VSOP Mission Operations Handbook

VLBI Space Observatory Programme

Institute of Space and Astronautical Science

3-1-1 Yoshinodai

Sagamihara, Kanagawa 229-8510

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1 Introduction

This aim of this document is to describe the interfaces among the various mission elements of the VLBI Space Observatory Programme (VSOP). For each item exchanged by mission elements, this handbook details the **what** (a brief description of the item), the **how** (the format and naming convention), the **when** (the timescale for the exchange), and the **where** (the exchange mechanism or location of the file).

Items are divided into sections depending on the element producing the item. These are somewhat arbitrarily separated into pre– and post-observation sections for the VSOG (VSOP Science Operations Group) and Navigation groups to give a more chronological feel to the document.

References in the text to documentation relating to formats, naming conventions etc. are given in full in §10.6, together with the locations of the documents, most of which can be obtained electronically. Internal procedures within each mission element are not described here, though references to these are given where possible.

Please e-mail any comments, corrections or suggestions regarding this handbook to vsog@vsop.isas.ac.jp.

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2 VSOP Mission Element Overview

2.1 Mission Elements

The main mission elements are:

- The VSOG, based at ISAS and NAO, which is responsible for the operation of the HALCA satellite.
- The ground tracking stations (GTSs), located at Usuda (operated by ISAS), Green Bank (GBTS, operated by NRAO), and Goldstone, Tidbinbilla, Madrid (DSN GTS, all three operated by the DSN). The interface for the DSN GTSs is the JPL DOTS team.
- The ground radio telescopes (GRTs), located around the world.
- The navigation groups, located at ISAS and JPL. The interface for the JPL Multimission navigation (MMNAV) group is the JPL DOTS team, although the ISAS and JPL navigation groups will bilaterally exchange various data products during normal operations.
- The correlators, located at Mitaka, Socorro, Penticton, and (from late 1998) Dwingeloo. Near real-time fringe detectors will also be located at Usuda, Sagamihara and Green Bank.
- The Principal Investigators (PI). This group will not be considered in detail in this document – a separate document specifically for PIs is in preparation by the VSOG.

2.2 Nomenclature

Before proceeding further, the nomenclature used within the handbook will be briefly described.

An *observation* is a single continuous event, usually lasting for between 1∼3 orbits.

An *experiment* is one or more observations of a single source at a single frequency within a single proposal. Experiment codes of five characters are used in naming GRT related files. For experiments with multiple epochs (i.e. multiple observations) the six character observation code is sometimes used.

A *tracking pass* is a single continuous occasion in which the two-way link is established between a single GTS and the space radio telescope (SRT). An observation consists of a number of tracking passes.

Ku-band telemetry is the real-time link between the GTS and the SRT. The up-link frequency is 15.3 GHz, and downlink is 14.2 GHz.

S-band telemetry is conducted between the Kagoshima Space Center (JKSC) and the SRT. Commanding is done at the uplink frequency of 2.1 GHz, and housekeeping telemetry (and range and range-rate monitoring) at the down-link frequency of 2.3 GHz.

2.3 Overview of this document

An overview of the data products and interfaces is given in the table on the following page. The 'X' in the file extension column refers to the designated code for the relevant tracking station or ground radio telescope. These are described in more detail later in the document.

Table 1: Overview

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3 VSOG Pre-Observation Products

3.1 Long-Term Experiment Schedule

- VSOG to Mission Elements

What: Long-term experiment schedules will describe the VSOP observing schedule on time scales of weeks up to the full Announcement of Opportunity period, as required. The file will be revised regularly to incorporate new information on the spacecraft orbit, resource availability, and operational efficiency. The long-term experiment schedule may be made available on a restricted access basis to the mission elements.

How: The long-term schedulers will produce a GSTS file for internal VSOG use. Filenames will be of the form 971127JAN98.gst, where where 971127 is the data that the GSTS file was written and DEC97 is the month covered by the file. A modified GSTS, with updated tracking station allocations, will be generated with the naming convention YYMMDD-MMDD-MMDD.gst (e.g. 971128-1205-0111.gst) where YYMMDD is the date the file was generated, and the following MMDDs are the start and end dates of the schedule respectively.

When: The file will be generated before each of the 4 month duration GRT blocks, and as often as required between these times. Modified GSTS files will be generated approximately weekly.

Where: A one-line-per-experiment summary of the long-term schedule will be made available from the VSOP WWW site.

3.2 SRT (Space Radio Telescope) Schedule (SRS) File

- VSOG to Tracking Stations

What: The Space Radio Telescope (SRT) schedule file, or SRS file, has more precise time stamps than long-term schedules, and also designates which GTS will be used when. A one-second precision is used for GTS activities, though the accuracy is dependent on the orbit used. It will contain a list of activities describing the tracking support for one week of the mission from Monday through Sunday UTC, continuing to the end of any tracking pass that starts before the end of Sunday UTC.

The SRS file also serves as the antenna pointing schedule file, as it describes the planned orientation of the spacecraft (and solar panels) as a function of time. The JPL MMNAV team will take detailed solar-pressure effects into consideration in generating the orbit predictions.

How: The file format is described in “SVLBI Space Radio Telescope Schedule File”. The files are named `YYMMDD.srs[.v]`, where the date corresponds to the Monday of the week for which the file is valid.

When: SRS files are generated each week for the following weeks – it is envisaged that each week SRS files will be generated for the following 4 weeks. The schedule for the following week is, unless some contingency arises (see §10.5), the final version; the schedule for 4 weeks in advance is preliminary, but allows mission elements to determine their staffing requirements, etc. The SRS files will be made available by Tuesday at 1900 UTC.

Where: The files are placed in the sub-directory vsop/vsopoper/schedule/srtsched on the VSOG FTP site (see §10.6).

3.3 Observation Summary File (OSF)

- VSOG to Correlators

What: The Observation Summary File is a condensed version of the long-term schedule GSTS file with additional details from the proposal cover sheets, with emphasis on which mission elements are participating in each observation, and for what length of time they will be recording VLBI data. This information will enable correlators to meet the tape needs of the various sites. A summary of tape usage for GRTs will appear at the end of the file.

How: The file format will be described in "VSOP Observation Summary File Format". The files are named `YYMMDD_YYMMDD.osf[.v]`, where the YYMMDDs are the first and last dates covered by the file.

When: The OSF file will be generated 4–5 weeks in advance of the week it describes. Particularly during the early stages of the mission it is expected that the schedule will change, sometimes significantly, in the intervening four weeks. Also, the GSTS file uses a simple algorithm to assign tracking stations, which may differ from the assignment made in the SRS. Once the SRS and GRT schedule files have been made, a revised OSF will be generated, which will more accurately describe the time and tape usage of the mission elements.

Where: The files are placed in /vsop/vsopoper/schedule/grtsched/summary on the VSOG FTP site.

3.4 GRT (Ground Radio Telescope) Schedule Files

- VSOG to Regional Servers

What: The VSOG will produce schedule files for all GRTs participating in a particular observation, in the format required by each GRT.

How: File-names will include the observation code and, for those GRTs not using VEX files, the 2-letter station code (see "Suggested 2-letter Observatory codes"). Further details are given in "Scheduling of GRTs for VSOP".

When: These files will be posted on the GRT regional servers 2 weeks before the observation or, in the case of the EVN, 2 weeks before the VLBI session commences.

Where: The file for each participating GRT is placed on the appropriate regional server. The regional server and 2-letter code for each GRT is given in §10.2.9.

4 Navigation Pre-Observation Products

4.1 Long-Term Predicted Orbit

- ISAS NAV to VSOG

What: The ISAS navigation team (in collaboration with JPL MMNAV) will generate a long-term predicted orbit which will be used by the VSOG to generate the long-term schedule.

How: The files will be ASCII text and named with the extension `opr`.

When: Files will be produced at the request of the VSOG when it has become necessary to revise the long term schedule.

Where: File will be placed in subdirectory /vsop/oddata/predict/long on the VSOG FTP site.

4.2 (Long-Term) Predicted Orbit for Scheduling

- ISAS NAV to VSOG
- JPL MMNAV to GBTS

What: The ISAS and JPL MMNAV navigation teams will work together to generate a predicted orbit for the spacecraft that will be used to generate the SRS file. The file will predict the trajectory of the spacecraft 6 weeks in advance. The JPL MMNAV team will make available a predicted orbit in SPICE SPK format.

How: The ISAS files will follow the same convention as in §4.1, with suffix `opr`. The JPL MMNAV team will supply files in SPICE SPK format, with files named `YYMMDD-YYMMDD-lp.bsp[.v].gz`, where the first YYMMDD group is the start date and the second YYMMDD group is the stop date (UTC days). The '-lp.bsp' indicates a long-term predicted binary SPICE format. The '.gz' extension indicates the file is 'gzip'-ed.

When: Files will be generated monthly for the next month, and weekly for the next week.

Where: ISAS NAV files will be placed in subdirectory /vsop/oddata/predict/mid (for the monthly files), and /vsop/oddata/predict/short (for the weekly files) on the VSOG FTP site. JPL MMNAV files will be placed on the DOTS FTP site in the directory /pub/vsop/oddata/pred.

4.3 (Detailed) Predicted Orbit for Tracking

- ISAS NAV to Usuda GTS
- JPL MMNAV to GBTS and DOTS

What: The ISAS and JPL MMNAV team will separately produce predicted orbit files for the GTSs. The ISAS NAV team will supply the Usuda GTS, and the JPL MMNAV team will supply the DSN GTSs and the GBTS. These files will be used for GTS antenna pointing and frequency doppler shift predictions.

How: The ISAS NAV team supplies antenna pointing data and frequency control data to the Usuda GTS.

The JPL MMNAV team will supply files in SPICE SPK format named YYMMDD-YYMMDD-p.bsp[.v].gz where the first YYMMDD group is the start date and the second YYMMDD group is the stop date (UTC days). The '-p.bsp' indicates a predicted Binary SPICE format. The '.gz' extension indicates the file is 'gzip'-ed.

When: JPL MMNAV prediction files will be generated twice a week, on Mondays and Thursdays (PST). Each file will contain one week's data.

Where: ISAS NAV files will be placed in subdirectories /vsop/muses-b/kudata/nco_predict and /vsop/muses-b/kudata/antenna/predict on the VSOG FTP site. JPL files will be placed on the DOTS FTP site in the directory /pub/vsop/oddata/pred.

