent risks, costs, and delays. Access to real time data in Green Bank is extremely limited, and correlation of data from around the world take weeks. The Green Bank site is currently storing and archiving their data, a process which is rapidly becoming untenable.

### ***Opportunity***

A high speed fiber link from Green Bank, WV through West Virginia University in Morgantown and then continuing the internet backbone of the region would greatly expand the opportunities for research activities within the state and the country, as well as allowing the Green Bank site to take advantage of the pre-existing computing and storage facilities existing at WVU.