ISAS server operation plan.

Y.Murata

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1 Purpose of this document

The purpose of this document is to make clear Who, Where, When and How will treat the files related with VSOP operation. This document will be marged with the operation handbook. All related with GRT inputs/outputs are still under negotiation, and will be decided in GVWGtwg. But some have already tested by GRT test runs.

PLEASE SEND COMMENTS TO murata@vsop.isas.ac.jp or dit@vsop.isas.ac.jp, if the descriptions here are different from your understandings.

2 Location of ISAS server

There are two anonymous ftp servers in ISAS. One is:

ftp://ftp.vsop.isas.ac.jp/
(133.74.2.131)

and another is:

ftp://vsoper1.vsop.isas.ac.jp/
(133.74.17.21)

The former is used for the AO issues and PI interaction. The latter is used for the operation file exchange. This document wrote about the operation server.

3 Files used for VSOP operations

Files treated by VSOG are described here. We specified the users of the files, but any other elements that needs knowledge in the file can get the files.

3.1 Schedule Files

3.1.1 Long Term Schedule

The long term schedule covers one AO(Announcement of Opportunity) period or 4 month GRT scheduling period. This is the output from long term scheduling software SVLBSCHED2, or the output of ISAS check software. This file is not formally open, and the file format is being changed frequently.

3.1.2 SRT schedule (DSN/Greenbank/Usuda/JPL-OD/MUSES-B)

SRT schedule file controls Spacecraft related elements, which are: tracking stations and spcaecraft itself. Navigation teams also look this file for generating predicted orbit/frequencies. This schedule file is a week-basis file starting at 0H UT on Monday (if there is tracking operation in this time, the file starts after the tracking pass is finished, and the last tracking operation is covered by the file of the previous week). VSOG starts to prepare the file 4 week before the operation week, and updates file using new revision of the orbit prediction, and the last values of other operation environments. Deadline for VSOG to prepare the file for tracking operation is 19UT on Tuesday, everyweek. Detailes are in "SVLBI Space Radio Telescope Schedule File". Naming convention of the SRT schedule file is:

```
YYMMDD.srs[.v]
```

where

1. `YYMMDD`: The start date of the file in UTC. It is always on Monday. 6 characters.

2. `.srs`: File ID (extention) of SRT schedule file.

3. `.v`: Version ID of the schedule file. First schedule file has no version ID, and the files after second one become '.a', '.b', ...

3.1.3 GRT Schedule

GRT Schedule is VLBI experiment schedule for GRTs. VSOP experiments use the format identical with that used for ground-based VLBI observations. But there are 3 kinds of format for the schedule. One is VEX format which is used for Mark IV field system Version 9 (FS9) which controls Mark IV, VLBA, (Mark III) and S2 terminals. The second is "crd file" format which is used for VLBA telescopes, Greenbank, and Effersberg VLBA terminals. The last is VSOP terminal schedule which is similar to old "Mark III drg file".

VSOG will generate "SCHED input file" from long term schedule, which is one of the GRT schedule read by NRAO sched ground VLBI scheduling software. "NRAO sched" has a function output VEX file, crd file, and Mark III drg file. VSOG will generate those files at ISAS using NRAO sched, and will distribute files to all GRT servers in Socorro, Bologna, ATNF, and Mitaka 2 weeks (TBD) before the observation. Summary file of the experiment is also generated by "NRAO sched" for the people who would like to look after the experiment run. Naming convention of the GRT schedule file is

`EXPNM.xxx`

where

1. `EXPNM`: Experiment name in 5 characters[1].

2. `.xxx`: File ID (extention) of GRT schedule file.
   'key': SCHED input file
   'skd': VEX schedule file
   'crd': VLBA crd schedule file
   'drg': drg schedule file for VSOPT
   'sum': summary file of the experiment

3.2 Outputs from tracking stations(DSN, Greenbank, Usuda)

Followings are the data from each tracking stations. Naming conventions of those files except for Data Processing Log, are,

`YYMMDDHHMM.EXT[.v]`

where

1. `YYMMDDHHMM`: Pass start time defined by BGN2LK or BGN_DL in SRT schedule file in YYMMDDHHMM time format. 10 characters.

