

# GSFC Technology Development Center Report

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## Abstract

This report summarizes the activities of the GSFC Technology Development Center (TDC) for 2006, and forecasts planned activities for 2006. The GSFC TDC develops station software including the Field System, scheduling software (SKED), hardware including tools for station timing and meteorology, scheduling algorithms, operational procedures, and 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 and Ed Himwich, employed by NVI, Inc.

The remainder of this report covers the status of the main areas of development that are currently being pursued.

## 2. Field System

The GSFC TDC center is responsible for development, maintenance, and documentation of the Field System (FS) software package. The FS provides equipment control at VLBI stations. It interprets the .snp schedule and .prc procedure file (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 all the IVS network stations (over 30) and also at many stations that do VLBI only for astronomical observations. The only major observatories not using it are the VLBA and VERA.

During this period some of the new features that were released in FS version 9.9 were:

- “autoftp” feature for near-realtime fringe tests implemented
- Pointing model expanded to 30 parameters
- Arbitrary length (up 512 character) SNAP procedure arguments supported
- numerous small bug fixes and improvements were added

In the next year, several other improvements are expected, among these are: (1) Support for Mark 5B recorders, (2) Support for DBBC and DBE racks, (3) a complete update to the documentation and in a more modern format that will be easier to use; (4) conversion of the FORTRAN source to use the g77 compiler, this will enable use of the source level debugger, *gdb* for development and field debugging; (5) use of *fsvue* or Real VNC for network operation; (6) *chekr* support for Mark 5A and 5B systems; (7) use of the Mark IV Decoder for phase-cal extraction in the field; and (8) support for periodic firing of the noise diode during observations.

### 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 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 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. During 2006 many changes were made to the catalogs, SKED, and DRUDG.

#### 3.1. Catalog Changes

Changes were made to the Catalog system in 2006 following suggestions received at the IVS General Meeting in Chile and at other times. Specifically, changes were made to:

- Allow simpler experiment setup in the case that there are more BBCs at a station than are used. This is the case for the RDVs which use only 8 BBCs. Previously the unused BBCs had to be set “by-hand” to a frequency that will not cause spurious signals.
- Allow simpler processing of experiments where different stations have different number of BBCs. This is done by assigning the same frequency to the same channels at all stations. Previously the frequencies were assigned to the first N-channels. This caused the correlators to have to “re-map” the channels prior to correlation.

As a result of the above changes, standard recording modes for the R1s, R4s, T2s and other sessions needed to be modified. In addition special recording modes were added for special tests.

USNO decided to begin recording in 16 channels for the R4s and the Intensives in January 2007. New catalog modes were added to support this change.

#### 3.2. SKED

Many bug-fixes and upgrades to SKED were made this year. Some of the more notable ones include:

- Modifying tag-along mode to use `snr_margin`. This means that an observation is flagged as good if the SNR at the maximum allowable duration is within `snr_margin` of the target. This makes tag-along mode consistent with normal scheduling, and results in more observations in tag-along mode.
- Removed a bug in Mark 5 schedules that caused extra time between observations. This was because SKED does not keep track of tape footage for Mark 5 schedules. Part of the code which looked at the tape footage assumed that each observation was at the start of a pass (since the footage was 0), and scheduled extra time.
- SKED used two different arrays to store the latitude and the longitude of stations. Further the arrays differed in the sense of the longitude. This led to much confusion. One of the arrays was removed.
- Many changes were made to reading and writing VEX files. This was done when it was discovered that sometimes SKED could not read in a VEX file it had written!

- The downtime command was enhanced so that you can have many downtimes at a station.
- Simultaneous visibility plot. SKED was modified to plot a graph showing which sources are simultaneously visible by a set of stations.
- Time format made much more flexible. Previously SKED only accepted time-tags in the form YYDDDDHHMMSS, e.g., 06345170000. Although this contains all the information, it is a little hard to read. SKED was modified to ignore “/”, “:” and “-” while parsing time strings. Hence the above time might be written as 06/345/17:00:00.

In addition we assisted many institutions in installing the Linux version of SKED which is becoming the new standard.

### **3.3. DRUDG**

Many modifications were made to support changing hardware specifications.