

Towards Automating Operations of SGP VGOS Stations

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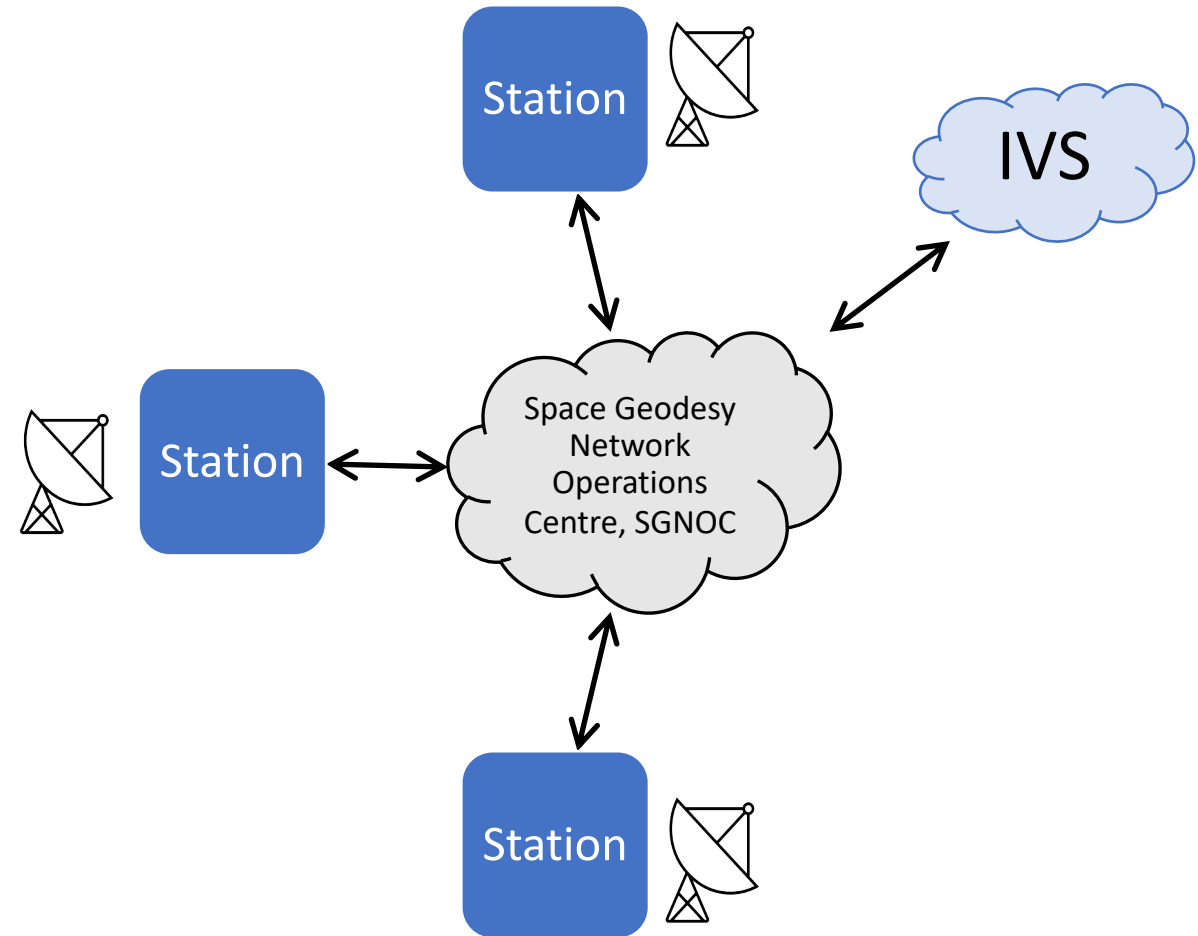
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Introduction: The Next Generation Field System (NGFS)

- Drivers:
 - VGOS: Broadband feeds and receivers, digital back ends and high bandwidth networks
 - Up to 10 stations in the NASA Space Geodesy Project (SGP) network, controlled and monitored centrally with stations unattended



Introduction: The Next Generation Field System (NGFS)

- Aims:
 - Support SGP VGOS stations,
 - Can be effectively maintained,
 - Adaptable to future technological developments (extensible),
 - Capable of a high level of automation.



