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**Gravity Probe-B Relativity Mission**

**Space Network and Ground Network  
Scheduling Procedures Users' Guide**

**P0810 Rev –  
15 May, 2003**

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**Required Signatures Prior to Executions**

None – this is an operational procedure

## Revision Record

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## Acronyms and Abbreviations

Acronym / Abbreviation	Meaning
AGS	Alaska Ground Station (Poker Flat)
DSMC	Data Services Management Center
FD	Flight Director
FDF	Flight Dynamics Facility
GP-B	Gravity Probe-B
GN	Ground Network
GNOM	Ground Network Operations Manager
IOC	Initial Orbit Capability (first 60 days of GP-B flight)
MA	Multiple Access
MP	Mission Planning
MGS	McMurdo Ground Station (Antartica)
RE	Responsible Engineer
SAR	Schedule Add Request (SN)
SDR	Schedule Delete Request (SN)
SGS	Svalbard Ground Station (Norway)
SN	Space Network
SNOM	Space Network Operations Manager
SSA	Single Satellite Access
SSR	Solid State Recorder
SV	Space Vehicle
SWSI	Software Scheduling Interface
TDRS	Tracking and Data Relay System
TDRSS	Tracking and Data Relay System Satellite
TLE	Two Line Element data
WPS	Wallops Ground Station (Virginia)

## 1.0 SCOPE

This procedure	<input type="checkbox"/> Does	<input checked="" type="checkbox"/> Does NOT	provide formal verification of GP-B Requirements.
This procedure	<input type="checkbox"/> Does	<input checked="" type="checkbox"/> Does NOT	include constraints and restrictions for the Payload.

This document describes the requirements and procedures used to schedule Space Network (SN) and Ground Network (GN) resources.

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## 2.0 PRE-REQUISITES

The Mission Planner that is scheduling contacts must have the available GP-B view periods, as predicted by STK per P0809, for the following links at least 3 weeks ahead of the current date:

- GP-B Forward Antenna to Ground Network
- GP-B Aft Antenna to Ground Network
- GP-B Forward TDRS Antenna to Space Network
- GP-B Aft TDRS Antenna to Space Network

### 2.1 CONSTRAINTS AND RESTRICTIONS

The Mission Planner executing this procedure must have access to the SWSI system and should be the only one making submissions to SWSI and the GN Scheduling Center.

### 2.2 OPERATIONS PERSONNEL RESPONSIBILITIES AND QUALIFICATIONS

Personnel must be familiar with GREAS and the Mission Timeline Database. Knowledge of time and date conventions for scheduling is also required.

### 2.3 QA PROVISIONS

RED-LINE AUTHORITY:

Authority to red-line (make minor changes during execution) this procedure is given solely to the Flight Director, and shall be approved by QA.

### 2.4 SAFETY

## 3.0 MOC HARDWARE REQUIRED

### 3.1 WORKSTATION(S) REQUIRED

Type	Label
UNIX workstation on MOC-server	MOC STK, MOC1-4, etc.
Workstation with internet access	--

### 3.2 OTHER HARDWARE REQUIRED

Type	Quantity
None	

## 4.0 MOC SOFTWARE REQUIRED

### 4.1 CSTOL Scripts

CSTOL Script Name	Version No.
None	

### 4.2 UNIX Scripts/Executables

UNIX Script Name	Version No.
SWSI (swsi/runclient2.csh)	Build 3 Patch 14

## 5.0 PROCEDURES REQUIRED

Procedure Name	Procedure No. & Rev.
None	

## 6.0 REFERENCES, APPLICABLE DOCUMENTS, and NOTES

Document	Document No.
Update Orbit Parameters and Recalculate Orbit Events	P0809
Scheduling Confirmed Space Network and Ground Network Contacts in the Mission Timeline	P0811
Space Network Users' Guide	450-SNUG
Space Network (SN) Web Services Interface (SWSI) Client Software User's Guide	452-UG-SWSI
Interface Control Document Between the Network Control Center Data System and the Mission Operations Centers	450-ICD-NCCDS/MOC
Interface Control Document between Gravity Probe B Mission and Ground Network (GN) / WSC TCP/IP Data Interface Service Capability (WDISC)	450-ICD-GN/WDISC-GP-B
Network Operations Support Plan (NOSP) for the Gravity Probe Mission	N/A

## 7.0 OPERATIONS

### 7.1 Pass Selection – General Requirements

The following scheduling requirements apply to both Space Network (SN) and Ground Network (GN) pass selection. The Mission Planning Lead must authorize any departure from these requirements.

**Things to Avoid:** Make sure the schedule conforms to these admonitions:

- Do not schedule GN passes and SN passes at the same time.
- Do not schedule GN or SN passes across load boundaries (PING/PONG).

**PING/PONG Upload Scheduling:** Ensure we have 2 (two) passes on SN to uplink each PING and PONG sequence. Use two passes because we want a primary and a backup. This applies to both IOC and Science Mission. During IOC, budget sufficient time to account for the results of the daily Timeline Approval Meeting, with an additional 1 hour buffer to assure that you are able to load the data to the MOC pod machines. SN passes should last no less than 15 minutes.

Ping details:

- Ping Upload cannot occur during a currently running Ping sequence.
- Ping Upload should not occur before the timeline committee has approved the load. In practice, the load will be approved by late afternoon, and scheduled for upload during the night shift.
- Ping Upload should end no later than 0800 Pacific Time.
- Ping Upload pass duration should be at least 15 minutes.

Pong details:

- Pong Upload cannot occur during a currently running Pong sequence.
- Pong Upload should not occur before the timeline committee has approved the load and the Mission Planning team has released it to the Ops team. Since this time is a variable, the following start time has been selected as being reasonably safe.
- Pong Upload should end no later than 0100 Pacific Time.
- Pong Upload pass duration should be at least 15 minutes.

## 7.2 Pass Selection – Space Network

Space Network contacts must be selected from the predicted view periods according to the following requirements. The Mission Planning Lead must authorize any departure from these requirements.

**Daily Real-Time Command Window:** There must be a 20-minute (or longer) SN event scheduled every day between 3 pm and 4 pm local time.

**Space Network Condition:** Space Network contacts must be separated by at least 10-minutes, unless approved by the Flight Director.

**Tracking Data Scheduling during IOC:** Ensure we have enough SN events to collect tracking data for FDF orbit determination. Schedule six (6) 25-minute events a day for IOC. The optimum time window for each pass is shown below.

