Chapter 7 - Data Return

Contents

Introduction to Chapter 7

This chapter is a report on the NIMS data return for the C10 orbit. Due to the low downlink data rates available for Galileo Jupiter Operations and other unforeseen and unpredictable events during the C10 Encounter and Cruise, not all NIMS data recorded on the tape recorder or selected in real-time were returned. The previous 6 chapters nominally describe the planning and intention of the NIMS observations for this orbit, except the obstab section in chapter 4 which was updated to give the latest parameters for the data that were actually returned.

Nine NIMS software reloads were inserted into the C10 Encounter sequence to protect against processor halts. During C10 only 5 NIMS observations was lost due to processor halts. The approach that we are taking to avoid data loss due to processor halts has proven to be very successful.

Detectors 3 and 8 are still not functioning and are expected to be lost for the rest of the mission.

During playback the rate control flag was inadvertently turned on for the playback of 8 obsrvations. These observations were played back a sencond time without rate control with minimal loss.

The plots on the pages 3 and 4 show the geometry of the NIMS C10 observations using a north trajectory pole projection. The 'returned' observations are in Bold characters and the 'non-returned' in gray.

The spreadsheets on pages 5 through 10 summarize the 'final' playback model for the 'returned' data.

The text on page 11 gives a 'recap' of the C10 playback events which affected which observations were returned.

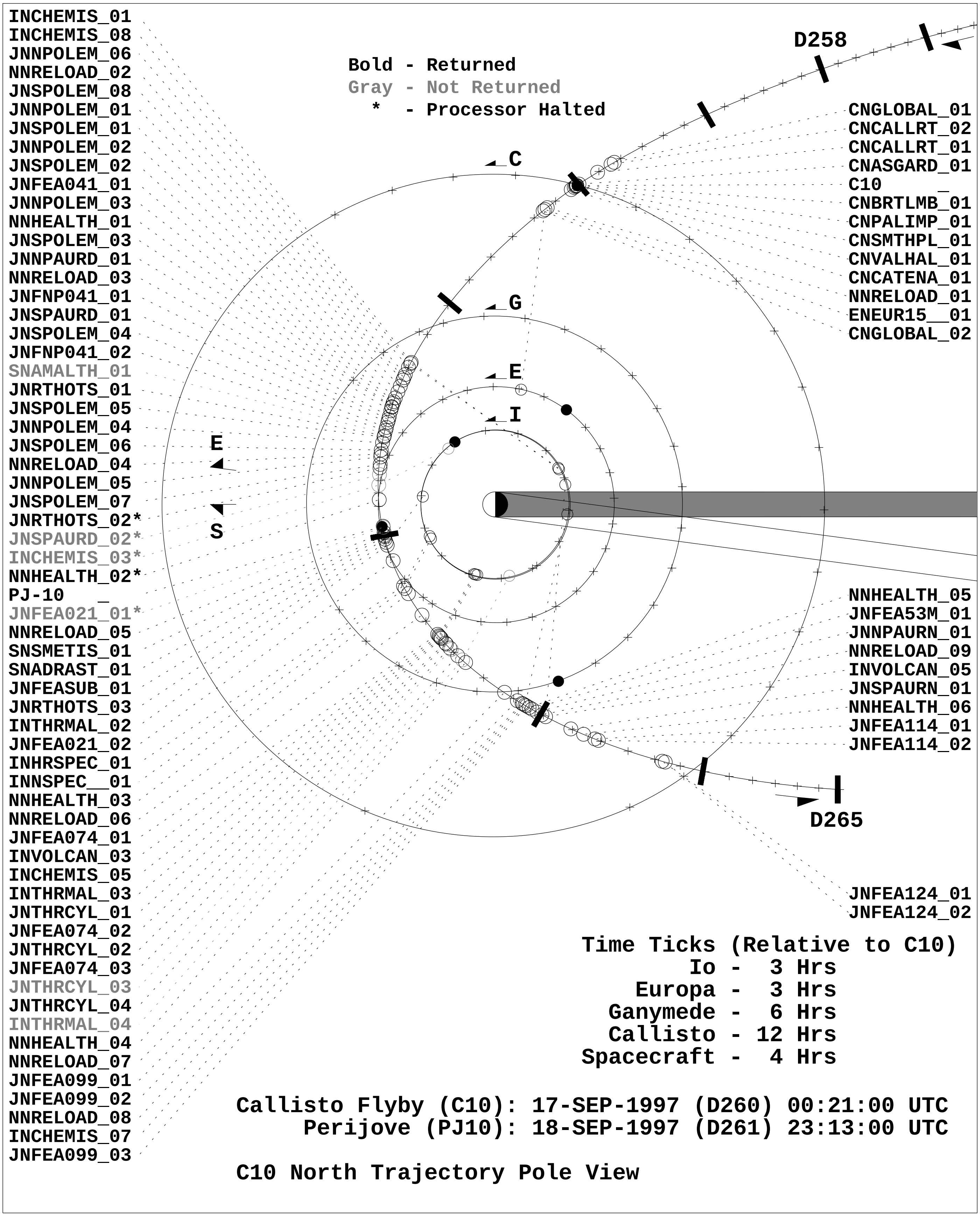
A Timeline of C10 playback events is on pages 12 through 16.

The text on pages 17 and 18 describes the C10 NIMS Anomalies.

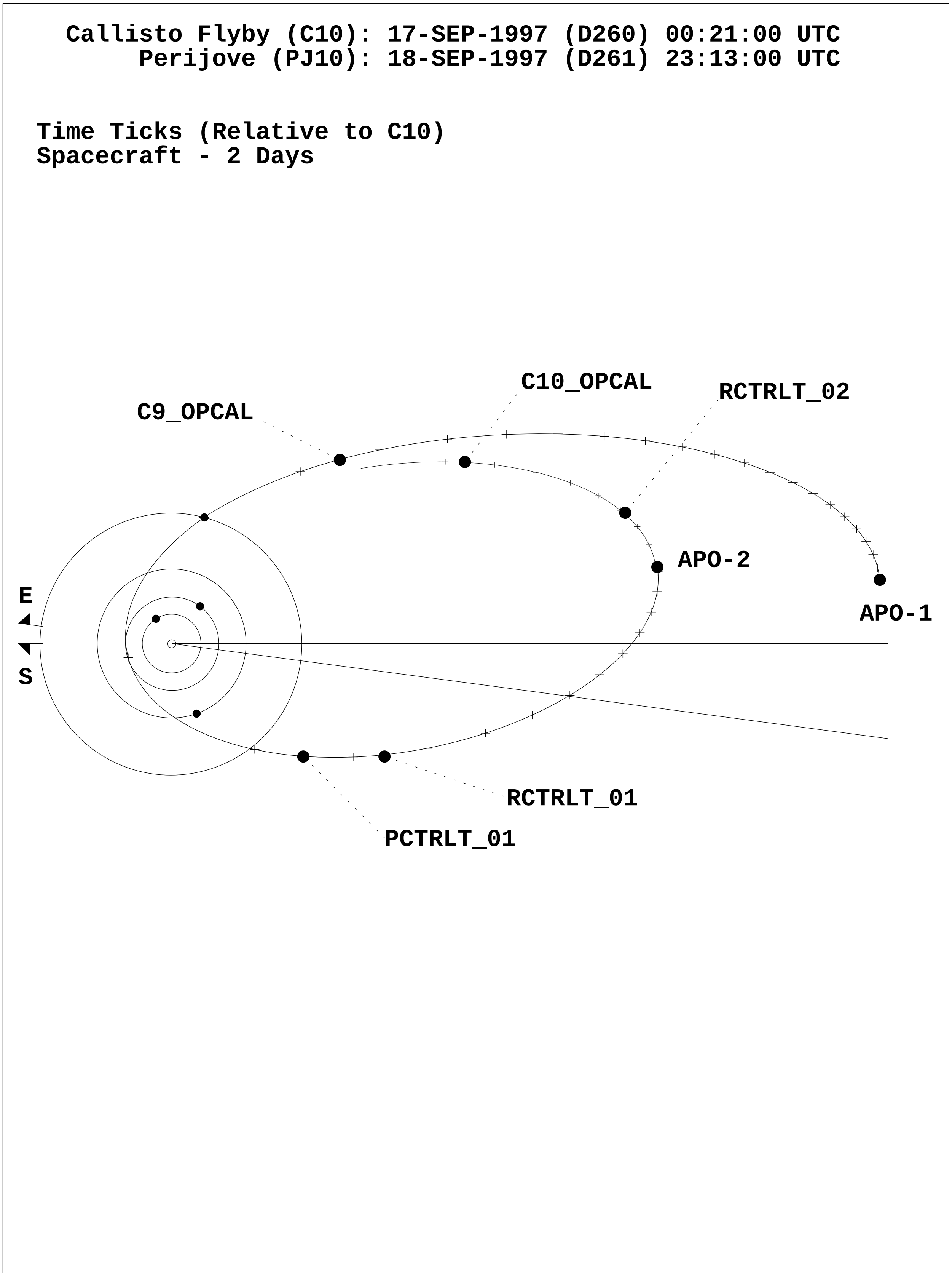
The text on page 19 gives a brief discussion of the NIMS data files. Additional information about NIMS data formats, data types, data labels and data access is given on pages 20 and 21.

