REQUIREMENTS FOR POLAR, WIND AND GEOTAIL SPACECRAFT OPERATIONS AND GROUND SYSTEM DATA HANDLING
Final, Revision – 6/24/2002

1. SCIENCE OPERATIONS PLANNING

Predictive Orbit and Platform Pointing Information

Requirements: The GSFC Flight Dynamics Facility (FDF) routinely generates separate orbit predict and attitude files for the Polar and Wind spacecraft. Predictive and definitive orbit and attitude files for Geotail are generated by ISAS of Japan. Currently, FDF generates 70-day predictive information every month or within ~72 hours after a maneuver. ISAS generates 30-day predictive and definitive files. The FDF and ISAS files contain orbital elements that must be processed further into daily files containing orbit and attitude parameters in several coordinate systems (inertial and geomagnetic) including the position and velocity of the spacecraft and reference positions of the Earth and Sun and other ancillary parameters. The use of common algorithms to calculate these parameters and the NSSDC CDF data format have been key to coordinated science activities between the different spacecraft. This product is heavily relied upon for science operations planning by the instrument teams and by the science community. The year-long predictive files are not processed further.

The large number of existing analysis programs, the wide use of automated scripts by instrument teams, and the NSSDC CDAWeb reliance on the CDF product mean that changes to file content, temporal length of the data, or to the file format would result in a need for significant software re-engineering at multiple institutions. There is a priority requirement for consistency in the content and format of the files. Processing to the orbital parameters file in CDF format and the subsequent delivery to the NSSDC/CDAWeb currently occur within 72 hours after receipt of the predict files from the FDF.

FDF Generated Science Planning Products

PO WA PRE	70-day Polar predictive attitude elements
PO WO PRE	70-day Polar predictive orbital elements
WI WA PRE	70-day Wind predictive attitude elements
WI WO PRE	70-day Wind predictive orbital elements

ISAS Generated Science Planning Products

GE WA DEF	30-day definitive attitude elements from ISAS
GE WA PRE	30-day predictive attitude elements from ISAS
GE WO DEF	30-day definitive orbital elements from ISAS
GE WO PRE	30-day predictive orbital elements from ISAS

PWG Generated Science Planning Products

PO AT PRE	Daily Polar predictive attitude parameters (derived from 70-day FDF file)
PO OR PRE	Daily Polar predictive orbital parameters (derived from 70-day FDF file)
WI AT PRE	Daily Wind predictive attitude parameters (derived from 70-day FDF file)
WI OR PRE	Daily Wind predictive orbital parameters (derived from 70-day FDF file)
GE AT DEF	Daily Geotail definitive attitude parameters (derived from 30-day ISAS file)
GE AT PRE	Daily Geotail predictive attitude parameters (derived from 30-day ISAS file)
GE OR DEF	Daily Geotail definitive orbital parameters (derived from 30-day ISAS file)
GE OR PRE	Daily Geotail predictive orbital parameters (derived from 30-day ISAS file)

Operating Environment for FY03: FDF should continue to supply 70-day predictive orbit and attitude for the Polar and Wind spacecraft on a monthly basis and, as required, after maneuvers. These files will be downloaded directly, via an automated ftp process, the re-engineered science data ftp site PWGDATA (pwgdata.gsfc.nasa.gov). Similarly, the predictive and definitive orbit/attitude files for Geotail will be auto-downloaded from ISAS directly to PWGDATA. The generation of day-long CDF format orbit and attitude products for science planning will occur via automated program execution on LEPPWG; the resulting files will be automatically transferred and stored on PWGDATA. The files will then be available to the science community via open ftp from PWGDATA.

Polar Despun Platform Pointing Planning

Requirements: The Polar imagers are pointed to geophysical phenomena that are not fixed with respect to inertial space and therefore require direction information that varies from orbit to orbit. Because several instrument teams require this information, it is efficient for one organization to generate the relevant parameters and supply the information to all interested parties. To date, the GSFC FDF and Polar project office have provided a high level of service maximizing imaging time with respect to varying Earth viewing windows, horizon sensor information, orientation of the sun, and any slow drifts of the spin axis.

Polar spacecraft platform pointing analysis will continue to be a high priority requirement for the imaging instruments, especially during the more complex operations anticipated during ecliptic normal spacecraft orientation. The large number of existing analysis programs and the wide use of automated scripts by instrument teams mean that changes to file content, the temporal length of the data, or to the file format would result in a need for significant software re-engineering at multiple institutions. There is a priority requirement for consistency in the content and format of the files.