4.4 NASDA OD Results

- NASDA to JKSC

What: S-band range and range-rate data received at JKSC is made available to the NASDA navigation group, who in turn provide a predicted orbit which is used at JKSC to track the spacecraft. (NASDA also supply orbit determination results as a back-up for the ISAS OD results.)

How: The ASCII text files are named `YYMMDDHHMMSS.onp`, where the time is when NASDA make the file available.

When: NASDA will supply their results weekly.

Where: The NASDA orbit will be placed in subdirectory /vsop/oddata/predict/nasda on the VSOG FTP site.

5 Ground Tracking Station (GTS) Products

The file naming conventions used in the section use a single letter to designate each GTS: 'u' for Usuda, 'd' for Goldstone, 't' for Tidbinbilla, 'm' for Madrid, and 'g' for Green Bank.

5.1 VLBI Tapes

- GTSs to Correlators

What: VLBI data from the satellite will be recorded on VLBI tapes at the GTSs. Tapes will be dismounted from the recorder when the tapes have reached their capacity or after n days have elapsed since the tape was mounted, whichever comes first. Currently, for VLBA tapes $n = 3$, and for S2 tapes $n = 7$. These tapes must arrive at the designated correlator within 2 weeks of the last observation on the tape.

How: Tape labelling and shipping schemes are available by e-mail from vlbatape@nrao.edu for VLBA tapes and are given in "S2 SVHS Tape Handling Overview for VSOP" for S2 tapes. Shipping addresses for correlators are given in §10.6.

When: Tapes must arrive at the correlator no later than 2 weeks after the last support period included on the tape. GBTS will ship tapes within 72 hours of the time data were last written to tape.

Where: Tapes will be shipped to the appropriate correlator, which is listed in the SRS (§3.2) and the Observation Summary File (§3.3) for each observation. GTS staff should use the appropriate tape tracking system when shipping tapes (see §9.3).

5.2 Telemetry Header File (THF)

- GTSs to VSOG

What: Ku-band telemetry headers will be used by the VSOG to monitor the health and safety of the spacecraft and to produce necessary log and calibration files. Telemetry headers are provided in 10 or 15 minute blocks in near real-time, and for the complete pass after the pass has finished.

5.2.1 THFs in near real-time

How: The GBTS will make telemetry headers available in 15 minute blocks. The 15 minute blocks will have names based on the start time of each block, in the format `YYMMDDHHMM.ktg`, where the YYMMDD is the date of the data in the file and the HHMM is the time of the first data in the file, but in even 15 minute boundaries (e.g. data taken on 97 March 15 from 0h22m01s to 0h30m00s UTC will be placed in a file named '9703150015.ktg').

DOTS will create 10 minute telemetry header files.

The file format is given in "VSOP Science Header Data Format".

When: For the GBTS, each telemetry header block will be available 2 minutes after the end of that 15 minute block (e.g. 9703150015.ktg will be available at 97 March 15 at 00h32m00s.)

DOTS will place files on its FTP site within 30 minutes of the start of each 10 minute telemetry header file.

Where: For DSN GTSs: the 10 minute THFs are available from
pub/vsop/vsopoper/data/srt/dsn/kutlm2, on the DOTS FTP site.
For the GBTS: the files are available in the GBTS FTP site in directory /ovlbi/out/kutlm2.
For the Usuda GTS: from /vsop/vsopoper/data/srt/udsc/kutlm on the VSOG FTP site.
See §10.1 for details of these sites.

5.2.2 THFs post-pass

How: Files are made available by the GTSs. File names are of the form `YYMMDDHHMM.ktX[.v]`, where the time refers to the start time defined by the BGN2LK command in the SRS file, and the X is the single letter code for the GTS.

For the GBTS and the DOTS, the telemetry headers will be recorded in a single file for the entire tracking pass. If there are data dropouts during the pass, there will be gaps in the THF records. If the two-way link begins on 97 March 15 at 0h22m01s UTC, all telemetry data will be placed in the file named '9703150022.ktg'.

After the file for the whole pass has been placed on the FTP site, all shorter intermediate files will be deleted for the GBTS, but will be maintained for the DOTS.

The file format is given in "VSOP Science Header Data Format".

When: The telemetry headers from the Usuda GTS will be made available to the VSOG less than one hour after reception at the GTS.

For the GBTS, the entire telemetry header data for a tracking pass will be made available no later than 24 hours after the pass ends.

DOTS will make the complete THF available within 30 minutes of the end of the pass.

Where: For DSN GTSs: The full tracking pass THFs will be placed in
pub/vsop/vsopoper/data/srt/dsn/kutlm on the DOTS FTP site.
For the GBTS: The files will be available in the GBTS FTP site in directory /ovlbi/out.
For the Usuda GTS: from /vsop/vsopoper/data/srt/udsc/kutlm on the VSOG FTP site.
See §10.1 for details of these sites.

5.3 Time Corrections File (TCF)

- GTSs to Correlators and VSOG

What: A time correction (or 'delta-t') file will be constructed from the phase residual file for each tracking pass. These files will be made available on a per-pass basis. This data product is used for correcting the time-tags for the VLBI tape data.

How: The file format is given in "Time Corrections File Interface". File names are of the form `YYMMDDHHMM.kcX[.v]`, where the time refers to the time at the start of the file, and the X is the single letter code for the GTS.

When: File will be made available to the VSOG and the correlators within 7 days of the tracking pass.

Where: For DSN GTSs: The full TCFs will be placed in pub/vsop/vsopoper/data/srt/dsn/delta_t on the DOTS FTP site.
For the GBTS: The files will be available in the GBTS FTP site in directory /ovlbi/out.

5.4 Time Components File

- GTSs to Correlators and VSOG

What: The Time Components File contains information on certain corrections used in the detailed production of each TCF; for example, the troposphere delay variation, ionospheric delay variation, and the station clock variation relative to UTC. At present, only the GBTS and the DOTS will produce this file.

How: The file format is described in "Time Components File for Space VLBI". File names are of the form `YYMMDDHHMM.tcX[.v]`, where the time refers to the time at the start of the file, and the X is the single letter code for the GTS.

When: File will be made available within 7 days of the tracking pass to the VSOG and the correlators.

Where: For DSN GTSs: The files will be placed in pub/vsop/vsopoper/data/srt/dsn/delta_t on the DOTS FTP site.
For the GBTS: The files will be available in the GBTS FTP site in directory /ovlbi/out.

5.5 Data Processing Log (DPL)

- GTSs to VSOG

What: One DPL is produced per pass per recorder. Each DPL line contains a time stamp and an entry. The various components of the DPL are described in turn in the following sub-sections.

How: The DPL format is described in "Data processing log format (tracking stations to VSOG)". Data Processing Logs are named `YYMMDDHHMM-R.kTX[.v]` where T is 'l' for VLBA logs and 's' for S2 logs, R is the recorder number defined in the SRS file and the X is the single letter code for the GTS.

When: File will be made available to the VSOG within 4 days of the tracking pass.

Where: For DSN GTSs: The files will be placed in pub/vsop/vsopoper/data/srt/dsn/dplog on the DOTS FTP site.
For the GBTS the files will be available on the GBTS FTP site in the directory /ovlbi/out.
The Usuda GTS log will be placed in vsop/vsopoper/data/srt/udsc/corrlog.

5.5.1 Partial Correlator Input Log

What: The DPL will include a 'partial' correlator input log file for each tracking pass. The GTS will supply only GTS-specific information in the log entries, hence the term 'partial'; the VSOG will supply spacecraft-specific information to create the 'merged' correlator input log to be supplied to correlators – see §8.2

How: See documents "Specifications for Input Log to the Mitaka FX-Correlator", "Alternative log input to the VLBA correlator for space VLBI observations", and "SVLBI Space Radio Telescope Log Input to the Canadian (S2) Correlator".

5.5.2 Phase Calibration (PCal) Table

What: Phase calibration tones will be extracted and placed as time-tagged entries in the DPL.

How: See "VSOP phase calibration format for SVLBI tracking stations", and "Supplementary record types in the correlator input logs created by the NRAO OVLBI Earth station at Green Bank".

5.5.3 Flag Table

What: The DPL will include flag entries, covering the parameters which relate to the GTS performance. The VSOG will add flags related to spacecraft performance and generate a final flag table for use by the PI. The file may be passed to the PI via the correlator output or may reside on one of the VSOG computer sites for retrieval by the PI.

How: See "Flag dictionary for space radio telescope log files".

5.5.4 Square Law Detector Record

What: This information is currently expected to be provided by the GBTS only.

How: See "Calibration and flagging data from the NRAO OVLBI tracking station at Green Bank".

5.6 (Station) Performance Log (SPL)

- GTSs to VSOG

What: Auxiliary information that is not needed by the correlator but has been requested by the VSOG is called a station performance log. This file contains information about GTS performance and may be constructed from a number of internal-GTS data products.

How: The file format is given in "(Spacecraft/Station) Performance Log Interface". File names are of the form `YYMMDDHHMM.kpX[.v]`, where YYMMDD is the date of the BGN2LK entry in the SRS file for that pass.

When: File will be made available within 4 days of the tracking pass.

Where: Files will be available via the GBTS FTP site in directory /ovlbi/out; on the // DOTS FTP site /pub/vsop/vsopoper/data/srt/dsn/perflog; and on the // VSOG FTP site in /vsop/vsopoper/data/srt/udsc/perflog.

5.7 JPL/DOTS Monitor Data File (MDF)

- JPL/DOTS to VSOG

What: DSN GTS monitor data will be made available by the JPL/DOTS for each pass. The monitor data contains information relating to DSN GTS antenna, boresight, transmitter, tracking and receiver, telemetry, pre-pass and post-pass tests, and subsystem performance.

How: File format is described in JPL/DSN internal document "820-13 MON-5-17". Filenames are of the form YYMMDDHHMM.kmX. Both binary and ('gzip'-ped, .gz) ASCII versions of the MDF will be made available.

When: A complete file will be made available post-pass from the JPL/DOTS archive within 24 hours after the support period.

Where: Files will be available via on the DOTS FTP site /pub/vsop/vsopoper/data/srt/dsn/mondata.

5.8 GTS Status Reports

- GTSs to VSOG

What: Status reports will be generated by each GTS on a regular basis, nominally once a week, and submitted to the VSOG. The VSOG will have the responsibility of reviewing the reports and making recommendations to ensure the optimal performance of each mission element. These status reports from the mission elements will allow the VSOG to optimize the scheduling and execution of SVLBI experiments.

