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STUDIES OF VESTIBULAR NEURONS IN NORMAL, HYPER- AND HYPOGRAVITY

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OVERVIEW

GROUND BASED PREFLIGHT STUDIES AT UTMB RELATED TO COSMOS FLIGHT 2229 (BION 10)

11/1/92 - 8/22/92

- Established stereotaxic coordinates for medial vestibular nucleus, abducens nucleus and vestibular nerve then redesigned the head ring platform and microelectrodes to permit recordings from these deep neural structures.
- Completed development of surgical procedures to chronically implant orthodromic stimulation electrodes. Implanted two control rhesus monkeys at UTMB
- Completed evaluation of eye movement measurement using ISCAN. Installed the ISCAN camera on the multi-axis rotator
- Completed development of a system to permit active and passive head motion testing. Installed components on the multi-axis rotator.
- Participated in the development of the flight amplifier used to process neural signals during space flight.
- Evaluated several technologies used to produce a multiple microelectrode array. Developed and tested thin microelectrodes that were implanted as a bundle multiple microelectrode array in several flight candidates.
- Continued to develop computer programs in anticipation of recording from rectifying neurons (vestibular nuclei neurons).

GROUND BASED PREFLIGHT STUDIES AT THE INSTITUTE OF BIOMEDICAL PROBLEMS (IBP) IN MOSCOW RELATED TO COSMOS FLIGHT 2229 (BION 10)

8/22/92 - 9/6/92

- J. David Dickman (JDD), Ph.D. and Manning J. Correia (MJC), Ph.D. implanted microelectrode guide tube carrier platforms stereotaxically in 12 monkey flight candidates.

8/29/92 - 9/13/92

- Adrian A. Perachio (AAP), Ph.D., Denise Helwig and Samantha Edmonds implanted orthodromic stimulating electrodes in the bony labyrinths of 7 monkey flight candidates.

9/29/92 - 10/4/92

- AAP and JDD implanted 5 flight monkey candidates with orthodromic stimulating electrodes.

10/3/92 - 10/29/92

- MJC x-rayed all 12 flight candidates. MJC, AAP and JDD conducted electrophysiological studies to determine the stereotaxic coordinates of the vestibular nerve, the medial vestibular nucleus and the abducens nucleus.

11/11/92 - 11/21/92

- Studies were carried out to obtain preflight data from each of the flight monkey candidates. Recordings were obtained from monkeys 803, 775,151, 907, 1401, and 856. From these monkeys, recordings were obtained from 35 horizontal canal afferents, 8 medial vestibular nucleus type II neurons, 8 medial vestibular nucleus type I neurons, 3 untyped medial vestibular nucleus neurons and one vertical medial vestibular nucleus neuron.

11/29/92 - 12/12/92

- Indwelling microelectrodes were implanted in several of the leading flight candidates.

GROUND BASED PREFLIGHT STUDIES AT THE INSTITUTE OF BIOMEDICAL PROBLEMS (IBP) REMOTE FACILITY IN PLESETZ RELATED TO FLIGHT 2229 (BION 10)

12/18/92 - 12/23/92

- Indwelling flight microelectrodes were implanted by JDD and AAP in other flight candidates. The location and number of Implants are summarized in the table below

Flight Candidate Microelectrode Implants (Dec.1992)

Monkey	Location		
	Nerve	Nuclei	Cerebellum
803	multiple electrode (3)	multiple electrode (2)	single electrode (1)
907	single electrode (1)	single electrode (1)	single electrode (1)
151	single electrode (1)	single electrodes(4)	none
775	single electrode (1)	single electrode (1)	none
906	single electrode (1)	single electrodes(6)	single electrode (1)
892	multiple electrode (2)	multiple electrode (3) single electrodes(2)	single electrode (1)
476	none	single electrodes(3)	single electrode (1)

INFLIGHT STUDIES RELATED TO COSMOS FLIGHT 2229 (BION 10)

12/26/92 - 12/23/92

- Studies were carried out in which recordings were made from the vestibular nerve and the vestibular nuclei in the two cosmonaut monkeys, 151 and 906.

GROUND BASED POSTFLIGHT STUDIES AT THE INSTITUTE OF BIOMEDICAL PROBLEMS (IBP) IN MOSCOW RELATED TO COSMOS FLIGHT 2229 (BION 10)

1/5/92 - 1/23/93

- Synchronous control studies were made on flight candidate monkeys 803 & 907. Recordings were obtained from 11 horizontal canal afferents from these monkeys (See Appendix 1).

- Postflight studies were carried out in which recordings were made from the vestibular nerve of the two cosmonaut monkeys, 151 and 906 as well as the vestibular nerve and vestibular nucleus of control monkeys 803, 907, 1401, 892 (See Appendix 1). Recovery was on 1/10/93. First recordings were made on: 1/11/93-13 horizontal afferents recorded from monkey 906 and 5 afferents recorded from monkey 151; 1/12/93-5 afferents recorded from monkey 906 and 13 afferents recorded from monkey 151; 1/14/93-2 afferents recorded from monkey 906 and 10 afferents recorded from monkey 151; and on 1/21/93-10 afferents recorded from monkey 906 and 0 afferents recorded from monkey 151. During postflight tests on the control monkeys listed above, 12 horizontal canal afferents and 6 medial vestibular nucleus type I neurons were studied.

1/23/93 - 1/27/93

- Laboratory packed with the exception of the monkey multi-axis rotator.

5/3/93 - 5/7/93

- The monkey multi-axis rotator was disassembled, reassembled and packed for shipment to UTMB.

1/23/93 - 11/14/93

Derived usable data from preflight , post flight and synchronous control tests. The results of those analyses are summarized in Tables 1-31 on pages T1-T12 in Appendix 2. Graphical summary of these data are presented throughout the text that follows.

Presentations, abstracts and publications

1. Correia, M.J.; Perachio A.A.; Dickman, J.D. and Kozlovskaya, I.B. Sensitivity changes in semicircular canals following microgravity. *World Space Congress*, F1.2-M.1.02, p. 541, 1992.

2. Correia, M.J.; Perachio, A.A.; Dickman, J.D. The effects of space flight on the inner ear of non human primates. *Eleventh Annual Houston Conference on Biomedical Engineering Research*, p. 131, 1993.

3. Correia, M. J., Dickman, J. D., Perachio, A. A., Kozlovskaya, I.B. and Sirota, M. G. Post-flight responses of horizontal semicircular canal afferents to pulse rotations, Cosmos 2229 symposium, Ames Research Center, 1993.

ABSTRACT

During the past year, pre-, in- and postflight studies were conducted in association with the Axon project for Bion 10 (Cosmos 2229). Recordings were made during pre- and postflight studies, from 118 horizontal semicircular canal afferents and 27 vestibular nucleus neurons in 7 rhesus monkeys; 137 pulse rotation protocols alone were executed (548 acceleration and deceleration responses were curve fit). Usable data was obtained from 127 horizontal afferents concerning their spontaneous discharge. Curve fits and analysis was made of sinusoidal and sum of

sinusoidal responses from 42 and 35 horizontal afferemts, respectively. Also recordings were made from neurons inflight from the two flight animals. The mean spontaneous rate varied from 128 spikes/sec. during preflight to 92 spikes/sec during postflight (day 5) - a change of 28%. In direct contrast to the results of Cosmos 2044, the best fitted neural adaptation operator (k) and the gain of the pulse response were decreased during post flight when compared to preflight. Surprisingly, the best fitted gain and k values for the sum of sines were slightly elevated during post flight tests. The gain and phase of single sine responses were compared for pre- and post flight tests and compared to a larger population of afferents (Miles and Braitman, 1980). In contrast to Cosmos 2044 results where on the first day of post flight testing the gains of the best fitted sine response were skewed toward the higher values of the Miles and Braitman distribution, the gain of the best fitted sine responses during the first day of post flight testing (day 2) during Cosmos 2229 were exactly on the mode of the Miles and Braitman distribution. Thus, at least for the periodic stimuli, (pulses and sine waves) we found no change in gain and neural adaptation during post flight testing following Cosmos 2229. This conclusion is different from the one derived following the Cosmos 2044 flight (Correia et. al., 1992). Cosmos flight 2229 differed from Cosmos flight 2044 in several significant ways: For example, during *preflight*; (1) The animals preflight training was different (less well trained on the gaze task) and (2) the animals were exposed to more experimental manipulations (surgical and rotational). *Inflight*, (1) the animals were required to make a pointing gesture (motor response) in association with eye movements to obtain reward, (2) the inflight diet was different (more balanced), (3) the feeder for one of the animals clogged following 9 days of flight resulting in evident dehydration and probably less head motion exposure in that monkey and (4) there was limited video taping of the monkeys in space. During *postflight*, (1) we were unable to test the flight animals until 26 hours postflight as compared to 14.5 hours during Cosmos 2044, (2) the animals received significantly more exposure to motion stimuli during postflight testing than during Cosmos 2044. These differences in the vestibular environment will require analysis of several parameters other than just neural and eye movement responses. For example, computer programs will have to be written and used to recover and quantitate the number of head movements made by each animal during flight. This activity is critical to the production of neural adaptation and increased gain.

METHODS AND RESULTS

Differences from Cosmos 2044 (Correia et al. 1992)

A summary of the neural recordings and stimulation protocols carried out on five control and two flight monkeys during preflight and postflight tests associated with Cosmos Flight 2229 are presented in Appendix 1. Because of time restrictions, two types of neurons were studied in association with this flight. These two types of neurons were horizontal (lateral) semicircular canal afferents and type I or type II vestibular nuclei neurons found in the medial vestibular nucleus. Rotation protocols used for study of the horizontal semicircular canal afferents where similar to those used during Cosmos Flight 2044 (Correia et al., 1992) except that the number of protocols were abbreviated to include: test of spontaneous discharge, pulse rotation test, sum of signs tests (bandwidth from 0.2 hertz to 1.0 hertz) and sinewave test (0.2 hertz). Rotation protocols for the vestibular nuclei neurons included: spontaneous sinusoidal discharge test, oscillations at 0.2 hertz, 0.5 hertz, 1.0 hertz; a pulse of constant velocity of 60 degrees per second and a sum of sines stimulus covering the band width from 0.02 hertz to 1.0 hertz.

Neurons in the vestibular nuclei and semicircular canal afferents were identified and functionally characterized by their responses to natural vestibular stimulation and to electrical stimulation of the vestibular nerve. The technique for the latter test required that a method be developed for chronic implantation of electrodes for stimulation across the bony labyrinth of

awake rhesus monkeys. In a single monkey, the implantation technique used by Broussard et al (1992) was attempted. This technique requires dissection through the mastoid bone to locate the superior semicircular canal. An opening is made in the canal wall near the ampullae for the placement of one of a pair of stimulating electrodes. The reference electrode is placed near the posterior wall of the ear canal. The technique also involves exposure of the dura overlying the lateral tip of the dorsal paraflocculus. The technique was judge to be too difficult for our application and carried the added risk that vertical canal function might be compromised during the course of the entire project. Dr. Lisberger informed us that cathodal stimulation, such as would be used in our studies, might lead to bone growth and to the eventual occlusion of the implanted canal.

The approach we finally used was derived from a method reported by Minor and Goldberg (1991) for galvanic stimulation of the squirrel monkey labyrinth. This involves a placement of a single electrode into a hole drilled into the promontory near the round window. The tip of the electrode seals an opening made into the perilymphatic space. The electrode consists of a platinum plated, teflon insulated silver wire (250 micron uncoated diameter) with a 1.0 mm exposed tip. The reference electrode is of similar material but with a longer tip exposure (3.0 mm). That electrode is placed into a hole drilled deep into the posterior attachment of the zygomatic arch.

Surgery was performed under general anesthesia and sterile conditions. In our facilities at UTMB, we successfully implanted three rhesus monkeys, two unilaterally and one bilaterally. The post auricular incision was made and the platyzma divided. The remaining underlying soft tissue of the ear canal was dissected to expose the external bony auditory meatus and the zygomatic arch. Two self-tapping, stainless steel screws were placed near the ear canal into the parietal bone, dorsal to the parietal-occipital ridge. The soft tissue was carefully dissected along the posterior wall of the meatus to level of the annulus. The tympanic membrane was incised inferiorly and posteriorly to gain entrance to the middle ear. In immature rhesus monkeys, the external meatus is so oriented as to allow direct visualization of the round window via this approach. In more mature animals, the canal is rotated forward relative to the basal skull, thus obscuring the promintory and the long process of the malleus, requiring further dissection.

Exposure of the round window in mature rhesus monkeys is achieved by drilling away the deepest most posterior wall of the external auditory meatus. This is best achieved with a diamond coated drill so as to minimize danger to the underlying facial nerve and middle ear ossicles. In a series of eleven unilaterally implanted rhesus monkeys, facial nerve damage occurred in only one animal. Following further exposure, the long process of the malleus and the facial nerve are visualized. The site of implantation of the stimulating electrode is posterior to the malleus. The facial nerve is displaced rostrally to protect it during implantation. The ossicles are not this disarticulated. The surface of the promontory is scraped to remove the periosteum and thinned with a diamond tipped round bur. A hole is then drilled in the center of the resulting concavity and the electrode tip is inserted, seated firmly at the shoulder formed by the teflon insulation. The wire is pushed against the posterior wall of the meatus and formed against the drilled surface. The external portion of the wire is wound around one of the skull screws and cemented to it with dental acrylic. The reference electrode is placed into the hole in the zygomatic arch, wound around the second screw and cemented in place. The two leads are then passed under the temporalis muscle and exteriorized at the head restraint implant with a curve needle. The wound is closed in layers with absorbable suture and the skin closed with silk suture material. Antibiotics are routinely administered perioperatively.

The animals implanted in Moscow generally recovered from surgery with no sequelae. One monkey, that was diagnosed as having meningitis at the time of surgery, was found to have a positional nystagmus postoperatively. Since this animal was tested only during the postoperative period, it was not possible to definitively assess the relationship of those symptoms to the implant. Another monkey was reported to have an ipsilateral head tilt and was acutely ataxic. Those symptoms resolved quickly. No vestibulo-ocular abnormalities were reported by other investigators in that animal. Afferent activity and vestibular nuclear responses were comparable to those of the remaining animals.

In Figure 1, an example of an entrained response of a horizontal semicircular canal afferent is illustrated. The latency of the action potential is less than 0.5 msec. This response was obtained during ground based testing and strongly argues that we recorded from primary afferents. No histological verification has been possible. Response thresholds ranged from the 30 to 100 microamps for single monophasic cathodal pulses. Diphasic responses were recorded in neurons located contralaterally at the stereotaxic location of the abducens nuclei. Cells in those areas discharge tonic/phasically with ipsilateral horizontal eye position/movement.

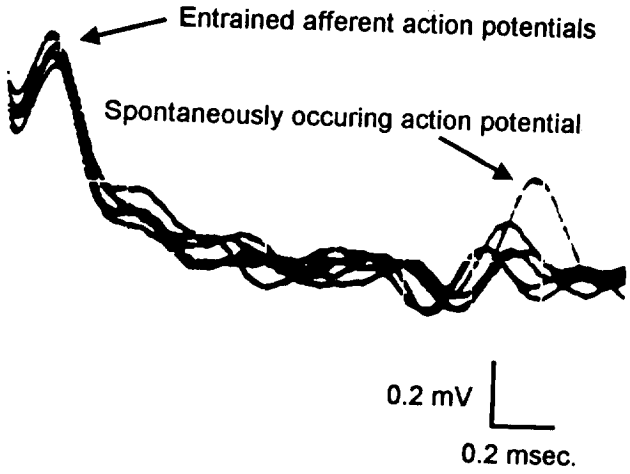

Figure 1. Entrained action potentials from a horizontal semicircular canal afferent. The orthodromic stimulation produced entrained action potentials with latencies less than 0.5 msec. Also observed at the right of the figure is a spontaneously occurring action potential.

Recordings were made from 86 neurons in control animals and 59 neurons in the flight animals. Thus 145 neurons were studied in total during pre- and postflight ground base tests. Neurons studied during flight have not yet been analyzed. The procedures for analysis of the data resulting from the rotation protocols that stimulated the horizontal semicircular canals have been published elsewhere (Correia et al., 1981, Correia et al., 1992). Briefly, this analysis can be stated as follows: pulse response analysis-using nonlinear curve fitting techniques, one model was (the adaptation model - Correia et al., 1992) was fit to each of the four pulse responses that occur during a given rotation pulse protocol. In some cases the responses were so noisy that the data was rejected. These responses are denoted by *** in the Tables in Appendix 2. If the protocols were repeated, the protocol that yielded the histogram with the least noise was chosen. Data from repeated protocols was not included. That is, only one set of parameters from the four pulses is included for each neuron. For each sinusoidal rotation, curve fit techniques were used to estimate the gain and phase of each of the sinusoidal responses to head velocity. For the sum of sinusoidal stimuli, the total neural response was exposed to cross Fourier techniques to determine the gain and phase of the cycle histogram re head velocity. Mathematical functions based on the adaptation model (Thorson and Biederman-Thorson, 1974, Correia et al., 1981, Correia et al., 1992) was used to curve fit the pulse response and the frequency response data. The parameters derived from analysis of the time and frequency domain responses of the semicircular canal afferents was clustered into groups along the preflight and postflight time continuum and compared. As yet we have not been able to statistically compare the parameters. This will be the next step. However, descriptive first order statistics have been completed and they are presented in Appendix 2 and in the graphs that follow.

It should be noted that in *all* the figures that follow and in the tables in Appendix 2 that during Cosmos 2229 during Post-flight days 6 and 7 only control animals were tested..

Figure 2 presents mean gain values derived from best fitted responses to pulse stimulation. The numbers in the bars represent the number of afferents that comprise the mean. It can be seen that in contrast to Cosmos 2044 the postflight mean gains are depressed relative to preflight, synchronous and postflight controls (Post-Flight day 6).

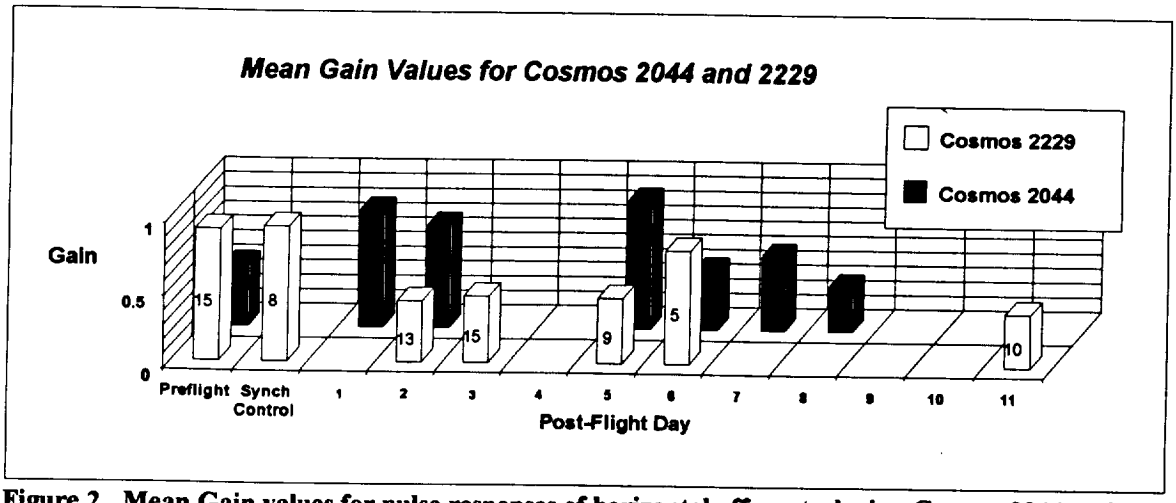

Figure 2. Mean Gain values for pulse responses of horizontal afferents during Cosmos 2044 and 2229.

As with the mean gain values, the parameter that represents the degree of neural adaptation (k), plotted in Figure 3 is depressed on postflight days 2, 3, and 5 when compared to preflight and postflight controls and when compared to comparable test days following Cosmos flight 2044.

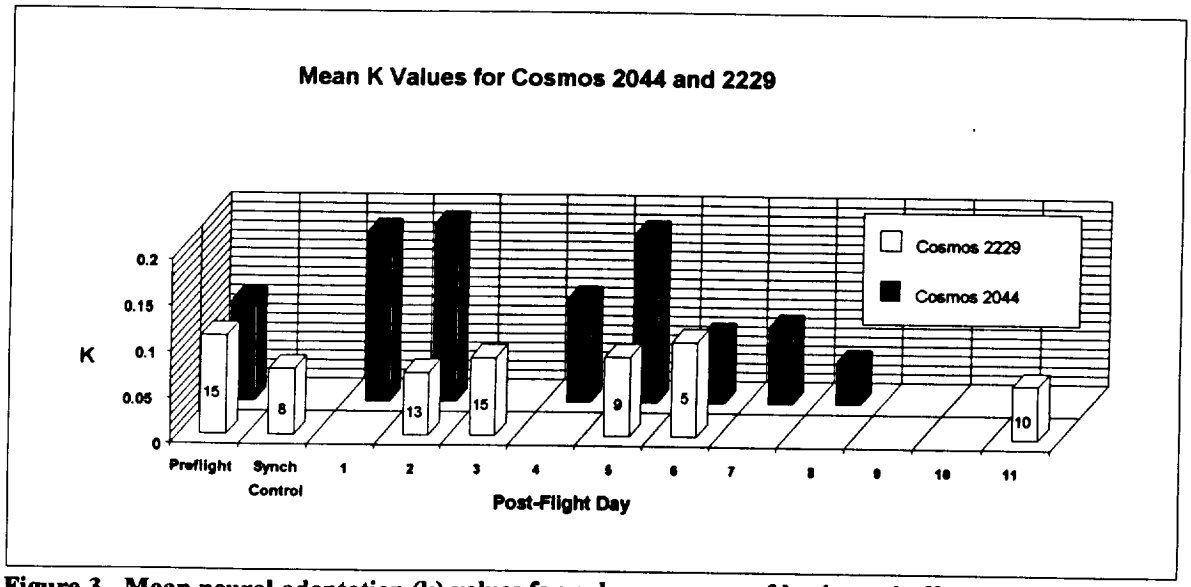

Figure 3. Mean neural adaptation (k) values for pulse responses of horizontal afferents during Cosmos 2044 and 2229.

Again in contrast to the results derived from the postflight data following Cosmos 2044, the mean long time constant of the semicircular canal deduced from best fitted functions of the

pulse histogram response and shown plotted in Figure. 4. lengthened in the flight animals when compared to preflight, synchronous controls and postflight controls (post-flight day 6).

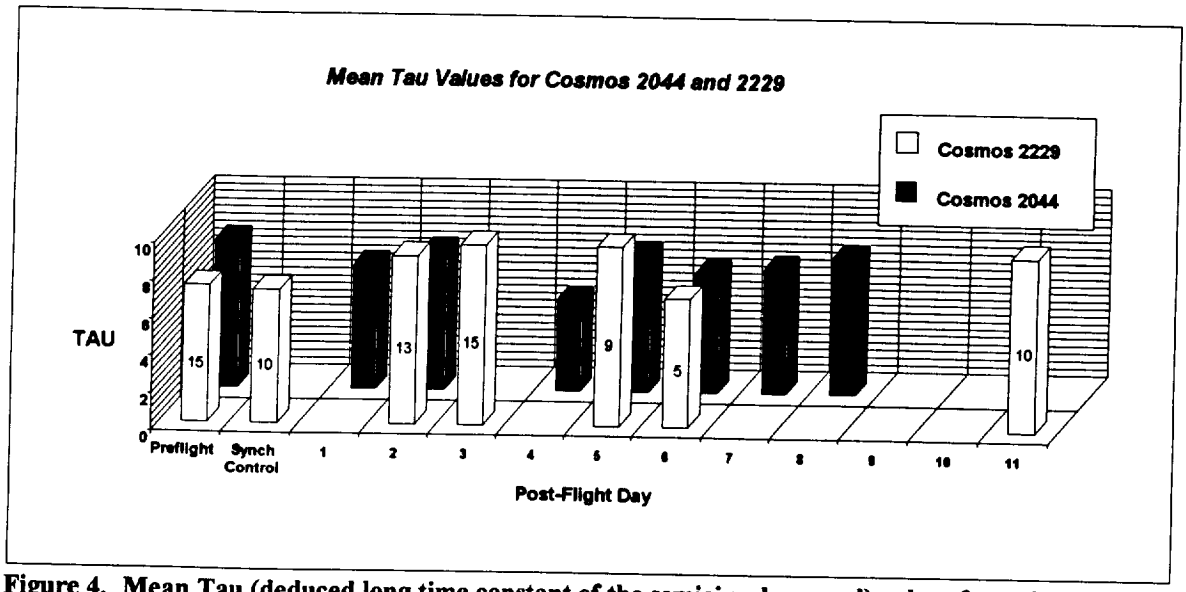

Figure 4. Mean Tau (deduced long time constant of the semicircular canal) values for pulse responses of horizontal afferents during Cosmos 2044 and 2229.

Like the data following Cosmos 2044, the mean baseline of the frequency of firing between pulses (DC level), plotted in Figure 5, was not much different during post-flight testing when compared to control responses. The mean responses differed from 125 spikes/sec to 95 spikes/sec. These values fall around the mean firing rate determined by other investigators (e.g. ~100 spikes/sec. Mlles and Braitman,1981).

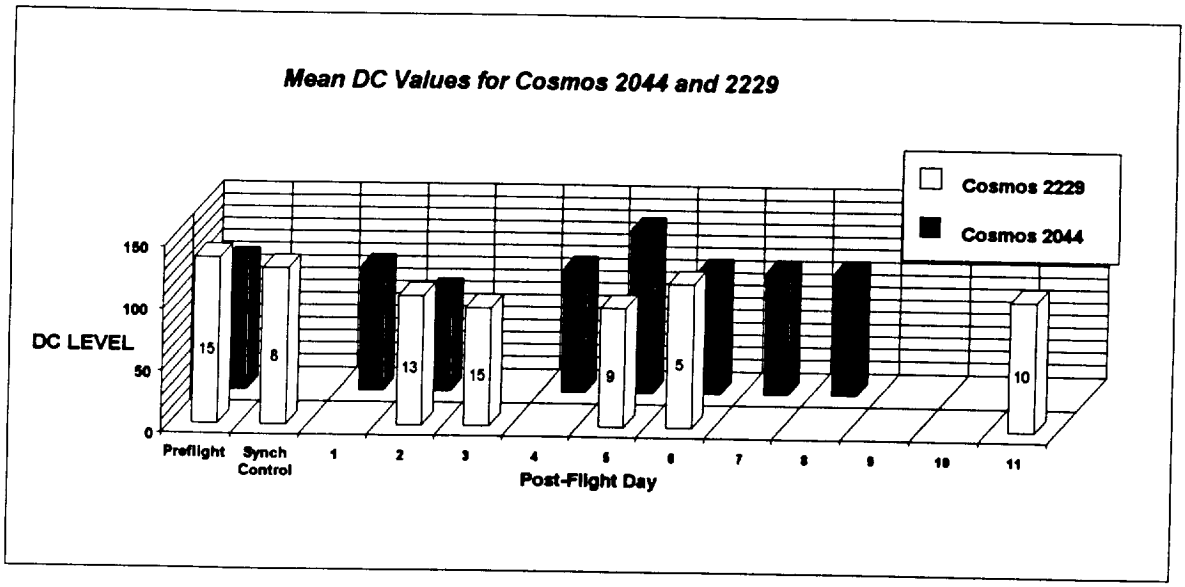

Figure 5. Mean spontaneous values (DC level) obtained as an asymptotic response following pulse rotations during Cosmos 2044 and 2229.

The mean spontaneous firing rate, plotted in Figure 6 was obtained from interspike interval histograms of spontaneous discharge prior to the first pulse rotation. The mean values

showed depression during the post-flight testing but like the mean DC level values, the firing rate was near 100 spikes/sec.

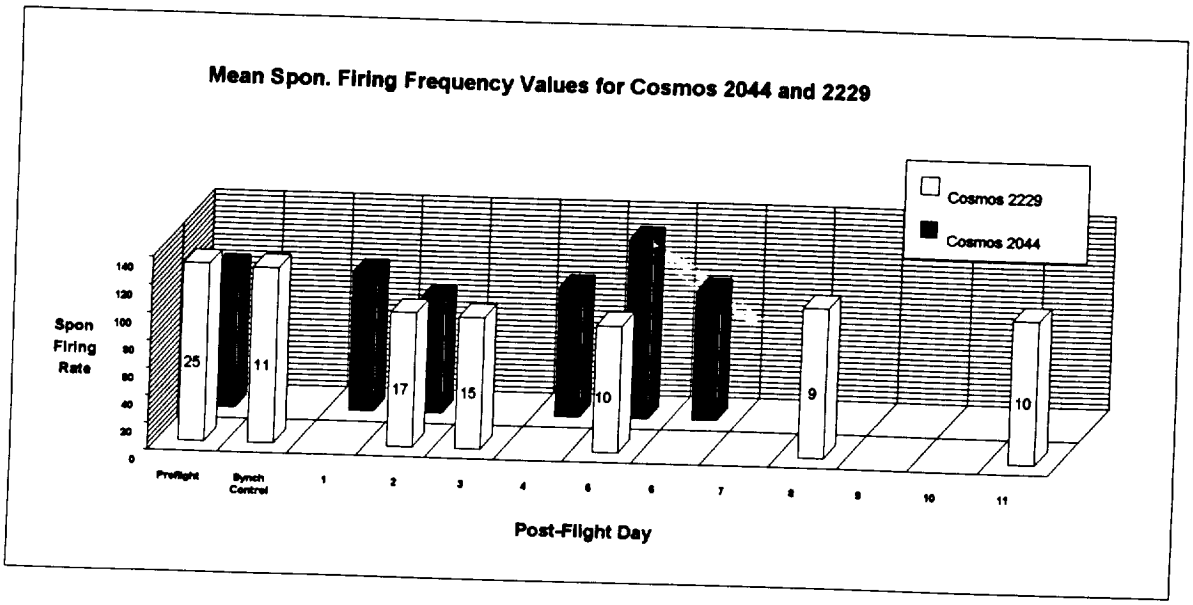

Figure 6. Mean frequency of firings values for spontaneously discharging horizontal afferents during Cosmos 2044 and 2229.

In the control animals the coefficient of variation (CV) for all afferents (see Table 8 in appendix 2) ranged from 0.34 to 0.03. But the mean values for each day, (plotted in Figure 7) ranged from 0.09 to 0.15. That is, the mean CV of the afferents across days would be classified as regularly firing after the distribution of Louie and Kimm (1976). In this statistic our results during flight 2229 were almost identical to the results of flight 2044.

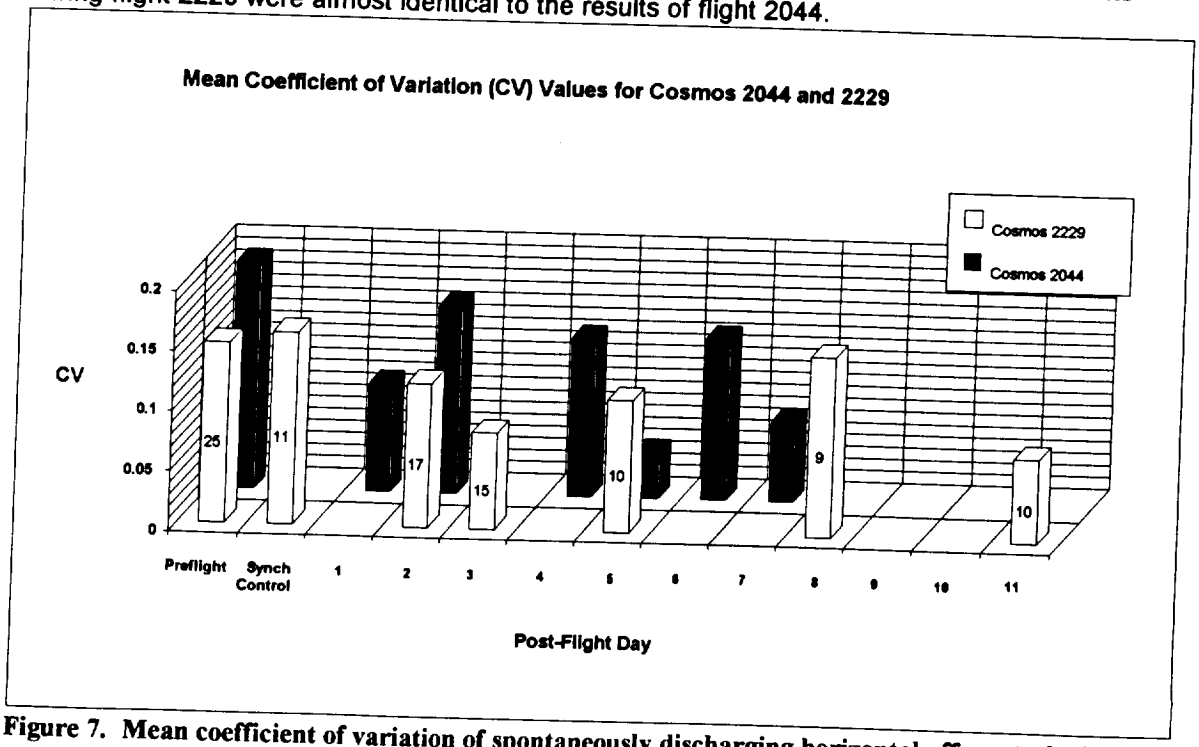

Figure 7. Mean coefficient of variation of spontaneously discharging horizontal afferents during Cosmos 2044 and 2229.

The best fitted parameters plotted in Figures 1-5 were derived from the equation:

$$r(t) = (G/t^{k})[\gamma^{*}(-k,-t/\tau_{L})e^{-t/\tau_{L}}] + DC; \text{ where } \gamma^{*}(a,t) = ((t^{-a}/\Gamma(a))\int_{0}^{t} x^{a-1}e^{-x}\,dx \qquad (1)$$

and $\gamma^{*}(a,t)$ is the incomplete gamma function (which is single-valued and finite in terms of a and t), G = gain, k = across frequency adaptation, τ_L (TAU) = cupula long time constant and DC = non stimulated (spontaneous) firing rate (Correia et al., 1981).

The Laplace transform of Eq. 1 with a term ($\tau_V s$ +1), representing the response to cupula velocity at higher frequencies (Fernandez and Goldberg, 1971), is a transfer function of the form

$$H(s) = Gs^{k+1}(\tau_V+1)(\tau_L+1)^{-1} \qquad (2)$$

where G= the frequency independent gain ; k = the across frequency adaptation operator; $s=1+j\omega$; $\omega = 2\pi f$; τ_V = velocity time constant and τ_L = the long time constant of the semicircular canals. In the next 3 figures the parameters k, τ_V and τ_L are presented. These parameters represent best fitted values of Eq. 2 to a sum of sines frequency response.