Operating Environment for FY03: The Polar project office will retain the current methods of supplying Polar despun platform pointing information. FDF should continue to supply platform predictive information, as required. The generation of platform attitude files will continue to be the responsibility of Scott Boardsen and will be served from the PWGDATA open ftp server.

Submission Of Commanding Sequences By Instrument Teams

Requirement: Polar and Wind have a very high priority requirement for a conduit for the timely submission of instrument commands and command instructions to be used in the building of real-time and stored command loads for uplink to the Polar and Wind spacecraft. Error checking of these command uploads is recognized as an important function which is performed through automated software processing within the Polar and Wind MOC. The Wind portion of this commanding flow is very low as compared to Polar.

Several of the Polar and Wind instrument teams submit weekly commanding plans with few variations other than to the time tag. There are a few Polar instrument teams that submit daily varying, sometimes complex commanding plans due to changing position or attitude with respect to geophysical locations. The Polar/VIS instrument team generates and submits frequent microload commanding sequences that require further processing before insertion into the overall spacecraft commanding sequence. In the case of a future instrument anomaly, a Polar or Wind instrument team may require FOT assistance in the development of new commanding microloads to aid in instrument operation diagnosis.

The commands are sent to the project using email. Software on the SPOF7 machine (spof7.gsfc.nasa.gov, with backup spof8.gsfc.nasa.gov) strips the personal email header, validates the Flexible Image Transport System (FITS) format header to identify the file type, logs receipt, and then renames the file. The file naming convention is defined in the Interface Control Document (CSC/TR-90/6126, 514,4ICD/0790). The files extension identifies the type of information being transmitted:

.RQL: Command Request List files provide a list of time-tagged payload commands to be loaded into the daily stored command table.

.ACT: Activity files provide a list of commands to reside in the Command Management System (CMS) as command macros that can be referenced within RQLs. Activity files, though submitted through the SPOF infrequently, are an important mechanism for handling repetitive commanding sequences.

.MIC: Microprocessor Load files are binary files with a FITS header used to provide a memory load to an instrument processor.

.MAC: Macro files provide a list of commands to reside in the spacecraft onboard processor (CAP).

.RTC: Real time files provide a list of commands to be executed in real time by the FOT.

.TXT: Text files are not executable and are not command files. They contain instructions or information to be conveyed to the FOT. There is currently no known use of this file type by the instrument teams.

The processed files are placed in a polling directory. The CMS performs file reception by directory polling using a TCP/IP ftp protocol. The CMS validates the FITS header and/or the content of the file body of each type of file submit. A validation report for each type of file is generated and transmitted back to the SPOF machine for transmission to the originating instrument team. Receipt of this validation report provides the primary assurance that the command sequence has been accepted.

Operating Environment for FY03: The Polar and Wind instrument teams are expected to continue their current level of commanding. Reliable operation of the commanding conduit, within the Polar and Wind MOC is essential to the operation of the spacecraft with timeliness requirements at the direction of the flight operations director. The performance of system administration and system maintenance should, for cost saving purposes, be integrated with that of other Unix systems within the MOC.

2. FLIGHT OPERATIONS PLANNING

Preparation Of Spacecraft And Instrument Commanding Sequences

Requirement: Preparation of the stored command tables for Polar and Wind, including instrument microloads, is performed on the CMS within the MOC. The CMS system was re-engineered for reliability during FY02. The verification and preparation of Polar and Wind spacecraft and instrument commanding sequences remains a high priority requirement. Timely generation of these commanding sequences is essential to the operation of the spacecraft; timeliness requirements should remain under the direction of the flight operations crew.

.RQL: Command Request Lists for a given day are placed by the CMS in a time-ordered sequence to create a master Stored Command Table. The Stored Command Integrated Print Report, created within the CMS, is the record of the stored table.

.ACT: When an RQL contains a command to execute an Activity file macro, the CMS loads the command sequence stored in the activity files into the stored command table starting at the execution time called for in the RQL.

.MIC: The CMS software prepares the binary format Microprocessor Load files for uplink in real time to the instrument's processor.

.MAC: The content of the Macro file is loaded at a specific starting address in the spacecraft CAP macro heap. The macro files are kept in the CMS, together with a pointer table (referred to as the Macro Static Reference Table) indicating the starting addresses of the macros as they reside in the spacecraft processor. Macros are executed by commands in the stored command table.

.RTC: Real time files are processed by the CMS into a format appropriate for real time execution by the Flight Operations Team (FOT).