How: Reports are named `YYMMDD.stX`, where YYMMDD is the first start date covering the period of the report. Normally the interval reported in a single file is the 1 week period matching the interval scheduled in the latest SRS file. An example report, showing the preferred format is as follows:

```
Status Report
Element : SRT
Period  : FROM Jan 6, 1997  TO Jan 13, 1997
Reporter: Y.Murata (murata@vsop.isas.ac.jp)
Status  : OK
Comments: Satellite was packed in the container on Jan 8.
          It left ISAS Sagamihara campus on Jan 10, and
          reached Kagoshima Space Center (JKSC) on Jan 13.
Problems: None
```

When: Files are available 1 day after the last day of the interval reported. Usually files for the previous week are generated on the following Monday.

Where: Files will be available from the GBTS FTP site in directory /ovlbi/out,
from the DOTS FTP site in /pub/vsop/vsopoper/status/gts/,
and from the VSOG FTP site in sub-directory /vsop/vsopoper/status/gts.

6 Ground Radio Telescope (GRT) Products

6.1 VLBI Tapes

- GRT to Correlators

What: The VLBI data will be recorded on VLBI tapes of the type appropriate for the scheduled correlator for a given support session.

How: Tape labelling and shipping schemes are available by e-mail from vlbatape@nrao.edu for VLBA tapes and are given in "S2 SVHS Tape Handling Overview for VSOP" for S2 tapes. Shipping addresses for correlators are given in §10.6.

When: These tapes must arrive at the designated correlator within 2 weeks of the observation.

Where: Tape shipments should be logged with the tape tacking software of the appropriate correlator as described in §9.3.

6.2 GRT Log File

- GRT to Regional Servers

What: Co-observing GRTs will each generate a log file identical to those for ground-based VLBI experiments.

How: Log formats vary between recording formats. Log file names will include the observation code and the 2-letter station code. The VLBA generates one single TSM file containing the information for all participating GRTs within the VLBA and the VLA: the MkIII sections of this file will constitute the log files for correlators other than that at Socorro.

When: File will be made available within a week of the observation.

Where: Each GRT will place the log file on its designated regional server (§10.2.10), in the sub-directory named MMMYY for the month and year in which the observation began (in UTC), e.g. may97. For DSN telescopes the files will be placed on the DSN FTP site (see §10.1) in directory /pub/vlbiscpr.

6.3 GRT Calibration Data

- GRTs to Regional Servers

What: GRTs will make available data required for amplitude calibration of their data. Ideally, phase calibration data and a flag table will also be made available, although this is unlikely to be the case for all GRTs initially.

How: The data should be made available in a format which can be read by AIPS: i.e. ANCAL or ANTAB for amplitude calibration data, PCLOD for phase calibration data, and UVFLG for flagged data. The VLBA generates a single TSM file which contains this information for all participating GRTs within the VLBA and the VLA. The bare minimum will be an amplitude calibration data file. These are typically named `OBScal.XX`, where `OBS` is the observation code, and `XX` is the GRT '2-letter code' (which is 'VLBA' for the VLBA and 'Y' for the VLA).

When: File(s) will be placed on the regional server within a week of the observation.

Where: Each GRT will place the file(s) on its designated regional server (§10.2.10) in the sub-directory named for the month and year in which the observation began (in UTC). For DSN telescopes the files will be placed on the DSN FTP site (see §10.1) in directory /pub/vlbiscpr.

6.4 GRT Clock Offset Data

- GRTs to Regional Servers

What: GRTs should monitor the offset between their station clock and a time standard (ideally GPS). This monitoring should be undertaken both during and between VSOP observations – at least weekly – to allow the station clock drift to be accurately modelled.

How: The format for these files is given in
http://www.nfra.nl/reduce/describe/vlbi/GPS_prog_jdr.html .
The preferred file naming convention is `GPS.xx`, where `xx` is the 2-letter code for the GRT.

When: Files will be updated at least weekly.

Where: Files are placed by GRTs on their regional server (§10.2.10) in the sub-directory named for the month and year (e.g. `may97`) below the sub-directory named `gps`. For DSN telescopes the files will be placed on the DSN FTP site (see §10.1) in directory /pub/vlbiscpr.

6.5 GRT Gain Curves

- GRTs to Regional Servers

What: Gain as a function of elevation, ideally parametrized as a polynomial.

How: See the files below as examples.

When: Files will be regularly updated.

Where: Files are placed by GRTs on their regional server (§10.2.10). For the EVN these are in the evngains files in the cal sub-directory of the EVN FTP site.
For the VLBA these are available by anonymous FTP from ftp.aoc.nrao.edu (146.88.1.103) in the file pub/vlba_gains.key. For Japanese GRTs these will be available from the Mitaka FTP site (see 10.1). For Australian GRTs these will be available from the ATNF WWW site.

6.6 GRT Status

- GRTs to VSOG

What: GRTs will not provide regular status reports, but will operate assuming 'no known problems' and will provide reports at any change of status. Any known problems with a GRT should be communicated (by the GRT itself, by correlators, or by PIs) to the VSOG as soon as possible. The VSOG will communicate this information to all other elements that may be affected. Serious problems will result in that GRT being withdrawn from scheduling until the problem is fixed.

How: Email to vsog@vsop.isas.ac.jp . Suggested format as given in §5.8.

When: As soon as possible after the problem is discovered, and again as soon as the problem is fixed.

7 Navigation Post-Observation Products

7.1 GPS State Vectors

- ISAS NAV to JPL MMNAV

What: The state vectors generated on-board the spacecraft from the GPS receiver are downlinked in the S-band telemetry. They will be analyzed by the ISAS navigation team and the results will be made available to the JPL MMNAV team.

How: Files will be named `YYMMDD-isas-g.icv`, where YYMMDD is the start date in UTC of the contents of the file. The file format is TBD.

When: File will be made available TBD times per week, in general TBD days after the data is downloaded from the satellite.

Where: Files will be placed in /vsop/oddata/isasicv/gps on the VSOG FTP site.

7.2 State Vectors

- JPL MMNAV to ISAS NAV
- ISAS NAV to JPL MMNAV

What: The state vectors will be exchanged between navigation groups and are used in comparing the reconstructed orbits.

How: In files named `YYMMDD-isas-t.icv` and `YYMMDD-jpl-t.icv` respectively.

When: Files will be exchanged once per week.

Where: The ISAS files will be placed in /vsop/oddata/isasicv/track on the VSOG FTP site. // The JPL MMNAV files will be made available on the JPL MMNAV FTP site in directory [VSOP.ODDATA.JPLICV.TRACK] (note the capital letters).

7.3 Tracking Data

7.3.1 Ku-Band Doppler Data

- DSN GTS and GBTS to JPL MMNAV to ISAS NAV
- Usuda GTS to ISAS NAV to JPL MMNAV

What: Ku-band Doppler tracking data will be transmitted in near real-time from the DSN GTS to the JPL MMNAV team and from the Usuda GTS to the ISAS navigation team, and post-pass (via FTP) from the GBTS to the JPL MMNAV team.

How: Files will be named `YYMMDD-YYMMDD-xxxx-x.odf`, where the first YYMMDD is the start date in UTC of the contents of the file, and the second YYMMDD is the stop date in UTC of the contents of the file. Files named `YYMMDD-YYMMDD-isas-s.odf` will contain S-band range and range-rate data; `YYMMDD-YYMMDD-isas-k.odf` will contain Ku-band doppler data from the Usuda GTS; and `YYMMDD-YYMMDD-jpl-k.odf` will contain Ku-band doppler data from the DSN and GBTS GTSs. GBTS files will be named YYMMDDHHMM.dop, where the YYMMDDHHMM correspond to the date and time of the BGN2LK entry in the SRS file. Data transferred between the DSN GTSs and GBTS and JPL MMNAV conforms to the JPL/DSN 'TRK 2-30' format, whereas data transferred between ISAS and JPL MMNAV will be in (the compatible) 'TRK 2-18' format.

When: The GBTS doppler data will typically be available within 2 hours after a tracking pass, or by the next morning (local time).

Where: ISAS data will be placed in vsop/oddata/isasodf/kudop on the VSOG FTP site.
JPL MMNAV data will be placed on the JPL MMNAV FTP site in [VSOP.ODDATA.JPLODF.KUDOP] (note the capital letters) as shown in §10.1. GBTS files will be available via the GBTS FTP site in the directory /ovlbi/out.

7.3.2 S-Band Range and Range-Rate Data

- ISAS NAV to JPL MMNAV
- ISAS NAV to NASDA

What: S-band range-rate data will be sent from the JKSC to the ISAS navigation team in real-time during the telemetry down-link sessions. The range data will be made available to the JPL MMNAV team and range-rate (Doppler) data to NASDA (see §4.4).

How: In format TBD, filename extension `odf`.

When: File will be available TBD days after the telemetry has been received.

Where: Files will be placed in vsop/oddata/isasodf/sband on the VSOG FTP site.

7.4 Reconstructed Orbit

7.4.1 JPL MMNAV Reconstructed Orbit

- JPL MMNAV to VLBA and Canadian Correlators

What: The reconstructed orbits will be based on S- range and S- and Ku-band range-rate data. The VLBA and Canadian correlators will retrieve the reconstructed orbit from the JPL MMNAV team via the DOTS.

How: The JPL MMNAV team will supply files in SPICE SPK format named YYMMDD-YYMMDD-r.bsp[.v].gz where the first YYMMDD group is the start date and the second YYMMDD group is the stop date (UTC days). The '-r.bsp' indicates a reconstructed binary SPICE format. The '.gz' extension indicates the file is 'gzip'-ed.

When: Each orbit will cover a period of 7 days (to the end of that tracking pass, i.e. no tracking pass will be segmented), and will be made available within 2 weeks of the observation. New files will generally be made available once per week by the end of day Friday (PST).

Where: DSN orbits will be available in pub/vsop/oddata/rec on the DOTS FTP site.

7.4.2 ISAS Reconstructed Orbit

- ISAS NAV to VSOP Correlator

What: The reconstructed orbits will be based on S- and Ku-band range and range-rate data. The Mitaka correlator is expected to retrieve the reconstructed from the ISAS navigation team.

How: Orbits will be supplied in SCEF format, and provide the state vectors of the satellite every second. File extension is `scf`.

When: Each orbit will cover a period of TBD days (to the end of that observation where possible!), and be made available within 2 weeks of the observation.

Where: ISAS orbits will be available in vsop/oddata/scef on the VSOG FTP site.

7.5 Navigation Status Reports

- DSN and ISAS NAV to VSOG

What: A short summary of navigation activities will be written by the navigation groups. It will include a summary of the quality of the orbit processing and anomalies.