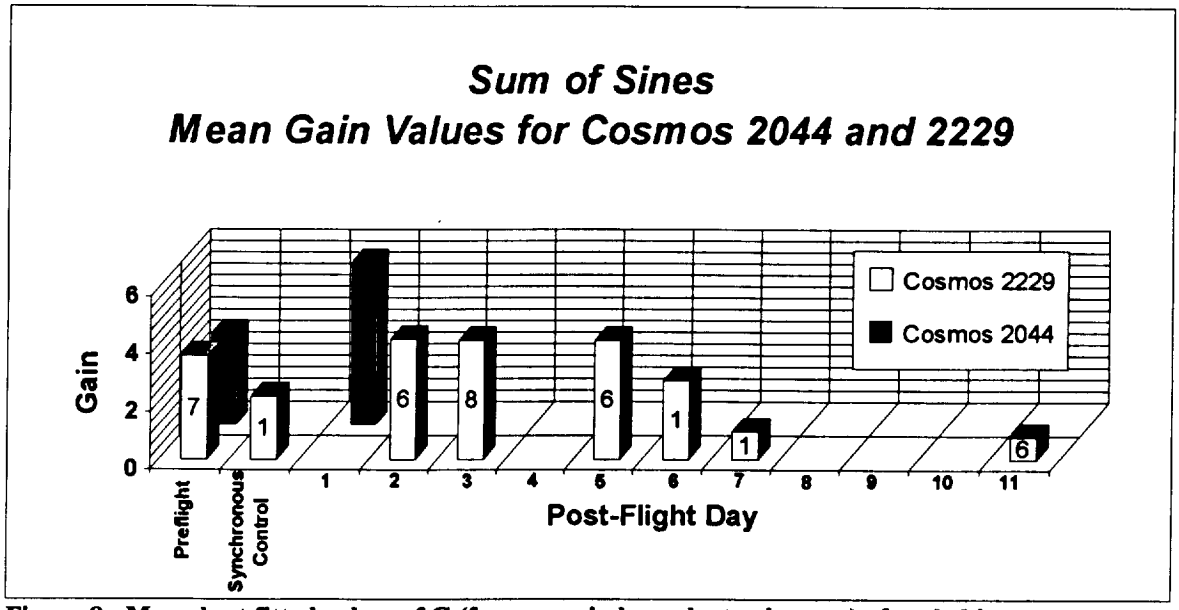

Figure 8. Mean best fitted values of G (frequency independent gain term) of cycle histogram response to sum of sines by horizontal afferents during Cosmos 2044 and 2229.

It is interesting that the frequency domain equivalent of the pulse response produces an increase in gain during post flight days 2, 3, and 5 relative to the pre- and post flight controls . The sum of sines differs from the pulse in that most of the frequency content is below 0.4 Hz and the sum of sines is an unpredictable stimulus.

In Figure 9 (below) it can be noted that while the mean value of k increases on the second post flight day, the increase is not nearly as dramatic as noted during Cosmos 2044 (black bars)

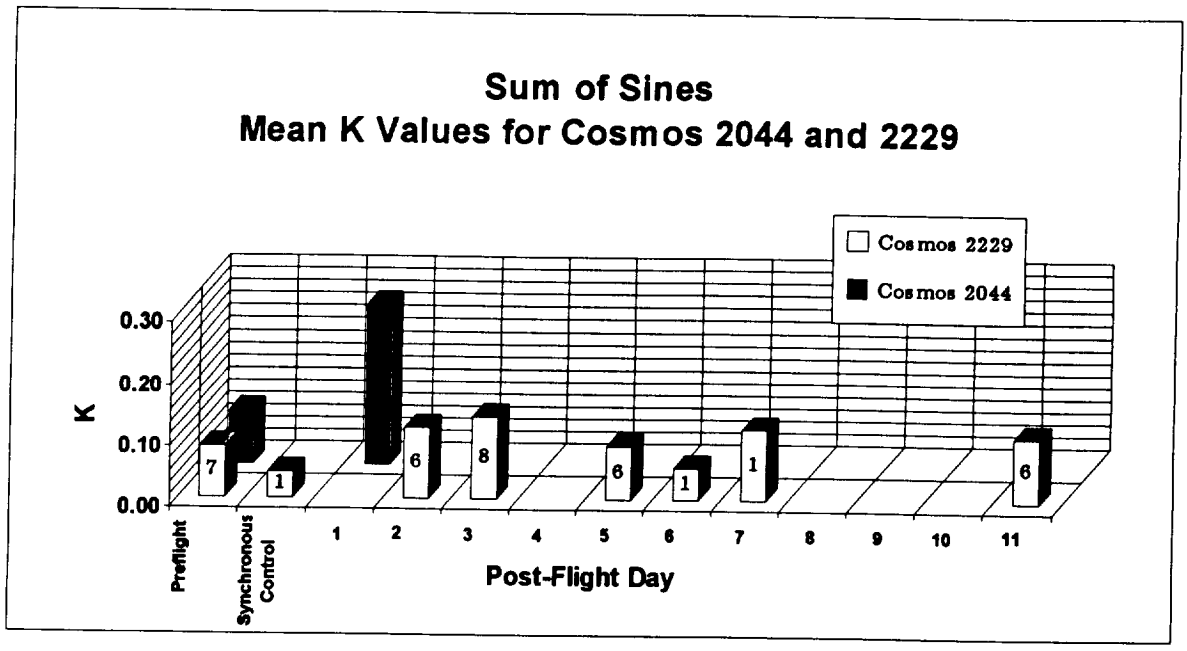

Figure 9. Mean best fitted values of K (across frequency neural adaptation operator) of cycle histogram response to sum of sines by horizontal afferents during Cosmos 2044 and 2229.

There does not appear to be a systematic change in the mean best fitted parameter τ_V.shown plotted in Figure 10 below.

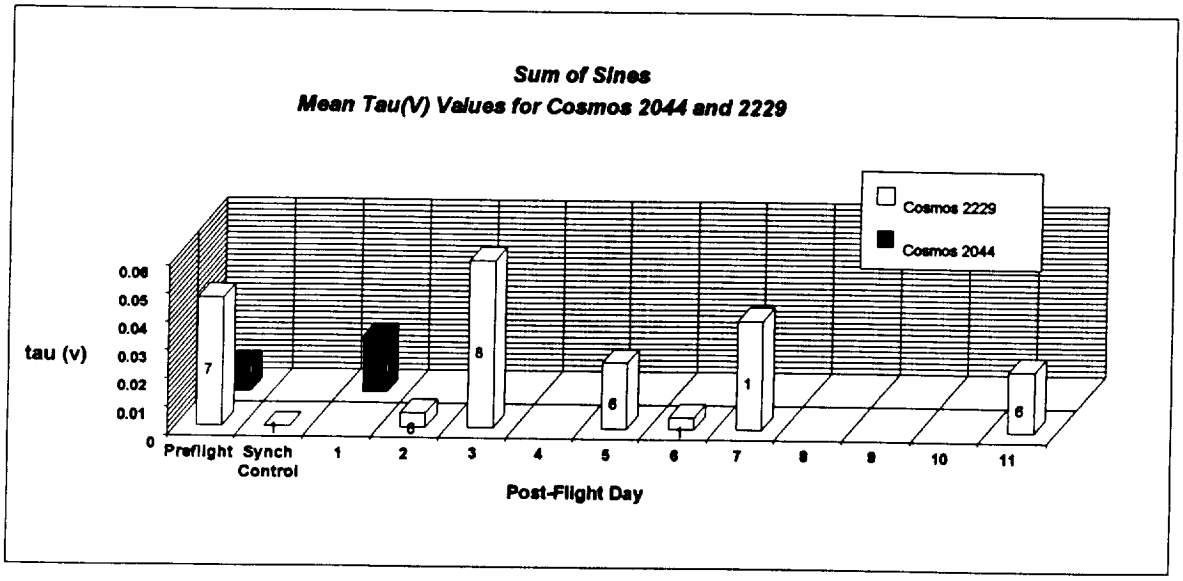

Figure 10. Mean best fitted values of τ_V (across frequency neural adaptation operator) of cycle histogram response to sum of sines by horizontal afferents during Cosmos 2044 and 2229.

During the first day of post-flight testing during Cosmos 2044, the long time constant of the semicircular canal decreased as indicated by the black bars. During the first post-flight day of Cosmos 2229, the parameter τ_L increased.

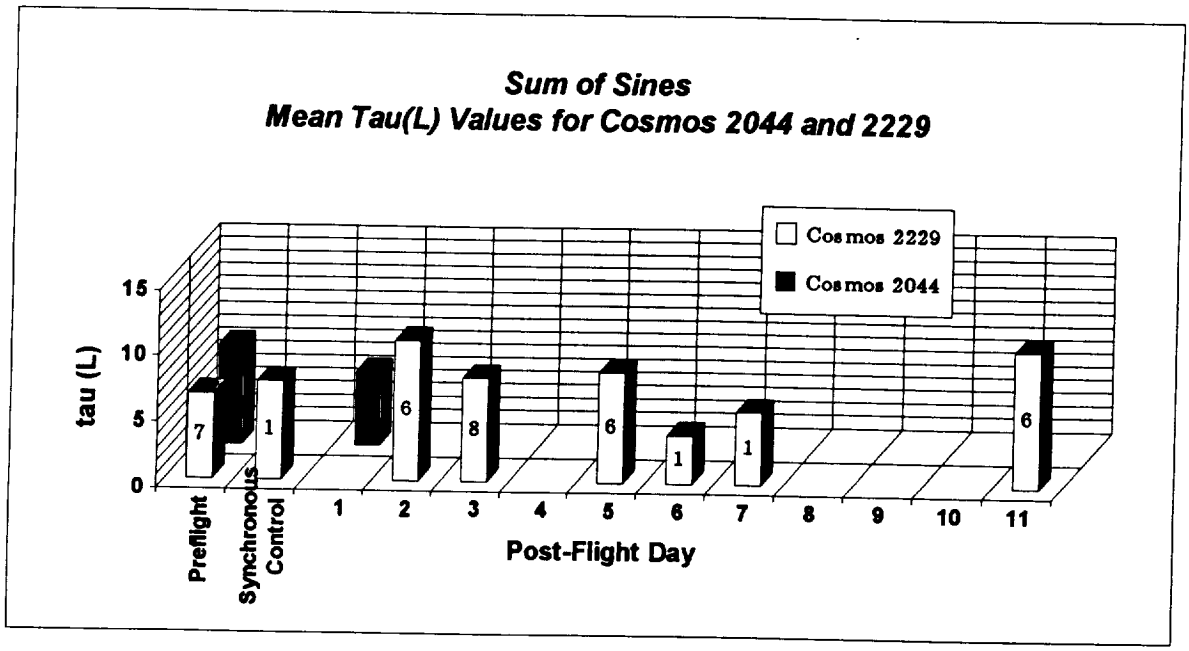

Figure 11. Mean best fitted values of τ_L (semicircular canal long time constant operator) of cycle histogram response to sum of sines by horizontal afferents during Cosmos 2044 and 2229.

The next 2 three dimensional bar histograms display gain values calculated from the best fitted sine function to the cycle histogram of the afferent response to a sinusoidal yaw rotation of 30°/sec. amplitude and 0.2 Hz frequency. As a reference, the histogram of gains from Miles and Braitman (1980) sinusoidal response to 0.2 Hz are presented. Presented in Figure 12 are the gains for the control monkeys during both Cosmos 2044 and 2229. It can be seen, for example that the distribution of gains from post -flight controls in Cosmos 2229 are similar to those published by Miles and Braitman (1980).

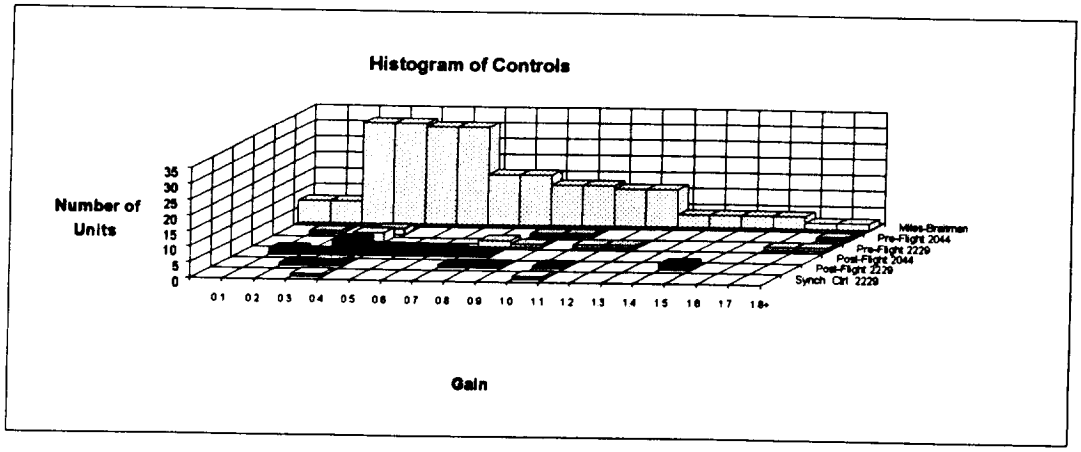

Figure 12. A three dimensional histogram of sinusoidal gains from control monkeys during testing associated with Cosmos 2044 and Cosmos 2229. The data of Miles and Braitman (1980) are presented for comparison.

Figure 13 presents the same type plot but post-flight data from different days during Cosmos 2044 and 2229 are presented. The striking difference between the gains during Cosmos 2044 and 2229 can be observed by comparing post-flight day 1 - Cosmos 2044 and

post-flight day 2 - Cosmos 2229. During Cosmos 2044, the gain values are skewed toward the higher end of the Miles and Braitman distribution; during the first post - flight test day (day 2) during Cosmos 2229, the values are directly in line with the central tendency values of Miles and Braitman (1980).

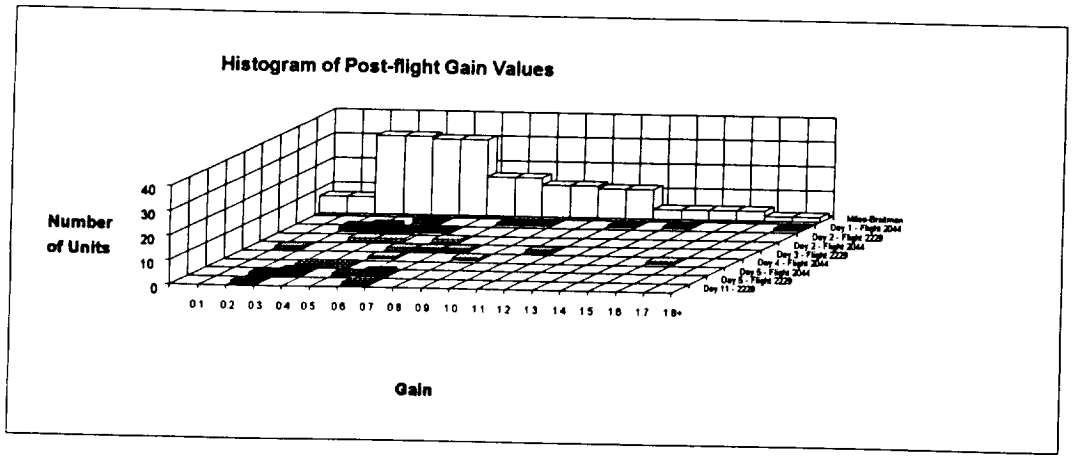

Figure 13. A three dimensional histogram of sinusoidal gains from flight monkeys during post-flight testing associated with Cosmos 2044 and Cosmos 2229. The data of Miles and Braitman (1980) are presented for comparison.

DISCUSSION

In contrast to Cosmos 2044 results (Correia et al., 1992) where on the first day of post flight testing the gains of the best fitted pulse, sine and sum of sine response were skewed toward the higher values of the Miles and Braitman (1980) distribution, the gain of the best fitted sine and pulse responses during the first day of post flight testing (post-flight day 2) during Cosmos 2229 were exactly on the mode of the Miles and Braitman (1980) distribution. Thus, at least for the periodic stimuli, (pulses and sine waves) we found no change in gain during post flight testing following Cosmos 2229. Moreover, during post-flight day 1 during Cosmos 2044 we found an increased level of neural adaptation as reflected by an increased mean k value. After issuing the caveat that we only sampled a small number of afferents, we (Correia et al., 1992) suggested the increased gain could result from some non-vestibular factor secondary to spaceflight such as stress or changes in body calcium levels or some vestibular factor such as a strategy to obtain reward without having to make large head movements by increasing the semicircular canal gain. This latter speculation is predicated on the assumption that the monkeys during spaceflight make numerous head movements. Increase in neural adaptation would also logically follow from numerous head movements. Also, increased gain, increased k and irregular firing are correlated in semicircular canal afferents. Thus, we could have simply sampled a population of neurons with high G and k. But, most of the units we sampled were regularly firing. Analysis of the mean sinusoidal gain data from Cosmos 2229 (summarized in Figure 13), indicated that relative to post-flight controls, the gain and k values were depressed, but relative to the data of Miles and Braitman (1980), the values were on the mean of their distribution. Future statistical comparisons will be necessary to determine if the mean gain and k values from flight 2229 and those of flight 2044 and those of Miles and Braitman (1980) are from the some population. The gain and particularly the neural adaptation observed during Cosmos 2044 was dramatic and showed a reversible trend with time following recovery. Why could these data be different from those of flight 2044? Cosmos flight 2229 differed from Cosmos flight 2044

in several significant ways: First, different monkeys were flight monkeys. Although during both flights the microgravity exposure was similar, several differences existed. For example, during *preflight*; (1) The animals' preflight training was different (the animals were less well trained on the gaze task) and (2) the animals were exposed to more experimental manipulations (surgical and rotational) and in flight 2229 the animals carried an indwelling electrode in one labyrinth. *Inflight*, (1) the animals were required to make a pointing gesture (motor response) in association with eye movements to obtain reward, (2) the inflight diet was different (more balanced), (3) the feeder for one of the animals clogged following 9 days of flight resulting in evident dehydration and probably less head motion exposure in that monkey and (4) there was limited video taping of the monkeys in space. During *postflight*, (1) we were unable to test the flight animals until 26 hours postflight as compared to 14.5 hours during Cosmos 2044, (2) in the intervening interval between recovery and testing, and on subsequent post-flight days, the animals received significantly more exposure to linear and angular motion stimuli than during Cosmos 2044.

Since gravity acts primarily on the otolith organs, It was a surprise that the gain and neural adaptation of the semicircular canals was increased following microgravity during Cosmos 2044. It may ultimately turn out that with a large sample of afferent data that gain and adaptation may not change. However, to fairly compare the results, we must prove that the angular head motion environment in flight was the same for Cosmos 2044 and 2229. To accurately compare the angular head motion environment will require analysis of several parameters other than just neural and eye movement responses. For example, it must be determined that during Cosmos flight 2229 that both monkeys made as many head movements during the gaze test as their counterparts during Cosmos flight 2044. The number of head movements made by each animal during both flight must be quantitated.

One inescapable conclusion that can be drawn from the results presented in Appendix 3 is that the afferent response of the semicircular canals was statistically significantly different following microgravity. In one case (Cosmos 2044), the gain was increased and in the other case (Cosmos 2229) it was decreased. However, in both cases the gain was statistically significantly DIFFERENT from the preflight/synchronous controls.

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APPENDIX 1

A summary of the pre- and post flight testing. The Table on pages T1-T7 chronicles the pre and post-flight testing of all monkeys. The column type denotes whether the neuron was a lat. (horizontal) afferent, a type I or type II vestibular nuclear neuron and whether the neuron could be further classified as a pvp type neuron. The location column denotes the anterior - posterior and the lateral stereotaxic coordinates of the electrode tract. For example, ap0l10 means anterior-posterior 0 and lateral 10 mm from the midline of the skull. The protocol describes the test. The terms step and pulse are used interchangeably throughout this report.

Summary of individual neurons and experimental conditions observed during pre-and post flight testing

Time	cell	time	date	type	side	location	monkey	protocol	tape	footage
preflight	1	pre control	11/14/92	lat. aff.	left	ap0l12	803	spon	1	2200
preflight	1	pre control	11/14/92	lat. aff.	left	ap0l12	803	step	1	2250
preflight	1	pre control	11/14/92	lat. aff.	left	ap0l12	803	ss	1	2300
preflight	1	pre control	11/14/92	lat. aff.	left	ap0l12	803	sine0.2	1	2460
preflight	2	pre control	11/14/92	lat. aff.	left	ap0l12	803	spon	1	2536
preflight	2	pre control	11/14/92	lat. aff.	left	ap0l12	803	step	1	2600
preflight	2	pre control	11/14/92	lat. aff.	left	ap0l12	803	step-rpt	1	2662
preflight	2	pre control	11/14/92	lat. aff.	left	ap0l12	803	sine0.2	1	2727
preflight	2	pre control	11/14/92	lat. aff.	left	ap0l12	803	ss	1	2770
preflight	2	pre control	11/14/92	lat. aff.	left	ap0l12	803	sine1.0	1	2855
preflight	3	pre control	11/14/92	lat. aff.	left	ap0l12	803	spon	1	2887
preflight	4	pre control	11/14/92	lat. aff.	left	ap0l12	803	spon	1	2946
preflight	4	pre control	11/14/92	lat. aff.	left	ap0l12	803	step	1	2946
preflight	5	pre control	11/14/92	lat. aff.	left	ap0l12	803	spon	1	2982
preflight	5	pre control	11/14/92	lat. aff.	left	ap0l12	803	step	1	3001
preflight	6	pre control	11/14/92	lat. aff.	left	ap0l12	803	spon	1	3025
preflight	6	pre control	11/14/92	lat. aff.	left	ap0l12	803	step	1	3040
preflight	6	pre control	11/14/92	lat. aff.	left	ap0l12	803	sine0.2	1	3040
preflight	7	pre control	11/14/92	lat. aff.	left	ap0l12	803	spon	1	3170
preflight	7	pre control	11/14/92	lat. aff.	left	ap0l12	803	step	1	3140
preflight	7	pre control	11/14/92	lat. aff.	left	ap0l12	803	sine0.2	1	3190
preflight	7	pre control	11/14/92	lat. aff.	left	ap0l12	803	ss	1	3230
preflight	7	pre control	11/14/92	lat. aff.	left	ap0l12	803	ss-rpt	1	3305
preflight	7	pre control	11/14/92	lat. aff.	left	ap0l12	803	sine1.0	1	3370
preflight	8	pre control	11/14/92	lat. aff.	left	ap0l12	803	spon	1	3397
preflight	9	pre control	11/15/92	lat. aff.	left	ap0l10	775	spon	1	3399
preflight	10	pre control	11/15/92	lat. aff.	left	ap0l10	775	spon	1	3466
preflight	11	pre control	11/15/92	lat. aff.	left	ap0l10	775	spon	1	3470
preflight	12	pre control	11/15/92	lat. aff.	left	ap0l10	775	spon	1	3489
preflight	12	pre control	11/15/92	lat. aff.	left	ap0l10	775	step	1	3566
preflight	12	pre control	11/15/92	lat. aff.	left	ap0l10	775	step-rpt	1	3631
preflight	12	pre control	11/15/92	lat. aff.	left	ap0l10	775	sine	1	3631
preflight	13	pre control	11/15/92	lat. aff.	left	ap0l10	775	spon	1	3697
preflight	14	pre control	11/15/92	lat. aff.	left	ap0l10	775	spon	1	3791
preflight	15	pre control	11/15/92	lat. aff.	right	ap0l10	151	spon	1	3780
preflight	15	pre control	11/15/92	lat. aff.	right	ap0l10	151	step	1	3810
preflight	16	pre control	11/16/92	lat. aff.	left	ap0l10	907	spon	1	3880
preflight	16	pre control	11/16/92	lat. aff.	left	ap0l10	907	step	1	3900
preflight	16	pre control	11/16/92	lat. aff.	left	ap0l10	907	sine0.2	1	3950
preflight	16	pre control	11/16/92	lat. aff.	left	ap0l10	907	ss	1	3999
preflight	17	pre control	11/16/92	lat. aff.	left	ap0l10	907	spon	1	4058
preflight	17	pre control	11/16/92	lat. aff.	left	ap0l10	907	step	1	4089
preflight	17	pre control	11/16/92	lat. aff.	left	ap0l10	907	stp-rpt	1	4173
preflight	17	pre control	11/16/92	lat. aff.	left	ap0l10	907	sine0.2	1	4229
preflight	17	pre control	11/16/92	lat. aff.	left	ap0l10	907	spon-rpt	1	4290
preflight	18	pre control	11/16/92	lat. aff.	left	ap0l10	907	spon	1	4295
preflight	18	pre control	11/16/92	lat. aff.	left	ap0l10	907	step	1	4313
preflight	18	pre control	11/16/92	lat. aff.	left	ap0l10	907	step-rpt	1	4360
preflight	19	pre control	11/16/92	lat. aff.	left	ap0l10	907	spon	1	4392
preflight	20	pre control	11/16/92	lat. aff.	left	ap0l10	907	spon	1	4430
preflight	21	pre control	11/16/92	lat. aff.	left	ap0l10	907	step	1	4486
preflight	22	pre control	11/16/92	lat. aff.	left	ap0l10	907	step	1	4540
preflight	23	pre control	11/16/92	lat. aff.	left	ap0l10	907	step	1	4623
preflight	24	pre control	11/16/92	lat. aff.	left	ap0l10	907	step	1	4643
preflight	25	pre control	11/16/92	lat. aff.	left	ap0l10	907	step	1	4687

Summary of individual neurons and experimental conditions observed during pre-and post flight testing

preflight	25	pre control	11/16/92	lat. aff.	left	ap0l10	907	step-rpt	1	4739
preflight	25	pre control	11/16/92	lat. aff.	left	ap0l10	907	sine0.2	1	4780
preflight	25	pre control	11/16/92	lat. aff.	left	ap0l10	907	ss	1	4816
preflight	26	pre control	11/16/92	lat. aff.	left	ap0l10	907	step	1	4860
preflight	26	pre control	11/16/92	lat. aff.	left	ap0l10	907	step-rpt	1	4908
preflight	26	pre control	11/16/92	lat. aff.	left	ap0l10	907	sine0.2	1	4950
preflight	26	pre control	11/16/92	lat. aff.	left	ap0l10	907	ss	1	4980
preflight	26	pre control	11/16/92	lat. aff.	left	ap0l10	907	sine1.0	1	5046
preflight	27	pre control	11/16/92	lat. aff.	left	ap0l10	907	step	1	5063
preflight	27	pre control	11/16/92	lat. aff.	left	ap0l10	907	ss	1	5105
preflight	27	pre control	11/16/92	lat. aff.	left	ap0l10	907	spon	1	5150
preflight	27	pre control	11/16/92	lat. aff.	left	ap0l10	907	sine0.2	1	5170
preflight	27	pre control	11/16/92	lat. aff.	left	ap0l10	907	sine1.0	1	5200
preflight	27	pre control	11/16/92	lat. aff.	left	ap0l10	907	sine0.5	1	5246
preflight	28	pre control	11/16/92	lat. aff.	left	ap0l10	907	step	1	5262
preflight	29	pre control	11/16/92	lat. aff.	left	p1l10	1401	step	1	5290
preflight	29	pre control	11/16/92	lat. aff.	left	p1l10	1401	sine0.2	1	5317
preflight	29	pre control	11/16/92	lat. aff.	left	p1l10	1401	ss	1	5348
preflight	29	pre control	11/16/92	lat. aff.	left	p1l10	1401	spon	1	6394
preflight	29	pre control	11/16/92	lat. aff.	left	p1l10	1401	sine1.030	1	5410
preflight	29	pre control	11/16/92	lat. aff.	left	p1l10	1401	sine0.5	1	5435
preflight	29	pre control	11/16/92	lat. aff.	left	p1l10	1401	step-rpt	1	5457
preflight	29	pre control	11/16/92	lat. aff.	left	p1l10	1401	step-rpt	1	5500
preflight	30	pre control	11/16/92	lat. aff.	left	p1l10	1401	step	1	5553
preflight	30	pre control	11/16/92	lat. aff.	left	p1l10	1401	step-rpt	1	5570
preflight	30	pre control	11/16/92	lat. aff.	left	p1l10	1401	sine0.2	1	5620
preflight	30	pre control	11/16/92	lat. aff.	left	p1l10	1401	step-rpt	1	5658
preflight	30	pre control	11/16/92	lat. aff.	left	p1l10	1401	ss	1	5696
preflight	30	pre control	11/16/92	lat. aff.	left	p1l10	1401	sine1.0	1	5743
preflight	30	pre control	11/16/92	lat. aff.	left	p1l10	1401	sine0.5	1	5761
preflight	31	pre control	11/16/92	lat. aff.	left	p1l10	1401	step	1	5775
preflight	31	pre control	11/16/92	lat. aff.	left	p1l10	1401	ss	1	5823
preflight	31	pre control	11/16/92	lat. aff.	left	p1l10	1401	sine0.2	1	5867
preflight	31	pre control	11/16/92	lat. aff.	left	p1l10	1401	sine0.5	1	5898
preflight	32	pre control	11/17/92	mvnii	left	p4l2	151	sine0.2	1	5982
preflight	33	pre control	11/17/92	mvnii	left	p4l2	151	sine0.2	1	6000
preflight	34	pre control	11/18/92	mvni	left	p4l3	856	field pot.	1	6050
preflight	34	pre control	11/18/92	mvni	left	p4l3	856	sine0.2	1	6190
preflight	34	pre control	11/18/92	mvni	left	p4l3	856	sine0.5	1	6220
preflight	34	pre control	11/18/92	mvni	left	p4l3	856	sine1.0	1	6236
preflight	34	pre control	11/18/92	mvni	left	p4l3	856	elec. stim.	1	6249
preflight	35	pre control	11/18/92	mvnvert	left	p4l3	856	elec. stim.	1	6340
preflight	36	pre control	11/18/92	mvni	left	p4l3	856	elec. stim.	1	6360
preflight	36	pre control	11/18/92	mvni	left	p4l3	856	sine0.2	1	6370
preflight	37	pre control	11/18/92	mvni	left	p4l3	856	elec.stim.	1	6400
preflight	37	pre control	11/18/92	mvni	left	p4l3	856	sine0.2	1	6420
preflight	37	pre control	11/18/92	mvni	left	p4l3	856	sine0.2	1	6457
preflight	37	pre control	11/18/92	mvni	left	p4l3	856	sine0.5	1	6490
preflight	37	pre control	11/18/92	mvni	left	p4l3	856	sine1.0	1	6502
preflight	37	pre control	11/18/92	mvni	left	p4l3	856	sine1.0	1	6512
preflight	38	pre control	11/18/92	mvnii	left	p5l3	856	spon	1	6563
preflight	39	pre control	11/18/92	mvnii	left	p5l3	856	spon	1	6570
preflight	39	pre control	11/18/92	mvnii	left	p5l3	856	sine0.2	1	6592
preflight	39	pre control	11/18/92	mvnii	left	p5l3	856	sine0.2	1	6613
preflight	39	pre control	11/18/92	mvnii	left	p5l3	856	sine0.5	1	6633
preflight	39	pre control	11/18/92	mvnii	left	p5l3	856	sine1.0	1	6651

Summary of individual neurons and experimental conditions observed during pre-and post flight testing

preflight	39	pre control	11/18/92	mvnii	left	p5l3	856	sine 1.0	1	6661
preflight	39	pre control	11/18/92	mvnii	left	p5l3	856	sine0.5	1	6674
preflight	40	pre control	11/19/92	mvnii	left	p3l3	803	elec.stim	2	0
preflight	40	pre control	11/19/92	mvnii	left	p3l3	803	sine0.2	2	0
preflight	41	pre control	11/19/92	mvn	left	p3l3	803	elec.stim	2	148
preflight	42	pre control	11/19/92	mvn	left	p4l3	803	elec.stim	2	300
preflight	42	pre control	11/19/92	mvn	left	p4l3	803	sine0.2	2	300
preflight	43	pre control	11/19/92	mvni	left	p4l3	803	elec.stim	2	405
preflight	43	pre control	11/19/92	mvni	left	p4l3	803	sine0.2	2	474
preflight	44	pre control	11/19/92	mvni	left	p4l3	907	sine0.2	2	528
preflight	45	pre control	11/19/92	mvnii	left	p4l3	907	spon	2	643
preflight	46	pre control	11/19/92	mvni	left	p4l3	907	spon	2	654
preflight	47	pre control	11/19/92	mvni	left	p4l3	907	spon	2	711
preflight	48	pre control	11/19/92	mvni	left	p3l3	907	spon&elec	2	809
preflight	49	pre control	11/19/92	mnvipvp	left	p3l3	907	spon&elec	2	827
preflight	49	pre control	11/19/92	mnvipvp	left	p3l3	907	sine0.2	2	827
preflight	49	pre control	11/19/92	mnvipvp	left	p3l3	907	sine0.5	2	827
preflight	49	pre control	11/19/92	mnvipvp	left	p3l3	907	sine1.0	2	827
preflight	50	pre control	11/19/92	mvn	left	p3l3	907	spon	2	1140
preflight	50	pre control	11/19/92	mvn	left	p3l3	907	elec.stim	2	1140
preflight	50	pre control	11/19/92	mvn	left	p3l3	907	sine0.2	2	1140
preflight	51	pre control	11/19/92	mvnii	left	p3l3	907	sine0.2	2	1304
preflight	52	pre control	11/20/92	lat.aff.	left	ap0l10	1401	step	2	1537
preflight	52	pre control	11/20/92	lat.aff.	left	ap0l10	1401	step	2	1625
preflight	52	pre control	11/20/92	lat.aff.	left	ap0l10	1401	sine0.2	2	1707
preflight	52	pre control	11/20/92	lat.aff.	left	ap0l10	1401	ss	2	1749
preflight	52	pre control	11/20/92	lat.aff.	left	ap0l10	1401	sine1.0	2	1823
preflight	52	pre control	11/20/92	lat.aff.	left	ap0l10	1401	spon	2	1844
preflight	53	pre control	11/20/92	lat.aff.	left	ap0l10	1401	step	2	1866
preflight	53	pre control	11/20/92	lat.aff.	left	ap0l10	1401	sine0.2	2	1925
preflight	53	pre control	11/20/92	lat.aff.	left	ap0l10	1401	ss	2	1966
preflight	53	pre control	11/20/92	lat.aff.	left	ap0l10	1401	sine1.0	2	2034
preflight	53	pre control	11/20/92	lat.aff.	left	ap0l10	1401	spon	2	2054
preflight	53	pre control	11/20/92	lat.aff.	left	ap0l10	1401	sine0.5	2	2078
preflight	53	pre control	11/20/92	lat.aff.	left	ap0l10	1401	step rpt	2	2103
preflight	54	pre control	11/20/92	lat.aff.	left	ap0l10	1401	step rpt	2	2240
preflight	54	pre control	11/20/92	lat.aff.	left	ap0l10	1401	sine0.2	2	2298
preflight	54	pre control	11/20/92	lat.aff.	left	ap0l10	1401	ss	2	2336
preflight	54	pre control	11/20/92	lat.aff.	left	ap0l10	1401	sine1.0	2	2401
preflight	54	pre control	11/20/92	lat.aff.	left	ap0l10	1401	sine0.5	2	2418
preflight	54	pre control	11/20/92	lat.aff.	left	ap0l10	1401	spon	2	2442
preflight	55	pre control	11/20/92	lat.aff.	left	ap0l10	1401	step	2	2461
preflight	55	pre control	11/20/92	lat.aff.	left	ap0l10	1401	sine0.2	2	2518
preflight	55	pre control	11/20/92	lat.aff.	left	ap0l10	1401	ss	2	2558
preflight	55	pre control	11/20/92	lat.aff.	left	ap0l10	1401	sine1.0	2	2619
sync. cont.	56	sync control	1/9/93	lat.aff.	left	ap0l12	803	step	1	0
sync. cont.	56	sync control	1/9/93	lat.aff.	left	ap0l12	803	step rpt	1	136
sync. cont.	56	sync control	1/9/93	lat.aff.	left	ap0l12	803	step rpt	1	404
sync. cont.	57	sync control	1/9/93	lat.aff.	left	ap0l12	803	step	1	500
sync. cont.	58	sync control	1/9/93	lat.aff.	left	ap0l12	803	step	1	629
sync. cont.	59	sync control	1/9/93	lat.aff.	left	ap0l12	803	step	1	720
sync. cont.	59	sync control	1/9/93	lat.aff.	left	ap0l12	803	step rpt	1	797
sync. cont.	60	sync control	1/9/93	lat.aff.	left	ap0l12	803	step	1	876
sync. cont.	61	sync control	1/9/93	lat.aff.	left	ap0l12	803	step	1	1209
sync. cont.	62	sync control	1/9/93	lat.aff.	left	ap0l12	803	step	1	1307
sync. cont.	63	sync control	1/9/93	lat.aff.	left	ap0l12	803	step	1	1440

