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# Orbital Anomalies in Goddard Spacecraft for Calendar Year 1995

J. W. Remez
*Goddard Space Flight Center*
*Greenbelt, Maryland*

H. C. McLeod
*Hernandez Engineering, Inc.*
*Greenbelt, Maryland*

National Aeronautics and Space Administration

Goddard Space Flight Center
Greenbelt, Maryland 20771

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## Abstract

During 1995, GSFC had 28 orbiting spacecraft, including 11 launched for the National Oceanic and Atmospheric Administration (GOES and NOAA spacecraft). Two SPARTAN spacecraft are included in this report. SPARTAN spacecraft are "free flyers," launched and retrieved from the Space Shuttle. There were 212 reported anomalies distributed among 21 spacecraft. SAMPEX accounted for 100 of these anomalies and the GOES series of spacecraft accounted for another 67 anomalies. The SAMPEX anomalies are treated separately in this report since that project records and classifies its anomaly data differently than other projects. Of the non-SAMPEX anomalies, only three affected spacecraft missions “substantially” or greater; that is, caused the loss of 33% or more of the mission objectives. The most frequent subsystems to suffer anomalies were the instrument/payload (29%), attitude control (23%), and telemetry/data handling (22%). 52% of the anomalies resulted in subsystem degradation while 21% of the anomalies had no effect on the mission. 34% of the anomalies were identified as “systematic” while only 12% were identified as “random”, and 30% could not be classified as to anomaly type. Design problems were the leading cause (31%) of anomalies although the cause of 33% of the anomalies could not be determined.

## Background

Each project’s management at Goddard Space Flight Center has recorded the performance data of Goddard-managed spacecraft since the center’s beginning. More detailed data, combining all of Goddard's spacecraft, began to be collected and analyzed about twenty-five years ago. In 1983, the first detailed report, containing performance data over all spacecraft, was issued as a contractor report, *Analysis of Spacecraft On-Orbit Anomalies and Lifetimes* , PRC R-3579, February 10, 1983; this report covered the period from 1978 to mid-1983. It contained data for the Jet Propulsion Laboratory (JPL) and Goddard Space Flight Center (GSFC) spacecraft. The next report, *Orbital Anomalies in Goddard Spacecraft 1982-1983,* included only GSFC spacecraft. Since 1984, the Office of Flight Assurance has issued annual Goddard orbital-anomaly reports. These annual reports collectively document GSFC’s spacecraft performance.

## Introduction

This annual report addresses the calendar year 1995 on-orbit performance of spacecraft built, or managed, by Goddard Space Flight Center. This report summarizes the operations and performance of GSFC spacecraft, and catalogues the anomalies reported for each spacecraft. To the extent possible, each anomaly is classified according to the subsystem in which it occurred, the time of its occurrence, its effect on the spacecraft’s mission (criticality), and the failure causes and corrective actions.

Beginning with a list of active spacecraft, spacecraft operations are then briefly described for each spacecraft in "Spacecraft Operation Summaries" section. This section includes a short description of each spacecraft, science information (when applicable), and a summary of the spacecraft’s 1995 performance. In the "Detailed Anomaly Data" section, we provide the classification scheme used to characterize the anomalies. We also provide summaries of anomaly data, followed by data tables and charts that further illustrate anomaly classifications. Finally, appendices 1 and 1-1 provide classification data regarding the anomalies in this report. Appendices 2 and 2-1 together provide a detailed log of the 212 anomalies occurring in 1995. GSFC's "Spacecraft Lifetime Data" table is updated and presented in Appendix E.

Data included in this report were derived from the following sources:

- Interviews with GSFC Flight Operations Team members,
- Interviews with NOAA personnel,
- Interviews with project scientists and principal investigators,
- Interviews with Jet Propulsion Laboratory personnel,
- NASA Internet resources,
- Spacecraft Orbital Anomaly (SOAR) data base,
- Tiros Orbital Anomaly Report (TOAR) data base,
- GOES Incident Reports (GIRs),
- GIR data base,
- the *Mission Requirements and Data Systems Forecast* , November 1994 and April 1996,
- Interviews with authors of the 1994, and earlier, *Orbital Anomalies in Goddard Spacecraft* Reports,
- Interviews with Adam Johnson and Adrienne Davis, Allied Signal,
- Project anomaly reports from project-specific data bases, SAMPEX, HST, etc.,
- Goddard News,
- Press Releases, and
- Project Status Reports.

Data collected and reported here are current with the publication date of this report. Some data regarding open anomalies may change after anomaly investigations are completed.

**Summary of Spacecraft Activity during 1995**

During 1995, GSFC had 28 orbiting spacecraft, including 11 launched for the National Oceanic and Atmospheric Administration (GOES and NOAA spacecraft). Two SPARTAN spacecraft are included in this report. SPARTAN spacecraft are "free flyers," launched and retrieved from the Space Shuttle. Goddard spacecraft (active in 1995) are shown in Table 1.

Three new spacecraft were launched in 1995: GOES-9 (J), TDRS-7, and XTE. The SPARTAN 201-03 was the third Shuttle launch of this free flyer. It was carried in the Space Shuttle's cargo bay, and launched for orbits lasting approximately 40 hours. Then it was retrieved by the Space Shuttle and returned to Earth. SPARTAN 204 was the fifth flight of the SPARTAN project, and flew on STS-63 in February of 1995.

The telemetry was turned off for ICE in 1995, and the spacecraft was transferred to JPL for use in the DSN.

Although the Hubble Space Telescope (HST) was built under contract to Marshall Space Flight Center (MSFC), it is included in this report because management of its flight operations and servicing missions has been assigned to GSFC.

Of the GOES spacecraft still in orbit, GOES-2, GOES-3, and GOES-5 have been deactivated and are serving as transponders. GOES-7, GOES-8, and GOES-9 were operational satellites in 1995. No anomaly data was reported for GOES-7.

Although LANDSAT was constructed under GSFC management, it is no longer included in this report because anomalies are not reported to GSFC.

Table 1. List of Spacecraft Operating (1995) [1] [2]

| Spacecraft | Launch Date (MM/DD/YY) | Operating Agency | Notes: |
|---|---|---|---|
| CGRO | 04/05/91 | NASA | Some references reflect launch as 04/07/91. |
| ERBS | 10/05/84 | NASA | |
| EUVE | 06/07/92 | NASA | |
| HST | 04/24/90 | NASA | |
| ICE (ISEE-3) | 08/12/78 | NASA | |
| IUE | 01/26/78 | NASA | |
| IMP-8 | 10/25/73 | NASA | Some references reflect launch as 10/26/73[3] |
| SAMPEX | 07/03/92 | NASA | Verified launch date. |
| SPARTAN 201-03 | 09/06/95 | NASA | |
| SPARTAN 204 | 02/04/95 | NASA | |
| TDRS-1 | 04/04/83 | NASA | |
| TDRS-3 | 09/29/88 | NASA | |
| TDRS-4 | 03/13/89 | NASA | |
| TDRS-5 | 08/02/91 | NASA | |
| TDRS-6 | 01/13/93 | NASA | |
| TDRS-7 | 07/13/95 | NASA | |
| UARS | 09/15/91 | NASA | |
| WIND | 11/01/94 | NASA | GGS |
| XTE | 12/30/95 | NASA | NEW |
| GOES-2 | 06/16/77 | NOAA | Deactivated -serving as a transponder |
| GOES-3 | 06/17/78 | NOAA | Deactivated - serving as a transponder |
| GOES-5 | 05/22/81 | NOAA | Deactivated - serving as a transponder |
| GOES-7 | 02/26/87 | NOAA | Operational - no anomalies reported |
| GOES-8 | 04/13/94 | NOAA | Operational |
| GOES-9 | 05/23/95 | NOAA | NEW, Operational |
| NOAA-9 | 12/12/84 | NOAA | |
| NOAA-10 | 09/17/86 | NOAA | |
| NOAA-11 | 09/24/88 | NOAA | |
| NOAA-12 | 05/14/91 | NOAA | |
| NOAA-14 | 12/30/94 | NOAA | |

## Spacecraft Operations Summaries

### Compton Gamma-Ray Observatory (CGRO) / Class B

***General Description***

Weighing over 35,000 pounds, it was launched by the Space Shuttle Atlantis, on April 5, 1991. CGRO is the largest civilian satellite ever deployed from the Shuttle. Although a variety of smaller

[1] LANDSAT not included here because anomaly data is no longer being reported to GSFC.
[2] Information regarding GOES spacecraft status provided by Mr. Richard Reynolds at NOAA, 6/14/96.
[3] ISTP home page reflects IMP-8 with a launch date of September 23, 1972.

satellites, and high-altitude balloons, have carried instruments to study the universe in gamma-ray light during the past thirty years, CGRO represents a dramatic improvement in sensitivity, spectral range, and resolution.

Each of CGRO's four instruments has a unique design, and is specialized for particular types of observations.[4] These instruments are the Burst and Transient Source Experiment (BATSE), the Oriented Scintillation Spectrometer Experiment (OSSE), the Imaging Compton Telescope (COMPTEL), and the Energetic Gamma Ray Experiment Telescope (EGRET).

With a design life of two years, the CGRO’s mission is to study the sources and astrophysical processes, from the cosmos, that produce the highest energy electromagnetic radiation. Some of the most violent sites in the universe—solar flares, supernova explosions, pulsars, quasars and the mysterious gamma-ray bursts—produce the gamma rays CGRO detects.

***Science***

The CGRO continues to make new findings with each pointing. CGRO and radio telescopes have aided the discovery of a new class of object in our Galaxy, called superluminal jet sources. [5] These transient sources, have monthly outbursts for about a year. Then they just disappear from view. When they are in outburst, they are the brightest objects in the gamma-ray sky. These amazing sources jettison material after each gamma-ray outburst. The jets are seen in the radio band, using ground-based telescopes. Small knots of radio emission are seen to spread out from the source. Sometimes these emissions appear to move faster than the speed of light. This perception is an optical illusion based on effects of Einstein special relativity. These blobs of gas are actually moving less than, but close to, the speed of light. Such effects have been seen before in extragalactic quasars, but never before in galactic sources.

Another major discovery, facilitated by CGRO, has been the "Bursting Pulsar." This bizarre object appeared in the gamma-ray sky in December 1995. It was characterized by bright bursts of gamma-rays that lasted seconds, and occurred roughly every hour. In addition, the source pulsed every 0.5 second, indicating that it is a rapidly spinning stellar core.

***Performance***

During 1995, CGRO continued to operate reliably, with the except for two anomalies: 1. remote interface unit (RIU) failure, and 2, increased Gyro # 3 motor currents. On November 24, 1995, the analog to digital converter (ADC) of COMPTEL's A side remote RIU failed. COMPTEL instrument scientific and engineering data was unaffected by the failure. This ADC facilitates the monitoring of COMPTEL detector assembly temperatures and power voltages. However, independent (redundant) COMPTEL instrument digital electronic telemetry continued to provide relevant experiment state-of-health information, without a problem. Operation procedures were adjusted to compensate for this loss of monitoring capability.

In addition, on November 25, 1995, CGRO's Gyro # 3 experienced an increase in motor currents. After December 15, the current returned to the normal range. No further instances of this problem were encountered. There was no impact to spacecraft or science operations.

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[4] See GRONEWS: Electronic Bulletin Board for a complete discussion of CGRO performance during 1995 and enhancements to instrument capabilities.

[5] CGRO science information provided by Neil Gehrels, of GSFC on July 7, 1996.

**Earth Radiation Budget Satellite (ERBS) / No class assigned - estimated as Class B**

***General Description***

Designed to study the Earth's climates, ERBS is one of the oldest GSFC operational satellites. Designed for a two year mission life, it was deployed by the Space Shuttle on October 5, 1984, into a low Earth orbit.

***Science***

Earth radiation budget measurements made by the Earth Radiation Budget Experiment (ERBE) instrument, on the ERBS spacecraft, provide a valuable continuous record for long-term studies of global climate, including cloud-radiative forcing and solar variability. During 1995, atmospheric scientists at NASA/Langley Research Center (LaRC) worked with scientists from France and Germany in an intercomparison study of ERBE data with Earth radiation budget data from the French ScaRab instrument. Langley scientists also produced a 10-year time series of monthly anomalies in longwave, shortwave, and net radiation in the region between 40 degrees south latitude and 40 degrees north latitude. These data clearly show the effect of the 1991 Mt. Pinatubo eruption on the Earth radiation budget.

In addition to these science achievements, ERBE data has been used by the LaRC Data Management Office to provide simulated level 0 data for the Clouds and the Earth's Radiant Energy System (CERES) instrument, which is part of NASA's Mission to Planet Earth program. The first CERES instrument is scheduled for launch in August 1997, and ERBE data plays a major role in the CERES data validation plan.

***Performance***

During 1995, there were only five anomalies. All five of the anomalies were associated with the command memory. Specifically, these anomalies were the recurrence of memory locations failing validity checks. The anomalies were all corrected by immediately uplinking the correct commands; but, because of the frequent recurrence of this anomaly, operations personnel began to perform memory checks 3 or 4 times per day, to determine if bit changes had occurred. No significant science data was lost as a result of the five memory validation failures.

**Extreme Ultraviolet Explorer (EUVE) / Class B**

***General Description***

This "Explorer" satellite was launched June 7, 1992, aboard a Delta II launch vehicle. It is in a low Earth orbit of 507 by 521 kilometers, and rotates about the Earth every 95 minutes. EUVE was the first satellite to make spectroscopic and wide-band observations, over the entire extreme ultraviolet radiation spectrum. It consists of scanning telescopes and a deep survey/spectrometer instrument, weighing 270 and 710 pounds, respectively.

***Spacecraft Improvements***

EUVE engineers introduced some improvements to preclude anomalous experiences. On May 3, 1995, a software patch algorithm, called *Dither*, was issued to allow for a continuous update of the commanded quarternion to move the spacecraft in the shape of an Archimedes Spiral, starting at the target and rotating outward. This patch was required as a result of non-uniform readings from science instrument detectors. Images were being taken with spikes at the region of the bad sensors. This problem was interfering with science analysis of the image. Taking a series of data samples around the target, compensates for the non-uniform readings.

### *Science*

The spacecraft captured 99% of all science data in 1995.

### *Performance*

The EUVE flight operations team reported that EUVE had no anomalies in 1995. However, during October and November of 1995, "both star trackers occasionally experienced the partial horizontal scan anomaly, and difficulty to lock on guide stars for several orbits...." [6] The author of the EUVE status report indicated that, "the cause of the problem is under investigation."

While reconfiguring EUVE gyros, to diminish attitude disturbance, in the event of a future gyro failure, the spacecraft was inadvertently put in safehold for 24 hours on October 17, 1995.

The spacecraft was operating successfully at the end of 1995.

## Hubble Space Telescope (HST) / Class B

### *General Description*

HST was launched aboard the Space Shuttle Discovery on April 24, 1990, and deployed into a low Earth orbit. The HST is 2.4 meters in diameter, with optics supporting astronomical observations in the vacuum of space: ultraviolet, visible and near-infrared (wavelengths from 1150 angstroms through several microns). It has a planned 15 year science mission, and will be periodically serviced in-orbit by Space Shuttle crews. The HST is a joint endeavor of NASA and the European Space Agency (ESA). ESA provided the Faint Object Camera and the solar arrays.

HST's two well-known post-launch problems, the aberration in its telescope mirror and a solar array jitter affecting its instruments, were resolved with the first servicing mission in December 1993. The mission installed the Corrective Optics Space Telescope Axial Replacement (COSTAR) and the Wide Field/Planetary Camera 2 (WFPC2). The other science instruments currently on-board are the Faint Object Camera (FOC), the Faint Object Spectrograph (FOS), and the Goddard High Resolution Spectrograph (GHRS). The HST's Fine Guidance Sensors (FGS’s) also support astrometric science. The Second Servicing Mission, planned for February 1997, will replace the FOS and GHRS with an advanced Space Telescope Imaging Spectrograph (STIS) and the Near Infrared Camera and Multi-Object Spectrometer (NICMOS).

### *Science*

The Hubble Space Telescope spent ten days in December 1995 observing a single tiny patch of sky. These observations resulted in the deepest image of the sky, revealing galaxies fainter than have ever been seen before. Astronomers analyzing the Hubble Deep Field—the faintest view of the universe taken with NASA's Hubble Space Telescope—identified what may prove to be the most distant objects observed to date.[7] Scattered among the nearly 2,000 galaxies in the Hubble images, which were taken in December 1995, researchers found several dozen galaxies they believe exhibit characteristics that make them appear to be more distant than any seen previously. Six of the galaxies

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[6] EUVE Status Report, November 6 - November 19, 1995, by Hn K. Tann

[7] Press Release: 96-123, Findings from Hubble Deep Field Home in on Distant Galaxies, Ann.M.Jenkins.1@gsfc.nasa.gov

appear to be more distant than the farthest quasars, the current distance record holders. The galaxies are so far away they may have existed when the universe was less than five percent its present age. If this early galaxy population can be confirmed through further observations, it means that such galaxies would have formed remarkably early in the history of the universe—only a few hundred million years after the Big Bang. The images also give an estimate of how many galaxies were forming at this time in the very early universe.

### *Performance*

HST reported only five anomalies in 1995, none of which caused more than "minor" effects on the mission. There were three Power anomalies, one TLM&DH anomaly, and one Instrument anomaly. Five consecutive "high torque" flag reports for the Solar Array Drive Electronics (SADE) caused HST to enter a software sunpoint safemode on January 8, 1995. A workaround, placing SADE #2 on line and powering off SADE-1R, precluded any significant mission impact. The other two Power subsystem anomalies, characterized as possible short circuit in Solar Array II, caused temperature monitor #3 to go into saturation. The science tape recorder #2 anomaly proved the most serious anomaly, resulting in a slight degradation of HST's ability to collect science data.

## International Cometary Explorer (ICE) / No class assigned - estimated as Class B

### *General Description*

ICE was launched on August 12, 1978 to study the composition and physical state of a comet's nucleus, and to investigate interactions between the solar wind and cometary atmosphere. The design life for ICE was 2 years. However, it celebrated its seventeenth year in orbit in August 1995. ICE was originally called ISEE-3; but after it flew through the tail of the GIACOBINI-ZINNER comet on September 11, 1995, its name was changed to ICE.

### *Science*

The following are the major scientific results [8] obtained using data obtained from the ICE spacecraft during the year 1995:

- The variation of electron fluxes over the solar cycle was examined using ICE data from the cosmic ray electron experiment. Additional evidence for charge sign dependence of cosmic ray modulation was found. Specific predictions for positron abundance were made. [9]

- Magnetic field data from ICE was used to corroborate Ulysses observations. As Ullysses traveled from southern to northern latitudes, it made a rapid traversal of the heliospheric current sheet. This was the first 3-dimensional "slice" through one of the largest structures in the heliosphere. During much of 1995, ICE and Ullyses were aligned in longitude, and ICE received enhanced tracking for the Deep Space Network. ICE magnetic field data was used in conjunction with Ullysses data to identify crossings of the heliospheric current sheet. Comparisons of this structure were made with predictions of solar models.

### *Performance*

ICE continued science data collection, until it experienced a somewhat serious anomaly on August 27, 1995. One of the words assigned to the SBH experiment (Steinberg experiment) in the Variable

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[8] Provided by Marcia Burton of the Jet Propulsion Laboratory, Pasadena, CA, June 7, 1996.
[9] These results appeared in Astrophysical Journal (J. Clem et al, June, 1996).

Access Memory (VAM) of the data formatter changed by one bit. The Steinberg experiment was then turned off on December 19, 1995.

Subsequently, the spacecraft was transferred to the Jet Propulsion Laboratory (JPL) for use in the Deep Space Network (DSN). The spacecraft telemetry was turned off on December 19, 1995, because the spacecraft was approaching a position near the sun's horizon where the sun could block telemetry commands. JPL will use the spacecraft to collect radio science data while it is located near the sun's horizon for approximately six years. ICE will not be included in future *Orbital Anomalies in Goddard Spacecraft* reports.

**International Ultraviolet Explorer (IUE) / No class assigned - estimated as Class C**

***General Description***

Launched on January 26, 1978, IUE is the oldest operating spacecraft in this report. IUE was launched into an elliptical geosynchronous orbit, and is always visible from Goddard Space Flight Center. When launched, IUE had a stated lifetime expectancy of three to five years. In 1995, IUE had reached its eighteenth year, while continuing to operate 24 hours a day, seven days a week.

***Science***

During April 1995, IUE obtained a number of observations of Jupiter's North Aurora, at Jupiter's North pole, while tracking on the Galilean moon Ganymede. [10] The data are part of continuing observations of the Jovian Aurora and the planet's ultraviolet reflectance following the impact of fragments of Comet Shoemaker-Levy in July 1994. The IUE spectra were obtained in coordination with Hubble Space Telescope observations, and will be analyzed in conjunction with IUE spectra of the Jovian Auroral systems and upper atmosphere, dating back to 1979.

These follow-up observations are of particular relevance, since IUE was the only telescope, either ground or orbit based, capable of observing all 21 impact events, and providing nearly 24 hour coverage of the collision phase of the Jupiter encounter in July 1994. Jupiter's North and South polar aurorae are electromagnetic phenomena similar to aurorae seen on Earth (the southern and northern lights). The new, and past, IUE data will help to better understand long-term changes in the chemistry, composition, and temperature of the Jovian upper atmosphere, ionosphere, and aurorae. This information will then help us to better define these systems for all planets in the solar system, including Earth.

***Performance***

In 1995, IUE experienced only two anomalies: 1. Worker time-out with On Board Computer (OBC) "hit" counter incrementing by 1, and 2. Power Amplifier 4 (PA4) signal strength drop.

During the first three years of IUE operation, the OBC was prone to crashes that caused loss of attitude. Even during prelaunch, the OBC was the cause of major concern, due to malfunctions when running "hot." The OBC software analysts, OBC hardware engineers, and operations personnel identified the conditions under which these crashes occurred. The software analysts then inserted code to detect the failures and restart the OBC control. As various failure modes occurred over time, the OBC code was modified until OBC crashes were no longer a significant operational problem. This worked so well that continuing failures, "hits," would have gone undetected if a counter had not

[10] Goddard News, May 1995, Vol. 42, No. 6, *What's Up*, page 3.

been inserted to record them. Many times there were several hundred "hits" per day, from which recovery was automatic, without impact. The hits decreased to only a few per day, as the years passed. The anomaly documented in 1995 (“hit”) actually required that an "OBC dump" be performed.

A decrease in power output of PA4 first occurred in 1984. The spacecraft contains four PA's. Each PA consists of a three stage amplifier. A likely cause of the decrease in power output by PA4, both in 1984, and then in 1995, was that one or more of the individual amplifiers, which comprise the three stage power amplifier, had partially failed. This anomaly was termed, "expected wearout during extended mission phase." with "operations workarounds" planned for any limitations caused by the reduced PA4 performance.

### Interplanetary Monitoring Platform (IMP-8) / No class assigned - estimated as Class B

#### *General Description*

IMP-8, the last of the IMP series, was launched October 25, 1973. It is a drum-shaped spacecraft, 135.6 cm across and 157.4 cm high. It measures magnetic fields, plasmas, and energetic charged particles (e.g., cosmic rays) of the Earth's magnetotail and magnetosheath. It also measures the near-Earth solar wind. IMP-8 had a design life of 2 years; however, it continues to operate satisfactorily.

#### *Science*

In 1995, the IMP-8 spacecraft continued to provide important in situ magnetic field, plasma, and energetic particle data. This data is important for long-term variation studies related to baseline observations relative to deep space measurements (e.g., those from Ulysses and Voyager). It is also important for solar wind-magnetosphere studies in concert with the International Solar Terrestrial Physics Program (ISTP).

Perhaps the most significant IMP-8 science discovery in 1995 was evidence that shows direct correlation between the solar wind mass fluxes and solar neutrino fluxes. This discovery points to subsurface processes that may yield insights into the very fundamental solar neutrino problem—less neutrino flux than is predicted by many models. [11]

#### *Performance*

The IMP-8 flight operations team reported that IMP-8 was fully operational for the entire year, and experienced no anomalies in 1995. However, the Electron Isotopes Experiment that began deteriorating in 1992 was turned off September 2, 1995. [12] As a result of the McMurdo Sound VHF telemetry station becoming operational in late 1995, IMP telemetry coverage increased to the 90-95% level.

### Solar Anomalous and Magnetospheric Particle Explorer (SAMPEX)) / Class C

#### *General Description*

Launched on July 3, 1992, SAMPEX is the first spacecraft operated under GSFC's Small Explorer Program. It is designed to study the composition of energetic particles arriving at Earth from the solar

[11] IMP-8 science events provided by Joe King, GSFC Space Science Data Operations Office, June 6, 1996.
[12] Telecon with Bill Potter, GSFC, July 29, 1996.

atmosphere and interstellar space. It also measures the number of relativistic electrons entering the atmosphere from outer space. Relativistic electrons contribute to ozone destruction.

Designed for a mission life of 3 years, SAMPEX uses several innovative technologies, including an optical fiber buss, powerful on-board computers, and large solid state memories (instead of the usual tape recorders). Also, SAMPEX is the first NASA mission to fully implement a packet switched data network throughout the system.

***Science***

SAMPEX had a number of outstanding scientific results [13] in 1995. Among these results are:

- definitive measurements showing that anomalous cosmic ray nitrogen, oxygen and neon were >95% singly ionized at low energies.
- discovery of an energy dependence in the ionization states of solar energetic particle Iron nuclei, which were measured for the first time over a broad energy range.
- direct evidence for production of upper atmospheric odd nitrogen, due to relativistic electrons precipitating into the atmosphere.
- demonstration that the sign of the solar magnetic polarity (which reverses in alternate sunspot cycles) has a major effect on the transport of anomalous cosmic rays throughout the heliosphere.
- detailed studies of trapper interstellar material.
- global characterizations of the Earth's magnetic polar cap size and its dependence on geomagnetic indices.
- discovery that small solar energetic particle events, rich in heavy ions, can accelerate particles to surprisingly high energies.

***Performance***

In 1995, SAMPEX provided full mission service for the entire year, except for a two day safehold period occurring on October 24, 1995. The SAMPEX spacecraft went into an analog safehold at approximately 9:41:28. It appeared that a Recorder Packet Processor (RPP) Watchdog Time-out occurred, which caused the processor to perform a cold restart, and consequently, place the spacecraft in safehold. SAMPEX returned to full science collection on Thursday, October 24, 1995 at approximately 15:55 p.m. EDT. It appeared that the RPP health and safety task failed to reset a Watchdog Timer. The exact reason for the Watchdog Time-out, and its failure to reset remains a mystery. ACS, Engineering, and science data was lost as a result of this safehold.

The current SAMPEX RPP operating system flight software has a known "bug" that corrupts the processor registers. It causes a general protection fault and a warm reset by the flight software. This situation is a problem because: 1. It causes additional work for the Flight Operations Team (FOT) to restore the state of the RPP prior to the warm reset, and 2. the warm resets are an indication of a problem. A Versatile Real-Time Executive (VRTX) patch has been issued to correct this register corruption problem.

The remaining anomalies reported in 1995 were basically inconsequential. The SAMPEX Flight Operations Team (FOT) reports all anomalies, even though some are known anomalies with a repair

[13] Glenn Mason, University of Maryland, Department of Physics, 5/31/96 memo.

in place that is functioning properly. However classifications, regarding *criticality*, or *mission effect*, *anomaly effect*, *anomaly type*, *and failure category*, reflect this approach to the data collection. Thus, data compilation for this report and trending will not be distorted as a result of this anomaly documentation policy. However, in some cases summary information in this report is presented without SAMPEX included in the totals. When this occurs, it is clearly labeled.

Examples of the SAMPEX policy to collect all anomaly data are the eleven anomalies associated with the flagging of the AINTSTAT mnemonic. The AINTSTAT mnemonic is a known anomaly. This problem, at the level that it is occurring, is not serious. It is being reported to ensure that the flagging of the AINTSTAT mnemonic doesn't occur concurrent with the reaction wheels exceeding 200 rpms. This situation would be more serious.

Another known anomaly, "LEICA monitor points 15 and 16 out of limits" is also being reported, even though the Telemetry and Statistics Monitors which were set up to handle this problem executes the planned response "accordingly."

All one hundred SAMPEX anomalies may be reviewed at Appendix D.

**SPARTAN 201-03 / Class D**

***General Description***

SPARTAN 201 is a small shuttle-launched and shuttle-retrieved Solar Physics spacecraft designed to perform remote sensing of the hot (>$10^6$K) outer layers of the sun's atmosphere or corona. [14] The objectives of the observations are to investigate the mechanisms causing the heating of the solar corona and the acceleration of the solar wind, which originates in the corona. SPARTAN 201 carries a pair of complementary instruments, which perform co-registered observations of the sun's corona: The Smithsonian Astrophysical Observatory (SAO) Ultraviolet Coronal Spectrometer (UVCS) and the Goddard Space Flight Center (GSFC)/High Altitude Observatory (HAO) White Line Coronograph (WLC). The instruments are mated and co-aligned inside the SP201 Instrument Carrier (IC).

***Performance***

SPARTAN 201-03 experienced two anomalies. The SP201 Tape Recorder reversed tape direction too early—before the actual End of Tape (EOT). Also, the SP201-03 spacecraft was found to be in Minimum Reserve Shutdown (MRS) mode when the orbiter returned to retrieve it. The tape recorder is configured to complete three passes during the SP201 mission (forward-reverse-forward) with data being recorded on 4 of the 12 tracks each pass. The first pass ended at Mission Elapsed Time (MET) 00:12:33 instead of the 00:14:50 anticipated. The second pass and third pass were also short, as a result of the early first pass reversal. The net effect of the false triggering of EOT was a tape recorder shutdown 3 hours and 44 minutes early. This resulted in the loss of data from the last two science observation orbits.

The initial investigation revealed evidence of tape stacking problems and subsequent mechanical contact and dragging between the outer tape reel and the housing. The dragging apparently caused variations in tape speed that triggered the false EOT. The SP201 Tape Recorder had experienced tape stacking problems during preflight testing. These problems were not fully diagnosed because of time constraints.