How: Suggested format as given in §5.8. Reports are named `YYMMDDxxxx.stn`, where YYMMDD is the first start date covering the period of the report and xxxx is either 'isas' or 'jpl'.

When: Normally the interval reported in a single file is the 1 week period matching the interval scheduled in the latest SRS file.

Where: E-mailed to vsog@vsop.isas.ac.jp, and/or placed on the Nav group's FTP site.

8 VSOG Post-Observation Products

8.1 Executed Sequence of Events

- VSOG to JPL MMNAV

What: If the actual executed sequence of events (XSOE) differs significantly from the predictions (i.e. maneuvers and slews) listed in the SRS (§3.2), an XSOE file summarizing the actual events of the spacecraft and will be generated for use as a diagnostic aid when deriving the reconstructed orbit file.

How: Files will be named `YYMMDD.xse` where YYMMDD is the UTC date of the first event in the file.

When: Files will be 1–2 days in length, and will be made available 1–2 days after the final event described in the file.

Where: File will be placed in vsop/vsopoper/data/srt/xsoe on the VSOG FTP site.

8.2 Merged Correlator Input Log

- VSOG to Correlators

What: The VSOG produces the 'merged' correlator input log file based on the Data Processing Logs (§5.5) supplied by the GTSs to produce a single correlator input log for all the GTSs for each observation. Spacecraft-specific information is added to the merged log file.

How: See documents "Specifications for Input Log to the Mitaka FX-Correlator", "Alternative log input to the VLBA correlator for space VLBI observations", and "SVLBI Space Radio Telescope Log Input to the Canadian (S2) Correlator". The file names will be `OBSlog.vs` for input to the VLBA correlator, `OBSslg.vs` for input to the Penticton correlator, and `OBSvlg.vs` for input to the VSOP correlator, where OBS is the observation code.

When: The VSOG will produce the file within within a week of the observation.

Where: Logs will be placed in vsop/vsopoper/data/srt/corrinputs/log/MMMYY on the VSOG FTP site, where MMMYY is the month and year in which the observation started.

8.3 Calibration and Flag files

- VSOG to Correlators and PI

What: The calibration and flag information from the GTSs and the satellite and combined to form a VLBA 'TSM' file. The components of the TSM file are described in the following sub-sections.

How: The file name will be `OBStsm.vs`, where OBS is the observation code. See "NRAO Array Operations Center Requirements on VSOP Calibration Data" for details of the TSM format.

When: The VSOG will produce the file within a week of the observation.

Where: Files will be placed in vsop/vsopoper/data/srt/corrinputs/calib on the VSOG FTP site. In the future the file may also be passed to the PI via the correlator output.

8.3.1 SRT Amplitude Calibration Data

What: The telemetry headers contain data necessary for the calibration of the SRT which are essential for the final analysis of the scientific data. The calibration data include on-board voltages (that will be used for system temperature calculations), spacecraft pointing angles, and boresighting results. The VSOG will generate the amplitude calibration section of the TSM from the telemetry headers.

How: The methods for producing the SRT amplitude calibration data are described in "VSOP Spacecraft Calibration".

8.3.2 Flag Table

What: GTSs will flag the data downlinked from the satellite according to criteria such as signal lock, signal strength etc. The VSOG will extract flag entries from the DPLs from each GTS and add related to spacecraft performance to generate a final flag table section within the TSM for use by the PI.

How: The flag dictionary is described in "Flag dictionary for space radio telescope log files".

8.3.3 Phase Calibration (PCal) Data

- VSOG to Correlators and PI

What: The GTSs will extract phase-calibration tones from the downlink data and provide the results to the VSOG in the DPL. The VSOG will combine the results from all GTSs and add the appropriate frequency information to form the PCal section of the TSM file.

8.4 VSOG Status Reports

- VSOG to Mission Elements

What: The VSOG will provide regular updates on the mission status to all mission elements.

How: The report will be compiled from reports to the VSOG from mission elements, as well as reports from the VSOG. Suggested format as given in §5.8. Files will be named `YYMMDD.svg`, where YYMMDD is the first start date covering the period of the report.

When: Reports will be issued weekly, though probably more often during the In-Orbit Checkout.

Where: The report will be emailed to Data Interface Team (DIT) members, and made available on the VSOP WWW site.

9 Correlator Products

9.1 Correlator Output

- Correlators to Principal Investigators

What: Once correlation is completed and the data quality assurance have been completed, data will be released to the PI(s) in the standard FITS format. Additional documentation from the correlator and VSOG will notify the PI of where additional files and assistance can be obtained.

How: FITS format on DAT or Exabyte tapes.

When: As soon as the correlator is satisfied with the correlator output.

9.2 Correlator Feedback

- Correlators to VSOG and mission elements

9.2.1 Quality Assurance Data

What: Each correlator will perform a series of checks on the correlator output. Sub-sets of the data may be made available for analysis. Any problems with a particular GTS or GRT will be reported to the VSOG and the affected mission element.

How: Format differs among correlators.

For the Canadian correlator, files are listed in §10.2.7. Requests by other mission elements for specific data not included in the DQA reports should be made be emailing vlbiop@drao.nrc.ca. These requests will be handled on a case-by-case basis.

When: As soon as correlation and checking is complete.

Where: For the Canadian correlator, files are listed in §10.2.7.

9.2.2 Correlator Output Files

What: The correlator will provide feedback to the mission elements in the form of correlator output files.

How: Format differs among correlators.

When: As soon as the correlator is satisfied with the correlation of the data.

Where: Files will be placed on the correlator's FTP site.

9.3 VLBI Tape Management

- Correlators to GTSs and GRTs

- Correlators to Correlators

What: Each correlator will maintain a data base including the status of all VLBI tapes under its control. The data base will be kept current by personnel at all mission elements, who have the responsibility to enter all changes in tape status (e.g. shipped or received) at their mission element.

How: For the VLBA, using the TRACK software. For S2 tapes, and email should be sent to vlbiop@drao.nrc.ca listing the site/station name, date, tape serial numbers/root tape-ids, shipment waybill number, destination.

When: When tapes are shipped or received.

Where: TRACK can be operated via its WWW interface at http://magnolia.nrao.edu/track/ – a password is necessary.

9.4 VLBI Tapes

- Correlators to GTSs
- Correlators to GRTs
- Correlators to Correlators

What: After correlation, the VLBI tapes will be erased and returned to the tape pool of that correlator. The correlators will distribute tapes to mission elements based on the Observation Summary File produced by the VSOG (§3.3) to ensure each element has enough tapes to support SVLBI observations. These tape shipments will be logged on the tape management databases (§9.3).

How: Tape labelling and shipping schemes are available by e-mail from vlbatape@nrao.edu for VLBA tapes and are given in "S2 SVHS Tape Handling Overview for VSOP" for S2 tapes. Shipping addresses for correlators are given in §10.6.

When: Tapes will be distributed to the global tape pool and sent out to mission elements at least once per week.

9.5 Near Real-Time Fringe Detector Results

- Usuda Near Real-Time Fringe Detector to VSOG
- Sagamihara Near Real-Time Fringe Detector to VSOG
- GBTS Near Real-Time Fringe Detector to VSOG

What: During the mission, it will be necessary to have periodic and quick checks of the SRT performance using the near real-time fringe detectors at Usuda, Sagamihara and Green Bank. These single baseline correlators will provide prompt checks of the satellite's health. Delays and delay rates will be made available, together with details of the orbit used, to correlators and navigation teams.

How: TBD

When: Results reported within TBD days of the observation.

Where: TBD

9.6 Correlator Status Reports

- Correlators to VSOG

What: Each correlator will inform the VSOG of the status of correlating the space VLBI experiments. These status reports will include the release date of data to PIs (which defines the proprietary period for the data), and note any anomalies detected or delays experienced during correlation.

How: Reports are named `YYMMDDxxxx.sco` where YYMMDD is the date of the report, and xxxx identifies the correlator. Suggested format as given in §5.8.

When: File will describe activities since the previous report, i.e. nominally activities for each Monday through Sunday UTC period.

Where: Emailed to vsog@vsop.isas.ac.jp, and/or placed on the correlator's FTP site.

10 Mission Operations Data Transfer

10.1 Mission Element FTP sites

The method for exchange of SVLBI data products will be via anonymous or restricted-access file transfer protocol (FTP) on designated computer sites. Table 2 lists the nodes involved in the data exchange process. Furthermore, an ISDN line between the JPL/DOTS and the VSOG is in place.

Table 2: Mission Element FTP Sites

Site	**Host Name**	**IP Address**	**Account**
VSOP (for AO etc)	ftp.vsop.isas.ac.jp	133.74.2.131	anonymous
VSOG	vsoper1.vsop.isas.ac.jp	133.74.17.21	anonymous
DOTS	dots.jpl.nasa.gov	137.78.8.207	anonymous
Green Bank	ftp.gb.nrao.edu	192.33.116.115	anonymous
ISAS Navigation	vsoper1.vsop.isas.ac.jp	133.74.17.21	anonymous
JPL MMNAV	oscar.jpl.nasa.gov	128.149.139.3	(*)
VSOP Correlator	hotaka.mtk.nao.ac.jp	133.40.121.232	vlbi (*)
VLBA Correlator	aspen.aoc.nrao.edu	146.88.5.8	vlbiobs (*)
S2 Correlator	ftp.drao.nrc.ca	192.139.21.39	anonymous
	or	192.139.21.65	
U. of Calgary	cougar.ras.ucalgary.ca	136.159.55.14	anonymous and (*)
EVN Regional Server	vlbeer.ira.bo.cnr.it	192.167.165.196	evn (*)
VLBA Regional Server	aspen.aoc.nrao.edu	146.88.5.8	vlbiobs (*)
Mitaka Regional Server	hotaka.mtk.nao.ac.jp	133.40.121.232	vlbi (*)
ATNF Regional Server	ftp.atnf.csiro.au	130.155.194.32	anonymous
DSN 70m Regional Server	dsn.jpl.nasa.gov	137.79.62.111	anonymous
Arecibo server	ftp.naic.edu	192.65.176.4	anonymous

(*) indicates that a password is needed to gain access to these accounts. These may be obtained on request. Passwords should not be exchanged by electronic means.

10.2 Mission Element FTP Directory Structures

10.2.1 VSOG FTP Directory Structure

See "ISAS server operation plan" and the table on the next page.