2. `EXT`: Extention with 3 characters, defined later in this document. File and tracking station ID.

3. `.v`: Version ID of the schedule file. First schedule file has no version ID, and the files after second one become '.a', '.b', ...

3.2.1 Data Processing Log (DSN, Greenbank, Usuda)

Data Processing Log is a SNAP type log generated by tracking stations. Most of the entries in the log are related with the recording issues; Phase Cal Data and Flag Data (Tsys Measurement data) are also included. VSOG gets those data and adds information obtained from telemetry data; then VSOG generates correlator input log.

There are 3 kinds of log data. One is the log from VLBA recorder, the other is the log from S2 recorder, and the third is from VSOPT recorder.

VSOG expects to have this file 4 days (96 hours) after the tracking pass.

[1] The EXPNAM will *normally* be five characters, but in some cases must be six characters. If more than one epoch of an experiment is observed in the same month, there must be the epoch number to distinguish the files in the same directory.

Naming conventions of Data Processing Log, is,

```
YYMMDDHHMM-R.klX[.v]
```

for VLBA logs and,

```
YYMMDDHHMM-R.ksX[.v]
```

for S2 logs.
where

1. `YYMMDDHHMM`: Pass start time defined by BGN2LK or BGN_DL in SRT schedule file in YYMMDDHHMM time format. 10 characters.
2. `-R`: Recorder ID. R is one of '1', '2', or '3'. The assigned number is same as the number of COREL#, CNFIG#, BGNRC#, and ENDRC# in SRT schedule file.
3. `klX, ksX`: Extention of data processing log. klX is VLBA recorder log and ksX is S2 log. X is one of 'g', 'd', 't', 'm', and 'u', which are correspond to Greenbank, Goldstone, Tidbinbila, Madrid and Usuda, respectively. Only the exception is the extention of Usuda S2 log, which has 'kls' extension.
4. `.v`: Version ID of the schedule file. First schedule file has no version ID, and the files after second one become '.a', '.b', ...

3.2.2 Time correction file (DSN, Greenbank, Usuda)

Time correction file contains the difference between tape time tag and the satellite time. It is derived from doppler data, GPS data, and atomospheric delays. This file is available for correlators on ISAS server, and on tracking station servers. Correlators and VSOG expect to have this file 7 days after the tracking pass.

3.2.3 Ku telemetry data (DSN, Greenbank, Usuda)

Ku telemetry data are extracted from Aux telemetry header of science acquisition Ku downlink. They contain auxiliary information, such as ON/OFF status, temperature, IF level, and attitude control status.

This file will be supplied every 10 - 15 minutes from tracking stations when VSOG requests to serve telemetry data in near realtime mode. VSOG can get a single file of the telemetry after the pass operations of the tracking stations.

3.2.4 Performance Log (DSN,Greenbank)

Performance log will available in tracking station servers and ISAS server. JPL and NRAO performace logs will be copied to ISAS server and checked by VSOG. VSOG expect this file within 24 hours after the tracking pass.

3.2.5 Time component file (optional; DSN, Greenbank)

Time component file contains the informations of the times to be corrected for Time correction file, which are troposphere delay variation, ionospheric delay variation, and the station clock variation relative to UTC. It is negotiatied that this file is transferred from DSN and Greenbank tracking stations to VLBA correlator, but whether Usuda tracking station supply this file, or whether VSOP and Canada Correlator use this file, are under negotiating.

This file will not be used when there is no problem. This file is used for debugging tracking stations and correlators.

3.2.6 Monitor data (optional; DSN only)

This is DSN internal file sent to JPL. VSOG can scan this file when VSOG needs/wants to scan it.

3.2.7 Phase residual data (optopnal; DSN only)

Phase residual data are measured in DSN. They are used for the generation of delta T file. They are internal DSN data. VSOG can get this data for the purpose of DSN tracking station checkout.

