

GSFC Technology Development Center Report

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Abstract This report summarizes the activities of the GSFC Technology Development Center (TDC) for 2013 and describes plans for 2014. The GSFC TDC develops station software including the Field System (FS), scheduling software (SKED), hardware including tools for station timing and meteorology, scheduling algorithms, and operational procedures. It provides a pool of individuals to assist with station implementation, check-out, upgrades, and training.

1 Technology Center Activities

The GSFC IVS Technology Development Center (TDC) develops hardware, software, algorithms, and operational procedures. It provides manpower for station visits for training and upgrades. Other technology development areas at GSFC are covered by other IVS components such as the GSFC Analysis Center. The current staff of the GSFC TDC consists of John Gipson, Ed Himwich, and Rich Strand, all employed by NVI, Inc. The remainder of this report covers the status of the main areas supported by the TDC.

2 Field System

The GSFC TDC is responsible for development, maintenance, and documentation of the Field System (FS) software package. The FS provides equipment con-

trol at VLBI stations. It interprets the .snp schedule and .prc procedure files (both as prepared by DRUDG from the .skd schedule). The FS controls the antenna, data acquisition hardware, and related ancillary equipment needed for making VLBI measurements. All major VLBI data acquisition backends are supported. The FS is customizable to allow it to control station specific equipment. It is used at almost all the IVS Network Stations (more than 35) and also at many stations that do VLBI only for astronomical observations. The only major VLBI facilities not using it are the VLBA and VERA.

There was one minor release of the FS (9.11.0) during this year. Full details can be found in the FS release notes, but some of the major changes are listed here:

- Support for the DBBC DDC personality was added, both for continuous and on-off noise diodes.
- A work around for the “Day 49” kernel issue was included.
- A new version of the *gnplt* program, written in Python, was included.
- A new command, *satellite*, was added to allow simple pointing at satellites.
- A new command, *holog*, was added to facilitate collecting data from holographic antenna measurements.
- The pointing data analysis programs were modified to plot first antenna coordinate offsets in “cross” coordinate units, e.g., to use “Cross-El” instead of Azimuth and to use “cross” coordinate reweighting constants when fitting the first coordinate offsets.
- The metserver/metclient programs were improved to better support multiple clients.
- The handling of Mark 5 communications was improved to prevent partial responses from terminat-

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ing input prematurely. There were general improvements to error messages for Mark 5 communications.

In addition several development projects were underway. These include:

- Patriot 12 m Interface. Development of the interface for Patriot Antenna Control Unit (ACU) continued. Several improvements were made including the handling and the reporting of status word represented errors and improvements in cable-wrap handling to make it independent of the limits for any particular antenna.
- Mark 5C/RDBE. Preliminary support for Mark 5C recorders and RDBE DASs was developed to facilitate VGOS test activities. This support will be fed into the distributed FS next year.
- Miscellaneous. Many small improvements and bug fixes were made for the new releases expected in 2014. These included a new “time-out” feature for the *onsource* command to facilitate local antenna measurements, making all DBBC IF power measurement displays all consistent support for the DBBC astro2 mode, and preventing the changing of schedules while recording.
- VEX2. Considerable effort has gone into defining the second version of VEX, which will provide schedule file format support for new “sampling-before-channelization” systems such as the RDBE.

2.1 Plans for 2014

Several other improvements are expected in future releases, including:

- Support for RDBE racks.
- Support for DBBC PFB personality.
- Support for Mark 5C and Mark 6 recorders.
- Use of *idl2rpc* for remote operation.
- A complete update to the documentation and conversion to a more modern format that will be easier to use and maintain.
- Conversion of the FORTRAN source to use the *gfortran* compiler, which will enable use of the source level debugger, *gdb*, for development and field debugging.
- *Chekr* support for Mark 5A and Mark 5B systems.

- FS Linux 9 (based on Debian *wheezy*, skipping *squeeze*) distribution.
- Support for periodic firing of the noise diode during observations.
- Support for NMEA standard wind sensors.
- Completion of the VEX2 standard and implementation of it.

3 SKED and DRUDG

The GSFC TDC is responsible for the development, maintenance, and documentation of SKED and DRUDG. These two programs are very closely related, and they operate as a pair for the preparation of the detailed observing schedule for a VLBI session and its proper execution in the field. In the normal data flow for geodetic schedules, first SKED is run at the Operation Centers to generate the .skd file that contains the full network observing schedule. Then stations use the .skd file as input to DRUDG for making the control files and procedures for their station. Catalogs are used to define the equipment, stations, sources, and observing modes which are selected when writing a schedule with SKED.

Changes to SKED and DRUDG are driven by changes in equipment and by feedback from the users. The following summarizes some of the important changes to these programs in 2012.

3.1 SKED Changes

- Better calculation of SNR. The calculation now includes the effects of 1- and 2-bit sampling and the correlator efficiency factor.
- Addition of the descriptive parameters “SCHEDULING_SOFTWARE”, “SOFTWARE_VERSION”, and “SCHEDULE_CREATE_DATE”. This was done because *vie-sched* is now being used to write some schedules, and we wanted to be able to tell which software wrote a schedule.
- Addition of the \$BROADBAND section to the schedule file, which provides limited support for broadband. This section lists the stations that are observing in broadband and gives the bandwidth of the observing.

- Correction of a problem with adding a station to a schedule that already has observations. This problem occurred because each station has a preferred one-character station code. It is possible to have two stations with the same preferred code in the same schedule. In this case, one of the stations will use another code. Previously, if you added a station to a schedule and the one-letter code of the station was already in use, sked would sometimes change the code for a station in the schedule.

3.2 DRUDG Changes

Many changes were made to support new equipment in the field, particularly DBBCs. A fuller description can be found in the FS release notes.

3.3 Plans for 2014

Plans for 2014 include the following:

- In 2012, we began work on making VEX the native format for SKED. We plan to finish this project in 2014.
- We also plan to expand support for RDBEs and DBBCs. This will involve changes to SKED, DRUDG, and the catalogs.
- If time permits, we will convert SKED to compile using a freely available compiler such as *gfortran*.