Daily SN Passes During IOC	Optimum Time Window (Pacific Time)	Minimum Duration	Purpose
1	0000 to 0100	25 min	PONG Upload Backup
2	0300 to 0500	25 min	PING Upload
3	0500 to 0700	25 min	PING Upload Backup
4	1000 to 1200	25 min	
5	1500 to 1600	20 min	Realtime/Contingency Commands
6	1700 to 1900	25 min	
7	2100 to 0000	25 min	PONG Upload

**Tracking Data Scheduling during Science Mission:** Ensure we have enough SN events to collect tracking data for FDF orbit determination. Schedule at least four (4) 25-minute events for science mission. The optimum time windows are shown below.

Daily SN Passes During Science	Optimum Time Window (Pacific Time)	Minimum Duration	Purpose
1	0000 to 0100	25 min	PONG Upload Backup
2	0300 to 0500	25 min	PING Upload
3	0500 to 0700	25 min	PING Upload Backup
4	1500 to 1600	20 min	Science and Realtime Commands
5	2100 to 0000	25 min	PONG Upload

**Critical Event Coverage:** If a critical event requires real-time tracking, schedule an SN event to cover it. To ensure that these events receive real-time coverage, all critical events occurring outside of a PING/PONG Upload or the daily Realtime Commanding window should be scheduled alongside R-tasks (realtime tasks) in the mission timeline. These tasks will be filtered using TASKviewer, and the resulting

R-task timeline will be used when scheduling SN and GN passes.

**Event Services:** Each event should include the following services for the entire event duration: forward link, return link, and tracking data.

**Single or Multiple Access Selection during IOC:** IOC events should be SSA events using 2000 bps forward and 2048 bps return, except for the first event(s) after launch, which will be on SSA with 125 bps forward, 1024 bps return.

**Single or Multiple Access Selection during Science Mission:** Science mission events can be MA (125 forward, 1024 return) or SSA (2k forward, 2048 return).

**Antenna Selection:** Each SN event should be for a particular GP-B antenna (forward or aft) - we should not have to switch antennas mid-event.



### 7.3 Pass Selection – Ground Network

Ground Network contacts must be selected from the available view periods according to the following requirements. The Mission Planning Lead must authorize any departure from these requirements.

**Ground Station Selection:** Use AGS, WPS, or SGS. MGS will only be utilized for collection of engineering data.

**Event Services:** Each event should include uplink and downlink services. Do not schedule any uplink-only or downlink-only passes.

**SSR Playback Scheduling during IOC:** Four GN passes per day will be needed to completely playback the SSR without gaps. Each GN pass must be at least 11 minutes in duration. Every GN pass requires 5 minutes for ground station acquisition and antenna switching on the satellite in mid-pass. SSR playback rate is approximately 1.33 hours of telemetry data for every minute of ground station contact. To completely playback the SSR, 6 additional minutes of ground contact will be required ( $6 \text{ min} \times 1.33 \text{ data hrs/min} = 8 \text{ hours of telemetry data}$ ). Although 3 GN passes per day could achieve complete SSR playback, a fourth GN pass is included as backup. The optimum time windows for each GN pass is shown below:

Daily GN Pass for IOC	Optimum Time Window (Pacific Time)	Minimum Duration	Purpose
1	0400 to 0500	11 min	SSR Playback
2	0900 to 1000	11 min	SSR Playback
3	1500 to 1700	11 min	SSR Playback
4	2200 to 0000	11 min	SSR Playback

**SSR Playback Scheduling during Science Mission:** Scheduling requirements are the same as in IOC.

## 7.4 Pass Selection – Early Mission Requirements

The initial 72-hour period after launch features some specific mission scheduling requirements. Here is the general plan:

**First 24 hours (day 1) in General:** One GN pass every other orbit beginning the second orbit. The first GN pass will be scheduled at Poker Flats (AGS). When there is no GN pass scheduled, fill up the time with SN passes.

**Next 48 hours (days 2-3) in General:** One GN pass every third orbit. When there is no GN pass scheduled, fill up the time with SN passes.

Here are some specific requirements:

**Initial TDRSS Contact:** After the transponders and transmitters are activated around Launch+660 sec, schedule constant SSA time with the SN using the GP-B forward antenna only. No contacts using the aft antenna can be scheduled until the GP-B satellite separates from the launch vehicle at around Launch+76 min.

**Initial Ground Contact:** The first GN pass should use AGS on the second orbit (~ Launch+173 min), according to view period predictions.

**Use Forward Antenna until SV Separation:** Until the Space Vehicle separates from the launch vehicle (Launch +4500 sec or Launch+75 min), we can only use the forward antenna, since the aft antenna is pointing toward the launch vehicle. This should only affect the first SN tracking pass, as the separation should occur before the first GN pass.

**Bandwidth for Early Passes:** The first SN pass should use 125/1024 on SSA. Passes after the first SN pass should be scheduled at 2000/2048 on SSA.

## 7.5 Pass Selection – Daily Schedule Summary

Launch day includes the following passes:

Number	Network	Duration	Start Time	Purpose
1	SN	Max.	L + 660 sec	SSA pass using forward antenna. First SN contact after launch.
1	SN	Max.	L + 4560 sec	SSA pass using aft antenna. First SN contact after GP-B separation
1	SN	Max.	L + 6000 sec	SSA pass using forward antenna. Second SN contact after GP-B separation.
1	GN	Max.	L + 173 min	First GN pass after launch. Use AGS.
*	SN	20 min	1500-1600 Pacific Time	Realtime Command Window
*	GN	Max.		Schedule 1 ground pass (using fwd + aft) every other orbit.
*	SN	Max.		Schedule as much time as possible around GN passes.

Days 2 and 3 of the mission include the following passes:

Number	Network	Duration	Purpose
*	GN	Max.	Schedule 1 ground pass (using fwd + aft) every third orbit.
*	SN	Max.	Schedule as much time as possible around GN passes.
1	SN	20 min	RT Command Window, 1500-1600 Pacific Time

During IOC, a nominal day would include:

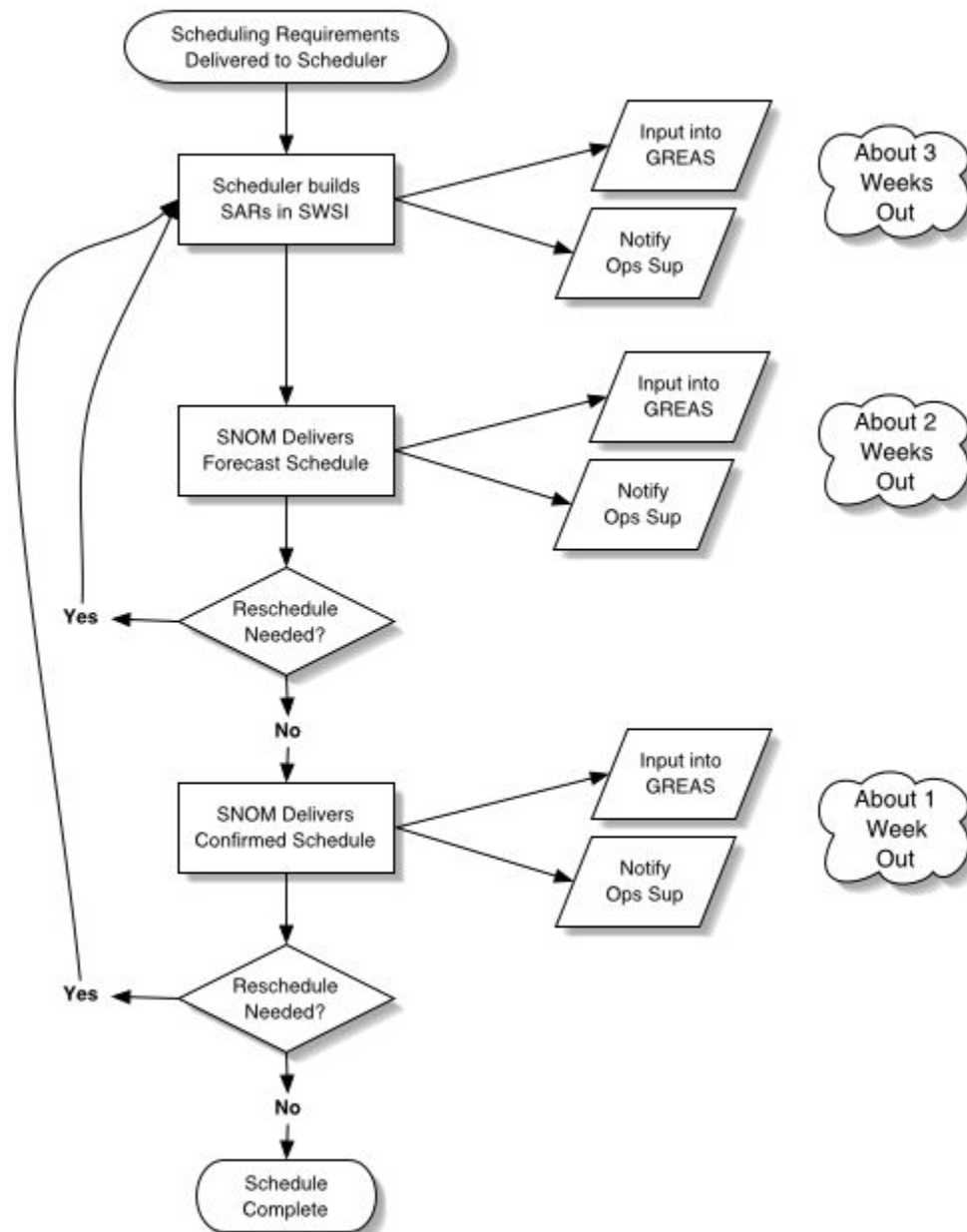
Number	Network	Duration	Purpose
1	SN	20 min	RT Command Window, 1500-1600 Pacific Time
6	SN	25 min	Tracking Data with optional PING/PONG Upload
4	GN	> 11 min	SSR Playback
as needed	SN	TBD	Critical Event Coverage

During Science Mission, a nominal day would include:

Number	Network	Duration	Purpose
1	SN	20 min	Realtime Command Window
4	SN	25 min	Tracking Data with optional PING/PONG Upload
4	GN	> 11 min	SSR Playback
as needed	SN	TBD	Critical Event Coverage

## 7.6 Space Network Pass Scheduling – Timeline Flow

The following diagram highlights the process flow for SN scheduling. See Appendix E for a more detailed SN Scheduling Timeline.



## 7.7 Space Network Pass Scheduling – SWSI Assumptions & Terms

This procedure assumes that the Ground Data Systems manager has given you the following:

- a SWSI login
- the SWSI pass phrase
- the “ops” or “analyst” login to the MOC pod machines

Note: The use of Pod computers requires ssh capability to moc-server under individual user account to run SWSI software.

Also, the following TDRSS designators should be used when scheduling SN passes:

Number	Name	GREAS/STK	SWSI
TDRS 3	TDZ	275	275
TDRS 4	TDRS East	041	TDE
TDRS 5	TDRS West	174	TDW
TDRS 6	TDS	047	TDS
TDRS 8	--	171	171

Use of TDRSS 1, 2 and 7 is not permitted. TDRSS 9 and 10 are currently in on-orbit testing and will be added to the SN later.

Note: Updates to the TDRSS system status will be made as available per White Sands Network Advisory Messages (NAMs).

## 7.8 Space Network Pass Scheduling – SWSI Login

This procedure will explain how to login to SWSI.

### Procedure Summary

1. Login to an appropriate MOC machine, either in the Scheduling Room or the MOC, as appropriate.
2. `ssh -l <username> moc-server`
3. `cd projects/swsi` (within `/home/<username>/`)
4. `./runclient2.csh`
5. Enter username, password, pass phrase, and select operational mode.
6. Read and accept any dialog boxes that appear after login.

### Detailed Procedure

1. Login to a MOC Sun machine.
2. From a local terminal, ssh to moc-server. Login as yourself by using the "-l" argument:

```
ssh -l <username> moc-server
```

If you do not include the -l argument with your username, you will not be able to ssh into moc-server. You must use `-l <username>`.

3. Once on moc-server, change directory to the SWSI program directory:

```
cd projects/swsi
```

4. Now run the most recent "runclient" script (currently runclient2.csh):

```
./runclient2.csh
```

Two windows will appear. The first of these is entitled "SWSI":



Figure 1: The SWSI console

The four connection states listed here should all be "Disconnected" at this point - that's fine.

The second window to appear is the "Connection Parameters Panel":

The image shows a software window titled "Connection Parameters Panel". It contains several input fields: "Host" with the value "150.144.213.13", "Port" with the value "4100", "User ID", "Password", and "PassPhrase". Below these fields are three radio buttons: "Normal operational mode" (which is selected), "Test (EIF) mode", and a checkbox labeled "Initiate Password Change?". At the bottom, there are labels for "Last login:" and "Number failed login attempts:", followed by "Login", "Logout", and "Done" buttons.