3.3 Navigation related files

3.3.1 Orbit Prediction Data

Orbit prediction informations for schedule/command generation. There are 2 kinds of orbit prediction file. One is from NASDA and another one is from ISAS navigation team. ISAS orbit prediction data are generated for 3 time ranges: long-term (18 months), middle-term (4 months) and short-term. Long-term and middle-term predictions are used for observation planning. Short-term prediction is used for AOCS operation SW, APS operation SW, command genaration, and planning of observations.

3.3.2 Orbit determination data for non-Japanese correlator

Orbit determination (OD) file will be used by VLBA, S2 (Canada), and JIVE correlators. This is NAIF (or SPICE) format and it will be available on JPL-DOTS server for the elements with NAIF libraries.

3.3.3 Orbit determination data for VSOP correlator

Orbit Determination (OD) File will be sent to VSOP Correlator (SCEF format). This file provides state vector of the satellite every second. This is Japan internal file.

3.3.4 Orbit determination data(for JPL/ISAS OD results exchange)

JPL navigation group supplies their OD results obtained from Ku doppler measurements at tracking stations and from S band range measurements. ISAS navigation group supply two OD results: one is the result from onboard GPS receiver, and another is the result from doppler and range data. File naming convention is

`YYMMDD-xxxx-x.icv`

where

1. `YYMMDD:` Start date of the content of the file in UT. 6 characters
2. xxxx-x: Data ID code. 'isas-t' means OD result by range and doppler data from ISAS navigation group. 'isas-g' means OD result by GPS receiver, and 'jpl-t' means OD result from JPL.
3. `icv:` File extension of OD result file

3.3.5 Tracking Data

Navigation teams exchange with tracking data they recieve from tracking stations and Kagoshima command/telemetry station. JPL navigation group recieves Ku doppler data from DSN and Greenbank, and ISAS navigation group recieves Ku doppler data from Usuda, and S range and doppler from Kagoshima. File naming conventions are as follows:

`YYMMDD-YYMMDD-xxxx-x.odf`

where

1. first `YYMMDD:` Start time of the content of file in UT. 6 characters.
2. second `YYMMDD:` Stop time of the content of file in UT. 6 characters.
3. xxxx-x: Data ID code 'isas-s' means S band range and doppler data from Kagoshima. 'isas-k' means Ku band doppler data, and 'jpl-k' meens Ku doppler data from US tracking stations (DSN and Greenbank).
4. `odf:` File extention of tracking data

3.3.6 Sequence of Events

VSOG will supply the sequence of the satellite for JPL navigation people to understand what happens in the satellite. VSOG did not propose how we put the informations on the server yet.

3.4 SRT outputs for Correlators / PIs

3.4.1 Correlator Input Log (SRT)

Observation Log from Space Radio telescope (SRT) contains information necessary for correlator. Data Processing Log from each tracking station has similar format as the correlator input log, but some information required from correlators might be missed. VSOG extracts that information from satellite telemetry data and puts entries to the Data Processing Log. Then VSOG will merge the logs which belong to a given experiment to be correlated by VLBA correlator and Canada correlator. The log for VSOP correlator will be sent by pass basis, because VSOP correlator treats multi-log format.

Naming conventions of those files are such that
for VLBA log,

`EXPNMlog.vs`

for S2 log,

`EXPNMslg.vs`

where

1. `EXPNM:` Experiment code. 5 characters.
2. `vs:` VSOP obsmsn=2-character code (not yet defined).

for VSOPT log,

`EXPNMvlg.Xz`

where

1. `EXPNM:` Experiment code. 5 characters.
2. `Xz:` Xz is the tracking station 2 character code. uz:Usuda, gz:Goldstone, tz:Tidbinbila, nz:Greenbank, and rz:Madrid.

3.4.2 VLBI calibration tables (SRT)

Correlators and PIs require the calibration files from SRT, which contain antenna gain table, phase calibration tone (pcal), and flag table. Those tables are readable by AIPS tasks, ANTAB, PCLOD, and UVFLG respectively.

SRT generate a calibration file called "TSM file", which has the entries about the antenna gain, phase calibration, flag informations, and others. Detailes are in the VSOP Calibratoin Manual.