.TXT: These files are currently used during CMS testing rather than in routine operational support.

The CMS generates three reports that document the commands to be executed during upcoming contacts. The Integrated Print, the Combined Request List Report, and Daily Operations Schedule (DOS). The DOS includes planned activities, stored commands to be executed during the contact, and the command loads (and real-time commands) to be uplinked during the associated contact.

Operating Environment for FY03: The Polar and Wind instrument and spacecraft commanding load is expected to continue at current levels. Reliable operation of the Command Management System, within the Polar and Wind MOC, is essential to the operation of the spacecraft. Reliability and timeliness requirements are at the direction of the flight operations director. The re-engineered PC-based CMS system is expected to require less system administration and system maintenance than that required by the previous system. The performance of system administration and system maintenance should, for cost saving purposes, be integrated with that of other PC-based systems within the MOC.

DSN Antenna Pointing Information

Requirements: The GSFC Flight Dynamics Facility (FDF) routinely generates antenna pointing information for Polar and Wind for use by the DSN. Similar ranging information for the Geotail spacecraft is generated at JPL. Timely generation of these antenna pointing files is a high priority requirement and is essential to the operation of the spacecraft.

Operating Environment for FY03: The DSN ranging load for Polar and Wind is expected to continue at current levels. FDF should continue their current practice for generating this information with a timeliness requirement at the direction of the flight operations director.

DSN Scheduling

Requirement: Polar, Wind and Geotail have a high priority requirement for competent DSN scheduling. The MOC supports Polar and Wind DSN scheduling. Geotail DSN scheduling is based at JPL, is part time, and is separately funded. The Polar, Wind and Geotail contact schedules are, on average, well known in advance although the Polar and Wind projects maintain a high priority requirement for DSN contact adjustments in the case of spacecraft or instrument anomalies or problems with scheduled DSN stations. Polar and Wind spacecraft and instrument anomalies requiring additional DSN contact time have occurred on an average of 1 time per year.

Operating Environment for FY03: Timely DSN scheduling is a high priority requirement and is essential to the operation of the spacecraft. We anticipate the current load and distribution of support for Polar, Wind and Geotail DSN scheduling to continue for the next few years. Timeliness requirements remain under the direction of the flight operations director.

Special Operations Planning/Scheduling

Requirement: Twice per year the Polar spacecraft spin axis direction is reoriented with respect to the ecliptic. The current orientation of the orbit requires special planning for prolonged eclipse periods. Planning is underway to stretch the remaining Polar fuel reserves and to periodically maintain ecliptic normal operations beginning in FY02.

Several times per year the Wind spacecraft requires orbit corrections and maneuvers. Management of the Wind fuel reserves is important and aims at efficient fuel usage.

Polar and Wind have a high priority requirement for special operations planning and scheduling. Continued, careful engineering analysis of fuel measurements and utilization is required. The complexities of the operations and the complexities of the spacecraft present a high priority requirement for access to and retention of experienced personnel.

Operating Environment for FY03: We anticipate the current load of special operations planning to continue. We plan to continue the current level of service within the flight dynamics and spacecraft engineering areas. As the spacecraft age and the need for varied engineering expertise increases, use of the civil service engineering staff available within GSFC is recommended.

Anomaly Analysis, Generation Of Recommendations

Requirement: On occasion, understanding of Polar and Wind spacecraft and instrument anomalies requires in-depth study and analysis by specialized engineering and science staff.

There is a high priority requirement for the understanding of the Polar and Wind spacecraft subsystems and instrument operations after anomalies and the generation of recommendations for recovery or mitigation.

Operating Environment for FY03: The load of instrument and spacecraft anomaly analysis cannot be anticipated. We plan to continue the current level of service within the flight dynamics and spacecraft operations area. As the spacecraft age and the need for varied engineering expertise increases, use of the civil service engineering staff available within GSFC is recommended.

Generation Of Routine Spacecraft Status Reports and Reference Files

Requirements: Polar and Wind have a high priority requirement to meet spacecraft reporting requirements as set by GSFC and NASA HQ management.

Operating Environment for FY03: Spacecraft status reports should be maintained and supplied at the minimum level required. The Polar and Wind projects will not support reporting exercises for other agencies, organizations, or businesses; or at a higher level than that required by GSFC and NASA HQ directives. We recommend investigating the feasibility of shifting this function to civil service personnel.

