Title: GFFC Experiment Progress

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The GFFC instrument was delivered to MSFC on August 4, 1983, and moved to the clean room, where the electronic connections were made and the instrument was powered up. Several problems were apparent upon attempting to execute a scenario for the first time. The control panel indicated an oil leak and switched to the standby mode. The UV cover was removed to inspect the leak detection system located on the oil bellows. Repeated measurements showed no oil leak was occurring, but the switch had been incorrectly positioned. The leak detection system was temporarily overridden in order to operate the instrument. After the UV cover was replaced, the instrument was charged with GN_2. By the next day most of it had leaked out. An inspection showed the leak was occurring through two electrical connectors. The connectors were repotted with a more appropriate compound.

In mid-August the GFFC was moved to the vibration facility where it was tested to flight levels on all three axes. This was the third vibration test. The first one several years ago was not successfully passed because a fracture in the data annotation housing occurred. The second test was successful. However, subsequent redesign invalidated this test, and a third vibration test was required. Afterward the instrument was returned to the clean room, and the turntable was removed in order to replace the silicon oil. The oil had inadequate photochromic dye dissolved in it, and the tracer dots had a short lifetime.

The Spacelab 3 crew received training on the operation of the GFFC instrument. The crew included payload specialists Mary Helen Johnston, Eugene Trinh, Lodewijk van den Berg, and Taylor Wang as well as mission specialists Norm Thagard and Don Lind, and pilot Fred Gregory. The training sessions were conducted by Fred Leslie and George Fichtl who briefed the crew on the science issues addressed by the experiment and gave a description of the hardware. The next day, the crew assembled in the clean room and operated the instrument. Training was also performed at KSC during the Level IV Mission Sequence Test. Additional training will be conducted with a GFFC simulator at MSFC's Payload Crew Training Complex.

During October, the GFFC instrument successfully completed the out-gas test and acoustic test at MSFC, completing the instrument's flight qualification. The final ground science tests were conducted and the observations were reviewed with PI Prof. John Hart. The results of these tests were used to finalize the flight experiments to be conducted on-orbit. The scenarios were loaded into GFFC's memory, and some were run on the ground.

The GFFC is programmed for 59 experiments totaling more than 200 hours. Twenty experiments are related to the dynamics of the solar atmosphere. In general these are characterized by a rotating hot isothermal inner sphere and a relatively cool isothermal outer sphere. Fourteen experiments model the Jovian atmosphere having an unstable radial temperature gradient as well as a latitudinal temperature gradient. Stratified spin-up in a hemispherical shell comprises 10 experiments. This is a more basic experiment in fluid dynamics which examines the time-dependent motion of a fluid initially at rest reacting to the sudden start of rotation of its container. The process is further complicated by imposing a radially stable temperature gradient which suppresses radial motion. Nine general experiments examine the onset of convection for various Rayleigh and Taylor numbers. For a particular rotation rate and radial temperature gradient, the Rayleigh number will be gradually increased by increasing the effective gravity until the initiation of convection begins. Finally, six experiments are related to ocean circulation in that the fluid is stably-stratified in the radial directions, and the fluid motion is driven by a latitudinal temperature gradient.

Because of continued false-alarms by the oil leak detection system, the turntable of the GFFC was removed from the instrument housing and a new detection system was installed on the two accessible expansion bellows. The turntable was then reinstalled and functionally tested with no problems. A helium leak test was then performed to test the instrument's ability to retain gaseous nitrogen. The results of this test showed no significant leakage.

The GFFC Pre-Ship Review was held on January 5, 1984. Representatives from each lab presented materials summarizing their discipline's evaluation of the GFFC instrument. There were no open items for the experiment and the Review Board approved shipping the instrument to KSC. The GFFC was shipped the next day. A management decision was made not to perform any post-ship functional tests of the instrument.

Experiment emphasis now focuses on Spacelab integration and mission planning. A meeting of the Investigator's Working Group was held January 18-20. GFFC PI Dr. John Hart presented his plans for POCC (Payload Operations Control Center) operations and contingency procedures. Details of POCC training and familiarization were also discussed.

Dr. Fred Leslie travelled to KSC to support the GFFC functional test. The instrument is installed in Rack 11 and is mounted on the Spacelab floor along with the other experiments. The purpose of the test is to verify the interfaces between the Spacelab and the individual experiments. Some problems did arise. The turntable did not rotate initially as commanded. Troubleshooting traced the problem to some broken wires in a connector behind the electronics box. The cable was repaired, and the turntable performed as commanded. A second problem was the inability of the GFFC time code generator to remain synchronized with the Orbiter's Master Timing Unit although it would do so with an independent source. Rather than take the time and risk of removing the electronics box, it was decided to allow the GFFC to run on iternal timing and have a crewman note the Mission Elapsed Time of the start of each scenario.

Also during March, the Spacelab 3 Mission Sequence Test (MST) was completed. Dr. Leslie particiapted in the operation of the GFFC experiment during the appropriate timeline runs. Because of time signal synchronization problems, the GFFC operated on its internal clock alone, and crew procedures were revised to allow correlation between the internal clock and the actual Mission Elapsed Time Clock. Although no anomalies were noted using this method, a Field Engineering Change (FEC) was requested to insure that the GFFC would not pick up spurious noise. The FEC directed a 75 ohms resistor to be placed across the timing input line. This was accomplished before the end of the MST, and additional runs were made with the GFFC. One Interim Problem Report was filed against the experiment. This resulted when a measured sphere temperature was $5^{o}C$ lower than commanded. A similar problem occurred during testing at MSFC and was traced to inadequate grounding. All the grounding measurements were repeated at KSC and were within tolerance. Although this under-temperature condition could be a result of operating the experiment in a 1g environment, it is being investigated further.