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[14] See the SPARTAN 201-03 Mission Report for a complete discussion on SPARTAN's scientific and engineering performance.

The SP201-03 MRS anomaly required an Orbiter fly-around to achieve proper orientation for grappling. MRS was initiated in spite of a healthy spacecraft. The cause of the initiation of MRS during SP201-03 mission was a latent design implementation error in the MRS system, compounded by a recent change to the system. As configured, the spacecraft will automatically go into MRS, 90 seconds after end of mission (EOM).

### SPARTAN 204 / Class D

#### *General Description*

SPARTAN 204 was the fifth flight of the SPARTAN Project's reusable carrier that flew on STS-63 in February 4 through February 9, 1995. SPARTAN carried a science instrument called the Far Ultraviolet Imaging Spectrograph (FUVIS), provided by the Naval Research Laboratory (NRL) and sponsored by the DOD Space Test Program.

#### *Science*

FUVIS obtained far ultraviolet spectroscopy of diffuse sources, both natural and man-made. The data acquired from natural sources, such as defuse nebulae and galactic background will provide information on interstellar gas and dust. A better understanding of their properties (composition, density, temperature, etc.) will provide a better understanding of the formation process of stars and planets.

On flight day 2, the shuttle arm grappled the SPARTAN carrier and lifted it out of the cargo bay, and pointed the FUVIS at a section of the shuttle's tail for observations of the shuttle glow phenomena. FUVIS was also pointed at the RCS thruster for observations of plume emissions. After a period of about 4.5 hours, SPARTAN returned to the cargo bay.

The data acquired from man-made sources, such as the shuttle surface glow and plume emissions from the Reaction Control System (RCS) thrusters, will provide information on the effect of man-made objects traveling through the space environment. A better understanding of these effects may provide a means for detecting and tracking ballistic and orbiting vehicles.

#### *Performance*

The carrier worked well. However, SPARTAN 204 experienced two anomalies associated with its instruments. With only minor mission effect, the low light level TV did not provide a usable signal for pointing. Instead the RMS remote manipulator had to be used for pointing. A failure of the slit exchange drive mechanism resulted in substantial mission loss. Specifically, observations were able to use only one wave length, precluding the possibility of getting the varied data that was hoped for.

### Tracking and Data Relay Satellite (TDRS) / Class A

#### *General Description*

The TDRS System is a communication signal relay system that provides tracking and data acquisition services for NASA, other satellites (customers), and the Space Shuttle. The system is capable of transmitting to, and receiving data from, customer spacecraft over at least 85% of the customer's orbit.

The TDRS space segment consists of six on-orbit Tracking and Data Relay Satellites in geosynchronous orbit. Three TDRS's are available for operational support at any given time. The operational spacecraft are located at 41, 174, and 275 degrees west longitude. The other TDRS satellites in the constellation provide backup in the event of a failure of an operational spacecraft and, in some specialized cases, serve as resources for targets of opportunity activities.

***Performance***

There were 6 active TDRS satellites in 1995. TDRS-7 was launched July 13, 1995. TDRS satellites experienced nine anomalies in 1995. TDRS-1 experienced two "negligible" anomalies related to the TLM&DH and ACS subsystems. TDRS-3 experienced two anomalies. TDRS-4 had one anomaly. TDRS-7 experienced four anomalies, all related to the loss of attitude control anomaly that occurred on December 6, 1995. At the end of 1995, all six TDRS satellites were operating nominally. TDRS's operational availability exceeds 99%.

**Upper Atmosphere Research Satellite (UARS) / Class B**

***General Description***

UARS is the first major spacecraft of NASA's Mission to Planet Earth series, a coordinated long-term program for studying the Earth's environmental systems. It was launched on September 15, 1991, from Space Shuttle Discovery. As the first element in NASA's Mission to Planet Earth, UARS is carrying out the first systematic, comprehensive study of the stratosphere. Through this study, it will furnish new data on the mesophere and thermosphere. UARS chemistry and dynamics sensors are measuring temperature, pressure, wind velocity, and gas species concentrations at various altitudes. The goal of upper atmosphere research is to understand the chemistry, dynamics, and energy balance above the troposphere, as well as to understand the coupling of these processes and atmosphere regions.

***Science***

An analysis of man-made chlorofluorocarbon trends, as measured by the Halogen Occultation Experiment (HALOE), showed results nearly equal to the trends expected based on surface measurements. Microwave Limb Sounder (MLS) measurements of C10, within the northern hemisphere winter vortex, show much internanual variability. It also provided information about the probability of the formation of a northern hemisphere ozone hole. Since UARS's launch, the solar phase has declined from near solar maximum to solar minimum, as recorded by the instruments which measure the energy and particle input to the Earth’s atmosphere. The record produced by the two wind instruments has reached a length that semi-annual, annual, and quasa-biennial components of the wind variability have been recorded from 15-20 km to about 200 km. UARS operations emphasize long term trends, as monitored mainly by the solar instruments and HALOE. [15]

***Performance***

As of January 1, 1995, UARS was operating well, and eight of the original 10 instruments were producing good scientific data. The Cryogenic Limb Array Etalon Spectrometer (CLAES) had completed its mission when oxygen ran out in the spring of 1993. The Improved Stratospheric and Mesospheric Sounder (ISAMS) had failed in 1992. One radiometer on the Microwave Limb Sounder had failed, but the instrument remains operational. The instruments which remained *completely* operational are the HALOE, Wind Imaging Interferometer (WINDII), High Resolution Doppler Imager (HRDI), Particle Environment Monitor (PEM), Solar Stellar Irradiance Comparison Experiment (SOLSTICE), Solar Ultraviolet Spectral Irradiance Monitor (SUSIM), and the instrument of opportunity, Active Cavity Radiometer Irradiance Monitor (ACRIM).

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[15] UARS science data provided by Anne Douglas, Code 910, June 13, 1996 memo.

On March 23, 1995, a spacecraft emergency, resulted in the failure of both solar array drives. The solar array anomalies associated with this emergency can be traced back to June 1992, when A-side, and then B-side, solar array drives stopped. The cause of these anomalies was not confirmed. Following erratic performance during a yaw-around maneuver, finally in April 1995, the array was parked at 298 degrees.

Since this 1995 emergency, which interrupted data collection from all the instruments for several weeks, the spacecraft has been operating with the “parked” solar array. In this low power situation, it is usually not possible to operate all of the instruments at once. Usually, 6 out of the 8 instruments are the maximum that can be operated with the power available. However, in the months following the emergency, an alternative observing strategy was implemented. Because all of the instruments do not require 30 out of 30 days for collection (some require only 7 out of 30 days), UARS is still able to perform the mission.

In 1995, all of the instruments had sufficient days of observations to fulfill, or exceed, their minimum science requirements.

**WIND (Global Geospace Science - GGS)   Class B**

***General Description***

WIND, launched November 1, 1994, is the first of two missions of NASA's Global Geospace Science (GGS) initiative. GGS is the U.S. portion of the International Solar-Terrestrial Physics (ISTP) program. WIND is designed to observe the Earth's “foreshock region,” to monitor the incoming solar wind, and its interaction with the Earth's magnetic field, and measure energetic particles in terms of mass, momentum, and energy. It carries eight science instruments.

This launch marks the first time a Russian instrument has flown on an American spacecraft. The KONUS Gamma-Ray Spectrometer, provided by the Ioffe Institute, St. Petersburg, Russia is one of two instruments on WIND that will study cosmic gamma-ray bursts, rather than the solar wind.

***Science***

WIND is an integral part of the multi-agency (NASA, NOAA, DOD) Space Weather initiative. As part of this effort, WIND supported the Air Force Solar Wind Interplanetary Measurement (SWIM) campaign with extended real-time contacts on March 13 through March 26, 1995, and again on September 12 through September 16, 1995.

WIND data has also been used to support rocket launches. The Sounding of the Cusp Ion Fountain Energization Region (SCIFER) rocket experiment was launched on January 25, 1995, from Spitzbergen, Norway. Extended, real-time Deep Space Network (DSN) support was scheduled from January 19 to February 5 to assist in the launch. Key geophysical parameters derived from real-time telemetry from the Solar Wind Experiment (SWE), Magnetic Field Instrument (MFI), and 3-D Plasma instruments were used to support the launch go/no-go decision. The data were available from the ISTP Central Data Handling Facility (CDHF) at GSFC in near real-time, to be accessed via the Internet from the launch site.

WIND, the most magnetically clean spacecraft ever developed by NASA, observed a magnetic cloud on October 18,1995. This unusual event was observed to generate strong magnetic disturbances and spectacular auroral displays.

The Transient Gamma Ray Spectrometer (TGRS) experiment has operated nominally since launch, with performance that exceeds pre-launch expectations. [16] Scientific highlights of 1995 include:

- Detection of ~ 50 gamma-ray bursts—high resolution spectroscopy has been possible on ~2/3 of these events. TGRS has much better spectral resolution than the previously flown gamma-ray burst detector.

- Detection of electron-positron annihilation from the center of our galaxy—this radiation may be the signature of a single massive black hole, or an ensemble of smaller compact objects. The absence of temporal variability on the TGRS observations suggests the latter.

- Detection of the transient source of 1655-40—this strong variable source is considered to be a black hole candidate.

***Performance***

WIND operations reported only one anomaly for 1995. On January 19, there was degraded telemetry data. The telemetry contained only the first 10 minor frames (of 250) of each major frame, and had an incorrect spacecraft time. Following an established contingency procedure, a switch from GGS Telemetry Module 1 (GTM1) to the redundant GTM2 resulted in full recovery. The problem was traced to a failed component within GTM1, probably a counter chip.

The following problems were encountered during 1995, but were not considered significant enough to be designated and documented as anomalies by the Flight Operations Team:

- April 95 - Anomalous 3D-Plasma resets—an incorrect command request
- by instrumenter caused an unusual instrument configuration.
- April 95 - The Solar Wind Ion Composition Spectrometer/ High Mass Resolution Spectrometer/ Suprathermal Ion Composition Spectrometer (SWICS/MASS/STICS) [SMS] instrument suffered a processor reset. This reset was a single event upset (SEU) of Digital Processing Unit (DPU). Operations estimates that there will probably be four SEUs per year.
- April 95 - The Energy Particle Acceleration, Composition, and Transport and Electron Isotope (EPACT/ELITE) instrument encountered an anomaly in the APE2 telescope. It was attributed to a crack in one of four detectors in the telescope.
- June 95 - Attempt to restart SWICS Microchannel Plate (MCP) power supply was not successful. The failure occurred during instrument activation. Earlier efforts to restart the power supply were also not successful. Only a single portion of one of the three SMS sensors is affected. This was determined to be a failed component, or connection.
- August 95 - Thruster 10-25% under-performance. This problem was compensated for in subsequent maneuvers.
- October 95 - Spacecraft clock Epoch rollover problem. This problem was overcome by manually resetting the clock. Another epoch rollover will not occur during the mission lifetime.

### X-Ray Timing Explorer (XTE) / Class C

***General Description***

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[16] TGRS update provided by Bonnard Teegarden, Centre d'Etudes Spatiale des Rayonnements, email memo dated July 3, 1996.

The X-Ray Timing Explorer (XTE) was launched from Cape Canaveral Air Station December 30, 1995. With a planned operational lifetime of 2 years, XTE was launched on a Delta II into a low Earth orbit of 362 miles, and a 23 degree inclination.

The purpose of the XTE mission is to provide an understanding of the structure and dynamics of galactic and extragalactic compact X-ray sources. XTE will gather data about X-ray emitting objects within the Milky Way, and beyond. It will perform timing studies of X-ray sources, which vary in intensity of their emissions. It will also perform spectral studies, which will reveal emission processes and locations emitting X-rays. XTE has three instruments studying the variable X-ray sky: Large Area Proportional Counter Array (GSFC), All Sky Monitor (Massachusetts Institute of Technology), and High Energy X-Ray Timing Experiment (University of California at San Diego).

***Science***

There were no science data collected by XTE in 1995.

***Performance***

Shortly after launch, during the in-orbit checkout phase, XTE experienced two anomalies. Its solar array performance was significantly degraded from nominal. Also, the star trackers did not maintain lock on guide stars in inertial hold.

The XTE Flight Operations Team (FOT) determined that the solar array problem was most likely the result of cracked solar array cells. The FOT observed the anomaly immediately after spacecraft deployment, prior to solar array deployment. They managed this problem by offsetting the arrays to 45 degrees (later changed to 40 degrees)—to keep the arrays colder. This procedure decreased maximum temperature by approximately 20 degrees. In addition, a gentle-motion flight software patch is being tested. This patch will allow the solar arrays to slowly ramp up and down, thereby limiting stress on array cells.

To correct the star tracker's problem, the FOT uplinked a sequence to automatically reissue directed search commands to a star tracker—in the event that the star tracker lost track of stars in its first four slots. XTE pointing accuracy and stability were unaffected by this anomaly, and there was only negligible affect on the mission. Gyros provide primary attitude reference. Star trackers are only used for low frequency correction.

**Geostationary Operational Environment Satellite (GOES) Class A**

***General Description***

GOES are a series of weather and environmental observation satellites. GOES-2, -3, -5 are deactivated, and are being used as transponders. GOES-7 was operational in 1995, but no anomalies were reported to GSFC. GOES-8, launched on April 13, 1994, was the first of a new generation of GOES, I-M, to provide significant improvements. GOES-9 was launched on May 23, 1995. It is the second of the new series of satellites designed to provide improved imaging. The anomalies included in this report relate only to GOES-8 and GOES-9. GOES-8 was referred to as GOES-I before launch. GOES-9 was referred to as GOES-J before launch.

GOES-8 and -9 are geostationary weather satellites developed and launched by NASA for the National Oceanic and Atmospheric Administration (NOAA), and are key elements in the National Weather Service (NWS) operations and modernization program. NOAA is responsible for program funding and the in-orbit operation of the systems, and also determines the need for satellite replacement. Once the satellite is launched and checked out, NOAA assumes responsibility for the command and control, data receipt and product generation and distribution.

A little background is helpful in understanding GSFC role, with respect to the new generation of NOAA spacecraft.[17] In 1983, NASA signed an agreement with the National Oceanic and Atmospheric Administration (NOAA) to design and build a new generation of weather satellites. These satellites carry instruments that will operate as never before—including half hour, or near continuous observation of Earth. The new series of GOES satellites (GOES I-M) provide significant improvements over the previous GOES system in weather and sounding information. This enhanced system improves weather services, particularly the timely forecasting of life and property threatening severe storms.

GOES is designed to operate in geosynchronous orbit 22,240 miles above the Earth, thereby appearing to remain stationary. GOES I-M are the first ever three-axis body stabilized spacecraft. This enables the satellite to "stare" at the Earth and provide more frequent images of clouds, the Earth's surface temperature, and water vapor fields. This also enables GOES to “sound” the atmosphere for its vertical thermal and vapor profiles. The new series of GOES satellites provide half hourly radiometric observation, measuring Earth emitted and reflection radiation from which atmospheric temperature, winds, moisture and cloud cover can be derived.

#### *Performance*

GOES-8 and GOES-9 are still suffering a significant number of anomalies, 29 and 38 in 1995, respectively. Of the 67 anomalies, 41 were termed Criticality 1 (loss 0f of 0-5% of the mission), and 26 were termed Criticality 2 (loss of 5-33% of the mission). The subsystem most affected was Instruments, with a combined total of 26 anomalies. See Appendix C for a complete description of all GOES anomalies.

### National Oceanic and Atmospheric Administration (NOAA) / Class B

#### *General Description*

Complementing the geostationary satellites are two polar-orbiting satellites, known as the advanced Television Infrared Observing System (TIROS) satellites. Constantly circling the Earth in an almost north-south orbit, passing close to both poles, the polar orbiters monitor the entire Earth. They track atmospheric variables and provide atmospheric data, and cloud images, for weather forecasting and environmental studies. They track weather patterns that affect the climate of the entire United States, providing visible and infrared radiometer data used for imaging purposes, radiation measurements, and temperature profiles.

In addition to weather and environmental data, NOAA spacecraft provide search and rescue capabilities through continuous world-wide monitoring for distress radio beacons. These services are provided through the coordinated and cooperative efforts of many nations.

The NOAA satellites are constructed and launched by NASA for the National Oceanic and Atmospheric Administration (NOAA).

#### *Performance*

[17] Goddard News, May 1995, Vol. 42, No. 6,*What's Up*, page 1.

In 1995, there were five active NOAA satellites: NOAA-9, NOAA-10, NOAA-11, NOAA-12, and NOAA-14. NOAA spacecraft suffered twelve anomalies in 1995. Eight of the anomalies were attributable to the recently-launched NOAA-14, two to NOAA-9, and one each to NOAA-10 and NOAA-12. NOAA-11 experienced no anomalies in 1995.

NOAA-14 was launched on December 30, 1994. In February 1995, NOAA-14 experienced three anomalies:

- Unsuccessful DTR-4A (digital tape recorder) GAC (global area coverage) playback
- SARP+12 (search and rescue processor) volt power supply dropped to +4.0 volts, and,
- An anomalous increase in ESA (Earth sensor assembly) quadrant 3 mean count level.

On March 3, 1995, the Microwave Sounding Unit (MSU) scanner stopped. An investigative board was formed to study this anomaly.[18] The problem was related to the microwave sounding unit, which measures the vertical temperature of the atmosphere up to about 12 miles. On March 2, the unit suddenly stopped performing its normal scan sequence. Its motor continued to draw current, causing some overheating. But engineers discovered the problem early, and shut the motor down before any apparent damage occurred.

On March 10, an investigation board was formed. As part of the board's initial investigation, the microwave sounding unit was reactivated for short periods on March 15 and 17. These reactivations were successful, and the unit was able to perform the scanning sequence. After the initial reactivations, and in an effort to avoid difficulties in the future, engineers developed a software patch designed to command the unit's motor to shut down, should the scanning sequence suddenly stop, as it did on March 3, 1995.

NOAA-14 experienced four additional anomalies during 1995:

- Solar Backscatter Ultraviolet Radiometer (SBUV) Cloud Cover Radiometer (CCR) data never indicated nominal values,
- Stratospheric Sounding Unit (SSU) scanner position detector # 5 reed switch is intermittent,
- SBUV grating does not achieve lock, and,
- The demodulation portion of the Command/Receiver Demodulator (CRD) stopped functioning.

NOAA-9's anomalies were:

- Loss of recorded data due to Manipulated Information Rate Processor (MIRP) power failure, and
- Control Central Processing Unit (CPU) switched from OBP1 to OBP2 (Onboard Processors 1&2) and safe state was initiated.

NOAA-10 experienced excessive reaction wheel assembly speeds on February 13, 1995. NOAA-12 had inaccurate analog telemetry indicators on November 10, 1995. See Appendix C for a complete description of NOAA spacecraft anomalies.

### Detailed Anomaly Data

This section provides detailed information regarding the quantity of anomalies, the impact on the mission, the distribution of the anomalies among spacecraft subsystems, the effect of the anomaly on the spacecraft system levels, the category of the failure (design, workmanship, etc.) and the anomaly

[18] Goddard News, May 1995, Vol. 42, No. 6, *What's Up*, page 7.

type (random, systematic, etc.). A discussion of the classification scheme provides the definitions and coding legends for interpretation of the tables and graphs appearing in this section, and the appendices.

Following the discussion of our classification scheme is a summary of the anomaly data compiled for this report. Here, we provide the significant divisions of the data.

Finally, we include a series of tables with data totals for the various categories and divisions significant to anomaly data. The data is further elucidated with graphs depicting the distribution of the anomaly data among the divisions of interest to this research.

### *Classification Scheme*

Anomaly data for this report was classified using the same categories used for previous reports in this series. The anomaly data reported here also corresponds to the categories and classifications used for data in the Spacecraft Orbital Anomaly Report (SOAR) data base. This classification scheme assigns numerical codes to various categories to facilitate anomaly data entry, sorting, and analysis of the data. The classification categories are defined below:

- Spacecraft - The nomenclature of the spacecraft.
- Index - A sequential reference number assigned to each anomaly beginning at the spacecraft's launch. For the year 1995 report, the indexed numbers are assigned the prefix "95." Hence, the number 9524 indicates that it is the twenty-fourth anomaly occurring since launch. It also indicates that the anomaly occurred in 1995.
- Date - The date of the anomaly.
- Days - The number of days since launch when the anomaly occurred.
- Subsystem - Spacecraft are divided into the following nine subsystems:

    1. Attitude Control Subsystem (ACS)
    2. Power
    3. Propulsion
    4. Structure
    5. Telemetry & Data Handling (TLM & DH)
    6. Thermal
    7. Timing, Control & Command (TC & C)
    8. Instrument (payload)
    9. Other (name to be entered)

- Criticality (Mission Effect) - A number denoting the effect of the anomaly on the spacecraft's mission objectives assigned according to the following classifications:

    1. Negligible (0 - 5%)[19]
    2. Non-negligible but small (Minor) (5 - 33%)

[19] The percentages indicate the approximate loss of the mission objectives as a result of the anomaly.

3. 1/3 - 2/3 Mission Loss (Substantial) (33 - 66%)
4. 2/3 to Nearly Total Loss (Major) (66 - 95%)
5. Essentially Total Loss (Catastrophic) (95 - 100%)

- Description - A description of the anomaly and, if known, its probable cause. This description is brief and has been edited for this report; however, every effort has been made to preserve the complete content provided by the original drafter of the anomaly.

- Effect/Action - The anomaly's effect on the mission and corrective action, either for the mission or future missions, if any, and if known. Again, the original anomaly content is preserved in an edited form.

- Reference - The primary information source for the anomaly, e.g, anomaly report number, team member's name, or other document.

- Each anomaly is also classified under the following criteria for sorting and analysis in the Spacecraft Orbital Anomaly Report (SOAR) database:

Anomaly Effect:

1 = Spacecraft failure
2 = Subsystem/instrument failure
3 = Component failure
4 = Assembly failure
5 = Part failure
6 = Subsystem/instrument degradation
7 = Indeterminate
8 = Loss of redundancy
9 = None

Failure Category:

1 = Design problem
2 = Workmanship problem
3 = Part problem
4 = Environmental problem
5 = Other (w/explanation)
6 = Unknown

Type of Anomaly:

1 = Systematic (would occur if identical equipment were operated under identical circumstances)
2 = Random
3 = Wearout (a special case of systematic)
4 = Indeterminate
5 = Intermittent
6 = Normal/Expected Operation

**Summary of Anomaly Data**

During 1995, Goddard had twenty-eight active orbiting satellites, and two “SPARTAN” Shuttle-launched and Shuttle-retrieved "free flyers." There were 212 anomalies reported among 22 satellites. GOES-8 accounted for 29 anomalies, and GOES-9 accounted for 38 anomalies. GOES-8 and GOES-9 experienced an inordinate number of anomalies, when compared to the other spacecraft. GOES spacecraft, with 67 anomalies, accounted for 32% of all reported anomalies. However, these spacecraft are the first two of the significantly-improved I through M series spacecraft. These spacecraft had integration and test problems before launch.

SAMPEX, with 100 "anomalies," accounted for 47% of all reported anomalies. Because of the large percentage of the anomalies experienced by SAMPEX, data in the following tables and charts are sometimes presented without SAMPEX included in the total anomaly count. This presentation allows for greater insight into the anomalies that occurred on all other Goddard spacecraft.

Of the 100 SAMPEX anomalies, only two were considered to have more than a negligible impact on the mission (criticality of 1). These two anomalies had a minor effect (criticality of 2).

Of the 112 anomalies reported for all spacecraft (excluding SAMPEX), only 3 impacted the mission "substantially" (criticality of 3). There were no anomalies in 1995 that had a “major” or “catastrophic” impact on the mission, criticality of 4 or 5 respectively.

The most frequent subsystem anomalies for all spacecraft were Instruments (97), Attitude Control System (44), Telemetry and Data Handling (37), Power (17), and Other (16). The Thermal subsystem experienced only 1 anomaly.

Of the non-SAMPEX anomalies, 51% caused subsystem or instrument degradation, while 21% had no affect on the spacecraft. For 14% of the anomalies, no anomaly effect on the spacecraft could be determined. See Figure 4-1 on page 30.

Excluding SAMPEX, 34% of the anomalies were deemed to be “systematic,” while the type of anomaly could not be determined for 30%. Random and Intermittent anomalies accounted for 12% and 11%, respectively. See Figure 5-1 on page 31.

Again excluding SAMPEX, 31% of the anomalies were designated as an anomaly related to a design problem. For 33% of the anomalies, the failure cause was unknown. For 20% of the anomalies, “other (known)” was the failure category. See Figure 6-1 on page 32.

## Anomaly Data - Classifications and Distributions [20]

The following tables, Table 2 through Table 7, Figures 1 through 8 depict the classification and distribution of the anomaly characteristics.

Table 2. 1995 Anomaly Distribution Among Spacecraft

| Spacecraft | Number of Anomalies | | Spacecraft | Number of Anomalies | |
|---|---|---|---|---|---|
| | Since Launch | 1995 | | Since Launch | 1995 |
| CGRO | 25 | 2 | TDRS-7 | 4 | 4 |
| ERBS | 43 | 5 | UARS | 19 | 2 |
| EUVE | 6 | 0 | WIND | 1 | 1 |
| HST | 97 | 5 | XTE | 2 | 2 |
| ICE (ISEE-3) | 1[21] | 1 | GOES-2 | Deactivated | 0 |
| IUE | 47 | 2 | GOES-3 | Deactivated | 0 |
| IMP-8 | 8[22] | 0 | GOES-5 | Deactivated | 0 |
| SAMPEX | 396 | 100 | GOES-7 | 22[23] | 0 |
| SPARTAN 201-03 | 2 | 2 | GOES-8 | 95 | 29 |
| SPARTAN 204 | 2 | 2 | GOES-9 | 38 | 38 |
| TDRS-1 | 73 | 2 | NOAA-9 | 36 | 2 |
| TDRS-3 | 21 | 2 | NOAA-10 | 25 | 1 |
| TDRS-4 | 31 | 1 | NOAA-11 | 28 | 0 |
| TDRS-5 | 12 | 0 | NOAA-12 | 19 | 1 |
| TDRS-6 | 13[24] | 0 | NOAA-14 | 10 | 8 |
| | | | Total | 1068 | 212 |
| | | | Total excluding SAMPEX | 672 | 112 |

[20] The term *distribution* here refers to the categorizaton of data among spacecraft and anomaly attributes rather than to a statistical distribution.

[21] Researched back to 1984. No anomalies experienced until 1995.

[22] Anomaly count provided by Bill Potter, GSFC, on July 29, 1996. No anomalies were reported in 1995.

[23] As of 1993. No anomalies were reported in 1994 or 1995.

[24] 12 in 1993, 1 in 1994, and 0 in 1995.

Table 3. 1995 Anomaly Distribution by Mission Effect (Criticality)

| Mission Effect = / Spacecraft | 1 (0 - 5%) | 2 (5 - 33%) | 3 (33 - 66%) | 4 (66 - 95%) | 5 (95 - 100%) | Total Anomalies | % of Total Anomalies |
|---|---|---|---|---|---|---|---|
| CGRO | 1 | 1 | | | | 2 | 0.9 |
| ERBS | 5 | | | | | 5 | 2.3 |
| EUVE | | | | | | | |
| HST | 4 | 1 | | | | 5 | 2.3 |
| ICE (ISEE-3) | | 1 | | | | 1 | 0.5 |
| IUE | 1 | 1 | | | | 2 | 0.9 |
| IMP-8 | | | | | | | |
| SAMPEX | 98 | 2 | | | | 100 | 47.2 |
| SPARTAN 201-03 | 2 | | | | | 2 | 0.9 |
| SPARTAN 204 | | 1 | 1 | | | 2 | 0.9 |
| TDRS-1 | 2 | | | | | 2 | 0.9 |
| TDRS-3 | 2 | | | | | 2 | 0.9 |
| TDRS-4 | 1 | | | | | 1 | 0.5 |
| TDRS-5 | | | | | | | |
| TDRS-6 | | | | | | | |
| TDRS-7 | 4 | | | | | 4 | 1.9 |
| UARS | | 1 | 1 | | | 2 | 0.9 |
| WIND | 1 | | | | | 1 | 0.5 |
| XTE | 1 | 1 | | | | 2 | 0.9 |
| GOES-8 | 17 | 12 | | | | 29 | 13.7 |
| GOES-9 | 24 | 14 | | | | 38 | 17.9 |
| NOAA-9 | 1 | | 1 | | | 2 | 0.9 |
| NOAA-10 | 1 | | | | | 1 | 0.5 |
| NOAA-11 | | | | | | | |
| NOAA-12 | 1 | | | | | 1 | 0.5 |
| NOAA-14 | 1 | 7 | | | | 8 | 3.8 |
| Total, excluding SAMPEX | 69 | 40 | 3 | 0 | 0 | 112 | 52.8 |
| Total for all Spacecraft | 167 | 42 | 3 | 0 | 0 | 212 | 100 |
| % of Total Anomalies, all spacecraft | 78.8 | 19.8 | 1.4 | 0 | 0 | 100 | 100 |

Note: Mission Effect denotes the percentage of mission loss attributable to the anomaly.