3. FLIGHT OPERATIONS

DSN Contacts with the Polar and Wind Spacecraft

Requirements: NASA HQ has assured GSFC that DSN contact costs will continue to be supported, separate from the funding responsibilities of the Polar and Wind project offices, at current levels. For Wind and Polar, spacecraft contacts are used for data downloads, command uploads, and health and safety checks of the spacecraft and payload.

Polar's 12.75-hour data recording capability results in a high priority requirement for three to four contacts per 24-hour period, each of approximately 1-hour duration. Wind has a 66 hour data recording capacity which, when used fully, allow one 3-4 hour contact per 60 hours of operation. In the case of Polar, occasional lengthening of the average contact period, and the use of a "hot" backup, is necessary for special spacecraft or instrument commanding. In addition, at least twice per year for both spacecraft, a series of longer contacts is necessary for spacecraft maneuvers.

Polar's transmitter/receiver capabilities and 2 x 9 R_E orbit require, on average, the use of a 26-meter antenna. Limited testing has been done using 16- and 18-meter antennas at Fairbanks and Wallops with mixed results. Currently, the 26-meter and 34-meter antennas at Canberra, Madrid, and Goldstone stations are used 80% and 20% of the time, respectively. Beyond a distance of ~60 R_E, the Wind transmitter/receiver capabilities require the use of 34-meter antennas. Currently 34-meter antennas are used almost exclusively. Geotail DSN scheduling averages 17 contacts/week using a 26-meter antenna, 3 contacts per week on a 34-meter, and 1 contact/week on a 70 meter. Constraints on this usage are not known at this time.

Polar and Wind utilize 2 concurrent receiving channels at each DSN site. During a pass, both channels are locked to the spacecraft's transmission signal. Science playback data are received on the direct carrier signal, and real time data is received on the subcarrier signal. There are several known issues with maintaining DSN signal lock with the Polar spacecraft. Shortly after launch, a defect was identified in the primary Polar antennae which causes fluctuations in transmission signal strength. A tiger team was unable to determine the absolute cause. The Polar signal strength is also periodically adversely affected by the antennae aspect angle related to the requirement to reorient every 6 months. As a result DSN suffers more 'false lock' problems with Polar than with other similar spacecraft.

The JPL has initiated a process for automated operation of the DSN stations. Periodic exercises to test this system and its applicability to the spacecraft require a varying amount of support from the Polar and Wind engineers and FOT personnel.

Operating Environment for FY03: We anticipate continuing with the current level of DSN support and to continue relying on the current mechanisms and funding sources to do so. The Polar and Wind projects assume that the additional support for DSN automation testing, if above that normally maintained by the MOC, will be supported by sources external to the Polar and Wind project offices.

Real Time Flight Operations:

Requirements: The health and safety of the Polar and Wind spacecraft and primary payloads remain the highest priority requirement of the program. Timely health and safety monitoring of spacecraft subsystems and payload parameters/red lines during each contact must be maintained. Commanding uploads to the spacecraft must be timed with sufficient margin to avoid load shed at the point that the command sequence ends. Measured responses to subsystem and instrument anomalies must be carried out with timeliness appropriate to the anomaly experienced.

All Polar and Wind instruments have a high priority requirement for the continued support of payload command uploads timed with sufficient margin to allow for unexpected events associated with this commanding process. There are no flight operations at GSFC associated with Geotail.

To date, the Polar and Wind spacecraft have been jointly operated by a flight operations team on a 24-hours per day, 7 days per week work schedule. Because DSN contact lock with both spacecraft is known to fail and to require FOT interaction with DSN personnel on an average of 1 out of 10 contacts, this level of flight operations was required to achieve the very high level (>99%) of data capture. However, because Polar and Wind are now extended missions and the normal behavior of the spacecraft and payloads are well known, NASA HQ has recommended the acceptance of some increased level of risk with respect to spacecraft operations and a data capture rate no higher than 95%. A careful requirements review has determined that Polar science goals can be met with an average of 90% of processed Level Zero data recovery per month. Dropping below an average 80% data recovery per month has been set as the level at which science productivity would be compromised and the level of attended operations should be re-evaluated. The corresponding percentages for Wind are 85% and 80%, respectively.

These percentages suggest the implementation of some unattended operations. It is recognized that loss of contact lock during unattended data downloads can result in a loss of an entire playback sequence (anywhere from 4 to 8 hours of data for Polar and up to sixty hours of data for Wind).