Summary of individual neurons and experimental conditions observed during pre-and post flight testing

sync. cont.	64	sync control	1/10/93	lat.aff.	left	ap0l10	907	step	1	1500
sync. cont.	64	sync control	1/10/93	lat.aff.	left	ap0l10	907	step rpt	1	1600
sync. cont.	65	sync control	1/10/93	lat.aff.	left	ap0l9	907	step	1	1668
sync. cont.	65	sync control	1/10/93	lat.aff.	left	ap0l9	907	step rpt	1	1734
sync. cont.	65	sync control	1/10/93	lat.aff.	left	ap0l9	907	ss	1	1792
sync. cont.	65	sync control	1/10/93	lat.aff.	left	ap0l9	907	sine0.2	1	1871
sync. cont.	65	sync control	1/10/93	lat.aff.	left	ap0l9	907	spon	1	1940
sync. cont.	66	sync control	1/10/93	lat.aff.	left	ap0l9	907	ss	1	1960
sync. cont.	66	sync control	1/10/93	lat.aff.	left	ap0l9	907	step	1	2046
sync. cont.	66	sync control	1/10/93	lat.aff.	left	ap0l9	907	spon	1	2106
sync. cont.	66	sync control	1/10/93	lat.aff.	left	ap0l9	907	sine0.2	1	2137
postcont	67	post control	1/15/93	lat.aff.	left	ap0l12	803	step	po1	5540
postcont	68	post control	1/15/93	lat.aff.	left	ap0l12	803	step	po1	5578
postcont	68	post control	1/15/93	lat.aff.	left	ap0l12	803	ss	po1	5620
postcont	68	post control	1/15/93	lat.aff.	left	ap0l12	803	sine0.2	po1	5663
postcont	69	post control	1/15/93	lat.aff.	left	ap0l12	803	step	po1	5689
postcont	70	post control	1/15/93	lat.aff.	left	ap0l12	803	step	po1	5713
postcont	71	post control	1/15/93	lat.aff.	left	ap0l12	803	step	po1	5756
postcont	71	post control	1/15/93	lat.aff.	left	ap0l12	803	step rpt	po1	5781
postcont	72	post control	1/15/92	lat.aff.	left	ap0l11	907	step	po1	5819
postcont	72	post control	1/15/92	lat.aff.	left	ap0l11	907	ss	po1	5870
postcont	72	post control	1/15/92	lat.aff.	left	ap0l11	907	sine0.2	po1	5913
postcont	72	post control	1/15/92	lat.aff.	left	ap0l11	907	spon	po1	5937
postcont	72	post control	1/15/92	lat.aff.	left	ap0l11	907	step	po1	5948
postcont	73	post control	1/15/92	lat.aff.	left	p1l10	907	step	po1	6005
postcont	73	post control	1/15/92	lat.aff.	left	p1l10	907	step	po1	6015
postcont	73	post control	1/15/92	lat.aff.	left	p1l10	907	ss	po1	6046
postcont	73	post control	1/15/92	lat.aff.	left	p1l10	907	sine0.2	po1	6058
postcont	74	post control	1/15/92	lat.aff.	left	p1l10	907	step	po1	6113
postcont	75	post control	1/15/92	lat.aff.	left	p1l10	907	step	po1	6144
postcont	76	post control	1/15/92	lat.aff.	left	p1l10	907	step	po1	6153
postcont	76	post control	1/15/92	lat.aff.	left	p1l10	907	ss	po1	6194
postcont	77	post control	1/15/92	lat.aff.	left	p1l10	907	step	po1	6268
postcont	77	post control	1/15/92	lat.aff.	left	p1l10	907	ss	po1	6304
postcont	78	post control	1/15/92	lat.aff.	left	p1l10	907	ss	po1	6350
postcont	79	post control	1/16/93	mvni	left	p5l2	892	elec stim	po1	6500
postcont	79	post control	1/16/93	mvni	left	p5l2	892	sine0.2	po1	6549
postcont	79	post control	1/16/93	mvni	left	p5l2	892	sine0.5	po1	6578
postcont	79	post control	1/16/93	mvni	left	p5l2	892	sine1.0	po1	6591
postcont	79	post control	1/16/93	mvni	left	p5l2	892	step	po1	6609
postcont	79	post control	1/16/93	mvni	left	p5l2	892	ss	po1	6642
postcont	79	post control	1/16/93	mvni	left	p5l2	892	step rpt	po1	6681
postcont	79	post control	1/16/93	mvni	left	p5l2	892	step	po1	6710
postcont	80	post control	1/16/93	mvni	left	p3l3	1401	elec stim	po1	6730
postcont	80	post control	1/16/93	mvni	left	p3l3	1401	sine0.2	po1	6791
postcont	80	post control	1/16/93	mvni	left	p3l3	1401	sine0.5	po1	6817
postcont	80	post control	1/16/93	mvni	left	p3l3	1401	sine1.0	po1	6839
postcont	80	post control	1/16/93	mvni	left	p3l3	1401	step	po1	6859
postcont	80	post control	1/16/93	mvni	left	p3l3	1401	ss	po1	6892
postcont	80	post control	1/16/93	mvni	left	p3l3	1401	step	po1	6936
postcont	81	post control	1/16/93	mvni	left	p3l3	1401	elec stim	po1	6980
postcont	81	post control	1/16/93	mvni	left	p3l3	1401	step	po1	7010
postcont	81	post control	1/16/93	mvni	left	p3l3	1401	sine0.2	po1	7063
postcont	81	post control	1/16/93	mvni	left	p3l3	1401	sine0.5	po1	7088
postcont	81	post control	1/16/93	mvni	left	p3l3	1401	sine1.0	po1	7103
postcont	81	post control	1/16/93	mvni	left	p3l3	1401	ss	po1	7119

Summary of individual neurons and experimental conditions observed during pre-and post flight testing

postcont	81	post control	1/16/93	mvni	left	p3l3	1401	elec stim	po1	7160
postcont	82	post control	1/16/93	mvni	left	p3l3	1401	elec stim	po1	7185
postcont	82	post control	1/16/93	mvni	left	p3l3	1401	sine0.2	po1	7207
postcont	83	post control	1/16/93	mvni	left	p3l3	1401	elec stim	po1	7231
postcont	83	post control	1/16/93	mvni	left	p3l3	1401	sine0.2	po1	7246
postcont	83	post control	1/16/93	mvni	left	p3l3	1401	sine0.2	po1	
postcont	83	post control	1/16/93	mvni	left	p3l3	1401	sine0.5	po1	7317
postcont	83	post control	1/16/93	mvni	left	p3l3	1401	sine1.0	po1	7330
postcont	83	post control	1/16/93	mvni	left	p3l3	1401	step	po1	7348
postcont	83	post control	1/16/93	mvni	left	p3l3	1401	ss	po1	7380
postcont	84	post control	1/17/93	mvni	left	p3l3	907	elec stim	po2	0
postcont	84	post control	1/17/93	mvni	left	p3l3	907	sine0.2	po2	93
postcont	84	post control	1/17/93	mvni	left	p3l3	907	sine0.5	po2	185
postcont	84	post control	1/17/93	mvni	left	p3l3	907	sine1.0	po2	237
postcont	84	post control	1/17/93	mvni	left	p3l3	907	step	po2	294
postcont	84	post control	1/17/93	mvni	left	p3l3	907	step rpt	po2	360
postflight	1	flt. animals	1/11/93	lat.aff.	right	ap0l11	906		1	
postflight	2	flt. animals	1/11/93	lat.aff.	right	a1l11	906	step	1	0
postflight	2	flt. animals	1/11/93	lat.aff.	right	a1l11	906	step	1	100
postflight	2	flt. animals	1/11/93	lat.aff.	right	a1l11	906	ss	1	220
postflight	2	flt. animals	1/11/93	lat.aff.	right	a1l11	906	step rpt	1	322
postflight	2	flt. animals	1/11/93	lat.aff.	right	a1l11	906	sine0.2	1	413
postflight	3	flt. animals	1/11/93	lat.aff.	right	a1l11	906	spon	1	481
postflight	4	flt. animals	1/11/93	lat.aff.	right	a1l11	906	step	1	523
postflight	5	flt. animals	1/11/93	lat.aff.	right	a1l11	906	step	1	600
postflight	5	flt. animals	1/11/93	lat.aff.	right	a1l11	906	step	1	723
postflight	5	flt. animals	1/11/93	lat.aff.	right	a1l11	906	ss	1	796
postflight	5	flt. animals	1/11/93	lat.aff.	right	a1l11	906	sine0.2	1	890
postflight	5	flt. animals	1/11/93	lat.aff.	right	a1l11	906	spon	1	942
postflight	6	flt. animals	1/11/93	lat.aff.	right	a1l11	906	step rpt	1	983
postflight	6	flt. animals	1/11/93	lat.aff.	right	a1l11	906	step	1	1057
postflight	6	flt. animals	1/11/93	lat.aff.	right	a1l11	906	ss	1	1138
postflight	6	flt. animals	1/11/93	lat.aff.	right	a1l11	906	spon	1	1217
postflight	7	flt. animals	1/11/93	lat.aff.	right	a1l11	906	sine0.2	1	1250
postflight	8	flt. animals	1/11/93	lat.aff.	right	a1l11	906	step	1	1304
postflight	8	flt. animals	1/11/93	lat.aff.	right	a1l11	906	step	1	1376
postflight	8	flt. animals	1/11/93	lat.aff.	right	a1l11	906	ss	1	1447
postflight	8	flt. animals	1/11/93	lat.aff.	right	a1l11	906	spon	1	1517
postflight	9	flt. animals	1/11/93	lat.aff.	right	a1l11	906	sine0.2	1	1544
postflight	10	flt. animals	1/11/93	lat.aff.	right	a1l11	906	step	1	
postflight	11	flt. animals	1/11/93	lat.aff.	right	a1l11	906	step	1	1650
postflight	12	flt. animals	1/11/93	lat.aff.	right	a1l11	906	step	1	1709
postflight	12	flt. animals	1/11/93	lat.aff.	right	a1l11	906	step	1	1762
postflight	12	flt. animals	1/11/93	lat.aff.	right	a1l11	906	ss	1	1824
postflight	12	flt. animals	1/11/93	lat.aff.	right	a1l11	906	step rpt	1	1893
postflight	12	flt. animals	1/11/93	lat.aff.	right	a1l11	906	sine0.2	1	1956
postflight	13	flt. animals	1/11/93	lat.aff.	right	a1l11	906	spon	1	1995
postflight	14	flt. animals	1/11/93	lat.aff.	right	a2l9	151	step	1	2012
postflight	14	flt. animals	1/11/93	lat.aff.	right	a2l9	151	step	1	2070
postflight	14	flt. animals	1/11/93	lat.aff.	right	a2l9	151	ss	1	2127
postflight	14	flt. animals	1/11/93	lat.aff.	right	a2l9	151	sine0.2	1	2193
postflight	15	flt. animals	1/11/93	lat.aff.	right	a2l9	151	spon	1	2236
postflight	15	flt. animals	1/11/93	lat.aff.	right	a2l9	151	step	1	2248
postflight	16	flt. animals	1/11/93	lat.aff.	right	a2l9	151	ss	1	2315
postflight	16	flt. animals	1/11/93	lat.aff.	right	a2l9	151	sine0.2	1	2385
postflight	17	flt. animals	1/11/93	lat.aff.	right	a2l9	151	step	1	2386

postflight	18	flt. animals	1/11/93	lat.aff.	right	a2l9	151	step	1	2440
postflight	19	flt. animals	1/12/93	lat.aff.	right	a1l11	906	step	1	2475
postflight	19	flt. animals	1/12/93	lat.aff.	right	a1l11	906	step	1	2500
postflight	19	flt. animals	1/12/93	lat.aff.	right	a1l11	906	ss	1	2545
postflight	20	flt. animals	1/12/93	lat.aff.	right	a1l11	906	step rpt	1	2606
postflight	20	flt. animals	1/12/93	lat.aff.	right	a1l11	906	step	1	2640
postflight	21	flt. animals	1/12/93	lat.aff.	right	a1l11	906	ss	1	2723
postflight	22	flt. animals	1/12/93	lat.aff.	right	a1l11	906	step	1	2785
postflight	22	flt. animals	1/12/93	lat.aff.	right	a1l11	906	step	1	2834
postflight	23	flt. animals	1/12/93	lat.aff.	right	a1l11	906	step rpt	1	2889
postflight	24	flt. animals	1/12/93	lat.aff.	right	a2l9	151	step	1	2944
postflight	24	flt. animals	1/12/93	lat.aff.	right	a2l9	151	step	1	2950
postflight	24	flt. animals	1/12/93	lat.aff.	right	a2l9	151	ss	1	3007
postflight	24	flt. animals	1/12/93	lat.aff.	right	a2l9	151	step	1	3063
postflight	25	flt. animals	1/12/93	lat.aff.	right	a2l9	151	sine0.2	1	3101
postflight	25	flt. animals	1/12/93	lat.aff.	right	a2l9	151	step	1	3140
postflight	25	flt. animals	1/12/93	lat.aff.	right	a2l9	151	ss	1	3185
postflight	25	flt. animals	1/12/93	lat.aff.	right	a2l9	151	step rpt	1	3248
postflight	26	flt. animals	1/12/93	lat.aff.	right	a2l9	151	sine0.2	1	3301
postflight	27	flt. animals	1/12/93	lat.aff.	right	a2l9	151	step	1	3338
postflight	27	flt. animals	1/12/93	lat.aff.	right	a2l9	151	step	1	3385
postflight	27	flt. animals	1/12/93	lat.aff.	right	a2l9	151	ss	1	3430
postflight	28	flt. animals	1/12/93	lat.aff.	right	a2l9	151	sine0.2	1	3483
postflight	28	flt. animals	1/12/93	lat.aff.	right	a2l9	151	step	1	3518
postflight	28	flt. animals	1/12/93	lat.aff.	right	a2l9	151	step	1	3571
postflight	28	flt. animals	1/12/93	lat.aff.	right	a2l9	151	ss	1	3617
postflight	29	flt. animals	1/12/93	lat.aff.	right	a2l9	151	sine0.2	1	3669
postflight	30	flt. animals	1/12/93	lat.aff.	right	a2l9	151	step	1	3730
postflight	31	flt. animals	1/12/93	lat.aff.	right	a2l9	151	step	1	3823
postflight	31	flt. animals	1/12/93	lat.aff.	right	a2l9	151	step	1	3871
postflight	32	flt. animals	1/12/93	lat.aff.	right	a2l9	151	ss	1	3912
postflight	33	flt. animals	1/12/93	lat.aff.	right	a2l9	151	step	1	3962
postflight	33	flt. animals	1/12/93	lat.aff.	right	a2l9	151	step	1	3978
postflight	33	flt. animals	1/12/93	lat.aff.	right	a2l9	151	ss	1	4018
postflight	33	flt. animals	1/12/93	lat.aff.	right	a2l9	151	sine0.2	1	4069
postflight	34	flt. animals	1/12/93	lat.aff.	right	a2l9	151	spon	1	4103
postflight	35	flt. animals	1/12/93	lat.aff.	right	a2l9	151	step	1	4117
postflight	35	flt. animals	1/12/93	lat.aff.	right	a2l9	151	step	1	4157
postflight	36	flt. animals	1/12/93	lat.aff.	right	a2l9	151	ss	1	4200
postflight	36	flt. animals	1/12/93	lat.aff.	right	a2l9	151	step	1	4256
postflight	37	flt. animals	1/12/93	lat.aff.	right	a2l9	151	ss	1	
postflight	37	flt. animals	1/12/93	lat.aff.	right	a2l9	151	step	1	4331
postflight	38	flt. animals	1/14/93	lat.aff.	right	a1l8	151	ss	1	4374
postflight	38	flt. animals	1/14/93	lat.aff.	right	a1l8	151	step	1	4370
postflight	38	flt. animals	1/14/93	lat.aff.	right	a1l8	151	ss	1	4416
postflight	39	flt. animals	1/14/93	lat.aff.	right	a1l8	151	sine0.2	1	4463
postflight	39	flt. animals	1/14/93	lat.aff.	right	a1l8	151	step	1	4511
postflight	40	flt. animals	1/14/93	lat.aff.	right	a1l8	151	ss	1	4553
postflight	40	flt. animals	1/14/93	lat.aff.	right	a1l8	151	step	1	4590
postflight	40	flt. animals	1/14/93	lat.aff.	right	a1l8	151	ss	1	4640
postflight	40	flt. animals	1/14/93	lat.aff.	right	a1l8	151	sine0.2	1	4683
postflight	41	flt. animals	1/14/93	lat.aff.	right	a1l8	151	step	1	4716
postflight	41	flt. animals	1/14/93	lat.aff.	right	a1l8	151	step	1	4760
postflight	41	flt. animals	1/14/93	lat.aff.	right	a1l8	151	ss	1	4800
postflight	41	flt. animals	1/14/93	lat.aff.	right	a1l8	151	step rpy	1	4841
postflight	42	flt. animals	1/14/93	lat.aff.	right	a1l8	151	sine0.2	1	4878

Summary of individual neurons and experimental conditions observed during pre-and post flight testing

postflight	42	flt. animals	1/14/93	lat.aff.	right	a1l8	151	step	1	4930
postflight	43	flt. animals	1/14/93	lat.aff.	right	a1l8	151	step rpt	1	4947
postflight	44	flt. animals	1/14/93	lat.aff.	right	a1l8	151	step	1	4981
postflight	44	flt. animals	1/14/93	lat.aff.	right	a1l8	151	step	1	4989
postflight	44	flt. animals	1/14/93	lat.aff.	right	a1l8	151	ss	1	5026
postflight	44	flt. animals	1/14/93	lat.aff.	right	a1l8	151	step rpt	1	5060
postflight	45	flt. animals	1/14/93	lat.aff.	right	a1l8	151	sine0.2	1	5105
postflight	45	flt. animals	1/14/93	lat.aff.	right	a1l8	151	step	1	5132
postflight	45	flt. animals	1/14/93	lat.aff.	right	a1l8	151	ss	1	5173
postflight	45	flt. animals	1/14/93	lat.aff.	right	a1l8	151	sine0.2	1	5216
postflight	46	flt. animals	1/14/93	lat.aff.	right	a1l8	151	spon	1	5240
postflight	47	flt. animals	1/14/93	lat.aff.	right	a1l8	151	step	1	5253
postflight	47	flt. animals	1/14/93	lat.aff.	right	a1l8	151	step	1	5295
postflight	48	flt. animals	1/14/93	lat.aff.	right	a1l11	906	ss	1	5330
postflight	48	flt. animals	1/14/93	lat.aff.	right	a1l11	906	step	1	5370
postflight	49	flt. animals	1/14/93	lat.aff.	right	a1l11	906	step rpt	1	5414
postflight	49	flt. animals	1/14/93	lat.aff.	right	a1l11	906	step	1	5434
postflight	49	flt. animals	1/14/93	lat.aff.	right	a1l11	906	ss	1	5470
postflight	50	flt. animals	1/21/93	lat.aff.	right	a2l11	906	sine0.2	2	5510
postflight	50	flt. animals	1/21/93	lat.aff.	right	a2l11	906	ss	2	
postflight	50	flt. animals	1/21/93	lat.aff.	right	a2l11	906	step	2	
postflight	51	flt. animals	1/21/93	lat.aff.	right	a2l11	906	sine0.2	2	
postflight	51	flt. animals	1/21/93	lat.aff.	right	a2l11	906	step	2	
postflight	51	flt. animals	1/21/93	lat.aff.	right	a2l11	906	ss	2	
postflight	52	flt. animals	1/21/93	lat.aff.	right	a2l11	906	sine0.2	2	
postflight	53	flt. animals	1/21/93	lat.aff.	right	a2l11	906	step	2	
postflight	53	flt. animals	1/21/93	lat.aff.	right	a2l11	906	step	2	
postflight	53	flt. animals	1/21/93	lat.aff.	right	a2l11	906	ss	2	
postflight	54	flt. animals	1/21/93	lat.aff.	right	a2l11	906	?	2	
postflight	54	flt. animals	1/21/93	lat.aff.	right	a2l11	906	step	2	
postflight	55	flt. animals	1/21/93	lat.aff.	right	a2l11	906	ss	2	
postflight	55	flt. animals	1/21/93	lat.aff.	right	a2l11	906	step	2	
postflight	56	flt. animals	1/21/93	lat.aff.	right	a2l11	906	ss	2	
postflight	57	flt. animals	1/21/93	lat.aff.	right	a2l11	906	step	2	
postflight	57	flt. animals	1/21/93	lat.aff.	right	a2l11	906	step	2	
postflight	58	flt. animals	1/21/93	lat.aff.	right	a2l11	906	ss	2	
postflight	58	flt. animals	1/21/93	lat.aff.	right	a2l11	906	step	2	
postflight	59	flt. animals	1/21/93	lat.aff.	right	a2l11	906	step	2	
postflight	59	flt. animals	1/21/93	lat.aff.	right	a2l11	906	ss	2	

APPENDIX 2

The 31 tables on pages T1-T12 summarize data for each of the test procedures. The tables are further organized to summarize the responses to each of the test procedures (listed by afferent) on each test day such as during the preflight tests, during the synchronous control tests and during each of the post-flight test days when data were obtained. At the bottom of each table are presented first order summary statistics where appropriate.

TABLE 1

Pulse Response - Pre-Flight (10-17-92 & 11-14-92 to 12-9-93)

		Curve 1				Curve 2				Curve 3				Curve 4				Average Inc.				Average Dec.			
osc	FILENAME	GAIN	t	K	DC	GAIN	t	K	DC	GAIN	t	K	DC	GAIN	t	K	DC	GAIN	t	K	DC	GAIN	t	K	DC
L	01o1701e	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
L	01o1701e	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
L	01o1701i	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
L	01o1702e	-0.4155	7.1328	0.0862	101.5656	0.3920	6.5779	0.0163	102.8482	0.4507	8.4296	0.0000	101.2178	-0.3642	5.3998	0.0715	99.3186	-0.3899	6.2663	0.0789	100.4421	0.4214	7.5038	0.0082	102.0330
L	03a1401e	-1.1234	7.8453	0.1986	183.5273	1.4998	5.5245	0.0157	156.3604	0.9933	0.9933	0.0326	156.3811	***	***	***	***	-1.1234	7.8453	0.1986	183.5273	1.2466	3.2589	0.0242	156.3708
L	03a1402e	***	***	***	***	2.2067	9.6983	0.2033	98.2926	2.1429	10.313	0.2209	96.8696	***	***	***	***	***	***	***	***	2.1748	10.006	0.2121	97.5811
L	03a1402e	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
L	03a1404e	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
L	03a1405e	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
L	03a1406e	-1.3253	3.182	0.0000	151.5878	***	***	***	***	***	***	***	***	***	***	***	***	-1.3253	3.182	0.0000	151.5878	***	***	***	***
L	03a1407e	-0.6237	3.8853	0.0000	143.0723	0.7533	6.4401	0.0374	141.8196	0.6130	4.7196	0.0000	145.3469	-0.6437	5.8132	0.0577	143.8768	-0.6337	4.8483	0.0289	143.4748	0.6832	5.5799	0.0187	143.5833
R	51a1501e	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
L	75a1504e	***	***	***	***	1.5134	9.2211	0.1598	60.9320	1.2947	6.1085	0.2845	68.8725	***	***	***	***	***	***	***	***	1.4041	7.6648	0.2222	64.9023
L	75a1504e	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
L	07a1601e	-1.7525	10.239	0.4874	124.8675	1.7469	9.0291	0.4024	122.2566	1.5845	6.8852	0.3921	131.2002	-1.6087	10.714	0.3766	119.0914	-1.6806	10.477	0.4320	121.9795	1.6657	7.9572	0.3973	126.7284
L	07a1602e	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
L	07a1602e	-0.6705	6.1416	0.0981	164.1014	0.7761	5.9755	0.1561	165.1752	0.8367	9.6322	0.2478	161.4111	-0.6532	3.8177	0.0293	159.8814	-0.6619	4.9797	0.0637	161.9914	0.8064	7.8039	0.2020	163.2932
L	07a1603e	-1.6439	4.0261	0.0000	120.5870	1.5306	9.0822	0.1698	117.4469	1.6624	5.7845	0.0919	123.7423	-1.2676	5.9707	0.0000	117.5146	-1.4558	4.9984	0.0000	119.0508	1.5965	7.4334	0.1309	120.5946
L	07a1603e	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
L	07a1606e	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
L	07a1607e	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
L	07a1608e	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
L	07a1609e	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
L	07a1610e	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
L	07a1610e	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
L	07a1611e	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
L	07a1611e	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
L	07a1612e	-0.5397	6.3241	0.0562	140.9330	0.6254	12.757	0.0512	135.8798	0.6024	12.454	0.1319	139.0757	-0.4524	8.1202	0.0535	136.0342	-0.4961	7.2222	0.0549	138.4836	0.6139	12.606	0.0916	137.4778
L	07a1613e	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
L	01a1601e	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
L	01a1601e	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
L	01a1601i	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
L	01a1602e	-0.5779	9.6917	0.1567	145.0000	0.5235	3.128	0.0000	147.0874	***	***	***	***	***	***	***	***	-0.5779	9.6917	0.1567	145.0000	0.5235	3.128	0.0000	147.0874
L	01a1602e	-0.5947	3.4463	0.0000	142.8078	***	***	***	***	0.5805	3.7909	0.0000	143.2554	-0.5988	4.2401	0.0000	138.4336	-0.5968	3.8432	0.0000	140.6207	0.5805	3.7909	0.0000	143.2554
L	01a1602i	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
L	01a1603e	-0.3152	5.7	0.0000	111.4161	0.3230	9.3387	0.0000	110.1967	0.3343	8.8109	0.0000	112.9107	-0.2654	17.303	0.1277	111.1201	-0.2903	11.502	0.0639	111.2681	0.3287	9.0748	0.0000	111.5537
L	01a2004e	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
L	01a2004e	-0.8592	3.5003	0.0740	155.0960	1.1598	5.959	0.0917	154.1314	1.1464	7.4675	0.1529	151.5107	-1.0263	5.2686	0.1477	151.1228	-0.9428	4.3845	0.1109	153.1094	1.1531	6.7133	0.1223	152.8211
L	01a2005e	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
L	01a2005e	-0.3193	8.2552	0.0931	130.3962	0.7314	17.975	0.0250	111.3644	0.3935	8.1509	0.0000	127.9710	-0.3630	7.5403	0.0808	127.0024	-0.3412	7.8978	0.0870	128.6993	0.5625	13.063	0.0125	119.6677
L	01a2006e	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
L	01a2006e	-0.4892	11.666	0.4433	153.0725	0.9133	3.746	0.0458	155.7657	0.8828	12.248	0.1630	145.1741	-0.8970	11.961	0.2000	160.3664	-0.8931	11.814	0.3217	156.7195	0.8981	7.997	0.1044	150.4699
L	01a2007e	-1.0981	2.3914	0.0209	164.0958	0.9417	6.4114	0.0750	161.3007	0.9790	4.8058	0.0403	157.1922	-0.6792	5.8074	0.0948	155.1292	-0.8887	4.0994	0.0579	159.8125	0.9604	5.6086	0.0577	159.2465
	STATISTICS	GAIN	t	K	DC	GAIN	t	K	DC	GAIN	t	K	DC	GAIN	t	K	DC	GAIN	t	K	DC	GAIN	t	K	DC
	MEAN	-0.8232	6.2285	0.1143	142.1417	1.0425	8.0576	0.0966	129.3905	0.9685	7.3729	0.1172	130.8088	-0.7350	7.663	0.1033	134.9076	-0.8065	6.8701	0.1103	141.0378	0.9762	7.4493	0.1002	131.0416
	ST. DEV.	0.4631	2.8662	0.1551	21.6397	0.5475	3.7194	0.1080	29.3851	0.5221	3.147	0.1246	26.1836	0.4013	3.9083	0.1043	20.1932	0.4220	2.8925	0.1233	21.8008	0.5226	2.8873	0.1120	26.9652
	N	15	15	15	15	15	15	15	15	15	15	15	15	12	12	12	12	15	15	15	15	16	16	16	16
	SEM	0.0454	0.1129	0.0263	0.3101	0.0493	0.1286	0.0219	0.3614	0.0482	0.1183	0.0235	0.3411	0.0528	0.1647	0.0269	0.3745	0.0433	0.1134	0.0234	0.3113	0.0452	0.1062	0.0209	0.3246
																						0.9000	7.313	0.1081	134.2808

TABLE 2

Pulse Response - Synchronous Control (1-9-93 to 1-10-93)

		Curve 1				Curve 2				Curve 3				Curve 4				Average Inc.				Average Dec.			
dec	FILENAME	GAIN	T	K	DC	GAIN	T	K	DC	GAIN	T	K	DC	GAIN	T	K	DC	GAIN	T	K	DC	GAIN	T	K	DC
L	03c0901a	-1.0421	4.2521	0.1051	138.0470	0.9455	26.163	0.1406	127.4103	1.0488	5.8041	0.0209	134.8712	***	***	***	***	-1.0421	4.2521	0.1051	138.0470	0.9972	15.983	0.0808	131.1408
L	03c0901e	***	***	***	***	***	***	***	***	0.0446	8.6511	0.0000	130.0422	***	***	***	***	***	***	***	***	***	***	***	***
L	03c0901i	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
L	03c0901m	-1.1119	5.3636	0.1526	140.1345	0.1818	6.8552	0.0000	140.0000	***	***	***	***	***	***	***	***	-1.1119	5.3636	0.1526	140.1345	***	***	***	***
L	03c0902a	-0.9136	2.0836	0.0000	164.5718	***	***	***	***	***	***	***	***	***	***	***	***	-0.9136	2.0836	0.0000	164.5718	***	***	***	***
L	03c0903a	-1.6117	4.546	0.0497	153.3475	1.4938	3.4043	0.0123	147.8993	1.2172	7.4228	0.1230	142.0520	-1.6443	5.8428	0.1653	148.4605	-1.6280	5.1944	0.1075	150.9040	1.3555	5.4136	0.0677	144.9757
L	03c0904a	-1.1497	1.8713	0.0580	130.8699	1.0548	9.9674	0.2445	121.3475	1.1319	4.6241	0.1393	116.9927	-1.1941	3.5058	0.0000	129.9557	-1.1719	2.6886	0.0290	130.4128	1.0934	7.2958	0.1919	119.1701
L	03c0904e	-0.9643	4.17	0.1170	120.2544	***	***	***	***	***	***	***	***	***	***	***	***	-0.9643	4.17	0.1170	120.2544	***	***	***	***
L	03c0905a	-0.8752	4.7275	0.2964	136.1300	***	***	***	***	***	***	***	***	***	***	***	***	-0.8752	4.7275	0.2964	136.1300	***	***	***	***
L	03c0906a	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
L	03c0906e	-0.4553	1.7019	0.0988	53.1023	***	***	***	***	***	***	***	***	***	***	***	***	-0.4553	1.7019	0.0988	53.1023	***	***	***	***
L	03c0907a	***	***	***	***	***	***	***	***	1.3871	16.869	0.2556	114.4782	-1.1847	4.2404	0.0000	122.5959	-1.1847	4.2404	0.0000	122.5959	1.3871	16.869	0.2556	114.4782
L	03c0908a	-0.3323	3.1711	0.0000	104.0870	0.3063	2.9193	0.0000	105.2517	0.3585	5.4577	0.0000	103.3527	***	***	***	***	-0.3323	3.1711	0.0000	104.0870	0.3324	4.1885	0.0000	104.3022
L	07c1001a	-1.0179	4.8937	0.0517	146.0618	1.2252	7.3702	0.1070	134.3165	0.9640	6.6274	0.1005	137.0171	-0.9977	3.2084	0.0470	127.5698	-1.0078	4.0511	0.0494	136.8158	1.0948	6.9988	0.1038	135.6668
L	07c1001e	***	***	***	***	***	***	***	***	0.8294	40.352	0.0000	102.3157	***	***	***	***	***	***	***	***	0.8294	40.352	0.0000	102.3157
L	07c1002a	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
L	07c1002e	-0.2682	6.5101	0.0000	100.2647	***	***	***	***	0.3284	6.4404	0.0000	100.4426	***	***	***	***	-0.2682	6.5101	0.0000	100.2647	0.3284	6.4404	0.0000	100.4426
L	07c1003e	-0.9410	4.0218	0.0341	128.5619	1.0594	8.6418	0.0659	125.2216	0.9892	5.5356	0.0693	127.6030	-1.0865	4.9259	0.0000	127.0119	-1.0138	4.4739	0.0171	127.7866	1.0243	7.0887	0.0676	126.4123
	STATISTICS	GAIN	T	K	DC	GAIN	T	K	DC	GAIN	T	K	DC	GAIN	T	K	DC	GAIN	T	K	DC	GAIN	T	K	DC
	MEAN	-0.8903	3.9427	0.0803	126.2861	0.8953	9.3316	0.0815	128.7781	0.8299	10.778	0.0709	120.9167	-1.2215	4.3447	0.0425	131.1188	-0.9207	4.0483	0.0748	125.0082	0.9380	12.292	0.0853	119.8783
	ST. DEV.	0.3781	1.4775	0.0842	29.5490	0.4792	7.8571	0.0904	13.8170	0.4389	10.964	0.0850	15.4889	0.2496	1.071	0.0716	10.0522	0.3756	1.3488	0.0656	27.6640	0.3850	11.452	0.0869	15.8397
	N	12	12	12	12	7	7	7	7	10	10	10	10	5	5	5	5	13	13	13	13	9	9	9	9
	SEM	0.0512	0.1013	0.0242	0.4530	0.0989	0.4004	0.0430	0.5310	0.0662	0.3311	0.0292	0.3936	0.0999	0.207	0.0535	0.6341	0.0471	0.0893	0.0225	0.4046	0.0889	0.376	0.0331	0.4422
																						0.9222	7.1218	0.0722	125.9306

TABLE 3

Pulse Response - Post-Flight Day 2 (1-11-93)