Root/	**Sub/**	**Sub/**	**Sub/**	**Sub/**	**Sub/**	**Ext**
vsop/	vsopoper/	status/	vsog/			(svg)
			sat/			(ssa)
			corr/			(sco)
			grt/			(srt)
			gts/			(stX)
		schedule/	longsched/			(gst)
			grtsched/	drg/	mmmyy/	(drg, sum)
				evn/	mmmyy/	(skd, sum)
				japan/	mmmyy/	(drg, skd)
				s2/	mmmyy/	(skd, sum)
				vlba/	mmmyy/	(crd, sum)
				summary/		(sum)
			srtsched/			(srs)
		data/	srt/	udsc/	kutlm/	(ktu)
					delta_t/	(kcu)
					corrlog/	(klu, kls)
					perflog/	(kpu)
				gb/	kutlm/	(ktg)
					kutlm2/	(ktg)
					delta_t/	(kcg)
					corrlog/	(klg, ksg)
					perflog/	(kpg)
				dsn/	kutlm/	(ktd,ktm,ktt)
					delta_t/	(kcd,kcm,kct)
					corrlog/	(kld,klm,klt)
						(ksd,ksm,kst)
					perflog/	(kpd,kpm,kpt)
					mondata/	(kmd,kmm,kmt)
					phred/	(krd,krm,krt)
				xsoe/		(xse)
				corrinputs/	log/mmmyy/	(log.vs, slg.vs,
						(vlg.vs, log.Xz)
						(vlg.Xz, slg.Xz)
					delta_t/	(kcg,kcd,kcm,
						kct,kcu)
					calib/	(tsm.vs)
			grt/(TBD)	corrinputs/	log/	(log.XX)
					clock/	(gps.XX),
					antab/	(agt.XX)
					pclod/	(pct.XX)
					uvflg/	(flg.XX)
	oddata/	predict/	short/			(opr)
			mid/			(opr)
			long/			(opr)
			nasda/			(onp)
		scef/				(scf)
		isasodf/	sband/			(odf)
			kudop/			(odf)
		jplodf/	kudop/			(odf)
		isasicv/	track/			(icv)
			gps/			(icv)
		jplicv/	track/			(icv)

10.2.2 GBTS FTP Directory Structure

Table 3: GBTS FTP Structure

Dir	**Sub/**	**Sub/**	**File**	**Ext**
ovlbi/	in/		SRT Schedule	srs
			Orbit prediction	bsp
ovlbi/	out/		Time Corrections File	kcg
			Time Components file	tcg
			Data processing log	kdg
			Performance Log	kpg
			Weekly status file	stg
			Telemetry headers files (THF)	ktg
ovlbi/	out/	kutlm2/	15-minute THFs	ktg

10.2.3 DOTS FTP Directory Structure

Table 4: DOTS FTP Structure

Dir/Sub	**Sub/**	**Sub/**	**Sub/**	**Sub/**	**Sub/**	**File**	**Ext**
pub/vsop/	vsopoper/	data/	srt/	dsn/	delta_t/	Time Corrections File	kcX
						Time Components File	tcX
					dplog/	VLBA Data Processing Log	klX
						S2 Data Processing Log	ksX
					kutlm/	Telemetry Header File	ktX
					kutlm2/	10-minute THFs	ktX
					mondata/	Monitor Data File	kmX
					perflog/	Station Performance Log	kpX
		schedule/	srtsched/			SRS Files	srt
		status/	gts/			DSN GTS Status Reports	stX
			nav/			JPL MMNAV Status Reports	TBD
	oddata/	pred/				Predicted Orbit	bsp
		rec/				Reconstructed Orbit	bsp

Note: 'X' is the DSN GTS identifier where d = Goldstone, m = Madrid, t = Tidbinbilla.

Files are stored in this directory structure for 33 days then moved to a similar directory structure under pub/archive where files are archived on a month by month basis.

10.2.4 Mitaka Correlator FTP Directory Structure

The Mitaka correlator FTP site is hotaka.mtk.nao.ac.jp (133.40.121.232). Files are placed in subdirectories according to month and year ("mmmyy") of the observation.

10.2.5 NRAO Array Operations Center FTP Directory Structure

Most of the VSOP data files at the Array Operations Center (AOC) in Socorro are for internal use, rather than being served for other mission elements. The files to be used in preparation for observing by the VLBA and VLA telescopes, and the calibration files generated by these telescopes, use the same computer, directory structure, and naming convention as for ground VLBI experiments, and appear in password-protected accounts. This greatly simplifies operations at the AOC. Files that are specific to the VSOP mission are archived on aspen5 and can be accessed via the same password protected vlbiobs account as used for ground telescope observing files. Since the AOC is not responsible for serving most files to other mission elements, it is not guaranteed that the collections of files such as SRT schedule files will be complete or will contain the latest file version.

Most subdirectories are broken down according to month and year ("mmmyy") as is the standard practice at the AOC. Files containing data for multiple months will be placed in the subdirectory corresponding to the first data in the file.

From 1 April 1998 the VLBA FTP directory structure changed from the former structure /home/aspen2/vlbiobs/mmmyy to /home/aspen6/astronomy/mmmyy/pppppp, where 'mmmyy' is a code for the month and year (UTC) of the beginning of the project and 'pppppp' is the project code. This change has been been retrospectively to files from the beginning of January 1998: files before this time are in the old directory structure.

Table 5: AOC Directory Structure for Local Ground Telescope Files

Dir/Sub	**Sub/**	**Sub/**	**File**	**Name**
/magnolia2/vlbacorr/	vlbaclocks/	mmmyy/	Clock (GPS) Files	gps.XX
Until 31Dec1997				
/aspen2/vlbiobs/		mmmyy/	VLBA & VLA Schedule Input	OBS.key
			VLBA & VLA Card Files	OBScrd.XX
			VLBA & VLA Sched Files	OBSsched.XX
			VLBA Summary File	OBS.sum
			VLBA Calibration File	OBScal.vlba.Z
			VLA Calibration File	OBScal.y.Z
From 1Jan1998				
/aspen6/vlbiobs/	astronomy/	mmmyy/pppppp/	VLBA & VLA Schedule Input	OBS.key
			VLBA & VLA Card Files	OBScrd.XX
			VLBA & VLA Sched Files	OBSsched.XX
			VLBA Summary File	OBS.sum
			VLBA Calibration File	OBScal.vlba.Z
			VLA Calibration File	OBScal.y.Z
		mmmyy/pppppp/jobs	correlator job scripts	
		mmmyy/pppppp/sniffer	quality control results	

Table 6: AOC Directory Structure for VSOP-Specific Files

Dir/Sub	**Sub/**	**File**	**Name**
/home/aspen5/pub/vsog/yymmm/	srtsch/	SRT Schedule File	YYMMDD.srs
		Observation Summary File	YYMMDD.osf
	srtlog/	SRT log from VSOG	OBSlog.vs
		SRT log from Tracking Station	OBSlog.klX
	srttcf/	Time Correction File	YYMMDDHHMM.kcX
		DSN Performance Summary	summary
		Time Component File	YYMMDDHHMM.tcX
	grtlog/	GRT Log File	OBSlog.XX
	grtcal/	GRT Calibration File	OBScal.XX
	odrec/	Reconstructed Orbits	YYMMDD-YYMMDD-rs.bsp
	odpre/	Predicted Orbits	YYMMDD-YYMMDD-p.bsp
	odtsv/	Tracking Station View Periods	YYMMDD-YYMMDD-vp.ps

10.2.6 Penticton Correlator FTP Directory Structure

The Penticton Correlator FTP site is ftp.drao.nrc.ca. The anonymous FTP main directory is /pub/vsop. Operations observation/experiment status summary (postscript file) will be stored in /pub/vsop/CVOC_status.ps

10.2.7 University of Calgary FTP Directory Structure

The University of Calgary FTP site is cougar.ras.ucalgary.ca . The directory structure is given in Table 7 Files in the pub/ directories are publicly available data: files in the usr/ directories are restricted access data. Account and password details for the latter are available from Bill Scott (bill@ras.ucalgary.ca).

10.2.8 Center for Research in Earth and Space Technology (CREST)

(CREST was formerly the Institute for Space and Terrestrial Science [ISTS].)

The CREST anonymous FTP site is s2.sgl.crestech.ca. The anonymous FTP main directory is /pub/s2/. The S2 software download directory is /pub/s2/swload/. The documentation directory is /pub/s2/doc/.

10.2.9 Regional Servers for GRT Schedules

The regional servers for GRT schedules are shown, together with the 'two-letter' codes for the telescopes/arrays in Table 8. IP addresses for these FTP sites are given in Table 2 The sub-directory containing the logs on most servers is of the form mmmyy, where mmmyy is the

Table 7: University of Calgary FTP Structure

Dir/Sub/	Sub/	Sub/	Sub/	Description
pub/vsop/				Main directory
	OBS/	calib/		ASCII calibration data
		OBS_DQA1.txt		Level 1 DQA report
		OBS_DQA2.txt		Level 2 DQA report
usr/home/	vsopobs/vsop/			Main directory
		OBS/	OBS_DQA1.ps	Level 1 DQA report (.ps)
			OBS_DQA1.txt	Level 1 DQA report (text)
			OBS_DQA2.ps	Level 2 DQA report (.ps)
			OBS_DQA2.txt	Level 2 DQA report (text)

Note: OBS is the observation code for the particular observation.

month and year of the start date (UTC) of the observation, e.g. sep97. The NRAO AOC site introduced the pppppp (observation code) sub-directory structure in 1998: see section 10.2.5 for more details.

10.2.10 Regional Servers for GRT logs etc

The regional servers for GRT logs are shown in Table 8. Many are the same as the server for schedule files, but there are some differences in both the server used and/or the subdirectory used. IP addresses for these FTP sites are given in Table 2 The sub-directory containing the logs on most servers is of the form mmmyy, where mmmyy is the month and year of the start date (UTC) of the observation, e.g. sep97. The NRAO AOC site introduced the pppppp (observation code) sub-directory structure in 1998: see section 10.2.5 for more details.

10.3 File Naming Conventions

Filename conventions are described in the earlier sections this document. Further details are available from e.g. "ISAS server operation plan". Many filenames include a version letter, designated by [.v] in the filename. The is no version number for the first version of a file (i.e. the version number is blank). The first revision takes '.a', and subsequent revisions take the corresponding letter of the alphabet.

Filenames should always be in lower case. Experiment names should not have leading zeroes suppressed or removed, e.g. experiment code v001 should not be shortened to v1.