Operating Environment for FY03: Some level of unattended spacecraft contacts for the purpose of downloading recorded data should be in place by FY03. A commiserate reduction in TPOC console monitoring is expected as well. We recognize that this new mode of operation and the ground system re-engineering effort may well result in increased responsibility for individual spacecraft operators; we recommend careful oversight such that this process does not result in lowered attention to detail. The Polar project scientist will continue to instruct the Polar instrument teams and spacecraft engineers to review their commanding procedures and implement streamlining measures to relieve some level of real-time commanding and to shorten the length of those that are necessary.

Spacecraft Engineering, Health And Safety

Requirements: The health and safety of the Polar and Wind spacecraft and payloads remain the highest priority requirement for the project. To meet that requirement, the Polar and Wind spacecraft require dedicated engineering support for spacecraft operations planning, subsystem maintenance, and spacecraft health and safety support. The new Polar ecliptic normal operations periods may require additional analysis support. The planning and implementation of unattended operations for Polar and Wind will require support from the spacecraft engineers.

Operating Environment for FY03: We anticipate continuing the current level of spacecraft operation planning, subsystem maintenance, and spacecraft health and safety oversight. The requirement for timely recovery to science mode operation levels after spacecraft or instrumentation anomalies/events should be scaled to fit within the overall data recovery and health and safety requirements.

Payload Engineering, Health And Safety

Requirements: During the life of the mission, the Polar and Wind instrument teams, the FOT spacecraft engineers, and the FOT console personnel have been supported by a dedicated

instrument engineer for payload operations planning and payload health and safety. We recognize the value of this knowledge base, both for the operation of the complement of complex instruments and the operation of the aging spacecraft subsystems. The Polar/CEPPAD, CAMMICE, MFE, PIXIE, TIDE, and TIMAS instrument teams have expressed a high priority requirement for planning, commanding, and health and safety support. The remaining teams could, if required, plan and execute their commanding requirements directly through interaction with the FOT console personnel.

Operating Environment for FY03: We anticipate continuing the current level of support for Polar instrument engineering functions. The requirement for timely recovery to science mode operation levels after spacecraft or instrumentation anomalies/events should be scaled to fit within the overall data recovery and health and safety requirements.

Maintenance Of Instrument GSEs

Requirements: A few instrument GSE systems remain operational, occupy space in the Polar and Wind FOT area and, occasionally, require minimal maintenance attention from FOT personnel. The Polar/CAMMICE and CEPPAD teams have a high priority requirement for continued access to their GSE. Polar/VIS and Polar/UVI have a medium priority requirement for continued access to their GSEs; their access is required only during real time commanding procedures.

We recognize that instrument GSEs, designed for pre-flight instrument testing and post flight commissioning operations, display diagnostic parameters unavailable within the real-time data stream visible to FOT console personnel and, in some cases, unavailable through the NRT network stream. Access to real-time or near-real-time data streams during special operations can be important to instrument and spacecraft safety. This is especially true for the particle instruments when performing HV procedures. Because the spacecraft and science instruments were not originally designed for "hands off" operations, re-engineering of these procedures is impractical and would be costly to the program.

Polar/CAMMICE and CEPPAD rely exclusively on their GSE to monitor instrument health and safety when returning their instruments to science mode after spacecraft maneuvers and other events. The Aerospace Corporation's network security requirements prevent their adapting to the "network push" setup of the NRT stream. Substantial re-engineering on the part of the CAMMICE and CEPPAD team or on the part of the project would be necessary to change this.

Polar/UVI remotely connects to their GSE during special operations and when necessary to obtain health and safety information for each major frame, a capability that is not available through any other UVI tool.

Polar/VIS uses either its GSE or the NRT network connection for instrument health and safety monitoring during real time instrument commanding. The frequency of VIS real time commanding has, to date, required the availability of both streams as the various types of network links has been unstable and has so prevented the exclusive use of one or the other monitoring capability.

Operating Environment for FY03: We anticipate maintaining the current level of support for the CAMMICE, CEPPAD, UVI and VIS GSE systems. We recommend reviewing the current real time data feed to these systems for possible architecture simplifications to decrease maintenance requirements.

Continuation of the Near Real Time (NRT) data stream

Requirements: The near real time data are level zero data, broken out by instrument, for the most recent contact with the spacecraft. The data are available, within several minutes of acquisition, to the instrument teams through open socket network connections. The data are also simultaneously written to files; these files typically cover anywhere from 1 to 3 hours of data. NRT data files should be retained online for a minimum of 72 hours.

