

# Fundamentalstation Wettzell - 20m Radiotelescope

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## Abstract

2006 was a very successful year for the 20m-Radiotelescope in Wettzell/Germany contributing strongly to the IVS observing program. Technical changes, improvements and upgrades were done to increase the reliability of the entire VLBI observing system.

## 1. General Information

The 20m-Radiotelescope in Wettzell (RTW) was designed in the years 1980/81 as a project of the former “Sonderforschungsbereich 78 Satellitengeodäsie”. RTW is an essential component of the Fundamentalstation Wettzell (FSW) and is jointly operated by Bundesamt für Kartographie und Geodäsie (BKG) and Forschungseinrichtung Satellitengeodäsie (FESG) of Technical University Munich. At the FSW the following geodetic space technique systems are co-located:

- WLRS (Wettzell Laser Ranging System), a laser ranging system designed for Satellite Laser Ranging (SLR) and Lunar Laser Ranging (LLR) contributing to the ILRS; presently a new laser Satellite Observing System (SOS-W) for low orbiting satellites is under construction.
- GPS receivers, involved in global network IGS, in the European network EUREF, and in the national network GREF as well as in time transfer experiments,
- “G”, a ringlaser dedicated for monitoring daily variations of Earth rotation with a relative accuracy of better than  $10^{-8}$ ,
- RTW, integrated into the geodetic observing programs of the IVS.

A time and frequency system (T&F) has been established for the generation of the timescale (UTC(IfAG)) and for the provision of very precise frequencies needed for VLBI, SLR/LLR and GPS observations, employing Cs-clocks, H-Masers and GPS time receivers. The time scale UTC(IfAG) is published in the monthly Bulletin T of BIPM. Additional in situ observations are carried out, such as gravity observations with a super conducting gravity meter, recording of earthquakes with a seismometer, meteorological observations to monitor pressure, temperature and humidity as well as wind speed, wind direction and rain fall, water vapour observations with radiometer(s), conventional geodetic control measurements to tie the reference points of the space geodetic systems RTW, WLRS, GPS and “G” to the local terrestrial coordinate system and to investigate the local stability.

## 2. Staff

The staff of the Fundamentalstation Wettzell consists in total of 35 members for operations, maintenance and repair, for improvement of all devices and for development of new systems. Within the responsibility of the Fundamentalstation Wettzell are also the

- TIGO systems (see special report in this volume), operated in Concepción/Chile jointly with a Chilean partner consortium, with 3 experts from Wettzell and



Figure 1. Fundamental Station Wettzell

- O'Higgins station (see special report in this volume) in the Antarctica jointly operated by the German Space Center (DLR) and the Institute for Antarctic Research Chile (INACH).

The staff operating RTW is summarized in Table 1.

Table 1. Staff - members of RTW

Name	Affiliation	Function	Working for
Wolfgang Schlüter	BKG	head of the FSW	RTW, TIGO, O'Higgins, T&F,...
Richard Kilger	FESG	group leader RTW	RTW
Erhard Bauernfeind	FESG	mechanical engineer	RTW
Ewald Bielmaier	FESG	technician	RTW
Gerhard Kronschnabl	BKG	electronic engineer	RTW, TIGO and O'Higgins (partly)
Christian Plötz	BKG/FESG	electronic engineer	O'Higgins, RTW (partly)
Raimund Schatz	FESG	software engineer	RTW
Walter Schwarz	BKG	electronic engineer	RTW, O'Higgins and WVR (partly)
Reinhard Zeitlhöfler	FESG	electronic engineer	RTW
Daniel Helmbrecht	FESG/BKG	student	RTW
Christian Hupf	FESG/BKG	student	RTW