10.4 On-Line Storage Requirement

Individual mission elements are responsible for archiving their original and processed data products. The length of time for these items to remain on-line is TBD.

Table 8: GRTs and their Regional Server for schedule files.

Element	Code	Server for schedule schedule files	Subdirectory
Arecibo	AR	aspen.aoc.nrao.edu	astronomy/mmmyy/pppppp
ATCA (Narrabri)	AT	ftp.atnf.csiro.au	/pub/people/vlbi/vsop/schedules/mmmyy
Bear Lakes	BL	vlbeer.ira.bo.cnr.it	vlbi_arch/mmmyy
Ceduna	CD	ftp.atnf.csiro.au	/pub/people/vlbi/vsop/schedules/mmmyy
Effelsberg	EB	vlbeer.ira.bo.cnr.it	vlbi_arch/mmmyy
Goldstone	GO	aspen.aoc.nrao.edu	astronomy/mmmyy/pppppp
Green Bank	GB	aspen.aoc.nrao.edu	astronomy/mmmyy/pppppp
Hartebeesthoek	HH	ftp.atnf.csiro.au	/pub/people/vlbi/vsop/schedules/mmmyy
Hobart	HO	ftp.atnf.csiro.au	/pub/people/vlbi/vsop/schedules/mmmyy
Jodrell Bank	JB	vlbeer.ira.bo.cnr.it	vlbi_arch/mmmyy
Kyazin	KL	vlbeer.ira.bo.cnr.it	vlbi_arch/mmmyy
Kashima	KA	hotaka.mtk.nao.ac.jp	mmmyy
Madrid	RO	aspen.aoc.nrao.edu	astronomy/mmmyy/pppppp
Medicina	MC	vlbeer.ira.bo.cnr.it	vlbi_arch/mmmyy
Metsahovi	MH	vlbeer.ira.bo.cnr.it	vlbi_arch/mmmyy
Mopra	MO	ftp.atnf.csiro.au	/pub/people/vlbi/vsop/schedules/mmmyy
Nobeyama	NO	hotaka.mtk.nao.ac.jp	mmmyy
Noto	NT	vlbeer.ira.bo.cnr.it	vlbi_arch/mmmyy
Onsala	ON	vlbeer.ira.bo.cnr.it	vlbi_arch/mmmyy
Shanghai	SH	vlbeer.ira.bo.cnr.it	vlbi_arch/mmmyy
Tidbinbilla	TI	aspen.aoc.nrao.edu	astronomy/mmmyy/pppppp
Torun	TR	vlbeer.ira.bo.cnr.it	vlbi_arch/mmmyy
Urumqi	UR	vlbeer.ira.bo.cnr.it	vlbi_arch/mmmyy
Usuda	UD	hotaka.mtk.nao.ac.jp	mmmyy
VLA-27	Y	aspen.aoc.nrao.edu	astronomy/mmmyy/pppppp
VLBA	VLBA	aspen.aoc.nrao.edu	astronomy/mmmyy/pppppp
WSRT	WB	vlbeer.ira.bo.cnr.it	vlbi_arch/mmmyy

Table 9: GRTs and their Regional Server for log files, and clock data.

Element	Code	Server for schedule log files	Subdirectory
Arecibo	AR	ftp.naic.edu	/pub/ast/vlbi/
ATCA (Narrabri)	AT	ftp.atnf.csiro.au	/pub/people/vlbi/vsop/logs/mmmyy
Bear Lakes	BL	vlbeer.ira.bo.cnr.it	vlbi_arch/mmmyy
Ceduna	CD	ftp.atnf.csiro.au	/pub/people/vlbi/vsop/logs/mmmyy
Effelsberg	EB	vlbeer.ira.bo.cnr.it	vlbi_arch/mmmyy
Goldstone	GO	dsn.jpl.nasa.gov	/pub/vlbiscpr/mmmyy
Green Bank	GB	aspen.aoc.nrao.edu	astronomy/mmmyy/pppppp
Hartebeesthoek	HH	ftp.atnf.csiro.au	/pub/people/vlbi/vsop/logs/mmmyy
Hobart	HO	ftp.atnf.csiro.au	/pub/people/vlbi/vsop/logs/mmmyy
Jodrell Bank	JB	vlbeer.ira.bo.cnr.it	vlbi_arch/mmmyy
Kashima	KA	hotaka.mtk.nao.ac.jp	vlbi_arch/mmmyy
Kalyazin	KL	vlbeer.ira.bo.cnr.it	vlbi_arch/mmmyy
Madrid	RO	dsn.jpl.nasa.gov	/pub/vlbiscpr/mmmyy
Medicina	MC	vlbeer.ira.bo.cnr.it	vlbi_arch/mmmyy
Metsahovi	MH	vlbeer.ira.bo.cnr.it	vlbi_arch/mmmyy
Mopra	MO	ftp.atnf.csiro.au	/pub/people/vlbi/vsop/logs/mmmyy
Nobeyama	NO	hotaka.mtk.nao.ac.jp	vlbi_arch/mmmyy
Noto	NT	vlbeer.ira.bo.cnr.it	vlbi_arch/mmmyy
Onsala	ON	vlbeer.ira.bo.cnr.it	vlbi_arch/mmmyy
Shanghai	SH	vlbeer.ira.bo.cnr.it	vlbi_arch/mmmyy
Tidbinbilla	TI	dsn.jpl.nasa.gov	/pub/vlbiscpr/mmmyy
Torun	TR	vlbeer.ira.bo.cnr.it	vlbi_arch/mmmyy
Urumqi	UR	vlbeer.ira.bo.cnr.it	vlbi_arch/mmmyy
Usuda	UD	hotaka.mtk.nao.ac.jp	vlbi_arch/mmmyy
VLA-27	Y	aspen.aoc.nrao.edu	astronomy/mmmyy/pppppp
VLBA	VLBA	aspen.aoc.nrao.edu	astronomy/mmmyy/pppppp
WSRT	WB	vlbeer.ira.bo.cnr.it	vlbi_arch/mmmyy

10.5 Contingency Plans

Any change from the routine operations described in the preceding sections will entail notification to mission elements at short notice. Mission element contact details are given in §10.6. Each mission element should ensure that their contact information remains current and notify the VSOG of any changes.

The most likely contingency will be a change in the satellite observing schedule, which could arise if there is a time-critical Target of Opportunity observation, a correction to the existing schedule, etc. For simplicity, notification of the mission elements by the VSOG will be made via an e-mail distribution list – dit@vsop.isas.ac.jp – which contains multiple direct points of contact for the VSOG, tracking stations, orbit determination centers, correlators, and GRT arrays. GRTs will be notified individually or collectively as necessary to inform them of the location and name of new schedule files, or of the cancellation of observations as appropriate.

Non-VSOG mission elements will also use the "dit" list to notify the VSOG (and all other mission elements) of unexpected events that may impact operations elsewhere, e.g., if a tracking station discovers that the spacecraft is in an unexpected configuration. Such notification by non-VSOG mission elements should be considered "information-only" communications that do NOT imply specific unscheduled action by other non-VSOG mission elements. When and if possible (see next paragraph), the VSOG will respond with clarification of future expectations, recommendations, or directives.

In the special case of unexpected spacecraft problems (e.g., unexplained loss of downlink signal at a tracking station), rapid notification of appropriate spacecraft operations personnel in the VSOG is possible via a pager system that is activated by email sent to vsopsos@vsop.isas.ac.jp. To alert other mission elements to the possibility of forthcoming recommendations from the VSOG, any email sent to this address will be forwarded to the "dit" distribution. However, it will usually be necessary to wait for a Kagoshima Space Center operations tracking pass to better determine the satellite's status (see the VSOP WWW site http://www.vsop.isas.ac.jp/ops/Operations.html for the KSC schedule). For this reason, observations should continue at all mission elements until the VSOG determines the utility of continuing and, if necessary, explicitly cancels observations.

In general, two-way communications on timescales shorter than 24 hours is most desirable between the VSOG and the tracking stations for clarification of real-time spacecraft status and information. However, the many complexities of scheduling space VLBI observations imply that meaningful changes to the observing schedule on this timescale or shorter are extremely difficult and failure-prone, except perhaps for explicit cancellations, and are therefore very unlikely. Thus, receipt and acknowledgement of such communications will be undertaken on a locally-determined best-efforts basis, especially at mission elements not directly involved spacecraft operations. Any mission element with special requirements in this regard should make them clear to the entire mission.

Since the pager system is monitored principally by spacecraft operations personnel, communications via vsopsos@vsop.isas.ac.jp which concern non-spacecraft emergencies are discouraged (especially Monday–Saturday in Japan) unless a response is absolutely required within a few hours. Use of dit@vsop.isas.ac.jp as described below should be sufficient in most if not all such cases, with a reply from a VSOG representative usually available within 24 hours.

Since the "dit" list is also used for routine communication among the mission elements, information that is, as determined by the originator, especially time-critical in nature should be so indicated with "** VSOP SOS **" in the Subject line of the message. In the body of the message, the sender should indicate their name, the date, and the mission element they represent, and concisely describe the nature of the contingency. If acknowledgement from other mission elements is required or desired this should be explicitly requested. To avoid confusion, "** VSOP SOS **" messages (and all replies to them) should be carefully considered before sent. Only explicit directives from the VSOG should be considered authoritative instructions to alter operations (except for local determinations of safety, etc.).

