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Gravity Probe B – Relativity Mission

ATC Mini-Sim Plan
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Goals and Success Criteria

The purpose and objectives of the ATC mini-sim are the following:

1. Primary Goals
 - c. Test end-to-end Orbit Determination/Orbit Trim (OD/OT) interface using simulated GPS solutions.
 - d. Properly configure the Vehicle Environment Simulator (VES) to verify ATC tasks and procedures that were slated for Sim4.
2. Secondary Goals
 - c. Test previously unsimulated ATC procedures (if ready): (1) Mass Trim; (2) increasing spacecraft roll rate.
 - d. Test GSS turn-on procedures (if ready).
 - e. Miscellaneous
 - i. Checkout newly approved flight procedures.
 - ii. Exercise the GSS simulator.
 - iii. Exercise the ParamGen interfaces for Orbit Trim, Ephemeris Update, and GPS Coefficient Update.
 - iv. Provide flight team training for select Stanford REEs as well as the general Operations Team (Realtime, Mission Planning, Orbit Determination, Data Processing, Ground Data Systems, and Flight Directors).

The associated success criteria for this mini-sim are the following:

Run through basic ATC functions from the Sim4 Timeline: ATC subsystem turn-on and initialization, command and telemetry functions, attitude capture, guide star acquisition (i.e., dwell scan), and neighbor star maneuvers.

Conduct end-to-end orbit determination and trim using GPS data from the WellNav simulator.

Support verification of the following Project MOC requirements:

- MOC-048 Orbit Accuracy for Science – Help verify orbit determination to 25 m position and 7 cm/sec velocity, as well as consistency with the GPS receiver for orbit trim support.
- MOC-064 Data Processing Interface – Help verify the interface with telemetry data processing using realistic GPS data (not done to date).
- MOC-065 Parameter Generation Interface – Help verify the interface between OD and ParamGen, including orbit trim.

In addition, this mini-sim will test the orbit trim capability with realistic data in an end-to-end fashion, which is something that has not been done to date.

Discussion

The ATC mini-sim will be conducted over a 12-hour period on 11 October 2002 beginning at ~2pm PDT and using the ITF simulators. Pre-launch setup will begin at ~2pm on that day, with simulated launch scheduled for 4pm (2300 GMT); no launch go/no-go poll will be conducted.

To satisfy the primary goals of this mini-sim, after launch we will exercise the basic mission timeline for deployment and SV initialization, including the early-orbit ATC functions that were not properly exercised in Sim4 due to the VES misconfiguration problem. We will also make use of the WellNav GPS simulator to determine the orbit, calculate and update the Orbit Trim parameters, and verify the Orbit Trim direction. If the proper SPC templates and procedures are ready, for the secondary goals of the mini-sim we will exercise the Mass Trim and changing roll-rate scenarios, as well as the GSS box turn-on functions. We will be using MSS 3.3.2, and may have to use unapproved templates for some of the ATC and GSS work, which is acceptable for this exercise.

During the mini-sim we will also exercise four ParamGen interfaces: Launch Times, Ephemeris, GPS Coefficients, and Orbit Trim. We will also periodically switch between the Default and Science telemetry formats so as to gather GPS data sufficient for the orbit determination work, as well as for use by the Science Team for subsequent analysis. Due to time constraints, there will be no daily status meetings during the mini-sim.

For communications purposes, the following e-mail aliases will be used:

gpbsim – Used pre-sim by the Sim Director to provide general information to mini-sim participants.

ops – Used by the Operations Team for general e-mail correspondence.

All relevant on-line materials from this mini-sim (e.g., documents, load files, etc.) will be archived in the simulations area of the itar folder on the DBM drive:

`/home/dbm/itar/simulations/ATC_mini-sim`

Mini-Sim Schedule of Events

The basic course of events for this mini-sim is outlined in Table 1 below.

Table 1: General sequence of events for ATC mini-sim.

MET (Hours)	Activities and Events				LOAD
	OD/GPS	ATC	GSS	Other	
-2					Setup
-1	PG: Load GPS Almanac			PG: Load Launch Times	
0				LAUNCH	
1	PG: Update Ephemeris				PING001 (Deployment)
2	GPS On		GSS On	SSR Dump #1	
3	32k Science Format			SSR Dump #2 (Timely!)	PONG002 (SV Activation)
4	GPS-based OD	Mass Trim		Ground Processing of SSR Dump #2 (GPS Data)	
5				SSR Dump #3	
6				PG: Orbit Trim; Load and Enable PING 003	
7		Rollrate Change			
8		Orbit Trim			PING003
9					
10				SSR Dump #4	

Resources Required

This mini-sim will require the following resources:

1. Facilities -- All of these are existing resources, except for the WellNav GPS simulator, which has been moved into the ITF for ~2 weeks to cover its setup, checkout, and use in the mini-sim:
 - a. ITF spacecraft and payload simulators, including the VES and WellNav GPS simulators
 - b. MOC facilities and equipment
2. Functions/Personnel (all full-time unless indicated otherwise):
 - a. REEs: ATC, Nevitt and Young; GPS, Shestople; GSS, Hipkins
 - b. Operations Team:
 - i. Realtime (RT): 2 TBD (per Campo)
 - ii. Mission Planning (MP): Picard, Newquist
 - iii. Orbit Determination (OD): Galal, Vanrenen, Walsh
 - iv. Data Processing (DP): Mullins, Patterson
 - v. Ground Data Systems (GDS; on call only): Sharbaugh, Wade

- vi. Flight Directors (FD): 2 TBD (per Smith)
- c. Sim Team: Stroozas, Campo (~8 hours consulting), O'Loughlin (~8 hours consulting), other TBD FDs (per Smith)
- d. Miscellaneous support:
 - i. ITF simulator and FEP data transfer – TBD, 50% (per Campo)
 - ii. WellNav setup and integration into ITF – Campbell (~4 hours) and Shestople
 - iii. GSS simulator support – TBD, 50% (per Hipkins)
 - iv. VES training/support – Kirschenbaum (~4 hours or as required)

Assumptions and Ground Rules

The following ground rules and assumptions will be in effect during this mini-sim:

All operations will be conducted as per flight.

Only approved and configuration-controlled SPC command templates and procedures shall be used for all activities run during Sim4. For the new ATC and GSS activities, it is acceptable to use unapproved templates and procedures for this exercise; QA will control the situation so as to not leave mixed approved and unapproved templates on the PODs.

All CSTOL procedures to be used will be pre-loaded onto the PODs.

The FD will ensure the maintenance of a status board showing a variety of TBD information.

Personnel not specifically on duty will be available by phone or pager.

All personnel will adhere to the existing L&AP and Flight Rules documents.

The Sim Team will act as NASA elements: FDF, SAFS, and SN/GN.

Anomalies and Contingencies

Since this will be a first-time run for most of the core activities supporting the goals of this mini-sim, the Sim Team will not introduce any significant planned engineering anomalies. It may, however, introduce operational anomalies in order to exercise the response of the Operations Team.