NGFS Development Path

While the NGFS is being built, we are developing the techniques required for automation, using the existing Field System and a test VLBI Operating Centre (VOC).

Two initial applications at the station end of the operations network:

1. Fesh2
2. SGPAutomate

Testing on Field System at Hobart (thanks!), then SGP sites

Fesh2: Automated schedule file preparation at the station

- Keeps a local, current version of Master files
- Checks all IVS servers for latest schedule file
- Automatic processing with Drudg
- Can be run once or in monitoring mode with continually updating status reports
- Checks if local files have been modified and won't overwrite by default.
- Can run as a foreground task or in background as a service
- Compatible with Python 3.5 and above

Fesh2 in action

```
Fesh2 status for Ke
Fesh2 is running. Press 'P' for details.

Master files -----
  UT of latest download:
                        24h sessions: 2021-10-29 21:05
                        Intensive sessions: 2021-10-29 21:05

Sessions in the next 14 days: -----
Session  Start (UT)  Got schedule?  Age (hrs)*  FS files prepared?
aia082   2021-11-09 17:30   Yes           188         Yes
aov065   2021-11-16 17:30   No            188         No
-----
Key:
[*] Age = time since the schedule file was released.

Next update in 23 s
Q = Quit | P = Fesh2 processes | R = Reprocessing notes
```

Where do I get Fesh2?

- May be released with the next FS update (10.1)
- Or if you can't wait, get in touch: jejlovell@gmail.com

Next steps

- A VOC version that will:
 - Notify SGNOC of schedule status at the station
 - Receive push notifications of schedule changes rather than regular polling of IVS servers
 - Proof-of-concept only at this stage

2. SGPAutomation

- Software is intended to be highly configurable to suit individual station needs.
- It covers:
 - Pre-session procedures and checks
 - Start session procedures
 - In-session checks and monitoring
 - Post-session procedures

SGPAutomation GUI main page

Current Status

Scan: Unknown
Antenna: Unknown
Receiver: Unknown
DBE: Unknown
Recorder: Unknown

PreSession | **StartExperiment** | DuringSession | PostSession

Task	Wait?	Status	log	run
<input checked="" type="checkbox"/> NTP Checker	info	Done	log	run
<input checked="" type="checkbox"/> Start FS log file	info	Done	log	run
<input checked="" type="checkbox"/> Check RDBE Status	info	Done	log	run
<input checked="" type="checkbox"/> Check Mark 6 Status	info	Done	log	run
<input checked="" type="checkbox"/> Check MCI Status	info	Done	log	run
<input checked="" type="checkbox"/> Mount Mark6 Modules	info	Done	log	run
<input checked="" type="checkbox"/> Verify RDBE Time, offsets and VDIF epoch	info	Done	log	run
<input checked="" type="checkbox"/> Initialize the pointing config, go to a cal source	info	<input checked="" type="checkbox"/> Done	log	run
<input checked="" type="checkbox"/> Set mode and attenuators	info	Pending	log	run
<input checked="" type="checkbox"/> Check the RDBEs are healthy	info	Pending	log	run
<input checked="" type="checkbox"/> Check antenna pointing	info	Pending	log	run
<input checked="" type="checkbox"/> Make a test recording	info	Pending	log	run

Go Stop

Console

```
22:41:54: CheckTiming:INFO: Module b is OK
22:41:54: CheckTiming:INFO: Module c is OK
22:41:54: CheckTiming:INFO: Module d is OK
22:41:54: CheckTiming:INFO:
22:41:54: InitializePointing:INFO: Attempting the following task: Initialize the pointing config, go to a cal
source
22:41:57: InitializePointing:INFO: The Task "Initialize the pointing config, go to a cal source" completed su
ccessfully.
22:41:57: InitializePointing:INFO: Source command started.
22:42:08: AutoGui:INFO: Error window
22:42:16: AutoGui:INFO: Error window
```

Log search: Find Clear

Status summary

One tab per stage

Task list

Task to do (selectable)