The text on page 22 is a guide to understanding the NIMS MASK.

NIMS C10 OBSERVATIONS



NIMS C10 CALIBRATIONS



C10 North Trajectory Pole View, Apoapsis to Apoapsis

NIMS - FEL - 12/01/98

NIMS C10 DATA RETURN

Activity ID	Observation Title	NIMS Edit Table	NIMS PB Table	Mode	Gain	Grating Start	Grating Offset	Record Format	PSID
10JNFNP04101-	Jup Expanded NP Ftr Trk 41 deg phse pt 1	C10JFT68C	C10JFT25A	SM	2	1	4	LPU	DW
10JNSPAURD01-	Jupiter South Pole Aurora Daytime prt 1	C10JAU253B	C10JAU40B	LM	2	0	4	LPU	DX
10JNSPOLEM04-	Jupiter South Pole Map prt 4	C10JFT68C	C10JFT25A	SM	2	1	4	LPU	DY
10JNFNP04102-	Jup Expanded Ftr Trk 41 deg phse pt 2	C10JFT68C	C10JFT25A	SM	2	1	4	LPU	EA
10JNRTHOTS01	Jupiter Real-Time Observation	C10JLM442/MB	R/T	LM	4	0	4	R/T	KJ
10JNSPOLEM05-	Jupiter South Pole Map prt 5	C10JFT68C	C10JFT25A	SM	2	1	4	LPU	EC
10JNNPOLEM04-	Jupiter North Polar Map prt 4	C10JFT68C	C10JFT25A	SM	2	1	4	LPU	ED
10JNSPOLEM06-	Jupiter South Pole Map prt 6	C10JFT68C	C10JFT25A	SM	2	1	4	LPU	EG
10JNNPOLEM05-	Jupiter North Pole Map prt 5	C10JFT68C	C10JFT25A	SM	2	1	4	LPU	EE
10JNSPOLEM07-	Jupiter South Pole Map prt 7	C10JFT68C	C10JFT25A	SM	2	1	4	LPU	EF
10SNSMETIS01-	NIMS Small Satelite Obs. of Metis	C10SLM442	C10SLM360	LM	4	0	4	MPW	EK
10SNADRAST01-	NIMS Small satellite Obs. of Adrastea	C10SLM442	C10SLM360	LM	4	0	4	MPW	EL
10JNFEASUB01-	Jupiter Campaign Feature Sub-Spectra	C10JSB253A	C10JSB80A	LM	2	0	4	LPU	EM
10JNRTHOTS03	Jupiter Real-Time Observation	C10JLM442/MB	R/T	LM	4	0	4	R/T	KL
10INTHRMAL02-	MONITORING OF IO'S NIGHTSIDE	C10ILM442	C10ILM408	LM	4	0	4	MPW	EO
10JNFEA02102-	Jupiter Feature Track 21 deg phase pt 2	C10JFT68C	C10JFT25A	SM	2	1	4	LPU	EP
10INHRSPEC01-	HIGH SPATIAL & SPECTRAL OBS. OF IO	C10ILM442	C10ILM360	LM	2	0	4	MPW	EQ
10INNSPEC 01-	NIGHTSIDE SPECTRA AT HIGH RESOLUTION	C10ILM442	C10ILM360	LM	4	0	4	MPW	ER
10NNHEALTH03-	NIMS Health Observation	C10RCVY3	R/T	LM	2	0	4	R/T	KC
10JNFEA07401-	Jupiter Feature Track 74 deg phase pt 1	C10JFT68C	C10JFT25A	SM	2	1	4	LPU	ES
10INVOLCAN03-	MONITORING OF SELECTED VOLCANIC REGIONS	C10ILMDK243D	C10ILMDK102D	LM	4	0	4	LPU	ET
10JNTHRCYL01-	Jupiter Thermal Cylindrical Map prt 1	C10J5M253B	C10J5M253B	LM	4	0	4	LPU	EW
10JNFEA07402-	Jupiter Feature Track 74 deg phase pt 2	C10JFT68C	C10JFT25A	SM	2	1	4	LPU	EX
10JNTHRCYL02-	Jupiter Thermal Cylindrical Map prt 2	C10J5M253B	C10B_J5M127B	LM	4	0	4	LPU	EZ
10JNFEA07403-	Jupiter Feature Track 74 deg phase pt 3	C10JFT68C	C10JFT25A	SM	2	1	4	LPU	FA
10JNTHRCYL04-	Jupiter Thermal Cylindrical Map prt 4	C10J5M253B	C10J5M253B	LM	4	0	4	LPU	FE
10NNHEALTH04-	NIMS Health Observation	C10RCVY3	R/T	LM	2	0	4	R/T	KD
10JNFEA09901-	Jupiter Feature Track 99 deg phase pt 1	C10JFT68C	C10JFT25A	SM	2	1	4	LPU	FJ
10JNFEA09902-	Jupiter Feature Track 99 deg phase pt 2	C10JFT68C	C10JFT25A	SM	2	1	4	LPU	FL
10INCHEMIS07-	MONITORING OF IO'S DAYSIDE	C10ILM243C	C10ILM228C	LM	2	0	4	LPU	FI
10JNFEA09903-	Jupiter Feature Track 99 deg phase pt 3	C10JFT68C	C10JFT25A	SM	2	1	4	LPU	FM
10NNHEALTH05-	NIMS Health Observation	C10RCVY3	R/T	LM	2	0	4	R/T	KE
10JNFEA53M01-	Jupiter Campaign Feature 5 and 3 um Map	C10J35157	C10J35157	LM	4	0	4	LPU	FN
10JNNPAURN01-	Jup North Pole Aurora Nite Time prt 1	C10JAU253A	C10JAU40A	LM	4	0	4	LPU	FO
10INVOLCAN05-	MONITORING OF SELECTED VOLCANIC REGIONS	C10ILMDK243D	C10ILMDK102D	LM	4	0	4	LPU	FQ
10JNSPAURN01-	Jupiter South Pole Aurora Night Time	C10JAU253A	C10JAU40A	LM	4	0	4	LPU	FS
10NNHEALTH06	NIMS Health Observation	C10RCVY3	R/T	LM	2	0	4	R/T	KF
10JNFEA11401-	Jupiter Feature Track 114 deg phase pt 1	C10JFT68C	C10JFT25A	SM	2	1	4	LPU	FV
10JNFEA11402-	Jupiter Feature Track 114 deg phase pt 2	C10JFT68C	C10JFT25A	SM	2	1	4	LPU	FW
10JNFEA12401-	Jupiter Feature Track 124 deg phase pt 1	C10JFT68C	C10JFT25A	SM	2	1	4	LPU	FX
10JNFEA12402-	Jupiter Feature Track 124 deg phase pt 2	C10JFT68C	C10JFT25A	SM	2	1	4	LPU	FY