The Polar/TIDE, TIMAS, and VIS instrument teams have a very high priority requirement for continued access to the NRT data stream for instrument health and safety monitoring both during real time commanding and for day-to-day monitoring. This is especially true for the particle instruments performing HV procedures. The near real time stream allows access to science data and diagnostic parameters unavailable within the real-time data stream visible to FOT console personnel.

Several instrument teams have a high priority requirement for access to the stored NRT data files for daily monitoring of instrument health and safety. The NRT data are also utilized to provide timely, processed science data products after important sun-earth connection events. The Polar imaging teams rely on the NRT data stream to update their "current" or "latest" auroral images at their web sites for outreach purposes. It is desirable to continue this service for the smooth, continued operation of our outreach efforts.

Operating Environment for FY03: We anticipate continuing NRT service to the Polar instrument teams through the re-engineered LEPPWG computer system which will receive the real time data stream from the IRTS system. The NRT system reliability is expected to be of increased importance during Polar's new phase of unattended operations. Because the NRT software has been rehosted on more modern equipment, the operation, system administration and system maintenance responsibilities will be significantly lower than experienced in previous years.

Continuation of Quicklook Data Products:

Requirements: Quicklook data is level zero data, broken out by instrument, for the most recent playback of the spacecraft tape recorder. Files typically cover anywhere from 4 to 8 hours of data for Polar. With respect to the basic operation of the spacecraft and the flow of level zero (LZ) data to the instrument teams, there is little or no requirement for Quicklook data products. Currently, the most compelling requirement for quicklook data products is for the production of PR products after an important sun-earth connection event. It is desirable to retain this. Ideally, quicklook data products would be produced within 24 hours of receipt of the data.

Operating Environment for FY03: While Level Zero processing procedures yield, with little or no additional expense, the quicklook data product, the project will temporarily maintain access to these files. The files will be downloaded from the LZP machines, via an automated ftp process, to the re-engineered science data ftp site, PWGDATA. The files will then be available, for a minimum of one month, to the science community via open ftp from PWGDATA. Because the quicklook data for Polar and Wind will be rehosted to more modern equipment the associated operation, system administration and system maintenance responsibilities should be minimal.

4. DATA PROCESSING, ARCHIVING AND DISTRIBUTION

Level Zero (LZ) Processing

Requirement: Polar, Wind and Geotail have a high priority requirement for the timely delivery of LZ data to their instrument teams and supported science investigators. LZ files should be processed and provided to the instrument teams within seven days of the receipt of data.

The extensive collection of science analysis programs using the LZ format and the wide use of automated scripts by instrument teams mean that changes to file content, file naming convention, temporal length of the data, or to the file format would result in a need for significant software re-engineering at multiple institutions. There is a high priority requirement for consistency in the content and format of the files. It is desirable to preserve the file naming convention and temporal length for these files.

Polar and Wind LZ data production starts with the acquisition of tape recorder playback files and NRT files during spacecraft contacts. Using custom processing software that includes the proprietary LABVIEW and ORACLE software packages, the varying length playback and NRT files are decommutated and optimally combined into 24-hour level zero files, one for each instrument. Geotail LZ data production follows a similar path with the exception that the original blocked telemetry files are downloaded from the JPL Central Data Receiver (CDR) facility. The Geotail LZ processing software supports the processing of Sirius format files as well.

The Polar and Wind LZ processing system is being re-engineered to better take advantage of the similar NRT and LZ processing algorithms, to reduce the number of proprietary software packages, and to anticipate a simplified system for downstream Wind processing requirements. The Wind and Polar playback files, originally obtained from JPL, will be automatically transferred to the LEPPWG system. A new fully automated processing algorithm is being developed, using the NRT software core, to create the 24-hour LZ files from the playback and NRT stored files. We recognize that a fully automated processing system will occasionally result in delays in LZ data delivery and the occasional loss of data. Under the new method, Polar and Wind instrument teams will have the responsibility for file verification. The system is designed to handle a modest amount of data reprocessing which will be performed only at the request of the instrument teams at a level to be moderated by the Polar and Wind project scientists.

Operating Environment for FY03: It is expected that the current equipment, software, and methods for Polar, Wind and Geotail LZ processing will be required through December, 2002. In January, 2003, the automated Polar and Wind LZP system will be operational on the LEPPWG system with Geotail LZ and Sirius processing remaining as before. A “best effort” level of LZ data reprocessing will be supported within the overall data recovery guidelines given above and in keeping with maintaining other data processing functions. Because the Wind and Polar LZP software will be rehosted on more modern equipment, the operations, system administration and system maintenance responsibilities will be significantly lower than experienced in previous years.