		Curve 1				Curve 2				Curve 3				Curve 4				Average Inc.				Average Dec.			
cav	FILENAME	GAIN	t	K	DC	GAIN	t	K	DC	GAIN	t	K	DC	GAIN	t	K	DC	GAIN	t	K	DC	GAIN	t	K	DC
R	06c1101a	0.3671	9.3428	0.0000	129.6178	-0.1181	6.2437	0.0582	124.1026	-0.2563	9.8951	0.0052	127.0000	0.3503	13.537	0.0208	127.0000	0.3587	11.44	0.0104	126.3089	-0.1872	8.0894	0.0317	125.5513
R	06c1102a	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
R	06c1102e	0.5008	9.2185	0.0287	112.0816	-0.3728	4.9926	0.0386	108.5857	-0.3708	7.7244	0.0999	110.1776	0.4796	11.939	0.0433	110.0000	0.4902	10.579	0.0360	111.0408	-0.3718	6.3585	0.0693	109.3817
R	06c1103a	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
R	06c1104a	***	***	***	***	-1.0035	1.8266	0.2287	68.4754	***	***	***	***	***	***	***	***	***	***	***	***	-1.0035	1.8266	0.2287	68.4754
R	06c1105a	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
R	06c1105e	0.3834	7.8656	0.0248	124.1607	-0.4062	10.427	0.0000	120.0000	-0.4056	9.6673	0.0369	116.4590	0.5898	10.619	0.0000	120.0000	0.4866	9.2424	0.0124	122.0804	-0.4059	10.047	0.0185	118.2295
R	06c1106a	0.3649	11.811	0.0526	120.7111	-0.2287	7.6198	0.1131	119.7221	-0.2921	17.477	0.0795	122.2796	0.3690	6.6155	0.0124	120.9043	0.3670	9.2131	0.0325	120.8077	-0.2604	12.548	0.0963	121.0009
R	06c1107a	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
R	06c1108a	0.3397	12.638	0.0585	125.4427	-0.1717	4.2239	0.0727	120.5247	-0.3763	17.013	0.1570	124.1263	0.3865	8.595	0.0755	120.0000	0.3631	10.616	0.0670	122.7214	-0.2740	10.619	0.1149	122.3255
R	06c1109a	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
R	06c1110a	0.9315	6.4472	0.1066	91.9747	-1.0891	8.5007	0.0094	90.0000	-0.7067	7.1062	0.0000	85.4837	0.8908	4.0849	0.4065	112.7193	0.9112	5.2661	0.2566	102.3470	-0.8979	7.8035	0.0047	87.7419
R	06c1111a	0.4959	7.0482	0.0838	140.7837	***	***	***	***	***	***	***	***	***	***	***	***	0.4959	7.0482	0.0838	140.7837	***	***	***	***
R	06c1112a	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
R	06c1112e	0.2893	8.515	0.0000	110.6316	-0.1866	8.4459	0.0692	107.0000	-0.2605	8.0316	0.0536	107.0000	0.3149	3.4212	0.0000	114.3209	0.3021	5.9681	0.0000	112.4763	-0.2236	8.2388	0.0614	107.0000
R	06c1113a	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
R	51c1101a	0.2491	21.15	0.1320	63.8801	-0 1997	4.4541	0.0154	61.3223	-0.2527	6.9523	0.0553	63.7192	0.3069	7.512	0.0000	62.0000	0.2780	14.331	0.0660	62.8401	-0.2262	5.7032	0.0354	62.5208
R	51c1102a	0.5496	5.8583	0.1593	114.9663	***	***	***	***	-0.5905	5.2922	0.1847	110.2709	***	***	***	***	0.5496	5.8583	0.1593	114.9663	-0.5905	5.2922	0.1847	110.2709
R	51c1103a	0.2310	13.477	0.0718	61.0000	-0.2088	14.578	0.1104	59.0000	-0.2594	7.5999	0.0000	59.6991	***	***	***	***	0.2310	13.477	0.0718	61.0000	-0.2341	11.089	0.0552	59.3496
R	51c1104a	0.4849	11.074	0.0824	106.8724	***	***	***	***	***	***	***	***	***	***	***	***	0.4849	11.074	0.0824	106.8724	***	***	***	***
R	51c1105a	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
	STATISTICS	GAIN	t	K	DC	GAIN	t	K	DC	GAIN	t	K	DC	GAIN	t	K	DC	GAIN	t	K	DC	GAIN	t	K	DC
	MEAN	0.4323	10.37	0.0667	108.4936	-0.3985	7.1313	0.0716	97.8733	-0.3771	9.6759	0.0672	102.6215	0.4610	8.2905	0.0698	110.8681	0.4432	9.5094	0.0732	108.8537	-0.4250	7.9632	0.0819	99.2588
	ST. DEV.	0.1880	4.1827	0.0499	24.8077	0.3532	3.6406	0.0678	26.1181	0.1563	4.2006	0.0643	24.5377	0.1975	3.6088	0.1386	20.4658	0.1785	2.9791	0.0722	24.1528	0.2849	3.0786	0.0703	25.2237
	N	12	12	12	12	10	10	10	10	10	10	10	10	8	8	8	8	12	12	12	12	11	11	11	11
	SEM	0.0361	0.1704	0.0186	0.4151	0.0594	0.1908	0.0260	0.5111	0.0395	0.205	0.0254	0.4954	0.0556	0.2375	0.0465	0.5655	0.0352	0.1438	0.0224	0.4095	0.0485	0.1595	0.0241	0.4586
																						0.4158	8.971	0.0687	104.8454

TABLE 4

Pulse Response - Post-Flight Day 3 (1-12-93)

		Curve 1				Curve 2				Curve 3				Curve 4				Average Inc.				Average Dec.			
mc	FILENAME	GAIN	t	K	DC	GAIN	t	K	DC	GAIN	t	K	DC	GAIN	t	K	DC	GAIN	t	K	DC	GAIN	t	K	DC
R	06c1214a	0.3772	11.878	0.0000	111.5303	-0.2337	14.756	0.0954	112.0000	-0.3395	10.424	0.0639	112.9932	0.3858	8.1561	0.0000	111.9267	0.3815	10.017	0.0000	111.7285	-0.2866	12.59	0.0797	112.4966
R	06c1214e	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
R	06c1215a	0.4804	11.088	0.1302	137.1729	-0.3238	3.2983	0.0761	128.5631	-0.5181	8.9505	0.1673	133.2148	0.5420	14.763	0.2024	133.0000	0.5112	12.926	0.1683	135.0865	-0.4210	6.1244	0.1217	130.8890
R	06c1215e	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
R	06c1216a	0.4379	14.923	0.0083	109.8733	-0.2617	11.496	0.2273	106.7153	-0.3744	15.835	0.1182	109.2550	0.3830	13.691	0.0481	113.5597	0.4105	14.307	0.0282	111.7185	-0.3181	13.666	0.1728	107.9852
R	06c1217a	0.3872	14.96	0.0000	105.0854	-0.2172	8.2276	0.0000	105.7105	-0.2558	5.534	0.0000	103.6375	0.2067	6.6703	0.0000	108.0000	0.2970	10.815	0.0000	106.5427	-0.2365	6.8808	0.0000	104.6740
R	06c1217e	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
R	06c1218a	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
R	51c1206a	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
R	51c1206e	0.5049	11.1	0.1230	86.8458	-0.5222	12.77	0.0631	90.5675	-0.4705	7.5629	0.1026	85.4418	0.5217	6.8672	0.0805	86.0000	0.5133	8.9835	0.1018	86.4229	-0.4964	10.166	0.0829	88.0047
R	51c1207a	0.1282	11.19	0.1912	60.0000	-0.1300	5.3517	0.0000	58.8753	-0.1529	3.3888	0.0336	58.4394	0.1550	7.7039	0.0371	59.0000	0.1416	9.4466	0.1142	59.5000	-0.1415	4.3703	0.0168	58.6574
R	51c1207e	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
R	51c1208a	0.7131	14.097	0.1515	77.0818	-0.4418	3.4934	0.0269	75.8387	***	***	***	***	***	***	***	***	0.7131	14.097	0.1515	77.0818	-0.4418	3.4934	0.0269	75.8387
R	51c1209a	0.7861	22.256	0.2722	68.9035	-0.7998	3.9073	0.2893	63.7725	-0.9351	24.656	0.3451	77.8924	1.1446	14.394	0.3768	67.9524	0.9654	18.325	0.3245	68.4280	-0.8675	14.282	0.3172	70.8325
R	51c1210a	0.5503	7.8306	0.0000	98.0551	-0.5401	1.7222	0.0559	112.7361	-0.8743	5.1445	0.0338	114.9877	0.7696	4.0534	0.0000	114.0000	0.6600	5.942	0.0000	106.0276	-0.7072	3.4334	0.0449	113.8619
R	51c1210e	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
R	51c1212a	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
R	51c1213a	0.1994	15.582	0.0652	51.3553	-0.1469	11.021	0.1230	52.1476	-0.1655	6.7444	0.0000	52.1086	0.2166	10.65	0.0714	51.9621	0.2080	13.116	0.0683	51.6587	-0.1562	8.8827	0.0615	52.1281
R	51c1214a	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
R	51c1215a	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
R	51c1216a	0.5615	7.2442	0.0322	99.3973	-0.5027	5.5549	0.0130	96.0157	-0.5147	6.6398	0.0467	94.1453	0.5351	4.9926	0.0000	97.9292	0.5483	6.1184	0.0161	98.6633	-0.5087	6.0974	0.0299	95.0905
R	51c1217a	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
R	51c1218a	0.8513	16.845	0.0988	144.2215	-0.5950	3.3352	0.0944	145.7813	-0.7524	5.9673	0.0620	155.4045	0.7058	6.8713	0.1106	148.7001	0.7786	11.858	0.1047	148.4608	-0.6737	4.6513	0.0782	150.5929
R	51c1219a	0.3509	5.8637	0.0176	70.8891	-0.2548	5.4715	0.0354	67.2858	-0.3183	6.4292	0.0194	67.8813	0.3195	8.3391	0.1035	70.3391	0.3352	7.1014	0.0606	70.6141	-0.2866	5.9504	0.0274	67.5836
R	51c1220a	0.4447	19.85	0.1915	101.0000	-0.3095	9.4473	0.0915	102.1764	-0.3629	8.262	0.0677	102.5974	0.4265	10.674	0.0361	101.0000	0.4356	15.262	0.1138	101.0000	-0.3362	8.8547	0.0796	102.3869
	STATISTICS	GAIN	t	K	DC	GAIN	t	K	DC	GAIN	t	K	DC	GAIN	t	K	DC	GAIN	t	K	DC	GAIN	t	K	DC
	MEAN	0.4838	13.193	0.0916	94.3865	-0.3771	7.1323	0.0851	94.1561	-0.4642	8.8875	0.0816	97.5384	0.4855	9.0635	0.0820	97.1823	0.4928	11.308	0.0893	95.0665	-0.4196	7.6173	0.0814	95.0723
	ST. DEV.	0.2037	4.6809	0.0879	27.2265	0.1941	4.1238	0.0835	27.5607	0.2522	5.6357	0.0924	29.4118	0.2710	3.5077	0.1061	28.9257	0.2279	3.8377	0.0881	27.6694	0.2140	3.6847	0.0816	28.1039
	N	14	14	14	14	14	14	14	14	13	13	13	13	13	13	13	13	14	14	14	14	14	14	14	14
	SEM	0.0322	0.1545	0.0212	0.3727	0.0315	0.1451	0.0206	0.3750	0.0386	0.1826	0.0234	0.4172	0.0400	0.1441	0.0251	0.4137	0.0341	0.1362	0.0212	0.3757	0.0330	0.1371	0.0204	0.3787
																						0.4518	9.5912	0.0852	95.7586

TABLE 5

Pulse Response - Post-Flight Day 5 (1-14-93)

		Curve 1				Curve 2				Curve 3				Curve 4				Average Inc.				Average Dec.			
axis	FILENAME	GAIN	t	K	DC	GAIN	t	K	DC	GAIN	t	K	DC	GAIN	t	K	DC	GAIN	t	K	DC	GAIN	t	K	DC
R	06c1419a	0.5520	7.3488	0.0539	143.5036	-0.4491	9.0711	0.0809	139.0000	-0.4554	5.3215	0.0161	135.7669	0.5801	8.335	0.0487	139.0760	0.5661	7.8419	0.0513	141.2898	-0.4523	7.1963	0.0485	137.3835
R	06c1420a	0.3441	13.532	0.1154	98.3431	-0.2580	5.1762	0.0067	98.6656	-0.3281	8.5215	0.0561	98.9763	0.3747	14.525	0.1970	100.0000	0.3594	14.029	0.1562	99.1716	-0.2931	6.8489	0.0314	97.8210
R	51c1421a	0.7600	13.168	0.0464	79.5173	-0.5324	4.4052	0.0947	79.5173	-0.5179	15.985	0.2841	80.0000	0.9589	3.9641	0.0325	78.3175	0.8595	8.566	0.0395	78.9174	-0.5252	10.195	0.1894	79.7587
R	51c1423a	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
R	51c1424a	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
R	51c1424e	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
R	51c1425a	0.4194	10.587	0.0000	77.9694	-0.3748	2.3328	0.0000	78.7878	***	***	***	***	***	***	***	***	0.4194	10.587	0.0000	77.9694	-0.3748	2.3328	0.0000	78.7878
R	51c1425e	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
R	51c1426a	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
R	51c1426e	0.3542	12.293	0.1326	111.2541	-0.3824	5.6478	0.0613	108.3304	-0.4328	5.6262	0.0270	112.5027	0.3578	4.5766	0.0645	119.0206	0.3560	8.4349	0.0966	115.1374	-0.4076	5.637	0.0442	110.4166
R	51c1427a	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
R	51c1428a	0.1615	6.734	0.0000	58.4764	-0.1248	5.6626	0.0969	55.0579	-0.2252	22.801	0.1551	57.7466	0.1987	7.9448	0.0107	56.1225	0.1801	7.3394	0.0054	57.2995	-0.1750	14.232	0.1270	56.4023
R	51c1428e	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
R	51c1429a	0.6539	10.935	0.0773	77.8983	-0.6549	12.504	0.2434	79.0000	-0.6806	13.635	0.1990	80.0000	0.7784	17.611	0.2127	80.0000	0.7162	14.273	0.1450	78.9492	-0.6678	13.069	0.2212	79.5000
R	51c1430a	0.5950	11.108	0.0804	92.8470	***	***	***	***	-0.2527	2.7071	0.1299	86.0800	***	***	***	***	0.5950	11.108	0.0804	92.8470	-0.2527	2.7071	0.1299	86.0800
R	51c1431a	0.3832	20.679	0.1554	119.3101	-0.3365	6.4954	0.0416	121.6669	-0.3505	7.1334	0.0000	122.7646	0.3944	10.139	0.0573	119.1683	0.3888	15.409	0.1084	119.2392	-0.3435	6.8144	0.0208	122.2158
	STATISTICS	GAIN	t	K	DC	GAIN	t	K	DC	GAIN	t	K	DC	GAIN	t	K	DC	GAIN	t	K	DC	GAIN	t	K	DC
	MEAN	0.4693	11.821	0.0735	95.4577	-0.3891	6.4118	0.0784	94.7532	-0.4054	10.216	0.1084	96.7296	0.5204	9.5849	0.0891	98.8150	0.4834	10.843	0.0759	95.0467	-0.3880	7.6702	0.0903	94.2629
	ST. DEV.	0.1853	4.0641	0.0547	25.9275	0.1625	3.1058	0.0764	27.2056	0.1495	6.7307	0.1010	25.7694	0.2675	5.0009	0.0812	28.9876	0.2094	3.0652	0.0563	25.9369	0.1485	4.1452	0.0792	26.2056
	N	9	9	9	9	8	8	8	8	8	8	8	8	7	7	7	7	9	9	9	9	9	9	9	9
	SEM	0.0478	0.224	0.0280	0.5658	0.0504	0.2203	0.0345	0.6520	0.0483	0.3243	0.0397	0.6345	0.0739	0.3195	0.0407	0.7691	0.0508	0.1945	0.0284	0.5658	0.0428	0.2262	0.0313	0.5578
																						0.4445	9.5783	0.0869	96.3340

TABLE 6

Pulse Response - Post-Flight Day 6 (1-15-93)

		Curve 1				Curve 2				Curve 3				Curve 4				Average Inc.				Average Dec.			
axis	FILENAME	GAIN	t	K	DC	GAIN	t	K	DC	GAIN	t	K	DC	GAIN	t	K	DC	GAIN	t	K	DC	GAIN	t	K	DC
L	03c1515a	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
L	03c1516a	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
L	03c1517a	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
L	03c1519a	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
L	03c1520a	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
L	07c1501a	-0.9186	4.4045	0.0942	131.2077	1.2352	9.4236	0.0932	120.0000	1.2160	3.894	0.0412	128.4114	-1.2070	7.2593	0.2160	122.6370	-1.0628	5.8319	0.1551	126.9224	1.2256	6.6588	0.0672	124.2057
L	07c1501e	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
L	07c1502a	-1.1701	8.832	0.2957	117.5990	1.0648	3.8647	0.1473	113.3886	1.7323	12.536	0.5338	114.9521	***	***	***	***	-1.1701	8.832	0.2957	117.5990	1.3986	8.2006	0.3406	114.1704
L	07c1503a	-0.7480	3.2568	0.0235	102.8084	0.8576	5.7204	0.0000	97.7981	0.6968	15.877	0.1254	103.1659	***	***	***	***	-0.7480	3.2568	0.0235	102.8084	0.7772	10.799	0.0627	100.4820
L	07c1505a	-0.3808	4.4436	0.0087	106.0946	0.3972	5.4608	0.0000	106.1003	0.3998	6.7877	0.0787	107.4101	***	***	***	***	-0.3808	4.4436	0.0087	106.0946	0.3985	6.1243	0.0394	106.7552
L	07c1507a	-0.2921	4.7628	0.0000	126.0421	0.2750	6.4958	0.0000	126.1790	0.2882	6.9419	0.0317	126.7815	-0.2672	6.9048	0.0715	126.0000	-0.2797	5.8338	0.0358	126.0211	0.2816	6.7189	0.0159	126.4803
	STATISTICS	GAIN	t	K	DC	GAIN	t	K	DC	GAIN	t	K	DC	GAIN	t	K	DC	GAIN	t	K	DC	GAIN	t	K	DC
	MEAN	-0.7019	5.1399	0.0844	116.7504	0.7660	6.1931	0.0481	112.6932	0.8666	9.2073	0.1622	116.1442	-0.7371	7.0821	0.1438	124.3185	-0.7283	5.8396	0.1038	115.8891	0.8163	7.7002	0.1051	114.4187
	ST. DEV.	0.3672	2.1416	0.1238	12.2882	0.4168	2.0438	0.0686	11.1923	0.6027	4.8678	0.2110	11.2891	0.6645	0.2507	0.1022	2.3780	0.3967	2.0641	0.1220	11.1170	0.4921	1.8961	0.1332	11.1163
	N	5	5	5	5	5	5	5	5	5	5	5	5	2	2	2	2	6	5	5	5	5	5	5	5
	SEM	0.1212	0.2927	0.0704	0.7011	0.1291	0.2859	0.0524	0.6691	0.1553	0.4413	0.0919	0.6720	0.4076	0.2503	0.1598	0.7710	0.1260	0.2887	0.0689	0.6668	0.1403	0.2754	0.0730	0.6668
																						0.7733	6.8745	0.1036	116.2692

TABLE 7

Pulse Response - Post-Flight Day 11 (1-21-93)

		Curve 1				Curve 2				Curve 3				Curve 4				Average Inc.				Average Dec.			
cur	FILENAME	GAIN	t	K	DC	GAIN	t	K	DC	GAIN	t	K	DC	GAIN	t	K	DC	GAIN	t	K	DC	GAIN	t	K	DC
R	06c2101a	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
R	06c2102a	0.5560	11.929	0.1317	144.9696	-0.4646	6.5906	0.1015	145.0000	-0.4817	8.8068	0.0937	147.6365	0.6207	7.0589	0.1186	147.5611	0.5884	9.493	0.1252	146.2654	-0.4732	7.5987	0.0976	146.3183
R	06c2103a	0.1637	4.999	0.0000	123.2332	-0.1324	1.7803	0.0000	112.9866	***	***	***	***	***	***	***	***	0.1637	4.999	0.0000	123.2332	-0.1324	1.7803	0.0000	112.9866
R	06c2104a	0.2916	10.539	0.0000	99.8146	-0.2209	8.81	0.0595	98.9913	-0.1728	15.991	0.1173	97.0000	0.3055	7.0596	0.0305	100.1172	0.2986	8.7994	0.0153	99.9659	-0.1969	12.4	0.0884	97.9957
R	06c2105a	0.6483	16.644	0.1278	135.0000	-0.5063	16.548	0.1602	136.3037	-0.5750	8.585	0.0000	138.6500	0.6075	6.645	0.0000	137.9972	0.6279	11.644	0.0639	136.4986	-0.5407	12.566	0.0801	137.4769
R	06c2106a	0.3410	9.1932	0.0000	129.0232	-0.1631	9.2358	0.1877	128.0000	-0.2209	6.9685	0.0785	129.7718	0.2793	8.4484	0.0245	131.6427	0.3102	8.8208	0.0123	130.3330	-0.1920	8.1022	0.1331	128.8859
R	06c2107a	0.1475	10.089	0.0000	67.0000	-0.1667	8.2602	0.0598	66.0000	-0.2211	15.526	0.0857	68.1612	0.1603	3.1156	0.0000	69.0000	0.1539	6.6024	0.0000	68.0000	-0.1939	11.893	0.0728	67.0806
R	06c2108a	0.3919	9.0583	0.0000	131.9548	-0.2538	6.1776	0.0351	129.7954	-0.3783	14.177	0.0595	136.5542	0.3657	6.7153	0.0159	133.7009	0.3788	7.8966	0.0080	132.8279	-0.3161	10.177	0.0473	133.1748
R	06c2109a	0.1133	7.1098	0.0000	63.4890	-0.1469	19.106	0.1249	63.9057	-0.1589	15.725	0.0825	63.0000	0.1684	10.628	0.0990	63.0000	0.1409	8.869	0.0495	63.2445	-0.1529	17.415	0.1037	63.4529
R	06c2110a	0.7218	10.31	0.1416	56.0890	-0.7615	3.3513	0.0000	45.6636	-0.8349	3.8461	0.0000	47.4698	0.6808	4.5655	0.1835	55.5557	0.7013	7.4375	0.1626	55.8224	-0.7982	3.5987	0.0000	46.5667
R	06c2111a	0.4256	11.233	0.0211	115.0000	-0.2509	5.1901	0.0189	111.6070	-0.2912	11.653	0.0839	112.0170	0.3729	11.175	0.0099	112.0000	0.3993	11.204	0.0155	113.5000	-0.2711	8.4217	0.0514	111.8120
	STATISTICS	GAIN	t	K	DC	GAIN	t	K	DC	GAIN	t	K	DC	GAIN	t	K	DC	GAIN	t	K	DC	GAIN	t	K	DC
	MEAN	0.3801	10.11	0.0422	106.5573	-0.3067	8.5049	0.0748	103.8253	-0.3705	11.231	0.0668	104.4734	0.3957	7.2678	0.0535	105.6194	0.3763	8.5756	0.0452	106.9691	-0.3267	9.3954	0.0674	104.5750
	ST. DEV.	0.2117	3.0651	0.0636	32.9912	0.2058	5.4731	0.0663	34.2929	0.2249	4.4265	0.0408	37.2510	0.1959	2.5807	0.0648	35.3694	0.2041	1.995	0.0566	33.3889	0.2143	4.5667	0.0434	34.7407
	N	10	10	10	10	10	10	10	10	9	9	9	9	9	9	9	9	10	10	10	10	10	10	10	10
	SEM	0.0460	0.1751	0.0252	0.5744	0.0454	0.2339	0.0258	0.5856	0.0527	0.2338	0.0224	0.6782	0.0492	0.1785	0.0283	0.6608	0.0452	0.1412	0.0238	0.5778	0.0463	0.2137	0.0208	0.5894
																						0.3622	9.28	0.0593	105.1227

Spontaneous Rate

TABLE 8

Spontaneous Rate - Pre-Flight

Filename	Mean ISI (ms)	SP Rate (S/s)	CV
01o1701a	***	***	***
01o1701e	***	***	***
01o1701i	6.93	144.30	0.23
01o1702a	9.99	100.10	0.04
03a1401a	5.85	170.94	0.17
03a1402a	10.52	95.06	0.16
03a1402e	9.85	101.52	0.14
03a1404a	***	***	***
03a1405a	***	***	***
03a1406a	7.86	127.23	0.20
03a1407a	6.97	143.47	0.05
51a1501a	9.13	109.53	0.07
75a1504a	10.05	99.50	0.17
75a1504e	12.33	81.10	0.30
07a1601a	8.68	115.21	0.25
07a1602a	6.12	163.40	0.06
07a1602e	6.10	163.93	0.06
07a1603a	7.99	125.16	0.18
07a1603e	9.34	107.07	0.17
07a1606a	39.25	25.48	0.09
07a1607a	9.59	104.28	0.20
07a1608a	5.85	170.94	0.24
07a1609a	9.24	108.23	0.03
07a1610a	6.46	154.80	0.25
07a1610e	6.98	143.27	0.25
07a1611a	7.08	141.24	0.26
07a1611e	8.05	124.22	0.22
07a1612a	7.17	139.47	0.03
07a1613a	***	***	***
01a1601a	6.81	146.84	0.27
01a1601e	8.59	116.41	0.34
01a1601i	7.28	137.36	0.28
01a1602a	7.05	141.84	0.10
01a1602e	6.83	146.41	0.10
01a1602i	7.72	129.53	0.10
01a1603a	8.99	111.23	0.03
01a2004a	5.95	168.07	0.06
01a2004e	6.30	158.73	0.10
01a2005a	7.83	127.71	0.05
01a2005e	7.90	126.58	0.05
01a2006a	8.35	119.76	0.25
01a2006e	6.6	151.52	0.14
01a2007a	6.45	155.04	0.15
mean	8.69	128.85	0.15
st dev	5.31	29.07	0.09
n	38.00	38.00	38.00
sem	0.06	0.14	0.01

TABLE 9

Spontaneous Rate - Post Flight Day 1

Filename	Mean ISI (ms)	SP Rate (S/s)	CV
03c0901a	7.03	142.25	0.06
03c0901e	7.00	142.86	0.06
03c0901m	7.05	141.84	0.06
03c0901i	6.88	145.35	0.06
03c0902a	7.06	141.64	0.30
03c0903a	6.79	147.28	0.17
03c0904a	7.68	130.21	0.25
03c0904e	8.83	113.25	0.30
03c0905a	7.29	137.17	0.19
03c0906a	7.69	130.04	0.28
03c0906e	11.72	85.32	0.55
03c0907a	8.44	118.48	0.17
03c0908a	9.47	105.60	0.04
07c1001a	7.38	135.50	0.12
07c1001e	7.35	136.05	0.12
07c1002a	9.94	100.60	0.02
07c1002e	9.88	101.21	0.02
07c1003a	7.85	127.39	0.07
mean	8.07	128.78	0.16
st dev	1.37	18.41	0.14
n	18.00	18.00	18.00
sem	0.07	0.24	0.02

TABLE 10

Spontaneous Rate - Post Flight DAY 2

Filename	Mean ISI (ms)	SP Rate (S/s)	CV
06c1101a	7.91	126.42	0.03
06c1102a	8.63	115.87	0.04
06c1102e	9.00	111.11	0.03
06c1103a	12.23	81.77	0.18
06c1104a	10.91	91.66	0.14
06c1105a	10.30	97.09	0.15
06c1105e	9.77	102.35	0.15
06c1106a	8.16	122.55	0.03
06c1107a	16.20	61.73	0.34
06c1108a	7.98	125.31	0.03
06c1109a	18.62	53.71	0.51
06c1110a	11.58	86.36	0.17
06c1111a	7.32	136.61	0.04
06c1112a	9.49	105.37	0.03
06c1112e	9.60	104.17	0.03
06c1113a	11.16	89.61	0.37
51c1101a	15.84	63.13	0.03
51c1102a	9.25	108.11	0.08
51c1103a	16.45	60.79	0.03
51c1104a	9.27	107.87	0.04
mean	10.98	97.58	0.12
st dev	3.26	23.88	0.14
n	20.00	20.00	20.00
sem	0.09	0.24	0.02

Spontaneous Rate

TABLE 11

Spontaneous Rate - Post Flight DAY 3

Filename	Mean ISI (ms)	SP Rate (S/s)	CV
06c1214a	8.84	113.12	0.03
06c1214e	9.09	110.01	0.03
06c1215a	7.38	135.50	0.06
06c1216a	8.87	112.74	0.04
06c1217a	9.21	108.58	0.04
06c1217e	9.05	110.50	0.04
51c1206a	12.03	83.13	0.04
51c1206e	11.96	83.61	0.03
51c1207a	16.96	58.96	0.04
51c1207e	17.68	56.56	0.04
51c1208a	13.22	75.64	0.31
51c1209a	14.98	66.76	0.20
51c1210a	10.12	98.81	0.22
51c1213a	19.02	52.58	0.03
51c1215a	7.96	125.63	0.12
51c1216a	10.24	97.66	0.03
51c1218a	6.60	151.52	0.08
51c1219a	14.13	70.77	0.03
51c1220a	10.08	99.21	0.05
mean	11.44	95.33	0.08
st dev	3.63	27.60	0.08
n	19.00	19.00	19.00
sem	0.10	0.28	0.01

TABLE 12

Spontaneous Rate - Post Flight DAY 5

Filename	Mean ISI (ms)	SP Rate (S/s)	CV
06c1419a	7.11	140.65	0.03
06c1420a	10.14	98.62	0.04
51c1421a	13.16	75.99	0.33
51c1425a	12.63	79.18	0.26
51c1426a	8.72	114.68	0.05
51c1426e	8.94	111.86	0.05
51c1427a	13.37	74.79	0.04
51c1428a	17.54	57.01	0.04
51c1428e	17.87	55.96	0.07
51c1429a	12.40	80.65	0.06
51c1430a	10.42	95.97	0.27
51c1431a	8.29	120.63	0.04
mean	11.72	92.16	0.11
st dev	3.46	28.15	0.11
n	12.00	12.00	12.00
sem	0.18	0.43	0.03

TABLE 13

Spontaneous Rate - Post Flight DAY 8

Filename	Mean ISI (ms)	SP Rate (S/s)	CV
03c1515a	14.05	71.17	0.03
03c1516a	17.42	57.41	0.73
03c1517a	7.36	135.87	0.10
03c1520e	9.57	104.49	0.16
07c1501a	7.79	128.37	0.10
07c1501e	7.34	136.24	0.09
09c1502e	8.68	115.21	0.16
07c1503a	9.77	102.35	0.06
07c1505a	9.25	108.11	0.03
07c1507a	7.85	127.39	0.03
mean	9.91	108.66	0.15
st dev	3.29	26.61	0.21
n	10.00	10.00	10.00
sem	0.18	0.52	0.05

TABLE 14

Spontaneous Rate - Post Flight DAY 11

Filename	Mean ISI (ms)	SP Rate (S/s)	CV
06c2102a	7.06	141.64	0.06
06c2103a	8.67	115.34	0.03
06c2104a	10.21	97.94	0.03
06c2105a	7.31	136.80	0.07
06c2106a	7.66	130.55	0.04
06c2107a	15.25	65.57	0.03
06c2108a	7.45	134.23	0.03
06c2109a	16.80	59.52	0.04
06c2110a	20.39	49.04	0.32
06c2111a	8.80	113.64	0.04
mean	10.96	104.43	0.07
st dev	4.76	34.71	0.09
n	10.00	10.00	10.00
sem	0.22	0.59	0.03

TABLE 15

Sum of Sines Protocols - Pre-Flight (11-14-92 to 12-8-92) — *total neurons =* 7

	Frequency	0.0293		0.0879		0.2051		0.3809						
ear	FILENAME	gain	phase	gain	phase	gain	phase	gain	phase	G	k	tau V	tau L	MSE
L	03a1401b	0.2800	80.3990	0.7200	23.3340	0.7600	23.3640	0.8300	36.2630	2.0550	0.0721	0.2491	2.7290	1.33E-02
L	03a1402b	***	***	***	***	***	***	***	***	***	***	***	***	***
L	03a1407b	***	***	***	***	***	***	***	***	***	***	***	***	***
L	03a1407f	0.4400	48.7050	0.6100	24.6950	0.7000	12.9190	0.6800	7.1110	3.3030	0.0320	0.0000	4.8730	3.70E-04
L	07a1601b	***	***	***	***	***	***	***	***	***	***	***	***	***
L	07a1610b	***	***	***	***	***	***	***	***	***	***	***	***	***
L	07a1611b	***	***	***	***	***	***	***	***	***	***	***	***	***
L	07a1612b	0.3700	38.0860	0.5000	19.9640	0.5500	13.4000	0.5800	12.1250	4.9170	0.1030	0.0000	9.2460	1.13E-04
L	01a1601b	***	***	***	***	***	***	***	***	***	***	***	***	***
L	01a1602b	0.3700	48.2020	0.5100	22.5190	0.5700	18.4460	0.6300	18.9400	3.9880	0.1070	0.0403	7.0890	1.94E-04
L	01a1603b	0.2500	32.9740	0.3100	14.2050	0.3100	5.5030	0.3100	4.3610	2.4410	0.0020	0.0047	7.8470	5.55E-05
L	01a2004b	***	***	***	***	***	***	***	***	***	***	***	***	***
L	01a2005b	***	***	***	***	***	***	***	***	***	***	***	***	***
L	01a2006b	0.4400	57.5410	0.5800	34.0490	0.7600	25.8270	0.8300	24.1720	4.8460	0.1920	0.0229	6.8270	8.59E-04
L	01a2007b	0.3600	44.4870	0.5100	9.0640	0.6600	########	0.7900	########	***	***	***	***	***
	STATISTICS	gain	phase	gain	phase	gain	phase	gain	phase	G	k	tau V	tau L	MSE
	MEAN	0.3586	50.0563	0.5343	21.1186	0.6157	11.9160	0.6643	5.2526	3.5917	0.0847	0.0528	6.4352	2.48E-03
	ST. DEV.	0.0724	15.5353	0.1258	7.9718	0.1584	14.1037	0.1847	33.3278	1.2046	0.0665	0.0974	2.3087	5.30E-03
	N	7	7	7	7	7	7	7	7	6	6	6	6	6
	SEM	0.0384	0.5631	0.0507	0.4033	0.0569	0.5365	0.0614	0.8247	0.1829	0.0430	0.0520	0.2532	1.21E-02

TABLE 16

Sum of Sines Protocols - Synchronous Controls (1-8-93 to 1-10-93) — *total neurons =* 1

	Frequency	0.0293		0.0879		0.2051		0.3809						
ear	FILENAME	gain	phase	gain	phase	gain	phase	gain	phase	G	k	tau V	tau L	MSE
L	07c1002b	0.2200	37.6450	0.2800	18.9080	0.0300	9.7090	0.3100	5.7590	2.2000	0.0430	0.0000	7.4190	4.01E-05
L	07c1003b	***	***	***	***	***	***	***	***	***	***	***	***	***
	STATISTICS	gain	phase	gain	phase	gain	phase	gain	phase	G	k	tau V	tau L	MSE
	MEAN	0.2200	37.6450	0.2800	18.9080	0.0300	9.7090	0.3100	5.7590	2.2000	0.0430	0.0000	7.4190	4.01E-05
	ST. DEV.	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0
	N	1	1	1	1	1	1	1	1	1	1	1	1	1
	SEM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0