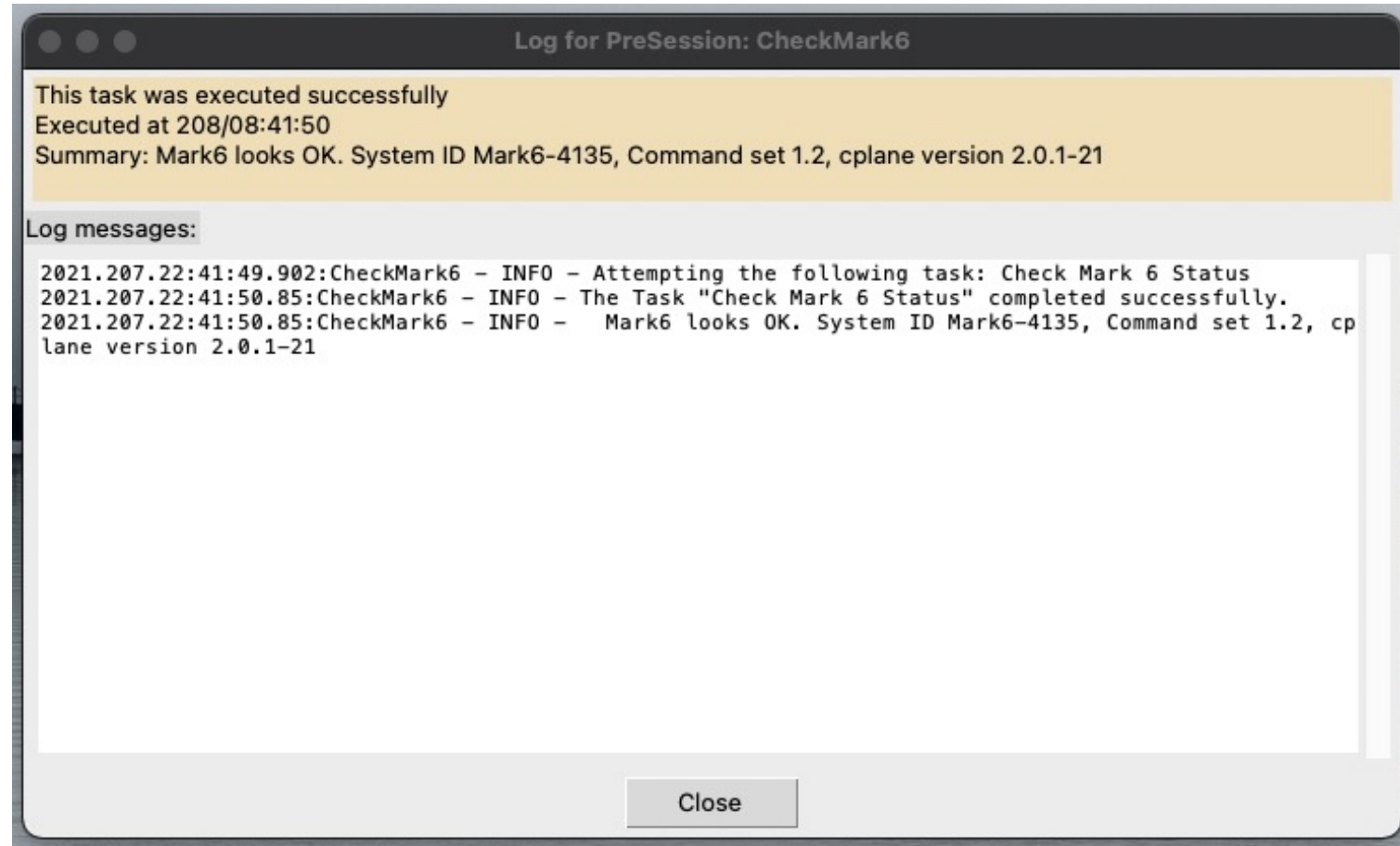
Documentation

Wait before continuing?

Status

View log

Summaries of individual task activity can be shown via a the 'log' button.