Table 4. 1995 Anomaly Distribution Among Spacecraft Subsystems

| Spacecraft Subsystems = / Spacecraft | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Total Anomalies | % of Total Anomalies |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CGRO | 1 | | | | 1 | | | | | 2 | 0.9 |
| ERBS | | | | | 5 | | | | | 5 | 2.3 |
| EUVE | | | | | | | | | | | |
| HST | | 3 | | | 1 | | | 1 | | 5 | 2.3 |
| ICE (ISEE-3) | | | | | 1 | | | | | 1 | 0.5 |
| IUE | 1 | | | | 1 | | | | | 2 | 0.9 |
| IMP-8 | | | | | | | | | | | |
| SAMPEX | 18 | 6 | | | 12 | | | 64 | | 100 | 47.2 |
| SPARTAN 201-03 | 1 | | | | 1 | | | | | 2 | 0.9 |
| SPARTAN 204 | | | | | | | | 2 | | 2 | 0.9 |
| TDRS-1 | 1 | | | | 1 | | | | | 2 | 0.9 |
| TDRS-3 | 1 | | | | 1 | | | | | 2 | 0.9 |
| TDRS-4 | | | | | 1 | | | | | 1 | 0.5 |
| TDRS-5 | | | | | | | | | | | |
| TDRS-6 | | | | | | | | | | | |
| TDRS-7 | 2 | 1 | | | 1 | | | | | 4 | 1.9 |
| UARS | 1 | 1 | | | | | | | | 2 | 0.9 |
| WIND | | | | | 1 | | | | | 1 | 0.5 |
| XTE | 1 | 1 | | | | | | | | 2 | 0.9 |
| GOES-8 | 7 | 1 | | | 3 | | | 12 | 6 | 29 | 13.7 |
| GOES-9 | 8 | 3 | | | 2 | 1 | | 14 | 10 | 38 | 17.9 |
| NOAA-9 | | 1 | | | 1 | | | | | 2 | 0.9 |
| NOAA-10 | 1 | | | | | | | | | 1 | 0.5 |
| NOAA-11 | | | | | | | | | | | |
| NOAA-12 | | | | | 1 | | | | | 1 | 0.5 |
| NOAA-14 | 1 | | | | 3 | | | 4 | | 8 | 3.8 |
| Total, excluding SAMPEX | 26 | 11 | 0 | 0 | 25 | 1 | 0 | 33 | 16 | 112 | 52.8 |
| Total for all Spacecraft | 44 | 17 | 0 | 0 | 37 | 1 | 0 | 97 | 16 | 212 | 100 |
| % of Total Anomalies, all spacecraft | 20.8 | 8.0 | 0 | 0 | 17.5 | 0.5 | 0 | 45.7 | 7.5 | 100 | 100 |

Subsystems:

1- Attitude Control
2 - Power
3 - Propulsion
4 - Structure
5 - Telemetry and Data Handling
6 - Thermal
7 - Timing Control & Command
8 - Instrument (Payload)
9 - Other

Table 5.  1995 Anomaly Distribution by Anomaly Effect

| Anomaly Effects = <br> Spacecraft | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Total Anomalies | % of Total Anomalies |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CGRO | | | | | | | | 1 | 1 | 2 | 0.9 |
| ERBS | | | | | | | | | 5 | 5 | 2.3 |
| EUVE | | | | | | | | | | | |
| HST | | | | | | 4 | 1 | | | 5 | 2.3 |
| ICE (ISEE-3) | | | | | | 1 | | | | 1 | 0.5 |
| IUE | | | | 1 | 1 | | | | | 2 | 0.9 |
| IMP-8 | | | | | | | | | | | |
| SAMPEX | | | | | | 3 | 43 | | 54 | 100 | 47.2 |
| SPARTAN 201-03 | | 1 | 1 | | | | | | | 2 | 0.9 |
| SPARTAN 204 | | | | | | 2 | | | | 2 | 0.9 |
| TDRS-1 | | | | 1 | | 1 | | | | 2 | 0.9 |
| TDRS-3 | | | | | | 1 | 1 | | | 2 | 0.9 |
| TDRS-4 | | | | | | 1 | | | | 1 | 0.5 |
| TDRS-5 | | | | | | | | | | | |
| TDRS-6 | | | | | | | | | | | |
| TDRS-7 | | | | | | 3 | 1 | | | 4 | 1.9 |
| UARS | | 1 | | | 1 | | | | | 2 | 0.9 |
| WIND | | | | | | | | 1 | | 1 | 0.5 |
| XTE | | | | | | 1 | 1 | | | 2 | 0.9 |
| GOES-8 | | | | | | 17 | 6 | | 6 | 29 | 13.7 |
| GOES-9 | | | | | | 21 | 5 | 1 | 11 | 38 | 17.9 |
| NOAA-9 | | | 1 | | | 1 | | | | 2 | 0.9 |
| NOAA-10 | | | | | | | | | 1 | 1 | 0.5 |
| NOAA-11 | | | | | | | | | | | |
| NOAA-12 | | | | | | | 1 | | | 1 | 0.5 |
| NOAA-14 | | 2 | 1 | | | 5 | | | | 8 | 3.8 |
| Total, excluding SAMPEX | 0 | 4 | 3 | 2 | 2 | 58 | 16 | 3 | 24 | 112 | 52.8 |
| Total for all Spacecraft | 0 | 4 | 3 | 2 | 2 | 61 | 59 | 3 | 78 | 212 | 100 |
| % of Total Anomalies, all spacecraft | 0 | 1.9 | 1.4 | 0.9 | 0.9 | 28.8 | 27.9 | 1.4 | 36.8 | 100 | 100 |

Anomaly Effects:

- 1 - Spacecraft Failure
- 2 - Subsystem or Instrument Failure
- 3 - Component Failure
- 4 - Assembly Failure
- 5 - Part Failure
- 6 - Subsystem or Instrument Degradation
- 7- Unknown (Not Determined)
- 8 - Loss of Redundancy
- 9 - None

Table 6. 1995 Anomaly Distribution by Anomaly Type

| Anomaly Type = / Spacecraft | 1 | 2 | 3 | 4 | 5 | 6 | Total Anomalies | % of Total Anomalies |
|---|---|---|---|---|---|---|---|---|
| CGRO | | | | 2 | | | 2 | 0.9 |
| ERBS | | 5 | | | | | 5 | 2.3 |
| EUVE | | | | | | | | |
| HST | | | | | 5 | | 5 | 2.3 |
| ICE (ISEE-3) | | | | 1 | | | 1 | 0.5 |
| IUE | 1 | | | | | 1 | 2 | 0.9 |
| IMP-8 | | | | | | | | |
| SAMPEX | 4 | 3 | | 5 | 48 | 40 | 100 | 47.2 |
| SPARTAN 201-03 | 2 | | | | | | 2 | 0.9 |
| SPARTAN 204 | | | 2 | | | | 2 | 0.9 |
| TDRS-1 | 1 | | 1 | | | | 2 | 0.9 |
| TDRS-3 | 1 | | | 1 | | | 2 | 0.9 |
| TDRS-4 | | 1 | | | | | 1 | 0.5 |
| TDRS-5 | | | | | | | | |
| TDRS-6 | | | | | | | | |
| TDRS-7 | 2 | | | 1 | | 1 | 4 | 1.9 |
| UARS | 1 | | 1 | | | | 2 | 0.9 |
| WIND | | 1 | | | | | 1 | 0.5 |
| XTE | 2 | | | | | | 2 | 0.9 |
| GOES-8 | 9 | 3 | | 11 | 1 | 5 | 29 | 13.7 |
| GOES-9 | 17 | | | 15 | 3 | 3 | 38 | 17.9 |
| NOAA-9 | | | 1 | | 1 | | 2 | 0.9 |
| NOAA-10 | 1 | | | | | | 1 | 0.5 |
| NOAA-11 | | | | | | | | |
| NOAA-12 | | | | 1 | | | 1 | 0.5 |
| NOAA-14 | 1 | 3 | | 2 | 2 | | 8 | 3.8 |
| Total, excluding SAMPEX | 38 | 13 | 5 | 34 | 12 | 10 | 112 | 52.8 |
| Total for all Spacecraft | 42 | 16 | 5 | 39 | 60 | 50 | 212 | 100 |
| % of Total Anomalies, all spacecraft | 19.8 | 7.5 | 2.4 | 18.4 | 28.3 | 23.6 | 100 | 100 |

Anomaly Type:

1 - Systematic
2 - Random
3 - Wearout
4 - Indeterminant
5 - Intermittent
6 - Expected Operations

Table 7.  1995 Anomaly Distribution by Failure Category

| Failure Category = / Spacecraft | 1 | 2 | 3 | 4 | 5 | 6 | Total Anomalies | % of Total Anomalies |
|---|---|---|---|---|---|---|---|---|
| CGRO | | | | | | 2 | 2 | 0.9 |
| ERBS | 5 | | | | | | 5 | 2.3 |
| EUVE | | | | | | | | |
| HST | | | | 1 | 4 | | 5 | 2.3 |
| ICE (ISEE-3) | | | | | | 1 | 1 | 0.5 |
| IUE | | | | 1 | 1 | | 2 | 0.9 |
| IMP-8 | | | | | | | | |
| SAMPEX | | | | | 14 | 86 | 100 | 47.2 |
| SPARTAN 201-03 | 1 | | 1 | | | | 2 | 0.9 |
| SPARTAN 204 | 2 | | | | | | 2 | 0.9 |
| TDRS-1 | 1 | | 1 | | | | 2 | 0.9 |
| TDRS-3 | | | | 1 | | 1 | 2 | 0.9 |
| TDRS-4 | | | 1 | | | | 1 | 0.5 |
| TDRS-5 | | | | | | | | |
| TDRS-6 | | | | | | | | |
| TDRS-7 | 2 | | | | 1 | 1 | 4 | 1.9 |
| UARS | | | 2 | | | | 2 | 0.9 |
| WIND | | | 1 | | | | 1 | 0.5 |
| XTE | 2 | | | | | | 2 | 0.9 |
| GOES-8 | 8 | 1 | | 1 | 7 | 12 | 29 | 13.7 |
| GOES-9 | 14 | 1 | | | 8 | 15 | 38 | 17.9 |
| NOAA-9 | | | | | 1 | 1 | 2 | 0.9 |
| NOAA-10 | | | | 1 | | | 1 | 0.5 |
| NOAA-11 | | | | | | | | |
| NOAA-12 | | | | | | 1 | 1 | 0.5 |
| NOAA-14 | | 1 | 3 | 1 | | 3 | 8 | 3.8 |
| Total, excluding SAMPEX | 35 | 3 | 9 | 6 | 22 | 37 | 112 | 52.8 |
| Total for all Spacecraft | 35 | 3 | 9 | 6 | 36 | 123 | 212 | 100 |
| % of Total Anomalies, all spacecraft | 16.6 | 1.4 | 4.2 | 2.8 | 17.0 | 58.0 | 100 | 100 |

Failure Category:
- 1 - Design Problem
- 2 - Workmanship Problem
- 3 - Part Problem
- 4 - Environmental Problem
- 5 - Other (Known)
- 6 - Unknown

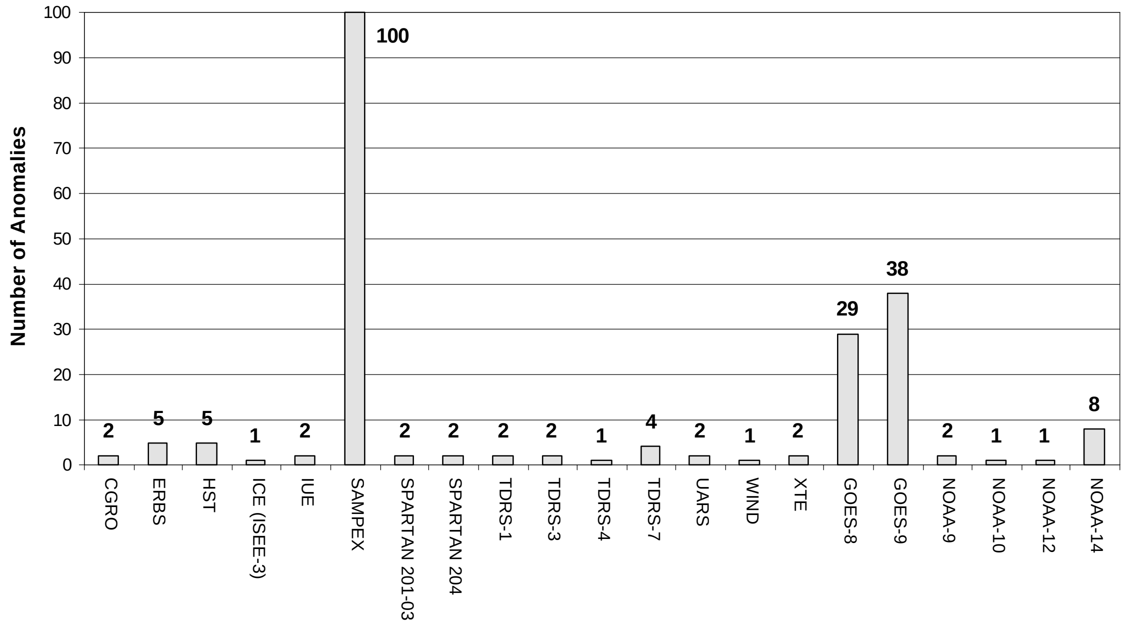


**Figure 1. Anomaly distribution among spacecraft.**

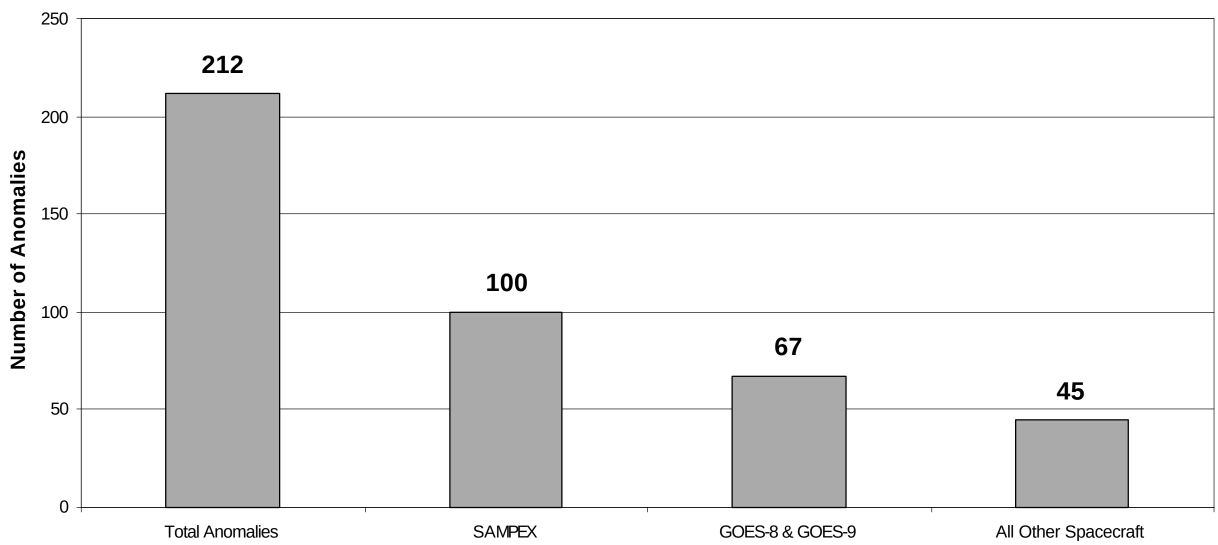


**Figure 1-1. 1995 Anomaly Distribution**

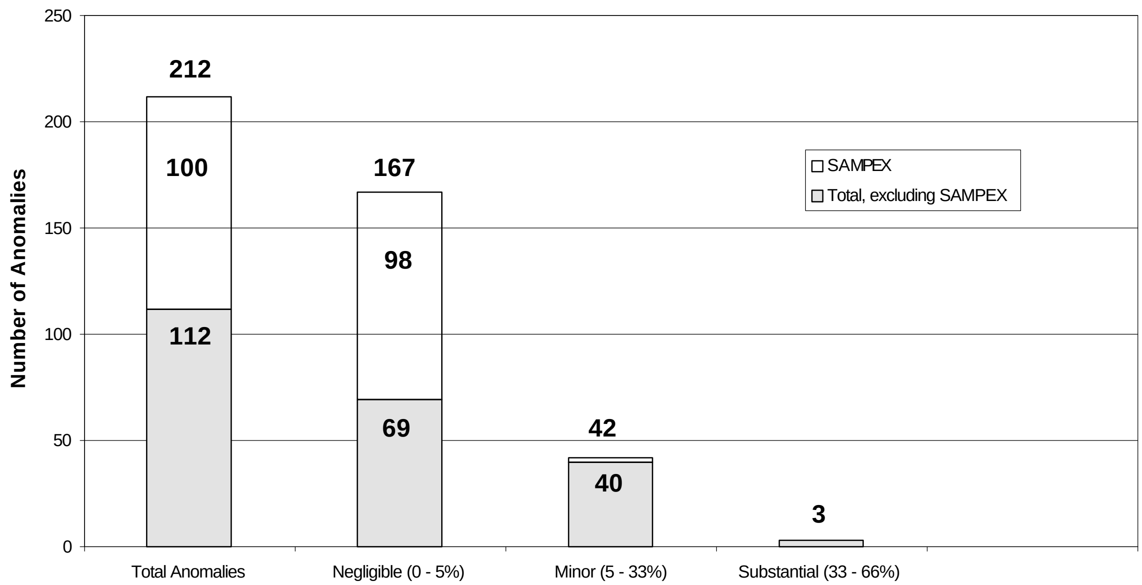


**Figure 2. Anomaly effects on spacecraft missions.**

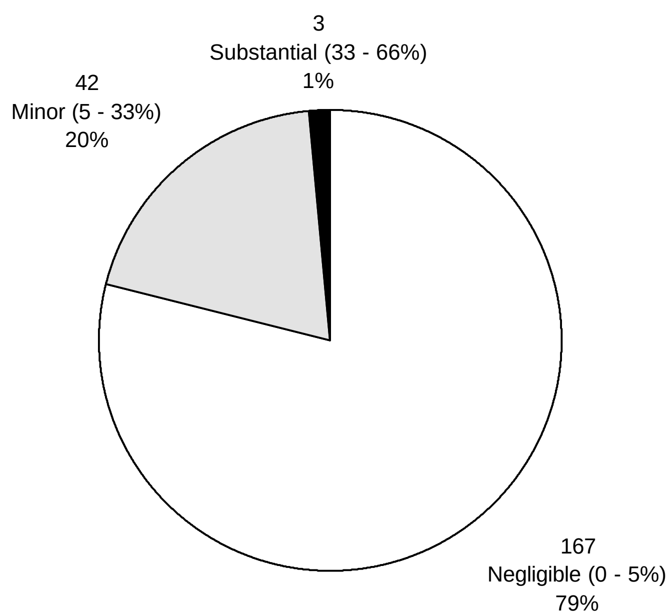


**Figure 2-1. Mission effect (Criticality) percentages, all spacecraft.**

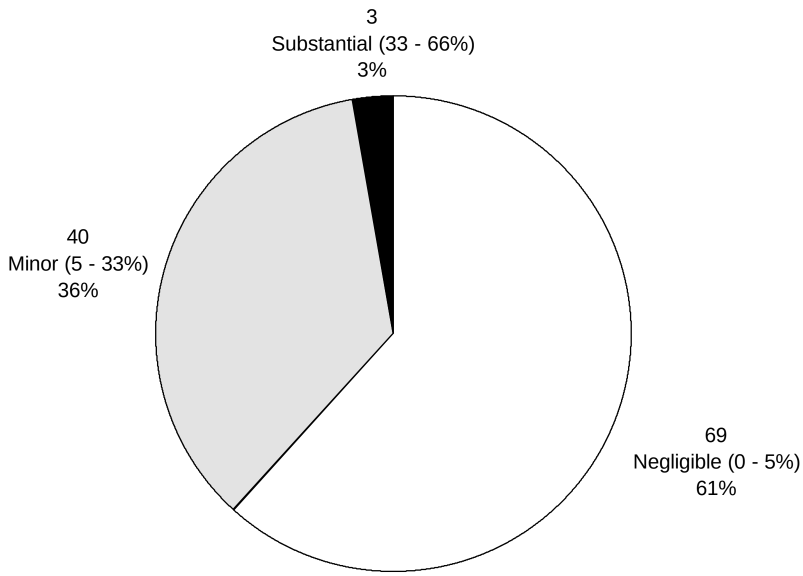


**Figure 2-2. Mission effect percentages, excluding SAMPEX.**

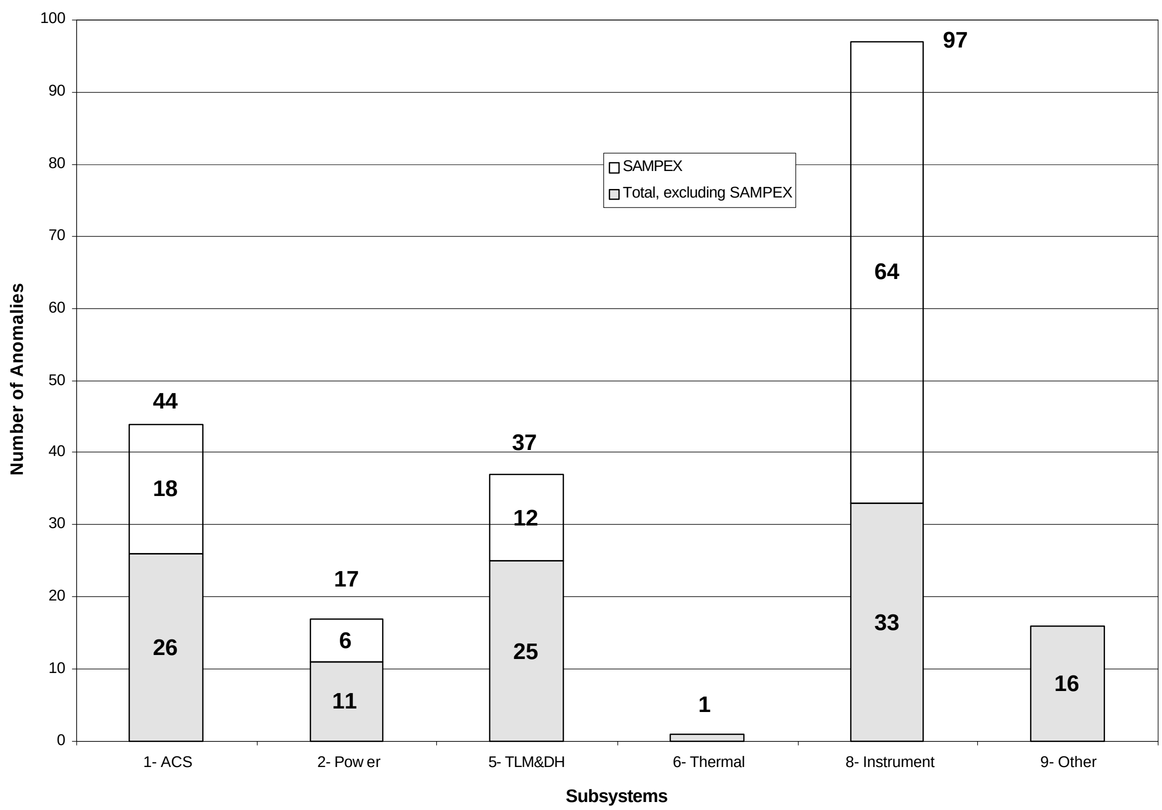


**Figure 3. Anomaly distribution among subsystems.**

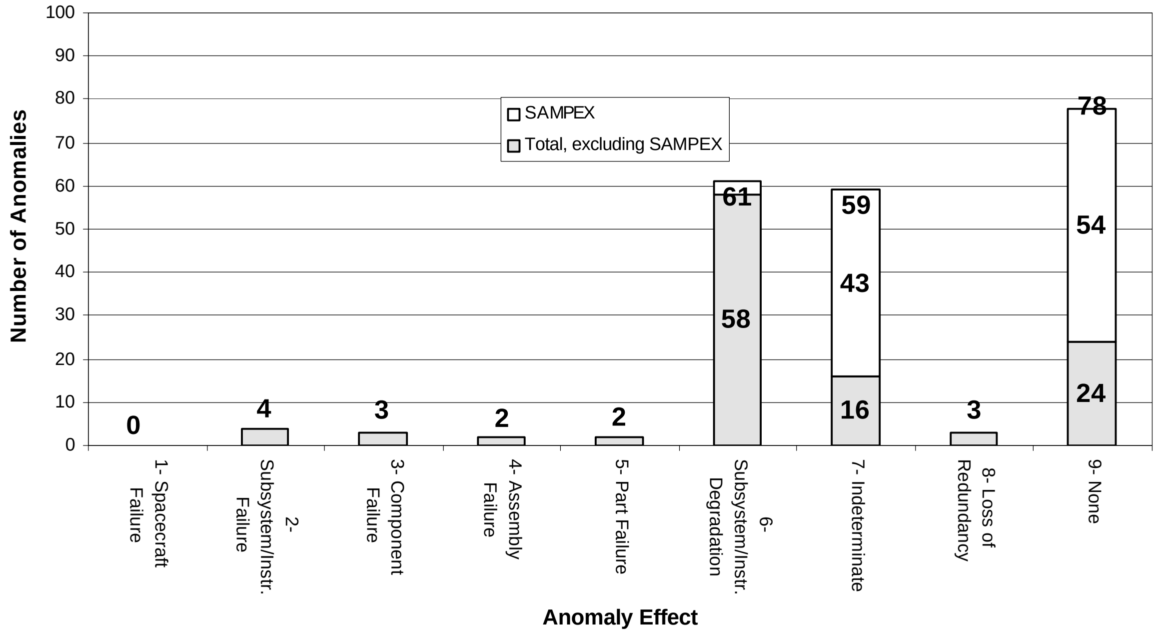


**Figure 4. Distribution by anomaly effects.**

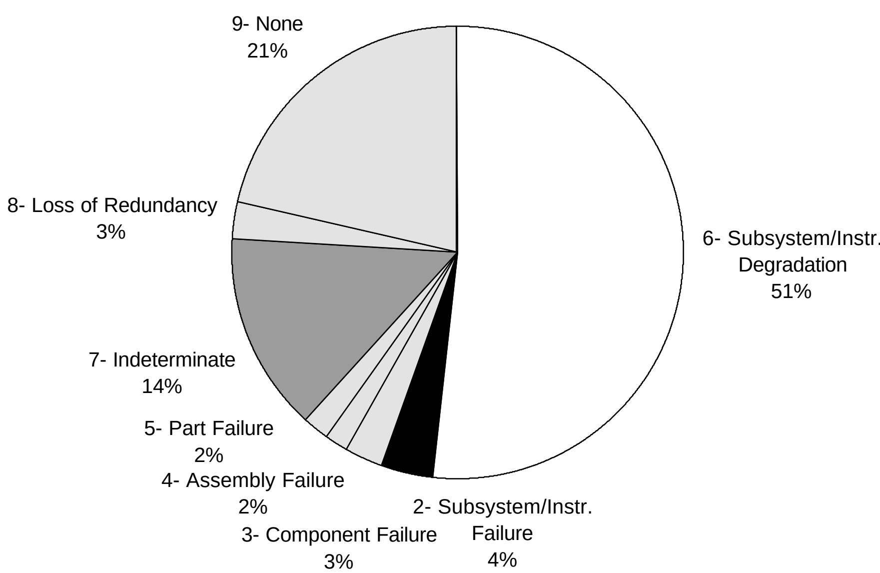


**Figure 4-1. Anomaly effect percentages, excluding SAMPEX.**

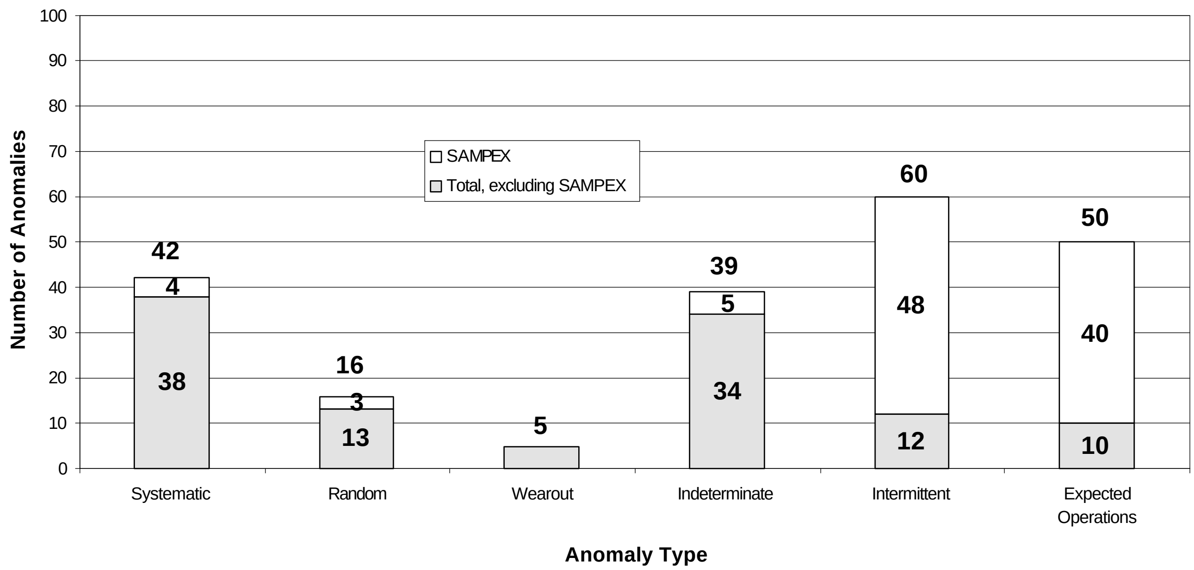


**Figure 5. Distribution by anomaly types.**

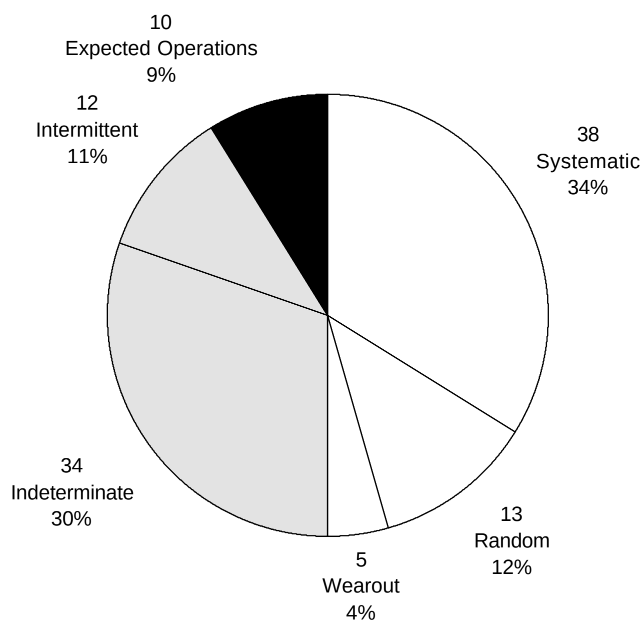


**Figure 5-1. Anomaly type percentages, excluding SAMPEX.**

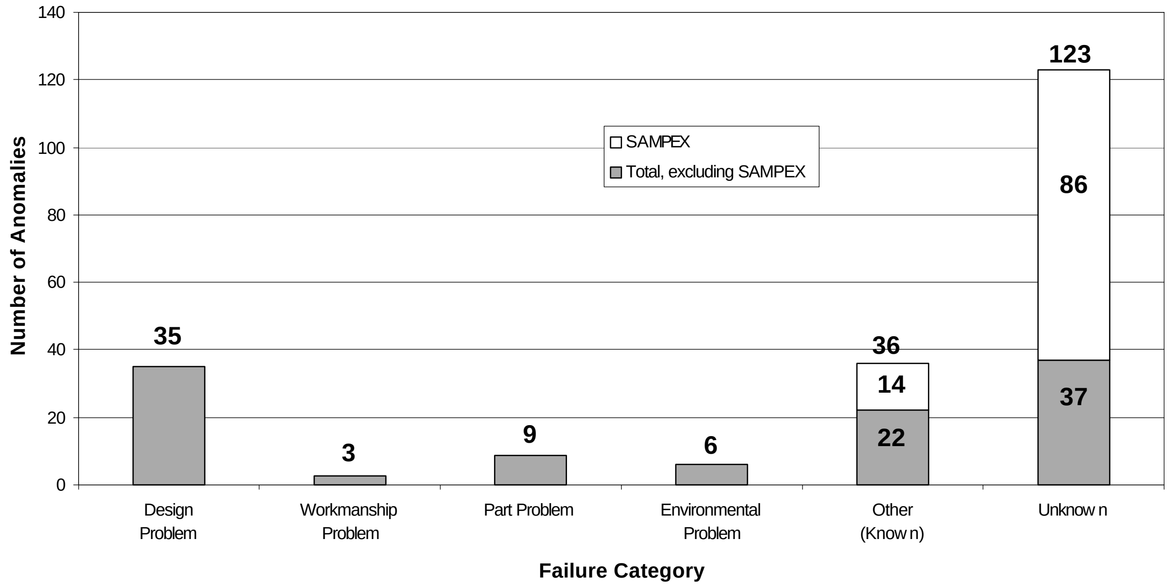


**Figure 6. Distribution by failure category.**

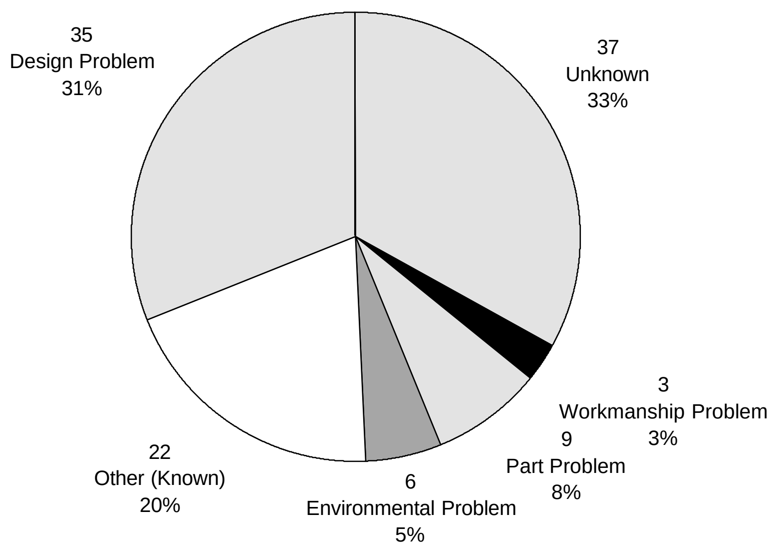


**Figure 6-1. Failure category percentages, excluding SAMPEX.**

**GSFC Spacecraft Lifetime Data**

Appendix E contains a performance summary for all GAFC spacecraft from 1960 through December 1995. Five spacecraft were added for this year's report: GOES-9, Spartan 201-03, Spartan 204, XTE, and TDRS-7. The Spartan spacecraft were STS attached payloads which accumulate very little on-orbit time due to their short missions.