Naming convention of TSM file is

`EXPNMtsm.xx`

3.4.3 Correlation Parameters

Correlator needs to have the correlation parameters such as, the frequency resolution, integration time, the position of the phase center and so on. The format, naming conventions are under negotiation.

3.5 GRT outputs for Correlators / PIs

All GRT related file conventions are TDB, and will be decided in GVWGtwg.

3.5.1 VLBI Observation Log (GRT)

Observation Log from each GRT will be send to correlators / PIs. All logs are SNAP type log. But the format depends on the Field system of VLBI experiment. Most of S2, VLBA, and MarkIV telescopes provide FS9.x SNAP log for the correlators. VSOPT telescopes generate Mark III SNAP type log defined by VSOP correlator. The logs from VLBA telescopes to VLBA correlator are generated in internal format, but if other correlators need to correlate VLBA telescope, VLBA will produce SNAP type log from their internal file.

Naming convention of the log is

`EXPNMlog.XX`

where

1. `EXPNM`: Experiment code. 5 characters.
2. `XX`: GRT 2-character code defined by B.Clark (NRAO).

3.5.2 Clock offset table (GRT)

Correlators require the clock offset of the station time relative to GPS time. This information is needed not only at the time when GRTs are observing, but periodical monitoring is also required.

Naming convention of the log is

`EXPNMgps.xx`

where

1. `EXPNM`: Experiment code. 5 characters.
2. `xx`: GRT 2-character code defined by B.Clark (NRAO).

3.5.3 VLBI calibration tables (GRT)

Correlators and PIs require the calibration files from each GRT, which contains antenna gain table, phase calibration tone (pcal), and flag table. Those informations are passed through observation log, in case of FS9 SNAP logs and VSOPT SNAP logs. VLBA correlator have no plan to get those informations for log. Instead of those, VLBA accepts TSM files from GRTs.

3.6 Status informations from operation elements

Status information from operation elements will be produced as ASCII text file from each operation elements. The format and reporting period are TBD.

3.7 Correlator outputs for VSOG and tracking stations

VSOG and tracking stations want to know how the correlation process goes, to know how well the elements work. The portion of the data, bit statistics, the fringe peak error, etc, will be edpected. VSOG now preparing the requirements.

4 Files for VSOP Operation

Data	EXT	Source	Users
Navigation related(ODDATA)			
Orbit Prediction Data(ISAS)	opr	ISAS/OD	SSOC Operation
Orbit Prediction Data(NASDA)	onp	NASDA/OD	SSOC Operation
Navigation Data for VSOP correlator	scf	ISAS/OD	Correlator
JPL Navigation Data	icv	JPL/OD	ISAS/OD
ISAS Navigation Data	icv	ISAS/OD	JPL/OD
ISAS-GPS Navigation Data	icv	ISAS/OD	JPL/OD
Ku Doppler Data(NASA/DSN-GB)	odf	JPL/OD	ISAS/OD
Ku Doppler Data(ISAS/USUDA)	odf	ISAS/OD	JPL/OD
KSC S Range Data	odf	ISAS/OD	JPL/OD
Attitude control history	xse	VSOG	JPL/OD
Status File(STATUS)			
SAT Status	ssa	VSOG	Each element
Tracking station Status	str	Tracking stations	Each element
GRT Status	srt	GRTs	Each element
Correlator Status	sco	Correlators	Each element
VSOG Status	svg	VSOG	Each element
VSOP Operation (VSOPOPER)			
Long term schedule	gst	VSOG	Each element
GRT Schedule(SCHED input)	key	VSOG	NRAO sched
GRT Schedule(VEX)	skd	VSOG	Mark IV GRTs
GRT Schedule(crd)	crd	VSOG	VLBA GRTs
GRT Schedule(drg)	drg	VSOG	VSOPT GRTs
GRT Schedule Sumary File(sum)	sum	VSOG	ALL
SRT Log (VLBA,Mark4, SRT)	log.vs	VSOG	Correlators
SRT Log (S2, SRT)	slg.vs	VSOG	Correlators
SRT Log (VSOPT,SRT)	vlg.vs	VSOG	Correlators
TMS File (Calib. data, SAT)	tsm.vs	VSOG	Correlators, PIs
GRT Log (GRT),TBD	log.XX	GRTs	Correlators
Antenna Calib.Table(GRT),TBD	act.xx	GRTs	Correlators, PIs
Phase-cal. Table(GRT),TBD	pct.xx	GRTs	Correlators, PIs
Flag Table(GRT),TBD	flg.xx	GRTs	Correlators, PIs
Clock Offset Table (GRT),TBD	gps.xx	VSOG	Correlators