TABLE 17

Sum of Sines Protocols - Post Flight Day 2 (1-11-93) — *total neurons =* 6

	Frequency	0.0293		0.0879		0.2051		0.3809						
ear	FILENAME	gain	phase	gain	phase	gain	phase	gain	phase	G	k	tau V	tau L	MSE
R	06c1102b	0.3900	33.4080	0.4400	21.2040	0.4900	14.8150	0.5200	14.4350	5.5570	0.0970	0.0297	11.5620	2.35E-04
R	06c1105b	***	***	***	***	***	***	***	***	***	***	***	***	***
R	06c1106b	0.2500	31.7430	0.3200	20.7750	0.3400	12.9110	0.3600	9.7150	3.8010	0.0990	0.0000	11.4105	1.12E-04
R	06c1108b	0.2500	32.7230	0.3100	20.8840	0.3500	13.4920	0.3600	10.9630	3.8890	0.1090	0.0000	11.6672	7.70E-05
R	06c1112b	0.2600	35.2010	0.3200	16.0630	0.3500	11.3730	0.3700	11.1070	3.5970	0.0880	0.0000	10.5206	2.97E-05
R	51c1101b	0.2100	34.6150	0.2500	14.9520	0.2900	6.8780	0.2700	5.0350	2.1755	0.0255	0.0000	8.0624	1.21E-04
R	51c1102b	0.2900	47.0570	0.4600	38.2450	0.6400	29.7180	0.7300	25.4460	5.9963	0.2820	0.0000	10.4932	9.06E-04
	STATISTICS	gain	phase	gain	phase	gain	phase	gain	phase	G	k	tau V	tau L	MSE
	MEAN	0.2750	35.7912	0.3500	22.0205	0.4100	14.8645	0.4350	12.7835	4.1693	0.1168	0.0050	10.6193	2.47E-04
	ST. DEV.	0.0619	5.6592	0.0820	8.3928	0.1310	7.7756	0.1655	6.9086	1.3986	0.0863	0.0121	1.3547	3.30E-04
	N	6	6	6	6	6	6	6	6	6	6	6	6	6
	SEM	0.0415	0.3965	0.0477	0.4828	0.0803	0.4647	0.0678	0.4381	0.1971	0.0490	0.0184	0.1940	3.03E-03

TABLE 18

Sum of Sines Protocols - Post Flight Day 3 (1-12-93) — *total neurons =* 8

	Frequency	0.0293		0.0879		0.2051		0.3809						
ear	FILENAME	gain	phase	gain	phase	gain	phase	gain	phase	G	k	tau V	tau L	MSE
R	51c1206b	0.3600	39.5360	0.4800	23.5260	0.5600	14.2580	0.5900	10.0700	4.3218	0.1014	0.0000	8.0928	3.70E-04
R	51c1207b	0.1100	32.7560	0.1400	19.9343	0.1600	12.5860	0.1600	7.5270	1.7962	0.1205	0.0350	12.0030	2.99E-05
R	51c1209b	0.3100	61.6880	0.5300	45.7570	0.8000	38.4280	0.9900	32.9780	5.6336	0.3539	0.0000	7.8378	9.90E-04
R	51c1210b	0.4500	52.7780	0.6000	32.5680	0.7000	22.2800	0.7300	22.0900	3.8624	0.1050	0.0653	5.7020	8.33E-04
R	51c1214b	***	***	***	***	***	***	***	***	***	***	***	***	***
R	51c1216b	0.4300	35.1300	0.5300	18.0620	0.5900	12.0630	0.6000	8.1310	5.3490	0.0746	0.0000	9.4252	1.15E-04
R	51c1218b	0.5200	60.9930	0.6300	34.3380	0.8100	23.3930	0.8500	16.8570	4.2850	0.1510	0.0011	5.5630	3.38E-03
R	06c1214b	0.2800	27.2340	0.2400	8.7000	0.3300	6.5380	0.2000	27.0350	1.7020	0.1695	0.2514	6.7120	2.81E-03
R	06c1215b	0.7500	38.6490	0.8700	25.6400	0.8200	20.7320	0.8600	17.6130	6.0460	0.0130	0.1191	7.0320	6.89E-03
	STATISTICS	gain	phase	gain	phase	gain	phase	gain	phase	G	k	tau V	tau L	MSE
	MEAN	0.4013	43.5954	0.5025	26.0682	0.5963	18.7848	0.6225	17.7876	4.1245	0.1361	0.0590	7.7960	1.93E-03
	ST. DEV.	0.1884	13.1592	0.2278	11.3892	0.2422	9.8357	0.3044	9.2099	1.6428	0.1001	0.0687	2.1238	2.36E-03
	N	8	8	8	8	8	8	8	8	8	8	8	8	8
	SEM	0.0543	0.4534	0.0597	0.4218	0.0615	0.3920	0.0690	0.3793	0.1602	0.0395	0.0372	0.1822	6.07E-03

TABLE 19

Sum of Sines Protocols - Post Flight Day 5 (1-14-93) — *total neurons =* 6

	Frequency	0.0293		0.0879		0.2051		0.3809						
ear	FILENAME	gain	phase	gain	phase	gain	phase	gain	phase	G	k	tau V	tau L	MSE
R	51c1421b	0.4500	47.6670	########	23.8790	0.6400	18.0500	0.7200	18.8500	5.0150	0.1240	0.0312	7.9290	5.00E-04
R	51c1423b	***	***	***	***	***	***	***	***	***	***	***	***	***
R	51c1424b	***	***	***	***	***	***	***	***	***	***	***	***	***
R	51c1425b	0.1700	58.6760	0.3000	14.4220	0.3400	13.7400	0.3900	5.4700	1.3860	0.0150	0.0000	3.9900	1.34E-03
R	51c1428b	0.2300	35.6620	0.2700	18.3830	0.3000	9.2420	0.3100	6.3640	2.5240	0.0530	0.0000	8.6030	5.37E-05
R	51c1429b	0.6200	39.2860	0.7600	23.5840	0.9000	16.5800	0.9900	14.8180	9.2420	0.1430	0.0000	10.6700	3.14E-04
R	51c1431b	0.2900	51.8320	0.3800	24.1930	0.4100	17.8730	0.4500	19.9790	2.2297	0.0474	0.0829	5.5049	1.44E-04
R	06c1420b	0.2400	34.4880	0.3000	22.8490	0.3400	17.6990	0.3700	18.4740	4.3530	0.1440	0.0263	13.2760	2.07E-05
	STATISTICS	gain	phase	gain	phase	gain	phase	gain	phase	G	k	tau V	tau L	MSE
	MEAN	0.3333	44.6018	59.5017	21.2183	0.4883	15.5307	0.5383	13.9925	4.1250	0.0877	0.0234	8.3288	3.98E-04
	ST. DEV.	0.1696	9.6976	########	3.9601	0.2358	3.4753	0.2636	6.4965	2.8526	0.0560	0.0324	3.3761	4.96E-04
	N	6	6	6	6	6	6	6	6	6	6	6	6	6
	SEM	0.0686	0.5190	2.0053	0.3317	0.0809	0.3107	0.0856	0.4248	0.2815	0.0394	0.0300	0.3062	3.71E-03

TABLE 20

Sum of Sines Protocols - Post Flight Day 6 (1-15-93) — *total neurons =* 1

	Frequency	0.0293		0.0879		0.2051		0.3809						
ear	FILENAME	gain	phase	gain	phase	gain	phase	gain	phase	G	k	tau V	tau L	MSE
L	07c1501b	***	***	***	***	***	***	***	***	***	***	***	***	***
L	07c1502b	***	***	***	***	***	***	***	***	***	***	***	***	***
L	07c1505b	***	***	***	***	***	***	***	***	***	***	***	***	***
L	07c1507b	***	***	***	***	***	***	***	***	***	***	***	***	***
L	07c1508b	0.3900	61.2390	0.6400	31.1720	0.7400	14.1180	0.7900	13.1660	2.7421	0.0523	0.0040	3.6669	6.09E-04
L	03c1516b	***	***	***	***	***	***	***	***	***	***	***	***	***
L	03c1518b	***	***	***	***	***	***	***	***	***	***	***	***	***
	STATISTICS	gain	phase	gain	phase	gain	phase	gain	phase	G	k	tau V	tau L	MSE
	MEAN	0.3900	61.2390	0.6400	31.1720	0.7400	14.1180	0.7900	13.1660	2.7421	0.0523	0.0040	3.6669	6.09E-04
	ST. DEV.	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0
	N	1	1	1	1	1	1	1	1	1	1	1	1	1
	SEM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0

TABLE 21

Sum of Sines Protocols - Post Flight Day 7 (1-16-93) — *total neurons =* 1

	Frequency	*0.0293*		*0.0879*		*0.2051*		*0.3809*						
ser	FILENAME	gain	phase	gain	phase	gain	phase	gain	phase	G	k	tau V	tau L	MSE
L	92c1601b	***	***	***	***	***	***	***	***	***	***	***	***	***
L	01c1601b	***	***	***	***	***	***	***	***	***	***	***	***	***
L	01c1602b	***	***	***	***	***	***	***	***	***	***	***	***	***
L	01c1604b	3.0700	54.0910	5.1600	30.1210	5.5100	19.4080	6.4200	20.8810	0.9620	0.1173	0.0385	5.4995	4.59E-05
	STATISTICS	gain	phase	gain	phase	gain	phase	gain	phase	G	k	tau V	tau L	MSE
	MEAN	3.0700	54.0910	5.1600	30.1210	5.5100	19.4080	6.4200	20.8810	0.9620	0.1173	0.0385	5.4995	4.59E-05
	ST. DEV.	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0
	N	1	1	1	1	1	1	1	1	1	1	1	1	1
	SEM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0

TABLE 22

Sum of Sines Protocols - Post Flight Day 11 (1-21-93) — *total neurons =* 6

	Frequency	*0.0293*		*0.0879*		*0.2051*		*0.3809*						
ser	FILENAME	gain	phase	gain	phase	gain	phase	gain	phase	G	k	tau V	tau L	MSE
R	06c2101b	0.1400	73.8120	0.1700	19.1320	0.2400	21.6990	0.2200	21.6820	0.0000	0.0590	0.0718	4.2580	1.04E-13
R	06c2102b	0.4000	37.2170	0.5100	28.5430	0.6200	23.5580	0.7000	23.6410	0.0001	0.2140	0.0224	15.8620	1.63E-14
R	06c2104b	0.2300	30.9860	0.2700	14.3720	0.2900	8.7490	0.2900	7.1110	2.9420	0.0480	0.0031	10.4350	1.40E-05
R	06c2105b	0.4100	33.0500	0.5300	21.0970	0.5800	17.1940	0.6200	15.2290	0.0001	0.1340	0.0134	13.1940	1.47E-14
R	06c2106b	0.1600	48.9780	0.2600	13.9430	0.2900	13.2710	0.3100	14.2840	1.7730	0.0770	0.0108	6.3430	7.15E-04
R	06c2108b	***	***	***	***	***	***	***	***	***	***	***	***	***
R	06c2109b	***	***	***	***	***	***	***	***	***	***	***	***	***
R	06c2111b	0.2500	32.4000	0.3200	19.9780	0.3500	14.5400	0.3600	12.5940	0.0000	0.1100	0.0076	12.0430	8.37E-15
	STATISTICS	gain	phase	gain	phase	gain	phase	gain	phase	G	k	tau V	tau L	MSE
	MEAN	0.2650	42.7405	0.3433	19.5108	0.3950	16.5018	0.4167	15.7568	0.7859	0.1070	0.0215	10.3558	1.22E-04
	ST. DEV.	0.1161	16.5762	0.1453	5.3267	0.1631	5.5077	0.1954	6.0740	1.2723	0.0614	0.0255	4.3477	2.91E-04
	N	6	6	6	6	6	6	6	6	6	6	6	6	6
	SEM	0.0568	0.6786	0.0635	0.3847	0.0673	0.3911	0.0737	0.4108	0.1680	0.0413	0.0266	0.3475	2.84E-03

Sine Protocol
0.2051 Hz

TABLE 23
Pre-Flight (11-14-92 to 12-9-92)

sect	FILENAME	gain	phase
L	**01c1702d	0.43	9.8610
L	03a1401d	1.02	19.2150
L	03a1402d	2.26	25.6480
L	03a1407d	0.70	12.1920
L	75a1504d	***	***
L	01a1601d	***	***
L	01a1602d	0.60	21.0840
L	01a1603d	0.31	-16.7600
L	01a1603h	***	***
L	07a1601d	1.64	36.8490
L	07a1602d	0.77	22.3990
L	07a1610d	0.36	10.6120
L	07a1611d	0.38	9.1950
L	07a1612d	0.57	12.1480
L	01a2004d	1.12	25.9100
L	01a2005d	0.39	13.1760
L	01a2006d	0.81	24.8050
L	01a2007d	***	***
	STATISTICS	gain	phase
	MEAN	0.81	16.1667
	ST. DEV.	0.56	12.4152
	N	14	14
	SEM	0.05	0.2517

TABLE 24
Synchronous Control
(1-9-93 to 1-10-93)

sect	FILENAME	gain	phase
L	07a1002d	0.31	10.1680
L	07a1003d	1.09	18.7090
	STATISTICS	gain	phase
	MEAN	0.70	14.4385
	ST. DEV.	0.55	6.0394
	N	2	2
	SEM	0.37	1.2288

TABLE 25
Post-Flight Day 2 (1-13-93)

sect	FILENAME	gain	phase
R	06c1102d	0.49	14.6520
R	06c1105d	0.58	16.4380
R	06c1106d	0.34	11.6900
R	06c1108d	0.34	10.5890
R	06c1112d	0.37	10.7400
R	51c1101d	0.26	8.8000
R	51c1103d	0.27	9.1140
	STATISTICS	gain	phase
	MEAN	0.38	11.7461
	ST. DEV.	0.11	2.8758
	N	7	7
	SEM	0.05	0.2423

TABLE 26
Post-Flight Day 3 (1-13-93)

sect	FILENAME	gain	phase
R	51c1206d	0.56	14.5580
R	51c1207d	0.16	11.7780
R	51c1209d	1.02	11.1400
R	51c1210d	0.71	21.0360
R	51c1211d	***	***
R	51c1216d	0.61	10.6730
	STATISTICS	gain	phase
	MEAN	0.61	13.8370
	ST. DEV.	0.31	4.2974
	N	5	5
	SEM	0.11	0.4146

TABLE 27
Post-Flight Day 5 (1-14-93)

sect	FILENAME	gain	phase
R	51c1421d	0.60	20.7930
R	51c1424d	0.52	26.9100
R	51c1425d	0.35	21.7340
R	51c1426d	0.20	11.0700
R	51c1429d	0.66	16.4580
R	06c1420d	0.34	18.7500
	STATISTICS	gain	phase
	MEAN	0.45	19.2658
	ST. DEV.	0.18	5.3325
	N	6	6
	SEM	0.07	0.3849

TABLE 28
Post-Flight Day 6 (1-15-93)

sect	FILENAME	gain	phase
L	03c1516d	0.37	25.2260
L	07c1501d	1.42	23.2340
L	07c1502d	1.44	42.1090
	STATISTICS	gain	phase
	MEAN	1.08	30.1897
	ST. DEV.	0.61	10.3704
	N	3	3
	SEM	0.26	1.0734

TABLE 29
Post-Flight Day 7 (1-16-93)

sect	FILENAME	gain	phase
L	01c1601d	***	***
L	01c1602d	0.74	14.7970
L	01c1603d	***	***
L	01c1604d	***	***
L	01c1604h	0.29	18.1610
L	92c1601d	***	***
	STATISTICS	gain	phase
	MEAN	0.52	16.4790
	ST. DEV.	0.32	2.3787
	N	2	2
	SEM	0.28	0.7712

TABLE 30
Post-Flight Day 8 (1-17-93)

sect	FILENAME	gain	phase
L	07c1701d	0.81	3.8540
	STATISTICS	gain	phase
	MEAN	0.81	3.8540
	ST. DEV.	0.00	0.0000
	N	1	1
	SEM	0.00	0.0000

TABLE 31
Post-Flight Day 11 (1-21-93)

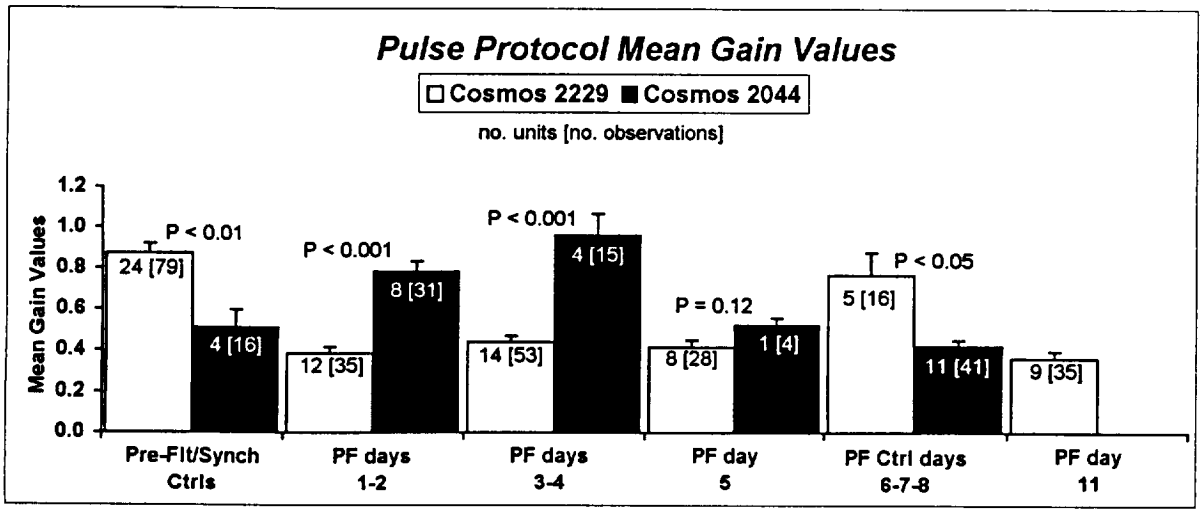
sect	FILENAME	gain	phase
R	06c2101d	***	***
R	06c2102d	0.61	24.4030
R	06c2102h	***	***
R	06c2104d	0.28	9.2520
	STATISTICS	gain	phase
	MEAN	0.45	16.8275
	ST. DEV.	0.23	10.7134
	N	2	2
	SEM	0.24	1.6366

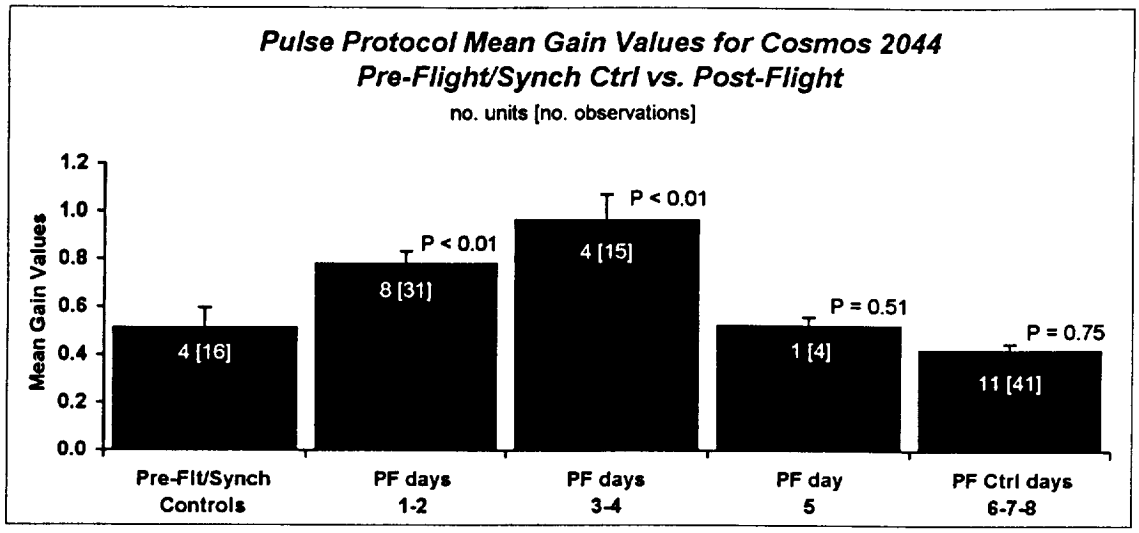
APPENDIX 3

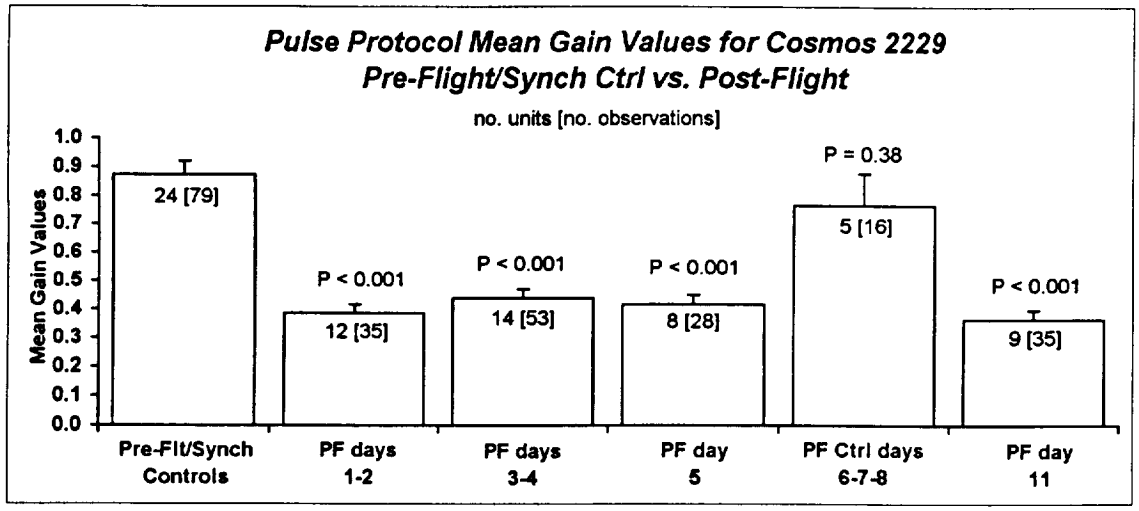
Histograms comparing the parameters measured for primary afferent activity for Cosmos flight 2044 and Cosmos flight 2229. The probability values above each pair of bars result from a statistical comparison of adjacent bars - One from flight 2044 and one from flight 2229. When a histogram is presented for each flight alone, the statistical comparisons above each bar is referring to the preflight/synchronous controls values. In addition to the histograms, supporting mean data are also included.

Pulse Analysis

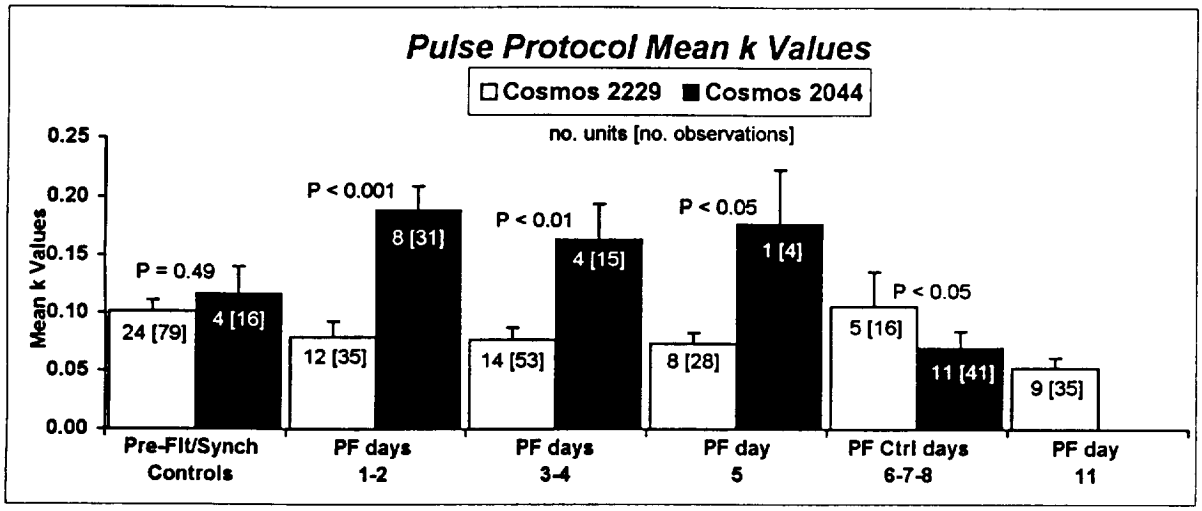
	plot order	COSMOS 2044 Gain	SEM	no. units	no. observations	COSMOS 2229 Gain	SEM	no. units	no. observations	Statistical Significance: 2044 vs. 2229	Ctrl. vs. PFDays Cosmos 2044	Ctrl. vs. PFDays Cosmos 2229
Pre-Flt/Synch Ctrls	1	0.5123	0.065	4	16	0.8721	0.048	24	79	**0.0019		
Days 1-2	2	0.7816	0.051	8	31	0.3855	0.032	12	35	***0.0000	**0.0062	***0.0000
Days 3-4	3	0.9638	0.105	4	15	0.4407	0.029	14	53	***0.0000	**0.0012	***0.0000
Day 5	4	0.5232	0.036	1	4	0.4179	0.034	8	28	0.1239	0.5083	***0.0000
Post-Flt Ctrl	5	0.4238	0.026	11	41	0.7666	0.110	5	16	*0.0173	0.7492	0.3815
Day 11	6					0.3636	0.033	9	35			***0.0000

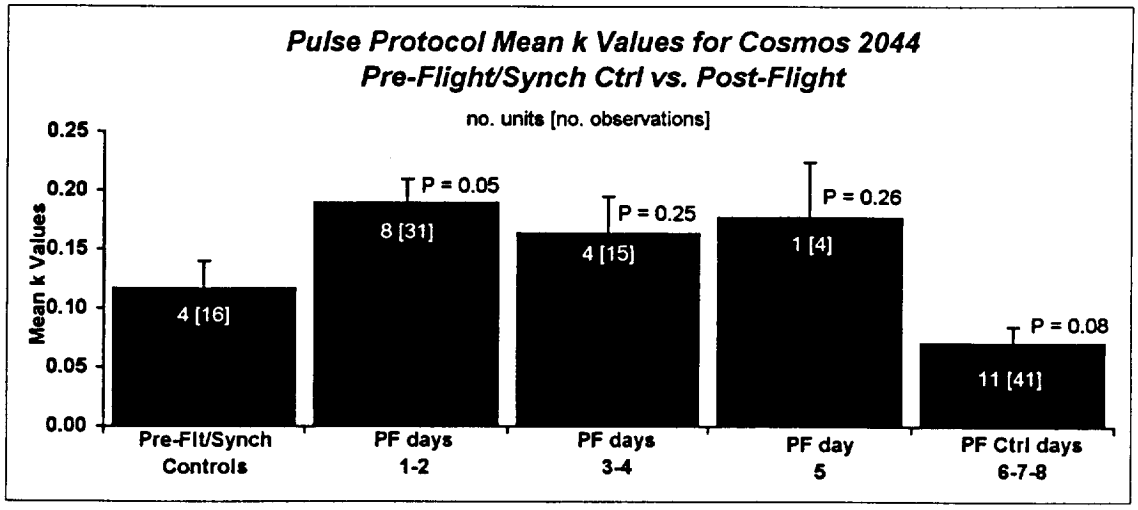


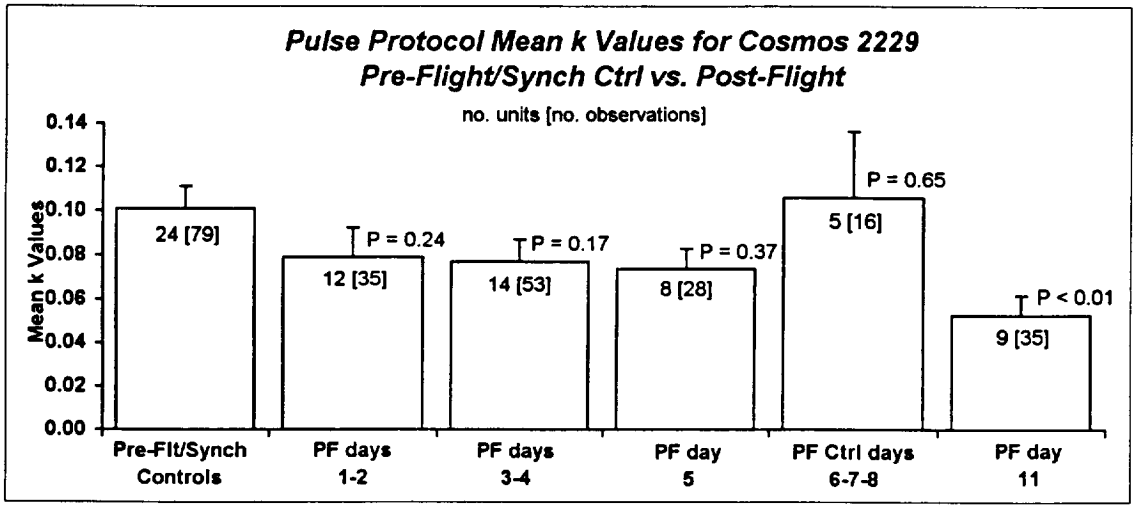

Pulse Protocol Mean Gain Values for Cosmos 2044
Pre-Flight/Synch Ctrl vs. Post-Flight
no. units [no. observations]
Mean Gain Values
1.2
1.0
0.8
0.6
0.4
0.2
0.0
4 [16]
8 [31]
4 [15]
1 [4]
11 [41]
P < 0.01
P < 0.01
P = 0.51
P = 0.75
Pre-Flt/Synch Controls
PF days 1-2
PF days 3-4
PF day 5
PF Ctrl days 6-7-8


Pulse Protocol Mean Gain Values for Cosmos 2229
Pre-Flight/Synch Ctrl vs. Post-Flight
no. units [no. observations]
Mean Gain Values
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
24 [79]
12 [35]
14 [53]
8 [28]
5 [16]
9 [35]
P < 0.001
P < 0.001
P < 0.001
P = 0.38
P < 0.001
Pre-Flt/Synch Controls
PF days 1-2
PF days 3-4
PF day 5
PF Ctrl days 6-7-8
PF day 11

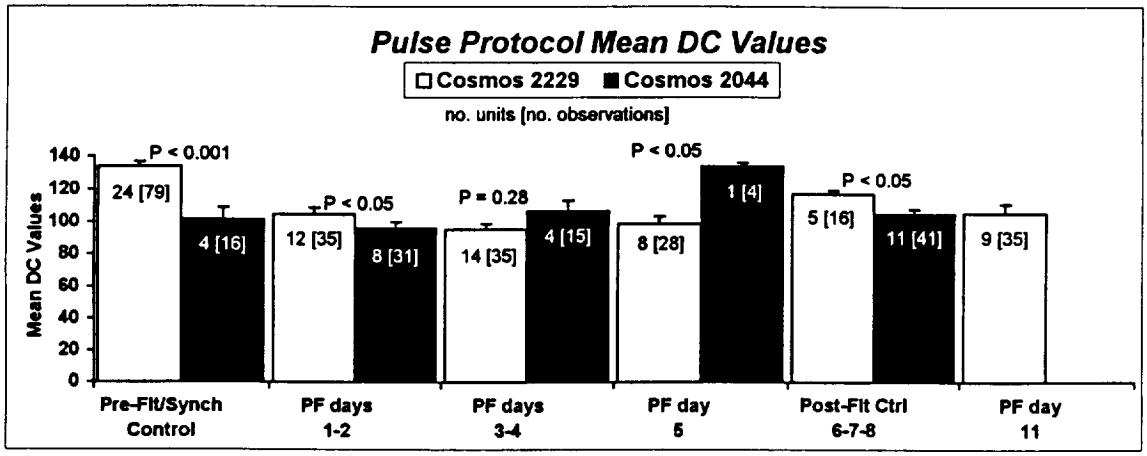
	plot order	COSMOS 2044 k	SEM	no. units	no. observations	COSMOS 2229 k	SEM	no. units	no. observations	Statistical Significance: 2044 vs. 2229	Ctrl. vs. PFDays Cosmos 2044	Ctrl. vs. PFDays Cosmos 2229
Pre-Flt/Synch Ctrls	1	0.1167	0.023	4	16	0.1009	0.010	24	79	*0.4909*		
Days 1-2	2	0.1889	0.020	8	31	0.0793	0.014	12	35	***0.0000*	*0.0506*	*0.2427*
Days 3-4	3	0.1638	0.031	4	15	0.0772	0.010	14	53	**0.0056*	*0.2517*	*0.1731*
Day 5	4	0.1770	0.047	1	4	0.0739	0.009	8	28	**0.0402*	*0.2550*	*0.3709*
Post-Flt Ctrl	5	0.0705	0.014	11	41	0.1060	0.030	5	16	**0.0146*	*0.0792*	*0.6458*
Day 11	6					0.0526	0.009	9	35			***0.0077*

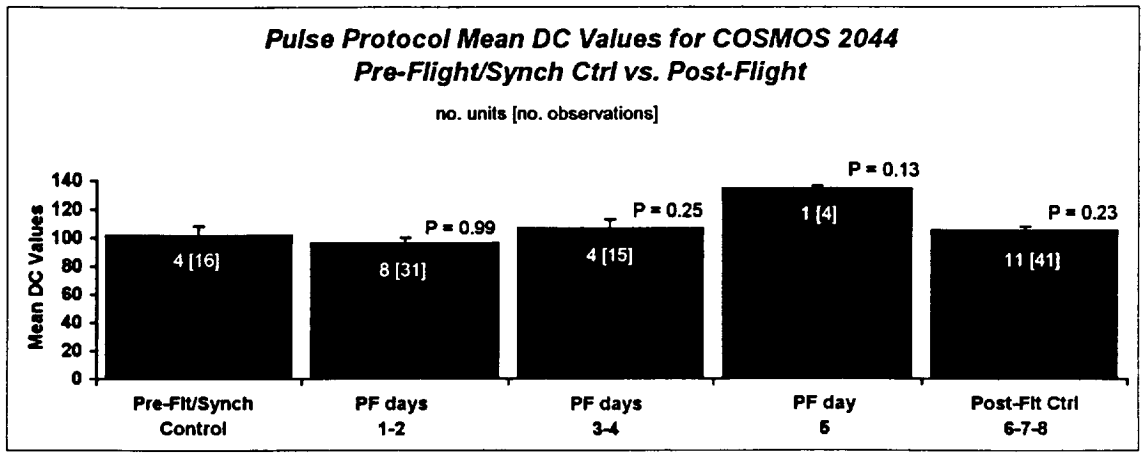


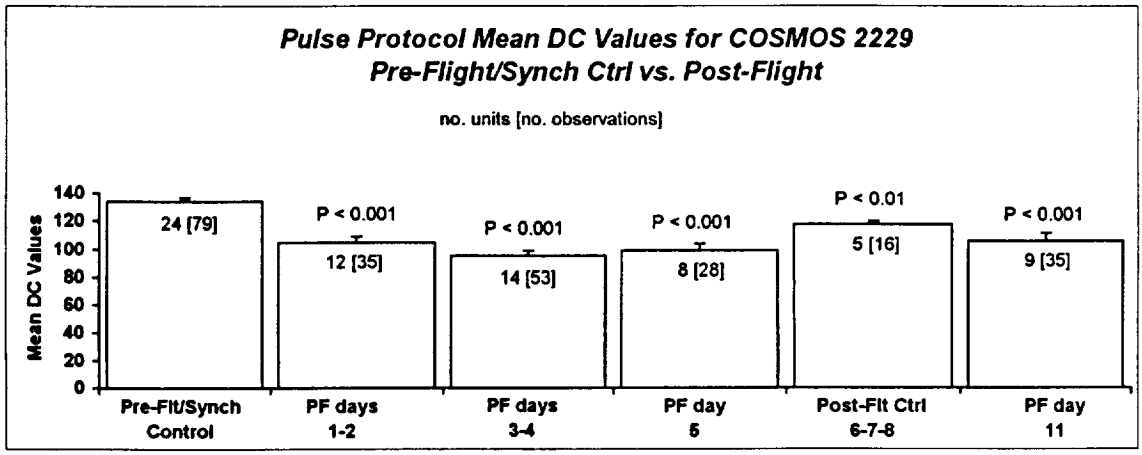

Pulse Protocol Mean k Values for Cosmos 2044
Pre-Flight/Synch Ctrl vs. Post-Flight
no. units [no. observations]
Mean k Values
0.25
0.20
0.15
0.10
0.05
0.00
4 [16]
P = 0.05
8 [31]
P = 0.25
4 [15]
P = 0.26
1 [4]
P = 0.08
11 [41]
Pre-Flt/Synch Controls
PF days 1-2
PF days 3-4
PF day 5
PF Ctrl days 6-7-8