Figures 7 and 8 illustrate the historical performance of GSFC spacecraft. Figure 7 compares the actual years of service and the active on-orbit life (in years) with spacecraft designed life ("planned service") over four decades: 1960-1969, 1970-1979, 1980-1989, and 1990-1995. For the first three decades, GSFC spacecraft average lifetimes ranged from 1.2 to 3.9 and 1.5 to 4.6 times the design life for their useful and active lives, respectively. Note that the 1990-1995 data are incomplete at this time since most of these spacecraft are still active and their useful and active lives have not yet been established. Many of the 1980-1989 data are similarly incomplete as are a few data points from the earlier decades.

Firgure 8 shows the percentage of GSFC spacecraft attaining 3 years, 4 to 5 years, 6 to 7 years, and 8 to 10 years of useful life versus the year of launch. This is essentially a "reliability growth curve." Early years showed fewer spacecraft attaining 3-year lifetimes, but these improved to 70 to 100 percent by the 1980's. Many of the early spacecraft were designed for only 0.25 to 1 year missions while modern spacecraft are commonly designed for 3 to 5 year missions.

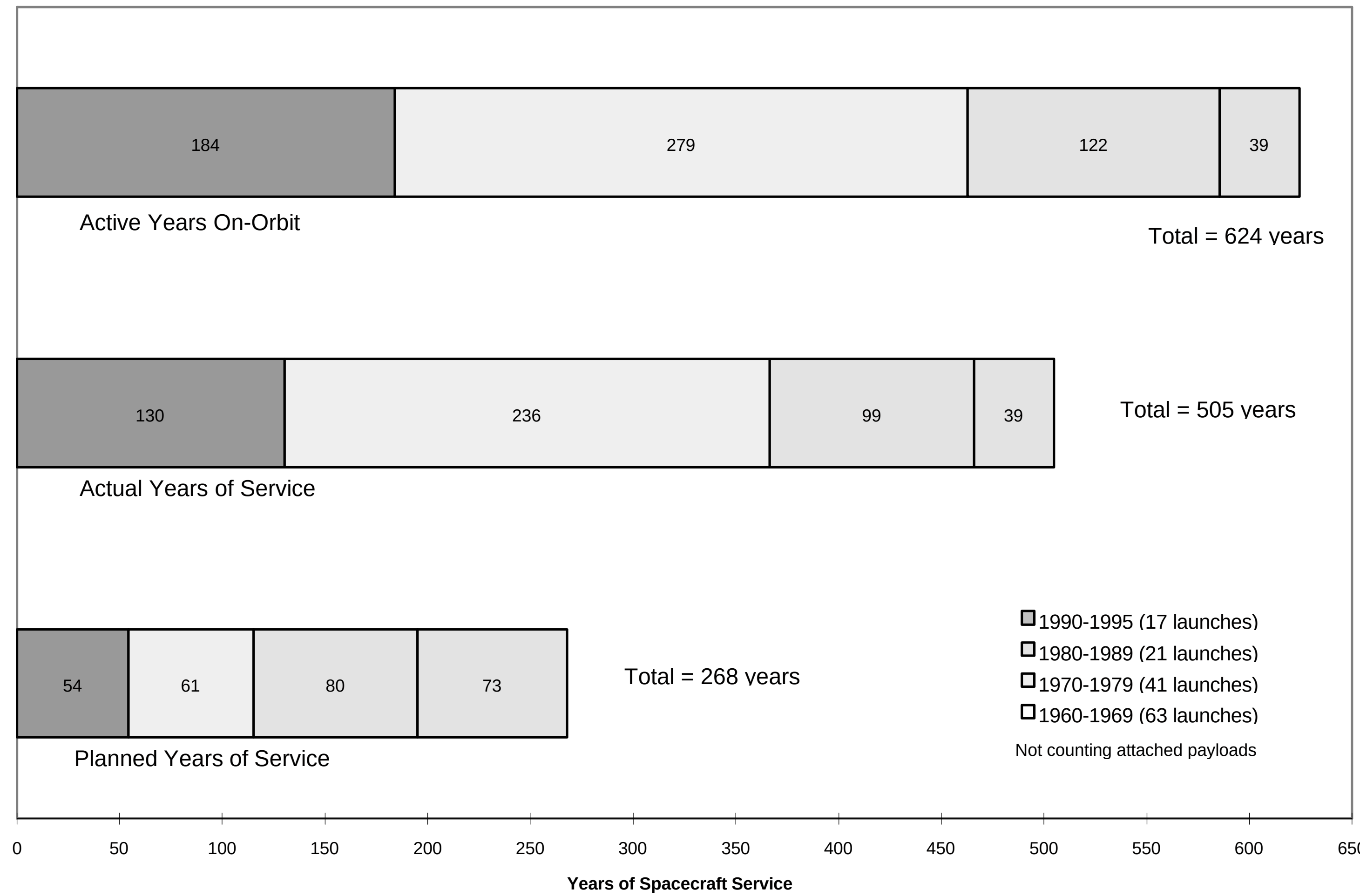


**Figure 7. Goddard spacecraft longevity through 1995**

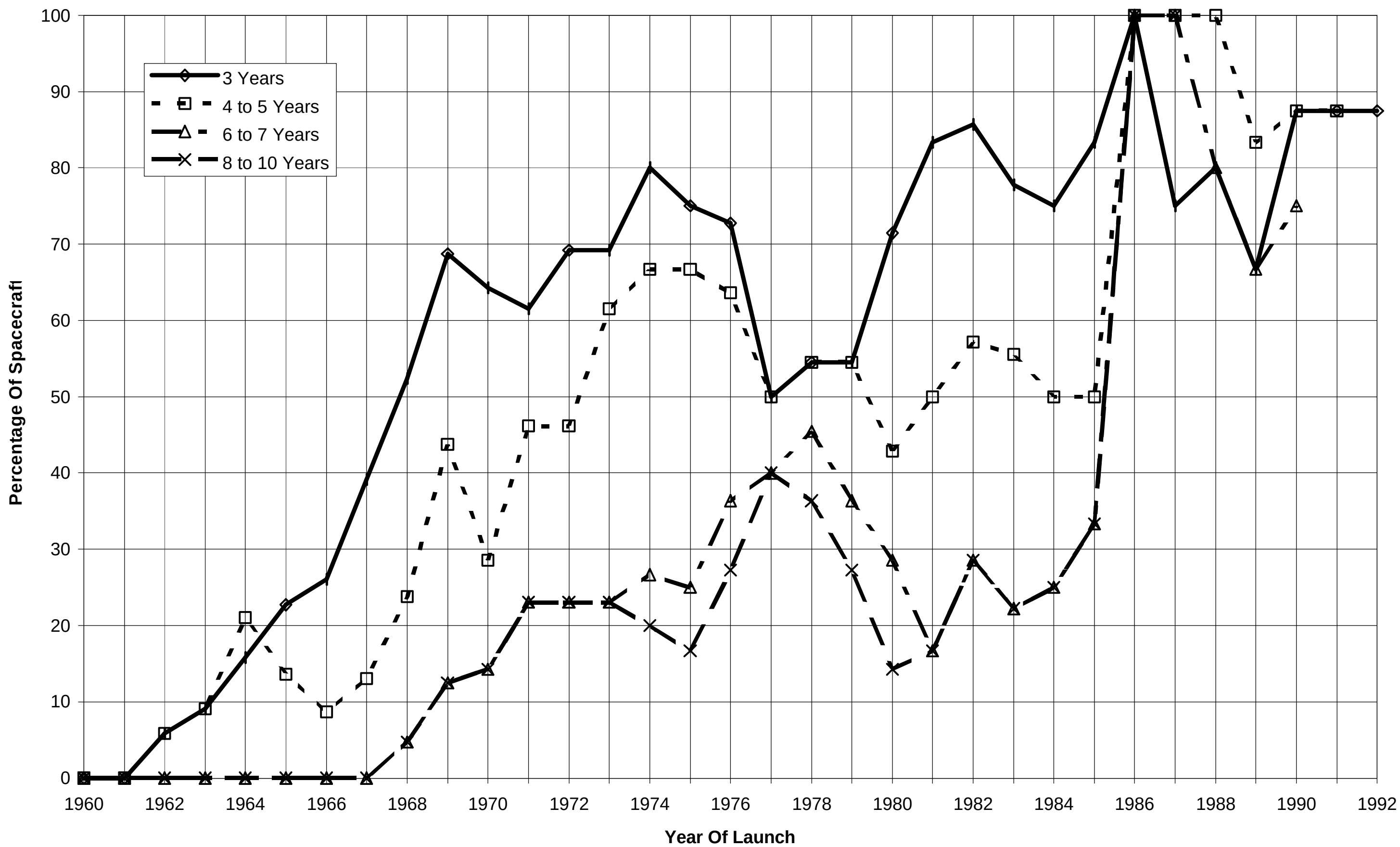


**Figure 8. Success rate for achieving x years of useful life on-orbit for GSFC spacecraft (three year moving average through 1995)**

| ABBREVIATION | MEANING |
|---|---|
| ACRIM | Active Cavity Radiometer Irradiance Monitor |
| ACS | Attitude Control Subsystem |
| ADC | Analog to Digital Converter |
| BATSE | Burst and Transient Source Experiment |
| CCR | Cloud Cover Radiometer |
| CDHF | Central Data Handling Facility |
| CERES | Clouds and the Earth's Radiant Energy System |
| CGRO | Compton Gamma-Ray Observatory |
| CLAES | Cryogenic Limb Array Etalon Spectrometer |
| COMPTEL | Imaging Compton Telescope |
| COSTAR | Corrective Optics Space Telescope Axial Replacement |
| CPU | Central Processing Unit |
| CRD | Command/Receiver Demodulator |
| DOD | Department of Defense |
| DPU | Digital Processing Unit |
| DSN | Deep Space Network |
| EDT | Eastern Daylight Time |
| EGRET | Energetic Gamma-Ray Experiment Telescope |
| EOM | End of Mission |
| EOT | End of Tape |
| EPACT/ELITE | Energy Particle Acceleration, Composition, and Transport and Electron Isotope |
| ERBE | Earth Radiation Budget Experiment |
| ERBS | Earth Radiation Budget Satellite |
| ESA | European Space Agency |
| EUVE | Extreme Ultraviolet Explorer |
| FGS | Fine Guidance Sensors |
| FOC | Faint Object Camera |
| FOS | Faint Object Spectrograph |
| FUVIS | Far Ultraviolet Imaging Spectrograph |
| GGS | Global Geospace Science |
| GHRS | Goddard High Resolution Spectrograph |
| GIR | Goes Incident Report |
| GOES | Geostationary Operational Environment Satellite |
| GSFC | Goddard Space Flight Center |
| GTM | GGS Telemetry Module |
| HALOE | Halogen Occultation Experiment |
| HAO | High Altitude Observatory |
| HRDI | High Resolution Doppler Imager |
| HST | Hubble Space Telescope |
| IC | Instrument Carrier |
| ICE | International Cometary Explorer |
| IMP | Interplanetary Monitoring Platform |
| ISAMS | Improved Stratospheric and Mesospheric Sounder |

| ABBREVIATION | MEANING |
|---|---|
| ISTP | International Solar Terrestrial Physics Program |
| IUE | International Ultraviolet Explorer |
| JPL | Jet Propulsion Laboratory |
| LEICA | Low Energy Ion Composition Analyzer |
| MASS | High Mass Resolution Spectrometer |
| MCP | Microchannel Plate |
| MET | Mission Elapsed Time |
| MFI | Magnetic Field Instrument |
| MIRP | Manipulated Information Rate Processor |
| MLS | Microwave Limb Sounder |
| MRS | Minimum Reserve Shutdown |
| MSFC | Marshall Space Flight Center |
| MSU | Microwave Sounding Unit |
| NASA | National Aeronautical and Space Administration |
| NASA/LaRC | NASA/Langley Research Center |
| NICMOS | Near Infrared Camera and Multi-Object Specrometer |
| NOAA | National Oceanic and Atmospheric Administration |
| NRL | Naval Research Laboratory |
| OBC | On Board Computer |
| OBP1 | On-board Processor 1 |
| OSSE | Oriented Scintillation Spectometer Experiment |
| PA4 | Power Amplifier 4 |
| PEM | Particle Environment Monitor |
| RCS | Reaction Control System |
| RIU | Remote Interface Unit |
| RPP | Recorder Packet Processor |
| SADE | Solar Array Drive Electronics |
| SAMPEX | Solar Anomalous and Magnetospheric Particle Explorer |
| SAO | Smithsonian Astrophysical Observatory |
| SBH | Steinberg Experiment |
| SBUV | Solar Backscatter Ultraviolet Radiometer |
| SCIFER | Sounding of the Cusp Ion Fountain Energization Region |
| SEU | Single Event Upset |
| SMS | SWICS/MASS/STICS |
| SOAR | Spacecraft Orbital Anomaly Report |
| SOLSTICE | Solar Stellar Irradiance Comparison Experiment |
| SPARTAN | Shuttle Pointed Autonomous Research Tool for Astronomy |
| SSU | Stratospheric Sounding Unit |
| STICS | Suprathermal Ion Composition Spectrometer |
| STIS | Space Telescope Imaging Spectrograph |
| SUSIM | Solar Ultraviolet Spectral Irradiance Monitor |
| SWE | Solar Wind Experiment |
| SWICS | Solar Wind Ion Composition Spectrometer |
| SWIM | Solar Wind Interplanetary Measurement |
| TC & C | Timing, Control & Command |

| ABBREVIATION | MEANING |
|---|---|
| TDRS | Tracking and Data Relay Satellite |
| TIROS | Television Infrared Observing System |
| TLM & DH | Telemetry & Data Handling |
| TOAR | TIROS Orbital Anomaly Report |
| UARS | Upper Atmosphere Research Satellite |
| UVCS | Ultraviolet Coronal Spectrometer |
| VAM | Variable Access Memory |
| VHF | Very High Frequency |
| VRTX | Versatile Real-Time Executive |
| WFPC2 | Wide Field/Planetary Camera 2 |
| WINDII | Wind Imaging Interferometer |
| WLC | White Line Coronograph |
| XTE | X-Ray Timing Explorer |

## Appendix A. Classification of 1995 Anomalies (excluding SAMPEX)

| SPACECRAFT | INDEX | ANOMALY DATE | SUBSYSTEM | CRITICALITY | ANOMALY EFFECT | FAILURE CATEGORY | ANOMALY TYPE |
|---|---|---|---|---|---|---|---|
| CGRO | 9524 | 11/24/95 | TLM&DH | 2 | 8 | 6 | 4 |
| CGRO | 9525 | 11/25/95 | ACS | 1 | 9 | 6 | 4 |
| ERBS | 9539 | 01/22/95 | TLM&DH | 1 | 9 | 1 | 2 |
| ERBS | 9540 | 02/12/95 | TLM&DH | 1 | 9 | 1 | 2 |
| ERBS | 9541 | 04/22/95 | TLM&DH | 1 | 9 | 1 | 2 |
| ERBS | 9542 | 07/07/95 | TLM&DH | 1 | 9 | 1 | 2 |
| ERBS | 9543 | 11/11/95 | TLM&DH | 1 | 9 | 1 | 2 |
| GOES-8 | 9567 | 01/13/95 | Other | 1 | 6 | 1 | 1 |
| GOES-8 | 9568 | 01/18/95 | Instruments | 2 | 6 | 1 | 1 |
| GOES-8 | 9569 | 01/31/95 | Instruments | 2 | 6 | 1 | 1 |
| GOES-8 | 9570 | 02/03/95 | ACS | 2 | 6 | 4 | 2 |
| GOES-8 | 9571 | 02/10/95 | Other | 1 | 7 | 6 | 4 |
| GOES-8 | 9572 | 02/14/95 | Instruments | 2 | 6 | 6 | 4 |
| GOES-8 | 9573 | 02/21/95 | ACS | 2 | 6 | 5 | 6 |
| GOES-8 | 9574 | 02/28/95 | Instruments | 2 | 6 | 1 | 1 |
| GOES-8 | 9575 | 02/28/95 | Other | 2 | 6 | 6 | 4 |
| GOES-8 | 9576 | 03/03/95 | Instruments | 2 | 6 | 1 | 2 |
| GOES-8 | 9577 | 03/14/95 | Instruments | 1 | 7 | 5 | 4 |
| GOES-8 | 9578 | 03/22/95 | Other | 1 | 7 | 5 | 4 |
| GOES-8 | 9579 | 03/24/95 | ACS | 2 | 7 | 6 | 1 |
| GOES-8 | 9580 | 03/24/95 | Instruments | 1 | 6 | 5 | 6 |
| GOES-8 | 9581 | 03/25/95 | Power | 1 | 9 | 5 | 6 |
| GOES-8 | 9582 | 04/01/95 | TLM&DH | 2 | 6 | 1 | 1 |
| GOES-8 | 9583 | 04/21/95 | Instruments | 1 | 6 | 1 | 4 |
| GOES-8 | 9584 | 05/06/95 | Instruments | 1 | 7 | 6 | 4 |
| GOES-8 | 9585 | 05/14/95 | ACS | 1 | 7 | 6 | 4 |
| GOES-8 | 9586 | 05/23/95 | Other | 1 | 9 | 2 | 1 |
| GOES-8 | 9587 | 06/02/95 | ACS | 1 | 6 | 6 | 4 |
| GOES-8 | 9588 | 06/17/95 | ACS | 1 | 6 | 6 | 4 |
| GOES-8 | 9589 | 09/07/95 | Instruments | 1 | 9 | 5 | 6 |
| GOES-8 | 9590 | 09/22/95 | TLM&DH | 1 | 9 | 6 | 4 |
| GOES-8 | 9591 | 10/23/95 | ACS | 2 | 6 | 1 | 1 |
| GOES-8 | 9592 | 10/30/95 | TLM&DH | 1 | 9 | 5 | 1 |
| GOES-8 | 9593 | 11/25/95 | Other | 2 | 6 | 6 | 5 |
| GOES-8 | 9594 | 11/28/95 | Instruments | 1 | 6 | 6 | 2 |
| GOES-8 | 9595 | 12/31/95 | Instruments | 1 | 9 | 6 | 6 |
| GOES-9 | 9501 | 05/23/95 | TLM&DH | 2 | 7 | 6 | 5 |
| GOES-9 | 9502 | 06/02/95 | Instruments | 2 | 6 | 1 | 1 |
| GOES-9 | 9503 | 06/06/95 | ACS | 2 | 6 | 1 | 1 |
| GOES-9 | 9504 | 06/09/95 | Instruments | 1 | 6 | 1 | 6 |
| GOES-9 | 9505 | 06/11/95 | ACS | 1 | 9 | 6 | 4 |
| GOES-9 | 9506 | 06/15/95 | Other | 1 | 9 | 1 | 1 |
| GOES-9 | 9507 | 06/16/95 | Other | 2 | 6 | 5 | 1 |
| GOES-9 | 9508 | 06/17/95 | Other | 1 | 7 | 5 | 6 |
| GOES-9 | 9509 | 06/20/95 | Other | 2 | 6 | 1 | 1 |
| GOES-9 | 9510 | 06/21/95 | ACS | 1 | 7 | 6 | 4 |
| GOES-9 | 9511 | 06/24/95 | Other | 2 | 6 | 1 | 1 |
| GOES-9 | 9512 | 06/27/95 | Instruments | 2 | 6 | 6 | 1 |
| GOES-9 | 9513 | 07/07/95 | Instruments | 1 | 6 | 1 | 1 |
| GOES-9 | 9514 | 07/10/95 | Instruments | 1 | 6 | 6 | 4 |
| GOES-9 | 9515 | 07/11/95 | Instruments | 1 | 9 | 1 | 1 |
| GOES-9 | 9516 | 07/13/95 | ACS | 2 | 6 | 1 | 1 |
| GOES-9 | 9517 | 07/16/95 | Instruments | 1 | 9 | 6 | 5 |
| GOES-9 | 9518 | 07/20/95 | Instruments | 1 | 9 | 6 | 4 |
| GOES-9 | 9519 | 07/26/95 | Instruments | 2 | 6 | 6 | 4 |
| GOES-9 | 9520 | 08/04/95 | Other | 2 | 6 | 5 | 1 |
| GOES-9 | 9521 | 08/09/95 | ACS | 2 | 6 | 5 | 4 |
| GOES-9 | 9522 | 08/10/95 | Other | 2 | 6 | 5 | 4 |
| GOES-9 | 9523 | 08/17/95 | Instruments | 2 | 7 | 5 | 4 |
| GOES-9 | 9524 | 08/31/95 | Power | 1 | 6 | 1 | 1 |
| GOES-9 | 9525 | 09/01/95 | ACS | 1 | 9 | 5 | 6 |
| GOES-9 | 9526 | 09/19/95 | Instruments | 1 | 9 | 6 | 5 |
| GOES-9 | 9527 | 09/20/95 | Power | 1 | 6 | 1 | 1 |
| GOES-9 | 9528 | 09/20/95 | Other | 1 | 9 | 6 | 4 |
| GOES-9 | 9529 | 09/20/95 | Instruments | 1 | 7 | 6 | 4 |
| GOES-9 | 9530 | 09/21/95 | TLM&DH | 1 | 9 | 6 | 4 |
| GOES-9 | 9531 | 10/03/95 | ACS | 1 | 6 | 6 | 4 |
| GOES-9 | 9532 | 10/04/95 | Power | 1 | 9 | 5 | 1 |

| SPACECRAFT | INDEX | ANOMALY DATE | SUBSYSTEM | CRITICALITY | ANOMALY EFFECT | FAILURE CATEGORY | ANOMALY TYPE |
|---|---|---|---|---|---|---|---|
| GOES-9 | 9533 | 10/17/95 | Thermal | 1 | 9 | 2 | 1 |
| GOES-9 | 9534 | 10/18/95 | ACS | 2 | 6 | 1 | 4 |
| GOES-9 | 9535 | 10/24/95 | Other | 1 | 8 | 6 | 4 |
| GOES-9 | 9536 | 11/28/95 | Other | 1 | 6 | 6 | 4 |
| GOES-9 | 9537 | 12/08/95 | Instruments | 1 | 6 | 1 | 1 |
| GOES-9 | 9538 | 12/12/95 | Instruments | 1 | 6 | 1 | 1 |
| HST | 9593 | 01/04/95 | TLM&DH | 2 | 6 | 5 | 5 |
| HST | 9594 | 01/08/95 | Power | 1 | 6 | 5 | 5 |
| HST | 9595 | 04/12/95 | Power | 1 | 6 | 4 | 5 |
| HST | 9596 | 04/17/95 | Instruments | 1 | 7 | 5 | 5 |
| HST | 9597 | 06/17/95 | Power | 1 | 6 | 5 | 5 |
| ICE (ISEE-3) | 9501 | 08/27/95 | TLM&DH | 2 | 6 | 6 | 4 |
| IUE | 9546 | 04/05/95 | ACS | 1 | 4 | 4 | 1 |
| IUE | 9547 | 08/05/95 | TLM&DH | 2 | 5 | 5 | 6 |
| NOAA-10 | 9525 | 02/13/95 | ACS | 1 | 9 | 4 | 1 |
| NOAA-12 | 9519 | 11/10/95 | TLM&DH | 1 | 7 | 6 | 4 |
| NOAA-14 | 9503 | 02/04/95 | TLM&DH | 2 | 6 | 6 | 2 |
| NOAA-14 | 9504 | 02/06/95 | Instruments | 2 | 2 | 3 | 2 |
| NOAA-14 | 9505 | 02/24/95 | ACS | 2 | 6 | 4 | 1 |
| NOAA-14 | 9506 | 03/03/95 | Instruments | 2 | 6 | 3 | 4 |
| NOAA-14 | 9507 | 04/01/95 | Instruments | 2 | 2 | 6 | 4 |
| NOAA-14 | 9508 | 04/28/95 | Instruments | 1 | 6 | 2 | 5 |
| NOAA-14 | 9509 | 05/01/95 | TLM&DH | 2 | 6 | 3 | 5 |
| NOAA-14 | 9510 | 10/27/95 | TLM&DH | 2 | 3 | 6 | 2 |
| NOAA-9 | 9535 | 02/13/95 | TLM&DH | 1 | 6 | 6 | 5 |
| NOAA-9 | 9536 | 08/02/95 | Power | 3 | 3 | 5 | 3 |
| Spartan 201-03 | 9501 | 09/08/95 | TLM&DH | 1 | 3 | 3 | 1 |
| Spartan 201-03 | 9502 | 09/10/95 | ACS | 1 | 2 | 1 | 1 |
| Spartan 204 | 9501 | 02/04/95 | Instruments | 3 | 6 | 1 | 3 |
| Spartan 204 | 9502 | 02/04/95 | Instruments | 2 | 6 | 1 | 3 |
| TDRS-1 | 9572 | 01/03/95 | ACS | 1 | 6 | 1 | 1 |
| TDRS-1 | 9573 | 03/24/95 | TLM&DH | 1 | 4 | 3 | 3 |
| TDRS-3 | 9520 | 07/20/95 | TLM&DH | 1 | 7 | 6 | 4 |
| TDRS-3 | 9521 | 11/02/95 | ACS | 1 | 6 | 4 | 1 |
| TDRS-4 | 9531 | 07/24/95 | TLM&DH | 1 | 6 | 3 | 2 |
| TDRS-7 | 9501 | 11/02/95 | ACS | 1 | 6 | 1 | 1 |
| TDRS-7 | 9502 | 12/06/95 | ACS | 1 | 6 | 1 | 1 |
| TDRS-7 | 9503 | 12/06/95 | Power | 1 | 6 | 5 | 6 |
| TDRS-7 | 9504 | 12/06/95 | TLM&DH | 1 | 7 | 6 | 4 |
| UARS | 9518 | 03/23/95 | ACS | 2 | 5 | 3 | 1 |
| UARS | 9519 | 03/23/95 | Power | 3 | 2 | 3 | 3 |
| WIND | 9501 | 01/19/95 | TLM&DH | 1 | 8 | 3 | 2 |
| XTE | 9501 | 12/30/95 | ACS | 1 | 6 | 1 | 1 |
| XTE | 9502 | 12/30/95 | Power | 2 | 7 | 1 | 1 |