NIMS C10 DATA RETURN

ACTID	Mode	Record Format	Wave- lengths ret	Record Time (sec.)	PB Time (sec.)	Total Bits of Tape BOT (Mbit)	Sel Bits of Tape sBOT (Mbit)	Mode Cycle Time	Thold	Comp	Total BTG (Mbits) (4% ohead)	Data Reduct Factor (sBOT/BTG)	Pass
10JNFNP04101-	SM	LPU	25	857.33	797.00	5.29	4.92	2.33	0	1.68	1.0588	4.64	1
10JNSPAURD01-	LM	LPU	40	1452.00	1446.00	8.96	8.92	8.667	0	1.65	0.8413	10.60	1
10JNSPOLEM04-	SM	LPU	25	818.00	813.33	5.05	5.02	2.33	0	1.64	1.1068	4.53	1
10JNFNP04102-	SM	LPU	25	696.67	692.00	4.30	4.27	2.33	0	1.63	0.9475	4.50	1
10JNRTHOTS01-	LM	R/T	408						0				
10JNSPOLEM05-	SM	LPU	25	818.00	813.33	5.05	5.02	2.33	0	1.59	1.1416	4.39	1
10JNNPOLEM04-	SM	LPU	25	818.00	813.33	5.05	5.02	2.33	0	1.57	1.1562	4.34	1
10JNSPOLEM06-	SM	LPU	25	818.00	813.33	5.05	5.02	2.33	0	1.57	1.1562	4.34	1
10JNNPOLEM05-	SM	LPU	25	818.00	813.33	5.05	5.02	2.33	0	1.55	1.1711	4.28	1
10JNSPOLEM07-	SM	LPU	25	818.00	813.33	5.05	5.02	2.33	0	1.55	1.1711	4.28	1
10SNSMETIS01-	LM	MPW	360	38.00	33.33	0.44	0.38	8.667	0	1.31	0.2198	1.75	1
10SNADRAST01-	LM	MPW	360	38.00	33.33	0.44	0.38	8.667	0	1.31	0.2198	1.75	1
10JNFEASUB01-	LM	LPU	80	724.67	720.00	4.47	4.44	8.667	0	1.67	0.8278	5.37	1
10JNRTHOTS03	LM	R/T	408						0				
10INTHRMAL02-	LM	MPW	408	236.00	231.33	2.72	2.66	8.667	2	1.64	1.3812	1.93	1
10JNFEA02102-	SM	LPU	25	218.00	213.33	1.34	1.32	2.33	0	1.59	0.2994	4.39	1
10INHRSPEC01-	LM	MPW	360	620.00	616.67	7.14	7.10	8.667	2	1.37	3.8889	1.83	1
10INNSPEC 01-	LM	MPW	360	345.00	341.67	3.97	3.94	8.667	2	1.62	1.8222	2.16	1
10NNHEALTH03	LM	R/T	3						0				
10JNFEA07401-	SM	LPU	25	224.67	220.00	1.39	1.36	2.33	0	1.61	0.3050	4.45	1
10INVOLCAN03-	LM	LPU	102	74.67	70.00	0.46	0.43	8.667	2	1.72	0.0996	4.33	1
10JNTHRCYL01-	LM	LPU	253	1199.00	1194.00	7.40	7.36	8.667	0	1.24	5.8465	1.26	1
10JNFEA07402-	SM	LPU	25	124.67	120.00	0.77	0.74	2.33	0	1.69	0.1585	4.67	1
10JNTHRCYL02-	LM	LPU	127	1199.00	1194.33	7.40	7.37	8.667	0	1.26	2.8890	2.55	1
10JNFEA07403-	SM	LPU	25	224.67	220.00	1.39	1.36	2.33	0	1.77	0.2774	4.89	1
10JNTHRCYL04-	LM	LPU	253	1370.00	1365.30	8.45	8.42	8.667	0	1.35	6.1406	1.37	1
10NNHEALTH04	LM	R/T	3						0				
10JNFEA09901-	SM	LPU	25	218.00	213.33	1.34	1.32	2.33	0	1.98	0.2405	5.47	1
10JNFEA09902-	SM	LPU	25	218.00	213.33	1.34	1.32	2.33	0	2.04	0.2334	5.64	1
10INCHEMIS07-	LM	LPU	228	91.33	86.67	0.56	0.53	8.667	2	5.55	0.0854	6.26	1
10JNFEA09903-	SM	LPU	25	224.67	220.00	1.39	1.36	2.33	0	2.17	0.2263	6.00	1
10NNHEALTH05	LM	R/T	3						0				
10JNFEA53M01-	LM	LPU	157	1559.00	780.00	9.62	4.81	8.667	0	1.54	1.9084	2.52	1
10JNNPAURN01-	LM	LPU	40	1755.00	840.00	10.82	5.18	8.667	0	1.88	0.4289	12.08	1
10INVOLCAN05-	LM	LPU	102	50.00	45.33	0.31	0.28	8.667	2	3.22	0.0345	8.11	1
10JNSPAURN01-	LM	LPU	40	1755.00	840.00	10.82	5.18	8.667	0	1.90	0.4244	12.21	1
10NNHEALTH06	LM	R/T	3						0				
10JNFEA11401-	SM	LPU	25	224.67	220.00	1.39	1.36	2.33	0	2.03	0.2419	5.61	1
10JNFEA11402-	SM	LPU	25	218.00	213.33	1.34	1.32	2.33	0	2.07	0.2300	5.72	1
10JNFEA12401-	SM	LPU	25	224.67	220.00	1.39	1.36	2.33	0	2.04	0.2407	5.64	1
10JNFEA12402-	SM	LPU	25	224.67	220.00	1.39	1.36	2.33	0	2.08	0.2361	5.75	1