SGPAutomation GUI main page

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Antenna: Unknown
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PreSession StartExperiment DuringSession PostSession

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<input type="checkbox"/> Check Mark 6 Status	<input type="checkbox"/>	Done	log	run
<input type="checkbox"/> Check MCI Status	<input type="checkbox"/>	Done	log	run
<input type="checkbox"/> Mount Mark6 Modules	<input type="checkbox"/>	Done	log	run
<input type="checkbox"/> Verify RDBE Time, offsets and VDIF epoch	<input type="checkbox"/>	Done	log	run
<input type="checkbox"/> Initialize the pointing config, go to a cal source	<input checked="" type="checkbox"/>	Done	log	run
<input type="checkbox"/> Set mode and attenuators	<input type="checkbox"/>	Pending	log	run
<input type="checkbox"/> Check the RDBEs are healthy	<input type="checkbox"/>	Pending	log	run
<input type="checkbox"/> Check antenna pointing	<input type="checkbox"/>	Pending	log	run
<input type="checkbox"/> Make a test recording	<input type="checkbox"/>	Pending	log	run

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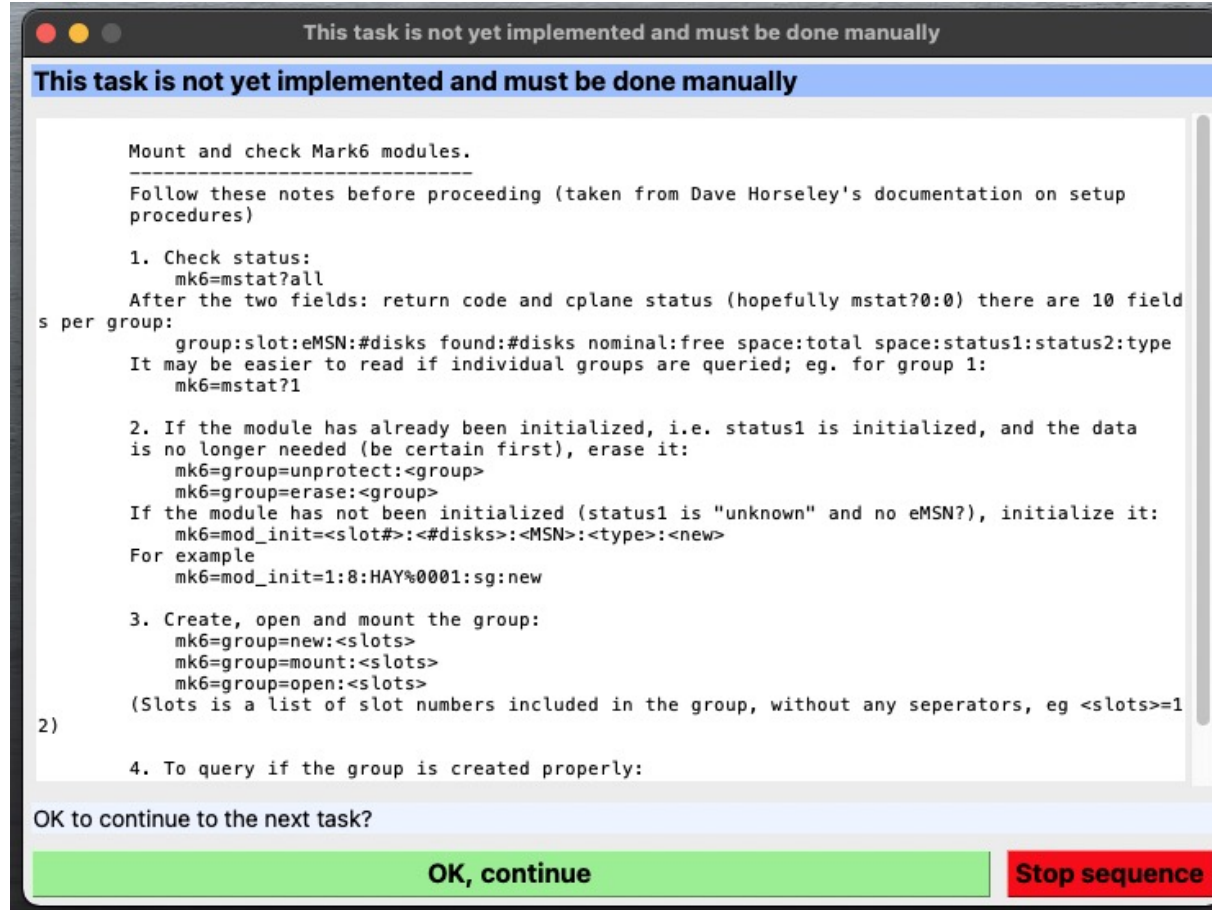
Run the task