## Appendix B. Classification of 1995 SAMPEX Anomalies

| SPACECRAFT | INDEX | ANOMALY DATE | SUBSYSTEM | CRITICALITY | ANOMALY EFFECT | FAILURE CATEGORY | ANOMALY TYPE |
|---|---|---|---|---|---|---|---|
| SAMPEX | 95297 | 01/07/95 | ACS | 1 | 9 | 6 | 6 |
| SAMPEX | 95298 | 01/10/95 | Power | 1 | 9 | 5 | 6 |
| SAMPEX | 95299 | 01/17/95 | Instruments | 1 | 7 | 6 | 5 |
| SAMPEX | 95300 | 01/17/95 | Instruments | 1 | 7 | 6 | 5 |
| SAMPEX | 95301 | 01/29/95 | Instruments | 1 | 9 | 6 | 5 |
| SAMPEX | 95302 | 02/01/95 | Power | 1 | 9 | 5 | 6 |
| SAMPEX | 95303 | 02/12/95 | Instruments | 1 | 7 | 6 | 5 |
| SAMPEX | 95304 | 02/14/95 | Instruments | 1 | 7 | 6 | 5 |
| SAMPEX | 95305 | 02/19/95 | Power | 1 | 9 | 6 | 6 |
| SAMPEX | 95306 | 03/02/95 | Instruments | 1 | 7 | 6 | 5 |
| SAMPEX | 95307 | 03/23/95 | ACS | 1 | 9 | 6 | 6 |
| SAMPEX | 95308 | 03/24/95 | TLM&DH | 1 | 9 | 6 | 6 |
| SAMPEX | 95309 | 03/24/95 | Instruments | 1 | 9 | 6 | 6 |
| SAMPEX | 95310 | 04/02/95 | TLM&DH | 2 | 9 | 6 | 4 |
| SAMPEX | 95311 | 04/02/95 | Power | 1 | 7 | 6 | 5 |
| SAMPEX | 95312 | 04/02/95 | Instruments | 1 | 7 | 6 | 5 |
| SAMPEX | 95313 | 04/02/95 | ACS | 1 | 9 | 6 | 5 |
| SAMPEX | 95314 | 04/02/95 | ACS | 1 | 9 | 6 | 6 |
| SAMPEX | 95315 | 04/02/95 | TLM&DH | 1 | 9 | 6 | 6 |
| SAMPEX | 95316 | 04/04/95 | ACS | 1 | 9 | 5 | 6 |
| SAMPEX | 95317 | 04/07/95 | Power | 1 | 9 | 5 | 6 |
| SAMPEX | 95318 | 04/08/95 | Instruments | 1 | 7 | 6 | 5 |
| SAMPEX | 95319 | 04/08/95 | Power | 1 | 9 | 5 | 6 |
| SAMPEX | 95320 | 04/10/95 | Instruments | 1 | 7 | 6 | 5 |
| SAMPEX | 95321 | 04/11/95 | Instruments | 1 | 7 | 6 | 5 |
| SAMPEX | 95322 | 04/12/95 | ACS | 1 | 9 | 6 | 6 |
| SAMPEX | 95323 | 04/13/95 | ACS | 1 | 9 | 6 | 6 |
| SAMPEX | 95324 | 04/15/95 | ACS | 1 | 9 | 6 | 6 |
| SAMPEX | 95325 | 04/16/95 | Instruments | 1 | 9 | 6 | 5 |
| SAMPEX | 95326 | 04/19/95 | Instruments | 1 | 9 | 6 | 6 |
| SAMPEX | 95327 | 04/20/95 | ACS | 1 | 9 | 6 | 6 |
| SAMPEX | 95328 | 04/30/95 | TLM&DH | 1 | 9 | 6 | 5 |
| SAMPEX | 95329 | 05/03/95 | Instruments | 1 | 7 | 6 | 5 |
| SAMPEX | 95330 | 05/07/95 | Instruments | 1 | 7 | 6 | 5 |
| SAMPEX | 95331 | 05/09/95 | TLM&DH | 1 | 9 | 6 | 6 |
| SAMPEX | 95332 | 05/25/95 | Instruments | 1 | 9 | 6 | 6 |
| SAMPEX | 95333 | 05/25/95 | Instruments | 1 | 9 | 6 | 6 |
| SAMPEX | 95334 | 05/26/95 | Instruments | 1 | 9 | 6 | 6 |
| SAMPEX | 95335 | 05/31/95 | TLM&DH | 1 | 9 | 6 | 4 |
| SAMPEX | 95336 | 06/20/95 | Instruments | 1 | 7 | 6 | 5 |
| SAMPEX | 95337 | 06/20/95 | ACS | 1 | 9 | 6 | 6 |
| SAMPEX | 95338 | 06/20/95 | Instruments | 1 | 6 | 6 | 1 |
| SAMPEX | 95339 | 06/21/95 | Instruments | 1 | 9 | 6 | 1 |
| SAMPEX | 95340 | 06/21/95 | Instruments | 1 | 9 | 6 | 5 |
| SAMPEX | 95341 | 07/01/95 | Instruments | 1 | 9 | 5 | 6 |
| SAMPEX | 95342 | 07/14/95 | Instruments | 1 | 9 | 6 | 2 |
| SAMPEX | 95343 | 07/14/95 | Instruments | 1 | 6 | 6 | 1 |
| SAMPEX | 95344 | 07/19/95 | Instruments | 1 | 9 | 6 | 2 |
| SAMPEX | 95345 | 07/24/95 | Instruments | 1 | 7 | 6 | 5 |
| SAMPEX | 95346 | 07/28/95 | TLM&DH | 1 | 9 | 6 | 6 |
| SAMPEX | 95347 | 07/28/95 | Instruments | 1 | 9 | 5 | 6 |
| SAMPEX | 95348 | 07/29/95 | Instruments | 1 | 9 | 5 | 6 |
| SAMPEX | 95349 | 07/29/95 | Instruments | 1 | 9 | 5 | 6 |
| SAMPEX | 95350 | 07/30/95 | Instruments | 1 | 9 | 6 | 5 |
| SAMPEX | 95351 | 07/31/95 | Instruments | 1 | 9 | 5 | 6 |
| SAMPEX | 95352 | 08/03/95 | ACS | 1 | 9 | 6 | 6 |
| SAMPEX | 95353 | 08/03/95 | Instruments | 1 | 6 | 6 | 1 |
| SAMPEX | 95354 | 08/06/95 | Instruments | 1 | 7 | 6 | 5 |
| SAMPEX | 95355 | 08/07/95 | Instruments | 1 | 7 | 6 | 5 |
| SAMPEX | 95356 | 08/07/95 | Instruments | 1 | 9 | 6 | 6 |
| SAMPEX | 95357 | 08/08/95 | Instruments | 1 | 7 | 6 | 5 |
| SAMPEX | 95358 | 08/08/95 | Instruments | 1 | 7 | 6 | 5 |
| SAMPEX | 95359 | 08/09/95 | ACS | 1 | 9 | 6 | 6 |
| SAMPEX | 95360 | 08/09/95 | Instruments | 1 | 7 | 6 | 5 |
| SAMPEX | 95361 | 08/10/95 | Instruments | 1 | 7 | 6 | 5 |
| SAMPEX | 95362 | 08/11/95 | Instruments | 1 | 7 | 6 | 5 |
| SAMPEX | 95363 | 08/12/95 | Instruments | 1 | 7 | 6 | 5 |
| SAMPEX | 95364 | 08/13/95 | Instruments | 1 | 7 | 6 | 5 |

| SPACECRAFT | INDEX | ANOMALY DATE | SUBSYSTEM | CRITICALITY | ANOMALY EFFECT | FAILURE CATEGORY | ANOMALY TYPE |
|---|---|---|---|---|---|---|---|
| SAMPEX | 95365 | 08/14/95 | Instruments | 1 | 7 | 6 | 5 |
| SAMPEX | 95366 | 08/15/95 | Instruments | 1 | 7 | 6 | 5 |
| SAMPEX | 95367 | 09/13/95 | Instruments | 1 | 7 | 6 | 5 |
| SAMPEX | 95368 | 09/15/95 | Instruments | 1 | 7 | 6 | 5 |
| SAMPEX | 95369 | 09/16/95 | Instruments | 1 | 7 | 6 | 5 |
| SAMPEX | 95370 | 09/20/95 | ACS | 1 | 7 | 6 | 5 |
| SAMPEX | 95371 | 09/24/95 | Instruments | 1 | 7 | 6 | 5 |
| SAMPEX | 95372 | 09/27/95 | Instruments | 1 | 7 | 6 | 5 |
| SAMPEX | 95373 | 09/28/95 | Instruments | 1 | 7 | 6 | 5 |
| SAMPEX | 95374 | 10/03/95 | Instruments | 1 | 7 | 6 | 5 |
| SAMPEX | 95375 | 10/04/95 | Instruments | 1 | 7 | 6 | 5 |
| SAMPEX | 95376 | 10/05/95 | Instruments | 1 | 7 | 6 | 5 |
| SAMPEX | 95377 | 10/05/95 | TLM&DH | 1 | 9 | 5 | 6 |
| SAMPEX | 95378 | 10/06/95 | Instruments | 1 | 7 | 6 | 5 |
| SAMPEX | 95379 | 10/07/95 | Instruments | 1 | 7 | 6 | 5 |
| SAMPEX | 95380 | 10/09/95 | ACS | 1 | 9 | 6 | 6 |
| SAMPEX | 95381 | 10/10/95 | TLM&DH | 1 | 9 | 5 | 6 |
| SAMPEX | 95382 | 10/12/95 | ACS | 1 | 9 | 6 | 6 |
| SAMPEX | 95383 | 10/15/95 | ACS | 1 | 9 | 6 | 6 |
| SAMPEX | 95384 | 10/23/95 | ACS | 1 | 9 | 6 | 6 |
| SAMPEX | 95385 | 10/24/95 | TLM&DH | 1 | 7 | 6 | 4 |
| SAMPEX | 95386 | 10/24/95 | TLM&DH | 2 | 7 | 6 | 4 |
| SAMPEX | 95387 | 10/25/95 | Instruments | 1 | 9 | 6 | 4 |
| SAMPEX | 95388 | 10/25/95 | Instruments | 1 | 7 | 6 | 5 |
| SAMPEX | 95389 | 11/05/95 | TLM&DH | 1 | 9 | 6 | 2 |
| SAMPEX | 95390 | 11/06/95 | Instruments | 1 | 9 | 6 | 6 |
| SAMPEX | 95391 | 11/07/95 | Instruments | 1 | 7 | 6 | 5 |
| SAMPEX | 95392 | 11/07/95 | Instruments | 1 | 7 | 6 | 5 |
| SAMPEX | 95393 | 11/12/95 | Instruments | 1 | 9 | 5 | 6 |
| SAMPEX | 95394 | 11/15/95 | Instruments | 1 | 9 | 6 | 5 |
| SAMPEX | 95395 | 12/17/95 | ACS | 1 | 9 | 5 | 6 |
| SAMPEX | 95396 | 12/26/95 | Instruments | 1 | 7 | 6 | 5 |

## Appendix C. Log of 1995 Orbital Spacecraft Anomalies (excluding SAMPEX)

| SPACECRAFT | INDEX | ANOMALY DATE | DAYS | SUBSYSTEM | CRITICALITY | DESCRIPTION | EFFECT/ACTION | REFERENCE |
|---|---|---|---|---|---|---|---|---|
| CGRO | 9524 | 11/24/95 | 1692 | TLM&DH | 2 | The active and passive parameters passed through the Remote Interface Unit (RIU) degraded over a three day period, finally showing a raw count of zero. Cause: analog to digital converter failure. | Redesign of display pages and tightening limits on redundant parameters. | SOAR C-75 |
| CGRO | 9525 | 11/25/95 | 1693 | ACS | 1 | Gyro # 3 experienced increased motor currents during the period. After December 15, the current returned to normal range. No further instances of this problem have been encountered. | No impact on spacecraft. No action required. | S. St. Pierre |
| ERBS | 9539 | 01/22/95 | 3761 | TLM&DH | 1 | The time field of two locations in block memory failed validation. | Five SAGE-II sunset events and three SAGE-II sunrise events were affected. No science data was lost. Immediately uplinked correct load for this recurring anomaly. | ERBS-518 |
| ERBS | 9540 | 02/12/95 | 3782 | TLM&DH | 1 | The time fields of sixteen locations in normal memory failed validation. The execution times are changed by + 17 feet, 4 inches. Four corrupted commands executed before anomaly was discovered. | Correct load was uplinked immediately, overwriting corrupt locations for this recurring anomaly. | ERBS-519 |
| ERBS | 9541 | 04/22/95 | 3851 | TLM&DH | 1 | The time field of one location in normal memory failed. The command executed before the anomaly occurred. | The command executed before the anomaly occurred; therefore, there was no effect on spacecraft operations. | ERBS-520 |
| ERBS | 9542 | 07/07/95 | 3927 | TLM&DH | 1 | The time field of one location in block memory failed validation. One SAGE-II sunset event began 2'2" early. | No science data was lost. | ERBS-521 |
| ERBS | 9543 | 11/11/95 | 4054 | TLM&DH | 1 | The time fields of three locations in block memory failed validation. | Anomaly impacted unknown number of SAGE-II science events. But the impact was too small to notice (2 seconds). Immediately uplinked BLK4 to overwrite corrupted locations. Recurring anomaly. | ERBS-522 |
| GOES-8 | 9567 | 01/13/95 | 275 | Other | 1 | Pointing Error @ SSAA Enable. Large [250 microrads] pitch error at SSAA enable that results in product degradation. | Fix installed in OATS but not tested by NASA or NOAA. But NOAA may have an alternate approach. The OATS fix may never be tested beyond the pre-installation test at SS/L, so closure is warranted. | IOPS-095 |
| GOES-8 | 9568 | 01/18/95 | 280 | Instruments | 2 | Data from the XRS at 0.5 second resolution shows a +/- 2 count noise level that appears to be independent of the instrument range. This noise level violates the data resolution spec on the instrument, and is well in excess of the anticipated noise level. | Actions to determine corrective action: 1) Obtain noise level data for the instrument as tested at Panametrics, 2) Compare flight level data with preflight spacecraft level test data. | IOPS-096 |
| GOES-8 | 9569 | 01/31/95 | 293 | Instruments | 2 | Dashed E/W lines appear in images in channels 1-5 during NH frames beginning at 21:46, 22:46 and 23:46 GMT [and possible 00:46 GMT] on day 31 and 32 of 1995. The dashes occurred only in data from detector 1. The problem has been most severe in the 23:46 GMT images. | Could be the first manifestation of a problem that could lead to complete failure of the sounder. | IOPS-131 |
| GOES-8 | 9570 | 02/03/95 | 296 | ACS | 2 | The GOES-8 AOCE #1 reprogram checksum indicated an error during execution of the 00:35z housekeeping | For all operational spacecraft, added a "checksum safety valve" to the software to disable the reprogram patch once a | IOPS-138 |

| SPACECRAFT | INDEX | ANOMALY DATE | DAYS | SUBSYSTEM | CRITICALITY | DESCRIPTION | EFFECT/ACTION | REFERENCE |
|---|---|---|---|---|---|---|---|---|
| | | | | | | period pitch gain slew CP on Day 35. | checksum error is detected. For GOES J-M spacecraft, increased shielding of the AOCS. | |
| GOES-8 | 9571 | 02/10/95 | 303 | Other | 1 | When the uplink power from the CDA is slowly increased and saturation is reached, no further operational improvement is obtained with further uplink power increases. The downlink noise and S/N stay constant. This is contrary to normal hard-limiting and has not been seen in any previous GOES spacecraft. | The hard limiter is poorly designed. | IOPS-139 |
| GOES-8 | 9572 | 02/14/95 | 307 | Instruments | 2 | An E/W shearing effect was discovered on Imager Full Disk. | This anomaly does not cause errors large enough for products to be noticeably degraded. | IOPS-157 |
| GOES-8 | 9573 | 02/21/95 | 314 | ACS | 2 | Noise in the pitch control loop [calculated from momentum wheel speeds] is about twice the 15 microrad allocation, about 30 microrads. | A patch has been developed for the Flight S/W that should minimize this noise. | IOPS-159 |
| GOES-8 | 9574 | 02/28/95 | 321 | Instruments | 2 | After the Imager was reconfigured following eclipse on Day 059, there was an E/W error large enough to cause all stars to be missed until a scan reset was performed. | Solar intrusion during eclipse season is now avoided by following the guidelines established by ITT. SN03 Imager instruments should not be powered on until 1.25 hours after spacecraft midnight. | IOPS-176 |
| GOES-8 | 9575 | 02/28/95 | 321 | Other | 2 | There are residual errors between the IMC correction calculated on board the spacecraft and the IMC calculated on the ground in the OATS. | The daily solar rate parameter calculated by OATS uses the units of microrads per second; GIMTACS uses microrads per hour. When OATS was corrected to use microrads per hour, the problem went away. | IOPS-175 |
| GOES-8 | 9576 | 03/03/95 | 324 | Instruments | 2 | The Imager and Sounder Scan Mirrors are susceptible to scene temperature variation, incident/scan angle, and mirror temperature. | An algorithm has been developed to allow ground correction of the data. | IOPS-186 |
| GOES-8 | 9577 | 03/14/95 | 335 | Instruments | 1 | There was a significant degradation in star sense performance for a period from 04:00 to 10:00 GMT. This loss of S/N is believed to be caused by the thermal gradients that distort the scan mirror, which in turn, causes the optical image to blur or defocus. | GOES-PCC-TM-6656 describes the modifications needed for the SPS and OATS to upgrade the star sense performance. These modifications were performed under Contract Mod 217 and are operational in the GOES OGE. | IOPS-199 |
| GOES-8 | 9578 | 03/22/95 | 343 | Other | 1 | Failure of the Power Amp C, which was the primary WEFAX configuration. | Investigate the failure of Power Amp C. | IOPS-210 |
| GOES-8 | 9579 | 03/24/95 | 345 | ACS | 2 | The Earth Sensor switched from acquisition mode to normal mode, and then to North scan inhibit. Large errors then appeared in the roll axis. Repeated several times for both Earth sensors. | Increase settling time to seven minutes after switching to normal mode, before allowing use of the scan inhibit function. | JETE4-002 |
| GOES-8 | 9580 | 03/24/95 | 345 | Instruments | 1 | The Sounder underwent an E/W cycle slip at approximately 16:45z causing the Sounder to miss stars and move frames several thousand Km West. The slip corrected itself during a star window at 18:24z. | GOES operations now precede every change of Sounder spacelook side with a star sequence command. This ensures that the scan mirror is stationary when the spacelook side change occurs, thus precluding an uncontrolled scan reversal. | IOPS-212 |
| GOES-8 | 9581 | 03/25/95 | 346 | Power | 1 | Battery 1 flags Yellow Low after eclipse, with the heater on. This did not happen last eclipse season. | The OP-SUN Yellow limit has been changed to -1.0 degree C from -0.5 degree C and the SOH has been revised to explain the | IOPS-228 |

| SPACECRAFT | INDEX | ANOMALY DATE | DAYS | SUBSYSTEM | CRITICALITY | DESCRIPTION | EFFECT/ACTION | REFERENCE |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | endothermic nature of the battery recharge process after eclipse. | |
| GOES-8 | 9582 | 04/01/95 | 353 | TLM&DH | 2 | Using the SS/L provided calibration curve, the SAR wideband ALC level reading was +55,437 dBm all night, obviously a bad TLM count. | Ground test procedures are being revised for better margin evaluations. | IOPS-236 |
| GOES-8 | 9583 | 04/21/95 | 373 | Instruments | 1 | In the extended Northern hemisphere image that began at 17:15 GMT on April 21,1995, the Imager had intense E/W stripes in the vicinity of the equator. | Should be closed with no further action. | IOPS-295 |
| GOES-8 | 9584 | 05/06/95 | 388 | Instruments | 1 | At time 126/00:60:00, the Imager halted a full-disk frame that still had 5 minutes to complete; the Imager then moved the mirror to nadir, showed immediate loss of wideband data, did not idle, and did not accept commands until a scan reset was sent at 01:03:34. The full-disk started at 125/23:45 and appeared normal until it halted. An SPS message "Imager Scan Clamp Excessive Interpolation Interval" appeared in the event log at 126/00:16:02. Also, an instrument current spike occurred just as the frame halted. | No action to be taken. | IOPS-305 |
| GOES-8 | 9585 | 05/14/95 | 396 | ACS | 1 | On May 14 at 10:26z , SADA POT A output dropped to zero raw counts. Again on the 15th, 16th, and 17th, the output dropped to zero raw counts at the same time. Each day shows an increase in the duration of the event. | None. | IOPS-313 |
| GOES-8 | 9586 | 05/23/95 | 405 | Other | 1 | Shortly after launch, the Imager and Sounder scan mirror temps followed a downward trend, reaching the Yellow Low limits at 143/12:20 GMT [Imager] and 143/11:40 GMT [Sounder]. Yellow Low limits are -5 degrees C for both instruments. The Imager scan mirror reached a min. of -5.3 degrees C at 12:40z, the Sounder scan mirror temp bottomed out at -9.368 degrees C [1.368 degrees below the Red limit]. | Mechanical closeout procedures have been modified to incorporate the launch configuration of the mirrors. | JACT-001 |
| GOES-8 | 9587 | 06/02/95 | 415 | ACS | 1 | An unexplained discontinuity in the pitch momentum occurred at approximately 04:40 z. All the Imager stars scheduled at 04:38 were lost [not seen]. No thruster firings occurred at this time. | It is not possible to determine the exact cause of the disturbance from spacecraft telemetry. Code 415 and SS/L recommend that IOPS-331 be placed on the Can-Not-Duplicate [CND] list. | IOPS-331 |
| GOES-8 | 9588 | 06/17/95 | 430 | ACS | 1 | The pitch Earth Sensor [ES] error telemetry changed by approximately 1 LSB on day 168 during single chord. It returned to zero value at the end of single chord. | No action required. | IOPS-349 |
| GOES-8 | 9589 | 09/07/95 | 512 | Instruments | 1 | Sounder scan mirror was pointed in such a way that at the end of eclipse, the Sun's image fell on the secondary mirror mounting spider. | The CP was moved and incorporated into schedules. | IOPS-375 |
| GOES-8 | 9590 | 09/22/95 | 527 | TLM&DH | 1 | CMD Receiver signal strength telemetry | Investigate corrective action only. | IOPS-377 |

| SPACECRAFT | INDEX | ANOMALY DATE | DAYS | SUBSYSTEM | CRITICALITY | DESCRIPTION | EFFECT/ACTION | REFERENCE |
|---|---|---|---|---|---|---|---|---|
| | | | | | | fluctuated daily between 17:00 and 19:00z. Appears to be seasonal--occurred last March. The same phenomenon is observable on GOES-9 (JSPOT-033). | | |
| GOES-8 | 9591 | 10/23/95 | 558 | ACS | 2 | After switching to the Luenberger PROM code, the magnetic torquer update period was delayed by 15 minutes. A minor bug exists between the AOCE Prom code and the reprogram patch. | None. When the wheel speed was changed from 4500 rpm to 2900 rpm, GOES-9 required two yaw unloads, which set IWUNLD equal to one, thus delaying the magnetic torquer update. This anomaly also applies to GOES-9. | OPS-126 |
| GOES-8 | 9592 | 10/30/95 | 565 | TLM&DH | 1 | S-band receiver signal strength varied upward on DOY 303, 302; downward on 301; upward on 300, 299, 296, 295, 294, 290. Other days; it appeared constant. This increase is usually around 05 to 12z. Power amp A output power is constant, and OK. | No corrective action is necessary. | IOPS-378 |
| GOES-8 | 9593 | 11/25/95 | 591 | Other | 2 | Command Unit Decoder A tripped from secure to clear mode and the time-out switched to short, from medium. All four telemetry outputs dropped to zero for eleven seconds, and appear to be the result of an internal power loss in the unit. Decoder A was commanded back to its nominal configuration for monitoring, and command operations were switched to Decoder B. | No corrective action is recommended. | IOPS-393 |
| GOES-8 | 9594 | 11/28/95 | 594 | Instruments | 1 | Schedule suspend on telemetry wait showed that the Sounder executed two successive Black Body Cals, when commanded to perform only one. | The problem has been determined to be a Sounder problem, rather than a schedule problem. | IOPS-392 |
| GOES-8 | 9595 | 12/31/95 | 627 | Instruments | 1 | Sounder detector mean values are deviating by approximately 1000 counts. | Affects GOES-9 also. | OPS-243 |
| GOES-9 | 9501 | 05/23/95 | 0 | TLM&DH | 2 | The telemetry trace for trim tab potentiometer 1B [ATTFNP1B] indicated anomalous behavior at trim tab angles >-20 deg. | Trim Tab potentiometer 1A should be used for primary data, for determining position and solar torque information. Trim Tab 1B raw data should be included in the monthly trend readout. Then, if potentiometer 1A data becomes unusable, Trim Tab 1B can by used, assuming that the trend data are favorable. | JACT-002 |
| GOES-9 | 9502 | 06/02/95 | 10 | Instruments | 2 | Based on tests at the launch base, magnetic contamination at a level of +/- 4nT was expected, and a waiver to that effect was approved [CCR#2232B]. However, results from the dipole maneuver show that in several measurements the 4nT level is exceeded for the Mag#2, implying that a magnetic source is closer to Mag#2 than Mag#1. | Directed manufacturing to eliminate the known magnetic material in the fabrication of the magnetometer boom. | JACT-016 |
| GOES-9 | 9503 | 06/06/95 | 14 | ACS | 2 | In testing the commanding of the magnetic torquers close to zero current, the lowest positive command that produces a non-zero current was 0.0096 amps. All commands, lower than this, resulted in the same current as a zero command. For negative currents, | An agreement with NOAA/NESDIS is in place for semi-annual calibrations. Thus, no further work is deemed necessary. | JACT-014 |

| SPACECRAFT | INDEX | ANOMALY DATE | DAYS | SUBSYSTEM | CRITICALITY | DESCRIPTION | EFFECT/ACTION | REFERENCE |
|---|---|---|---|---|---|---|---|---|
| | | | | | | all commands less than 0.016 amps resulted in the same current as a command of -0/0 amps. Currents should change at commands of +3.2mA, +6.4mA, -6.4mA, -9.6mA, and -12.8mA. But no changes occur. | | |
| GOES-9 | 9504 | 06/09/95 | 17 | Instruments | 1 | The Imager E/W servo error data exhibited large spikes of about +77 microradians/-19 microradians during full-disk imaging on day 160. Spikes were also seen in full-disk servo error data taken on days 163 and 166. The spikes are all of the same approximate amplitude and duration, but occur in various positions in the scan frame. | No corrective action is required at this time because the Imager 3-sigma pointing specification requirement is still being met, despite the spiking. | JACT-026 |
| GOES-9 | 9505 | 06/11/95 | 19 | ACS | 1 | Roll/yaw CASS and pitch CASS both exhibited glitches [spikes]. In general, pitch CASS followed R/Y CASS glitch by about 10 minutes. Glitches occurred 3-4 times per orbit during Days 143-153. Advent of earth pointing control resulted in an end to the phenomenon. | Close as a "Can-Not-Duplicate." | JACT-012 |
| GOES-9 | 9506 | 06/15/95 | 23 | Other | 1 | The XRS coarse position readout (XRSCRPOS) is showing values of +23.7 degrees most of the time, with occasional readings of 24.1 degrees. Since the actual solar latitude is +23.2 degrees, there seems to be an error of over 0.5 degree in this parameter. Since the summer solstice position of 23.5 degrees is only 1 degree from the hard stop of 24.5 degrees, and the readout TLM step size is 0.5 degree, there is concern that the XRS may run against the stop. | The position readout is a coarse telemetry indication, so the observed error is an acceptable tolerance. SOH Volume III has been changed to provide actual mechanical stop information, as described in PCC-TM-7225. | JACT-019 |
| GOES-9 | 9507 | 06/16/95 | 24 | Other | 2 | On DOY 167, when the XRS was being slewed back to its sun pointing position, the target angle of 23.4 degrees was overshot to 24.63 degrees, which was within one bit of the XRP mechanical stop of 25 degrees. | In order to ensure that there is no uncertainty in commanding the XRP position, a revised algorithm should be used in the SOCC command procedure ZEXRPSLA. | JACT-018 |
| GOES-9 | 9508 | 06/17/95 | 25 | Other | 1 | The GOES-9 IMC compensation relay was found to be disabled. This was unexpected because it is supposed to be enabled prior to launch. | A command procedure [CP] was executed to enable the relay. | JACT-030 |
| GOES-9 | 9509 | 06/20/95 | 28 | Other | 2 | The implementation of the SPS coregistration correction is not compatible with the GVAR format. An alternative implementation in the PM should be provided to correct Imager visible infrared mis-registration before sending IR landmark data to OATS. | Investigate corrective action only. | IOPS-356 |
| GOES-9 | 9510 | 06/21/95 | 29 | ACS | 1 | The AOCE2R1 reprogram patch does not always telemeter valid pitch momentum TLM when the DIRA is ON. | A new CP was implemented by MOST, which includes the sequence of commands required to correct the programming error. This CP is used whenever high resolution momentum telemetry is required while a | IOPS-347 |

