

USNO Green Bank 20-Meter Telescope

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Abstract

NRAO-Green Bank has been operating a 20-meter telescope for the USNO Earth orientation program since 1995. This report summarizes the characteristics of the system and its activities from 1995 to the present. One may also find information in the NRAO-Green Bank web page: <http://www.gb.nrao.edu/fgdocs/20m/GB20m.html>

1. Introduction

The NRAO-Green Bank 20-meter telescope is operated by the National Radio Astronomy Observatory (NRAO) under contract with the U.S. Naval Observatory (USNO), in support of USNO and NASA Earth Orientation, geodetic, and astrometric VLBI programs.

The 20-meter was built by RSI and completed in late 1994. Regular operations began in October of 1995. The delay between completion and starting regular operations happened because its encoders were lent to KPGO for several months.

Table 1. Location of Green Bank 20-meter telescope.

Longitude	79° 49' 31.865" W
Latitude	38° 26' 12.661" N

2. Description of Equipment

Similar to the geodetic antennas at KPGO (Kauai, Hawaii), and Ny Ålesund (Spitzbergen), the 20-meter telescope features a fast slew speed of 2 degrees per second in both azimuth and altitude axes, surface accuracy of about 0.8 mm rms, and an F/D ratio of 0.43 at prime focus.

The prime focus receiver is an NRAO-built S- and X-band dual polarization system using cooled (15 K) HEMT amplifiers. The design is somewhat novel because the RF signals are transmitted to the control room on optical fibers where the LO system and mixers are located. A 500 MHz reference signal locked to a H-maser standard is sent to the receiver on an optical fiber to drive the phase cal unit. The 500 MHz is returned to the control room where a round-trip phase measurement is done.

Typical system temperatures are 45 K at X-band and 30 K at S-band, typical SEFDs are 700-800 Jy at X-band and 400-500 Jy at S-band.

The VLBI recording system consists of a VLBA DAR rack with 14 baseband converters (BBC) and VLBA formatter, and a VLBA-type tape recorder. All experiments for the last two years are recorded only on thin tape.

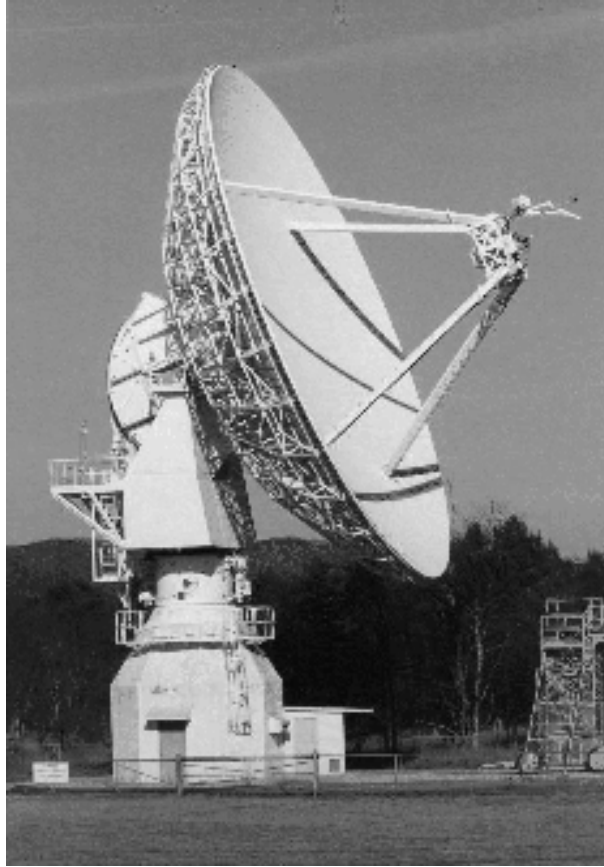


Figure 1. The USNO 20-Meter RSI telescope at Green Bank, WV

3. Technical Staff for the Green Bank 20-meter

The 20-meter project benefits from being located at a major radio astronomy observatory because all phases of maintenance, technical support, and repairs can for the most part be done by the local staff, who support all the telescopes at the site. Cryogenics technicians, telescope mechanics, electronics engineers and technicians, and programmers all contribute small portions of their time to maintenance and repairs of the 20-meter systems.

At the present time, the staff dedicated primarily to the 20-meter operations include two full-time telescope operators (K. Lehman and G. Monk), operations supervisor (M. Chestnut), electronic technician (W. Shank), and “friend of the telescope” (F. Ghigo).

