Note on SOT CO planning

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January 21, 2007

This document describes the workflow of observation planning. The latest document is kept in `sotcows1:documents` directory. Chief Observer (CO) of the week is requested to update this document.

1 Decide Science Objectives

Think.

2 Edit Observation Table

If you intend to perform observations that are not defined in current observation table, you need to edit observation table with following tools. Observation table has hierarchy of four layer, namely main-routine, sub-routine, sequence, and parameter block. By setting dependency among them, you can realize a variety of observation program.

2.1 pbgui

`pbgui` is a tool to create new macro commands for FPP. Macro command is a set of observation parameters such as field of view, exposure time, filters for FG, pixel summing, cycle number for SP etc. To start the tool, type

```
$$ pbgui
```

It is easy to begin with existing parameter block though you can create it from scratch. To create a new parameter block, select an existing parameter block, edit properties and save it as new one. It is strongly recommended not to overwrite existing parameter block, because it causes inconsistency for existing sequences and programs.

2.2 obstool

`obstool` edits sequences and programs.

```
$$ obstool
```

A sequence is composed of Parameter Block and FPP instrument commands. Sub-routine consists of sequences and main-routine consists of sub-routines. Observation is performed by invoking main-routine. Similar to pbgui, it is strongly recommended not to modify existing sequences or programs since one change affects all the dependencies.

3 Compose Timeline

Timeline tool selects programs to be loaded in observation table and specifies start time of the programs. Timeline also takes care of real-time upload sequence. To start the program, type

```
$$ SOTtimeline
```

3.1 Import operation information

Specify the date of plan start. Plan term, OP period, and orbital event files are imported by default. Import re-point file which specifies pointing time and coordinates decided in daily meeting. `STOP_ALL` will be automatically placed before re-pointing. It is to make sure everything is stopped during the pointing. `CT_DISK` will be added after re-pointing though wedge position should be changed to appropriate position by hand. Then import downlink file which defines downlink schedule and allowed data rate for observation. These input files are prepared by Chief Planner (CP). You will see a skeleton of timeline by pressing `[Run]` button.

3.2 Slot assignment for observation table entries

To execute programs not included in current program list, you have to assign slots for the program and its dependencies. When you start the timeline tool, slot allocations of the last plan is inherited. `tableviewer` will help to find out dependency of observation program, namely sequences and parameter blocks.

```
$$ tableviewer
```

When you click on a program, dependent elements are highlighted. It can also trace calls backward from lower hierarchy i.e. parameter block. The tool is particularly helpful to find an unused slot which can be populated by a new entry.

3.3 Work with Timeline

Put in observation programs on the timeline to achieve your scientific goal. Some requirements are:

- Stop observation and CT before re-pointing
  FG, SP, and CT must be stopped before re-pointing.

- Do not hit DR limit
  If Data Recorder (DR) usage reaches the limit, observation will be stopped.

- Stop all before OP transition
  No command execution are allowed during OP transition period defined as `OPPLN_PROHIBIT` in OP period file. Insert `STOP_ALL` before two `OPPLN_PROHIBIT` periods indicated by orange lines in the timeline, one for nominal plan end and the other for backup plan end.

- No command during SOT table upload
  Observation program sould not be started during SOT table upload pass. Consult operation schedule to check the time of SOT table upload pass. SOT table upload pass is scheduled a few hours before the nominal plan end. Note that observation will be stopped in the upload pass to upload observation table.

- Enable CT before observation start

There are guidelines for optimum planning.

- Take context FG images with SP map
  Execute context FG program in parallel with SP map in order to know what SP is looking.

- Prevent CT reset in large SP map
  It can be done by enabling Tip-Tilt (TT) reset flag of SP parameter block or CT off/on cycle.
  Note: TT flag of SP parameter block is currently prohibited. You need to insert CT servo off/on cycle to reset Tip-Tilt.

- Avoid SAA
  A lot of spikes in SAA degrade data, especially for SP and NFI magnetogram. It is not recommended to run large SP map in SAA.

- Adjust focus before and after limb pointing
  There is a slight change in best focus position between the disk center and the limb due to temperature variation of the telescope. Focus can be set by putting focus command just after the pointing when observation and CT are stopped. Consult the best focus history document to find a optimum focus position.

3.4 Set Real Time information

Consult *Hinode* daily events page to check operation schedule.
`http://www.isas.jaxa.jp/home/solar/hinode_op/hinode_daily_events.php`

- Select pass number
  Set ground station and four-digit pass number in which SOT tables are uploaded. It is different from OP/OG upload pass.

- Time of table upload
  Set middle time of the contact.

- Select Ram-sub number for tables
  Ram-sub numbers for tables are assigned incrementally. Consult previous ORL's stored in `~/ops/plans/ORL/` to find the last Ram-sub number. If upload is not necessary, corresponding Ram-sub number must be left `[no load]`.

4 Prepare Files

There is a script to submit plan files.

```
$$ cd ~/sw/shell/
$$ plan_submit
```

It automates the following procedure. If you experience a problem in the course of process, you have to perform following steps one by one.

4.1 Move previous plan to archive

Previous plan files must be moved from `~/cmdpln/latest/` to archive. Create `~/cmdpln/yyyymmdd/` directory and move previous files in it. `FIXED_OG_SOT.orl` must be left in `~/cmdpln/latest/` because it is necessary everytime.