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| | | | | | | | DIRA is ON. | |
| GOES-9 | 9511 | 06/24/95 | 32 | Other | 2 | Large discrepancies between the SS/L latch-level data, during spacecraft level testing and the in-orbit test results. | Investigate corrective action only. Ground test procedures are being revised for better margin evaluations. | JACT-036 |
| GOES-9 | 9512 | 06/27/95 | 35 | Instruments | 2 | Frames of space below the earth show the effects of scattered light. The effect is most apparent at spacecraft midnight [06:00 GMT], but is also apparent at other times during the day. | This is an off-disk phenomenon that appears to represent low reliability risk, and the mechanism is probably not resolvable. | JACT-051 |
| GOES-9 | 9513 | 07/07/95 | 45 | Instruments | 1 | Recently, after examination of an image for the Imager E/W servo error signals, it was determined that the E/W servo error was saturated after turn around. This saturation appears to only be occurring at the spacelook address, while the Imager is in the scan clamp mode. The E/W servo currents were also abnormal during this period. This anomaly is believed to be caused by the improper initialization of the CEI. | Investigate corrective action only. | JACT-050 |
| GOES-9 | 9514 | 07/10/95 | 48 | Instruments | 1 | Responsivity in GOES-9 Imager channels 4 & 5 has been decreasing continuously since the IR channels were turned on. By July 10,1995, the responsivity in channel 4 had decreased by 2%, and in channel 5 by 0.6%. | Recommend that this anomaly be closed, and that trending of the channel 4 & 5 responsivity data continue. | JACT-041 |
| GOES-9 | 9515 | 07/11/95 | 49 | Instruments | 1 | During Sounder scan frame testing on day 162, the E/W and N/S cycle counters jumped unexpectedly during a scan abort. | No corrective action is required. | JSPOT-029 |
| GOES-9 | 9516 | 07/13/95 | 51 | ACS | 2 | On day 193, from approx. 06:00 to 08:00z, while Earth Sensor #1 was selected for control, a batwing type signature (winglets) similar to that on GOES-8 was noticed. However, the magnitude of the disturbance is much less than that of GOES-8. | Investigate corrective action only. | JACT-044 |
| GOES-9 | 9517 | 07/16/95 | 54 | Instruments | 1 | The Sounder Filter Wheel Channel 1 Period Monitor shows some discontinuities of close to 20 raw counts at the same times when the Filter Wheel Period Monitor [1-digit] rolls over from 9 to zero or zero to 9. This same behavior was seen on GOES-8. Since it is near the middle of its range, the Channel 1 PM should not have discontinuities. | The Channel 1 Period Monitor provides a coarse assessment of filter wheel jitter, and is used in conjunction with the finer-resolution Filter Wheel Period Monitor which is sufficient for trending jitter, since the jitter is typically small. Since the 20-count discontinuity would hamper trending if the jitter were to worsen, the discontinuity has been corrected for SN06 [GOES-L] and above. | JACT-043 |
| GOES-9 | 9518 | 07/20/95 | 58 | Instruments | 1 | Sounder images taken during the 05:00 GMT hour on days 201-214 show unusual features near the Earth's west limb. The effect is clear in channels 1 & 2; other channels have actual atmospheric features that would overwhelm the anomalies, although the effect can be distinguished in channels 3 & 4. | Investigate corrective action only. | JSPOT-018 |

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| GOES-9 | 9519 | 07/26/95 | 64 | Instruments | 2 | Oscillations occur in data from channels 1 and 2 [and possibly others] of the GOES-9 Sounder. | None. | JSPOT-002 |
| GOES-9 | 9520 | 08/04/95 | 73 | Other | 2 | Dwell would not select the commanded mainframe dwell word. | Future incidents similar to JSPOT-006 can be prevented if both command decoders are operated in either the Clear Mode or the Secure Mode. | JSPOT-006 |
| GOES-9 | 9521 | 08/09/95 | 78 | ACS | 2 | On DOYs 208-210, high momentum wheel currents were noticed on MW #2. There appears to have been an increase in drag for a few days. | MW current change is within normal tolerances. The MW current will continue to be monitored and trended. | JSPOT-009 |
| GOES-9 | 9522 | 08/10/95 | 79 | Other | 2 | GOES-9 is showing significant spikes in some of the servo power supply voltages, especially the Sounder 25 volt positive and negative voltages. | Investigate corrective action only. | JSPOT-005 |
| GOES-9 | 9523 | 08/17/95 | 86 | Instruments | 2 | For the Imager servo power supply voltage, there have been some instances of gross level changes in the voltages. | Investigate corrective action only. | JSPOT-014 |
| GOES-9 | 9524 | 08/31/95 | 100 | Power | 1 | Analysis of SAS E/W data on GOES-9 shows oscillations at 90 minutes and 5.6 minutes with amplitude of about +/- 0.005 degree. | Because the magnitude of pitch attitude change is small, due to SAS data oscillations, and will not impact INR performance, no corrective action is required. | JSPOT-024 |
| GOES-9 | 9525 | 09/01/95 | 101 | ACS | 1 | On day 244, around 19:41z, an impulsive disturbance causing 0.08 degree roll and 0.005 degree pitch error was observed. | No corrective action required. | JSPOT-023 |
| GOES-9 | 9526 | 09/19/95 | 119 | Instruments | 1 | The output from the GOES-9 Imager visible detector 6 has been 3 to 7 counts high in the period from end of eclipse through 18:35z. At other times it is OK. Spacelook data, and star-sense data are all affected. In the spacelook data, the noise computed from 400 samples remains normal (2.9 counts); but the means of the 400 samples vary from spacelook, to spacelook, quite a bit more than normal. | There is no product that is effectively impacted with the modification by NESDIS of absolute counts to relative counts in the visible channel GVAR data eliminating any striping. Therefore, the recommendation is to inactive category. | JSPOT-028 |
| GOES-9 | 9527 | 09/20/95 | 120 | Power | 1 | Review of eclipse exit data shows that auto load restoration does not occur as advertised in SOH, particularly groups 4A, 4B, 5A, 6 and PCU. Plots from every eclipse this season show the same signature with timing varying slightly. | None. | JSPOT-027 |
| GOES-9 | 9528 | 09/20/95 | 120 | Other | 1 | DSN Telemetry Transmitter-A was OFF for about 24 hours. When it was commanded back ON, output power TLM indicated, on average, about one dB less than before it was commanded OFF. | No corrective action required. | JSPOT-034 |
| GOES-9 | 9529 | 09/20/95 | 120 | Instruments | 1 | Between 13:14 and 13:45 GMT BB cals, both detectors in Imager Ch 4 showed a step decrease in responsivity of 0.7% [calibration slopes showed a greater absolute value]. | No corrective action has been identified. | JSPOT-032 |
| GOES-9 | 9530 | 09/21/95 | 121 | TLM&DH | 1 | CMD Receiver signal strength telemetry | No spacecraft corrective action needs to be | JSPOT-033 |

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| | | | | | | fluctuated daily between 18:00 and 20:00z. A similar phenomenon also occurs on GOES-8 (IOPS-377). | taken at this time, since there is no interference with operational data products. | |
| GOES-9 | 9531 | 10/03/95 | 133 | ACS | 1 | At 276/03:27:10z, MW 2 had a 1.4 A current spike (~1.2 A over nominal). A corresponding increase in MW 2 speed was also observed. MW 2 current returned to normal within 3-4 seconds. | Continue to monitor wheel current and speed characteristics, on GOES-8 and GOES-9, for any MW current glitches. Monitor current speed data for both MW2 in T/V testing for future spacecraft. | JSPOT-030 |
| GOES-9 | 9532 | 10/04/95 | 134 | Power | 1 | Battery 1 charge current has consistently been less than battery 2 charge current by 0.05A to 0.09A. Also, when the batteries are not charging, battery 1 reads 0 raw (0.028EU) and battery 2 reads 5 raw (0.05EU). Integrating the telemetered charge values can show a difference of 2-5% state of charge between batteries. | The SOH Volume VII has been revised with new coefficients for batteries 1 and 2, and the correct telemetry word for battery 2 charge current is as shown in PCC-TM-7213. | JSPOT-031 |
| GOES-9 | 9533 | 10/17/95 | 147 | Thermal | 1 | Review of September statistics showed a drop in the main panel 1 temperature of 30 degrees on day 246, after exiting eclipse. Further data review shows a change, in the temperature rate of change entering and exiting the eclipse, possibly indicating the thermistor has become unbonded from the panel. | Continue trending of solar array panel temperature data. | JSPOT-035 |
| GOES-9 | 9534 | 10/18/95 | 148 | ACS | 2 | Post-launch testing has shown that the GOES 8 & 9 Earth Sensors show large roll and pitch thermal distortions at midnight. | Continue to use the Signal Chord Reprogramming Element (SCRE) to correct pointing errors during chord operations. No design changes are planned for the GOES K, L, M, earth sensors. | OPS-121 |
| GOES-9 | 9535 | 10/24/95 | 154 | Other | 1 | During GOES-9 operations, when the A trace of potentiometer 1 is used for data, the output is highly erratic. | The trim tab test procedures have been upgraded for future spacecraft. [GOES-K and subsequent]. For GOES-9, the trim tab potentiometer complement 2 is being used for mission operations. | JSPOT-038 |
| GOES-9 | 9536 | 11/28/95 | 189 | Other | 1 | Noise in Trim Tab coarse position potentiometer is causing limit violations in the telemetry. | Investigate corrective action only. | JOPS-002 |
| GOES-9 | 9537 | 12/08/95 | 199 | Instruments | 1 | PLT data shows the Sounder A/D is not working as expected. Quantification data shows disproportionate bin levels for bins 3900 to 4400. | None. | JOPS-008 |
| GOES-9 | 9538 | 12/12/95 | 203 | Instruments | 1 | PLT data shows a 50% degradation in signal-to-noise during star sense operations between 02002 and 08002. This S/N loss in the Sounder is consistent with GOES-8 performance during the same time span. | None. | JOPS-006 |
| HST | 9593 | 01/04/95 | 1716 | TLM&DH | 2 | Science tape recorder #2 data dump of track 2 has had recurring bit slips in observation data. | A re-dump of data produced bit slips, but at different locations. | HST-086 |
| HST | 9594 | 01/08/95 | 1720 | Power | 1 | The HST observatory autonomously entered software sunpoint "safemode" at 08:20z on Jan. 8, 1995. Cause: the cause of the safemode entry was five consecutive | Workaround: SADE-1R was powered "off" and SADE #2 was placed on-line as primary, FRB convened. | HST-087 |

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| | | | | | | "high torque" flag reports for the solar array drive electronics (SADE-1R). | | |
| HST | 9595 | 04/12/95 | 1814 | Power | 1 | Solar Array II minus Wing Blanket temperature monitor #3 (located on DD-SPA) is going into saturation (315 degrees C.) at transition to orbit day for each orbit. Monitor saturates for 90 seconds. At other times, the monitor performance is nominal. Cause: possible short circuit. Saturation means signal line is sensing a voltage +5 volts, possibly solar array voltage. | Anomaly poses no threat to vehicle health or safety. No corrective action. | HST-088 |
| HST | 9596 | 04/17/95 | 1819 | Instruments | 1 | FOS blue side was transitioning to high voltage (HV) while the GHRS was outputting science data. The FOS HV turn-on created a transient pulse which CV/SDF interpreted as a data frame start. NSSC-1 science computer software "EXEC" errors (STB 406, 405, 402) disabled the GHRS/SD interface and two GHRS observations were lost. Cause: transient pulse interpreted as a data frame start by CV/SDF, and NSSC-1 intervention disabled the GHRS Science Data (SD) interface. The SD interface should not be enabled during "high voltage" transition. | Workaround: the Science Institute agreed to change commanding so that FOS Science Data interface is not enabled until after "high voltage" transition. | HST-089 |
| HST | 9597 | 06/17/95 | 1880 | Power | 1 | Solar Array II Plus Wing Blanket temperature monitor #3 is noisy, intermittent, and exceeds limits at orbit transition (EOD, EON, and orbit noon). Cause: probable broken data line wires to silver mesh wiring. X-rays from a returned SA-I showed broken data lines in flexible harness; but continuity is shown at ambient temperature. | No action. | HST-090 |
| ICE (ISEE-3) | 9501 | 08/27/95 | 6224 | TLM&DH | 2 | One of the words assigned to the SBH experiment in the variable access memory of the data formatter changed by 1 Bit (146 from 144 octal). Cause: unknown. | The spacecraft will only operate in the variable format, due to its extreme distance from the Earth. This problem has occurred in the past and requires that the VAM be reloaded. There are 6 words assigned to the SBH experiment. The other five are okay. Workaround? | SOAR C-77 |
| IUE | 9546 | 04/05/95 | 6278 | ACS | 1 | At 2:19:14z Error flag W6 set to X20 (Worker-0 Time-out) DIACTR incremented by 1. | Performed an OBC dump on request by GSFC. Hit counter incremented by 1. | V-062 |
| IUE | 9547 | 08/05/95 | 6400 | TLM&DH | 2 | The S-Band Power Amplifier # 4 (PA4) had a drop in its power output. The down link signal strength received by Wallops dropped by approximately 10 dB, and the total power load of the spacecraft decreased by approximately 4.5 Watts at the same instant. It appears that the drop in power is final; no fluctuations have been observed since the initial decrease in power output. Cause: a likely cause of the decrease in | PA4 provides unique coverage for approximately 35-40 percent of the view angles. The VHF system can provide housekeeping data at all spacecraft attitudes for all times of the day. However, science data cannot be collected with VHF only operating; operations will have to work around any limitations the reduced performance PA4 causes. | G-207 |

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| | | | | | | power output (and consumption) by PA4 is that one or more of the individual amplifiers that comprise the three stage power amplifier has partially failed. | | |
| NOAA-10 | 9525 | 02/13/95 | 3071 | ACS | 1 | RWA speeds were excessively high after operating in rate nulling mode for one and one half orbits. | The anomaly was not a result of normal operation. Magnetic unloading was inhibited. Atmospheric density was high due to high solar activity. This caused the wheels to saturate sooner than expected. | TOAR-343 |
| NOAA-12 | 9519 | 11/10/95 | 1641 | TLM&DH | 1 | MSU analog telemetry indicators display inaccurate readings, while the digital A telemetry indicators are nominal. Suspect that a problem exists in the +3V supply voltage circuitry, which powers the electronic circuitry to provide the analog telemetry readings. | Unavailable. | TOAR-351 |
| NOAA-14 | 9503 | 02/04/95 | 36 | TLM&DH | 2 | The Wallops CDAS received only approx. 1% of a NOAA-14 DTR-4A GAC playback. Attempts to playback during subsequent passes, via different STX and both CDAS, were also unsuccessful. | Attempted to record and playback STIP data on both DTR-4A and -4B. Reinitialized STR-4A and -4B, and tried again, to record and playback GAC or LAC data. Analyzed CDAS recorded data to determine if the approx. 1% of good data are random bursts, or have a pattern. | TOAR-340 |
| NOAA-14 | 9504 | 02/06/95 | 38 | Instruments | 2 | The SARP +12 volt power supply drops to +4.0 volts, and all telemetry using the +12 volt supply read close to zero intercept values. USO frequency drifts, and timer was incorrect. Values fluctuated from bad to good, over several orbits. | SARP was commanded off at the request of CNES in France on (039) February 8, 1995 at 0606Z Rev. 562/W. Investigate failure, determine most probable cause, and report results and recommendations. | TOAR-341 |
| NOAA-14 | 9505 | 02/24/95 | 56 | ACS | 2 | The ESA quadrant 3 mean count level increased by more than 400 counts in less than 60 days since launch. The S detector count limit (SLIM) was exceeded on February 24, 1995, causing attitude control problems. | SLIM was increased on February 28, 1995 to restore normal ADACS operations; but quadrant 3 counts continue to increase. Investigate ESA quadrant 3 problem, determine the most probable cause, and report results and recommendations. | TOAR-342 |
| NOAA-14 | 9506 | 03/03/95 | 63 | Instruments | 2 | MSU scanner stopped. Motor, dicket loads, antenna bearing temperatures increased as high as 60 degrees Celius. | Unavailable. | TOAR-345 |
| NOAA-14 | 9507 | 04/01/95 | 92 | Instruments | 2 | SBUV CCR data never indicated nominal values. Data should have been approx. 2000 counts--was, and is, about 100 counts. | Loss of sensitivity. Investigate and determine probable cause. | TOAR-346 |
| NOAA-14 | 9508 | 04/28/95 | 119 | Instruments | 1 | SSU scanner position detector for earth position #5 reed switch is intermittent. | Investigate SSU scanner position detector problem, determine most probable cause, and report results and recommendations. What corrections have CEMCS made to the 1B data sets to account for this problem? Are quality flags being set? | TOAR-347 |
| NOAA-14 | 9509 | 05/01/95 | 122 | TLM&DH | 2 | SBUV grating does not achieve "lock" at all wavelengths. Switch to "backup" encoders does not help. Often, after "wavecal," grating is in "lock" for 12 to 36 hours. Bearing contamination is a probable cause. | Investigate SBUV grating lock anomaly, determine the most probable cause, and report results and recommendations. | TOAR-349 |
| NOAA-14 | 9510 | 10/27/95 | 301 | TLM&DH | 2 | The demodulator portion of the CRD which | NOAA-14's OBP1 can no longer be | TOAR-350 |

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| | | | | | | interfaces with the CIU and OBP1 stopped functioning. | commanded. Implement CPU1 turn-off procedure in conjunction with NASA and LMAS. Review Parts history for the CRD demodulator DC/DC converter to determine if failure is an isolated incident, or if a basic parts/design flaw may exist. Investigate NOAA-K cross strap design to determine if design improvements should be studied/developed in light of this failure. | |
| NOAA-9 | 9535 | 02/13/95 | 3715 | TLM&DH | 1 | The control CPU switched from OBP1 to OBP2, and safe state was initiated. | Investigate CPU switch problem, determine most probable cause, and report results and recommendations. | TOAR-344 |
| NOAA-9 | 9536 | 08/02/95 | 3885 | Power | 3 | Loss of recorded data caused by MIRP Power failure. Suspect MIRP blown fuse and other events caused by 28 volt buss overvoltage due to shunt loss, September 8, 1987. | Effect is loss of recorded data. Investigate spacecraft power related failures. | TOAR-348 |
| Spartan 201-03 | 9501 | 09/08/95 | 2 | TLM&DH | 1 | Tape Recorder prematurely reversed flight tape following erroneous end of tape (EOT) indication. Cause: initial investigation revealed evidence of tape stacking problems and subsequent mechanical contact, and dragging between the outer tape reel and the housing. The dragging caused variation in tape speed that triggered the false EOT. | Tape recorder was shut down 3 hours and 44 minutes early, resulting in the loss of data from at least two science observation orbits. Investigation is in progress. | C. Tooley |
| Spartan 201-03 | 9502 | 09/10/95 | 4 | ACS | 1 | Following Spartan Instrument carrier free flight, at approximately 47 hours, the spacecraft appeared to be in the minimum reserve shutdown (MRS) configuration under magnetic attitude control system (ACS) control. Cause: latent design implementation error in the MRS system, compounded by a recent change to the system. | Necessitated an Orbiter fly-around to achieve proper orientation for RMS grappling. Appropriate modifications will be implemented and tested prior to SP201-04. | C. Tooley |
| Spartan 204 | 9501 | 02/04/95 | 0 | Instruments | 3 | Slit exchange drive mechanism failed after first observation. | Observations only used one wave length. As a result, did not acquire as varied data as hoped, fewer wave length observations. | M. Steiner |
| Spartan 204 | 9502 | 02/04/95 | 0 | Instruments | 2 | Low level TV did not provide usable signal on orbiter aft flight deck for pointing. | RMS remote manipulator pointing was used. | M. Steiner |
| TDRS-1 | 9572 | 01/03/95 | 4292 | ACS | 1 | The CPE spontaneously halted and caused loss of attitude. Cause: CPE halt is probably caused by a Single Event Upset (SEU), to which many of the TDRS's are susceptible. | The CPE was returned to an operational configuration by reinitializing the CPE (CPE DISABLE/ENABLE) and reloading the proper RAM contents. An Earth re-acquisition was then accomplished. To avoid an attitude tumble resulting from future CPE halts, the CPE recover procedure has been modified to include a CPE "reboot." | SOAR 164-1 |
| TDRS-1 | 9573 | 03/24/95 | 4372 | TLM&DH | 1 | P4 panel temperatures indicated low temperatures. Appeared to mimic a heater failure. Delogs revealed the signature of the failure was abrupt; the helix current became erratic prior to a sharp increase to approximately 3.4 mA for one update, and | The redundant heaters were enabled and temperatures began to rise. Subsequent analysis of delogs showed that the TWTA #6 current had gone to 0.0. | SOAR #163-1 |

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| | | | | | | then dropped to -0.13 mA. Cause: preliminary conclusions suggests a fault in the EPC, or possibly a helix short to ground caused by barium deposits. | | |
| TDRS-3 | 9520 | 07/20/95 | 2485 | TLM&DH | 1 | During several re-configurations from S-Band to K-Band without a pilot uplink signal, receiver-B has failed to acquire lock on the K-Band uplink signal. After a pilot sweep and MFG lock, receiver-B acquires the K-band uplink with no problems. Receiver-A acquires the uplink with no problems, whether there is a pilot uplink or not. The readings from receiver-B show no signal presence and no changes to the signal strength or loop stress. | Unavailable. | SOAR #168-3 |
| TDRS-3 | 9521 | 11/02/95 | 2590 | ACS | 1 | R_ESA_N and P_ESA_N were toggling between 0.0 and -1.5 degrees. The spacecraft was stable and controlling on the north scan at the -2.0 degree roll bias. TDRS-3 was switched to the south scan. The data showed a quasi-cyclic pattern on both roll and pitch channels. The reaction wheels speed data indicated the control system was responding to the anomalous values. | This type of problem has occurred before on other TDRS spacecraft. The recovery action was to re-sync the CPE and CTE by disabling and immediately re-enabling CPE-A. This action was successful. | SOAR # 166-3 |
| TDRS-4 | 9531 | 07/24/95 | 2324 | TLM&DH | 1 | Between 24 July and 31 August 1995, the TWTA-4 helix current began to increase exponentially from 0.19 mA to 0.61 mA. On 24 August, a Periodic Payload Performance (PPP) test was run, and a 3.5 dB degradation was observed on KSA1R. A Link Characterization and Gain Transfer were performed on September 1, 1995, indicating a 4.4 dB degradation from S-805 specification power. In order to provide specification power, the TWTA would have had to be driven into the no-linear saturation region. | Instead of waiting for a "hard failure" of the KSAD, TWTA/upconverter #3 was switched in place of TWTA #4 to preclude any down time from occurring. | SOAR 165-4 |
| TDRS-7 | 9501 | 11/02/95 | 112 | ACS | 1 | Operation of the +Z2A/+Z4A thrusters during a routine momentum dump on 95/306 produced a thruster impulse that was about 30% lower than expected. | This has been identified as the same problem documented in SOARs 11, 12, 18, 149-1 and 158-G against TDRS-1 and TDRS-3, and is attributed to gas bubbles in the hydrazine line. | SOAR #167-7 |
| TDRS-7 | 9502 | 12/06/95 | 146 | ACS | 1 | A Single Event Upset (SEU) in the CPE or CTE caused loss of TDRS-7 attitude control. An emergency RAM reload did not help, and the spacecraft started a pitch tumble very quickly as the reaction wheel speeds started dropping. The only way to recover from this type of problem in time to prevent loss of earth lock is to reboot the CPE and resync the CPE/CTE, within several minutes after an SEU. Since the only command stacks to reboot the CPE are | Have corrective commands ready for use. | SOAR #171-7 |

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| | | | | | | not available for immediate use by the FOS's, any future CPE SEU's of this type will almost certainly result in a total loss of attitude control. SEU's cannot be predicted or avoided. | | |
| TDRS-7 | 9503 | 12/06/95 | 146 | Power | 1 | During the TDRS-7 ACS attitude divergence on December 6, 1995, the battery temperatures reached 86 to 91 degrees F. This temperature exceeded the normal range of 14 to 85 degrees F. Cause: an error was made when full charge was reached that left the batteries in a charge condition, which resulted in the high battery temperatures. | Thermal control was regained without disabling the battery protection circuitry, thus protecting the vehicle from any subsequent tumble during recovery. The battery thermal control was recovered 24 hours after the initial tumble, and has remained in the normal range from that time to present. This anomaly documents an engineering error--spacecraft misconfiguration. | SOAR #170-7 |
| TDRS-7 | 9504 | 12/06/95 | 146 | TLM&DH | 1 | During the TDRS-7 ACS attitude divergence on December 6, 1995, telemetry was lost due to the telemetry processor changing from 1K to 250 bps. Cause: reason for the change is unknown. | The spacecraft was configured back to 1K prior to an ETO. | SOAR #169-7 |
| UARS | 9518 | 03/23/95 | 1285 | ACS | 2 | Erratic scanner speed caused Attitude errors that configured the spacecraft to sun-pointing safehold. Cause: unknown. | None. | 95-052 |
| UARS | 9519 | 03/23/95 | 1285 | Power | 3 | Solar Array stopped while using B-side drive. Cause: unknown. Possible causes range from a deformed spring in the mechanism to the 1/4 HZ excitation caused by the harmonic drive wave generator in the drive module causing wear particle to continue to accumulator. | Culmination of A and B side solar array drive problems, dating back to June 1992. Due to the erratic behavior following a yaw-around in April 1995, the solar array was parked at a position of 298 degrees. With the array drive B parked, the instrument load must be managed to optimize power requirements. | 92-196B |
| WIND | 9501 | 01/19/95 | 79 | TLM&DH | 1 | Degraded telemetry data, no major frame updates; telemetry contains only the first 10 minor frames and wrong spacecraft time. Cause: the cause was probably a counter chip, part number, HCTS161DMSR. | Switched from prime to back-up GTM, and fully recovered. | PR-729 |
| XTE | 9501 | 12/30/95 | 0 | ACS | 1 | On launch day, both star trackers failed to maintain lock on guide stars in inertial hold. | Uplinked TSM/RTS sequence to automatically reissue commands to star tracker and ACS code patch to recommend a directed search if guide star is lost. | XTE AR#1 |
| XTE | 9502 | 12/30/95 | 0 | Power | 2 | Array performance was significantly degraded from nominal. | Offset arrays by 45 degrees to keep arrays cooler. Providing gentle-motion patch to slowly ramp up and ramp down any solar array slew. | XTE AR#2 |