10.6 Mission Element WWW sites

Mission Element	WWW Site
VSOG	http://www.vsop.isas.ac.jp/
Green Bank TS	http://www.gb.nrao.edu/ovlbi/
Mitaka correlator	http://hotaka.mtk.nao.ac.jp/index-e.html
Penticton correlator	http://www.drao.nrc.ca/web/vlbi/spacevlbi.html
U. of Calgary	http://www.ras.ucalgary.ca/Spacevlbi.html
NRAO Space VLBI	http://www.nrao.edu/ julvesta/aoc_svlbi.html
JPL/DOTS	http://sgra.jpl.nasa.gov/
ATNF	http://wwwatnf.atnf.csiro.au/
JIVE	http://www.nfra.nl/jive

11 Mission Element Points-of-Contact

```
_____________________________________The VSOG______________________________________

VSOG    vsog@vsop.isas.ac.jp                                          UT+9 hours
        Yas Murata                       murata@vsop.isas.ac.jp
        Emergency messages               vsopsos@vsop.isas.ac.jp
        Murata/Kobayashi/Okayasu Office:
          Ph : +81-42-759-8342 (direct)  Fax: +81-42-759-8340
        VSOP Operations Room, ISAS
          Ph : +81-42-759-8399 (direct)  Fax: +81-42-769-8949
        ISAS, 3--1--1 Yoshinodai, Sagamihara, Kanagawa 229-8510, Japan

The DIT (Data Interface Team)            dit@vsop.isas.ac.jp

________________________________Ground Tracking Stations____________________________

Usuda                                                                 UT+9 hours
         Nori Kawaguchi                  kawagu@vsop.isas.ac.jp
         Ph: +81-267-81-1230             Fax: +81-267-81-1234
         Usuda Deep Space Center, ISAS, Usuda, Minamisaku, Nagano, 384-0306, Japan

JPL/DOTS                                                            UT-8 hours *
         support@dots.jpl.nasa.gov       Fax: +1-818-393-0042
         Emergency messages              sos@dots.jpl.nasa.gov
         Kevin Miller                    Ph: +1-818-393-0565
         Rick Wietfeldt                  Ph: +1-818-393-1134
         U.S. Space VLBI Project, JPL, 4800 Oak Grove Drive, M/S 264-664,
         Pasadena, CA 91109, USA

Green Bank Tracking Station                                         UT-5 hours *
         OVLBI operator                  ovlbiops@nrao.edu
         Glen Langston                   glangsto@nrao.edu
         Larry D'Addario                 ldaddari@nrao.edu
         Toney Minter                    tminter@nrao.edu
         Ph: +1-304-456-2219/2315        Fax: +1-304-456-2200
         NRAO, Route 92, P.O. Box 2, Green Bank, WV  24944

                                          *    Add 1 hour between  April and October
                                          **   Add 1 hour between  October and April
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-------------------------------------Correlators------------------------------------

Mitaka Correlator                                                      UT+9 hours
       K. Shibata                           shibata@hotaka.mtk.nao.ac.jp
       S. Kameno                            kameno@hotaka.mtk.nao.ac.jp
       Ph: +81-422-34-3610                  Fax: +81-422-34-3869
       VSOP correlator, National Astronomical Observatory,
       Ohsawa 2--21--1, Mitaka, Tokyo 181-8588, Japan

Penticton Correlator                                                 UT-8 hours *
       Sean Dougherty                       sean.dougherty@hia.nrc.ca
       Brent Carlson                        Brent.Carlson@hia.nrc.ca
       Ph: +1-250-493-2277                  Fax: +1-250-493-7767
           Attn: Space VLBI, Dominion Radio Astrophysical Observatory,
           Hertzberg Inst. of Astrophysics, NRC of Canada,
           White Lake Rd (P.O. Box 248), Penticton, B.C., Canada V2A 6K3
       Operations email address (for tape shipment notification etc):
           vlbiop@drao.nrc.ca
       Radio Astronomy Laboratory (RAL) at Univ. of Calgary          UT-6 hours *
           Level 2 DQA [Data Quality Analysis]
       Bill Scott                           bill@ras.ucalgary.ca
       Russell Taylor                       russ@ras.ucalgary.ca
       Ph: +1-403-220-7424                  Fax: +1-403-289-3331
           Attn: Bill Scott/Russ Taylor, Physics and Astronomy Department,
           University of Calgary, 2500 University Dr. NW, Calgary,
           Alberta, Canada T2N 1N4

Socorro Correlator                                                   UT-7 hours *
       Fax: +1-505-835-7027
       Mailing address for all except tapes:
            NRAO, P.O. Box O, 1003 Lopezville Rd., Socorro, NM 87801 USA
       Preliminary data quality analysis
            Data Analysts         analysts@nrao.edu      Ph: +1-505-835-7238
       Correlator operators       vlbacorr@nrao.edu      Ph: +1-505-735-7252
       Correlator management
            Jon Romney            jromney@nrao.edu       Ph: +1-505-835-7360
       General user support
            Mark Claussen         mclausse@nrao.edu      Ph: +1-505-835-7284
            Jim Ulvestad          julvesta@nrao.edu      Ph: +1-505-835-7298
       AIPS support/Designated AIP   http://www.cv.nrao.edu/aips/d_aip.html
```

```
Socorro Correlator  (cont'd)                                             UT-7 hours *
       Tape librarian
            Robyn Harrison       vlbatape@nrao.edu      Ph: +1-505-835-7254
       Tape shipping address:
            Associated Universities Inc., National Radio Astronomy Observatory,
            Socorro Correlator, 1003 Lopezville Road, Socorro, NM 87801 USA

JIVE Correlator                                                          UT+1 hour *
       Huib van Langevelde              huib@jive.nfra.nl
       Ph: +31-521-596500               Fax: +31-521-597332
            JIVE, Postbus 2, 7991 PD Dwingeloo, The Netherlands

MIT Near real-time correlator                                            UT-5 hours *
       Max Avruch         avruch@halca.vsop.isas.ac.jp   Ph: +81-42-759-8346
       Toney Minter       tminter@nrao.edu               Ph: +1-304-456-2275

_____________________________________Navigation Teams_______________________________

ISAS                                                                     UT+9 hours
       Ben Ichikawa                     ben@newslan.isas.ac.jp
       Ph: +81-42-759-8357              Fax: +81-42-759-8458
          ISAS, 3--1--1 Yoshinodai, Sagamihara, Kanagawa 229-8510, Japan

JPL                                                                      UT-5 hours *
       Jordan Ellis                     Jordan.Ellis@Jpl.Nasa.Gov
       Ph:  +1-818-354-2788             Fax: +1-818-393-6558
          Jet Propulsion Laboratory, 4800 Oak Grove Drive, M/S 301-125J,
          Pasadena, CA 91109, USA


                                          *    Add 1 hour between  April and October
                                          **   Add 1 hour between  October and April
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__________________________________Ground Radio Telescopes___________________________

Arecibo                                                                UT-5 hours *
     Tapasi Ghosh                          tghosh@naic.edu
     Chris Salter                          csalter@naic.edu
     Ph: +1-787-878-2612                   Fax: +1-787-878-1861
       Arecibo Observatory, Barrio Esperanza,
       Route 625, Arecibo, Puerto Rico PR 00612, U.S.A.

ATCA (Narrabri), Mopra, Parkes                                        UT+10 hours **
     John Reynolds                         jreynold@atnf.csiro.au
     Ph: +61-2-9372-4165                   Fax: +61-2-9372-4310
     ATCA:    Ph: +61-67-90-4033           Fax: +61-67-90-4090
     Mopra:   Ph: +61-68-49-1800           Fax: +61-68-49-1888
     Parkes:  Ph: +61-68-61-1750           Fax: +61-68-61-1753
       ATNF/CSIRO, Cnr Vimiera Rd/Pembroke St, Marsfield, NSW 2122, Australia

Bear Lakes                                                             UT+2 hours *
     Misha Popov                           mpopov@dpc.asc.rssi.ru


Ceduna............. see Hobart                                       UT+9.5 hours **

DSN 70m: Goldstone, Madrid, Tidbinbilla                                UT-8 hours *
     Valery Altunin                        via@vlbira.jpl.nasa.gov
     Ph: +1-818-354-3358                   Fax: +1-818-354-6290
     Chuck Naudet                          Charles.J.Naudet@jpl.nasa.gov
     Pamela Wolken                         Pamela.R.Wolken@jpl.nasa.gov
     John LuValle                          John.V.Luvalle@jpl.nasa.gov

Effelsberg                                                              UT+1 hour *
     Reinhard Schulze                      schulze@mpifr-bonn.mpg.de
                                           evlbi@mpifr-bonn.mpg.de
     Ph: +49-2257-30115                    Fax: +49-2257-30189
         Max-Planck-Institut f\"ur Radioastronomie,
         Radio-Observatorium Effelsberg, D-53902 Bad M\"unstereifel, Germany

Evpatoria                                                              UT+2 hours *
     Misha Popov                           mpopov@dpc.asc.rssi.ru


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                                           **  Add 1 hour between  October and April
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Goldstone.................... see DSN UT-8 hours *
Goldstone Deep Space Communications Complex
AlliedSignal Technical Services 850 E. Main, Barstow, CA 92311, USA
DELIVER TO: DSS16 BLDG. G-201. ATTN: GDSCC Operations Supervisor

Green Bank UT-5 hours *
140' Telescope operator 140op@nrao.edu
Ph: +1-304-456-2345 Fax: +1-304-456-2200
NRAO, Route 28/92, Green Bank, WV 24944-0002, USA

Hartebeesthoek UT+1 hour **
Jonathan Quick vlbifriend@bootes.hartrao.ac.za
Ph: +27-11-6424692 Fax: +27-11-6422424
Hartebeesthoek Radio Astronomy Observatory
P.O. Box 443, Krugersdorp 1740, South Africa

Hobart, Ceduna UT+10 hours **
Marco Costa marco.costa@utas.edu.au
vlbi@phys.utas.edu.au
Peter McCulloch peter.mcculloch@utas.edu.au
Hobart: Ph: +61-3-624-85285 Fax: +61-3-62262410
Ceduna: Ph: +61-86-252-217 Fax: +61-86-252-704
Physics Dept, University of Tasmania, Hobart, 7000 Australia

Jodrell Bank UT+0 hours *
Alastair Gunn agg@jb.man.ac.uk
vlbi@jb.man.ac.uk
Ph: +44-1477-571-321 Fax: +44-1477-571-618
NRAL Jodrell Bank, Macclesfield, Cheshire SK11 9DL, United Kingdom

Kalyazin UT+2 hours *
Slava Slysh vslysh@dpc.asc.rssi.ru

Kashima UT+9 hours
For scheduling: H. Kobayashi hkobaya@vsop.isas.ac.jp
For operations: J. Nakajima nakaji@crl.go.jp
Ph: +81-299-84-7145 Fax: +81-299-84-7140