Figure 2: The Connection Parameters panel

5. We will now fill out the Connection Parameters Panel.

- a) In the "User ID" field, enter your SWSI user ID.
- b) In the "Password" field, enter your SWSI password. If this is your first SWSI login, or if the SWSI administrator has reset your account, get your password from a system administrator. You will be asked to change your password.
- c) In the "PassPhrase" field, enter the SWSI pass phrase exactly. Remember that spaces count, and the field is case sensitive.
- d) Prior to launch, we must select the "Test (EIF) mode" radio button. This is important, as the default selection is "Normal operational mode", which is what should be used for legitimate operational scheduling.
- e) If you want to force a change in password, check the "Initiate Password Change" checkbox.
- f) Finally, click the "Login" button.

6. You may get some dialog boxes to click through. Read and react to any of these appropriately.



## 7.9 Space Network Pass Scheduling – SWSI General Setup

This procedure will bring up all the windows and control panels you need to operate SWSI.

### Procedure Summary

1. Login to SWSI.
2. Open the Schedule Requests Summary window.
3. Open the Active Schedule Summary window.
4. Open the Alert Messages window.
5. Open a GMT Clock.
6. You probably don't want to open the About Box, but this step shows you how.

### Detailed Procedure

1. Once you login, you will see the SWSI main control panel appear toward the top of your screen. At least 2 of the connection states should have green "Connected" indications.



Figure 3: The SWSI Console after login is complete

2. Let's start pulling up some status screens. There are two main scheduling summary screens: the Schedule Requests Summary, and the Active Schedule Summary. In addition, we want to have the Alerts screen and a GMT clock.

The Schedule Request Summary shows you every Schedule Add Request (SAR) and other requests/messages that GP-B schedulers have submitted, and their current statuses. To display this screen, select the "Scheduling" pull-down menu, and click on the "Schedule Requests Summary" item.

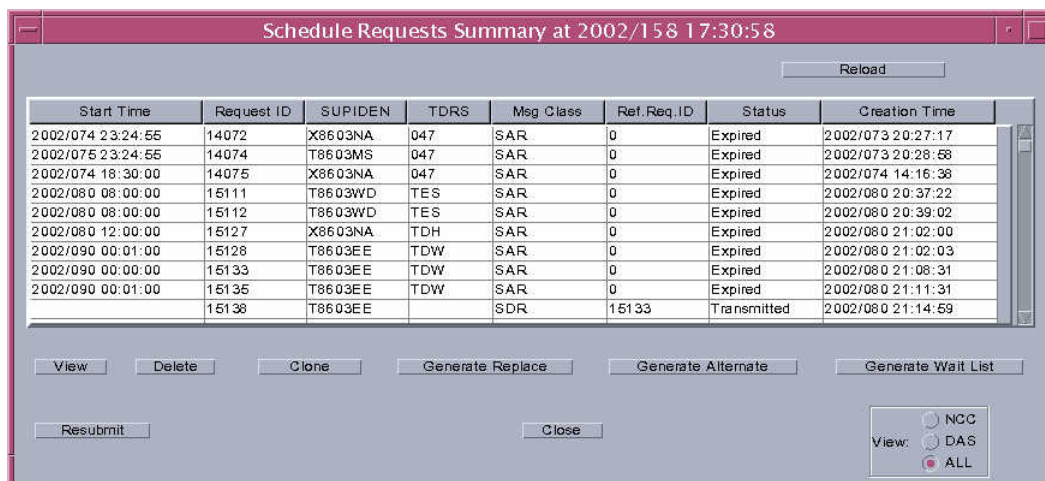


Figure 4: The Schedule Requests Summary window

The data table shows some key elements about each service message:

- Start Time: Scheduled start time in GMT.
- Request ID: The unique SWSI request ID for this request, which is assigned when you initially submit the SAR.
- SUPIDEN: The "support identification" for this request. These will be determined for the mission in the future. At the time of this writing, we are using "T8603EE" for testing.
- TDRS: Which TDRS satellite the SAR is requesting to use.
- Mgs Class: The possible options are:
  - SAR - Schedule Add Request. What we submit to SWSI when initially requesting resources.
  - RR - Return Request. A message sent back from SWSI informing us of an invalid or declined result.
  - SDR - Schedule Delete Request. Something we submit when we wish to delete a service request.
  - ASAR- Alternate Schedule Add Request. A request that references a SAR and is attempted to be scheduled only if the primary (referenced) SAR is denied.
- Status: The current status of the request. The possible options are:
  - Transmitted - The request has been sent in for processing.
  - Invalid - The request is not valid.
  - NCCQueued - The procedure has been taken into the system for processing.
  - Granted - The request has been granted.
  - Rejected - The request has been rejected due to a scheduling conflict with other competing resources.
  - Completed - The request has occurred, and the service is complete.
  - Deleted - The service request has been deleted. Presumably, only we can delete our own requests.
  - Expired - An ill-formed request that was not deleted will eventually expire when its slated start time has come and gone.
  - Creation Time - When the SWSI user (or system) created the service request.

From this window, you can click once on a service line item to select it, and then perform any number of actions:

- View: Display that SAR.
- Delete: Send a Delete Request to remove the SAR from processing.
- Clone: A quick way to submit a new SAR using the selected SAR as a template.
- Generate Replace }
- Generate Alternate } We do not use these options.
- Generate Wait List }

Let's view a SAR. Highlight a SAR on the Schedule Requests Summary window and then click the "View" button.

Figure 5: Create SAR window

We will become more familiar with this later. Click the cancel button to close the window and return to the summary window.

If you like, you can click any of the column labels to re-sort the message table according to that column's data. The default sort is by Request ID.

3. The Active Schedule Summary shows you every service request that's been "Granted" and has not yet occurred. To display this screen, select the "Scheduling" pull-down menu, and click on the "Active Schedule Summary" item.

Pe... D/R	Start Time	Stop Time	Event ID	SUPIDEN	TDRS	USM Type	Number of Services	Prototype Event ID	S-Band PN Code	K-Band PN Code
	2002/161 22:40:00	2002/161 23:00:00	0055702	T8603EE	275	Fixed-Normal	3		71	71

Figure 6: Active Schedule Summary window

The data table shows some key elements about each service message:

- Pend D/R: notification that a Delete Request is pending for the service
- Start Time: Scheduled start time in GMT.
- Stop Time: Scheduled stop time in GMT.
- Event ID: Once a SAR is accepted, an Event ID is generated for granted service. Currently, the Event ID is based on the SAR Request ID.
- SUPIDEN: The "support identification" for this request. These are determined for the mission in the future. At the time of this writing, we are using "T8603EE" for testing.
- TDRS: Which TDRS satellite the SAR is requesting to use.
- USM Type: whether the User Schedule Message consists only of fixed parameters or contains several flexible parameters, and whether the service is for Normal, Premium, or Simulation support.
- Number of Services: The number of services contained in the coverage. (Services like "SSAF" and "Tracking")
- Prototype Event ID: If the event is based on a prototype event, that event ID will be listed here. If not, the field will be blank.
- S-Band PN Code: Pseudorandom Noise code used for S-Band modulation.
- K-Band PN Code: Pseudorandom Noise code used for K-Band modulation (not used by GP-B)

From this window, you can click once on an event line item to select it, and then perform any number of actions:

- Display: Display the event.
- Delete: Send a Delete Request to remove the event from processing.
- Generate Replace } We do not use this option.
- Close: Close this window.
- Save: Save the Active Schedule Summary data table to a comma-delimited text file.
- The View box has three radio buttons. Since we will be dealing only with the NCC, you could click either "NCC" or "ALL", but since "ALL" is selected by default, we recommend that you do not change this setting.