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Activity ID	Observation Title		NIMS Edit Table	NIMS PB Table	Mode	Gain	Grating Start	Grating Offset	Record Format	PSID
10NNPCTRLT01	NIMS Real-Time PCT Calibration		C10PCT252	R/T	LM	4	0	4	R/T	FT
10NNRCTRLT01-	NIMS Real-Time RCT Calibration		C10RCT252	R/T	LM	1	0	4	R/T	XU
10NNRCTRLT02-	NIMS Real-Time RCT Calibration		C10RCT252	R/T	LM	1	0	4	R/T	XI
10NNOPCAL_01-	NIMS OPCAL		C10OPCAL120	R/T	LM	4	0	4	R/T	LW
10CNGLOBAL01-	Callisto Global Coverage		C10CLM243C	C10CLM228C	LM	4	0	4	LPU	DA
10CNCALLRT02-	Callisto Real-Time Observation		C10CLM442/MB	R/T	LM	4	0	4	R/T	KH
10CNCALLRT01-	Callisto Real-Time Observation		C10CLM442/MB	R/T	LM	4	0	4	R/T	KG
10CNPALIMP01-	Valhalla Palimpsest Spectroscopy		C10CLM442	C10CLM360	LM	4	0	4	MPW	DC
10CNSMTHPL01-	Callisto Smooth Plain		C10CFM221	C10CFM180	FM	4	0	4	MPW	DD
10CNSMTHPL01-	Callisto Smooth Plain		C10CFM221	C10CFM180	FM	4	0	4	MPW	DD
10CNVALHAL01-	Valhalla Basin/Rings Observation		C10CLM243C	C10CLM228C	LM	4	0	4	LPU	DE
10CNGLOBAL02-	Callisto Global Coverage	RCA	C10CLM243C	C10CLM228C	LM	4	0	4	LPU	DG
10INCHEMIS01-	MONITORING OF IO'S DAYSIDE	RCA	C10ILM243C	C10ILM228C	LM	2	0	4	LPU	DJ
10INCHEMIS08-	MONITORING OF IO'S DAYSIDE	RCA	C10ILM442	C10ILM228C	LM	2	0	4	MPW	DK
10JNSPOLEM08-	Jupiter South Pole Map prt 8	RCA	C10JFT68C	C10JFT25A	SM	2	1	4	LPU	DM
10JNSPOLEM01-	Jupiter South Pole Map prt 1	RCA	C10JFT68C	C10JFT25A	SM	2	1	4	LPU	DO
10JNSPOLEM02-	Jupiter South Pole Map prt 2	RCA	C10JFT68C	C10JFT25A	SM	2	1	4	LPU	DQ
10JNFEA04101-	Jupiter Feature Track 41 deg phase pt 1	RCA	C10JFT68C	C10JFT25A	SM	2	1	4	LPU	DR
10NNHEALTH01-	NIMS HEALTH OBSERVATION		C10RCVY2	R/T	LM	2	1	4	R/T	KA
10JNNPAURD01-	Jupiter North Pole Aurora Daytime prt 1	RCA	C10JAU253B	C10JAU40B	LM	2	0	4	LPU	DV
10INCHEMIS05-	MONITORING OF IO'S DAYSIDE		C10ILM243C	C10ILM228C	LM	2	0	4	LPU	EU
10INTHRMAL03-	MONITORING OF IO'S NIGHTSIDE		C10ILMDK243D	C10ILMDK228D	LM	4	0	4	LPU	EV
10JNTHRCYL01-	Jupiter Thermal Cylindrical Map prt 3		C10J5M253B	C10J5M253B	LM	4	0	4	LPU	FB
10JNFEA53M01-	Jupiter Campaign Feature 5 and 3 um Map		C10J35157	C10J35157	LM	4	0	4	LPU	FN
10JNNPAURN01-	Jup North Pole Aurora Nite Time prt 1		C10JAU253A	C10JAU40A	LM	4	0	4	LPU	FO
10JNSPAURN01-	Jupiter South Pole Aurora Night Time		C10JAU253A	C10JAU40A	LM	4	0	4	LPU	FS
10CNASGARD01-	ASGARD Basin observation		C10CFM221	C10CFM180	FM	4	0	4	MPW	DB
10CNBRTLMB01+	UVS Ride-along		C10CFM221	C10CFM24	FM	4	0	4	MPW	N/A
10CNSMTHPL01-	Callisto Smooth Plain		C10CFM221	C10CFM180	FM	4	0	4	MPW	DD
10CNCATENA01-	GIPUL Catena Coverage		C10CLM243C	C10CLM228C	LM	4	0	4	LPU	DF
10ENEUR_1501-	Europa Real-Time Observation		C10ELMRT102/MB	R/T	LM	4	0	4	R/T	FZ
10CNGLOBAL02-	Callisto Global Coverage		C10CLM243C	C10CLM228C	LM	4	0	4	LPU	DG
10INCHEMIS01-	MONITORING OF IO'S DAYSIDE		C10ILM243C	C10ILM228C	LM	2	0	4	LPU	DJ
10INCHEMIS08-	MONITORING OF IO'S DAYSIDE		C10ILM442	C10ILM228C	LM	2	0	4	MPW	DK
10JNNPOLEM06-	Jupiter North Pole Map prt 6		C10JFT68C	C10JFT04B	SM	2	1	4	LPU	DL
10JNSPOLEM08-	Jupiter South Pole Map prt 8		C10JFT68C	C10JFT04B	SM	2	1	4	LPU	DM
10JNNPOLEM01-	Jupiter North Pole Map prt 1		C10JFT68C	C10JFT04B	SM	2	1	4	LPU	DN
10JNSPOLEM01-	Jupiter South Pole Map prt 1		C10JFT68C	C10JFT25A	SM	2	1	4	LPU	DO