Spacecraft Health and Safety Data Processing

Requirements: Polar and Wind spacecraft housekeeping data, packaged into a LZ format are created by the LZP process and routed to the NSSDC for archival purposes and to the MOC for trending. It is a requirement that the performance history of the Polar and Wind spacecraft be archived. Housekeeping LZ files should be provided to the NSSDC within one month of the receipt of the data.

Operating Environment for FY03: See discussion for Level Zero processing.

KP Generation:

Requirement: The timely production of Key Parameter (KP) data for the Polar, Wind and Geotail spacecraft stands as a major achievement for the ISTP project. A large portion of the science community in the United States and other countries depends on this resource for efficient science analysis. There are several instruments on Polar and Wind for which the KP data represents a definitive high resolution science analysis product and is used as such. The generation of KP data and its archive within the NSSDC are necessary for coordinated SEC science efforts in the future.

When considering the basic operation of the spacecraft and the flow of LZ data to the instrument teams, there is little or no requirement for Polar, Wind or Geotail KP data generation. However, the Polar, Wind and Geotail project offices have a priority requirement to continue this function to ensure the continued high level of science productivity on the part of the science teams and the wider science community. Wind SWE and MFI KP data products should be produced within 1 week of the receipt of the data. Polar, Geotail and the remaining Wind KP data products should be produced and distributed within 2 months of the receipt of the data.

The extensive collection of science analysis programs using the CDF format and the wide use of automated scripts by instrument teams mean that changes to file content, file naming convention, temporal length of the data, or to the file format would result in a need for significant software re-engineering at multiple institutions. There is a high priority requirement for consistency in the content and format of the files. It is desirable to preserve the file naming convention and temporal length for these files.

Operating Environment for FY03: The generation of day-long KP format data products for Polar, Wind and Geotail will occur via fully-automated program execution on LEPPWG; the resulting files will be automatically transferred and stored on the NSSDC/CDAWeb. The files will then be available to the science community via ftp through the NSSDC/CDAWeb open interface. With the exception of temporary staging of the files to support the transfer process, the files will not be archived on the PWGDATA system. The Polar, Wind, and Geotail instrument teams have the responsibility for file verification. The system is designed to handle a modest amount of data reprocessing which will be performed only at the request of the instrument teams and at a level to be moderated by the Polar and Wind project scientists. Because the Wind and Polar KP software has been rehosted on more modern equipment, the operations, system administration and system maintenance responsibilities will be significantly lower than experienced in previous years.

Definitive Orbit and Attitude Files

Requirement: The Polar and Wind predictive spacecraft orbit and attitude files are also used as the definitive spacecraft orbit and attitude product and are delivered to the instrument teams via network connections and the CD-ROM LZ distribution. ISAS delivers definitive orbit and attitude elements for the processing of definitive products for Geotail. There have been infrequent updates to a small number of these files. Polar despun platform attitude and Polar, Wind and Geotail spacecraft spin phase files are derived from the LZ files. These are heavily relied upon for data interpretation and science analysis.

Timely generation of the Geotail definitive orbit and attitude data; and the Polar, Wind and Geotail definitive platform attitude and spin phase files; remains a high priority requirement for data interpretation and science analysis. Definitive files should be generated within 3 weeks of receipt of the data.

The extensive collection of science analysis programs using this data and the wide use of automated scripts by instrument teams mean that changes to file content, file naming convention, temporal length of the data, or to the file format would result in a need for significant software re-engineering at multiple institutions. There is a high priority requirement for consistency in the content and format of the files. It is desirable to preserve the file naming convention and temporal length for these files.

Operating Environment for FY03: We plan to continue to supply definitive orbit, attitude, platform attitude and spin phase information and, as needed, corrected spacecraft orbit and attitude information. The generation of day-long CDF format definitive products for science analysis will occur via automated program execution on LEPPWG; the resulting files will be automatically transferred and stored on PWGDATA. The files will then be available to the science community via open ftp from PWGDATA. Because the associated software has been rehosted on more modern equipment, the operations, system administration and system maintenance responsibilities will be significantly lower than experienced in previous years.

Ancillary Data Ingestion

Requirements: The Polar, Wind and Geotail projects will no longer support the ingestion of externally created KP and ancillary data products.

Operating Environment for FY03: All ancillary data ingestion will be direct to the NSSDC. The data will be available to the science community via the NSSDC/CDAWeb interface.