Pulse Protocol Mean k Values for Cosmos 2229
Pre-Flight/Synch Ctrl vs. Post-Flight
no. units [no. observations]
Mean k Values
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
24 [79]
P = 0.24
12 [35]
P = 0.17
14 [53]
P = 0.37
8 [28]
P = 0.65
5 [16]
P < 0.01
9 [35]
Pre-Flt/Synch Controls
PF days 1-2
PF days 3-4
PF day 5
PF Ctrl days 6-7-8
PF day 11

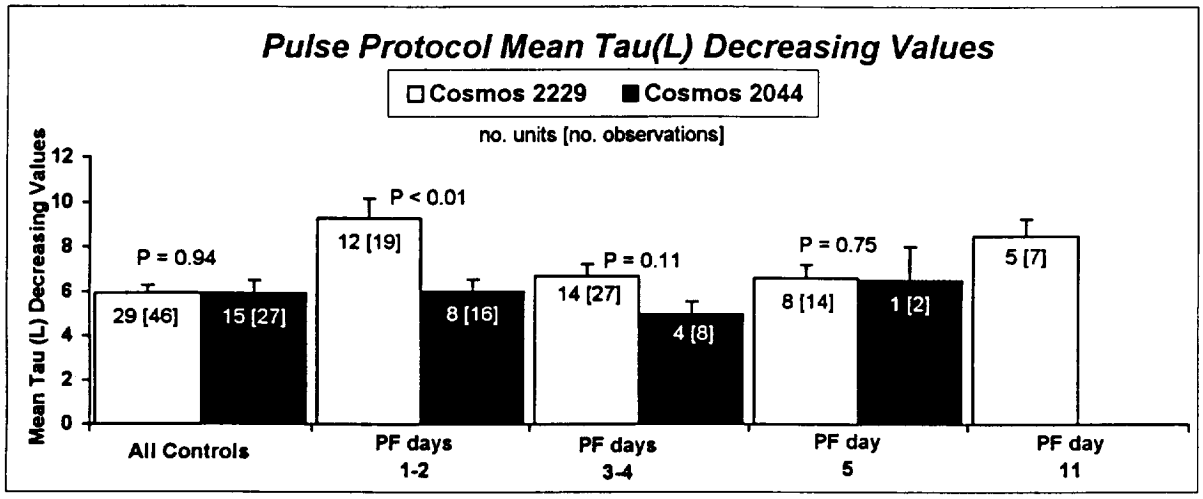
	plot order	COSMOS 2044 DC	COSMOS 2044 SEM	COSMOS 2044 no. units	COSMOS 2044 no. observations	COSMOS 2229 DC	COSMOS 2229 SEM	COSMOS 2229 no. units	COSMOS 2229 no. observations	Statistical Significance: 2044 vs. 2229	Pre- vs. Post-Flt Cosmos 2044	Pre- vs. Post-Flt Cosmos 2229
Pre-Flt/Synch Ctrl	1	101.7738	7.072	4	16	134.0860	2.617	24	79	***0.0001		
Day 1-2	2	96.1805	3.825	8	31	105.0165	4.071	12	35	*0.0215	0.9910	***0.0000
Day 3-4	3	106.9954	6.186	4	15	95.2533	3.817	14	53	0.2770	0.2517	***0.0000
Day 5	4	134.3414	1.982	1	4	98.7476	5.034	8	28	*0.0143	0.1306	***0.0000
Post-Flt Ctrl	5	105.4221	2.838	11	41	117.1660	2.582	5	16	*0.0146	0.2306	**0.0013
Day 11	6					105.6231	5.743	9	35			***0.0000

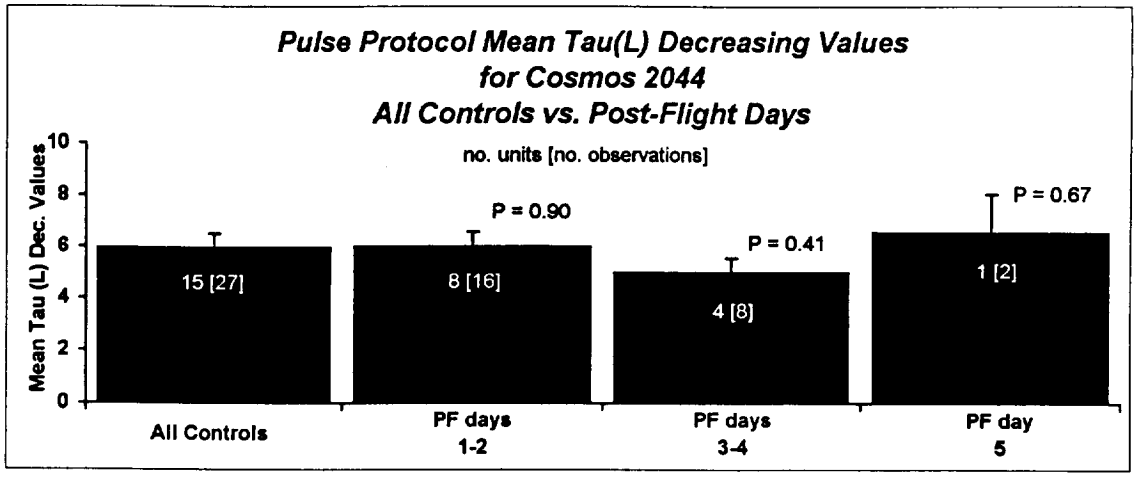


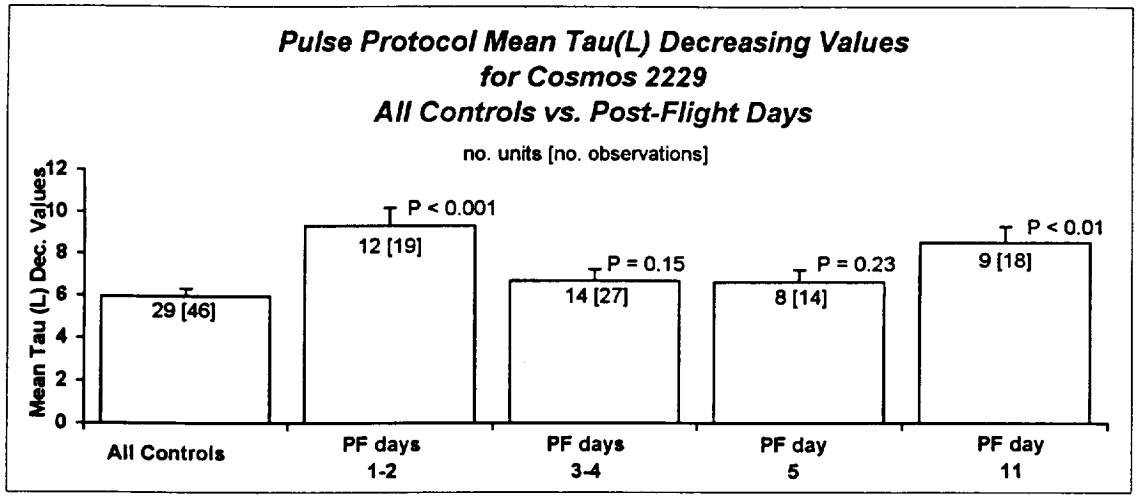

Pulse Protocol Mean DC Values for COSMOS 2044
Pre-Flight/Synch Ctrl vs. Post-Flight
no. units [no. observations]
Mean DC Values
140
120
100
80
60
40
20
0
4 [16]
P = 0.99
8 [31]
P = 0.25
4 [15]
P = 0.13
1 [4]
P = 0.23
11 [41]
Pre-Flt/Synch Control
PF days 1-2
PF days 3-4
PF day 5
Post-Flt Ctrl 6-7-8


Pulse Protocol Mean DC Values for COSMOS 2229
Pre-Flight/Synch Ctrl vs. Post-Flight
no. units [no. observations]
Mean DC Values
140
120
100
80
60
40
20
0
24 [79]
P < 0.001
12 [35]
P < 0.001
14 [53]
P < 0.001
8 [28]
P < 0.01
5 [16]
P < 0.001
9 [35]
Pre-Flt/Synch Control
PF days 1-2
PF days 3-4
PF day 5
Post-Flt Ctrl 6-7-8
PF day 11

	plot order	COSMOS 2044 Tau(L) dec.	SEM	no. units	no. observations	COSMOS 2229 Tau(L) dec.	SEM	no. units	no. observations	Statistical Significance 2044 vs. 2229	Ctrl. vs. PFDays Cosmos 2044	Ctrl. vs. PFDays Cosmos 2229
All Controls	1	5.9404	0.555	15	27	5.9332	0.351	29	46	0.9362		
Day 1-2	2	6.0006	0.562	8	16	9.3065	0.849	12	19	**0.0023	0.9000	***0.0001
Day 3-4	3	4.9870	0.579	4	8	6.6974	0.544	14	27	0.1073	0.4094	0.1499
Day 5	4	6.5457	1.493	1	2	6.6196	0.592	8	14	0.7508	0.6670	0.2278
Day 11	5	***	***	***	***	8.5129	0.770	9	18			**0.0014

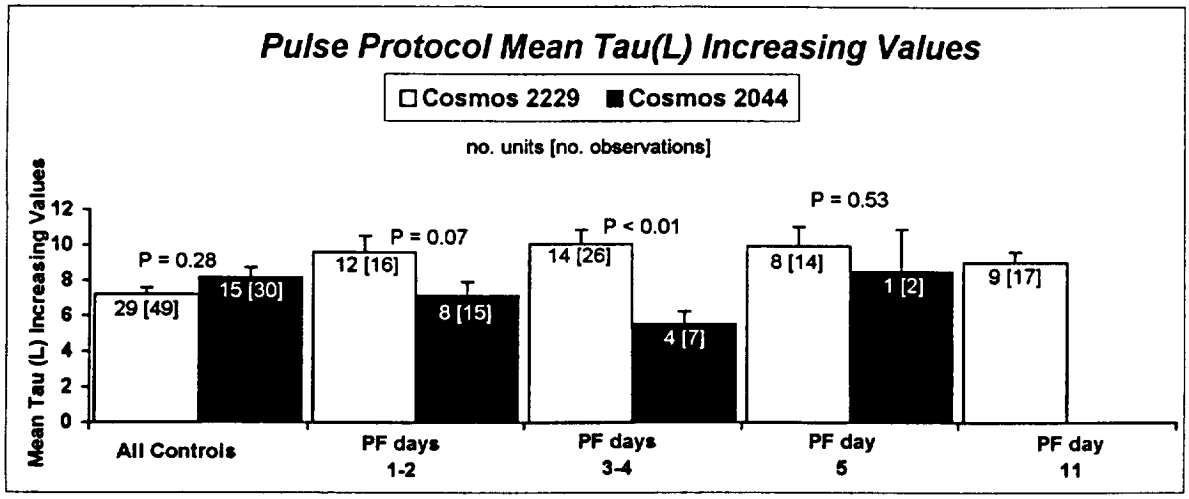


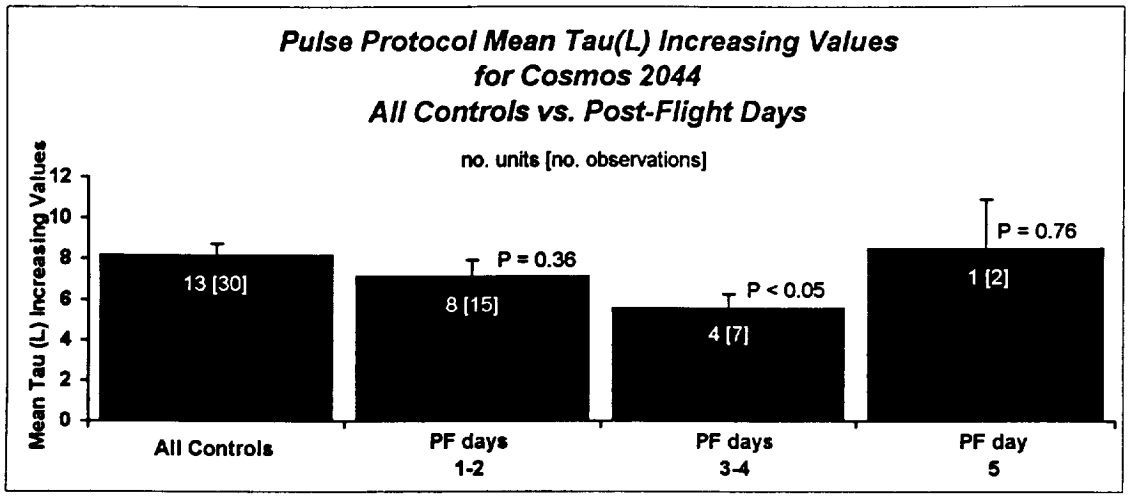

Pulse Protocol Mean Tau(L) Decreasing Values
for Cosmos 2044
All Controls vs. Post-Flight Days
no. units [no. observations]
Mean Tau (L) Dec. Values
0
2
4
6
8
10
15 [27]
8 [16]
4 [8]
1 [2]
P = 0.90
P = 0.41
P = 0.67
All Controls
PF days 1-2
PF days 3-4
PF day 5

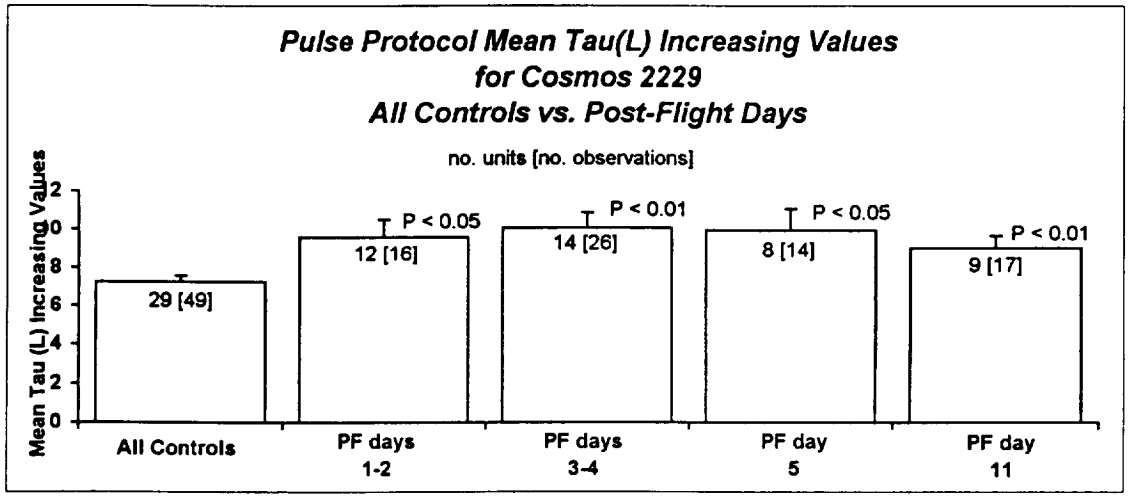

Pulse Protocol Mean Tau(L) Decreasing Values
for Cosmos 2229
All Controls vs. Post-Flight Days
no. units [no. observations]
Mean Tau (L) Dec. Values
0
2
4
6
8
10
12
29 [46]
12 [19]
14 [27]
8 [14]
9 [18]
P < 0.001
P = 0.15
P = 0.23
P < 0.01
All Controls
PF days 1-2
PF days 3-4
PF day 5
PF day 11

Pulse Analysis

	plot order	COSMOS 2044 Tau (L) Inc.	SEM	no. units	no. observations	COSMOS 2229 Tau (L) Inc.	SEM	no. units	no. observations	Statistical Significance: 2044 vs. 2229	Ctrl. vs. PFDays Cosmos 2044	Ctrl. vs. PFDays Cosmos 2229
All Controls	1	8.1546	0.570	15	30	7.2351	0.337	29	49	0.2843		
Day 1-2	2	7.1331	0.767	8	15	9.5870	0.929	12	16	0.069	0.3602	*0.0155
Day 3-4	3	5.5618	0.715	4	7	10.0820	0.784	14	26	**0.0048	*0.0299	**0.0031
Day 5	4	8.4872	2.405	1	2	9.9398	1.122	8	14	0.5254	0.7555	*0.0158
Day 11	5	***	***	***	***	9.0181	0.613	9	17			**0.0057




Pulse Protocol Mean Tau(L) Increasing Values
for Cosmos 2044
All Controls vs. Post-Flight Days
no. units [no. observations]
Mean Tau (L) Increasing Values
0
2
4
6
8
10
12
13 [30]
P = 0.36
8 [15]
P < 0.05
4 [7]
P = 0.76
1 [2]
All Controls
PF days 1-2
PF days 3-4
PF day 5


Pulse Protocol Mean Tau(L) Increasing Values
for Cosmos 2229
All Controls vs. Post-Flight Days
no. units [no. observations]
Mean Tau (L) Increasing Values
0
2
4
6
8
10
12
29 [49]
P < 0.05
12 [16]
P < 0.01
14 [26]
P < 0.05
8 [14]
P < 0.01
9 [17]
All Controls
PF days 1-2
PF days 3-4
PF day 5
PF day 11

Pulse Response Protocol
COSMOS 2044

Pulse Ear Data Reference

	Decreasing Pulse 1	*Increasing Pulse 1*	*Increasing Pulse 2*	*Decreasing Pulse 2*
Left Ear	*Step 1*	*Step 2*	*Step 3*	*Step 4*
Right Ear	*Step 2*	*Step 1*	*Step 4*	*Step 3*

TABLE XX

COSMOS 2044 Pre-Flight Control (07/23/89-08/02/89)

number of units: 4

Pulse Response				*Decreasing Pulse 1*				*Increasing Pulse 1*				*Increasing Pulse 2*				*Decreasing Pulse 2*				*Average Decreasing*				*Average Increasing*			
Monkey	Unit	File	Ear	Gain	K	Tau L	DC	Gain	K	Tau L	DC	Gain	K	Tau L	DC	Gain	K	Tau L	DC	Gain	K	Tau L	DC	Gain	K	Tau L	DC
2483	6	m2483m37	L	1.3149	0.0000	2.1422	76.5792	0.9143	0.3039	9.6990	80.0000	0.9114	0.2296	5.1297	76.3429	0.9094	0.0588	1.5954	68.0881	1.1122	0.0294	1.8688	72.3337	0.9129	0.2668	7.4144	78.1715
782	1	m782m013	R	0.3764	0.1388	4.8025	92.0427	0.3431	0.1081	13.6075	96.9355	0.4734	0.0594	9.9058	93.0000	0.4296	0.1372	8.6922	94.4665	0.4030	0.1380	6.7474	93.2546	0.4083	0.0838	11.7567	94.9678
	2	m782m025	R	0.4709	0.1717	6.8522	145.5444	0.4731	0.2014	13.8062	146.0000	0.4941	0.0860	4.0336	151.6752	0.4992	0.1824	9.2075	146.1608	0.4851	0.1771	8.0299	145.8526	0.4836	0.1437	8.9199	148.8376
774	2	m774m019	R	0.1494	0.0000	3.2839	87.9727	0.1476	0.0000	7.7689	90.3075	0.1199	0.0000	3.1618	93.2652	0.1703	0.1902	14.7509	90.0000	0.1599	0.0951	9.0174	88.9864	0.1338	0.0000	5.4654	91.7864
STATISTICS				Gain	K	Tau L	DC	Gain	K	Tau L	DC	Gain	K	Tau L	DC	Gain	K	Tau L	DC	Gain	K	Tau L	DC	Gain	K	Tau L	DC
		mean		0.5779	0.0776	4.2702	100.5348	0.4695	0.1534	11.2204	103.3108	0.4997	0.0938	5.5577	103.5708	0.5021	0.1422	8.5615	99.6789	0.5400	0.1099	*6.4159*	100.1068	0.4846	0.1236	*8.3891*	103.4408
		st. dev.		0.510	0.091	2.037	30.712	0.325	0.130	2.978	29.300	0.324	0.097	3.008	33.032	0.306	0.060	5.394	33.063	0.391	0.079	*4.417*	29.545	0.301	0.111	*4.104*	28.906
		n		4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	8	8	*8*	8	8	8	*8*	8
		sem		0.255	0.045	1.019	15.356	0.163	0.065	1.489	14.650	0.162	0.049	1.504	16.516	0.153	0.030	2.697	16.531	0.138	0.028	*1.562*	10.448	0.106	0.039	*1.451*	10.220
																							total mean	0.5123	0.1167	7.4025	101.7738
																							st. dev.	0.338	0.093	4.243	28.289
																							n	16	16	16	16
																							sem	0.085	0.023	1.061	7.072

TABLE XX

COSMOS 2044 Post-Flight Day 1 (09/29/89)

number of units: 6

Pulse Response				*Decreasing Pulse 1*				*Increasing Pulse 1*				*Increasing Pulse 2*				*Decreasing Pulse 2*				*Average Decreasing*				*Average Increasing*			
Monkey	Unit	File	Ear	Gain	K	Tau L	DC	Gain	K	Tau L	DC	Gain	K	Tau L	DC	Gain	K	Tau L	DC	Gain	K	Tau L	DC	Gain	K	Tau L	DC
2483	2	a83anc02	L	***	***	***	***	***	***	***	***	***	***	***	***					***	***	***	***	***	***	***	***
	5	m2483m40	L	1.2276	0.1806	3.3631	92.7486	0.9443	0.2920	5.9504	94.2712	0.9033	0.2876	6.8559	91.5773	0.9736	0.2482	5.4534	90.0000	1.1006	0.2144	4.4083	91.3743	0.9238	0.2898	6.4032	92.9243
782	3	a82and03	R	1.0950	0.1828	4.0016	125.3732	0.8626	0.3370	8.8430	135.0000	0.8668	0.2196	2.9038	140.9206	1.1751	0.3415	6.7672	126.0134	1.1351	0.2622	5.3844	125.6933	0.8647	0.2783	5.8734	137.9603
	4	a82anb04	R	0.5940	0.0000	4.5126	110.2716	0.6958	0.0629	4.2010	113.5936					0.3870	0.1341	3.5965	95.7135	0.4905	0.0671	4.0546	102.9926	0.6958	0.0629	4.2010	113.5936
	5	a82anb05	R	0.3913	0.0640	5.9773	84.7106	0.4143	0.0979	8.6729	85.1466	0.3776	0.0489	4.4703	86.8376	0.3669	0.0665	6.8350	83.3294	0.3791	0.0653	6.4082	84.0200	0.3960	0.0734	6.5716	85.9921
	6	a82anb06	R	0.5312	0.2962	7.8934	100.0000	0.5660	0.1405	10.4512	102.5355	0.6783	0.1287	5.6974	95.0000	0.4977	0.2703	9.6385	100.0000	0.5145	0.2833	8.7660	100.0000	0.6222	0.1346	8.0743	98.7678
	7	a82anb07	R	1.1518	0.1766	4.8030	83.6300	1.2036	0.2779	8.8351	86.0537	1.2996	0.2956	3.6459	105.0000	1.1115	0.1659	6.1702	86.1321	1.1317	0.1713	5.4866	84.8811	1.2516	0.2868	6.2405	95.5269
STATISTICS				Gain	K	Tau L	DC	Gain	K	Tau L	DC	Gain	K	Tau L	DC	Gain	K	Tau L	DC	Gain	K	Tau L	DC	Gain	K	Tau L	DC
		mean		0.8318	0.1500	5.0918	99.4557	0.7811	0.2014	7.8256	102.7668	0.8251	0.1961	4.7147	103.8671	0.7520	0.2044	6.4101	96.8647	0.7919	0.1772	*5.7510*	98.1602	0.8011	0.1990	*6.4115*	103.2669
		st. dev.		0.366	0.104	1.627	16.136	0.283	0.115	2.294	19.069	0.337	0.106	1.584	21.760	0.375	0.100	1.981	15.533	0.356	0.102	*1.860*	15.161	0.293	0.105	*2.505*	19.275
		n		6	6	6	6	6	6	6	6	5	5	5	5	6	6	6	6	12	12	*12*	12	11	11	*11*	11
		sem		0.149	0.042	0.664	6.587	0.115	0.047	0.937	7.785	0.151	0.047	0.708	9.731	0.153	0.041	0.809	6.341	0.103	0.029	*0.537*	4.377	0.088	0.032	*0.755*	5.812
																							total mean	0.7963	0.1876	6.0660	100.6025
																							st. dev.	0.320	0.102	2.167	17.047
																							n	23	23	23	23
																							sem	0.067	0.021	0.452	3.555

Pulse Response Protocol
COSMOS 2044

TABLE XX

COSMOS 2044 Post-Flight Day 2 (09/30/89)

number of units: 2

Pulse Response				*Decreasing Pulse 1*				*Increasing Pulse 1*				*Increasing Pulse 2*				*Decreasing Pulse 2*				*Average Decreasing*				*Average Increasing*			
Monkey	Unit	File	Ear	Gain	K	Tau L	DC	Gain	K	Tau L	DC	Gain	K	Tau L	DC	Gain	K	Tau L	DC	Gain	K	Tau L	DC	Gain	K	Tau L	DC
782	2	a82anb09	R	0.5623	0.2955	11.5784	110.0000	0.5512	0.4409	6.6714	120.0000	0.8707	0.3024	5.3663	100.1446	0.7031	0.1315	3.7112	106.1926	0.6327	0.2135	7.6448	108.0963	0.7110	0.3717	6.0189	110.0723
	3	a82anb10	R	0.6883	0.0114	6.4298	60.1017	0.8653	0.1726	12.4370	58.0000	0.9602	0.1861	11.9946	57.3669	0.7140	0.0000	5.2786	55.9318	0.7012	0.0057	5.8542	58.0168	0.9128	0.1794	12.2158	57.6835
2483	4	a83anb09	L																								
STATISTICS				Gain	K	Tau L	DC	Gain	K	Tau L	DC	Gain	K	Tau L	DC	Gain	K	Tau L	DC	Gain	K	Tau L	DC	Gain	K	Tau L	DC
			mean	0.6253	0.1535	9.0041	85.0509	0.7083	0.3068	9.5542	89.0000	0.9155	0.2443	8.6805	78.7558	0.7086	0.0658	4.4949	81.0622	0.6669	0.1096	*6.7495*	83.0565	0.8119	0.2755	*9.1173*	83.8779
			st. dev.	0.089	0.201	3.641	35.283	0.222	0.190	4.077	43.841	0.063	0.082	4.687	30.248	0.008	0.093	1.108	35.540	0.071	0.137	*3.407*	29.005	0.179	0.125	*3.622*	31.315
			n	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	4	4	*4*	4	4	4	*4*	4
			sem	0.063	0.142	2.574	24.949	0.157	0.134	2.883	31.000	0.045	0.058	3.314	21.389	0.005	0.066	0.784	25.130	0.035	0.069	*1.703*	14.503	0.090	0.062	*1.811*	15.658
																							total mean	0.7394	0.1926	7.9334	83.4672
																							st. dev.	0.148	0.150	3.492	27.947
																							n	8	8	8	8
																							sem	0.052	0.053	1.235	9.881

TABLE XX

COSMOS 2044 Post-Flight Days 1,2 (09/29/89,09/30/89)

number of units: 8

Pulse Response	*Decreasing Pulse 1*				*Increasing Pulse 1*				*Increasing Pulse 2*				*Decreasing Pulse 2*				*Average Decreasing*				*Average Increasing*			
STATISTICS	Gain	K	Tau L	DC	Gain	K	Tau L	DC	Gain	K	Tau L	DC	Gain	K	Tau L	DC	Gain	K	Tau L	DC	Gain	K	Tau L	DC
mean	0.7802	0.1509	6.0699	95.8545	0.7629	0.2277	8.2578	99.3251	0.8509	0.2098	5.8477	96.6924	0.7411	0.1698	5.9313	92.9141	0.7607	0.1603	*6.0006*	94.3843	0.8040	0.2194	*7.1331*	98.0965
st. dev.	0.325	0.116	2.658	20.206	0.256	0.130	2.603	23.978	0.280	0.096	3.013	24.865	0.318	0.112	1.940	20.156	0.311	0.111	*2.249*	19.556	0.261	0.112	*2.971*	23.543
n	8	8	8	8	8	8	8	8	7	7	7	7	8	8	8	8	16	16	*16*	16	15	15	*15*	15
sem	0.115	0.041	0.940	7.144	0.090	0.046	0.920	8.477	0.106	0.036	1.139	9.398	0.112	0.040	0.686	7.126	0.078	0.028	*0.562*	4.889	0.067	0.029	*0.767*	6.079
																				total mean	0.7816	0.1889	8.6488	96.1805
																				st. dev.	0.2843	0.1134	2.6418	21.2943
																				n	31	31	31	31
																				sem	0.051	0.020	0.474	3.825

TABLE XX

COSMOS 2044 Post-Flight Day 4 (10/02/89)

number of units: 4

Pulse Response				*Decreasing Pulse 1*				*Increasing Pulse 1*				*Increasing Pulse 2*				*Decreasing Pulse 2*				*Average Decreasing*				*Average Increasing*			
Monkey	Unit	File	Ear	Gain	K	Tau L	DC	Gain	K	Tau L	DC	Gain	K	Tau L	DC	Gain	K	Tau L	DC	Gain	K	Tau L	DC	Gain	K	Tau L	DC
782	1	a82an13c	R	1.0422	0.2933	3.6525	137.5574	0.9209	0.0000	3.1560	141.4602	1.1223	0.4052	4.4570	150.6433	1.2560	0.3572	5.6754	141.5051	1.1491	0.3253	4.6640	139.5313	1.0216	0.2026	3.8065	146.0518
	2	m782mb09	R	0.5117	0.1487	3.1212	79.1615	0.5353	0.0445	5.4145	88.1918					0.3791	0.1431	4.4232	77.4652	0.4454	0.1459	3.7722	78.3134	0.5353	0.0445	5.4145	88.1918
	8	a82an19c	R	0.6413	0.1924	7.9714	102.0000	0.7440	0.1375	8.9165	101.9291	0.7031	0.0519	7.1071	95.0000	0.6892	0.1344	6.0362	101.4789	0.6553	0.1634	7.0038	101.7395	0.7236	0.0947	8.0118	98.4646
	11	a82an22c	R	1.5092	0.0176	3.4493	94.4673	1.7254	0.2153	4.7950	88.4138	1.3303	0.1948	5.0863	108.1643	1.3877	0.1206	5.5666	97.4937	1.4385	0.0691	4.5080	95.9805	1.5279	0.2051	4.9407	98.2891
STATISTICS				Gain	K	Tau L	DC	Gain	K	Tau L	DC	Gain	K	Tau L	DC	Gain	K	Tau L	DC	Gain	K	Tau L	DC	Gain	K	Tau L	DC
			mean	0.9261	0.1630	4.5486	103.2966	0.9814	0.0993	5.5705	104.9987	1.0519	0.2173	5.5501	117.9359	0.9180	0.1888	5.4254	104.4857	0.9221	0.1759	*4.9870*	103.8911	1.0116	0.1499	*5.5618*	110.5432
			st. dev.	0.450	0.114	2.292	24.738	0.520	0.096	2.426	25.142	0.319	0.178	1.385	29.080	0.472	0.113	0.698	26.823	0.427	0.106	*1.637*	23.896	0.413	0.138	*1.892*	25.412
			n	4	4	4	4	4	4	4	4	3	3	3	3	4	4	4	4	8	8	*8*	8	7	7	7	7
			sem	0.225	0.057	1.146	12.369	0.260	0.048	1.213	12.571	0.184	0.103	0.799	16.789	0.236	0.056	0.349	13.412	0.151	0.037	*0.579*	8.449	0.156	0.052	*0.715*	9.605
																							total mean	0.9638	0.1638	5.2562	106.9954
																							st. dev.	0.4080	0.1183	1.7213	23.9599
																							n	15	15	15	15
																							sem	0.105	0.031	*0.444*	6.186

Pulse Response Protocol
COSMOS 2044

TABLE XX

COSMOS 2044 Post-Flight Day 5 (10/03/89)

number of units: 1

Pulse Response				*Decreasing Pulse 1*				*Increasing Pulse 1*				*Increasing Pulse 2*				*Decreasing Pulse 2*				*Average Decreasing*				*Average Increasing*			
Monkey	Unit	File	Ear	Gain	K	Tau L	DC	Gain	K	Tau L	DC	Gain	K	Tau L	DC	Gain	K	Tau L	DC	Gain	K	Tau L	DC	Gain	K	Tau L	DC
782	3	a82an27e	R	0.4635	0.2487	8.0386	135.0000	0.5401	0.2411	10.8917	139.2302	0.6166	0.0465	6.0826	129.6399	0.4727	0.1716	5.0527	133.4955	0.4681	0.2102	6.5457	134.2478	0.5784	0.1438	8.4872	134.4351
STATISTICS				Gain	K	Tau L	DC	Gain	K	Tau L	DC	Gain	K	Tau L	DC	Gain	K	Tau L	DC	Gain	K	Tau L	DC	Gain	K	Tau L	DC
			mean	0.4635	0.2487	8.0386	135.0000	0.5401	0.2411	10.8917	139.2302	0.6166	0.0465	6.0826	129.6399	0.4727	0.1716	5.0527	133.4955	0.4681	0.2102	*6.5457*	134.2478	0.5784	0.1438	*8.4872*	134.4351
			st. dev.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.007	0.055	*2.111*	1.064	0.054	0.138	*3.401*	6.781
			n	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	*2*	2	2	2	*2*	2
			sem	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.005	0.039	*1.493*	0.752	0.038	0.097	*2.405*	4.795
			total mean																					0.5232	0.1770	*7.6184*	134.3414
			st. dev.																					0.0710	0.0936	*2.5686*	3.9646
			n																					4	4	*4*	4
			sem																					0.036	0.047	*1.284*	1.982