NIMS C10 DATA RETURN

ACTID	Mode	Record Format	Wave-lengths ret	Record Time (sec.)	PB Time (sec.)	Total Bits of Tape BOT (Mbit)	Sel Bits of Tape sBOT (Mbit)	Mode Cycle Time	Thold	Comp	Total BTG (Mbits) (4% ohead)	Data Reduct Factor (sBOT/BTG)	Pass
10NNPCTRLT01-	LM	R/T	252										
10NNRCTRLT01-	LM	R/T	252										
10NNRCTRLT02-	LM	R/T	252										
10NNOPCAL_01-	LM	R/T	120										
10CNGLOBAL01-	LM	LPU	228	1580.00	1473.76	9.75	9.09	8.667	2	2.14	3.7683	2.41	2
10CNCALLRT02-	LM	R/T	408										
10CNCALLRT01-	LM	R/T	408										
10CNPALIMP01-	LM	MPW	360	304.00	300.67	3.50	3.46	8.667	0	1.79	1.4512	2.39	2
10CNSMTHPL01	FM	MPW	180	670.00	220.00	7.72	2.53	4.333	0	1.96	0.9699	2.61	2
10CNSMTHPL01	FM	MPW	180	670.00	232.00	7.72	2.67	4.333	0	2.00	1.0023	2.67	2
10CNVALHAL01-	LM	LPU	228	544.00	539.33	3.36	3.33	8.667	0	2.03	1.4537	2.29	2
10CNGLOBAL02-	LM	LPU	228	1529.00	720.00	9.43	4.44	8.667	2		1.22	(anomaly)	2
10INCHEMIS01-	LM	LPU	228	174.67	170.00	1.08	1.05	8.667	2		0.183	"	2
10INCHEMIS08-	LM	MPW	228	87.33	82.67	1.01	0.95	8.667	2		0.098	"	2
10JNSPOLEM08-	SM	LPU	25	691.33	686.67	4.26	4.24	2.33	0		0.231	"	2
10JNSPOLEM01-	SM	LPU	25	818.00	813.33	5.05	5.02	2.33	0		0.28	"	2
10JNSPOLEM02-	SM	LPU	25	818.00	813.33	5.05	5.02	2.33	0		0.299	"	2
10JNFEA04101-	SM	LPU	25	224.67	220.00	1.39	1.36	2.33	0		0.075	"	2
10NNHEALTH01-	LM	R/T	3										
10JNNPAURD01-	LM	LPU	40	1740.00	840.00	10.73	5.18	8.667	0		0.159	"	2
10INCHEMIS05-	LM	LPU	228	159.33	154.67	0.98	0.95	8.667	0	1.13	0.7490	1.27	3
10INTHRMAL03-	LM	LPU	228	126.00	121.33	0.78	0.75	8.667	0	1.86	0.3569	2.10	3
10JNTHRCYL03-	LM	LPU	253	1199.00	182.00	7.40	1.12	8.667	0	1.23	0.8984	1.25	3
10JNFEA53M01-	LM	LPU	157	1559.00	786.00	9.62	4.85	8.667	0	1.57	1.8863	2.57	3
10JNNPAURN01-	LM	LPU	40	1755.00	920.00	10.82	5.67	8.667	0	1.98	0.4460	12.72	3
10JNSPAURN01-	LM	LPU	40	1755.00	920.00	10.82	5.67	8.667	0	1.86	0.4748	11.95	3
10CNASGARD01-	FM	MPW	180	544.67	541.33	6.27	6.24	4.333	0	1.83	2.5560	2.44	4
10CNBRTLMB01+	FM	MPW	24	364.00	364.00	4.19	4.19	4.333	0	2.00	0.2097	20.00	4
10CNSMTHPL01	FM	MPW	180	670.00	220.00	7.72	2.53	4.333	0	1.99	0.9552	2.65	4
10CNCATENA01-	LM	LPU	228	1423.33	1356.00	8.78	8.36	8.667	0	2.20	3.3726	2.48	4
10ENEUR_1501-	LM	R/T	102										
10CNGLOBAL02-	LM	LPU	228	1529.00	1519.00	9.43	9.37	8.667	2	1.97	4.2191	2.22	4
10INCHEMIS01-	LM	LPU	228	174.67	170.00	1.08	1.05	8.667	2	1.63	0.5707	1.84	4
10INCHEMIS08-	LM	MPW	228	87.33	82.67	1.01	0.95	8.667	2	1.5	0.3016	3.16	4
10JNNPOLEM06-	SM	LPU	4	818.00	813.33	5.05	5.02	2.33	0	1.80	0.1613	31.09	4
10JNSPOLEM08-	SM	LPU	4	691.33	686.67	4.26	4.24	2.33	0	1.75	0.1401	30.23	4
10JNNPOLEM01-	SM	LPU	4	818.00	813.33	5.05	5.02	2.33	0	1.69	0.1718	29.19	4
10JNSPOLEM01-	SM	LPU	25	818.00	813.33	5.05	5.02	2.33	0	1.71	1.0615	4.73	4

NIMS C10 DATA RETURN

Activity ID	Observation Title	NIMS Edit Table	NIMS PB Table	Mode	Gain	Grating Start	Grating Offset	Record Format	PSID
10JNNPOLEM02-	Jupiter North Pole Map prt 2	C10JFT68C	C10JFT04B	SM	2	1	4	LPU	DP
10JNSPOLEM02-	Jupiter South Pole Map prt 2	C10JFT68C	C10JFT25A	SM	2	1	4	LPU	DQ
10JNFEA04101-	Jupiter Feature Track 41 deg phase pt 1	C10JFT68C	C10JFT04B	SM	2	1	4	LPU	DR
10JNNPOLEM03-	Jupiter North Pole Map prt 3	C10JFT68C	C10JFT25A	SM	2	1	4	LPU	DS
10JNSPOLEM03-	Jupiter South Pole Map prt 3	C10JFT68C	C10JFT04B	SM	2	1	4	LPU	DU
10JNNPAURD01-	Jupiter North Pole Aurora Daytime prt 1	C10JAU253B	C10JAU40B	LM	2	0	4	LPU	DV
NOTE:	RCA == Rate Control Anomaly								

NIMS C10 DATA RETURN

ACTID	Mode	Record Format	Wave- lengths ret	Record Time (sec.)	PB Time (sec.)	Total Bits of Tape BOT (Mbit)	Sel Bits of Tape sBOT (Mbit)	Mode Cycle Time	Thold	Comp	Total BTG (Mbits) (4% ohead)	Data Reduct Factor (sBOT/BTG)	Pass
10JNNPOLEM02-	SM	LPU	4	818.00	813.33	5.05	5.02	2.33	0	1.70	0.1708	29.36	4
10JNSPOLEM02-	SM	LPU	25	818.00	813.33	5.05	5.02	2.33	0	1.64	1.1068	4.53	4
10JNFEA04101-	SM	LPU	4	224.67	220.00	1.39	1.36	2.33	0	1.80	0.0436	31.09	4
10JNNPOLEM03-	SM	LPU	25	696.67	692.00	4.30	4.27	2.33	0	1.64	0.9417	4.53	4
10JNSPOLEM03-	SM	LPU	4	818.00	813.33	5.05	5.02	2.33	0	1.64	0.1771	28.33	4
10JNNPAURD01-	LM	LPU	40	1740.00	1217.00	10.73	7.51	8.667	0	1.66	0.7038	10.67	4
TOTAL										T Mbtg	71.5218		
ALLOCATION										Alloc	71.7250		
Over/Under										Diff	-0.2032		

7-10

RECAP OF NIMS C10 PLAYBACK EVENTS

More than 71 Megabits of NIMS data were successfully brought down in C10, making this the second largest NIMS data set obtained during the prime mission. At the same time, C10 was plagued by a greater number of problems than was the case for any other prime mission orbit. As in C9, a complex playback strategy was adopted to allow additional data taking during the cruise period, after the encounter. The "record during cruise" (RDC) complexities turned out to be the least of our worries.

During encounter recording, about 2 hours after perijove, NIMS took a radiation hit that caused a software crash. Three recorded observations and two realtime observations were lost.

A few days after initiation of playback, the tape recorder stopped sending down data. This was fixed but the event caused a loss of about 5 Mbits of downlink. Various other unscheduled data losses were caused by DSN problems and by appropriation of Galileo downlink to help with Mars Pathfinder anomaly efforts.

Later on an error in one NIMS playback command shifted data playback to "rate control" mode, in which only 4 of the 20 spatial pixels were sent down. A software patch was necessary to correct the problem as the CDS playback software did not respond when the rate control flag was reset for the following observation. This caused problems for all teams when playback ran ahead of schedule.

Lastly, near the end of playback, a combination of factors caused NIMS data to be returned with a significant quantity of useless fill bits. More than 2 Mbits of fill were received, cutting short the playback process before all the commanded data could be brought down. This regrettably prevented the return of some SSI lightning, aurora, and rings data.

The timeline below contains more details on the above events and helps explain why some observations came down without editing while other similar observations were severely wavelength-edited or truncated.

<u>C10 Playback Events Timeline</u> (07-09-97 to 11-2-97)

07-09-97: The C10 record during cruise strategy is defined. Observations on the third of the four tracks of the tape will be overwritten by new data during the cruise period. All encounter data recorded on track 3 must come down in the first tape pass.