4.2 Prepare Doppler shift parameters

SOT CO is responsible for preparing Doppler Shift Compensation (DSC) parameters of NFI. DSC parameters should be updated by OP command when the pointing spacecraft is changed, which happens in normal operation. Therefore, it should be prepared every time when OP is uploaded. An ORL file for setting DSC parameters can be prepared by just executing one IDL program.

```
$$ sswidl
IDL> sot_dsc_par2
```

The program generate a DSC ORL file `SOT_DSC_yyyymmddpppp.orl` in `~/ops/plans/ORL`.

Once a week, orbital element used for DSC calculation is updated. On Thursday evening, SOT CO also has to prepare a memory table being uploaded on Friday. To generate parameters, just do

```
* needed once a week *
IDL> sot_dsc_par1
```

First, check that orbital element file of this week is prepared. Then calculate the orbit. Make sure that error is within ± 0.025km/s range. Press `[Make]` to generate `MDPDPL-yyyymmddpppp.xml`. It is converted to an HEX file in the following step.

4.3 Generate HEX files

```
$$ cd ~/ops/plans
$$ ant
```

HEX files will be created in the directory `~/ops/plans/HEX`.

4.4 Copy Files

Copy plan files to `~/cmdplan/latest`.

```
$$ cp ~/ops/plans/ORL/*yyyymmdd* ~/cmdplan/latest
$$ cp ~/ops/plans/HEX/*yyyymmdd* ~/cmdplan/latest
$$ cp ~/ops/timeline/dr_SOT_yyyymmddpppp.txt ~/cmdplan/latest
```

FG and SP tables should be uploaded when their contents are different from on-board ones. Doppler table is uploaded once a week on Friday. Make sure that `FIXED_OG_SOT.orl` is placed in `~/cmdplan/latest`.

4.5 Is Everything Ready?

Following files must be found in `~/cmdplan/latest`.

```
SOT_yyyymmddpppp.orl         SOT ORL
SOT_DSC_yyyymmddpppp.orl     DSC ORL
FIXED_OG_SOT.orl             Fixed OG definition
dr_SOT_yyyymmddpppp.txt      DR file
MDP_OBS_F_yyyymmddpppp.hex  FG observation table (if modified)
MDP_OBS_S_yyyymmddpppp.hex  SP observation table (if modified)
MDP_DPL_yyyymmddpppp.hex    DSC table (Uploaded on Friday)
```

5 Self Check

5.1 DR limit Check

```
% sswidl
IDL> dr_tlmlmt_plan
```

Make sure that SOT DR usage is below the allocated limit.

5.2 ORL Syntax Check

```
$$ ISACS
% sh tool/coorlchk.sh
...
OK!
```

When an error occurs, check syntax of the ORL file.

5.3 Plan check

```
% sh tool/coplnchk.sh
...
(Answer yes when you are asked questions)
...
Good job!
```

If an error occurs, CO must resolve inconsistency among plan files. To perform plan check after submission deadline (10:00 JST), execute post-deadline script instead.

```
% sh tool/pdlchk.sh
```

6 Circulate your plan

Send a brief description of observation plan to SOT_CO (`sot_co@solar.isas.jaxa.jp`). Do not forget to put `sot_co:` in the subject line otherwise your mail will be rejected. You may get a last-minute request for modification of the plan. ORL files, USE files, and timeline GIF files are automatically archived at:

`http://sot.lmsal.com/operations/timeline/`

7 Review the plan

Look into the latest data from *Hinode* with ANA Browser. Have fun!

```
$$ browser
```

Appendix: Interface with Chief Planner

Incoming Files

Incoming files become available at `/home/flare/slb/cp/cmdpln/latest` when chief planner completed preparation. Post-deadline files are accessible at `/home/flare/slb/cp/cmdpln/today` after 10:00 JST.

- `op_period_yyyymmddpppp.evt` : OP period file
  OP start and end time
- `plan_term_yyyymmddpppp.evt` : Plan term file
  Define the term of ORL file. It covers OP periods.
- `re-point_yyyymmddpppp.txt` : Re-point file
  List of spacecarft re-pointing and their coordinates
- `obev_yyyymmddpppp.txt` : Orbital event file
  Entry and exit of SAA and HLA
- `stev_yyyymmddpppp.txt` : Station event file
  List of ground station contacts
- `dr_yyyymmddpppp.txt` : DR downlink file
  List of data downlinks
- `obsrate_yyyymmddpppp.txt` : Observation data rate file
  Data rate allowed for observation

Submitting Files

Submitting files must be put in `~/cmdpln/latest` directory. If you modified the plan after submission deadline (10AM JST), put files in `~/cmdpln/latest` directory and contact to chief planner.

- ORL file
  `SOT_yyyymmddpppp.orl` : OP and real time sequences
  `SOT_DSC_yyyymmddpppp.orl` : Update NFI Doppler parameter 2
  `FIXED_OG_SOT.orl` : Fixed OG definition for SOT

- DR file
  `dr_SOT_yyyymmddpppp.txt` : DR usage to be checked by Chief Planner
- HEX file
  `MDP_OBS_F_yyyymmddpppp.hex` : FG observation table
  `MDP_OBS_S_yyyymmddpppp.hex` : SP observation table
  `MDP_DPL_yyyymmddpppp.hex` : NFI Doppler compensation table
  If there is no change in the table, no need for submission. DPL table should be uploaded on Friday.