Start/stop task sequence

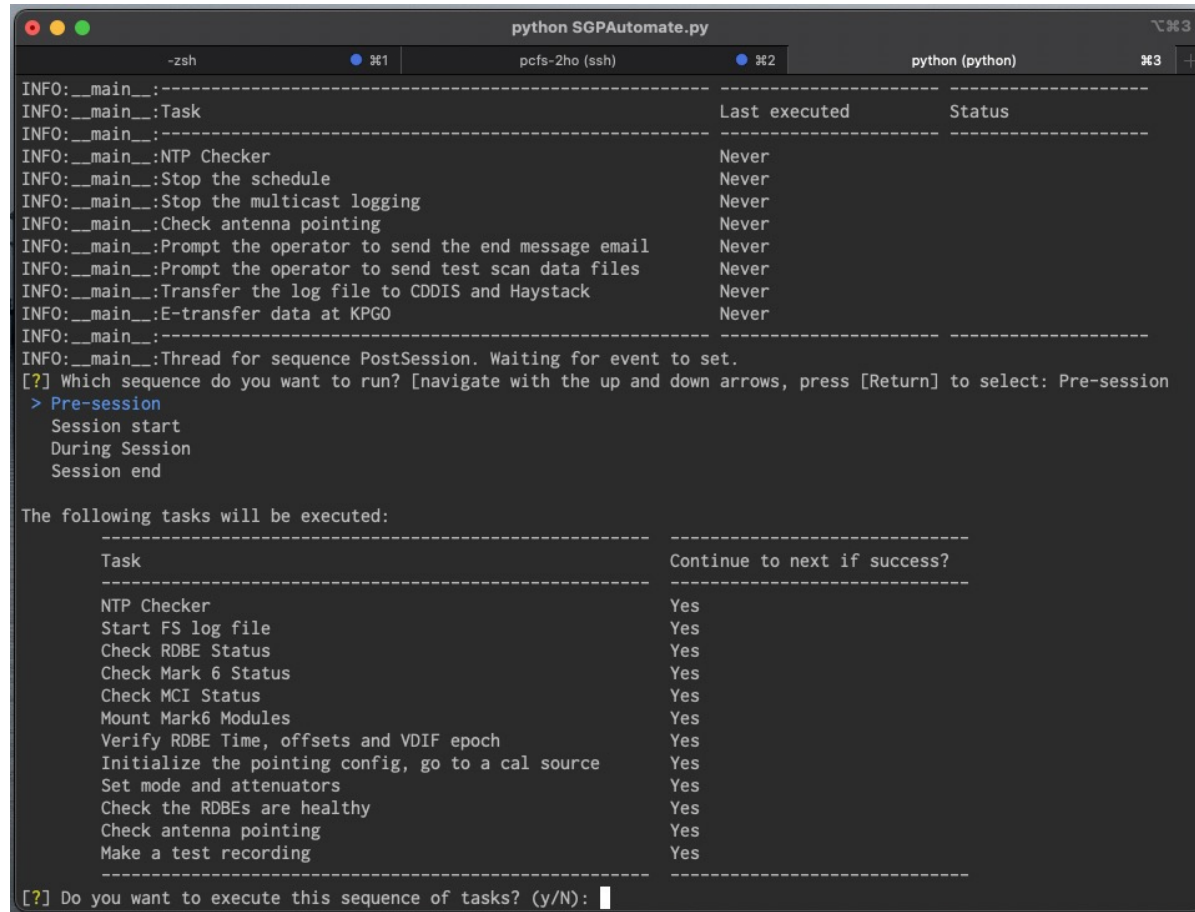
Log

Search log messages

When operator input is required, a dialog is shown.