Data distribution

Requirements: There is a high priority requirement for network access to Polar, Wind and Geotail LZ data, spacecraft orbit and attitude, platform attitude, spacecraft spin phase files and several ancillary files on a 24-hour basis.

Polar, Wind and Geotail LZ data, spacecraft orbit and attitude, platform attitude, spacecraft spin phase files and several ancillary files must also be routinely distributed on CD-ROM to several instrument and associated science teams that rely upon them for their data delivery and/or their data archive.

LZ files should be electronically provided to the instrument teams within seven days of the receipt of data. Any LZ CDs should be provided to the instrument teams within 3 months of the receipt of data.

Operating Environment for FY03: All Polar, Wind and Geotail science data will be served via open-read ftp access through the 1.9TB RAID-based PWGDATA system. The directory structure will be similar to that on the ISTP CD-ROM distributions. Instrument teams will have the responsibility of detecting new data files and automatically initiating the ftp transfer to their systems.

The PWGDATA system also has equipment and automated software processes to produce custom CD and DVD platters for the instrument teams that retain a high priority requirement for them. The volume of newly acquired data for each instrument team is monitored and when appropriate, a CD or DVD platter is created. On creation the platter is automatically labeled with the destination address so that mailing via a windowed envelope is all that is required for distribution. The project office has estimated that approximately 10 CD and DVD products will be created per regular business day.

The project scientists will continue to encourage instrument and science teams to implement procedures for the electronic transfer and storage of LZ and orbit/attitude files and to move away from CD or DVD distributions.

Data Archiving

Requirement: The Polar, Wind and Geotail projects are responsible for archiving LZ data, orbit/attitude information and a few ancillary data products with the National Space Science Data Center (NSSDC). It is desirable to maintain on-line storage of the full Polar, Wind and Geotail LZ data, orbit/attitude data and a few ancillary data products for timely delivery to the instrument teams and science community.

Operating Environment for FY03: Data archiving will be accomplished by the production of "POLAR ALL", "WIND ALL" and "GEOTAIL ALL" DVDs which will be stored within the NSSDC facility. These products should be provided to the NSSDC within 2 months of the receipt of data.

Generation Of Routine Processing Status Reports and Reference Files

Requirements: Polar and Wind have a high priority requirement to meet reporting requirements as set by GSFC and NASA HQ management.

Operating Environment for FY03: Processing status reports should be maintained and supplied at the minimum level required. The Polar and Wind projects will not support reporting exercises for other agencies, organizations, or businesses; or at a level higher than that required by GSFC and NASA HQ directives. We recommend investigating the feasibility of shifting this function to civil service personnel.

5. DESCRIPTION OF LEPPWG AND PWGDATA SYSTEMS:

A. FTP SERVER AND MEDIA CREATION (LINUX)

1. Dell Precision Workstation 340 Minitower, 2GHz P4, 128MB RAM, keyboard, mouse, nVidia Quadro2 EX/32MB video card, two 80GB 7200rpm drives, RedHat Linux 7.2, CD-ROM drive, 10/100 Ethernet, 3 years 4hr response onsite maintenance, 3 years Gold technical support
   1 GB PC800 ECC RDRAM
   Adaptec 39160 dual channel Ultra2 SCSI card and cables
2. P793 17" Diamondtron monitor,
3. CD/DVD duplicator with monochrome printer and software: Young Minds Power DVDstudio 120 disk autoloader with 3 years maintenance and technical support
4. RAID, Inc. 1.9 TB (1.6TB usable) Condor RAID-5 disk array with redundant power supplies and fans, Ultra2 SCSI to host, 12 160GB IDE drives, Infortrend IFT controller, 3 yr adv replacement and next day onsite support
5. LTO Ultrium tape drive and 20-36 slot autoloader
6. APC Smart-UPS 1400 and 1500

B. DATA PROCESSING AND NRT SERVER (VMS)

1. DEC AlphaServer DS20E EV67 667MHz CPU, 8MB DDR cache, 1.2 GB RAM, CDROM,two 18GB drives, Ultra2 HBA, 10/100 Ethernet, FDDI card (not used), ELSA GLoria Synergy 8MB 2D/3D graphics card,
2. P700 17" monitor
3. DLT7000 tape drive
4. 73GB SCSI drive
5. Annual maintenance for VMS software and hardware
6. Multinet 2 year maintenance with media and docs 7/1/02-6/30/04
7. NAG math library (no maintenance)

C. POSSIBLE HOT SPARE FOR NRT SERVER , LZ PROCESSING (VMS), TO BE ACQUIRED

END OF DOCUMENT