If you like, you can click any of the column labels to re-sort the event table according to that column's data. The default sort is by Event ID.

To view a service, click on one of the event line items and click "Display Service". This shows you a compact view of the upcoming event.

Service Display at 2002/158 18:05:56

Supiden: T8603EE Event ID: 0055702  
Start Time: 2002/161 22:40:00 TDRS: 275  
Stop Time: 2002/161 23:00:00 Prototype ID:  
S-Band PN Code: 71  
K-Band PN Code: 71

Service Type	SSC	Start Time	Stop Time	Link ID
SSAF	H93	2002/161 22:40:00	2002/161 23:00:00	1
SSAR	I95	2002/161 22:40:00	2002/161 23:00:00	1
TRKN	T90	2002/161 22:40:00	2002/161 23:00:00	

Parameters... Generate QCMR View Transitions Close

Figure 7: Service Display window

In this window is a table showing each requested service in the event. If you click on one and press the "Parameters..." button, you can get more information on that service. Here is one example.

SSAF Schedulable Parameters

SUPIDEN T8603EE SSC H93 Type SSAF

Fixed Parameters

SA Antenna: None  
Service Configuration: Normal User  
Power Mode: Normal  
User Interface Channel: W4G  
Maximum Data Rate: 2000 bps

Respecifiable Parameters

TSW Set ID:  
User Despun Antenna Type: No type  
Data Rate: 2000 bps  
Receive Frequency: 210640625 10 Hz  
Polarization: LCP  
Command Channel PN Modulation: Yes  
Doppler Compensation Required: Yes

Exit

Figure 8: Schedulable Parameters example: SSAF

4. The Alert Messages screen gives you a transaction log of all SWSI request and response activity and alerts you to upcoming events. This window will automatically appear when the first alert is generated after you login. To bring the window up manually, select the "Control/Monitor" pull-down menu and click on the "Alerts" item.

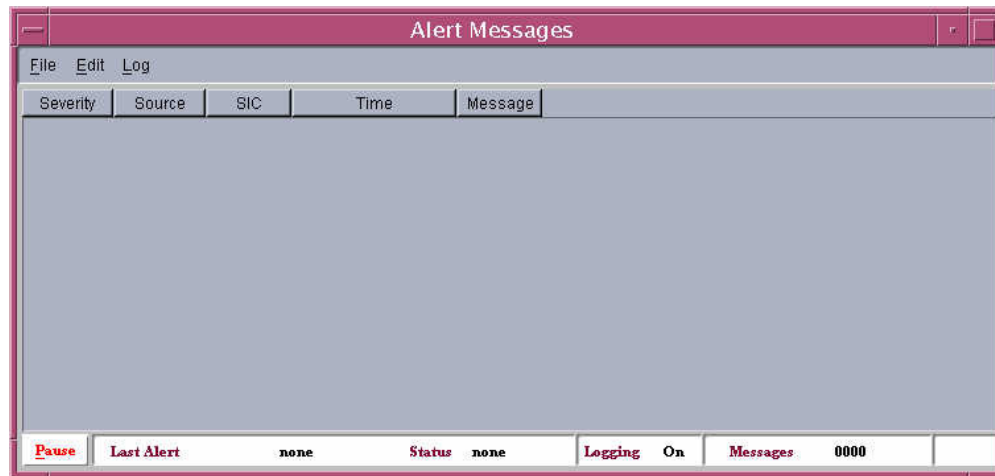


Figure 9: Alert Messages window

The lower left square of the screen shows "Pause" by default. To pause the alert screen (that is, to prevent it from scrolling), click on this button. Once you do, no more alerts will cause the screen to scroll by, and the "Pause" button will change to "Scroll". To resume normal event scrolling, click "Scroll". The button is a little confusing, as it reflects the state you will invoke if you click it, rather than the current state.

As with the other data tables, events in the alert window can be reordered if you click on the column labels.

You can print the alerts by selecting the File menu and clicking the "Print" item.

All alerts are by default logged to a file. To see which log file you are writing to, select the Log menu and click "Set File". As you can see in the Log menu, the "Write" option is toggled on by default.

5. By selecting the "Time" menu and clicking "GMT Clock", you will get a real-time incrementing GMT clock in a small window on your screen.

6. This concludes the initial setup of windows that is useful to operating SWSI. In case you want to check the version of SWSI that you are running, select the Help menu and click "About SWSI". As of this writing, we are on Build 3, Patch 14.



Figure 10: About SWSI window

## 7.10 Space Network Pass Scheduling – Building and Submitting a SAR

Here are the properties you'll need to build SARs. These properties were verified during the SWSI testing in late May 2002. Further testing and verification will be performed in June 2003. Changes to these properties will be made as available.

SUPIDEN:	x8603xx (Spacecraft ID = 8603)
Single-Access SSCs:	See Appendix A (Hxx, Ixx, T3x, T5x, T7x, T9x)
Multi-Access SSCs:	See Appendix A (Axx, Bxx, T2x, T4x, T6x, T8x)

Once you know which passes you want to schedule and you are confident that the schedule meets mission requirements, proceed.

### Procedure Summary

1. Login to SWSI and complete the general setup.
2. Open the Create SAR window.
3. Fill out the basic properties.
4. Fill out the timing properties.
5. Add SSCs. Nominal: forward, return, tracking, all lasting the whole period.
6. Edit SSCs.
7. Submit the SAR.
8. Confirm it was accepted for processing (not rejected with an error).

### Detailed Procedure

1. Login to the SWSI system and complete the general setup so that you have your basic window layout in place.
2. Select the Scheduling menu, click on the "NCC" option, and its sub-option: "Create Schedule Add Request". The "Create SAR" window should appear.