## Appendix D. Log of 1995 SAMPEX Anomalies

| SPACECRAFT | INDEX | ANOMALY DATE | DAYS | SUBSYSTEM | CRITICALITY | DESCRIPTION | EFFECT/ACTION | REFERENCE |
|---|---|---|---|---|---|---|---|---|
| SAMPEX | 95297 | 01/07/95 | 918 | ACS | 1 | The mnemonic AINTSTAT (reaction wheel interrupt speed) failed its configuration check during subsetting (VCI). | None. Not serious. | S-306 |
| SAMPEX | 95298 | 01/10/95 | 921 | Power | 1 | The PCTTI mnemonic went out of limits during real time support. | Condition is due to a deep eclipse, coupled with transmitter power. | S-307 |
| SAMPEX | 95299 | 01/17/95 | 928 | Instruments | 1 | Monitor ID's 15 and 16 entered threshold 0 at 017/20:45:19, and returned to normal at 017/20:46:19. | The Telemetry and Statistics Monitors that were set up to handle this problem executed the planned response accordingly. No further action was needed at the time. | S-309 |
| SAMPEX | 95300 | 01/17/95 | 928 | Instruments | 1 | Monitor ID's 15 and 16 entered threshold 0 at 017/11:11:19, and returned to normal at 017/11:13:19. | The Telemetry and Statistics Monitors that were set up to handle this problem executed the planned response accordingly. No further action was needed at the time. | S-308 |
| SAMPEX | 95301 | 01/29/95 | 940 | Instruments | 1 | The HINITCNT and HXPROFCT mnemonics flagged in the LOS configuration monitor during real time. | None. Edited LOS configmon. | S-310 |
| SAMPEX | 95302 | 02/01/95 | 943 | Power | 1 | During the pass, the battery current (WBATI) flagged Yellow Low (-3.824), which had a limit set at -3.75. The battery current returned within limits at 13:23:58. The spacecraft was in eclipse from 12:50:38 to 13:24:50. From subsetting, the WBATI reached -3.98 amps @ 13:23:28. | Condition was due to deep eclipse, coupled with transmitter power output. | S-311 |
| SAMPEX | 95303 | 02/12/95 | 954 | Instruments | 1 | Monitor ID's 15 and 16 flagged in the spacecraft events. | The Telemetry and Statistics Monitors that were set up to handle this problem executed the planned response accordingly. No further action was needed at the time. | S-312 |
| SAMPEX | 95304 | 02/14/95 | 956 | Instruments | 1 | Monitor ID's 15 and 16 flagged in the spacecraft events. | The Telemetry and Statistics Monitors that were set up to handle this problem executed the planned response accordingly. No further action was needed at the time. | S-313 |
| SAMPEX | 95305 | 02/19/95 | 961 | Power | 1 | The essential bus current spiked in real-time with a value of 2.516 amps at 19:04:28z and returned at 19:04:38z with a value of 2.148 amps (10 sec. r/t resolution). YH limit for WESPBLI currently set at 3.01 amps. The spacecraft exited sunlight at 19:05:17z. The essential bus spike correlates to a spike in reaction wheel current based on subsetting. | Verified that the spacecraft was not in SAA. Played the support back and subset on pkt14, pkt15 and pkt18, pktob files. | S-314 |
| SAMPEX | 95306 | 03/02/95 | 972 | Instruments | 1 | LEICA high voltage monitors 15 and 16 threshold zero went out of limits at 08:18:09z, and returned to normal at 08:19:09z. | The Telemetry and Statistics Monitors that were set up to handle this problem executed the planned response accordingly. No further action was needed at the time. | S-315 |
| SAMPEX | 95307 | 03/23/95 | 993 | ACS | 1 | The AADMEXE12 mnemonics flagged during VCI playback at 02:13:20. They returned within limits at 02:19:43. | Off-line analysis found the condition was a result of two or three coincidental occurrences: 1) A near-coalignment between geomag field and sun vectors, 2) SAA entry | S-316 |

| SPACECRAFT | INDEX | ANOMALY DATE | DAYS | SUBSYSTEM | CRITICALITY | DESCRIPTION | EFFECT/ACTION | REFERENCE |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | (large geometric field fluctuations), and 3) The A (Attitude) - matrix contained three large elements (values approaching 1). | |
| SAMPEX | 95308 | 03/24/95 | 994 | TLM&DH | 1 | The DPU clock error-detected flag tripped at a value of 1, when it was looking for a 0. This also caused DPU status to trip at a value of 200, when it was looking for 192. | None. This is a known anomaly. The DPU thinks that it is receiving a bad update time from SEDS, so it runs on its own internal clock until it is satisfied with the validity of the SEDS time. | S-317 |
| SAMPEX | 95309 | 03/24/95 | 994 | Instruments | 1 | Mnemonics failed their configuration check and limit check. | Cycled power to the instrument. Apparently, corrected the problem. The cause of the anomaly is being investigated. | S-318 |
| SAMPEX | 95310 | 04/02/95 | 1003 | TLM&DH | 2 | During WPS pass, clock correlation was attempted five times and it appeared the average time difference was around -5.041 seconds. During subsetting, SXBACEEC incremented from 78 to 86 at a time which corresponds to an ACS Invalid RAW SENSOR DATA DETECTED in the spacecraft events for the pass. | Sent commands to WPS and received TCU times to verify the TCU was working properly. Adjusted and verified clock. During the next WPS, will perform a clock check and adjust in milliseconds, accordingly. | S-319 |
| SAMPEX | 95311 | 04/02/95 | 1003 | Power | 1 | The PCTTI mnemonic flagged while subsetting (VC1). | None. Condition due to deep eclipse, coupled with transmitter power output. | S-324 |
| SAMPEX | 95312 | 04/02/95 | 1003 | Instruments | 1 | Monitor ID's 15 and 16 entered threshold 0 at 092/04:15:48 and returned to normal at 092/04:16:48. | The Telemetry and Statistics Monitors that were set up to handle this problem executed the planned response accordingly. No further action was needed at the time. | S-323 |
| SAMPEX | 95313 | 04/02/95 | 1003 | ACS | 1 | An Invalid RAW SENSOR DATA DETECTED message was received during the WPS support. | None. | S-322 |
| SAMPEX | 95314 | 04/02/95 | 1003 | ACS | 1 | Mnemonics failed configuration check during subsetting at 090/18:47:48. | None. Not serious. | S-320 |
| SAMPEX | 95315 | 04/02/95 | 1003 | TLM&DH | 1 | The PCTTI mnemonic flagged during subsetting. Note: This anomaly is not a duplicate of S-325 and S-326--different subsystem. | None. Condition due to deep eclipse, coupled with transmitter power output. | S-321 |
| SAMPEX | 95316 | 04/04/95 | 1005 | ACS | 1 | The WBATI and PCCTI mnemonics went out of limits during subsetting. Note: This anomaly is not a duplicate of S-321 and S-326--different subsystem. | None. Condition due to deep eclipse, coupled with transmitter power output. | S-325 |
| SAMPEX | 95317 | 04/07/95 | 1008 | Power | 1 | The WBATI and PCCTI mnemonics went out of limits during subsetting. Note: This anomaly is not a duplicate of S-321 and S-325--different subsystem. | None. Condition due to deep eclipse, coupled with transmitter power output. | S-326 |
| SAMPEX | 95318 | 04/08/95 | 1009 | Instruments | 1 | The following monitor ID's flagged in the spacecraft events: 15 and 16 @ 098/09:57:54 and returned to normal @ 098/09:58:54. | The Telemetry and Statistics Monitors that were set up to handle this problem executed the planned response accordingly. No further action was needed at the time. | S-327 |
| SAMPEX | 95319 | 04/08/95 | 1009 | Power | 1 | The WBATI and PCCTI mnemonics went out of limits during subsetting. | None. Condition due to deep eclipse, coupled with transmitter power output. | S-328 |
| SAMPEX | 95320 | 04/10/95 | 1011 | Instruments | 1 | The following monitor ID's flagged in the | The Telemetry and Statistics Monitors that | S-330 |

| SPACECRAFT | INDEX | ANOMALY DATE | DAYS | SUBSYSTEM | CRITICALITY | DESCRIPTION | EFFECT/ACTION | REFERENCE |
|---|---|---|---|---|---|---|---|---|
| | | | | | | spacecraft events: 15 and 16 @100/07:02:56 and returned to normal @ 100/07:03:56. 15 and 16 @ 100/08:38:56 and returned to normal @ 100/08:40:56. | were set up to handle this problem executed the planned response accordingly. No further action was needed at the time. | |
| SAMPEX | 95321 | 04/11/95 | 1012 | Instruments | 1 | The following monitor ID's flagged in the spacecraft events: 15 and 16 @ 101/07:12:57 and returned to normal @ 101/07:13:57. | The Telemetry and Statistics Monitors that were set up to handle this problem executed the planned response accordingly. No further action was needed at the time. | S-331 |
| SAMPEX | 95322 | 04/12/95 | 1013 | ACS | 1 | Mnemonics failed configuration check during subsetting at 101/17:11:54. | After playing back the data at a reduced rate, it was found that the packet was quality flagged at the above time, thus producing erroneous mnemonics. No action required. | S-332 |
| SAMPEX | 95323 | 04/13/95 | 1014 | ACS | 1 | The AINTSTAT mnemonic flagged during subsetting on 103/17:28. | None. Not serious. | S-333 |
| SAMPEX | 95324 | 04/15/95 | 1016 | ACS | 1 | The AINTSTAT mnemonic flagged during subsetting on 105/12:30. The mnemonic flagged at 105/05:02:57. | None. Not serious. | S-335 |
| SAMPEX | 95325 | 04/16/95 | 1017 | Instruments | 1 | HILT flow regulator valve telemetry indicates open=true and close=true. Nominal condition is open=false and close=true. Cause: The exact reason for the problem is a mystery. | Ran HFLVFIX procedure that sends correct HILT valve and cover commands to reset HILT Valve settings. This is a known anomaly that clearly indicates an impossible condition (a valve open and closed at the same time). It is believed that the problem lies in the telemetry, since the PI's do not show any other indications that the Flow Valve may have actually been in an open state. Sending the "Flow Regulator Valve Close" command seems to reset the telemetry so that the valve position reads as expected. | S-336 |
| SAMPEX | 95326 | 04/19/95 | 1020 | Instruments | 1 | The AINTSTAT mnemonic flagged during VCI playback at 109/08:25:18, and again at 109/10:02:50. The reaction wheel speed reached a minimum of 84.5 rpm during the subsetting. | None | S-337 |
| SAMPEX | 95327 | 04/20/95 | 1021 | ACS | 1 | The AINTSTAT mnemonic flagged during subsetting. | None | S-338 |
| SAMPEX | 95328 | 04/30/95 | 1031 | TLM&DH | 1 | Warm restart occurred @ 120/12:22:51. Coordinates -16 degrees N latitude by 335 degrees longitude (SAA-1). The cause was rHS012. This condition has been documented on AR # S-256, S-245, S-109, S-086, S-080 and S-047. | Started procedure SRPPWARMRECOVER that loaded the double warm restart patch, dumped warm restart cause, reset warm restart counter, and loaded RTS 18, 19, 20. | S-339 |
| SAMPEX | 95329 | 05/03/95 | 1034 | Instruments | 1 | LEICA TS Monitor ID's 15 and 16 tripped for 2 minutes. Threshold 0 entered @ 123/02:32:20 and threshold 4 entered @ 123/02:34:20. No safing RTS initiated. | The Telemetry and Statistics Monitors that were set up to handle this problem executed the planned response accordingly. No further action was needed at the time. | S-340 |
| SAMPEX | 95330 | 05/07/95 | 1038 | Instruments | 1 | The following monitor ID's flagged in the spacecraft events: 15 and 16 @ | The Telemetry and Statistics Monitors that were set up to handle this problem executed | S-341 |

| SPACECRAFT | INDEX | ANOMALY DATE | DAYS | SUBSYSTEM | CRITICALITY | DESCRIPTION | EFFECT/ACTION | REFERENCE |
|---|---|---|---|---|---|---|---|---|
| | | | | | | 126/01:24:23 and returned to normal @ 126/01:25:23. | the planned response accordingly. No further action was needed at the time. | |
| SAMPEX | 95331 | 05/09/95 | 1040 | TLM&DH | 1 | DPU status flag and the Clock Error flag miscompared on the nrmplos monitor briefly, during a Goldstone Pass. SEDS timing was resumed after one sample. | This is a known anomaly. The DPU thinks that it is receiving a bad update time from SEDS; so it runs on its own internal clock until it is satisfied with the validity of the SEDS time. | S-342 |
| SAMPEX | 95332 | 05/25/95 | 1056 | Instruments | 1 | The mnemonic, HDRHVM, flagged during WPS pass. The mnemonic never returned within limits during the pass. | None. This condition is characteristic of full sun season. | S-343 |
| SAMPEX | 95333 | 05/25/95 | 1056 | Instruments | 1 | The mnemonic, HDRHVM, flagged Yellow Low at 15:59:46 during GDS pass. | None. This condition is characteristic of full sun season. | S-344 |
| SAMPEX | 95334 | 05/26/95 | 1057 | Instruments | 1 | The MAST Low Voltage Power Supply +7.5V monitor flagged Yellow High (=7.56753) at 146-23:41:47. It remained out of limits for the rest of the pass. The Yellow High limit is currently set at 7.54. | None. This is a known anomaly during full sun conditions. | S-345 |
| SAMPEX | 95335 | 05/31/95 | 1062 | TLM&DH | 1 | The mnemonic, DTIMECNT, flagged during real time support. Degraded data was received during the support, but a subset, and sequential print on the value, seems to confirm a value of 1 (a count of 0 is nominal with YH and RH set as 1). | Played back data and performed a sequential print on the value seems to confirm a value of 1 (a count of 0 is nominal with YH and RH set at 1). | S-346 |
| SAMPEX | 95336 | 06/20/95 | 1082 | Instruments | 1 | Monitor ID's 15 and 16 entered threshold 0 at 05:56:20z and returned to normal at 05:57:20z. | The Telemetry and Statistics Monitors that were set up to handle this problem executed the planned response accordingly. No further action was needed at the time. | S-347 |
| SAMPEX | 95337 | 06/20/95 | 1082 | ACS | 1 | The following mnemonics flagged during subsetting, RH limit set at 0.314 for both. AAPTRTER = Pitch Angle Error (213/20:17:04 - 20:23:27) ACPTRTER = Pitch Rate Error (213/20:17:04 - 20:23:27) The spacecraft was in eclipse from 19:54:25 to 20:28:07. | None. | S-364 |
| SAMPEX | 95338 | 06/20/95 | 1082 | Instruments | 1 | During the support of GDS, MAST/PET was being turned off after a cycle of power. The mnemonic, MLVP37V Value - 36.461, flagged YL for two minutes during this pass, after MAST/PET was turned back on. This was the first time this mnemonic was observed to flag this way. The mnemonic went back into limits by the end of the support. After the mnemonic returned within limits, it went back to normal value. | This condition does not appear to be a major concern. It is being noted as system degradation. No action. | S-348 |
| SAMPEX | 95339 | 06/21/95 | 1083 | Instruments | 1 | During support with RID, MAST/PET was being turned on after a cycle of power. The mnemonic, MLVP37V, Value - 36.461, flagged YL after it returned within limits. | This condition does not appear to be a major concern at this time. It is being noted as system degradation. The MLVP3V YL has been changed to 36.460. | S-349 |
| SAMPEX | 95340 | 06/21/95 | 1083 | Instruments | 1 | HILT flow regulator valve telemetry indicates | Ran HFLVFIX procedure that sends correct | S-350 |

| SPACECRAFT | INDEX | ANOMALY DATE | DAYS | SUBSYSTEM | CRITICALITY | DESCRIPTION | EFFECT/ACTION | REFERENCE |
|---|---|---|---|---|---|---|---|---|
| | | | | | | open=true and close=true. Nominal condition is open=false and close=true. Cause: The exact reason for the problem is a mystery. | HILT valve and cover commands to reset HILT Valve settings. This is a known anomaly that clearly indicates an impossible condition (a valve open and closed at the same time). It is believed that the problem lies in the telemetry, since the PI's do not show any other indications that the Flow Valve may have actually been in an open state. Sending the "Flow Regulator Valve Close" command seems to reset the telemetry so that the valve position reads as expected. | |
| SAMPEX | 95341 | 07/01/95 | 1093 | Instruments | 1 | The mnemonics, DMCMD1C - Value 58, flagged at 19:29:19 during the LOS configmon. These mnemonics were out for the entire pass, and represent the MAST/PET command status word, which was changed on June 5, 1995. The mnemonics went back to the values that were previously set before the June 5 change. | The commands to set MAST/PET Command Status Word # 1 to expected values were issued on the next support. | S-351 |
| SAMPEX | 95342 | 07/14/95 | 1106 | Instruments | 1 | HILT flow regulator valve telemetry indicates open=true and close=true. Nominal condition: open=false and close=true. Cause: The exact reason for the problem is a mystery. | This is a known anomaly that clearly indicates an impossible condition (a valve open and closed at the same time). The problem may be in the telemetry, since the PI's do not show any other indications that the Flow Valve may have actually been in an open state. Sending the "Flow Regulator Valve Close" command seems to reset the telemetry so that the valve position reads as expected. | S-354 |
| SAMPEX | 95343 | 07/14/95 | 1106 | Instruments | 1 | The mnemonic, MLVP37V, flagged during the WPS pass. There was no cycling of MAST/PET power during this time. | None. This condition does not appear to be major concern at this time. It is being noted as a system degradation. | S-355 |
| SAMPEX | 95344 | 07/19/95 | 1111 | Instruments | 1 | The mnemonics, ADSSZER and ADSSXER, flagged during subset of VC1. They went YL. The Yellow Low Limit is currently set at 115. 115 counts was the lowest that the error went for both errors. The spacecraft exited eclipse at 19:56:16. The magnetic field strength was 0.4560. | None. | S-356 |
| SAMPEX | 95345 | 07/24/95 | 1116 | Instruments | 1 | Monitors 15 and 16 trip at 07:57:55. These monitor points went back to normal after one minute. Then at 08:02:55 monitors 15 and 16 went out again to threshold zero. But, one minute later, these monitor points went back to normal. | The Telemetry and Statistics Monitors that were set up to handle this problem executed the planned response accordingly. No further action was needed at the time. | S-357 |
| SAMPEX | 95346 | 07/28/95 | 1120 | TLM&DH | 1 | Uplink power was 200 watts. | Monitored the AGC's very closely during the pass. The mnemonic went Yellow High for | S-358 |

| SPACECRAFT | INDEX | ANOMALY DATE | DAYS | SUBSYSTEM | CRITICALITY | DESCRIPTION | EFFECT/ACTION | REFERENCE |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | 28 seconds and 100 seconds during the pass. Equipment problem at the station. | |
| SAMPEX | 95347 | 07/28/95 | 1120 | Instruments | 1 | The HILT Pressure Regulatory Valve Temperature mnemonic, HPREGVT, flagged YH during the support with Madrid on 209/22:34:00. It was out of limits for two minutes during the pass. This mnemonic never flagged before. The spacecraft entered eclipse during the pass at 22:30. | To keep the isobutane tank pressure constant, the HILT pressure regulator valve is heated to compensate for the loss in gas volume. This temperature, therefore, is an indication that the isobutane tank reservoir is nearing exhaustion. | S-359 |
| SAMPEX | 95348 | 07/29/95 | 1121 | Instruments | 1 | HPREGVT flagged RH during the pass with Wallops at 210/15:48:03 and remained out of limits for three minutes. We were in full sun for 38 minutes at the time. This is the second day in a row this mnemonic has flagged. | To keep the isobutane tank pressure constant, the HILT pressure regulator valve is heated to compensate for the loss in gas volume. This temperature, therefore, is an indication that the isobutane tank reservoir is nearing exhaustion. | S-360 |
| SAMPEX | 95349 | 07/29/95 | 1121 | Instruments | 1 | HPREGVT flagged YH during the pass at 210/19:00 and remained out of limits for the remainder of the pass (at least four minutes). This is the second day in a row this mnemonic has flagged. | Subsetting previous VCO data for trend. To keep the isobutane tank pressure constant, the HILT pressure regulator valve is heated to compensate for the loss in gas volume. This temperature, therefore, is an indication that the isobutane tank reservoir is nearing exhaustion. | S-361 |
| SAMPEX | 95350 | 07/30/95 | 1122 | Instruments | 1 | Two mnemonics flagged in the LOS Configuration Monitor during real-time. 13:30:39z - HINITCNT = The count HILT XINIT Pulses & 13:30:39z - HXPROFCT = The count of HILT XPWROFF Pulses. | Could have been due to a reload of the xilinx EEPROM. No action. Edited LOS configmon. | S-362 |
| SAMPEX | 95351 | 07/31/95 | 1123 | Instruments | 1 | HPREGVT broke limits two times during this pass, Red High at 212/14:26:03 and Yellow High at 212/14:33:05. | Subsetting previous VCO data for trend. To keep the isobutane tank pressure constant, the HILT pressure regulator valve is heated to compensate for the loss in gas volume. This temperature, therefore, is an indication that the isobutane tank reservoir is nearing exhaustion. | S-363 |
| SAMPEX | 95352 | 08/03/95 | 1126 | ACS | 1 | The AINTSTAT mnemonic flagged during subsetting at 215/13:47:57 spacecraft time. The interrupt speed flagged while above 120 rpm. | Reaction wheel speed is not very accurate at this low rate. An interrupt flag coupled with a reaction wheel speed greater than 200 rpm would be more of a concern. | S-365 |
| SAMPEX | 95353 | 08/03/95 | 1126 | Instruments | 1 | MLVP37V flagged Yellow Low four minutes before the scheduled turn off of the MAST/PET instruments. This indicates that the voltage was probably out at least two samples (a total of six minutes early) before the ground system flagged it. The MAST/PET turn off was scheduled for 22:38. This is our longest out of limits duration to date. | Subsetting. This condition does not appear to be a major concern at this time. It is being noted as system degradation. The MLVP37V YL limit has changed to 36.460. | S-366 |
| SAMPEX | 95354 | 08/06/95 | 1129 | Instruments | 1 | At 11:52:09, monitor points 15 and 16 went to threshold zero. After three minutes, the | The Telemetry and Statistics Monitors that were set up to handle this problem executed | S-367 |

| SPACECRAFT | INDEX | ANOMALY DATE | DAYS | SUBSYSTEM | CRITICALITY | DESCRIPTION | EFFECT/ACTION | REFERENCE |
|---|---|---|---|---|---|---|---|---|
| | | | | | | emergency sequence initiated at 11:54:09. The sequence was at the 15 minute turn off when the daily 15 minute turn off started. The daily turn off stopped the emergency sequence. At 12:15, the instrument was up and running fine. | the planned response accordingly. No further action was needed at the time. | |
| SAMPEX | 95355 | 08/07/95 | 1130 | Instruments | 1 | At 10:23:10, monitor points 15 and 16 went to threshold zero. Three minutes later, the emergency sequence started and finished at 10:43:10. During the pass, LEICA seemed to be fine. This is the second day in a row that the emergency sequence started. | The Telemetry and Statistics Monitors that were set up to handle this problem executed the planned response accordingly. No further action was needed at the time. | S-368 |
| SAMPEX | 95356 | 08/07/95 | 1130 | Instruments | 1 | AINTSTAT flagged at 218/14:23:40. The interrupt speed flagged while above 120 rpm. | Looked at packet 18 to determine the lowest reaction wheel speed attained. The lowest wheel speed that corresponds to the time the mnemonic went out of limits was 145.53 rpm. Reaction wheel speed is not very accurate at this low rate. An interrupt flag coupled with a reaction wheel speed greater than 200 rpm would be more of a concern. | S-369 |
| SAMPEX | 95357 | 08/08/95 | 1131 | Instruments | 1 | At 03:59:11, monitor points 15 and 16 went out. One minute later, they returned to normal. Then at 10:34:11, monitor points 15 and 16 went out again and were out for three minutes. The emergency sequence started at 10:36:11, and completed at 10:54:15. | The Telemetry and Statistics Monitors that were set up to handle this problem executed the planned response accordingly. No further action was needed at the time. | S-370 |
| SAMPEX | 95358 | 08/08/95 | 1131 | Instruments | 1 | At 19:14:11, monitor point 15 went out of limits. It returned within limit one minute later. At 19:52:11, monitor points 15 and 16 went out of limits. They both returned within limit one minute later. At 20:05:11, monitor points 15 and 16 went out of limits. They both returned within limits one minute later. | The Telemetry and Statistics Monitors that were set up to handle this problem executed the planned response accordingly. No further action was needed at the time. | S-371 |
| SAMPEX | 95359 | 08/09/95 | 1132 | ACS | 1 | AINTSTAT miscompared with a value of 0 at 220/14:41. The minimum value for ARRWSP at this time was 148.76. | Reaction wheel speed is not very accurate at this low rate. An interrupt flag coupled with a reaction wheel speed greater than 200 rpm would be more of a concern. | S-373 |
| SAMPEX | 95360 | 08/09/95 | 1132 | Instruments | 1 | At 02:32:11 and 03:57:11, monitor points 15 and 16 went out of limits. They both returned within limits one minute later. At 05:33:12 monitor points 15 and 16 went out of limits again. They returned within limits two minutes later. At 05:41:12 monitor points 15 and 16 went out of limits a fourth time. Safing sequence was initiated and successfully completed. | The Telemetry and Statistics Monitors that were set up to handle this problem executed the planned response accordingly. No further action was needed at the time. | S-372 |
| SAMPEX | 95361 | 08/10/95 | 1133 | Instruments | 1 | At 221/21:51:13, 222/02:30:13, and 222/04:16:13, monitor points 15 and 16 went out of limits. The monitors returned within | The Telemetry and Statistics Monitors that were set up to handle this problem executed the planned response accordingly. No further | S-374 |

| SPACECRAFT | INDEX | ANOMALY DATE | DAYS | SUBSYSTEM | CRITICALITY | DESCRIPTION | EFFECT/ACTION | REFERENCE |
|---|---|---|---|---|---|---|---|---|
| | | | | | | limits one minute later. At 222/05:41:13, monitor points 15 and 16 went out of limits a fourth time, this time for three minutes. A safing sequence was initiated, and completed successfully. | action was needed at the time. | |
| SAMPEX | 95362 | 08/11/95 | 1134 | Instruments | 1 | Monitor points 15 and 16 went out at 223/10:59:14 and remained out for three minutes. Safing sequence began at 11:01:14. | The Telemetry and Statistics Monitors that were set up to handle this problem executed the planned response accordingly. No further action was needed at the time. | S-375 |
| SAMPEX | 95363 | 08/12/95 | 1135 | Instruments | 1 | Monitor points 15 and 16 went out at 224/11:08:15 and remained out for three minutes. Safing sequence began at 11:10:15. | The Telemetry and Statistics Monitors that were set up to handle this problem executed the planned response accordingly. No further action was needed at the time. | S-376 |
| SAMPEX | 95364 | 08/13/95 | 1136 | Instruments | 1 | The monitor points 15 and 16 went out at 225/11:18:16 and remained out for three minutes. The safing sequence started at 11:20:16. | The Telemetry and Statistics Monitors that were set up to handle this problem executed the planned response accordingly. No further action was needed at the time. | S-377 |
| SAMPEX | 95365 | 08/14/95 | 1137 | Instruments | 1 | TS monitors 15 and 16 went out at 226/09:27:16; and at 226/09:38:16 for one minute. | The Telemetry and Statistics Monitors that were set up to handle this problem executed the planned response accordingly. No further action was needed at the time. | S-378 |
| SAMPEX | 95366 | 08/15/95 | 1138 | Instruments | 1 | TS monitors 15 and 16 went out at 227/06:62:18 for two minutes, and returned to normal. | The Telemetry and Statistics Monitors that were set up to handle this problem executed the planned response accordingly. No further action was needed at the time. | S-379 |
| SAMPEX | 95367 | 09/13/95 | 1167 | Instruments | 1 | Monitor points 15 and 16 reached threshold zero at 11:01:54. After one minute, these points went back within limits. | The Telemetry and Statistics Monitors that were set up to handle this problem executed the planned response accordingly. No further action was needed at the time. | S-380 |
| SAMPEX | 95368 | 09/15/95 | 1169 | Instruments | 1 | Monitor Points went to threshold zero for five trips. All these trips went back to normal after one minute. | The Telemetry and Statistics Monitors that were set up to handle this problem executed the planned response accordingly. No further action was needed at the time. | S-381 |
| SAMPEX | 95369 | 09/16/95 | 1170 | Instruments | 1 | LEICA's monitor points 15 and 16 trip for one minute at 8:50:57. LEICA High Voltages returned to normal at 8:51:57. | The Telemetry and Statistics Monitors that were set up to handle this problem executed the planned response accordingly. No further resolution was needed at this time. | S-882 |
| SAMPEX | 95370 | 09/20/95 | 1174 | ACS | 1 | The AAPTRTER mnemonics flagged during subsetting. They were out for approximately 10 minutes. SAMPEX entered eclipse at 00:51:12, and was in eclipse the entire time at the limits, Red Low. SAMPEX also experienced several mode changes during that time. | Notified OE. | S-383 |
| SAMPEX | 95371 | 09/24/95 | 1178 | Instruments | 1 | Monitor Points 15 and 16 went out of limits at 10:03:05. They returned within limits after two minutes. During the pass all telemetry from LEICA seemed normal. | This is a known anomaly. The Telemetry and Statistics Monitors that were set up to handle this problem executed the planned response accordingly. No further action was needed at the time. | S-384 |

| SPACECRAFT | INDEX | ANOMALY DATE | DAYS | SUBSYSTEM | CRITICALITY | DESCRIPTION | EFFECT/ACTION | REFERENCE |
|---|---|---|---|---|---|---|---|---|
| SAMPEX | 95372 | 09/27/95 | 1181 | Instruments | 1 | Monitor Points 15 and 16 went out of limits at 17:01:08. They returned within limits after two minutes. During the pass all telemetry from LEICA seemed normal. | This is a known anomaly. The Telemetry and Statistics Monitors that were set up to handle this problem executed the planned response accordingly. No further action was needed at the time. | S-385 |
| SAMPEX | 95373 | 09/28/95 | 1182 | Instruments | 1 | Monitor Points 15 and 16 went out of limits at 07:26:08. They returned within limits after two minutes. During the pass all telemetry from LEICA seemed normal. | This is a known anomaly. The Telemetry and Statistics Monitors that were set up to handle this problem executed the planned response accordingly. No further action was needed at the time. | S-387 |
| SAMPEX | 95374 | 10/03/95 | 1187 | Instruments | 1 | Monitor Points 15 and 16 went out of limits at 11:27:13. They returned within limits after two minutes. | This is a known anomaly. The Telemetry and Statistics Monitors that were set up to handle this problem executed the planned response accordingly. No further action was needed at the time. | S-388 |
| SAMPEX | 95375 | 10/04/95 | 1188 | Instruments | 1 | Monitor points 15 and 16 went out of limits on DOY 277 at 00:33:14 for one minute, 09:57:14 for two minutes, 11:03:14 for two minutes, 11:35:14 for two minutes, and 13:13:14 for one minute. No safing sequence was activated. | This is a known anomaly. The Telemetry and Statistics Monitors that were set up to handle this problem executed the planned response accordingly. No further action was needed at the time. | S-389 |
| SAMPEX | 95376 | 10/05/95 | 1189 | Instruments | 1 | The LEICA safing sequence initiated @ 278/10:10:15 due to the failure of monitor ID's 15 and 16. The Start and Stop High voltage plates were at maximum voltage for three successive counts (3 mins.). LEICA underwent the emergency power sequence and the instrument was back on line at 10:28:19. | Safing sequence fired automatically. This is a known anomaly. The Telemetry and Statistics Monitors, which were set up to handle this problem executed the planned response accordingly. No further resolution was needed at this time. | S-390 |
| SAMPEX | 95377 | 10/05/95 | 1189 | TLM&DH | 1 | The following spacecraft event message was received during this support: Mnemonic S/CEVENT. The ACS partition had filled up @ 278/17:55:48z, causing 40 minutes, and 18 seconds of ACS data loss. | The FOT allowed the ACS partition to be closed, and dumped SCP. The ACS partition was freed using UWALLOPS at 278/ 18:36:06z. The ACS partition had filled up due to WPS scheduling giving SAMPEX the next orbit Wallops support (the planned Space Shuttle mission had priority on the first Wallops opportunity). This caused the recorder to collect ACS data for about 25 hours and 48 minutes, without being freed. | S-391 |
| SAMPEX | 95378 | 10/06/95 | 1190 | Instruments | 1 | The LEICA safing procedure initiated @ 278/23:06 due to the failure of monitor ID's 15 and 16. The Start and Stop high voltage plates were at maximum voltage for three successive counts (3 mins.). LEICA underwent the emergency power sequence and the instrument was back on line at 278/23:23:19. | Safing sequence fired automatically. This is a known anomaly. The Telemetry and Statistics Monitors which were set up to handle this problem executed the planned response accordingly. No further resolution was needed at the time. Lost approximately 18 minutes of LEICA science data. | S-392 |
| SAMPEX | 95379 | 10/07/95 | 1191 | Instruments | 1 | LEICA High Voltage emergency sequence fired at 07:11:17 after monitor points 15 and | This is a known anomaly. The Telemetry and Statistics Monitors that were set up to handle | S-393 |