4. Status of the Green Bank 20-meter

The 20-meter primarily supports the USNO weekly NEOS-A and daily INTensive experiments. In the past two years, it has also observed experiments including the VLBA (RDGEO, RDV, and RDWPS), and bi-monthly CORE-B experiments. In 1997-1998 it participated in observations of the Mars spacecraft.

The primary experiments (NEOSA and weekday Intensives) are run with full coverage by tele-

scope operators. The other experiments (CORE-B, RDV, etc) are generally run partly unmanned.

Table 2 summarizes the usage from October 1995 through May 1999; (GLOBAL,etc: includes Reference Frame, GBTies, GLOBALS, CRF, and GEOCAT.) Figure 2 shows total usage in graphical form.

Table 2. Hours scheduled October 1995 through May 1999

Experiments	1995	1996	1997	1998	1999	Total
NEOS-A	274	1237	1296	1304	520	4631
INTensive	37	400	616	659	243	1955
NAVEX	48	91	48	0	22	209
Fringe Tests	6	5	3	6	2	22
GLOBAL, etc.	24	232	22	70	0	348
RDV, RDGEO, RDWPS	0	163	138	133	23	457
CONT96	0	587	0	0	0	0
CORE-B	0	0	113	135	68	316
MARS	0	0	41	6	0	47
TOTALS	389	2715	2277	2313	878	8572
Percent Time Lost	10.1	4.7	2.0	5.4	3.5	

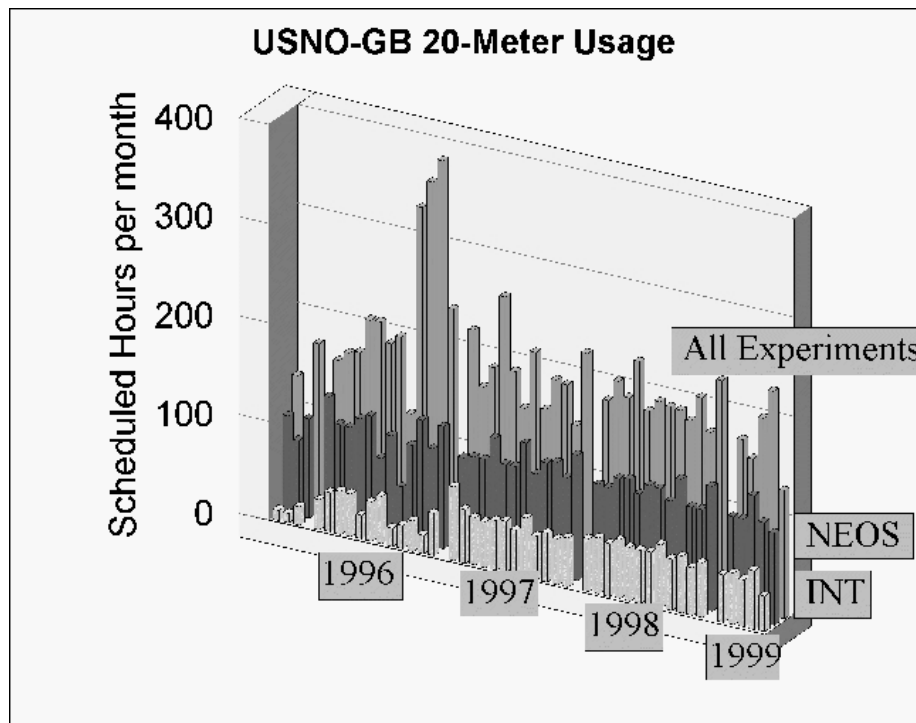


Figure 2. Usage of the 20-meter, 1995-present.

In October 1998, the 20-meter back end electronics and the operations area was moved into a new control building. The new building has shielded control and electronics rooms. The shielding

is primarily to protect the new 100-meter GBT from locally generated RFI. The ST H-maser time standard was also relocated to the new building, where it provides reference and time signals for all systems on the site as well as the 20-meter VLBI system.

Some major maintenance was done during May 1999: oil was changed in all gear boxes, and a leaky oil seal on one of the azimuth motors was replaced.

5. Future Plans

Both the Green Bank and Kokee systems will be upgraded to Mark IV operations early in 2000. New Mark IV formatters and decoders will be obtained, and the recorders will be modified for the faster data rates and for the addition of an extra head stack.

We also plan to install a Turbo Rogue GPS station at Green Bank later this year.