Message Class: SAR, Request ID: 0000000, SUPIDEN: T8603EE, TDRS: 047, Referenced Request ID: None, Priority: 1

Explanation: [Empty text area]

Prototype Events (selected) SSC (Add)

Nominal Event Start Time: 2002 158 21 48 49

Plus Tolerance: 00 00 00

Minus Tolerance: 00 00 00

Freeze Interval: [Empty]

Use TSWs to constrain scheduling [ ]

Wait List if unscheduled [ ]

Buttons: Remove, Move Up, Move Down, Remove All, Modify Service..., Parameters..., Submit, Cancel

Figure 11: Create SAR window

3. Now we need to fill out the form. It is critical that all fields be completed properly. Start at the top and go down:

- SUPIDEN - From the pull-down list, select the appropriate option.
- TDRS - From the pull-down list, select the TDRS satellite that you need.
- Priority - This defaults to 1. Unless there is an explicit reason to downgrade the priority (there should not be), keep it at 1.

4. Now we move to the next block of fields. Let's start with the right side first. Fill out these fields:

- Nominal Event Start Time: The format for this field is YYYY DDD HH MM SS. You can click into each box and type, or click in each box and use the up and down arrows to adjust the value one step at a time.
- Plus Tolerance }
- Minus Tolerance } We do not use these values.
- Freeze Interval }

In addition, there are two checkboxes:



- Use TSWs to constrain scheduling: We do not use TDRS Scheduling Windows (TSWs) at this time.
- Wait List if unscheduled: Sometimes, a request will be rejected because a TDRS user with higher priority than GP-B will have a request in for a conflicting timeslot. On the off chance that this user deletes the event that's causing the conflict, the SWSI system consults its "wait list" to determine if any events can be scheduled. Use this checkbox to add an event to a wait list.

5. With the right-middle section filled out, go to the middle-left block. At the top of this block, you'll see two radio buttons:

- Prototype Events: At some point in the future, we will set up Prototype Events for different kinds of passes. Prototype Events simplify the scheduling process for SN coverage with repeating duration and service types (forward, return, and tracking). No prototype events are currently configured for GP-B.
- SSC: Service Specification Codes (SSC). These codes specify exactly what kind of service we want from a large menu of choices.

During SWSI testing, we will be selecting the SSC radio button and building events from the valid SSC combinations listed in Appendix A. In general, a nominal pass should have:

- One forward SSC, lasting the whole period.
- One return SSC, lasting the whole period.
- One tracking SSC, lasting the whole period.

Note that the duration of the event is determined simply by how the SSCs stack out. If they all start at time 00:00 (mm:ss) and all last, say, 20:00, then your event will last 20:00.

Click on the first SSC you need for the event type (single or multiple access). You may need to scroll down quite a ways to locate the SSC. Once you highlight it, the "Add" button above, next to the radio buttons, is enabled. Click it once. You should now see that SSC added to the bottom portion of the screen.

Repeat this for each of the other SSCs you need. You should now have a screen that looks something like this:

**Create SAR**

Message Class: SAR Request ID: 0000000

SUPIDEN: T8603EE TDRS: 047

Referenced Request ID: None Priority: 1

Prototype Events: ☒ SSC ☐ Add

Name	Type
T80	TRKN
T81	TRKN
T82	TRKN
T83	TRKN
T84	TRKN
T85	TRKN
T90	TRKN
T91	TRKN
T92	TRKN
T93	TRKN
T94	TRKN
T95	TRKN

Nominal Event Start Time: 2003 100 12 12 00

Plus Tolerance: 00 00 00

Minus Tolerance: 00 00 00

Freeze Interval: 00 00 00

☐ Use TSWs to constrain scheduling

☐ Wait List if unscheduled

Number	SSC	Service Type	Nominal Start	Nominal Duration	CSN	SBSN	(+)Tolerance	(-)Tolerance	Minimum Duration
1	H93	SSAF	00:00:00	00:01:00					
2	I96	SSAR	00:00:00	00:01:00					
3	T90	TRKN	00:00:00	00:01:00					

Remove Move Up Move Down Remove All Modify Service... Parameters...

Submit Cancel

Figure 12: Partially completed SAR

6. Now that you've added SSCs into the lower panel, it's time to specify the start times and durations. Note that the event start time was set by you in step 4. By defining the durations of each SSC, you define the duration of the entire event. Observe the following SWSI restrictions:

- SSC nominal start time "00:00:00" (HH:MM:SS) is relative to the Nominal Event Start Time. At least one event **MUST** start at time 00:00:00.
- There can be no time segment during the event duration when no SSCs are occurring. That is, if you have two 5-minute SSCs going from 00:00:00 to 00:05:00, and a third 5-minute SSC going from 00:10:00 to 00:15:00, your SAR will be rejected because nothing is happening between them.

The bottom data panel contains information on each of the SSCs you added in the previous step. The fields are:

- Number: The order in which you added them to this list.
- SSC: The Service Specification Code itself.
- Service Type: The service type associated with the SSC.
- Nominal Start: The time relative to the Nominal Event Start Time.
- Nominal Duration: The duration the SSC will last.

- CSN: Coupled Service Number, used when the service start time is relative to another referenced service (we do not use this feature).
- SBSN: used when service start/end times are relative to another referenced service (we do not use this feature).
- (+)Tolerance: flexibility for scheduling service start time (we do not use this feature).
- (-)Tolerance: flexibility for scheduling service start time (we do not use this feature).
- Minimum Duration: flexibility for scheduling service duration (we do not use this feature).

Click on the first SSC in the list. You should see a number of buttons below the data table become active. They are:

- Remove: This removes the SSC from the list.
- Move Up: Move this SSC up in the list. Use this if you want to reorder your SSCs more logically.
- Move Down: Move this SSC down in the list. Use this if you want to reorder your SSCs more logically.
- Remove All: Clear out your list of SSCs.
- Modify Service: Use this to modify the various properties of the SSC.
- Parameters: Schedulable parameters for the Service Type.

Now click the "Modify Service" button. You should see an "Edit Service Flexibility Parameters" window for this SSC. Here's an example:

Edit Service Flexibility Parameters	
SUPIDEN	T8603EE
Service Number	01
SSC	H93
Request ID	0000000
Nominal Start	00 00 00
Nominal Duration	00 01 00
Plus Tolerance	
Minus Tolerance	
<input type="checkbox"/> Minimum Duration	
<input type="checkbox"/> Coupled Service Number (CSN)	
<input type="checkbox"/> Service Bounded By Service Number (SBSN)	
[Update] [Cancel]	

Figure 13: Edit Service Flexibility Parameters

The following parameters can be adjusted:

- Nominal Start - The time the service will begin.
- Nominal Duration - The duration the service will run for.
- Plus Tolerance – flexibility (+ time) for service start.
- Minus Tolerance – flexibility (- time) for service start.
- Minimum Duration – shortest allowable coverage period.