| SPACECRAFT | INDEX | ANOMALY DATE | DAYS | SUBSYSTEM | CRITICALITY | DESCRIPTION | EFFECT/ACTION | REFERENCE |
|---|---|---|---|---|---|---|---|---|
| | | | | | | 16 went out of limits for three minutes. The sequence ran completely and returned LEICA to normal operation. Also, there were three other LEICA trips, but the emergency sequence didn't fire. | this problem executed the planned response accordingly. No further resolution was needed at the time. | |
| SAMPEX | 95380 | 10/09/95 | 1193 | ACS | 1 | During subsetting, AINTSTAT flagged twice. The interrupt speed flagged while above 120 rpm. | Reaction wheel speed is not very accurate at this low rate. An interrupt flag coupled with a reaction wheel speed greater than 200 rpm would be more of a concern. | S-394 |
| SAMPEX | 95381 | 10/10/95 | 1194 | TLM&DH | 1 | During the pass, the previous load was accidentally loaded. After the table checksum did not validate, the table was accidentally committed. This produced two spacecraft events: ATS A Currently in Use: Load Rejected Commit TBL ops failed: > 0000 Two error counters also incremented due to this problem: SNAPLECT and SSMUCOPC (ATP Load Error Counter and Commit Ops error Counter). These values were 0, and they incremented to one. | Loaded correct ATS. Updated all Configmon. The error counters incremented due to this problem. No further investigation is needed. | S-395 |
| SAMPEX | 95382 | 10/12/95 | 1196 | ACS | 1 | During subsetting, the spacecraft encountered unusually large Z axis errors (as determined by the sun sensors) when the spacecraft entered sun. During the eclipse prior to this anomaly, AINTSTAT flagged and RW speed was low, at 56 rpm. This indicates that the ACS software wasn't receiving tachometer readings from the reaction wheel often enough, given its 2 Hz process. It is possible that the low RW speed caused the software to misjudge the spacecraft attitude. An attitude error was apparent, and corrected for at sunlight acquisition. | "plots and thoughts" | S-396 |
| SAMPEX | 95383 | 10/15/95 | 1199 | ACS | 1 | The reaction wheel interrupt speed, AINTSTAT, flagged during subsetting @ 288/10:05:04. The interrupt speed flagged while above 120 rpm. | Looked at packet 18 to determine the lower reaction wheel speed attained. The lowest wheel speed that corresponds to the time the mnemonic went out of limits was 156.849 rpm. Reaction wheel speed is not very accurate at this low rate. An interrupt flag coupled with a reaction wheel speed of greater than 200 rpm would be more of a concern. | S-397 |
| SAMPEX | 95384 | 10/23/95 | 1207 | ACS | 1 | During subsetting, the mnemonics AAPTRTER, ACPTRTER, SNACERT all broke Red Low. Mag Model Magnitude near 0.3 threshold. AMAGMDLM = 0.3002 at coastmode entry. Next Sample showed: Mag Model Magnitude has just crossed 0.3 | Performed subsetting of several ACS parameters and investigated spacecraft events for correlation to coastmode. | S-398 |

| SPACECRAFT | INDEX | ANOMALY DATE | DAYS | SUBSYSTEM | CRITICALITY | DESCRIPTION | EFFECT/ACTION | REFERENCE |
|---|---|---|---|---|---|---|---|---|
| | | | | | | threshold. AMAGMDLM = 0.3002 at coastmode entry. Coastmode was entered at 06:15:08. | | |
| SAMPEX | 95385 | 10/24/95 | 1208 | TLM&DH | 1 | SAMPEX was not acquired at the scheduled Wallops support. | The spacecraft was in safehold. The negative acquisition resulted in loss of entire real-time support (no telemetry and no command). | S-399 |
| SAMPEX | 95386 | 10/24/95 | 1208 | TLM&DH | 2 | The SAMPEX spacecraft went into analog safehold control at 297/13:41:28z (9:41 AM). | Initiated safehold recovery procedures. It appears that a RPP Watchdog Time-out occurred which caused the processor to perform a cold restart, and consequently, placed the spacecraft in safehold. Why the watchdog time-out occurred remains a mystery. ACS, Engineering, and Science data were lost. | S-400 |
| SAMPEX | 95387 | 10/25/95 | 1209 | Instruments | 1 | The FOT was in the process of loading patches to the DPU, recovering from safehold (S-399). While running the procedure DPUPATCH2 (the second of the DPU patches), the DPU started to reboot. The procedure made it as far as the first segment (following the initial write segment), when the reboot occurred. | On the next support, the FOT ran the procedure MEPWROF and LPWROF to disable the MAST/PET and LEICA PD/PCU relays as a safety precaution, prior to turning the instruments back on (HILT was off at the time of the reboot). The DPU reinitialization was started, and the DP was successfully brought back up, after several subsequent passes, including loading the patch contained in the procedure DPUPATCH2. | S-402 |
| SAMPEX | 95388 | 10/25/95 | 1209 | Instruments | 1 | LEICA High Voltage emergency sequence fired at 09:00:20 after monitor point 16 went out of limits for three minutes. The sequence ran completely and returned LEICA to normal operation. There were four other LEICA trips, but the emergency sequence didn't fire. | This is known anomaly. The Telemetry and Statistics Monitors that were set up to handle this problem executed the planned response accordingly. No further resolution was needed at the time. | S-401 |
| SAMPEX | 95389 | 11/05/95 | 1220 | TLM&DH | 1 | During the R/T GDS support, the following mnemonic flagged: "SNDSUCER, Value 1, Limit YH." It is described as the SEDS data set total number of uncorrected memory errors detected. Also, an event message was generated, "EDAC multiple bit error at 09D1687A" at 14:50:42. The spacecraft was in eclipse, but not in the SAA. | No action at the time. More analysis forthcoming when recorder data is received. Being tracked. | S-406 |
| SAMPEX | 95390 | 11/06/95 | 1221 | Instruments | 1 | The mnemonic DPUCFGRG went from 59 (hex) after the DPU was powered up during SAMPEX safehold recovery. Cause: The DPU has two operational CPU controller gate arrays on-board and two operational Miscellaneous controller gate arrays on-board. This DPU Configuration Register indicates which set of CPU (bit 0 of the register) and Miscellaneous (bit 1 of the | Due to the DPU being powered up during the safehold recovery, the gate arrays came up in the next configuration. Since all arrays are considered operational, this DPU configuration is not a problem. The FOT adjusted the LOS Configuration Monitor to account for this change. | S-405 |

| SPACECRAFT | INDEX | ANOMALY DATE | DAYS | SUBSYSTEM | CRITICALITY | DESCRIPTION | EFFECT/ACTION | REFERENCE |
|---|---|---|---|---|---|---|---|---|
| | | | | | | register) controller gate arrays are currently selected. These gate arrays are cycled whenever the DPU is powered up. | | |
| SAMPEX | 95391 | 11/07/95 | 1222 | Instruments | 1 | While verifying Significant Events, LEICA Emergency Sequence initiated, but aborted. Cause: Whenever the DPU reboots, the interfaces between the DPU and the instruments are disabled. At the time of this reboot, the full updated Boot list had yet to be loaded (RTS 18 still needed uplinked). Therefore, the EEPROM Boot list never re-enabled the interfaces as the updated Boot list would have. Whenever the interfaces between the DPU and the instruments are disabled, invalid telemetry is output. Since the LEICA Emergency Sequence depends upon certain LEICA telemetry (i.e., the start and stop plate high voltages) the Telemetry and Statistics monitors were tricked into thinking that an emergency recovery was needed. | Likewise, the emergency sequence was aborted due to invalid telemetry received from the instrument. The instrument was never in any apparent danger, as was first thought. Ran procedure LPWROF to disable the LEICA PD/PCU relay. | S-403 |
| SAMPEX | 95392 | 11/07/95 | 1222 | Instruments | 1 | LEICA High Voltage emergency sequence fired at 298/17:20:53 after monitor point 16 went out of limits for three minutes. The sequence ran completely and returned LEICA to normal operation. | This is a known anomaly. The Telemetry and Statistics Monitors, which were set up to handle this problem, executed the planned response accordingly. No further resolution was needed at this time. | S-404 |
| SAMPEX | 95393 | 11/12/95 | 1227 | Instruments | 1 | HPREGVT, the HILT pressure regulator valve temperature, broke limits at 20:42, and reached a maximum of 4.21 degrees C before LOS. | Cycle HILT's power every 3 days to get pressure readings. This temperature is an indication that the isobutane tank is nearing exhaustion. | S-407 |
| SAMPEX | 95394 | 11/15/95 | 1230 | Instruments | 1 | HILT flow regulator valve telemetry indicates open=true and close=true. Nominal condition is open=false, and close=true. | This is a known anomaly that clearly indicates an impossible condition (a valve open and closed at the same time). The exact reason is a mystery. Ran HFLVFIX procedure, which sends a correct HILT valve and cover commands to reset HILT valve settings. | S-408 |
| SAMPEX | 95395 | 12/17/95 | 1262 | ACS | 1 | The following spacecraft event message was received: Partition Overflow>300. The ACS partition had filled up @ 351/07:45:36 causing ~ 7 hours of ACS data loss. | Freed VC1 & VC2 data set 2. ACS data started to be collected again. Added "Free DS # 2" commands to the daily load after LOS of the Blind Wallops support to prevent future data loss, due to operator error. | S-409 |
| SAMPEX | 95396 | 12/26/95 | 1271 | Instruments | 1 | LEICA monitor points 15 and 16 went out of limits, twice. The first time was at 04:06:56. The emergency sequence started and completed. These monitor points also went out at 16:47:56, then returned after two minutes. | This is a known anomaly. The Telemetry and Statistics Monitors, which were set up to handle this problem, executed the planned response accordingly. No further resolution was needed at the time. Continue to track AINTSTAT to ensure it doesn't become a problem. | S-410 |

## Appendix E. Spacecraft Lifetime Data

In the following table, the term, "useful life" refers to the time during which the major mission objectives were met. Active life is the total lifetime during which the satellite remained in service. Design, useful life and active lives are given in years. A blank space means the information was not available. This chart is updated here through December 31, 1995. Notes are provided at the end of this table.

| Spacecraft | Launch Date | Design Life | Useful Life | Active Life | Remarks |
|---|---|---|---|---|---|
| TIROS | 04/01/60 | 0.25 | 0.24 | 0.24 | TV system useful for 77 days. |
| Explorer VIII (S-30) | 11/03/60 | 0.25 | 0.15 | 0.15 | Last transmission 12/28/60. |
| TIROS-II | 11/23/60 | | 0.63 | 1.03 | TV data useful to 07/12/61. |
| Explorer XI (S-15) | 04/27/61 | | 0.61 | 0.61 | Last transmission 12/7/61. |
| TIROS-III | 07/12/61 | 0.25 | 0.40 | 0.63 | TV data useful to 12/04/61. Lost tape recorders. |
| Explorer XII (S-3) | 08/15/61 | 1.00 | 0.31 | 0.31 | Transmission ceased abruptly. |
| TIROS-IV | 02/08/62 | 0.25 | 0.36 | 0.44 | TV useful to 06/09/62. Lost tape recorders. |
| OSO-I | 03/07/62 | 0.50 | 1.40 | 1.40 | Lost tape recorder @ 2 months. Starfish incident degraded power system. |
| Ariel-I (S-51) | 04/26/62 | 1.00 | 0.88 | 0.88 | Degraded by Starfish incident of 07/09/62. |
| TIROS-V | 06/19/62 | 0.50 | 0.88 | 0.88 | TV useful to 05/04/63. Camera filaments failed. |
| TIROS-VI | 09/18/62 | 0.50 | 1.06 | 1.06 | TV useful to 10/11/63. Filaments and focus out. |
| Explorer XIV (S-3a) | 10/02/62 | | 0.85 | 1.20 | Last transmission 02/17/64. |
| Explorer XV (S-3b) | 10/27/62 | 0.17 | 0.26 | 0.55 | Despin system failed. Last transmission 05/19/63. |
| Relay I | 12/13/62 | 2.00 | 2.53 | 2.53 | |
| Syncom I | 02/14/63 | 2.00 | 0.00 | 0.00 | Lost power: mission failure. |
| Explorer XVII (S-6) | 04/03/63 | 0.25 | 0.27 | 0.27 | Batteries degraded: no solar array. |
| TIROS-VII | 06/19/63 | 0.50 | 4.33 | 4.96 | Deactivated: camera focus out 12/65. |
| Syncom II | 07/26/63 | 2.00 | N/A | N/A | |
| IMP-A | 11/26/63 | 1.00 | 0.82 | | |
| TIROS-VIII | 12/21/63 | 0.50 | 3.53 | 3.53 | Deactivated. |
| Relay II | 01/21/64 | 1.00 | 1.68 | 3.50 | |
| Ariel-II (S-52) | 03/27/64 | 1.00 | 0.53 | | Had spin rate and attitude control problems. |
| Syncom III | 08/19/64 | 3.00 | N/A | N/A | |

| Spacecraft | Launch Date | Design Life | Useful Life | Active Life | Remarks |
|---|---|---|---|---|---|
| Explorer XX (S-48) | 08/25/64 | | 1.60 | 1.60 | Based on last transmission 03/30/66. |
| Nimbus-I | 08/28/64 | 0.50 | 0.07 | 0.07 | Solar array drive failed. |
| OGO-1(A) | 09/04/64 | 1.00 | 5.23 | 5.23 | Mission failure: 3-axis stabilization not achieved. |
| IMP-B | 10/03/64 | 1.00 | 0.50 | 1.25 | Reentered: placed in wrong orbit. |
| Explorer XXVI (S-3c) | 12/21/64 | 1.00 | 2.10 | 2.10 | Last transmission 01/21/67. |
| TIROS-IX | 01/22/65 | 0.50 | 2.73 | 3.40 | Deactivated: camera contrast out 10/66. |
| OSO-II | 02/03/65 | 0.50 | 0.75 | 0.75 | Used up control gas. |
| IMP-1(C) | 05/29/65 | 1.00 | 1.92 | 1.92 | Reentered. |
| TIROS-X | 07/02/65 | 1.00 | 1.16 | 2.00 | Deactivated. |
| OGO-2(C) | 10/14/65 | 1.00 | 3.48 | | Mission failure: horizon scanners did not maintain earth lock. |
| ESSA-I | 02/03/66 | 1.00 | 2.36 | 2.36 | Deactivated. |
| ESSA-II | 02/28/66 | 1.00 | 4.64 | 4.64 | Deactivated. |
| OAO-I | 04/08/66 | 1.00 | 0.00 | 0.00 | Mission failure: lost power. |
| Nimbus-II | 05/16/66 | 0.50 | 2.67 | 2.67 | ACS scanner failed. |
| AE-B | 05/25/66 | 0.50 | 0.82 | | Higher than planned orbit. Two sensors did not work. |
| OGO-3(B) | 06/06/66 | 1.00 | 2.04 | 3.50 | Boom oscillation problem. |
| AIMP-2(D) | 07/01/66 | 0.50 | 4.92 | | Failed to achieve lunar orbit. |
| ESSA-III | 10/02/66 | 1.00 | 2.02 | 2.02 | Deactivated: cameras failed. |
| ATS-I | 12/06/66 | 3.00 | | ***ACTIVE*** | Gas expended: limited service. |
| ESSA-IV | 01/26/67 | 1.00 | 0.41 | 1.27 | Deactivated: one camera failed, one degraded. |
| OSO-III | 03/08/67 | 0.50 | 3.00 | 3.00 | Tape recorder failure at 18 months. ACS controlled manually. |
| ESSA-V | 04/20/67 | 1.00 | 2.83 | 2.83 | Deactivated: IR failed, cameras gradually degraded. |
| IMP-3(F) | 05/24/67 | 1.00 | 1.95 | 1.95 | Reentered. |
| AIMP-4(E) | 07/19/67 | | 3.50 | 3.50 | Lunar orbit. Subsequent period of intermittent operation. |
| OGO-4(D) | 07/28/67 | 1.00 | 2.24 | 2.75 | Thermal bending of antenna caused stabilization control problem. |
| OSO-IV | 10/18/67 | 0.50 | 0.90 | | Tape recorder failure at 6 months. |
| ATS-III | 11/05/67 | 3.00 | | ***ACTIVE*** | Instruments no longer in use. |
| ESSA-VI | 11/10/67 | 1.00 | 2.09 | 2.09 | Deactivated: cameras degraded. |

| Spacecraft | Launch Date | Design Life | Useful Life | Active Life | Remarks |
|---|---|---|---|---|---|
| OGO-5(E) | 03/04/68 | 1.00 | 3.60 | 3.60 | Deactivated: data glut. |
| RAE-A | 07/04/68 | 1.00 | 4.50 | 4.50 | Deactivated: data quality had become marginal. |
| ESSA-VII | 08/16/68 | 1.00 | 0.92 | 1.56 | Deactivated: early camera and tape recorder failures. |
| OAO-II | 12/07/68 | 1.00 | 4.20 | 4.20 | Prime instrument (WEP) failed. |
| ESSA-VIII | 12/15/68 | 1.00 | 4.95 | 6.75 | Deactivated: camera problems. |
| OSO-V | 01/22/69 | 0.50 | 3.90 | 3.90 | |
| ESSA-IX | 02/26/69 | | 4.10 | 4.10 | Deactivated: standby after 04/71. |
| Nimbus-3 | 04/19/69 | 0.50 | 2.67 | | ACS Scanner failed 01/72. |
| OGO-6 (F) | 06/05/69 | 1.00 | 2.06 | 2.25 | Deactivated: data glut. |
| IMP-5(G) | 06/21/69 | | 3.51 | 3.51 | Reentered. |
| OSO-VI | 08/09/69 | 0.50 | 3.30 | 3.30 | |
| ATS V | 08/12/69 | 3.00 | 14.84 | 14.84 | Mission officially unsuccessful: stabilization not achieved. Deorbited 03/20/84. |
| TIROS-M | 01/23/70 | 1.00 | 1.40 | 1.40 | Momentum wheel assembly failed. |
| Nimbus-4 | 04/08/70 | 1.00 | 10.00 | 10.00 | Deactivated. |
| NOAA-1 (ITOS-A) | 12/11/70 | 1.00 | 0.56 | 0.75 | Deactivated: momentum wheel assembly problems. |
| SAS-A | 12/12/70 | 0.50 | 4.00 | 4.00 | Transmitter failure: terminated mission. |
| IMP-6(I) | 03/13/71 | 1.00 | 3.56 | 3.56 | Reentered. |
| OSO-VII | 09/29/71 | 0.50 | 3.17 | 3.17 | Reentered due to bad orbit. |
| SSS-A | 11/15/71 | 1.00 | 2.87 | 2.87 | Deactivated: battery unusable, *as expected*, after one year. |
| Landsat-1 (ERTS-A) | 07/23/72 | 1.00 | 5.58 | 5.58 | Deactivated: funding withdrawn. |
| OAO-C | 08/21/72 | 1.00 | 8.50 | 8.50 | Deactivated: funding withdrawn. |
| IMP-7(H) | 09/22/72 | 2.00 | 6.10 | 6.10 | Power system failed. |
| NOAA-2 (ITOS-D) | 10/15/72 | 1.00 | 2.25 | 2.40 | Standby after 03/74. Some experiments failed. |
| SAS-B | 11/16/72 | 0.50 | 0.54 | 0.54 | Experiment low voltage power supply failed. |
| Nimbus-5 | 12/12/72 | 1.00 | 10.30 | 10.30 | Second HDRSS failed 07/27/82. Deactivated 03/31/83. |
| RAE-B | 06/10/73 | 1.00 | 3.75 | 3.75 | Deactivated: mission objectives achieved. |
| IMP-8(J) | 10/25/73 | 2.00 | ***ACTIVE*** | ***ACTIVE*** | All instruments operating, except Electron Isotopes Experiment: turned off 09/02/95. |
| NOAA-3 (ITOS-F) | 11/06/73 | 1.00 | 2.84 | 2.84 | Deactivated: radiometer, VTPR, VHRR out. |

| Spacecraft | Launch Date | Design Life | Useful Life | Active Life | Remarks |
|---|---|---|---|---|---|
| AE-C | 12/16/73 | 1.00 | 5.00 | 5.00 | Reentered. |
| SMS-1 | 05/17/74 | 2.00 | 1.60 | 6.70 | Standby after 01/76. Deactivated 01/31/81. |
| ATS-6(F) | 05/30/74 | 5.00 | 5.17 | 5.17 | Deactivated. |
| NOAA-4 (ITOS-G) | 11/15/74 | 1.00 | 4.00 | 4.00 | Deactivated: radiometer, VHRR out. |
| Landsat-2 | 01/22/75 | 1.00 | 8.51 | 8.51 | Yaw flywheel stopped 11/79, recovered 05/80. Deactivated 07/27/83. |
| SMS-2(B) | 02/06/75 | 2.00 | 6.50 | 7.50 | Second encoder failed on 08/05/81. |
| SAS-C | 05/07/75 | 1.00 | 4.92 | 4.92 | Reentered. |
| Nimbus-6(F) | 06/12/75 | 1.00 | 7.18 | 8.28 | Yaw flywheel failed 08/14/82. |
| OSO-8(I) | 06/21/75 | 1.00 | 3.40 | 3.40 | Funding withdrawn. |
| AE-D | 10/06/75 | 1.00 | 0.42 | 0.42 | Shorted diode in power supply electronics. |
| GOES-1(A) | 10/16/75 | 3.00 | 9.30 | 9.40 | VISSR failed 02/85. |
| AE-E | 11/20/75 | 1.00 | 5.56 | 5.56 | Reentered 06/10/81. |
| NOAA-5 (ITOS-H) | 07/29/76 | 1.00 | 2.96 | 2.96 | Failed 07/79. |
| GOES-2 (B) | 06/16/77 | 3.00 | 1.55 | ***ACTIVE*** | VISSR failed 01/79, batteries degraded; made semi-operational as WEST DCS spacecraft 09/92. |
| ISEE-1(A) | 10/22/77 | 2.00 | 9.93 | 9.93 | Spacecraft reentered 09/26/87. |
| IUE | 01/26/78 | 3.00 | ***ACTIVE*** | ***ACTIVE*** | Fully operational. Some problems with computer “halts”. |
| Landsat-3(C) | 03/05/78 | 3.00 | 5.07 | 5.51 | Problems with MSS instrument. |
| AEM-A (HCMM) | 04/26/78 | 1.00 | 2.40 | 2.40 | Deactivated: battery degraded 09/14/80. |
| GOES-3(C) | 06/17/78 | 3.00 | 2.21 | ***ACTIVE*** | VISSR degraded 09/80 & failed 05/06/81. Spacecraft to standby 04/28/87. PEACESAT, only for S-band communication 04/90. |
| ISEE-3 (C) [ICE] | 08/12/78 | 2.00 | ***ACTIVE*** | ***ACTIVE*** | Some instrument losses. JPL funding science 10/92. Telemetry turned off on 12/19/95. JPL will use for DSN. |
| TIROS-N | 10/13/78 | 2.00 | 2.38 | 2.38 | ACS failed 02/27/81. |
| Nimbus-7(G) | 10/24/78 | 1.00 | 15.18 | 15.46 | Ceased its science mission 12/93: spacecraft degraded. Lost spacecraft acquisition 04/94. |
| AEM-B (SAGE) | 02/18/79 | 1.00 | 2.75 | 2.75 | Battery degraded: failed 11/18/81. |
| NOAA-6(A) | 06/27/79 | 2.00 | 7.39 | 7.75 | Spacecraft turned off 03/31/87. |
| Magsat | 10/30/79 | 0.40 | 0.61 | 0.61 | Reentered as planned 06/11/80. |
| SMM* | 02/14/80 | 2.00 | 0.83+5.62 | 9.78 | Lost fine pointing control 12/12/80: repaired. Mission |

| Spacecraft | Launch Date | Design Life | Useful Life | Active Life | Remarks |
|---|---|---|---|---|---|
| | | | | | terminated 11/24/89; reentered 12/02/89. |
| GOES-4(D) | 09/09/80 | 7.00 | 2.21 | 6.66 | VAS failed 11/25/82. |
| GOES-5(E) | 05/22/81 | 7.00 | 3.19 | 9.20 | VAS failed 07/30/84. Loss of station keeping 12/89. Deactivated 07/18/90: out of fuel. |
| NOAA-7(C) | 06/23/81 | 2.00 | 3.62 | 4.92 | Failed HIRS, degraded SSU, disabled power system. |
| DE-1(A) | 08/03/81 | 1.00 | 9.57 | 9.57 | Mission terminated 02/28/91: can't command spacecraft. |
| DE-2(B) | 08/03/81 | 1.00 | 1.54 | 1.54 | Reentered as expected 02/19/83. |
| OSS-1 | 03/22/82 | | | | Shuttle attached payload mission. |
| Landsat-4(D) | 07/16/82 | 3.00 | | | ***No longer monitored nor reported herein.*** |
| NOAA-8(E) | 03/28/83 | 2.00 | 1.25 | 1.25 | Failed 07/01/84. Recovered 05/85. Failed again 01/86. |
| TDRS-1(A) | 04/04/83 | 10.0** | ***ACTIVE*** | ***ACTIVE*** | Some loss of capability. Activated in 1993 for GRO data via Australia. |
| GOES-6(F) | 04/28/83 | 7.00 | 5.73 | ***ACTIVE*** | VAS failed 01/21/89. Loss of station keeping 05/92. West DCS ops terminated 09/92. Provides SEM data. |
| Landsat-5(D) | 03/01/84 | 3.00 | | | ***No longer monitored nor reported herein.*** |
| AMPTE/CCE | 08/16/84 | 1.00 | 4.92 | 4.92 | Some solar array degradation. Mission terminated 07/14/89. |
| ERBS | 10/05/84 | 2.00 | ***ACTIVE*** | ***ACTIVE*** | All gyros except IRU-I/Z failed. ERBE-S failed 02/90. Battery #1 disconnected 08/92 (2 shorted cells). Battery #2 lost 2 cells 06/07/93. ERBE-NS is temporarily off. |
| NOAA-9(F) | 12/12/84 | 2.00 | 3.92 | ***ACTIVE*** | MSU & ERBE-S failure. Into standby 11/08/88. |
| SPARTAN-1 | 06/20/84 | | | | STS attached payload mission. |
| SPOC/HITCHHIKER | 01/12/86 | | | | STS attached payload mission. |
| NOAA-10(G) Class B | 09/17/86 | 2.00 | ***ACTIVE*** | ***ACTIVE*** | Array shunts degraded. ERBE-S & SARP failed. Roll gyro failed. AVHRR degraded 11/92: in standby ops. |
| GOES-7(H) Class B | 02/26/87 | 7.00 | ***ACTIVE*** | ***ACTIVE*** | |
| NOAA-11(H) Class B | 09/24/88 | 2.0 | ***ACTIVE*** | ***ACTIVE*** | Y-Gyro & DTR-5 A&B failed in late 1989. DTR-1B failed 02/92. |
| TDRS-3(C) Class A | 09/29/88 | 10.0** | ***ACTIVE*** | ***ACTIVE*** | Standby status 08/91. |

| Spacecraft | Launch Date | Design Life | Useful Life | Active Life | Remarks |
|---|---|---|---|---|---|
| TDRS-4(D)<br>Class A | 03/13/89 | 10.0** | ***ACTIVE*** | ***ACTIVE*** | |
| COBE | 11/18/89 | 0.83 | 4.10 | 4.10 | Gyro-B failed 11/89, ESA-A failed 04/91, BX gyro failed 09/91 & gyro A&C failed 1993. Science mission ended 12/23/93. No longer monitored nor reported herein. |
| PEGSAT | 04/05/90 | 0.25 | 0.75 | 0.75 | PEGASUS launched. Limited life mission. |
| HST<br>Class B | 04/24/90 | 15.0*** | ***ACTIVE*** | ***ACTIVE*** | Spherical aberration in primary mirror. Gyros 4&5 failed. Gyros 1&6 failed 10/11/92. 1st service mission 12/93. |
| SSBUV | 10/06/90 | | | | STS attached payload mission. |
| BBXRT | 12/02/90 | | | | STS attached payload mission. |
| CGRO | 04/07/91 | 2.25 | ***ACTIVE*** | ***ACTIVE*** | Propulsion system damaged/degraded. DTR ops stopped 04/92 due to high error rate. MPS bad 07/92. Orbit reboosted to 450 km late 1993. |
| NOAA-12(D)<br>Class B | 05/14/91 | 2.00 | ***ACTIVE*** | ***ACTIVE*** | |
| TDRS-5(E)<br>Class A | 08/02/91 | 10.0** | ***ACTIVE*** | ***ACTIVE*** | |
| UARS<br>Class B (Spacecraft)<br>Class C (Instruments) | 09/15/91 | 3.00 | ***ACTIVE*** | ***ACTIVE*** | ISAMS instrument failed 07/92. Cryogens depleted in CLAES instrument 05/93: science ended. |
| SSBUV | 03/24/92 | | | | STS attached payload mission. |
| EUVE<br>Class B | 06/07/92 | 1.13 | ***ACTIVE*** | ***ACTIVE*** | 2 out of 4 transponders lost. 1 out of 2 transmitters lost. |
| SAMPEX (SMEX-1)<br>Class C | 07/03/92 | 3.00 | ***ACTIVE*** | ***ACTIVE*** | Extended operations. |
| TDRS-6(F)<br>Class A | 01/13/93 | 10.0** | ***ACTIVE*** | ***ACTIVE*** | Put in on-orbit storage 06/93. |
| NOAA-13(I)<br>Class B | 08/09/93 | 2.00 | 0.03 | 0.03 | Anomaly in power subsystem caused loss of spacecraft 08/21/93. |
| Landsat-6(E) | 10/05/93 | | | | ***No longer monitored nor reported herein.*** |
| HST[SM-01] | 12/02/93 | | | | HST servicing mission: WF/PC II, 2RSUs, S.A.s |

| Spacecraft | Launch Date | Design Life | Useful Life | Active Life | Remarks |
|---|---|---|---|---|---|
| | | | | | installed. HST entry above. |
| GOES-8(I)<br>Class A | 04/13/94 | | ***ACTIVE*** | ***ACTIVE*** | |
| SPARTAN 201-02<br>Class D | 09/00/94 | | | | STS attached payload mission. |
| Wind (GGS)<br>Class B | 11/01/94 | | ***ACTIVE*** | ***ACTIVE*** | |
| NOAA-14(J)<br>Class B | 12/30/94 | | ***ACTIVE*** | ***ACTIVE*** | |
| GOES-9 (J)<br>Class A | 05/23/95 | 7.00 | ***ACTIVE*** | ***ACTIVE*** | |
| Spartan 201-03<br>Class D | 09/06/95 | | | | STS attached payload mission. |
| Spartan 204<br>Class D | 02/04/95 | | | | STS attached payload mission. |
| XTE<br>Class C | 12/30/95 | 2.00+ | ***ACTIVE*** | ***ACTIVE*** | Possible cracked solar array cells noticed shortly after launch. |
| TDRS-7<br>Class A | 07/13/95 | 10.0 | ***ACTIVE*** | ***ACTIVE*** | |

Notes:
*Repaired by crew of shuttle flight 41-C on April 12, 1984.
**Complex warranty provisions call for 10 year service from TDRS system.
***Based on periodic servicing in orbit. MSFC launched spacecraft; GSFC manages operational phase.