The text-based interface is more limited than the GUI but is available if preferred.



```
python SGPAutomate.py
-zsh  #1  pcfs-2ho (ssh)  #2  python (python)  #3  +
INFO: __main__:-----
INFO: __main__:Task                               Last executed   Status
INFO: __main__:-----
INFO: __main__:NTP Checker                         Never
INFO: __main__:Stop the schedule                   Never
INFO: __main__:Stop the multicast logging          Never
INFO: __main__:Check antenna pointing              Never
INFO: __main__:Prompt the operator to send the end message email Never
INFO: __main__:Prompt the operator to send test scan data files  Never
INFO: __main__:Transfer the log file to CDDIS and Haystack        Never
INFO: __main__:E-transfer data at KPGO                Never
INFO: __main__:-----
INFO: __main__:Thread for sequence PostSession. Waiting for event to set.
[?] Which sequence do you want to run? [navigate with the up and down arrows, press [Return] to select: Pre-session
> Pre-session
  Session start
  During Session
  Session end

The following tasks will be executed:
-----
Task                               Continue to next if success?
-----
NTP Checker                         Yes
Start FS log file                    Yes
Check RDBE Status                    Yes
Check Mark 6 Status                  Yes
Check MCI Status                     Yes
Mount Mark6 Modules                  Yes
Verify RDBE Time, offsets and VDIF epoch Yes
Initialize the pointing config, go to a cal source Yes
Set mode and attenuators              Yes
Check the RDBEs are healthy           Yes
Check antenna pointing                 Yes
Make a test recording                  Yes
-----
[?] Do you want to execute this sequence of tasks? (y/N):
```

SGPAutomate is configurable

You can configure the tasks to be done for each stage (e.g. a task list for pre-session)

Commented template code is provided to help in writing new tasks

What next?

- VOC communications
- Complete implementation of main tasks for SGP sites
- Eventually make available through FS distribution.

Thankyou.

“... standing on the
shoulders of Giants.”

– I. Newton



Ed Himwich

Configure tasks and task sequences

Name task, description and config

Order tasks in a sequence. Can be re-used

```
[tasks.StartFSLogFile]
```

```
name = "Start FS log file"
```

```
description = ''
```

```
Open a FS experiment log. The current or next session, determined from the Master file, is used by default but the user can enter a name manually.
```

```
'''
```

```
timeout = 3.0
```

```
continue_if_ok = true
```

```
[tasks.CheckRDBE]
```

```
name = "Check RDBE Status"
```

```
description = ''
```

```
Runs the command rdbestat
```

```
'''
```

```
timeout = 3.0
```

```
continue_if_ok = true
```

```
[tasks.CheckMark6]
```

```
name = "Check Mark 6 Status"
```

```
description = ''
```

```
Issue the command mk6=dts_i  
that the cplane and dplane
```

```
'''
```

```
timeout = 3.0
```

```
continue_if_ok = true
```

```
[sequences]
```

```
# Arrays contain a list of tasks (given above) in the order they should be executed for a a  
# specific activity For example, the PreSession sequence contains all tasks to be carried out  
# before a session starts
```

```
[sequences.PreSession]
```

```
name = "Pre-session"
```

```
description = "Procedures to be carried out before the session."
```

```
repeating = false
```

```
repeat_gap_min = 0
```

```
tasks = ["CheckNTP", "StartFSLogFile", "CheckRDBE", "CheckMark6", "CheckMCI", "MountMark6",
```

```
"CheckTiming", "InitializePointing", "SetModeAtten", "CheckRDBEs", "CheckPointing", "TestRecording"]
```

```
[sequences.StartExperiment]
```

```
name = "Session start"
```

```
description = "Procedures to be carried out at the start of the session."
```

```
repeating = false
```

```
repeat_gap_min = 0
```

```
tasks = ["StartMulticastLogging", "SendReadyMessage", "StartSched", "SendStartMessage"]
```

Coding the tasks

- Use code templates to build new tasks

```
[tasks.StartFSLogFile]  
    name = "Start FS log file"  
    description = ''
```

```
class StartFSLogFile(Task):  
    def add_data(self, log: str):  
        self.log_name = log  
  
    def act(self):  
        """  
        Tell the FS to open a log file  
  
        1. Reads the current master schedule and determines the next or current experiment involving this station  
        2. Prompts the user to check this is the log file to write, gives the option to change it  
        3. Tells the FS to open the log file and reports the result  
  
        :return: status: True if log file name was set, False if not or an error  
        :rtype: bool  
        :return: message: text describing success or failure  
        :rtype: strings  
        """  
  
        # Read the master schedule and get the current or next session code for this site  
  
        self.ok, self.message, sched_name = self.get_next_session()  
        if not self.ok:  
            # return with a failure if we couldn't get a sched file name  
            return  
  
        log_name = "{}-{}".format(sched_name, self.config["Station"]["name"].lower())  
        fsc = open_FSCCommand(self)
```