

AN INTERNET OBSERVATORY FOR SOLAR SYSTEM ASTRONOMY AT THE UNIVERSITY OF NORTH DAKOTA. P. S. Hardersen¹, S. de Silva¹, V. Reddy¹, P. Cui¹, S. Kumar¹, and M.J. Gaffey¹ ¹Department of Space Studies, Box 9008, University of North Dakota, Grand Forks, ND 58202, Hardersen@space.edu, desilva@space.edu, moonyguy@yahoo.com, pcui@aero.und.edu, sanatumar@yahoo.com, gaffey@space.edu.

Introduction: The availability of Internet controllable telescopes for research, education, and profitable ventures has increased substantially over the past decade. This is largely due to the continuing development of increasingly reliable browser astronomy software that can reliably and easily control a remote telescope and CCD camera [1,2].

However, there are still relatively few educational institutions that have invested the resources to build and operate their own Internet observatories [3,4,5,6,7,8,9,10,11]. Most K-12 schools, colleges, and universities use free, low-cost, or paid-service observatories that are operated by other organizations, such as the Bradford Robotic Telescope, Telescopes in Education (TIE), and New Mexico Skies [12,13,14]. This is likely due to a combination of factors such as the lack of funding, the lack of personnel with the requisite expertise, poor location, and inadequate institutional support.

Despite these potential difficulties and challenges, the University of North Dakota (UND) Department of Space Studies has recently begun operating a small Internet controllable observatory. This is the culmination of an 8-year effort that witnessed substantial hardware, software, and infrastructure modifications to the original observatory design.

History: Originally built in 1997 ~10 km west of Grand Forks, North Dakota, the observatory consists of a partially-underground roll-off roof that contains the observatory telescope (Meade classic 16-inch LX200 Schmidt-Cassegrain), CCD (SBIG STL-6303e), focuser, computers, and associated hardware. See Figures 1 and 2. Envisioned initially as an observatory dedicated to planetary sciences research and global distance education [3,5], the observatory has experienced a series of hardware and software difficulties and changes that has prevented reliable operation until recently [5,15].

However, thanks to a renewed commitment from UND and the Department of Space Studies, the observatory has just completed an extensive five-month renovation and upgrade that has corrected and improved many of the initial observatory design problems. The most significant renovations include: 1) elevation of the roof that allows full motion of the telescope without risk of collision with the roof, 2) purchase of two industrial computers, and 3) purchase of commercially available software such as PinPoint and

ACP Observatory Control Software [1]. In addition, a T1 network line has been installed at the site, although network access is still being provided by a wireless link at the present time.

Current status and operations: During the Fall 2005 semester, the observatory was used in support of SpSt 425: Observational Astronomy. This is a distance education class that is a part of the UND Space Studies distance Master's degree program [16]. Throughout the semester, students learned the fundamentals of observing, the characteristics of astronomical equipment, and the theory and practice of astrometry, photometry, and CCD image processing and color imaging.

Students from locales as distant as Sofia, Bulgaria, undertook two observational assignments: astrometry of a main-belt asteroid and CCD color imaging of deep-sky objects. Despite relatively poor weather and less than two months of observing time, many students were able to complete at least one of the assignments. Students who were not able to gather their own data were given existing data to process.

Lessons learned: Although the observatory was originally envisioned as being totally student-controlled, that is not a realistic or practical option. Currently, the instructor remotely opens the roof, powers up the telescope/CCD, and aligns and focuses the telescope. Once these tasks are accomplished, the instructor then allows the first student to observe for the evening. The instructor is also required to close the observatory in the morning after all observing sessions have concluded.

Maintenance and upkeep of a relatively remote Internet observatory is a significant undertaking. Minor, resolvable problems and operational issues involve a major time commitment and include: 1) preparing the observatory for nightly operations, 2) maintaining telescope focus, 3) being on-call all night to troubleshoot problems, 4) closing the observatory in the morning, and 5) making frequent trips to the observatory for a variety of equipment-related issues. If an educational institution commits to operating its own small Internet observatory, then it must be willing to invest the money and the people to ensure successful operations.

Future plans: The Internet observatory will eventually be just one part of a diverse astronomical complex that is being constructed at the UND Observatory

site. The vision is to operate multiple telescopes at different wavelength regions (optical and radio) and in different observing modes (solar, broadband photometry, visible-wavelength spectroscopy, etc.) that will build and expand the astronomical expertise at UND for both scientific research and instrumentation development.

During Summer 2006, plans call for further improvements to the Internet observatory as well as installation of a Small Radio Telescope [17]. Besides purchasing additional narrow- and broad-band filters, an SBIG Self-Guiding Spectrograph [18] and an SBIG AO-7 adaptive optics system will be tested [18]. Additional goals include making one Meade 10-inch LX200 telescope Internet controllable for nighttime astronomy, while making another similar telescope Internet accessible for solar astronomy.

Once complete, the observatory complex will be able to offer multiple types of astronomical research facilities that will support a wide variety of research and educational projects. The ultimate goal is to build a 1-meter-class professional observatory that will be a regional astronomical resource for North Dakota and the Upper Midwest region [19].

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Figure 1. Interior image of renovated UND Internet observatory.



Figure 2. External view of the UND Internet observatory.