Kashima Space Research Center, Communications Research Laboratory,
893--1, Hirai, Kashima-machi, Kashima-gun, Ibaraki 314, Japan

* Add 1 hour between April and October
** Add 1 hour between October and April

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Madrid........... see DSN                                          UT+1 hour *
         Madrid Tracking and Data Acquisition Station (NASA-INTA)
         Calle Orense, 4-9th Floor, 28020 Madrid, SPAIN
         M/F: Logistic Supervisor/MDSCC, +34-1-867-7022

Medicina                                                           UT+1 hour *
     Tiziana Venturi                  tventuri@ira.bo.cnr.it
     Ph: +39-51-639-9385              Fax: +39-51-696-9431
           Stazione Radioastronomica di Medicina, Via Fiorentina,
           40059 Medicina, Bologna, ITALY
           Attn: Giuseppe Maccaferri, +39-51-6965831

Metsahovi                                                          UT+1 hour *
     Kaj Wiik                         vlbi@hut.fi,  kaj.wiik@hut.fi
     Kirsi Karlamaa                   kirsu@kurp.hut.fi
     Ph: +358-9-264419                Fax: +358-9-264531
           TKK/Metsaehovi Radio Research Station, Metsaehovintie 114,
           Fin-02540 Kylmala, Finland

Mopra................ see ATCA                                    UT+10 hours **

Nobeyama                                                            UT+9 hours
       Seiji Kameno                   kameno@nro.nao.ac.jp
       Ph: +81-422-34-3603 (Mitaka)   Fax: +81-422-34-3869 (Mitaka)
       Nobeyama Radio Observatory, Nobeyama, Minami-saku, Minami-maki,
       Nagano 384-13, Japan

Noto                                                               UT+1 hour *
       Corrado Trigilio               trigilio@ira.noto.cnr.it
       Ph: +39-931-835622             Fax: +39-931-573265
          Istituto di Radioastronomia  C.N.R., Contrada Renna Bassa,
          Localita Case di Mezzo, I-96017 Noto (SR), Italy

Onsala                                                             UT+1 hour *
       John Conway                    jconway@oso.chalmers.se
                                      vlbi@oso.chalmers.se
       Antonis Polatidis              apolatid@oso.chalmers.se
       Ph: +46-31-772-5550            Fax: +46-31-772-5590
          Onsala Space Observatory,
          Chalmers University of Technology, S-43992 Onsala, Sweden

                                      *   Add 1 hour between  April and October
                                      **  Add 1 hour between  October and April
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Shanghai UT+8 hours *

Qian Zhihan qzh@center.shao.ac.cn
Huang Xin-yong xhuang@shao.ac.cn
Ph: +86-21-57651763 Fax: +86-21-64384618
Mr Xue Zhuhe, Shanghai Observatory, Chinese Academy of Science
80 Nandan Road, Shanghai 200030, China

Tidbinbilla...........see DSN UT+10 hours **

Tidbinbilla Deep Space Communication Complex
Paddy's River Road, Tidbinbilla, via Tharwa, ACT 2620, AUSTRALIA

Torun UT+1 hour *

Kazimierz Borkowski kb@astro.uni.torun.pl
vlbi@astro.uni.torun.pl
Roman Feiler rf@astro.uni.torun.pl
Ph: +48-56-511651 Fax: +48-56-511651
Torun Radio Astronomy Observatory, Nicolaus Copernicus University,
PL 87-100, Torun, Gagarina 11, Poland

Urumqi UT+8 hours *

Li Suqin uao@public.wl.xj.cn
Ph: +86-991-3835750 Fax: +86-991-3838628
Urumqi Astronomical Observatory, Chinese Academy of Sciences,
40 sub 5 Beijing South Road, Urumqi, Xingjiang, 830011 P.R. of China

Usuda UT+9 hours

Kenta Fujisawa kenta@vsop.isas.ac.jp
Takeshi Miyaji miyaji@nro.nao.ac.jp
Ph: +81-267-81-1230 Fax: +81-267-81-1234
Usuda Deep Space Center, ISAS, Usuda, Minamisaku, Nagano 384-0306, Japan

* Add 1 hour between April and October
** Add 1 hour between October and April

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VLA and VLBA Operations                                          UT-7 hours *
       Experiment Schedules
          Data Analysts                  analysts@nrao.edu
          Ph: +1-505-835-7238            Fax: +1-505-835-7027
       Telescope Operator/Overall Operations
          VLBA Telescope Operator        vlbaops@nrao.edu
          Ph: +1-505-835-7250            Fax: +1-505-835-7027
          NRAO, P.O. Box O, 1003, Lopezville Road, Socorro, NM 87801 USA

Westerbork                                                        UT+1 hour *
       Tony Foley                        foley@nfra.nl
       Ph: +31-521-595230 (Dwingeloo)    Ph: +31-593-592421 (Westerbork)
       Fax: +31-521-597332
       Radiosterrenwacht Westerbork, Schattenberg 1, NL 9433 TA Zwiggelte,
       THE NETHERLANDS


-----------------------------------------Other-------------------------------------

CREST (formerly ISTS)                                            UT-4 hours *
       S2 Support                        s2support@sgl.crestech.ca
       Wayne Cannon                      wayne@sgl.crestech.ca
       Ph: +1-416-665-5470               Fax: +1-416-665-1815
          Center for Research in Earth and Space Technology,
            (formerly the Institute for Space and Terrestrial Science)
          Space Geodynamics Lab., 4850 Keele St., North York,
          Ontario,  Canada M3J 3K1

GSFC -- FS Support                                               UT-5 hours *
       Ed Himwich                         weh@vega.gsfc.nasa.gov
       Nancy Vandenberg                   nrv@gemini.gsfc.nasa.gov
       PCFS e-mail exploder               pcfs@vega.gsfc.nasa.gov
       Ph: +1-301-286-4876/9019           Fax: +1-301-286-0213
       Code 920.1, Building 22/Room C-291, NASA/GSFC, Greenbelt MD 20771, USA


                                          *   Add 1 hour between  April and October
                                          **  Add 1 hour between  October and April
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13 Appendix A: Acronyms and Abbreviations

ATNF	Australia Telescope National Facility
DIT	Data Interface Team
DOTS	Data Oversight & Transfer System
DPL	Data Processing Log
DSN	Deep Space Network
EVN	European VLBI Network
FTP	File transfer protocol
GBTS	Green Bank Tracking Station
GPS	Global Positioning System
GRT	Ground Radio Telescope
GTS	Ground Tracking Station
HALCA	Highly Advanced Laboratory for Communications and Astronomy
IP	Internet Protocol
ISAS	Institute of Space and Astronautical Science
ISTS	Institute for Space and Terrestrial Science
JIVE	Joint Institute for VLBI in Europe
JKSC	Kagoshima Space Centre
JPL	Jet Propulsion Laboratory
Mbps	Megabits per second
MDF	Monitor Data File
ME	Mission Element
MMNAV	(JPL) Multi-Mission Navigation
NAO	National Astronomical Observatory
NASA	National Aeronautics and Space Administration
NASDA	National Space Development Agency
NAV	Navigation Groups
NRAO	National Radio Astronomy Observatory
NRT	Near Real-Time
OD	Orbit Determination
OSF	Observation Summary File
PI	Principal Investigator
PST	Pacific Standard Time
S2	S2 Recording System
SPL	Station Performance Log
SRS	Space Radio-Telescope Schedule
SRT	Space Radio Telescope
SVLBI	Space Very Long Baseline Interferometry
TCF	Time Corrections File
THF	Telemetry Header File
TSM	TSys Monitor
UT	Universal (Coordinated) Time
UTC	Coordinated Universal Time
VEX	VLBI Experiment (file format)
VLA	Very Large Array
VLBA	Very Long Baseline Array
VLBI	Very Long Baseline Interferometry
VMOH	VSOP Mission Operations Handbook
VSOG	VSOP Science Operations Group
VSOP	VLBI Space Observatory Programme
VSOPT	VSOP Terminal Recording System
WSRT	Westerbork Synthesis Radio Telescope
XSOE	Executed Sequence of Events

14 Appendix B: Useful Japanese expressions

It has been suggested that a few Japanese phrases may be useful, particularly for occasions when phone calls have to be made to Japan – a few useful expressions are given here.

The traditional way of saying 'hello' on the phone in Japanese is *moshi moshi*.

However, if ringing a place such as ISAS, the switchboard operator will usually say 'This is ISAS': *Oo-choo Ka-gaku Ken-kyoo Sho des'*.

If you wanted to speak to Murata-san, a simple polite way of requesting this is *Murata-san o-nair-gah-ee shi-muss*.

To ensure you get the right Murata-san, by specifying the person you want works in Hirax's group: *Hirabayashi-ken no Murata-san o-nair-gah-ee shi-muss*.

If you want to try the Operations Room: *Oon-yoh Shitsu oh-nair-gah-ee shi-muss*.

If you need to resort to numbers to give a phone number listed in the VMOH for example:

zero	*zair-oh* or *ray*	five	*go*
one	*ichi*	six	*rock-oo*
two	*ni*	seven	*nana*
three	*sun*	eight	*hachi*
four	*yon* or *shi*	nine	*kyoo*

If someone has been very helpful, thank them! *Doh-moh A-ri-guh-toe*.

If all else fails, ask if they can speak English: *Ay-goh de-ki-muss-ka?*

A few other useful expressions:

Good morning	*O-high-oh go-zai-ee-muss*
Hello	*Kon-ni-chi-wuh*
Good evening	*Kon-bun-wuh*
Sorry	*Sue-mee-muss-sen*
How about a beer?	*Bee-roo wuh ik-kar-guh dess-ka?*

The above pronunciations are not transliterations from Japanese, but are intended to illustrate the way the word is pronounced. Japanese is generally spoken with no emphasis on any particular syllable.

15 Appendix C: VMOH revision history

Substantive changes between 18-Mar-1997 and 7-Jul-1997 version

- OSF (§3.3) re-written.
- Mission Element FTP Sites (§2) replaced.
- Contingencies (§10.5) re-drafted and contingency contacts added.
- Preliminary version of Mission Element FTP Sites (§10.6) added.
- Mission Contacts (§10.6) re-formatted and updated.
- Whole document 'latex2html'-ed and placed on the VSOP WWW site.

Substantive changes between 7-Jul-1997 and 12-Sep-1997 version

- OSF section (§3.3) further revised.
- U. of Calgary URL updated in WWW sites section (§10.6)
- VSOG FTP site updated in FTP sites section (§10.1)
- Appendix B added

Substantive changes between 12-Sep-1997 and 03-Feb-1998 version

- Directory structure altered for Merged Logs (§8.2)
- DOTS FTP site updated in FTP sites section (§10.1)
- Points of contact updated and Mission Contacts section (§10.6) reformatted.
- Contingencies section (§10.5) revised.
- GRT scheds (§10.2.9) and logs (§10.2.10) sections updated and expanded

Substantive changes between 03-Feb-1998 and 03-Apr-1998 version

- Japanese postal codes updated
- Mission Contacts updated
- NRAO AOC FTP Directory Structure updated

Substantive changes between 03-Apr-1998 and 13-Nov-1998 versions

- ISAS and Mitaka contact details changed
- EVN, Socorro AOC and DSN FTP site details updated