### 3. Observations in 2006

The 20m-RT-Wettzell is engaged in geodetic VLBI operation since the end of 1983 –now for 24 years. Table 2 shows the amount of scheduled and successfully observed sessions in the year 2006. According to the 2006 Master Schedule of IVS, RTW has run most 24h geodetic VLBI sessions compared to any other telescope in our community. This did not change over the last 7 years. Since April 1984, RTW participates daily to the one-hour, one-baseline INTENSIVE sessions–additional to the 24h-sessions–in order to determine UT1-UTC. At the beginning of 1984 it was observed together with Westford, since 1995 with Greenbank and since 1999 with Kokee Park in Hawaii. These sessions are called INT1 and are performed every weekday. The correlation is done at WACO. On Saturday and Sunday, Wettzell is engaged in INT2 together with Tsukuba/Japan,

filling the weekend gap with data. INT2, correlated at the VLBI correlator in Tsukuba, provides UT1-UTC with shortest latency. The VLBI correlator in Tsukuba has a fast Internet connection and obtains the data from the observing stations via e-VLBI. There is a continuous effort going on to shorten the latency, which is caused mostly by the data transfer between the stations and the correlator. RTW will improve its Internet connection in 2007 from 34 Mbit/sec to 622 Mbit/sec and will extend the data transfer to all correlators which already have fast Internet connection (Bonn, Tsukuba and Haystack).

Table 2. RTW observations in 2006

program	number of 24h-sessions
IVS R1	52
IVS R4	52
IVS T2	6
IVS R&D	10
RDV/VLBA	6
EUROPE	6
VIE	1
<b>in total</b>	<b>133 [d]</b>

program	number of 1h-sessions
INT1(Kokee-RTW)	237
INT2(Tsukuba-RTW)	78
<b>in total</b>	<b>315</b>

#### 4. Technical Improvements and Maintenance

VLBI observations require high reliability of all participating stations. Therefore careful service of all components is essential to ensure successfully performing VLBI measurements over the year(s). Additionally, the 20m-RTW has to be kept on a high technical standard and has to be upgraded according to technological advancement.

In 2006 the following actions were carried out

- to maintain the antenna hardware:
  - change of 3 Azimuth motors that were worn out by continuous load of observations,
  - replacement of tachos at Az-motors; replacement of broken coupling,
  - repair of servo failure at M9 (power surge),
  - careful adjustment of servos and drive system to split the power for all motors as exactly as possible,
  - replacement of the keys for all azimuth and elevation motors,
  - service of ventilators of all Az+El-motors ,
  - change of lubrication oil and grease of Az+El-gearings.
- to improve the receiver:
  - integration of a new X-band amplifier from Sandy Weinreb into the dewar, thus improving  $T_{\text{sys}}(X)$
  - integration of special HF-cables in the dewar in this context,
  - realisation of a dewar testing facility, thus testing and measuring a dewar on ground,
  - installing a more accurate pressure gauge built by Hastings at the dewar of the antenna,

- investigating issues concerning the 5V power-supply.
- to maintain the data acquisition system
  - investigations to locate spurious signals in VC01, 02 and 03; working hard finding reasons for it,
  - shielding of cables,
  - repairing formatter #116.
- to implement the Mark 5 recording system
  - installation of an additional Mark 5 unit (Mk5-684) as back-up (in practice already needed),
  - repair of a special power supply pack of Mk5-02, to avoid unexpected system shut-downs,
  - testing before Giga-Bit-recordings (R&D-sessions),
  - repair of 8-packs; interchange of fixed discs in BKG-units.
- to improve the software
  - on October 23, 2007 upgrade from FS 9.7.7 to FS 9.9.0,
  - on November 23, 2007 upgrade from FS 9.9.0 to FS 9.9.2,
  - reinstallation of the invar height measuring system.
- to support TIGO and O'Higgins
  - repair of phasecal unit for O'Higgins in Wettzell,
  - order and supply spare parts for TIGO and O'Higgins.
- and to contribute to VLBI 2010
  - prepare specifications for a new VLBI 2010 compatible telescope (TWIN-Telescope Wettzell) for the planned requests of bids from companies,
  - design the TWIN Telescope Wettzell, considering a broadband-feed capable to receive a frequency-band from 1 to 18 GHz.

## 5. Plans for 2007

During 2007, RTW plans are to keep up its standard in observing quality and quantity. Some dedicated items will be:

- upgrade the 34 Mbit/s Internet connection to 622 Mbit/s,
- integrate digital baseband converters (DBBC),
- integrate Mark 5B units
- design in detail the VLBI 2010 TWIN Telescope.