09-05-97: Playback table update. Estimated playback of NIMS satellite observations is 6.2 Mbits larger than our allocation. Wavelength and spatial coverage of CNCATENA01 and CNBRTLMB01 are cut back. Io observations INCHEMIS05, INTHRMAL03, and INTHRMAL04 are deleted from the playback plan.

09-11-97: Playback table update. Wavelengths on CNBRTLMB01 are increased from 3 to 24.

09-13-97: C10 encounter begins.

09-17-97: Callisto close approach is reached at 00:21 GMT.

09-18-97: Perijove occurs at 16:10 GMT.
At about 18:13 GMT NIMS software crashes. The realtime obseration JNRTHOTS02 returns garbage. JNSPAURSD02 and INCHEMIS03 fail to record. NNHEALTH02 (realtime) is garbage. JNFEA02101 fails to record. At 23:55 GMT software reload 5 occurs, correcting the problem.

09-19-97: The science turn to obtain high-phase Jupiter observations executes successfully.

09-20-97: Playback is initiated.

09-22-98: Playback table update. We are only able to remove the third of the 3 corrupted observations from the playback plan, because (due to the RDC strategy) they are scheduled to come down immediately. Some fine-tuning allows reinstatement of INCHEMIS05.

09-24-97: Playback table update. The following is from the playback memo written at that time:
Playback stopped Tuesday night at about 8 pm PDT. The anomaly (no movement of the tape) was noticed before 10 pm. During the night and this morning the problem was worked and the reason was found. The final playback segment from C9 had the same hex identification number as the second segment for C10. The processor did not pull the second segment into memory because it "thought" that segment 2 had already been processed.
The stoppage will end up costing some 5 Mbits of downlink capability. This morning the decision was made to re-uplink segment 2 at 11 am. The decision was announced in the 9:30 SSO meeting. I asked if it was still possible to modify segment 2, since it contains two NIMS observations taken after our instrument stopped (JNSPAURD02, INCHEMIS03). The initial answer was no.

I brought up the topic again and noted that it was not in anyone's best interest to bring down some 3 Mb of garbage while we might be returning good data. This led to a meeting with the Project Manager where the plan to change segment 2, regenerate the uplink files, and radiate to the spacecraft was approved. The risk of error in a short turnaround, and the downlink bits cost of a 2 hour delay, were considered acceptable.
We will have to cough up our share of the 5 Mb lost due to the glitch. However, we will save the 3 Mb that as of yesterday would have come down as garbage. Even with the glitch, we are coming out ahead.

10-01-97: Playback table update. The following is taken from the playback memo written at the time:
C10 is starting to shape up as a bad luck orbit. As previously noted we lost 4.7 Mb of downlink due to a software glitch, then lost about 3 Mb when a DSN pass was given to another mission. We are losing 1.6 Mb today and may lose 1.6 Mb tomorrow to Mars Pathfinder. MPF is not "calling home" as expected; they obtained carrier frequency and hope to get some telemetry soon for diagnostic purposes. The reduction in our downlink allocation at this moment is over 2 Mb, and this does not include the MPF losses yet.
We have just learned that DSN 43 has gone down and is not expected back on line for 4 hours. This happens just as we are playing back a number of observations from track 3, which is to be overwritten soon by record-during-cruise observations. Some part or all of the following observations may be lost:
SNMETIS01, SNADRAST01, JNFEASUB01, INTHRMAL02, JNFEA02102.
In addition, part of INHRSPEC may be lost. These bits count as part of our allocation, even though the DSN is not listening, so there is no question of using the bits on other observations.
The playback coordinator suggested a number of changes to help improve tape slewing efficiency / reduce the return of fill packets. 6 NIMS observations were cut in half or in thirds, with the pieces put in different tape passes. These are:
CNSMTHPL01, middle third moved to pass 4
CNGLOBAL02, second half moved to pass 4
JNNPAURD01, second half moved to pass 4
JNFEA53M01, first half moved to pass 1
JNNPAURN01, second half moved to pass 3
JNSPAURN01, first half moved to pass 1.
In addition, JNNPOLEM01 and 03 were moved from pass 2 to pass 4.

10-05-97: The C10 RDC executes. The Sun is occulted by Jupiter. A science turn is performed to permit SSI observations of Jupiter's dark side and rings. NIMS observations on track 3 of the tape, from 10JNFNP04101 to 10INNSPEC01, are overwritten.

C10 Playback Events Timeline (07-09-97 to 11-2-97)

10-08-97: Playback table update. The following is from the playback memo written on that date:
Consequences of the substantial bit losses in this orbit are not as bad as expected, so far. The DSN going down (as mentioned in the 10-1 message) did not result in the loss of any NIMS observations.
We were docked 2.63 Mb in order to rebuild an insurance policy (5 Mb of office margin) to deal with any additional snafus. We were able to adapt by deleting a single observation. These bits may come back to us if playback inefficiency is low.
The AWG JNTHRCYL01-04 observations received optimistically high compression estimates of 1.6 during playback plan development, since C9 observations of this type compressed well. However I realized that a more realistic figure was 1.3 or so, after looking at the proximity to Jupiter for these. This means AWG bits were underestimated by a total of 2.8 Mb for THRCYL01, 02, and 04, which have come down in pass 1. In order to bring AWG totals down and get in under our new allocation it was necessary to delete JNTHRCYL03.
JNTHRCYL03 is the only AWG observation on the tape that is not selected for playback. For SWG, there are two Io THRMAL observations (03,04) that were deleted from the plan earlier. These would cost about 0.9 Mb to return. In addition, CNCATENA01 will be returned with only 50% of spatial coverage, in the present plan. If tape slewing inefficiency is low and margin bits are released, part or all of these observations may be brought down.

10-15-97: Playback table update. Satellites observations have compressed better than expected, while Jupiter observations are compressing poorly. Open issues involve some addback of SWG observations; for AWG issues are prioritization of gap fills for THRCYL01 versus wavelength coverage for later observations.

10-20-97: Preliminary analysis of 10CNGLOBAL02 data by Bob Mehlman reveals that "rate control" has been mistakenly commanded, and only 20% of the recorded data is coming down. (See discussion of causes below).

10-21-97 to 10-22-97: Playback table update. The following is excerpted from playback status memos written at the time:
There was furious activity on the playback front over the past 36 hours due to a new 'playback anomaly.' The problem has now been diagnosed and a fix has been identified and implemented. However there have been significant impacts on C10 playback that will require some hard decisions to be made.
Six weeks ago a "1" was substituted for a "0" in one of the parameters of the playback command for CNGLOBAL02. The change was not caught in proofreading or modeling since that parameter is never deliberately changed in the pbt update process. The effect was to invoke the

rate-control mode. This mode trims pixels in sets of 4, from the 20 pixel NIMS scan, ultimately reducing the spatial coverage to 4 only, when certain test values are obtained in processing. The intent is to be able to specify in advance the compression of an observation, by forcing spatial coverage down if compression is not as good as expected. This mode has not been employed during the mission.
Rate-control worked on CNGLOBAL02. This was discovered by Bob Mehlman in processing last Sunday night. Rate control was not specified for the following observations in the table. Thus the effect of the error should have been limited to one observation. However Tuesday morning it was learned that subsequent observations were significantly smaller than expected, suggesting that rate control was still working on the NIMS data. This was confirmed and the problem was determined to be in the CDS programming. As a result of this software problem, several NIMS observations came down with only 4 pixels of spatial coverage per scan: INCHEMIS01, INCHEMIS08, JNSPOLEM08, JNSPOLEM01, JNSOPOLEM02, JNFEA04101, and JNNPAURD01.
Although the problem was not fully understood until today (10-22), a new C10 playback table was required at noon yesterday. This represented the last opportunity to play back Callisto data. Two changes to the playback table were made on the basis of the limited information available. Re-playback of CNGLOBAL02, starting at the 5th rim, and completing the observation, was implemented on the basis of Bob Mehlman's first look at the data that suggested the first 4 Rims were ok. Secondly, to use up some of the bits saved by rate control, CNCATENA spatial coverage was increased by another 25% to bring down the full observation.
It will be possible to replay all of the observations listed above that were affected by the CDS problem. However, to play them all in full would require 4.5 Mb, and we presently have about 1.8 Mb available. It is possible that a small amount of office margin will be released to us on Friday, in preparation for the last pbt update on Monday.