Data	EXT	Source	Users
MUSES-B Operation(KUDAT)			
Space Radio Telescope Schedule	srs	VSOG	NASA/DSN/GB
Data Processing Log(DSN/GS)	kld	NASA/DSN	VSOG
Data Processing Log(DSN/MD)	klm	NASA/DSN	VSOG
Data Processing Log(DSN/TD)	klt	NASA/DSN	VSOG
Data Processing Log(NRAO/GB)	klg	NRAO/GB	VSOG
Data Processing Log(UDSC)	klu	VSOG	VSOG
S2 Data Processing Log(DSN/GS)	ksd	NASA/DSN	VSOG
S2 Data Processing Log(DSN/MD)	ksm	NASA/DSN	VSOG
S2 Data Processing Log(DSN/TD)	kst	NASA/DSN	VSOG
S2 Data Processing Log(NRAO/GB)	ksg	NRAO/GB	VSOG
S2 Data Processing Log(UDSC)	kls	VSOG	VSOG
Time Correction File(DSN/GS)	kcd	NASA/DSN	Correlator
Time Correction File(DSN/MD)	kcm	NASA/DSN	Correlator
Time Correction File(DSN/TD)	kct	NASA/DSN	Correlator
Time Correction File(NRAO/GB)	kcg	NRAO/GB	Correlator
Time Correction File(UDSC)	kcu	VSOG	Correlator
Ku Telemetry Data(DSN/GS)	ktd	NASA/DSN	VSOG
Ku Telemetry Data(DSN/MD)	ktm	NASA/DSN	VSOG
Ku Telemetry Data(DSN/TD)	ktt	NASA/DSN	VSOG
Ku Telemetry Data(NRAO/GB)	ktg	NRAO/GB	VSOG
Ku Telemetry Data(UDSC)	ktu	VSOG	VSOG
Performance Log(DSN/GS)	kpd	NASA/DSN	VSOG
Performance Log(DSN/MD)	kpm	NASA/DSN	VSOG
Performance Log(DSN/TD)	kpt	NASA/DSN	VSOG
Performance Log(NRAO/GB)	kpg	NRAO/GB	VSOG
Performance Log(UDSC)	kpu	VSOG	VSOG
DSN Monitor Data(DSN/GS)	kmd	NASA/DSN	VSOG
DSN Monitor Data(DSN/MD)	kmm	NASA/DSN	VSOG
DSN Monitor Data(DSN/TD)	kmt	NASA/DSN	VSOG
Phase Residual Data(DSN/GS)	krd	NASA/DSN	VSOG
Phase Residual Data(DSN/MD)	krm	NASA/DSN	VSOG
Phase Residual Data(DSN/TD)	krt	NASA/DSN	VSOG

5 Directory structure of VSOG Operation Server

Root/	Sub/	Sub/	Sub/	Sub/	Sub/	Ext
vsop/	vsopoper/	status/	vsog/			(svg)
			sat/			(ssa)
			corr/			(sco)
			grt/			(srt)
			gts/			(str)
		schedule/	longsched/			(gst)
			grtsched/	keyin/		(key)
				vex/		(skd)
				crd/		(crd)
				drg/		(drg)
				summary/		(sum)
			srtsched/			(srs)
		data/	srt/	udsc/	kutlm/	(ktu)
					delta_t/	(kcu)
					corrlog/	(klu, kls)
					perflog/	(kpu)
				gb/	kutlm/	(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/	(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)