TABLE XX

COSMOS 2044 Post-Flight Day 6 Control (10/04/89)

number of units: 5

Pulse Response				*Decreasing Pulse 1*				*Increasing Pulse 1*				*Increasing Pulse 2*				*Decreasing Pulse 2*				*Average Decreasing*				*Average Increasing*			
Monkey	Unit	File	Ear	Gain	K	Tau L	DC	Gain	K	Tau L	DC	Gain	K	Tau L	DC	Gain	K	Tau L	DC	Gain	K	Tau L	DC	Gain	K	Tau L	DC
774	1	a74an01b	L																								
	2	a74an02*	L	0.5419	0.1454	6.8231	126.1586	0.7781	0.2246	10.7187	118.5010	0.6055	0.2394	5.6291	128.7241	0.6496	0.1195	8.0655	120.0000	0.5958	0.1325	7.4443	123.0793	0.6918	0.2320	8.1739	123.6126
	3	a74an03c	L																								
	4	a74an04c	L	0.3789	0.0294	10.8650	108.6520	0.3854	0.0826	10.9921	108.0000	0.5041	0.0321	14.0682	101.5135	***	***	***	***	0.3789	0.0294	10.8650	108.6520	0.4448	0.0574	12.5302	104.7568
	7	a74anb07	L	0.1802	0.0318	6.6112	90.2290	0.1883	0.0270	9.0409	91.9409	0.2084	0.0495	7.9772	92.6936	0.1892	0.0000	5.3114	90.0000	0.1847	0.0159	5.9613	90.1145	0.1984	0.0383	8.5091	92.3173
	9	a74an09c	L	0.2647	0.0898	3.5868	100.3454	0.2362	0.0825	8.5915	105.0000	0.3230	0.0262	5.4809	106.1138					0.2647	0.0898	3.5868	100.3454	0.2796	0.0544	7.0362	105.5569
	13	a74anc13	L																								
	15	a74an15c	L																								
	16	a74anc16	L																								
	17	a74an17*	L	0.1954	0.0484	7.7480	87.9995	0.2729	0.0000	10.7867	86.3682	0.2497	0.0058	6.4222	89.6608	0.2266	0.0010	3.6376	88.2434	0.2110	0.0247	5.6928	88.1215	0.2613	0.0029	8.6044	88.0145
STATISTICS				Gain	K	Tau L	DC	Gain	K	Tau L	DC	Gain	K	Tau L	DC	Gain	K	Tau L	DC	Gain	K	Tau L	DC	Gain	K	Tau L	DC
			mean	0.3122	0.0690	7.1268	102.2769	0.3722	0.0833	10.0260	101.9620	0.3781	0.0706	7.9155	103.7412	0.3551	0.0402	5.6715	99.4145	0.3283	0.0582	*6.5811*	101.2035	0.3752	0.0770	*8.9707*	102.8516
			st. dev.	0.150	0.049	2.610	15.348	0.238	0.087	1.120	12.873	0.170	0.096	3.579	15.452	0.256	0.089	2.236	17.849	0.179	0.054	*2.427*	15.094	0.195	0.086	*2.737*	13.440
			n	5	5	5	5	5	5	5	5	5	5	5	5	3	3	3	3	8	8	*8*	8	10	10	*10*	10
			sem	0.067	0.022	1.167	6.864	0.107	0.039	0.501	5.757	0.076	0.043	1.601	6.910	0.148	0.040	1.291	10.305	0.0634	0.0192	*0.8579*	5.3365	0.0617	0.0273	*0.8654*	4.2502
			total mean																					0.3543	0.0686	*7.9082*	102.1191
			st. dev.																					0.1843	0.0725	*2.8075*	13.7896
			n																					18	18	*18*	18
			sem																					0.043	0.017	*0.662*	3.250

TABLE XX

COSMOS 2044 Post-Flight Day 7 Control (10/05/89) — *number of units: 5*

Pulse Response				*Decreasing Pulse 1*				*Increasing Pulse 1*				*Increasing Pulse 2*				*Decreasing Pulse 2*				*Average Decreasing*				*Average Increasing*			
Monkey	Unit	File	Ear	Gain	K	Tau L	DC	Gain	K	Tau L	DC	Gain	K	Tau L	DC	Gain	K	Tau L	DC	Gain	K	Tau L	DC	Gain	K	Tau L	DC
774	1	a74an18*	L	0.3288	0.0328	5.5758	92.0471	0.3462	0.0032	5.3182	93.0846	0.3643	0.0370	6.8894	92.9026	0.2934	0.0431	4.7743	88.8988	0.3111	0.0380	5.1750	90.4729	0.3553	0.0201	6.1038	92.9936
	2	a74an19*	L	0.3849	0.0807	2.0364	96.9763	0.5678	0.0749	7.7263	83.4755	0.6118	0.0000	4.1180	80.7904	0.5317	0.0613	6.4399	84.0854	0.4583	0.0710	4.2381	90.5308	0.5898	0.0374	5.9221	82.1330
	5	a74anc22	L	0.4499	0.0000	3.0790	135.0660	0.4726	0.0000	4.1685	140.3780	0.6250	0.0393	7.8517	135.7231	0.4904	0.0000	5.6827	138.5094	0.4702	0.0000	4.3809	136.7877	0.5488	0.0197	6.0101	138.0506
	6	a74and23	L	0.6986	0.1144	6.5417	103.6759	0.7995	0.3341	11.9037	100.0000	0.5485	0.1283	12.2375	93.7810	0.4695	0.4238	7.5655	95.0000	0.5841	0.2691	7.0536	99.3380	0.6740	0.2312	12.0706	96.8905
	7	a74anc24	L	0.4122	0.0587	5.6305	130.8758	0.5669	0.0834	9.4932	134.0000	0.5935	0.0206	7.2359	132.5151	0.4943	0.0000	3.7607	132.1812	0.4533	0.0294	4.6956	131.5285	0.5802	0.0520	8.3648	133.2576
2592	1	a92anc01	R	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
STATISTICS				Gain	K	Tau L	DC	Gain	K	Tau L	DC	Gain	K	Tau L	DC	Gain	K	Tau L	DC	Gain	K	Tau L	DC	Gain	K	Tau L	DC
		mean		0.4549	0.0573	4.5727	111.7282	0.5506	0.0991	7.7220	110.1876	0.5486	0.0450	7.6665	107.1424	0.4559	0.1056	5.6446	107.7350	0.4554	0.0815	*5.1086*	109.7316	0.5496	0.0721	*7.6942*	108.6650
		st. dev.		0.143	0.044	1.915	19.881	0.166	0.137	3.124	25.438	0.107	0.049	2.929	25.181	0.094	0.180	1.469	25.598	0.114	0.126	*1.705*	21.710	0.132	0.101	*2.855*	23.916
		n		5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	10	10	*10*	10	10	10	*10*	10
		sem		0.064	0.020	0.856	8.891	0.074	0.061	1.397	11.376	0.048	0.022	1.310	11.261	0.042	0.080	0.657	11.448	0.036	0.040	*0.539*	6.865	0.042	0.032	*0.903*	7.563
																							total mean	0.5025	0.0768	6.4014	109.1983
																							st. dev.	0.129	0.111	2.649	22.237
																							n	20	20	20	20
																							sem	0.029	0.025	0.591	4.972

TABLE XX

COSMOS 2044 Post-Flight Day 8 Control (10/06/89) — *number of units: 1*

Pulse Response				*Decreasing Pulse 1*				*Increasing Pulse 1*				*Increasing Pulse 2*				*Decreasing Pulse 2*				*Average Decreasing*				*Average Increasing*			
Monkey	Unit	File	Ear	Gain	K	Tau L	DC	Gain	K	Tau L	DC	Gain	K	Tau L	DC	Gain	K	Tau L	DC	Gain	K	Tau L	DC	Gain	K	Tau L	DC
774	17	m774mg39	L	0.2855	0.0594	5.3299	96.9077	0.3171	0.0251	5.2857	101.4879	0.3445	0.0347	5.5887	101.7989	***	***	***	***	0.2855	0.0594	5.3299	96.9077	0.3308	0.0299	5.4372	101.6434
STATISTICS				Gain	K	Tau L	DC	Gain	K	Tau L	DC	Gain	K	Tau L	DC	Gain	K	Tau L	DC	Gain	K	Tau L	DC	Gain	K	Tau L	DC
		mean		0.2855	0.0594	5.3299	96.9077	0.3171	0.0251	5.2857	101.4879	0.3445	0.0347	5.5887	101.7989	***	***	***	***	0.2855	0.0594	*5.3299*	96.9077	0.3308	0.0299	*5.4372*	101.6434
		st. dev.		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	***	***	***	***	0.000	0.000	0.000	0.000	0.019	0.007	*0.214*	0.220
		n		1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	1	1	*1*	1	2	2	*2*	2
		sem		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	***	***	***	***	0.000	0.000	*0.000*	0.000	0.014	0.005	*0.151*	0.156
																							total mean	0.3157	0.0397	5.4014	100.0648
																							st. dev.	0.030	0.018	0.164	2.739
																							n	3	3	3	3
																							sem	0.017	0.010	0.094	1.581

TABLE XX

COSMOS 2044 All Post-Flight Controls (10/04/89-10/06/89) — *number of units: 11*

Pulse Response		*Decreasing Pulse 1*				*Increasing Pulse 1*				*Increasing Pulse 2*				*Decreasing Pulse 2*				*Average Decreasing*				*Average Increasing*			
STATISTICS		Gain	K	Tau L	DC	Gain	K	Tau L	DC	Gain	K	Tau L	DC	Gain	K	Tau L	DC	Gain	K	Tau L	DC	Gain	K	Tau L	DC
mean		0.3746	0.0628	5.8025	108.0848	0.4483	0.0852	8.5478	105.6578	0.4526	0.0557	7.5908	105.1106	0.4181	0.0811	5.6547	104.6148	0.3929	0.0705	*5.7403*	105.4659	0.4504	0.0705	8.0693	105.3842
st. dev.		0.152	0.042	2.418	16.850	0.209	0.105	2.627	18.546	0.157	0.070	3.002	18.795	0.162	0.145	1.631	22.000	0.154	0.096	*2.071*	18.615	0.180	0.088	2.796	18.223
n		11	11	11	11	11	11	11	11	11	11	11	11	8	8	8	8	19	19	*19*	19	22	22	22	22
sem		0.046	0.013	0.729	5.080	0.063	0.032	0.792	5.592	0.047	0.021	0.905	5.667	0.057	0.051	0.577	7.778	0.035	0.022	*0.475*	4.271	0.038	0.019	0.596	3.885
																					total mean	0.4238	0.0705	6.9800	105.4221
																					st. dev.	0.169	0.091	2.722	18.173
																					n	41	41	41	41
																					sem	0.026	0.014	0.425	2.838

TABLE XX

COSMOS 2044 All Controls

number of units: 15

Pulse Response		*Decreasing Pulse 1*				*Increasing Pulse 1*				*Increasing Pulse 2*				*Decreasing Pulse 2*				*Average Decreasing*				*Average Increasing*			
STATISTICS		Gain	K	Tau L	DC	Gain	K	Tau L	DC	Gain	K	Tau L	DC	Gain	K	Tau L	DC	Gain	K	Tau L	DC	Gain	K	Tau L	DC
	mean	0.4288	0.0668	5.3939	104.6048	0.4539	0.1034	9.2605	105.0319	0.4651	0.0659	7.0486	104.7000	0.4461	0.1014	6.6236	102.9695	0.4365	0.0822	*5.9404*	103.8780	0.4595	0.0846	*8.1546*	104.8660
	st. dev.	0.284	0.055	2.357	20.282	0.232	0.111	2.886	20.756	0.201	0.076	3.040	22.059	0.210	0.123	3.417	24.739	0.250	0.092	*2.884*	21.935	0.214	0.096	*3.122*	21.046
number	*n*	15	15	15	15	15	15	15	15	15	15	15	15	12	12	12	12	27	27	27	27	30	30	*30*	30
of units: 2	*sem*	0.073	0.014	0.609	5.237	0.060	0.029	0.745	5.359	0.052	0.020	0.785	5.696	0.061	0.036	0.986	7.142	0.048	0.018	*0.555*	4.221	0.039	0.017	*0.570*	3.842
																					total mean	0.4486	0.0835	*7.1058*	104.3980
																					st. dev.	0.230	0.093	*3.187*	21.284
																					n	57	57	*57*	57
																					sem	0.030	0.012	*0.422*	2.819

Pulse Response
COSMOS 2229

TABLE 1

COSMOS 2229 Pre-Flight (10-17-92 & 11-14-92 to 12-9-93) — *number of units: 15*

Pulse Response		*Curve 1 - Decreasing*				*Curve 2 - Increasing*				*Curve 3 - Increasing*				*Curve 4 - Decreasing*				*Average Decreasing*				*Average Increasing*			
ear	*FILENAME*	GAIN	K	τ	DC	GAIN	K	τ	DC	GAIN	K	τ	DC	GAIN	K	τ	DC	GAIN	K	τ	DC	GAIN	K	τ	DC
L	01o1702a	0.4155	0.0862	7.133	101.5656	0.3920	0.0163	6.578	102.8482	0.4507	0.0000	8.430	101.2178	0.3642	0.0715	5.400	99.3186	0.3899	0.0789	6.266	100.4421	0.4214	0.0082	7.504	102.0330
L	03a1401a	1.3627	0.0950	4.996	187.0614	1.5049	0.0227	6.475	157.1269	1.0146	0.0629	9.851	159.6976	1.5132	0.1339	6.122	172.0104	1.4380	0.1145	5.559	179.5359	1.2598	0.0428	8.163	158.4123
L	03a1402*	***	***	***	***	2.0630	0.1852	9.668	97.3200	2.0281	0.1699	8.507	97.3960	***	***	***	***	***	***	***	***	2.0456	0.1776	9.088	97.3580
L	03a1406a	1.1385	0.2732	8.805	155.2615	***	***	***	***	***	***	***	***	***	***	***	***	1.1385	0.2732	8.805	155.2615	***	***	***	***
L	03a1407a	0.6630	0.0000	4.462	143.2517	0.7342	0.0221	6.028	142.1191	0.6069	0.0192	5.027	145.4593	0.6480	0.0387	5.565	143.9785	0.6555	0.0194	5.013	143.6151	0.6706	0.0207	5.527	143.7892
R	61a1501a	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
L	75a1504*	***	***	***	***	1.5919	0.1805	9.162	62.1014	1.2940	0.2823	6.015	68.9665	***	***	***	***	***	***	***	***	1.4430	0.2314	7.589	65.5340
L	07a1601a	1.1016	0.2464	6.352	125.0365	1.4272	0.3095	6.958	122.3001	1.4104	0.2913	5.722	129.9503	1.1573	0.2511	7.564	117.3962	1.1295	0.2488	6.958	121.2164	1.4188	0.3004	6.340	126.1252
L	07a1602*	0.6546	0.0905	6.039	164.0605	0.7506	0.1128	5.312	165.0574	0.7831	0.1914	8.110	161.4796	0.6287	0.0630	4.730	160.4669	0.6417	0.0768	5.384	162.2637	0.7669	0.1521	6.711	163.2685
L	07a1603*	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
L	07a1606a	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
L	07a1607a	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
L	07a1608a	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
L	07a1610*	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
L	07a1611*	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
L	07a1612a	0.5397	0.0562	6.324	140.9330	0.6254	0.0512	12.757	135.8798	0.6024	0.1319	12.454	139.0757	0.4524	0.0535	8.120	136.0342	0.4961	0.0549	7.222	138.4836	0.6139	0.0916	12.606	137.4778
L	01a1601*	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
L	01a1602*	0.5880	0.0741	6.395	143.9039	0.5512	0.0808	10.080	140.9534	0.4983	0.1281	11.705	142.7787	0.5395	0.0356	4.358	137.9318	0.5638	0.0549	5.377	140.9179	0.5248	0.1044	10.892	141.8661
L	01a1603a	0.3152	0.0000	5.700	111.4161	0.3230	0.0000	9.339	110.1967	0.3343	0.0000	8.811	112.9107	0.2362	0.0000	7.678	109.7022	0.2757	0.0000	6.689	110.5592	0.3287	0.0000	9.075	111.5537
L	01a2004*	0.8592	0.0740	3.500	155.0960	1.1598	0.0917	5.959	154.1314	1.1464	0.1529	7.468	151.5107	1.0263	0.1477	5.269	151.1228	0.9428	0.1109	4.384	153.1094	1.1531	0.1223	6.713	152.8211
L	01a2005*	0.3193	0.0931	8.255	130.3962	0.3652	0.0000	8.777	126.1344	0.4336	0.0000	8.759	125.2418	0.3908	0.0595	7.675	128.2340	0.3551	0.0763	7.965	129.3151	0.3994	0.0000	8.768	125.6881
L	01a2006*	0.4876	0.4410	10.676	152.8405	0.8731	0.0897	4.402	155.6734	0.8828	0.1630	12.248	145.1741	0.8970	0.2000	11.961	160.3664	0.6923	0.3205	11.318	156.6035	0.8780	0.1264	8.325	150.4238
L	01a2007a	0.9805	0.1174	3.242	163.5059	0.9204	0.0896	6.889	161.0648	0.9497	0.0511	4.966	157.3065	0.6792	0.0948	5.807	155.1292	0.8299	0.1061	4.525	159.3176	0.9351	0.0704	5.927	159.1857
	STATISTICS	GAIN	K	τ	DC	GAIN	K	τ	DC	GAIN	K	τ	DC	GAIN	K	τ	DC	GAIN	K	τ	DC	GAIN	K	τ	DC
	mean	0.7250	0.1267	6.298	144.1791	0.9487	0.0894	7.742	130.9219	0.8882	0.1174	8.434	131.2975	0.7111	0.0958	6.687	139.3076	0.7183	0.1119	6.485	141.8408	0.9185	0.1034	8.088	131.1097
	st. dev	0.335	0.123	2.095	23.061	0.529	0.087	2.278	29.538	0.468	0.099	2.505	27.321	0.373	0.074	2.086	22.286	0.347	0.102	2.056	22.354	0.491	0.093	2.375	27.920
	n	13	13	13	13	14	14	14	14	14	14	14	14	12	12	12	12	25	25	25	25	28	28	28	28
	sem	0.093	0.034	0.581	6.396	0.141	0.023	0.609	7.894	0.125	0.026	0.669	7.302	0.108	0.021	0.602	6.433	0.069	0.020	0.411	4.471	0.093	0.017	0.449	5.276
																						total mean	0.8241	0.1074	7.332	136.1716
																						st. dev.	0.437	0.096	2.454	25.781
																						n	53	53	53	53
																						sem	0.060	0.013	0.322	3.541

Pulse Response
COSMOS 2229

TABLE 2

COSMOS 2229 Synchronous Control (1-9-93 to 1-10-93)

number of units: 9

Pulse Response		*Curve 1 - Decreasing*				*Curve 2 - Increasing*				*Curve 3 - Increasing*				*Curve 4 - Decreasing*				*Average Decreasing*				*Average Increasing*			
ear	*FILENAME*	GAIN	K	τ	DC	GAIN	K	τ	DC	GAIN	K	τ	DC	GAIN	K	τ	DC	GAIN	K	τ	DC	GAIN	K	τ	DC
L	03c0901*	1.0582	0.0842	4.394	139.6148	0.9507	0.0918	8.561	137.2771	1.1085	0.0996	5.712	135.0241	1.1867	0.1888	13.406	148.0000	1.1225	0.1365	8.900	143.8074	1.0296	0.0957	7.136	136.1506
L	03c0902a	0.7102	0.2358	2.271	159.0110	***	***	***	***	***	***	***	***	***	***	***	***	0.7102	0.2358	2.271	159.0110	***	***	***	***
L	03c0903a	1.5485	0.0000	3.852	153.2628	1.5471	0.0193	3.428	148.1066	1.3584	0.1817	8.501	142.2985	1.6533	0.0985	4.721	148.3388	1.6009	0.0493	4.287	150.8008	1.4528	0.1005	5.965	145.2026
L	03c0904*	0.9905	0.0905	3.231	125.3911	0.9482	0.1983	7.958	122.3845	1.1066	0.1042	4.232	116.4337	1.2155	0.0000	3.407	129.0197	1.1030	0.0453	3.319	127.2054	1.0274	0.1513	6.095	119.4091
L	03c0905a	0.7394	0.2493	3.093	132.6500	***	***	***	***	***	***	***	***	***	***	***	***	0.7394	0.2493	3.093	132.6500	***	***	***	***
L	03c0906*	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
L	03c0907a	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
L	03c0908a	0.3323	0.0000	3.171	104.0870	0.3063	0.0000	2.919	105.2517	0.3457	0.0000	4.641	104.4544	***	***	***	***	0.3323	0.0000	3.171	104.0870	0.3260	0.0000	3.780	104.8531
L	07c1001*	1.0697	0.1629	6.234	143.6938	1.2225	0.0844	6.743	134.5090	0.9912	0.1263	7.076	137.0619	1.0693	0.1527	4.377	127.5330	1.0695	0.1578	5.305	135.6134	1.1069	0.1054	6.910	135.7855
L	07c1002*	0.2718	0.0093	6.570	100.1713	***	***	***	***	0.3327	0.0000	6.436	100.4379	***	***	***	***	0.2718	0.0093	6.570	100.1713	0.3327	0.0000	6.436	100.4379
L	07c1003a	1.0265	0.0000	3.386	128.0698	***	***	***	***	1.0595	0.0607	5.325	127.5122	1.0748	0.0391	5.198	126.1097	1.0507	0.0196	4.292	127.0898	1.0595	0.0607	5.325	127.5122
	STATISTICS	GAIN	K	τ	DC	GAIN	K	τ	DC	GAIN	K	τ	DC	GAIN	K	τ	DC	GAIN	K	τ	DC	GAIN	K	τ	DC
	mean	0.8608	0.0924	4.022	131.7724	0.9950	0.0788	5.922	129.5058	0.9004	0.0818	5.989	123.3175	1.2399	0.0958	6.222	135.8002	0.9962	0.0936	*4.808*	133.2109	0.9398	0.0805	*5.961*	125.8960
	st. dev	0.397	0.102	1.468	20.086	0.457	0.078	2.599	16.358	0.400	0.067	1.478	16.485	0.240	0.078	4.070	11.339	0.388	0.091	*2.760*	17.084	0.407	0.068	*1.910*	15.990
	n	9	9	9	9	5	5	5	5	7	7	7	7	5	5	5	5	14	14	*14*	14	12	12	*12*	12
	sem	0.132	0.034	0.489	6.695	0.204	0.035	1.162	7.316	0.151	0.025	0.559	6.231	0.107	0.035	1.820	5.071	0.104	0.024	*0.738*	4.566	0.117	0.020	*0.551*	4.616
																					total mean	0.9702	0.0876	5.940	129.8348
																					st. dev.	0.390	0.080	2.431	16.676
																					n	26	26	26	26
																					sem	0.076	0.016	0.477	3.270

TABLE XXX

COSMOS 2229 Pre-Flight & Synchronous Control

number of units: 24

Pulse Response	*Curve 1 - Decreasing*				*Curve 2 - Increasing*				*Curve 3 - Increasing*				*Curve 4 - Decreasing*				*Average Decreasing*				*Average Increasing*			
STATISTICS	GAIN	K	τ	DC	GAIN	K	τ	DC	GAIN	K	τ	DC	GAIN	K	τ	DC	GAIN	K	τ	DC	GAIN	K	τ	DC
mean	0.7806	0.1127	5.367	139.1037	0.9609	0.0866	7.263	130.5493	0.8923	0.1055	7.619	128.6375	0.8666	0.0958	6.550	138.2760	0.8181	0.1053	*5.883*	138.7429	0.9249	0.0966	*7.450*	129.5456
st. dev	0.359	0.114	2.154	22.284	0.499	0.083	2.434	26.268	0.437	0.090	2.475	24.116	0.415	0.073	2.680	19.399	0.382	0.097	*2.437*	20.810	0.462	0.086	*2.431*	24.853
n	22	22	22	22	19	19	19	19	21	21	21	21	17	17	17	17	39	39	*39*	39	40	40	*40*	40
sem	0.077	0.024	0.459	4.751	0.114	0.019	0.558	6.026	0.095	0.020	0.540	5.263	0.101	0.018	0.650	4.705	0.061	0.016	*0.390*	3.332	0.073	0.014	*0.384*	3.930
																				total mean	0.8721	0.1009	6.678	134.0860
																				st. dev.	0.425	0.091	2.544	23.264
																				n	79	79	79	79
																				sem	0.048	0.010	0.286	2.617

TABLE 3

Pulse Response - Post-Flight Day 2 (1-11-93)

number of units: 12

		Curve 1 - Decreasing				Curve 2 - Increasing				Curve 3 - Increasing				Curve 4 - Decreasing				Average Decreasing				Average Increasing			
ear	FILENAME	GAIN	K	τ	DC	GAIN	K	τ	DC	GAIN	K	τ	DC	GAIN	K	τ	DC	GAIN	K	τ	DC	GAIN	K	τ	DC
R	06c1101a	0.1181	0.0582	6.244	124.1026	0.3314	0.0000	9.101	129.7100	***	***	***	***	0.2563	0.0052	9.895	127.0000	0.1872	0.0317	8.069	125.5513	0.3314	0.0000	9.101	129.7100
R	06c1102*	0.3899	0.0612	6.026	109.3437	0.5268	0.0482	11.330	110.7429	***	***	***	***	0.3708	0.0999	7.724	110.1776	0.3804	0.0806	6.875	109.7607	0.5268	0.0482	11.330	110.7429
R	06c1103a	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
R	06c1104a	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
R	06c1105*	0.4336	0.0000	12.264	121.8239	0.4104	0.0841	9.192	124.3425	0.5898	0.0000	10.619	120.0000	0.4056	0.0369	9.667	116.4590	0.4196	0.0185	10.966	119.1415	0.5001	0.0421	9.906	122.1713
R	06c1106a	0.2409	0.1627	9.482	119.9324	0.3622	0.0497	11.721	120.7054	***	***	***	***	0.3034	0.0956	19.347	122.5562	0.2722	0.1292	14.415	121.2443	0.3622	0.0497	11.721	120.7054
R	06c1107a	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
R	06c1108a	0.1780	0.1847	6.410	120.5982	0.3548	0.0854	14.406	125.1843	***	***	***	***	0.3327	0.1001	13.635	123.8314	0.2554	0.1424	10.023	122.2148	0.3548	0.0854	14.406	125.1843
R	06c1109a	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
R	06c1110a	***	***	***	***	0.9202	0.0783	5.553	92.5952	0.8908	0.4065	4.085	112.7193	0.7599	0.0148	7.204	84.5035	0.7599	0.0148	7.204	84.5035	0.9055	0.2424	4.819	102.6573
R	06c1111a	***	***	***	***	0.5276	0.1326	8.031	140.8876	***	***	***	***	***	***	***	***	***	***	***	***	0.5276	0.1326	8.031	140.8876
R	06c1112*	0.2063	0.1003	11.980	108.0000	0.2889	0.0000	8.673	110.5016	0.3149	0.0000	3.421	114.3209	0.2605	0.0536	8.032	107.0000	0.2334	0.0770	10.006	107.5000	0.3019	0.0000	6.047	112.4113
R	06c1113a	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
R	51c1101a	0.2036	0.0000	4.768	61.7686	0.2279	0.1091	17.826	64.0642	0.3059	0.0000	8.032	61.5124	0.2572	0.0553	6.952	63.7192	0.2304	0.0277	5.860	62.7439	0.2669	0.0546	12.929	62.7883
R	51c1102a	0.4434	0.1252	11.470	114.2406	0.6075	0.2329	7.534	114.6954	***	***	***	***	0.5164	0.1120	4.590	110.5916	0.4799	0.1186	8.030	112.4161	0.6075	0.2329	7.534	114.6954
R	51c1103a	0.1973	0.0842	13.500	59.0000	0.2042	0.0913	12.794	62.2429	***	***	***	***	0.2715	0.0251	7.632	59.8327	0.2344	0.0547	10.566	59.4164	0.2042	0.0913	12.794	62.2429
R	51c1104a	***	***	***	***	0.4849	0.0824	11.074	106.8724	***	***	***	***	***	***	***	***	***	***	***	***	0.4849	0.0824	11.074	106.8724
R	51c1105a	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
	STATISTICS	GAIN	K	τ	DC	GAIN	K	τ	DC	GAIN	K	τ	DC	GAIN	K	τ	DC	GAIN	K	τ	DC	GAIN	K	τ	DC
	mean	0.2679	0.0863	9.127	104.3122	0.4372	0.0828	10.603	108.5454	0.5254	0.1016	6.539	102.1382	0.3734	0.0599	9.468	102.5671	0.3234	0.0724	9.307	103.3937	0.4593	0.0875	9.587	106.9436
	st. dev	0.121	0.065	3.298	25.515	0.197	0.062	3.343	24.485	0.277	0.203	3.397	27.263	0.159	0.039	4.202	24.597	0.149	0.053	3.701	24.345	0.213	0.105	3.716	24.423
	n	9	9	9	9	12	12	12	12	4	4	4	4	10	10	10	10	19	19	19	19	16	16	16	16
	sem	0.040	0.022	1.099	8.505	0.057	0.018	0.965	7.068	0.138	0.102	1.699	13.632	0.050	0.012	1.329	7.778	0.034	0.012	0.849	5.585	0.053	0.026	0.929	6.106
																					total mean	0.3855	0.0793	9.478	105.0165
																					st. dev.	0.191	0.080	3.655	24.086
																					n	35	35	35	35
																					sem	0.032	0.014	0.618	4.071

Pulse Response
COSMOS 2229

TABLE 4

Pulse Response - Post-Flight Day 3 (1-12-93)

number of units: 14

		Curve 1 - Decreasing				*Curve 2 - Increasing*				*Curve 3 - Increasing*				*Curve 4 - Decreasing*				*Average Decreasing*				*Average Increasing*			
ear	*FILENAME*	GAIN	K	τ	DC	GAIN	K	τ	DC	GAIN	K	τ	DC	GAIN	K	τ	DC	GAIN	K	τ	DC	GAIN	K	τ	DC
R	06c1214*	0.2337	0.0954	14.756	112.0000	0.3671	0.0000	11.660	111.6632	0.3508	0.0012	8.043	112.0276	0.3261	0.0462	9.895	113.0047	0.2799	0.0708	12.325	112.5024	0.3590	0.0006	9.851	111.8454
R	06c1215a	0.3503	0.1028	3.460	128.4554	0.4804	0.1302	11.088	137.1729	0.4985	0.1689	13.674	133.0000	0.4832	0.1264	8.113	133.3105	0.4168	0.1146	5.786	130.8830	0.4895	0.1496	12.381	135.0865
R	06c1216a	0.2362	0.1591	7.411	105.9199	0.4339	0.0071	14.233	110.2341	***	***	***	***	0.3748	0.0000	9.491	109.2543	0.3055	0.0796	8.451	107.5871	0.4339	0.0071	14.233	110.2341
R	06c1217a	0.2136	0.0000	8.229	105.7112	0.3872	0.0000	14.960	105.0854	0.2081	0.0898	6.613	108.4279	0.2379	0.0000	5.535	103.6374	0.2258	0.0000	6.882	104.6743	0.2977	0.0449	10.787	106.7567
R	06c1218a	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
R	51c1206a	0.4730	0.0205	5.024	82.1492	0.5122	0.0594	6.332	85.8667	0.5112	0.0839	11.105	82.0000	0.4317	0.1256	8.976	79.7820	0.4524	0.0731	7.000	80.9656	0.5117	0.0717	8.719	83.9334
R	51c1207*	0.1300	0.0000	5.352	58.8753	0.1282	0.1912	11.190	60.0000	0.1550	0.0371	7.704	59.0000	0.1610	0.0236	3.338	58.5076	0.1455	0.0118	4.345	58.6915	0.1416	0.1142	9.447	59.5000
R	51c1208a	0.4559	0.0000	3.450	76.3346	0.7131	0.1515	14.097	77.0818	***	***	***	***	***	***	***	***	0.4559	0.0000	3.450	76.3346	0.7131	0.1515	14.097	77.0818
R	51c1209a	0.7998	0.2893	3.907	63.7724	0.7266	0.2735	12.392	73.6798	0.8822	0.2504	5.680	74.4383	0.7415	0.2380	6.928	70.3865	0.7707	0.2637	5.418	67.0795	0.8044	0.2620	9.036	74.0591
R	51c1210*	0.5401	0.0559	1.722	112.7361	0.6750	0.0000	6.550	97.8366	0.8115	0.0548	2.712	119.7078	0.8446	0.0459	5.419	114.9841	0.6924	0.0509	3.570	113.8601	0.7433	0.0274	4.631	108.7722
R	51c1212a	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
R	51c1213a	0.1469	0.1230	11.021	52.1476	0.1994	0.0652	15.582	51.3553	0.2089	0.0571	10.212	51.9666	0.1655	0.0000	6.744	52.1086	0.1562	0.0615	8.883	52.1281	0.2042	0.0612	12.897	51.6610
R	51c1214a	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
R	51c1215a	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
R	51c1216a	0.4984	0.0124	5.552	96.0235	0.5615	0.0322	7.244	99.3973	0.5351	0.0000	4.993	97.9292	0.5147	0.0467	6.640	94.1453	0.5066	0.0296	6.096	95.0844	0.5483	0.0161	6.118	98.6633
R	51c1217a	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
R	51c1218a	0.5950	0.0944	3.335	145.7813	0.8513	0.0988	16.845	144.2215	0.7058	0.1106	6.871	148.7001	0.7524	0.0620	5.967	155.4045	0.6737	0.0782	4.651	150.5929	0.7786	0.1047	11.858	146.4608
R	51c1219a	0.2621	0.0802	6.428	67.3171	0.3509	0.0176	5.864	70.8891	0.3195	0.1035	8.339	70.3391	0.3183	0.0194	6.429	67.8813	0.2902	0.0498	6.428	67.5992	0.3352	0.0606	7.101	70.6141
R	51c1220a	0.3095	0.0915	9.447	102.1764	0.4000	0.1449	17.474	101.0000	0.4265	0.0361	10.674	101.0000	0.3629	0.0677	8.262	102.5974	0.3362	0.0796	8.855	102.3869	0.4133	0.0905	14.074	101.0000
	STATISTICS	GAIN	K	τ	DC	GAIN	K	τ	DC	GAIN	K	τ	DC	GAIN	K	τ	DC	GAIN	K	τ	DC	GAIN	K	τ	DC
	mean	0.3746	0.0803	6.364	93.5286	0.4848	0.0837	11.822	94.6774	0.4678	0.0828	8.052	96.5447	0.4396	0.0617	7.057	96.5388	0.4059	0.0713	*6.697*	94.9779	0.4769	0.0833	*10.082*	95.5392
	st. dev	0.193	0.079	3.545	27.671	0.205	0.085	3.998	26.954	0.238	0.071	3.010	29.806	0.222	0.068	1.847	30.124	0.206	0.073	*2.825*	28.355	0.217	0.077	*3.997*	27.741
	n	14	14	14	14	14	14	14	14	12	12	12	12	13	13	13	13	27	27	*27*	27	26	26	*26*	26
	sem	0.051	0.021	0.947	7.395	0.055	0.023	1.069	7.204	0.069	0.021	0.869	8.604	0.062	0.019	0.512	8.355	0.040	0.014	*0.544*	5.457	0.042	0.015	*0.784*	5.441
																					total mean	0.4407	0.0772	9.568	95.2533
																					st. dev.	0.212	0.075	3.819	27.786
																					n	53	53	53	53
																					sem	0.029	0.010	0.524	3.817