10-24-97: Preliminary analysis shows that the software patch worked correctly, as INCHEMIS05 is down with all 20 pixels returned per scan.

10-28-97: Playback table update. The following is from the playback status memo issued at the time:
The amount of downlink required to bring down the rate-controlled observations, including CNGLOBAL02, came to only about 2.5 Mb. In addition, we received an additional 0.95 Mb from office margin as a result of a meeting last Friday. Thus this week we were able to add back all of the affected observations (for replay), though not with complete wavelength coverage in all cases.

For satellites, INCHEMIS01 and INCHEMIS08 were added back at full spatial and spectral resolution. (Note: a correction for last week's update-CNGLOBAL02 is coming down with full spatial coverage, not beginning with the 5th recorded Rim, as mentioned last week).
For Jupiter, the JNNPAURD01 was added back in full. JNFEA04101 was restored but with 4 wavelengths instead of 25. Three of the 14 polar haze observations (JNNPOLEM01-06, JNSPOLEM01-08) were impacted by the anomaly, while 5 others were scheduled for playback in the final tape pass. With longitudes information from Kent Tobiska and with Kevin's input I identified the highest-priority observations remaining to be played back. The NNPOLEM03 and NSPOLEM01-02 observations will come down with full spatial and wavelength (25) coverage, while NNPOLEM01, 02, and 06, and NSPOLEM03, 04, and 09, will come down with 4 colors. To sum up, 3 of the 6 NNPOLEM observations and 6 of the 8 NSPOLEM observations recorded in C10 are being brought down with 25 wavelengths.

10-31-97: Substantial quantities of fill packets begin arriving with the NIMS data starting with the observation 10JNNPOLEM06. In this, the worst case, 0.15 Mbits of data were accompanied by 0.81 Mbits of fill. In all more than 2 Mbits of fill were received. Part of the reason for this lies in the heavy wavelength editing of the observations involved (returning 4 wavelengths of 68 recorded). The tape must run over a considerable amount of recorded data before a full downlink packet is built. While no packet is available, fill is sent. Although this was recognized as a potential problem in earlier orbits, in 28 prior cases the same wavelength editing had been successfully employed.
Subsequent analysis showed two other significant factors. In CDS software, construction of AACS (attitude control data) packets is extremely inefficient. Since AACS data (needed for determining correct pointing) was also selected for the period of the NIMS observations, this also slowed the packet generation rate significantly. Lastly, playback occurred over high-data-rate DSN coverage periods, making the fill problem even more costly in terms of total downlink bits.

11-02-97: Playback is terminated. The final NIMS observation, 10JNNPAURD01, is truncated about 8 Rims from the end of the commanded playback. In addition, 14 small SSI playback command pairs placed after the final NIMS observation do not execute.

NIMS Anomaly Report - C10 Sequence

The NIMS processor halted once during the C10 Encounter. Detectors 3 and 8 are still not functioning and are expected to be lost for the rest of the mission. There was also a problem with rate control inadvertently being used during playback for a few observations, but almost all of the data were returned ok.

Processor Halts

Facts:

0. Between the start of the C10 Encounter and the single Halt NIMS returned 5 realtime observations and successfully reloaded NIMS from CDS 4 times. The NIMS SCLK engineering channels were continuously monitored for detecting a NIMS processor halt.

1. A NIMS processor halt was detected at SCLK 04136338 from the analysis of the NIMS SCLK engineering telemetry channels S-1931 and S-1932. This occurred about 5 hours before C10 perijove. A fifth NIMS reload occurred about 5 hours and 32 minutes later. No more Halts occurred during the rest of the encounter. A table of the NIMS engineering SCLK values near the time of the Halt follows (Note that the NIMS engineering SCLK value is normally 2 Rims behind the CDS SCLK Rim when it is reported):

NIMS SCLK	CDS SCLK	CDS SCET	GROUND ERT
04136200	04136202.58	1997-261T16:34:11.352	1997-261T15:57:04.892
04136338	04136367.43	1997-261T20:07:12.563	1997-261T18:43:44.886
04136338	04136400.40	1997-261T20:07:35.163	1997-261T19:17:04.885
04136338	04136585.05	1997-261T23:12:33.028	1997-261T22:23:44.878
04136800	04136802.58	1997-262T03:12:48.371	1997-262T02:03:44.870

2. Five NIMS observation was lost due to this Halt: 10JNRTHOTS02, 10JNSPAURD02, 10INCHEMIS03, 10NNHEALTH02, 10JNFEA02101.

Timing:

SCLK	Comments
04136336.00	NIMS HALTED
04136342.00	Start of NIMS observation 10JNRTHOTS02
04136367.43	Anomalous 04136338 SCLK reported
04136371.00	Start of NIMS observation 10JNSPAURD02
04136400.40	Anomalous 04136338 SCLK reported
04136430.00	Start of NIMS observation 10INCHEMIS03
04136502.00	Start of NIMS observation 10NNHEALTH02
04136585.05	Anomalous 04136338 SCLK reported
04136634.00	C10 Perijove
04136644.00	Start of NIMS observation 10JNFEA02101
04136667:06	Start of NIMS CDS Reload05 (#5)

NIMS Anomaly Report - C10 Sequence

Summary:

1. One NIMS processor halt occurred during the C10 Encounter.

2. Continous monitoring of the NIMS SCLK channels led to a rapid identification that NIMS processor halts had occurred.

3. The 9 NIMS software reloads from CDS greatly lessened the potentially disastrous effects of the C10 Halt and protected the NIMS observations in the encounter.

4. Frequent NIMS realtime observations, both science observations and instrument health monitoring observations, verified that NIMS was functioning normally at various time points throughout the encounter.

5. The error avoidance measures applied to the C10 Encounter as determined in the analysis of the processor halts that occurred in earlier orbits were shown to be the proper response for dealing with the inevitable occurrence of radiation-induced NIMS processor halts.

Detectors 3 and 8

Detectors 3 and 8 are still not functioning properly. These 2 detectors are still being monitored in the calibration observations as well as in the 408 wavelength realtime observations.

Rate Control Anomaly

During playback of NIMS C10 data, the never-used rate control flag was inadvertently turned on for 8 observations:

10CNGLOBAL02, 10INCHEMIS01, 10INCHEMIS08, 10JNSPOLEM08,
10JNSPOLEM01, 10JNSPOLEM02, 10JNFEA04101, 10JNNPAURD01.