- Coupled Service Number (CSN) – used to specify service times relative to a reference service (see above).
- Service Bounded by Service Number (SBSN) –used to specify service times relative to a reference service (see above).

To adjust a parameter, click in the text box containing the numbers, which are in the format HH:MM:SS. Once you click in a box, you can type your replacement number or use the related up/down arrows to adjust the value one step at a time.

With your values updated, you should see the changes reflected in the data table.

The 'Create SAR' window contains the following fields and controls:

- Message Class:** SAR
- Request ID:** 00000000
- Explanation:** (Empty text box)
- SUPIDEN:** T8603EE
- TDRS:** 047
- Referenced Request ID:** None
- Priority:** 1
- Prototype Events:** ☐ Prototype Events, ☒ SSC,
- Event List:**

Name	Type
T80	TRKN
T81	TRKN
T82	TRKN
T83	TRKN
T84	TRKN
T85	TRKN
T90	TRKN
T91	TRKN
T92	TRKN
T93	TRKN
T94	TRKN
T95	TRKN
- Nominal Event Start Time:** 2003 100 12 12 00
- Plus Tolerance:** 00 00 00
- Minus Tolerance:** 00 00 00
- Freeze Interval:** [ ] [ ] [ ]
- ☐ Use TSWs to constrain scheduling
- ☐ Wait List if unscheduled
- Service Request Table:**

Number	SSC	Service Type	Nominal Start	Nominal Duration	CSN	SBSN	(+)Tolerance	(-)Tolerance	Minimum Duration
1	H93	SSAF	00:00:00	00:11:00					
2	I95	SSAR	00:00:00	00:11:00					
3	T90	TRKN	00:00:00	00:11:00					
- Buttons:** Remove, Move Up, Move Down, Remove All, Modify Service..., Parameters..., Submit, Cancel

Figure 14: Create SAR, ready to submit

7. When you have finished reviewing your SAR, click the Submit button at the bottom of the window. You should see an Alert indicating that the SAR has been transmitted to the processing center.

8. If you've built an improper SAR, you should get an error message back within a few seconds to a few minutes. If this happens, review your SAR and build a replacement SAR. You cannot edit and resubmit a rejected or invalid SAR. If the SAR is properly formatted and if it is not a premium request (which is when you schedule the start time a couple hours or less within the time you are actually submitting the request), you will see it move into

"NCCQueued" status, where it will remain until the processing center processes the request and publishes a forecast schedule.

## **7.11 Space Network Pass Scheduling – Deleting a SAR**

Once you know how to build a SAR and know your way around the basic windows of SWSI, deleting is very simple. Obviously, you should be certain that you're deleting the right request before implementing this procedure.

1. Login to SWSI and complete the general setup.
2. Open either the Schedule Requests Summary (see Figure 4) or the Active Schedule Summary window (see Figure 6).
3. Click on the schedule item you want to delete.
4. Click on the Delete button, located below the schedule items table. Accept any dialog boxes that pop up.
5. An SDR (Schedule Delete Request) is now filed. You should see some log entries to this effect.
6. Once the deletion is registered, the Schedule Requests Summary will register the change, and you will see a new entry for your SDR, which becomes part of the permanent record.

## 7.12 Space Network Pass Scheduling – Submitting a GCMR

This procedure is to be used in the overall process of SN troubleshooting and data rate manipulation, such as might be required when reacting to a possible Safemode reaction. For a complete list of GCMR message formats, see Section 8.2 of the Interface Control Document Between the Network Control Center Data System and the Mission Operations Centers (451-ICD-NCCDS/MOC Rev 1, June 1999).

1. To change the expected telemetry and command data rates while in the middle of a pass, first open SWSI, and login. (Note: If it is not possible to send a GCMR for the existing pass for some reason, a new SN pass can be scheduled. Consult the section titled Space Network Pass Scheduling – Building and Submitting a SAR, which explains how to schedule new passes. Consult the Flight Director for decision guidance.)
2. Use the "Control/Monitor" menu, and select the "User Performance Data (UPDs)" item.
3. On the UPD screen, you will see two line items, one for your scheduled Forward Service, and one for Return. On the "GCMR" column of this table, each line item will have a blank button area. Click the service you need to change.
4. "A GCM Menu" window will appear, with a pull-down menu. Select the "Service Configuration" option, and click Submit.
5. A GCMR window will appear in two parts. The top part contains fixed parameters, which cannot be changed. The bottom part contains reconfigurable parameters. The existing values will be shown on the left side of the window, and a corresponding text box for each value will be presented to the right. In the "Data Rate" field, type in the value you would like to change the data rate to, and click Submit.
6. The SWSI Alert Window should indicate that the GCMR has been received, and another message following it will show if it was accepted or rejected. If it was rejected, it will provide a "reason code" which you can use in consultation with SWSI documentation to determine the cause.
7. Repeat this process for any additional services schedule for the given contact, as needed.

## 7.13 Space Network Pass Scheduling – Printing Schedules

### Forecast Schedule Printing

1. Login to SWSI and complete the general setup.
2. Open the Schedule Requests Summary window (see Figure 4).
3. Enlarge the window to take up as much vertical space as possible.
4. Scroll the window so that the first request for the period of time you are interested in is at the top of the window.
5. Right-click on the Solaris desktop. This will bring up a menu. Select the Snapshot tool. A control window will appear.
6. In the snapshot tool's control window, click the "hide" dialogue box. It will default to an 8-second delay. This is fine.
7. Use the snapshot tool to take a snapshot of the Schedule Requests Summary Window. A new window with the resulting image will appear.
8. Use the menus on this new window with the snapped SRS window to print a copy of this window.
9. If there are additional entries on the SRS table that you need printed, scroll down on the SRS table and repeat steps 5-8.
10. Close the snapshot windows.