TABLE 5

Pulse Response - Post-Flight Day 5 (1-14-93)

number of units: 8

		Curve 1 - Decreasing				*Curve 2 - Increasing*				*Curve 3 - Increasing*				*Curve 4 - Decreasing*				*Average Decreasing*				*Average Increasing*			
ear	*FILENAME*	GAIN	K	τ	DC	GAIN	K	τ	DC	GAIN	K	τ	DC	GAIN	K	τ	DC	GAIN	K	τ	DC	GAIN	K	τ	DC
R	06c1419a	0.4491	0.0809	9.071	139.0000	0.5520	0.0539	7.349	143.5036	0.5801	0.0487	8.335	139.0760	0.4554	0.0161	5.322	135.7669	0.4523	0.0485	7.196	137.3835	0.5661	0.0513	7.842	141.2898
R	06c1420a	0.2580	0.0067	5.176	96.6656	0.3441	0.1154	13.532	98.3431	0.3449	0.1448	12.095	100.0000	0.3281	0.0561	8.522	98.9763	0.2931	0.0314	6.849	97.8210	0.3445	0.1301	12.814	99.1716
R	51c1421a	0.5324	0.0947	4.405	79.5173	***	***	***	***	0.9344	0.0349	4.109	77.9422	***	***	***	***	0.5324	0.0947	4.405	79.5173	0.9344	0.0349	4.109	77.9422
R	51c1423a	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
R	51c1424a	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
R	51c1425*	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
R	51c1426*	0.3824	0.0613	5.648	108.3304	0.3542	0.1326	12.293	111.2541	0.3467	0.0498	4.420	118.9715	0.4328	0.0270	5.626	112.5027	0.4076	0.0442	5.637	110.4166	0.3505	0.0912	8.356	115.1128
R	51c1427a	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
R	51c1428*	0.1248	0.0989	5.663	55.0579	0.1615	0.0000	6.734	58.4764	0.1987	0.0107	7.945	56.1225	0.1921	0.1175	8.120	54.9302	0.1585	0.1082	6.892	54.9941	0.1801	0.0054	7.339	57.2995
R	51c1429a	0.5654	0.1650	11.567	80.0693	0.6539	0.0773	10.935	77.8983	0.6342	0.1213	9.485	83.5636	0.5618	0.0907	7.220	77.1282	0.5636	0.1279	9.393	78.5988	0.6441	0.0993	10.210	80.7310
R	51c1430a	***	***	***	***	0.5950	0.0804	11.108	92.8470	***	***	***	***	0.2527	0.1299	2.707	86.0800	0.2527	0.1299	2.707	86.0800	0.5950	0.0804	11.108	92.8470
R	51c1431a	0.3365	0.0416	6.495	121.6669	0.3832	0.1554	20.679	119.3101	0.3944	0.0573	10.139	119.1683	0.3513	0.0000	7.134	122.7645	0.3439	0.0208	6.815	122.2157	0.3888	0.1064	15.409	119.2392
	STATISTICS	GAIN	K	τ	DC	GAIN	K	τ	DC	GAIN	K	τ	DC	GAIN	K	τ	DC	GAIN	K	τ	DC	GAIN	K	τ	DC
	mean	0.3784	0.0784	6.861	97.1868	0.4348	0.0879	11.804	100.2332	0.4905	0.0668	8.075	99.2634	0.3677	0.0625	6.379	98.3070	0.3731	0.0705	*6.620*	97.7469	0.4627	0.0773	*9.940*	99.7483
	st. dev	0.155	0.050	2.548	28.437	0.173	0.052	4.633	27.864	0.246	0.048	2.932	28.672	0.126	0.051	2.003	27.937	0.136	0.049	*2.216*	27.089	0.206	0.049	*4.198*	27.166
	n	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	14	14	*14*	14	14	14	*14*	14
	sem	0.059	0.019	0.963	10.748	0.065	0.020	1.751	10.531	0.093	0.018	1.108	10.837	0.048	0.019	0.757	10.559	0.036	0.013	*0.592*	7.240	0.055	0.013	*1.122*	7.260
																					total mean	0.4179	0.0739	8.280	98.7476
																					st. dev.	0.177	0.049	3.702	26.640
																					n	28	28	28	28
																					sem	0.034	0.009	0.700	5.034

Pulse Response
COSMOS 2229

TABLE 6

Pulse Response - Post-Flight Day 6 (1-15-93) - Post Flight Control

number of units: 5

		Curve1 - Decreasing				Curve 2 - Increasing				Curve 3 - Increasing				Curve 4 - Decreasing				Average Decreasing				Average Increasing			
ear	FILENAME	GAIN	K	τ	DC	GAIN	K	τ	DC	GAIN	K	τ	DC	GAIN	K	τ	DC	GAIN	K	τ	DC	GAIN	K	τ	DC
L	03c1515a	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
L	03c1518a	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
L	03c1519a	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
L	04c1520a	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
L	07c1501a	1.0576	0.2317	5.936	130.3925	1.3321	0.1351	10.215	120.0000	1.2872	0.0817	4.346	128.9313	1.3605	0.2885	8.911	122.4968	1.2091	0.2601	7.423	126.4447	1.3097	0.1084	7.281	124.4657
L	07c1502e	1.1701	0.2957	8.832	117.5990	1.0648	0.1473	3.865	113.3886	1.2160	0.3426	6.946	115.8534	***	***	***	***	1.1701	0.2957	8.832	117.5990	1.1404	0.2450	5.405	114.6210
L	07c1503a	0.7135	0.0000	3.071	102.9881	0.8230	0.0000	5.754	97.8017	***	***	***	***	***	***	***	***	0.7135	0.0000	3.071	102.9881	0.8230	0.0000	5.754	97.8017
L	07c1505a	0.3616	0.0143	5.071	106.7786	0.3790	0.0000	5.492	106.1055	0.3771	0.0565	6.476	107.3180	***	***	***	***	0.3616	0.0143	5.071	106.7786	0.3781	0.0283	5.984	106.7118
L	07c1507a	0.2921	0.0000	4.763	126.0421	0.2750	0.0000	6.496	126.1790	0.2882	0.0317	6.942	126.7815	0.2672	0.0715	6.905	126.0000	0.2797	0.0358	5.834	126.0211	0.2816	0.0159	6.719	126.4803
	STATISTICS	GAIN	K	τ	DC	GAIN	K	τ	DC	GAIN	K	τ	DC	GAIN	K	τ	DC	GAIN	K	τ	DC	GAIN	K	τ	DC
	mean	0.7190	0.1083	5.535	116.7601	0.7748	0.0565	6.364	112.6950	0.7921	0.1281	6.178	119.7211	0.8139	0.1800	7.908	124.2484	0.7461	0.1288	*6.213*	118.8996	0.7825	0.0883	*6.281*	115.8177
	st. dev	0.396	0.144	2.116	11.853	0.448	0.077	2.357	11.190	0.533	0.144	1.241	10.058	0.773	0.153	1.418	2.477	0.454	0.138	*2.159*	10.394	0.455	0.111	*1.835*	10.689
	n	5	5	5	5	5	5	5	5	4	4	4	4	2	2	2	2	7	7	*7*	7	9	9	*9*	9
	sem	0.177	0.064	0.946	5.301	0.200	0.035	1.054	5.004	0.266	0.072	0.620	5.029	0.547	0.109	1.003	1.752	0.172	0.052	*0.816*	3.929	0.152	0.037	*0.612*	3.563
																				total mean		0.7666	0.1060	6.294	117.1660
																				st. dev.		0.440	0.121	1.813	10.327
																				n		16	16	16	16
																				sem		0.110	0.030	0.478	2.582

TABLE 7

Pulse Response - Post-Flight Day 11 (1-21-93)

number of units: 9

		Decreasing Curve 1				Increasing Curve 1				Increasing Curve 2				Decreasing Curve 2				Average Decreasing				Average Increasing			
ear	FILENAME		K	τ	DC	GAIN	K	τ	DC	GAIN	K	τ	DC	GAIN	K	τ	DC	GAIN	K	τ	DC	GAIN	K	τ	DC
R	06c2101a	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
R	06c2102a	0.4646	0.1015	6.591	145.0000	0.5560	0.1317	11.929	144.9696	0.6207	0.1186	7.057	147.5611	0.4817	0.0937	8.607	147.6365	0.4732	0.0976	7.599	146.3183	0.5884	0.1252	9.493	146.2654
R	06c2102a	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
R	06c2104*	0.2228	0.0573	8.194	96.8866	0.2916	0.0000	10.539	99.8146	0.2912	0.0241	7.007	100.0693	0.2720	0.0933	12.362	95.3260	0.2474	0.0753	10.278	96.1063	0.2914	0.0121	8.773	99.9420
R	06c2105a	0.4757	0.1314	9.309	132.6268	0.5902	0.1464	10.988	140.6817	0.6075	0.0000	6.645	137.9972	0.5750	0.0000	8.585	138.6500	0.5254	0.0657	8.947	135.6384	0.5989	0.0732	8.816	139.3395
R	06c2106a	0.1631	0.1877	9.236	128.0000	0.3410	0.0000	9.193	129.0232	0.2793	0.0245	8.448	131.6427	0.2209	0.0785	6.969	129.7718	0.1920	0.1331	8.102	128.8859	0.3102	0.0123	8.821	130.3330
R	06c2107a	0.1667	0.0598	8.260	66.0000	0.1548	0.0000	13.296	66.0000	0.1603	0.0000	3.116	69.0000	0.2211	0.0857	15.526	68.1612	0.1939	0.0728	11.893	67.0806	0.1576	0.0000	8.206	67.5000
R	06c2108a	0.2538	0.0351	6.178	129.7954	0.3919	0.0000	9.058	131.9548	0.3657	0.0159	6.715	133.7009	0.3783	0.0595	14.177	136.5542	0.3161	0.0473	10.177	133.1748	0.3788	0.0080	7.887	132.8279
R	06c2109a	0.1208	0.0000	6.695	62.3837	0.1133	0.0000	7.110	63.4890	0.1527	0.0586	9.489	63.0000	0.1357	0.0623	8.504	61.2672	0.1283	0.0312	7.599	61.8255	0.1330	0.0293	8.299	63.2445
R	06c2110a	0.7615	0.0000	3.351	45.6636	0.7218	0.1416	10.310	56.0890	***	***	***	***	0.8349	0.0000	3.846	47.4698	0.7982	0.0000	3.599	46.5667	0.7218	0.1416	10.310	56.0890
R	06c2111a	0.2509	0.0189	5.190	111.6070	0.4256	0.0211	11.233	115.0000	0.3729	0.0099	11.175	112.0000	0.2912	0.0839	11.653	112.0170	0.2711	0.0514	8.422	111.8120	0.3993	0.0155	11.204	113.5000
	STATISTICS	GAIN	K	τ	DC	GAIN	K	τ	DC	GAIN	K	τ	DC	GAIN	K	τ	DC	GAIN	K	τ	DC	GAIN	K	τ	DC
	mean	0.3200	0.0657	7.000	101.9959	0.3985	0.0490	10.406	105.2247	0.3563	0.0314	7.457	111.8714	0.3790	0.0619	10.025	104.0949	0.3495	0.0638	*8.513*	103.0454	0.3786	0.0407	*9.018*	108.3525
	st. dev	0.208	0.064	1.964	36.044	0.201	0.069	1.798	35.244	0.179	0.040	2.371	32.048	0.219	0.037	3.700	37.541	0.210	0.051	*3.268*	35.717	0.186	0.056	*2.526*	32.896
	n	9	9	9	9	9	9	9	9	8	8	8	8	9	9	9	9	18	18	*18*	18	17	17	*17*	17
	sem	0.069	0.021	0.655	12.015	0.067	0.023	0.599	11.748	0.063	0.014	0.838	11.331	0.073	0.012	1.233	12.514	0.049	0.012	*0.770*	8.419	0.045	0.014	*0.613*	7.978
																				total mean		0.3636	0.0526	6.758	105.6231
																				st. dev.		0.196	0.054	2.900	33.976
																				n		35	35	35	35
																				sem		0.033	0.009	0.490	5.743

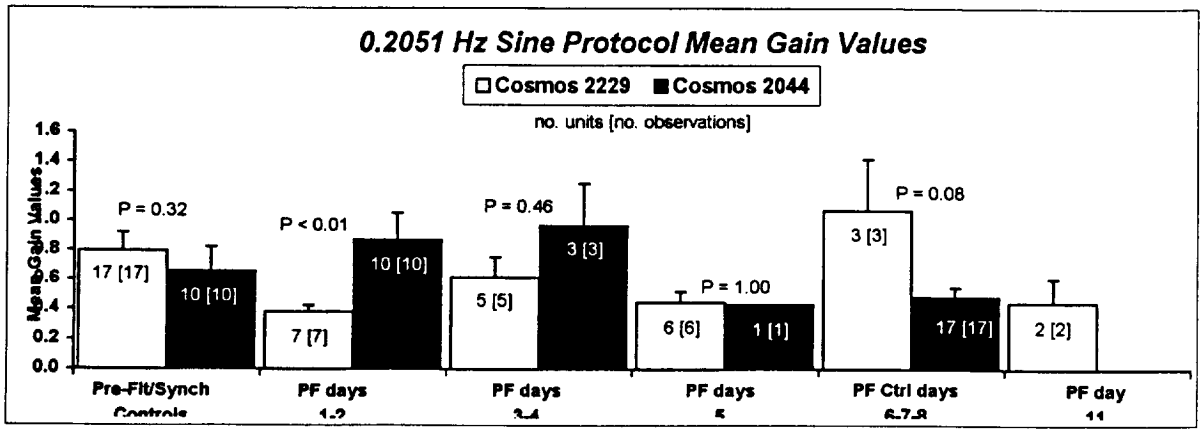
All Controls (Pre-Flight, Synchronous, & Day 6 Post-Flight Control)

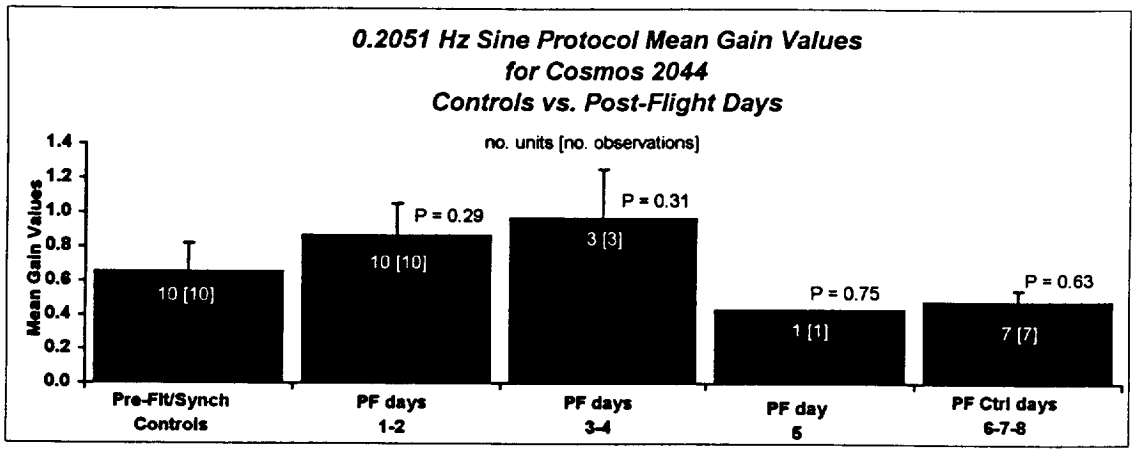
number of units: 29

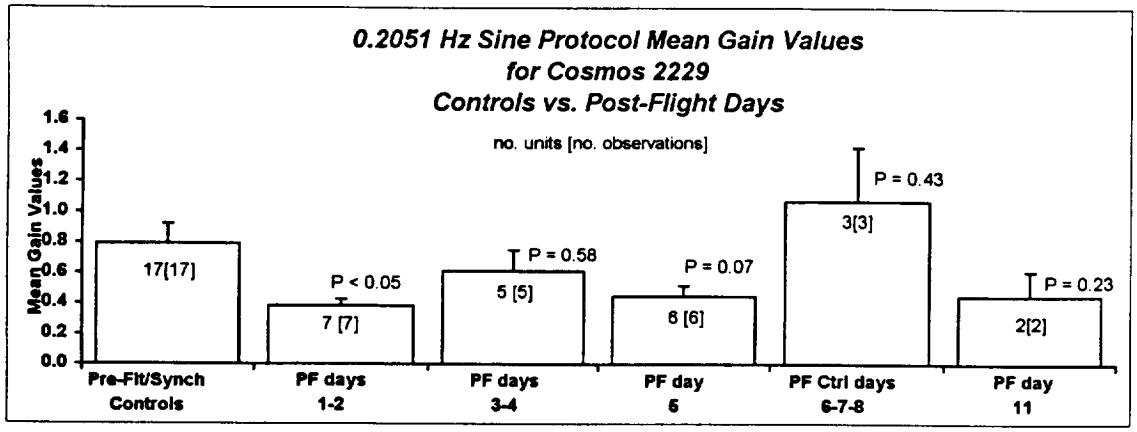
	STATISTICS	GAIN	K	τ	DC	GAIN	K	τ	DC	GAIN	K	τ	DC	GAIN	K	τ	DC	GAIN	K	τ	DC	GAIN	K	τ	DC
	mean	0.7692	0.1119	5.398	134.9660	0.9221	0.0803	7.076	126.8296	0.8763	0.1092	7.388	127.2109	0.8611	0.1047	6.693	136.7994	0.8071	0.1089	*5.933*	135.7233	0.8987	0.0950	*7.235*	127.0241
	st. dev	0.359	0.117	2.107	22.381	0.485	0.081	2.396	24.833	0.442	0.097	2.364	22.548	0.432	0.082	2.584	18.826	0.389	0.103	*2.377*	20.785	0.460	0.090	*2.360*	23.446
	n	27	27	27	27	24	24	24	24	25	25	25	25	19	19	19	19	46	46	*46*	46	49	49	*49*	49
	sem	0.069	0.022	0.406	4.307	0.099	0.017	0.489	5.069	0.088	0.019	0.473	4.510	0.099	0.019	0.593	4.319	0.057	0.015	*0.351*	3.065	0.066	0.013	*0.337*	3.349
																				total mean		0.8544	0.1018	6.605	131.2363
																				st. dev.		0.427	0.096	2.445	22.509
																				n		95	95	95	95
																				sem		0.044	0.010	0.251	2.309

0.2051 Hz Sine Analysis

	plot order	COSMOS 2044 Gain	COSMOS 2044 SEM	COSMOS 2044 no. observations	COSMOS 2229 Gain	COSMOS 2229 SEM	COSMOS 2229 no. observations	Statistical Significance 2044 vs. 2229	Ctrl. vs. PFDays Cosmos 2044	Ctrl. vs. PFDays Cosmos 2229
Pre-Flt/Synch Ctrls	1	0.6554	0.165	10	0.7935	0.126	17	0.3152		
PF days 1-2	2	0.8658	0.187	10	0.3814	0.043	7	**0.0084	0.2899	*0.0121
PF days 3-4	3	0.9660	0.288	3	0.6120	0.138	5	0.4561	0.3105	0.5832
PF day 5	4	0.4310	0.000	1	0.4450	0.072	6	1.0000	0.7518	0.0741
PF Ctrls Days 6-7-8	5	0.4814	0.068	17	1.0700	0.350	3	0.0806	0.6333	0.4269
PF day 11	6				0.4450	0.165	2			0.2317

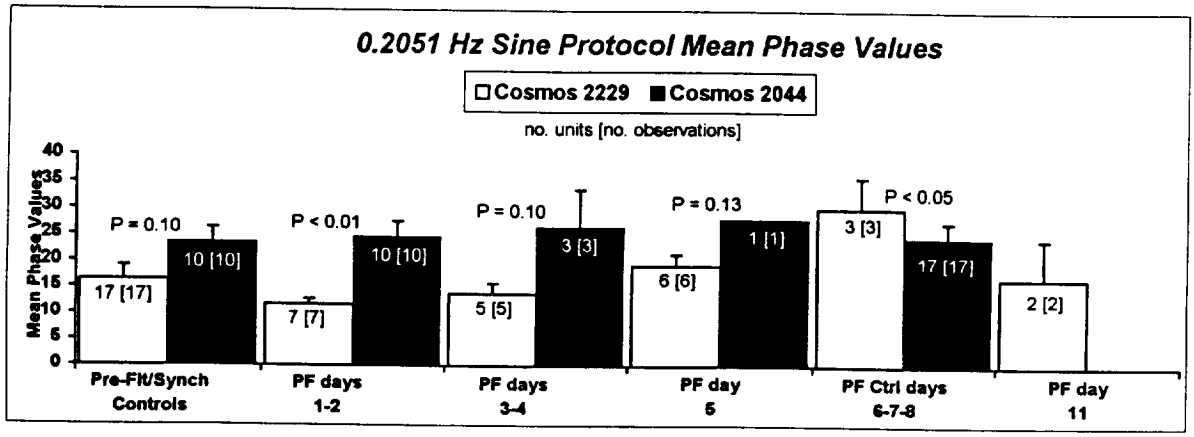


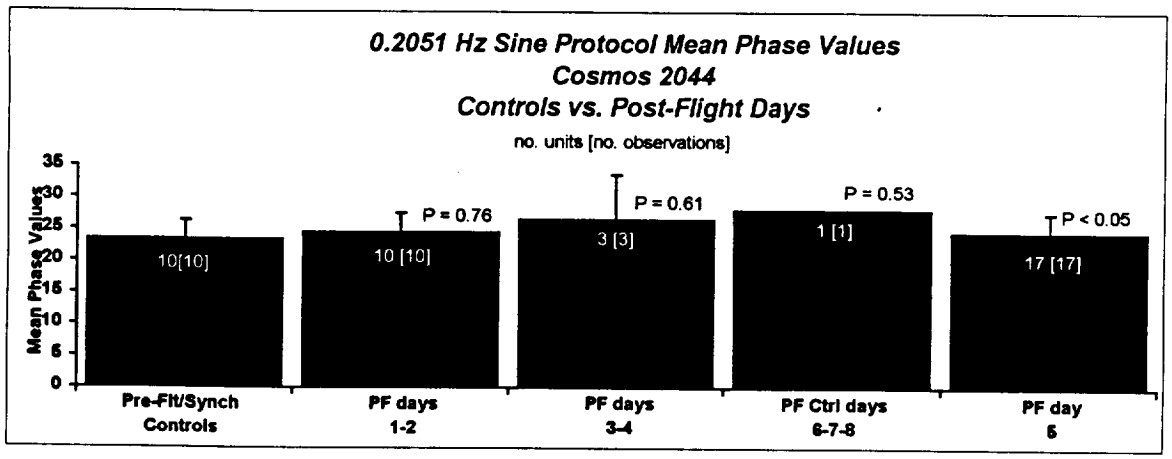

0.2051 Hz Sine Protocol Mean Gain Values
for Cosmos 2044
Controls vs. Post-Flight Days
no. units [no. observations]
Mean Gain Values
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
10 [10]
P = 0.29
10 [10]
P = 0.31
3 [3]
P = 0.75
1 [1]
P = 0.63
7 [7]
Pre-Flt/Synch Controls
PF days 1-2
PF days 3-4
PF day 5
PF Ctrl days 6-7-8

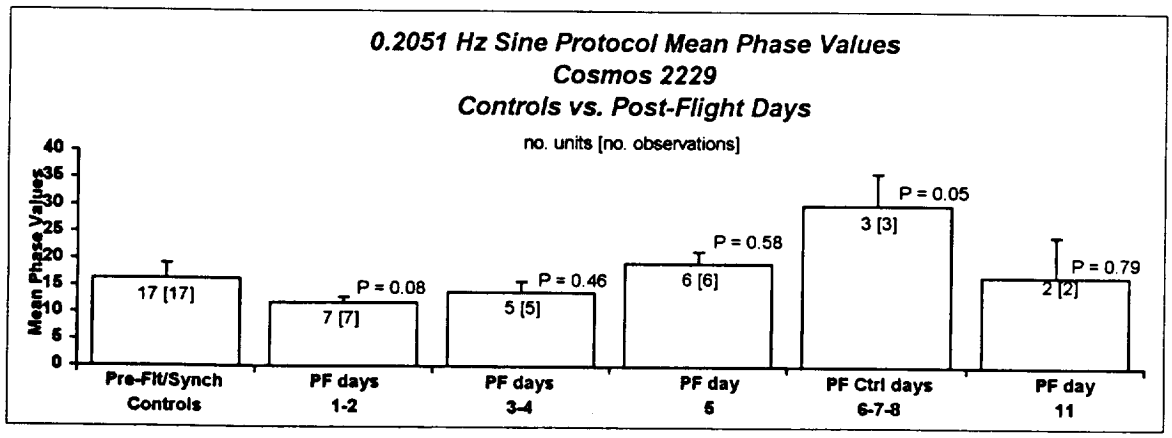

0.2051 Hz Sine Protocol Mean Gain Values
for Cosmos 2229
Controls vs. Post-Flight Days
no. units [no. observations]
Mean Gain Values
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
17[17]
P < 0.05
7 [7]
P = 0.58
5 [5]
P = 0.07
6 [6]
P = 0.43
3[3]
P = 0.23
2[2]
Pre-Flt/Synch Controls
PF days 1-2
PF days 3-4
PF day 5
PF Ctrl days 6-7-8
PF day 11

0.2051 Hz Sine Analysis

	plot order	COSMOS 2044 Phase	COSMOS 2044 SEM	COSMOS 2044 no. observations	COSMOS 2229 Phase	COSMOS 2229 SEM	COSMOS 2229 no. observations	Statistical Significance: 2044 vs. 2229	Ctrl. vs. PFDays Cosmos 2044	Ctrl. vs. PFDays Cosmos 2229
Pre-Flt/Synch Ctrl	1	23.3969	2.903	10	16.3417	2.770	17	0.0975		
PF days 1-2	2	24.4969	3.044	10	11.7461	1.067	7	**0.0047	0.7624	0.0607
PF days 3-4	3	26.5103	7.090	3	13.6370	1.922	5	0.1011	0.6121	0.4567
PF day 5	4	26.0230	0.000	1	19.2658	2.177	6	0.1336	0.5271	0.5754
PF Ctrl days 6-7-8	5	24.4969	3.044	10	30.0753	5.874	3	*0.0300	*0.0183	0.0502
PF day 11	6				16.8275	7.576	2			0.7905




0.2051 Hz Sine Protocol Mean Phase Values
Cosmos 2044
Controls vs. Post-Flight Days
no. units [no. observations]
Mean Phase Values
35
30
25
20
15
10
5
0
10[10]
P = 0.76
10 [10]
P = 0.61
3 [3]
P = 0.53
1 [1]
P < 0.05
17 [17]
Pre-Flt/Synch Controls
PF days 1-2
PF days 3-4
PF Ctrl days 6-7-8
PF day 5


0.2051 Hz Sine Protocol Mean Phase Values
Cosmos 2229
Controls vs. Post-Flight Days
no. units [no. observations]
Mean Phase Values
40
35
30
25
20
15
10
5
0
17 [17]
P = 0.08
7 [7]
P = 0.46
5 [5]
P = 0.58
6 [6]
P = 0.05
3 [3]
P = 0.79
2 [2]
Pre-Flt/Synch Controls
PF days 1-2
PF days 3-4
PF day 5
PF Ctrl days 6-7-8
PF day 11

Sine Data - COSMOS 2044
60 degrees/sec - 0.2051 Hz

PRE-FLIGHT CONTROLS

Pre-Flight	file	gain	phase
(2592)7/24-01B	a92an1b	0.141	32.948
(2592)7/25-05	a92an5a	0.195	8.626
(2556)7/26-01B	a56an1b	0.329	12.541
(2556)7/26-01D	a56an1d	***	***
(2556)7/26-02B	a56an2b	***	***
(2556)7/26-02C	a56an2c	***	***
(2556)7/26-02F	a56an2f	***	***
(2556)7/26-06B	a56an6b	0.306	20.198
(2556)7/26-06E	a56an6e	***	***
(2556)7/26-08B	a56an8b	0.916	27.045
(2556)7/26-09B	a56an9b	1.872	34.516
(2556)7/26-10B	a56an10b	0.804	25.023
(2483)7/27-06A	a83an6a	0.994	33.55
(782)7/28-01	a82an1b	***	***
(782)7/28-01C	a82an1c	***	***
(782)7/28-01F	a82an1f	0.438	14.679
(782)7/28-02B	a82an2b	0.559	24.863
(774) 7/31-02B	a74an2b	***	***
(774) 7/31-02C	a74an2c	***	***
	mean	0.6554	23.3989
	st. dev	0.5214	9.17915
	units	10	10
	sem	0.1649	2.9027

POST-FLIGHT DAYS

PF Day 1	file	gain	phase
(782)po1-01	a82anb01	2.239	25.063
(782)po1-03	a82anb03	1.176	34.621
(782)po1-05	a82anc05	0.434	11.891
(782)po1-07	a82anc07	1.392	36.415
(2483)po1-01	a83anb01	0.824	13.398
(2483)po1-02	a83anb02	0.402	13.396
(2483)po1-05C	a83an5c	0.731	32.392
	mean	1.0283	23.8823
	st. dev	0.6449	10.8771
	units	7	7
	sem	0.2438	4.11117

PF Day 2	file	gain	phase
(782)po2-02	a82anc09	0.621	34.486
(2483)po2-04	a83an4c	0.441	23.328
(2483)po2-05	a83an5b	0.398	19.979
	mean	0.4867	25.931
	st. dev	0.1183	7.59572
	units	3	3
	sem	0.0683	4.38539

Total Days 1, 2			
	mean	0.8658	24.4969
	st. dev	0.5906	9.62679
	units	10	10
	sem	0.1868	3.04426

PF Day 4	file	gain	phase
(782)po4-01	a82an1b	0.84	34.702
(782)po4-02	a82an2c	0.543	12.391
(782)po4-11	a82an11b	1.515	32.438
	mean	0.966	26.5103
	st. dev	0.4981	12.28
	units	3	3
	sem	0.2876	7.08985

PF Day 5	file	gain	phase
(782)po5-03	a82an3b	0.431	28.023
	mean	0.431	28.023
	st. dev	0	0
	units	1	1
	sem	0	0

POST-FLIGHT CONTROLS

PFC Day 6	file	gain	phase
(2592)po6-03	a92an3b	0.313	10.178
(774)po6-02	a74an02c	0.727	23.984
(774)po6-05	a74an5b	0.616	25.997
(774)po6-06	a74an6a	0.195	6.507
(774)po6-09	a74an09b	0.336	-0.107
(774)po6-13	a74an13b	0.696	-34.166
(774)po6-15	a74an15b	0.154	13.15
(774)po6-16	a74an16b	0.272	22.198
	mean	0.4136	8.46763
	st. dev	0.23	19.4804
	units	8	8
	sem	0.0813	6.88736

PFC Day 7	file	gain	phase
(774)po7-01B	a74an18b	0.311	9.618
(774)po7-01D	a74an18d	0.347	9.649
(774)po7-02	a74an19b	0.409	16.396
(774)po7-05	a74an5b	0.494	10.832
(774)po7-06C	a74an23c	0.565	27.103
(774)po7-07	a74an7b	0.475	13.686
(2592)po7-01	a92an1a	1.345	13.573
	mean	0.5637	14.4081
	st. dev	0.3554	6.11983
	units	7	7
	sem	0.1343	2.31308

PFC Day 8	file	gain	phase
(774)po8-04	a74an4b	0.597	16.057
(774)po8-17	a74an44b	0.332	9.956
	mean	0.4645	13.0065
	st. dev	0.1874	4.31406
	units	2	2
	sem	0.1325	3.0505

Post-Flt Ctrl			
	mean	0.4814	11.4477
	st. dev	0.2793	13.7772
	units	17	17
	sem	0.0677	3.34146

All Controls			
	mean	0.5459	15.8741
	st. dev	0.3866	13.4373
	units	27	27
	sem	0.0744	2.58601

Sine Protocol - 0.2051 Hz
COSMOS 2229

TABLE XX
Pre-Flight (11-14-92 to 12-9-92)

ear	FILENAME	gain	phase
L	01o1702d	0.43	9.861
L	03a1401d	1.02	19.215
L	03a1402d	2.26	25.648
L	03a1407d	0.70	12.192
L	75a1504d	***	***
L	01a1601d	***	***
L	01a1602d	0.60	21.084
L	01a1603d	0.31	-16.761
L	07a1601d	1.64	36.849
L	07a1602d	0.77	22.399
L	07a1610d	0.36	10.612
L	07a1611d	0.38	9.195
L	07a1612d	0.57	12.148
L	01a2004d	1.12	25.910
L	01a2005d	0.39	13.176
L	01a2006d	0.81	24.805
L	01a2007d	0.73	22.599

STATISTICS	gain	phase
MEAN	0.81	16.595
ST. DEV.	0.54	12.079
N	15	15
SEM	0.14	3.12

TABLE XX
Synchronous Control
(1-9-93 to 1-10-93)

ear	FILENAME	gain	phase
L	07c1002d	0.31	10.168
L	07c1003d	1.09	18.709

STATISTICS	gain	phase
MEAN	0.70	14.439
ST. DEV.	0.55	6.039
N	2	2
SEM	0.39	4.27

Pre-Flt/Synch Ctrl

STATISTICS	gain	phase
MEAN	0.79	16.34
ST. DEV.	0.52	11.42
N	17	17
SEM	0.13	2.77

TABLE XX
Post-Flight Day 2 (1-13-93)

ear	FILENAME	gain	phase
R	06c1102d	0.49	14.85
R	06c1105d	0.58	16.44
R	06c1106d	0.34	11.69
R	06c1108d	0.34	10.59
R	06c1112d	0.37	10.74
R	51c1101d	0.28	8.80
R	51c1103d	0.27	9.11

STATISTICS	gain	phase
MEAN	0.38	11.746
ST. DEV.	0.11	2.876
N	7	7
SEM	0.04	1.09

TABLE XX
Post-Flight Day 3 (1-12-93)

ear	FILENAME	gain	phase
R	51c1206d	0.56	14.558
R	51c1207d	0.16	11.778
R	51c1209d	1.02	11.140
R	51c1210d	0.71	21.036
R	51c1211d	***	***
R	51c1216d	0.61	10.673

STATISTICS	gain	phase
MEAN	0.61	13.837
ST. DEV.	0.31	4.297
N	5	5
SEM	0.14	1.92

TABLE XX
Post-Flight Day 5 (1-14-93)

ear	FILENAME	gain	phase
R	51c1421d	0.60	20.793
R	51c1424d	0.52	26.910
R	51c1425d	0.35	21.734
R	51c1428d	0.20	11.070
R	51c1429d	0.66	16.458
R	06c1420d	0.34	18.750

STATISTICS	gain	phase
MEAN	0.45	19.286
ST. DEV.	0.18	5.332
N	6	6
SEM	0.07	2.18

TABLE XX
Post-Flight Day 6 (1-15-93)
Post-Flight Control

ear	FILENAME	gain	phase
L	03c1516d	0.37	25.226
L	07c1501d	1.42	23.234
L	07c1502d	1.44	42.109
L	07c1502h	1.40	41.423
L	07c1502*	1.42	41.766

STATISTICS	gain	phase
MEAN	1.07	30.08
ST. DEV.	0.61	10.17
N	3	3
SEM	0.35	5.87

TABLE XX
Post-Flight Day 11 (1-21-93)

ear	FILENAME	gain	phase
R	06c2101d	***	***
R	06c2102d	0.61	24.403
R	06c2102h	***	***
R	06c2104d	0.28	9.252

STATISTICS	gain	phase
MEAN	0.45	16.828
ST. DEV.	0.23	10.713
N	2	2
SEM	0.17	7.58

All controls

STATISTICS	gain	phase
MEAN	0.84	18.40
ST. DEV.	0.53	12.09
N	20	20
SEM	0.12	2.70