These observations were played back again later on without rate contol on. The rate control data packets were not processed into UDRs. They were skipped in UDR production by windowing in ERT. Two observations (10JNSPOLEM08 and 10JNFEA04101) ended up with only 4 wavelengths instead of the original 25 wavelengths returned under rate control.

NIMS Archived EDRs and CUBEs

The NIMS data are stored in EDRs (Experimental Data Records) produced by JPL-MIPS (Multi-mission Image Processing System). The NIMS Phase2 EDR is described in the NIMS EDR SIS (Software Interface Specification) Number 232-08. The same information is available in both human and machine-readable form in the PDS (Planetary Data System) structure files EDRHDR.FMT and EDRDATA.FMT in the LABEL directory of the NIMS EDR CD-ROM. Each observation has at least one EDR. The EDR file name is derived from the 12 character observation name plus a single character which allows an observation to be broken up into multiple EDRs. The EDRs have a Vicar label, followed by a PDS/ISIS label, binary header records and the data records. For archiving on CD-ROM, the Vicar labels are detached from the EDR (but kept separately on CD) and the file is renamed so as to conform to the 8.3 DOS file-naming convention. The 8.3 EDR name consists of a 2 character orbit identifier, a single character target identifier, a 3 digit counter and the suffix EDR. For example, the MIPS EDR G1GNGLOBAL01A.1 becomes G1G001.EDR. More information about NIMS EDRs can be found in the VOLINFO.TXT file on the EDR CD-ROM.

NIMS EDR data typically require considerable processing before they are readily amenable to science analysis. Normally, the EDRs are processed into spectral image cubes by one of several sets of software. MIPS systematically processes the EDRs into CUBEs (band sequential image files) and MASKs (spatial/spectral summary images) which are distributed on the NIMS CUBE CD-ROMs. Information about the structure of the NIMS CUBEs can be found in the VOLINFO.TXT file on the CUBE CD-ROM. The name of the CUBE file is derived from the input EDR filename. For archiving on CD-ROM, the CUBE files are renamed so as to conform to the 8.3 DOS file-naming convention. The 8.3 CUBE name consists of a 2 character orbit identifier, a single character target identifier, a 3 digit counter, a single character cube-type identifier, a single character data unit-type (DN, radiance or IOF) and the suffix QUB. For example, the MIPS IOF radiance cube for the observation G1GNGLOBAL01A.1 (G1G001) becomes G1G001CR.EDR. The summary MASKs on the CD-ROM have the same 6 character name as the EDR name with the suffix JPG or GIF to denote its graphics format.

NIMS Data Format - Data types - Data Labels - Data Access

Data Format

All data files have PDS labels. The raw data (EDR) file contains time-sequential, 16 bit integers. Reduced data files (TUBES and CUBES) may be viewed as images or spectra. They contain VAX real numbers, are band sequential (BSQ - the images are stacked in band order) and have geometry information appended as backplanes after the last NIMS band.

Data Types

Mask files contain summary images (3 band BSQ) and spectra of up to six selected regions that provide a quick indication of data location, data quality and spectral content. A Guide to understanding the NIMS mask is available.

Cube files contain data that have been projected and resampled. The core data are BSQ - spatial in the first two dimensions, and spectral in the third. Cubes of the satellites are projected in point-of-view, and, with few exceptions have no photometric correction applied. Cubes of Jupiter are (generally) projected as simple cylindrical. Cubes of Europa, Ganymede, and Callisto have been despiked. The cubes are available both in radiance and I/F (intensity divided by flux) form.

Tube files contain data in (almost) time order and normally have a NIMS-related 20 pixel spatial dimension (20 x n or n x 20). Projection coordinates are contained in backplanes, but the data have not been resampled. The data are in units of radiance and no despiking has been applied. All data in cubes are also available in tube form. Some data (such as spatially undersampled data) appear in tube form only.

A spike file contains a list of pixels that have been identified as spikes, but not replaced, in the tube. Spike files can be used to remove spikes from both tube and EDR files.

EDR files contain the most primitive form of the data available. They should be used only for advanced data analysis. The format is complex and the files do not form images or spectra without prior processing.

Data Labels

A data label (PDS form) is attached to the front of each file (except masks, which have an attached VICAR label and a detached PDS label). The labels are in ASCII keyword=value format and contain pointers to various data objects in the file, descriptions of the data objects and descriptions of the observation associated with the file. A history object in similar format follows and describes the processing steps that produced the file. Much of this information is necessary for understanding and viewing the cube. In particular, the label contains the offset to the cube, the dimensions of the cube, axes labels, and explicit wavelength information.

Data Access

Software for processing this data is called ISIS and is available for DEC VAX VMS, SUN Solaris, DEC Alpha Digital Unix, Silicon Graphics Unix and PC LINUX systems. The Unix versions are available from the USGS Astrogeology team. Images from NIMS cubes and tubes can be viewed with any image display program which allows an offset from the beginning of the file to the selected image. Packages tested include ISIS, VICAR, ENVI, SAO IMAGE, and NASAVIEW. ISIS and ENVI (and soon NASAVIEW) additionally display spectra. The ISIS viewer is named CV (UNIX) or QL3 (VMS).

Labels may be displayed with some editors (eg DOS edit), and with most "type" and "search" functions. Some editors do not recognize the PDS line termination conventions. The label may be listed by the ISIS function LHLIST (VMS) or LABEL (UNIX).

Software for converting EDRs to cubes exist in both ISIS (DEC VAX VMS) and VICAR (DEC Alpha VMS) versions only. A primitive list of values in an EDR may be obtained with the program EDRDMP2.

Understanding the NIMS Mask

The NIMS mask is designed to provide a quick summary of the contents of a NIMS data cube (or tube). It displays a view of both the spatial and spectral content of the data.

The mask has four regions. Starting from the upper left and proceeding clockwise: a spatial display; six or fewer representative spectra; annotation; and a spectral histogram.

The spatial display of an observation which has been projected and resampled (a cube) has a maximum size of 600x600 pixels. This is overlaid with surface coordinates and is embedded in a 700x700 grid of pixel coordinates. It is accompanied by two 1-dimensional histograms describing the raw image and the image stretched for display. The data image can range from a simple combination of up to 3 NIMS bands displayed in the RGB planes, to complicated arithmetic functions of NIMS bands displayed in the RGB planes. (The formulas appear as annotation below the histograms.) The graphics directly below the image show the input and output data histograms for the three color planes. The "shortest" color for each bin displays in front. The image also contains from one to six numbered rectangles, which show the from which averaged spectra (displayed on the right) were taken.

The spatial display of an observation in time sequence (a tube) is a graphic showing a footprint of the observation over a grid of surface coordinates on the target body. Numerals 1-6 on the graphic mark the locations of the average spectra displayed on the right.

The spectra to the right of the image may display either BDRF or radiance (or both). If both are displayed, then a vertical "radiance fence" line will appear where the breakpoint occurs. This permits display of both atmospheric data, which have significant reflectance and thermal components, and I/F satellite surface data which have strong absorptions at longer wavelengths (such as water spectra.) The spectra are labelled with wavelength in microns and location in both pixel and latitude-longitude space.

The annotation provides information about the observation, including its name, a brief description, its geometry, instrument and projection parameters. TCA is the time from Galileo's closest approach to the target body.

The 2-dimensional spectral histogram in the lower left corner shows the number of pixels at a given radiance for each wavelength. If a surface contains spatial mixtures with significantly different spatial fractions for several components, the spectra of the components will be evident in this display.