### Active Schedule Printing

1. Login to SWSI and complete the general setup.
2. Open the Schedule Requests Summary window (see Figure 6).
3. Click the "Save" button. Select a sane place to save the file, and a sensible filename.
4. From a local xterm, `cd` to the directory where you saved the file.
5. To print the saved file, type: `lpr <filename>`



## 7.14 Ground Network Pass Scheduling – Timeline & Formats

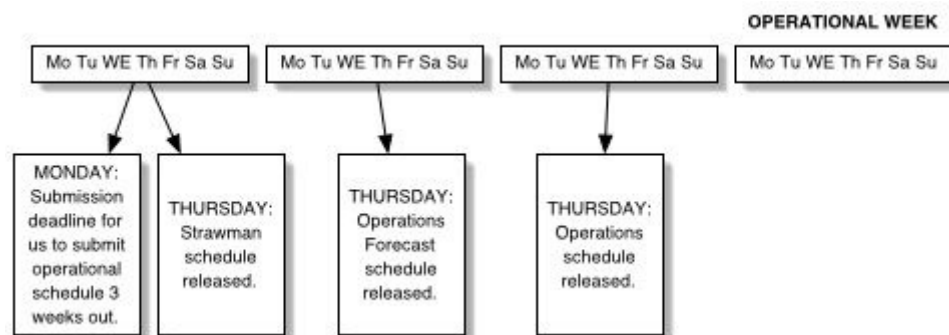
We submit our schedule requests electronically via ftp to the GP-B mailbox on the GN system. The Mission Planning Lead has the associated details on this mailbox -- ftp IP address, user name, and user password -- and will post these in the MOC.

### Schedule Timeline

The timeline for GN scheduling is as follows:

- We submit our forecast schedule by Monday, 3 weeks in advance of the operational week (i.e., the week for which we're forecasting events).
- The GN distributes its schedules on THURSDAYS:
  - Strawman -- ~2.5 weeks before operational week begins
  - Operations Forecast -- ~1.5 weeks before operational week begins
  - Operations -- ~0.5 weeks (4 days) before operational week begins

In graphical form:



See Appendix F for a more detailed GN Scheduling Timeline

We submit our schedule requests electronically via ftp to the GP-B mailbox on the GN system. (Specifics on FTP account access are available from the Mission Planning Lead.)

All of our requests are submitted via comma-delimited ASCII files. These GN contact request files will be generated by software to be developed (MCR#62). The request files must follow specific conventions:

- File naming: <X><USR>b<YEAR><DOY>d<##> where
  - <X> = i (initial/specific forecast), u (update to schedule)
  - <USR> = gpb
  - b = begin date for schedule
  - <YEAR> = 4-digit year (e.g., 2002)
  - <DOY> = day of year (e.g., 001-366)
  - d = duration
  - <##> = duration time in days (e.g., 07 for 7-day forecast schedule)

For example:

igpbb2002161d07 for the GP-B initial 7-day forecast covering DOYs 161-167 (10-16 June) in 2002.

NOTE: NO .TXT OR OTHER SUFFIXES SHOULD BE ATTACHED TO THESE FILENAMES.

- File format: SAT,PROJECT,FACILITY,BOT,EOT,SAC,ORBIT,BAND where
  - SAT = support ID – we leave this blank, as WSG generates this
  - PROJECT = user ID (i.e., GPB)
  - FACILITY = station ID (e.g., SGS)
  - BOT = beginning of track (i.e., AOS time in yyyydoyhhmmss format)
  - EOT = end of track (i.e., LOS time in yyyydoyhhmmss format)
  - SAC = support activity code (e.g., T1)
  - ORBIT = orbit number (see FDF PSAT described below)
  - BAND = band designator (e.g., S1)

For example:

A 10-minute event on Svalbard Ground Station would look like the following:

as submitted to GN: ,GPB,SGS,2002161111234,2002161112234,T1,1,S1  
 as confirmed by GN: W0223-2096,GPB,SGS,2002161111234,2002161112234,T1,1,S1

Mission Planning will submit an initial 'i-file' of requests and get back from the GN an 's-file' (s = schedule) of confirmed events. We then use the latest 's-file' as the basis for generating any updates (e.g., to add an event, we would copy the 's-file' to an appropriate 'u-file' and edit this file to insert the add request or delete a confirmed

request). For all requests that would occur within the next 24 hours (i.e., "realtime" requests), the protocol is to call WSG first before submitting the request in the usual manner via u-file.

NOTE: As mentioned above, regardless of when an update is requested -- e.g., two weeks in advance of the operational week or 7 days into it -- all updates are based on the last confirmed s-file from the GN.

- Determining orbit number using a PSAT (Predicted Site Acquisition Tables)
  1. FDF will automatically update the PSAT every other week during IOC. Additional updates may be requested when necessary.
  2. Download the PSAT file from the FDF website: go to [http://mmfd.gsfc.nasa.gov/prod\\_center](http://mmfd.gsfc.nasa.gov/prod_center) and select the PSAT product for GP-B. Save the file to disk and transfer to the moc-server.
  3. Find the ground network view period corresponding to the pass to be scheduled and record the orbit number for use in GN schedule requests as described above.

## 7.15 Ground Network Pass Scheduling – Forecast Schedule Procedure

This procedure should be used during the forecast schedule period.

1. Generate forecast schedule in 'i-file' format (see 7.14 above).
2. Submit forecast schedule via ftp:

```
ftp 129.165.0.134
user: GPB
password: <PASSWORD>
ftp> cd in
ftp> put <I-FILE>
ftp> bye
```

NOTE: input directory - /wotrsfts/gpb/in

3. GN will confirm requests and distribute strawman schedule via email (@relgyro) and an ftp file located at /home/wotis/incoming-schedules.

WSC GN contact information:     phone – (505)527-7123  
   email – wsg-wsc@ncc-comm.gsfc.nasa.gov

## 7.16 Ground Network Pass Scheduling – Schedule Change Procedure

This procedure should be used when changes are required with more than 24 hours notice.

1. Generate modifications to forecast schedule in 'u-file' format (see above).  
Remember to use the last confirmed 's-file' as the basis for any updates.
2. Submit the updates via ftp:

```
ftp 129.165.0.134
user: GPB
password: <PASSWORD>
ftp> cd in
ftp> put <U-FILE>
ftp> bye
```

3. GN will confirm requests and distribute strawman schedule via email (@relgyro) and an ftp file located at /home/wotis/incoming-schedules.

## **7.17 Ground Network Pass Scheduling – Realtime Schedule Requests**

This procedure should be used when changes are required with 24 hours or less notice.

1. Call WSG to give them a "heads up" and discuss any related issues.
2. Follow the steps in 'Ground Network Pass Scheduling – Schedule Change Procedure' above.

Note: for more details on Realtime Schedule Requests, see WSC NAM #762.

## **7.18 SN and GN Post-Request Activities**

ERROR: syntaxerror  
OFFENDING COMMAND: --nostringval--

STACK:

```
/
(http://gpbops.stanford.edu)
/URI
/URI
/S
-mark-
/Action
[0 0 0 ]
/Color
[0 0 0 ]
/Border
[383.25 593.25 518.25 611.25 ]
/Rect
-mark-
```